



FAO SPECIES IDENTIFICATION GUIDE FOR FISHERY PURPOSES

ISSN 1020-4547

THE LIVING MARINE RESOURCES OF THE
**WESTERN CENTRAL
PACIFIC**



Volume 1. Seaweeds, corals, bivalves and gastropods



FFA
South Pacific
Forum
Fisheries
Agency



Food
and
Agriculture
Organization
of
the
United
Nations

NORAD
Norwegian
Agency for
International
Development



FAO SPECIES IDENTIFICATION GUIDE FOR FISHERY PURPOSES

**THE LIVING MARINE RESOURCES OF THE
WESTERN CENTRAL PACIFIC**

VOLUME 1

Seaweeds, corals, bivalves and gastropods

edited by

Kent E. Carpenter

Department of Biological Sciences
Old Dominion University
Norfolk, Virginia 23529, USA

and

Volker H. Niem

Marine Resources Service
Species Identification and Data Programme
Fisheries Department
Food and Agriculture Organization
Viale delle Terme di Caracalla
00100 Rome, Italy

with the support of the

FFA

South Pacific
Forum Fisheries Agency

and

NORAD

Norwegian Agency for International Development

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 1998

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries.

M-43

ISBN 92-5-104051-6

All right reserved. No part of this publication may be reproduced by any means without the prior written permission of the copyright owner. Applications for such permissions, with a statement of the purpose and extent of the reproduction, should be addressed to the Director, Publications Division, Food and Agriculture Organization of the United Nations, via delle Terme di Caracalla, 00100 Rome, Italy.

© FAO 1998

Carpenter, K.E.; Niem, V.H. (eds)

FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Volume 1. Seaweeds, corals, bivalves and gastropods.

Rome, FAO. 1998. pp. 1-686.

SUMMARY

This multivolume field guide covers the species of interest to fisheries of the major marine resource groups exploited in the Western Central Pacific. The area of coverage includes FAO Fishing Area 71 and the southwestern portion of Fishing Area 77 corresponding to the South Pacific Commission mandate area. The marine resource groups included are seaweeds, corals, bivalves, gastropods, cephalopods, stomatopods, shrimps, lobsters, crabs, holothurians, sharks, batoid fishes, chimaeras, bony fishes, estuarine crocodiles, sea turtles, sea snakes, and marine mammals. The introductory chapter outlines the environmental, ecological, and biogeographical factors influencing the marine biota, and the basic components of the fisheries in the Western Central Pacific. Within the field guide, the sections on the resource groups are arranged phylogenetically according to higher taxonomic levels such as class, order, and family. Each resource group is introduced by general remarks on the group, an illustrated section on technical terms and measurements, and a key or guide to orders or families. Each family generally has an account summarizing family diagnostic characters, biological and fisheries information, notes on similar families occurring in the area, a key to species, a checklist of species, and a short list of relevant literature. Families that are less important to fisheries include an abbreviated family account and no detailed species information. Species in the important families are treated in detail (arranged alphabetically by genus and species) and include the species name, frequent synonyms and names of similar species, an illustration, FAO common name(s), diagnostic characters, biology and fisheries information, notes on geographical distribution, and a distribution map. For less important species, abbreviated accounts are used. Generally, this includes the species name, FAO common name(s), an illustration, a distribution map, and notes on biology, fisheries, and distribution. Each volume concludes with its own index of scientific and common names.

Editorial Notes

Geographical Limits and the Phrase “Western Central Pacific”

The terms Indo-West Pacific, western Pacific, and Central Pacific have had a variety of different meanings attached to them. Most authors in these volumes have used the term Indo-West Pacific in the sense defined by Sven Ekman in his 1953 book on “Zoogeography of the Sea”. Therefore, **Indo-West Pacific** refers to the warm water fauna of the entire Indian Ocean and associated seas, and the tropical and subtropical fauna of the western and central Pacific Ocean. This biogeographical unit is distinguished from the eastern Pacific which is the distinct fauna along the coast of the Americas. It is separated from the West and Central Pacific by the vast stretch of open ocean between Polynesia and the Americas. The term **Central Pacific** is now often used to describe the islands on the Pacific Plate. The **western Pacific** now mostly describes the area of Southeast Asia east of the Andaman Sea, northern and eastern Australia and the Pacific islands on the Philippine and Indo-Australian Plates. The area covered in these volumes is defined largely on the basis of economically defined units. These include the FAO Fishing Area 71 which is based on both biogeographical and political considerations, and the area covered by the economic cooperative of the South Pacific Commission. This includes all of the tropical and part of the subtropical biogeographical unit of the western and Central Pacific, or “West Pacific” in the sense of Ekman, without the Hawaiian Islands. We use the term **Western Central Pacific (WCP)** as a convenient shorthand to describe this nearly complete coverage of the warm water fauna of the western and Central Pacific. The biogeography of this area is discussed in more detail in the introductory chapter.

Project Institutional Affiliations

This identification guide was prepared under the direction of the Species Identification and Data Programme (SIDP) of the Marine Resources Service, Fishery Resources Division, Fisheries Department, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy. Project support came from the South Pacific Forum Fisheries Agency (FFA), Honiara; and the Norwegian Agency for International Development (NORAD) through the Norwegian Programme of the Institute of Marine Research, Bergen, Norway. Partial support for the Senior Editor came from Old Dominion University, Norfolk, USA.

Objectives

The purpose of this guide is to provide an accurate means to identify to the appropriate taxonomic level those organisms that are of potential use or likely to be captured by marine fisheries in the region. Correct identification is of utmost importance in marine resource management. The quality of fisheries statistics depends on the ability to correctly assign landing and catch data to taxon-specific categories. The species name is the link to all relevant biological and ecological information in the literature. This information is fundamental in any attempt to manage a fishery. Correct identification is also important for those scientists gathering biological data relevant to marine resource management. The fishery manager cannot confidently use the relevant biological data if the scientist collecting this information did not have an accurate means of identifying the species to begin with. Therefore, this identification tool will benefit fisheries workers gathering catch statistics and resource assessment information, and marine biologists researching information pertinent to resource management. This is particularly important for the WCP area because it encompasses the highest diversity of marine organisms exploited by fisheries than anywhere in the world. This work is the first attempt to provide comprehensive identification and biological information for marine resources in the region.

An additional objective of this guide is to document whenever possible the extent of the biodiversity likely to be affected by fisheries. Many of the questions regarding exploitation of resources are linked to issues of biodiversity because of potential adverse environmental effects of fisheries. Therefore, in important groups where it is feasible, as in the finfishes, an attempt has been made to list all species present in all families recorded from the WCP area.

History of the Project

In 1974, Walter Fischer, the founder and senior editor of the SIDP, produced the *FAO Species Identification Sheets for Fishery Purposes. Eastern Indian Ocean Fishing Area 57 and Western Central Pacific Fishing Area 71*. This was the second in the “Species Identification Sheet” series, following one published for the Mediterranean and Black Seas in 1972. Both these publications were important compilations of the state of the art knowledge of the taxonomy of the major groups of marine organisms exploited by fisheries. Both paved the way for later editions including the present work and the 1987 *Fiches FAO d'Identification des Espèces pour les Besoins de la Pêche (Révision 1). Méditerranée et Mer Noire*.

Major advances in our taxonomic knowledge have been made in virtually all groups covered by the early 1970's FAO Identification Sheets series. This fact was recognized by most researchers in the Western Central Pacific (WCP) in the early 1990's and in particular, by Andrew Wright of the FFA. At the time, he was editing the book *Nearshore Marine Resources of the South Pacific* and recognized the importance of updating an identification tool for fisheries workers in the WCP. His enthusiasm and commitment through support from the FFA created the momentum needed to initiate this project. The motivation of Gabriella Bianchi of the Institute of Marine Research in Bergen, provided the additional support through NORAD needed to complete the first draft of this document.

The first FAO Identification Sheets covering the WCP and a similar guide covering the Western Indian Ocean were preceded by workshops. These were attended by authors and the purpose was to facilitate completion of the manuscripts through examination of specimens accumulated for the workshops. This approach was helpful in improving the quality of the manuscripts because of the tremendous diversity in the Indo-West Pacific and the need to collect additional data on specimens from the region.

A similar workshop was considered vital to support preparation of this guide. Authors were first requested to complete a draft of their family and species accounts. These were then tested and edited in 1995 at a workshop held in the Philippines from October 1 to 10. Thirty-eight authors and around 20 local and international fisheries workers attended the workshop. The Philippines was chosen because of the very high diversity of marine organisms found in markets there. The workshop was held at the Marine Science Institute (MSI) of the University of the Philippines which is under the direction of Dr Edgardo Gomez. Both the main campus MSI facilities at Diliman, Quezon City and at Bolinao, Pangasinan were utilized during the workshop. Marine organisms were collected at several sites around the Philippines prior to the workshop and at markets and landings near the MSI facilities during the workshop. These specimens were used to gather relevant taxonomic information and were used in testing the identification keys in the manuscripts. In addition, authors attending the workshop were asked to read a certain number of manuscripts for editorial and peer review purposes. The ICLARM (International Center for Living Aquatic Resources Management) FISHBASE database project, under the direction of Dr Rainer Froese, was instrumental in administering the workshop. Ms Emily Capuli of the ICLARM FISHBASE team directed the logistics and administration of the workshop. In addition, the FISHBASE database was used as a reference tool by authors and editors during the workshop.

Identification “Sheets” versus Identification Guide

The “Species Identification Sheet” series was initiated by the estimable Dr Walter Fischer in the early 1970's. It was originally envisioned with the capability of periodic updates through correction and substitution of removable sheets in a ring binder cover. The state of taxonomic nomenclature is consistently changing because of improvements in our knowledge, perhaps even more so in the early 70's than now. Therefore, the concept of updates through removable sheets was considered an expedient means to cope with this flux. However, with the urgent need to cover other areas in the Identification Sheet series, and the limited resources available to the SIDP, it became practically impossible to pursue periodic updates. For this reason, the ring binder format was abandoned for the 1987 revision of the Identification Sheets covering the Mediterranean and Black Seas and the name formally changed to more accurately reflect this difference in the latest identification guide for the eastern Central Pacific in 1995 (*Guía FAO para la identificación de especies para los fines de la pesca. Pacífico centro-oriental*).

Publications of the Species Identification and Data Programme (SIDP)

The FAO Species Identification Guide series covers all marine resources for a major region with major species being covered on a full page with a figure, identification and biological information, and a distribution map. This is only one type of publication produced by the SIDP. Other types include the FAO Species Identification Field Guide series which covers only a single country or a sub-region. Field guides cover major species in abbreviated accounts and usually are covered with around 3 species per page. The FAO Species Catalogue series covers a single resource group worldwide with extensive species accounts when information is available. The FAO Species Synopsis series covers a single important major fisheries species with all known biological and fisheries information reviewed. In addition to these four basic kinds of SIDP publications, one ‘hybrid’ publication was produced which is a cross between an Identification Guide and a Species Catalogue. This was an FAO Species Identification Guide to the Marine Mammals of the World produced in 1994. The SIDP also produced the FAO database SPECIESDAB which includes the expert information found in the FAO Species Catalogue series for fishery purposes. This is a stand-alone database currently available through the FAO. SPECIESDAB formed the kernel that allowed the ICLARM/EC/FAO database FISHBASE to become developed.

FAO and other Common Names

The great diversity of species included in these volumes posed a problem for creating a comprehensive list of common names in the three primary FAO languages: English, French, and Spanish. The great majority of the authors use English as their primary language and therefore it was not difficult to produce an FAO English common name. English is the most common international language in the WCP area and therefore of the most widespread usefulness. French is also a primary language in New Caledonia and French Polynesia and therefore we attempted to find published French names or create new ones when practical. However, the coverage of French names is still patchy and we request that users of this guide send us common French names that are being utilized. These can be included in future editions. Spanish is not commonly used in the WCP area and therefore will be of limited use. Therefore, we did not actively attempt to create Spanish common names. French and Spanish speaking users may wish to write in the respective common names directly on the pages of this guide for easy reference.

The WCP area not only contains an extreme diversity of species, but also a corresponding diversity of national and regional languages. With each of these languages comes another set of common names applied to marine organisms captured in fisheries. An attempt to list these common names is beyond the scope of these volumes. In addition, we prefer to encourage fisheries workers to adopt the FAO common names as a standard to reduce confusion in the reporting of statistics. However, it is often useful to refer to local common names, especially when dealing with local fishermen. When this is useful, we encourage fisheries workers to annotate this guide with local names on the appropriate pages, next to the figure of the relevant species.

The FAO Codes Previously and Currently Included in the Identification Guide Series

Through and including the last FAO identification guides for fishery purposes, codes were always included to the right of the scientific species name. The original intention of these codes was for use in databases that relate the species name to information on biology and statistics. This code is used in the FAO database SPECIESDAB. However, since their inception, these codes have not been widely used. In addition, current databases no longer require a taxonomically-based code to make the database taxonomically relational. Current databases and hardware are fast enough to simply use the full genus and species as the relational tool. We therefore are omitting these codes in this and presumably all future FAO Species Identification Guide publications.

In contrast to the FAO SIDP species codes, the FAO 3 Alpha codes are and have been frequently used as a shorthand means of representing species and species groups for reporting statistics. We include in these volumes this code, whenever one is already in existence and reported in the 1995 FAO Yearbook of Fishery Statistics (Volume 80). These codes can be used for reporting catch and landing data to the FAO.

Different Levels of Taxonomic Coverage

In addition to the great diversity of species covered in this guide, there is also a wide diversity in the extent and methods of fisheries utilization. We attempt to give more extensive coverage to those species that are more important in fisheries. However, it is also often difficult to judge how fisheries importance will change with time, and whether an organism has potential for exploitation. In addition, exploitation must be carefully weighed against ecological impacts in order to ensure sustainability. Included in this consideration is the issue of biodiversity. Ideally, this document would include a comprehensive list of all species in the groups covered so that it can also be used as a benchmark for biodiversity. However, for many of the invertebrate groups which are very speciose, the work required to compile species lists is beyond the scope of this work. However, for the vertebrate groups, comprehensive species lists were possible and are included here.

The families most important in fisheries are covered with a family section summarizing family diagnostic characters, biological and fisheries information, notes on similar families occurring in the area, a key to species, a list of species, and a short list of relevant literature. However, for certain groups such as the plants and corals, family accounts are omitted and extensive information is included only under the species accounts. Species in the important families have a single side of a page to include the species name, the FAO common name or names, an illustration, diagnostic characters, biology and fisheries information, notes on geographical distribution, and a map showing a generalized area of coverage. For less important species, abbreviated accounts are used. This includes the species name, FAO common name or names, notes on biology and distribution, an illustration, and a generalized distribution map. Families which are monotypic (contain a single species) are covered similar to important species except that frequently 2 sides of a page are used and notes on similar species occurring in the area are included. Families that are less important have a family section similar to those for important families except a key to species may or may not be included, and no detailed species pages follow.

The Distribution Maps

The maps included for species of importance to fisheries are generalized maps with a total expected range. This masks the complexity of distribution of many species since the actual records of occurrence are not shown. However, the geographical coverage of the WCP (nearly 40% the earth's circumference) is great and space available on a page for a map limited. Any legible mark on a map of this scope will necessarily cover a large area. Also, since all points in between geographical limits are included in many maps, it gives the impression that species may also be found in inappropriate habitats. Obviously, however, a fish normally found on a coral reef is not expected to occur in the intervening open ocean indicated on the generalized map. These maps should be used to give a quick indication of the known or expected limits of geographical limits of occurrence, rather than as an absolute indication of occurrence.

Peer Review and Citations

Each separate section written by an author or authors was reviewed by a minimum of two, and most often at least four, peer reviewers. Therefore, they can be considered peer review publications. When citing a specific taxonomic work, the author or authors should be listed first. For example:

Smith-Vaniz, W.F. 1998. Carangidae. *In* *FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific*, edited by K.E. Carpenter and V.H. Niem. Rome, FAO.

When citing this work in its entirety the editors should be listed first. For example:

Carpenter, K.E. and V.H. Niem (eds). 1998. *FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific*. 6 vols. Rome, FAO.

Acknowledgments

The editors wish to thank the following for their valued help, support, and additional reviews of various sections in preparation of this guide: G. Bianchi, A. Bogusch, W. Fischer, C.H.J.M. Fransen, E. Gomez, L.B. Holthuis, I.-C. Liao, L.R. Parenti, J.R. Paxton, M.-T. Ruspantini-Campi, C. Sommer, V.G. Springer, J.T. Williams, and A. Wright.

We are particularly grateful to the current manager of FAO's Species Identification and Data Programme, Pere Oliver, for facilitating the production of this guide.

Very special thanks are due J.E. Randall for allowing us to use his extensive and excellent photograph library directly for inclusion of colour photographs and indirectly as models for many of the drawings prepared for these volumes.

MSI people who helped during workshop: M.C. Rañola; P. Aliño, S. Mamauag, C. Nañola (Marine Science Institute, University of the Philippines).

ICLARM people who helped during workshop: R. Atanacio, C. Binohlan, P. Bonilla, R. Cada, E. Capuli, C.M. Casal, M.T. Cruz, R. Froese, C. Garilao, M.L. Palomares, R. Reyes, P. Sa-a, A. Torres.

All testers who attended workshop: M.A. Acedera (PCAMRD Los Baños, Laguna, Philippines); V. Albaladejo, Bureau of Fisheries and Aquatic Resources, Diliman, Quezon City, Philippines; M. Alfaro, Department of Zoology, Field Museum, Chicago, IL, USA; Z. Batang, University of Philippines in the Visayas, Philippines; A. Bogusch, Marburg, Germany; R. Buendia, SEAFDEC, Iloilo, Philippines; J.-P. Chen, Institute of Zoology, Academia Sinica, Nankang, Taipei; P. Conlu, University of the Philippines in the Visayas, Miag-ao, Iloilo, Philippines; P.-H. Kao, Institute of Zoology, Academia Sinica, Nankang, Taipei; M. Luchavez, Silliman University, Dumaguete City, Philippines; S. Schoppe, Tropical Ecology Program, VISCA, Baybay, Leyte, Philippines; K.-T. Shao, Institute of Zoology, Academia Sinica, Nankang, Taipei; J.K. Skelton, National Fishing Heritage Centre, England; S.H. Tan, Department of Zoology, National University of Singapore; W. Uy, Mindanao State University Naawan, Iligan City, Philippines; S.-C. Wong, Institute of Zoology, Academia Sinica, Nankang, Taipei; J. Yang, M.A. Cusi, San Carlos University, Cebu City, Philippines.

The following authors participated in the workshop held in Manila and reviewed sections of the guide: K. Amaoka, W.D. Anderson, T. Bagarinao, K.E. Carpenter, T.Y. Chan, B.B. Collette, L.J.V. Compagno, J.K. Dooley, R. Fritzsche, E.D. Gomez, I.J. Harrison, P.C. Heemstra, D.A. Hensley, W. Ivantsoff, T. Iwamoto, L.W. Knapp, P.R. Last, K. Matsuura, E.F.B. Miclat, J.A. Moore, T.A. Munroe, P.K.L. Ng, V.H. Niem, M. Nizinski, M.D. Norman, N.V. Parin, J.R. Paxton, J.M. Poutiers, J.E. Randall, B.C. Russell, K. Sasaki, D.G. Smith, W.F. Smith-Vaniz, G.E. Trono, M.W. Westneat, J.T. Williams, T. Wongratana, D. Woodland.

Our special thanks to the Minsalan family who helped during the Iloilo expedition (Mr N. Minsalan II, Mr N. Minsalan III, Mr N. Minsalan IV, Mrs C.L. Minsalan Carpenter of the N. Minsalan Marine Biological Laboratory, Iloilo) as well as the Taiwan Fisheries Research Institute for the donation of specimens for the workshop through the efforts of the 'RV Fisheries Research I' during her cruise to the Philippines at the time of the workshop.

Institutional Acknowledgements

We thank the following institutions for permission to include illustrations in this guide: the **Australian Biological Resources Study** (ABRS) for specified cephalopod drawings by K. Hollis published in *Fauna of Australia Vol. 5. Mollusca*; the **Muséum National d'Histoire Naturelle, Laboratoire de Biologie des Invertébrés Marins et Malacologie** for shrimp drawings provided by Dr A. Crosnier; **Taylor and Francis Publishers**, London, for drawings of the Draconettidae published in an article of the *Journal of Natural History* by Dr R. Fricke.

Project Management

P. Oliver (FAO, Rome).

Editorial Assistance

N. DeAngelis and M. Kautenberger-Longo (FAO, Rome).

Desktop Publishers

M. Kautenberger-Longo and N. DeAngelis (FAO, Rome).

Illustrators (for new illustrations appearing here)

E. D'Antoni (scientific illustrator), M. Sadeir (various finfish; corals, in part), C. Verdecchi (gastropods, in part), and S. Schiavoni (Chaetodontidae, in part): Marine Resources Service, Fishery Resources Division, Fisheries Department, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy.

E. D'Antoni (introduction maps).

R. Cada (seaweeds): ICLARM, Bloomingdale Bldg., Salcedo Street, Legaspi Village, Makati City, 0718, Philippines.

B. Duckworth (atheriniform fishes): School of Biological Sciences, Macquarie University, North Ryde, NSW 2109, Australia.

K. Hollis (cephalopods, in part): 33 Park Street, Trentham 3458, Vic., Australia.

S.H. Tan, K. Lim, C.K. Ow-Yong, O. Chia, H.H. Tan, D. Yeo (crabs): School of Biological Sciences, National University of Singapore, Kent Ridge, Singapore 119260, Singapore.

Authors that Provided their own Original Illustrations

J.H. Caruso, R. Fricke, A.C. Gill, H. Kishimoto, K. Matsuura, R.M. McDowall, R.J. McKay, R. Mooi, P.K.L. Ng, M.D. Norman, J.M. Poutiers, K. Sasaki, H. Senou, T. Wongratana.

Digitization of Distribution Maps

The base map of the WCP area and the method to digitize the distribution maps using a GIS software, were set up by the late B. Crescenzi and L. Garibaldi under the guidance of E. Ataman (FAO GIS Centre). The maps were digitized by E. Lucchetti.

List of Authors and their Affiliations

Allen, G.R., Department of Aquatic Zoology, Western Australian Museum, Francis Street, Perth, WA 6000, Australia. - **Apogonidae, Chandidae, Kurtidae, Lutjanidae, Pomacentridae, Toxotidae.**

Amaoka, K., Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University, Hakodate, Hokkaido 041, Japan. - **Bothidae, Paralichthyidae.**

Anderson, M.E., J.L.B. Smith Institute of Ichthyology, Private Bag 1015, Grahamstown, 6140, South Africa. - **Zoarcidae.**

Anderson, W.D. Jr., Grice Marine Biological Laboratory, 205 Fort Johnson, Charleston, South Carolina 29412, USA. - **Callanthiidae, Lutjanidae, Symphysanodontidae.**

Bagarinao, T., SEAFDEC Aquaculture Department, 5021 Tigbauan, Iloilo, Philippines. - **Chanidae.**

Bellwood, D.R., Department of Marine Biology, James Cook University, Townsville, Qld 4811, Australia. - **Scaridae.**

Böhlke, E.B., Department of Ichthyology, Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103-1195, USA. - **Muraenidae.**

Bradbury, M.G., Moss Landing Marine Laboratories, P.O. Box 450, Moss Landing, CA 95039-0450, USA. - **Ogcocephalidae.**

Cabanban, A.S., Borneo Marine Research Unit, University Malaysia Sabah, Locked Bag 2073, 88999 Kota Kinabalu, Sabah, Malaysia. - **Leiognathidae.**

- Carpenter, K.E., Department of Biological Sciences, Old Dominion University, Norfolk, VA 23529, USA. - **Acropomatidae, Caesionidae, Cichlidae, Emmelichthyidae, Girellidae, Kuhlidae, Lethrinidae, Lobotidae, Microcanthidae, Ostracoberycidae, Scorpididae, Sparidae.**
- Caruso, J.H., LUMCON Marine Center, 8124 Hwy. 56, Chauvin, LA 70344-2110, USA. - **Chaunacidae, Lophiidae.**
- Carvalho, M.R., de, Department of Ichthyology, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024, USA. - **Batoid fishes (Narcinidae).**
- Chan, T.Y., Institute of Marine Biology, National Taiwan Ocean University, 2 Pei-Ning Road, 20224 Keelung, Taiwan P.O.C. - **Lobsters, shrimps.**
- Cohen, D.M., P.O. Box 192, Bodega Bay, CA 94923, USA. - **Argentinidae, Bathylagidae, Microstomatidae, Opisthoproctidae.**
- Collette, B.B., National Marine Fisheries Service National Systematics Laboratory, National Museum of Natural History, Washington, DC 20560-0153, USA. - **Ammodytidae, Belonidae, Coryphaenidae, Echineidae, Hemiramphidae, Pomatomidae, Rachycentridae, Scombridae.**
- Compagno, L.J.V., Shark Research Center, Division of Life Sciences, South African Museum, 25 Queen Victoria Street, P.O. Box 61, Cape Town 8000, South Africa. - **Sharks, batoid fishes, chimaeras.**
- Conand, C., Laboratoire d'ecologie marine, Universite de La Reunion, 97715 Saint Denis, Messag, cedex 9, France. - **Holothurians.**
- Crowley, L.E.L.M., School of Biological Sciences, Macquarie University, North Ryde, NSW 2109, Australia. - **Atherinidae, Dentatherinidae, Isonidae, Pseudomugilidae, Telmatherinidae.**
- Dooley, J.K., Department of Biology, Adelphi University, Garden City, Long Island, NY 11530, USA. - **Branchiostegidae.**
- Dunning, M.C., Fisheries Group, Queensland, Department of Primary Industries, GPO Box 3129, Brisbane, Qld 4001, Australia. - **Cephalopods (Chiroteuthidae, Enoploteuthidae, Histioteuthidae, Idiosepiidae, Loliginidae, Mastigoteuthidae, Nautilidae, Ommastrephidae, Onychoteuthidae, Spirulidae, Thysanoteuthidae).**
- Eschmeyer, W.N., Department of Ichthyology, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118, USA. - **Dactylopteridae.**
- Feltes, R.M., 208 Westchester Way, Battle Creek, Michigan 49015-8694, USA. - **Polynemidae.**
- Fernholm, B., Swedish Museum of Natural History, P.O. Box 50007, S-104 05 Stockholm, Sweden. - **Hagfishes.**
- Ferraris, C.J. Jr., Department of Ichthyology, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118, USA. - **Gonorhynchidae, Plotosidae.**
- Fricke, R., Ichthyology, Staatliches Museum fur Naturkunde, Rosenstein 1, D-70191 Stuttgart, Germany. - **Callionymidae, Draconettidae, Trypterigiidae.**
- Fritzsche, R., Department of Fisheries, Humboldt State University, Arcata, California 95521, USA. - **Aulostomidae, Centriscidae, Fistulariidae, Macrorhamphosidae, Solenostomidae.**
- Gill, A.C., Department of Zoology, The Natural History Museum, Cromwell Road, London SW7 5BD, UK. - **Centrogeniidae, Pseudochromidae, Xenisthmidae.**
- Gon, O., J.L.B. Smith Institute of Ichthyology, Private Bag 1015, Grahamstown 6140, South Africa. - **Epigonidae.**
- Gomez, E., Marine Science Institute, University of the Philippines, U.P. P.O. Box 1, Diliman, 1101 Quezon City, Philippines. - **Sea turtles.**
- Greenfield, D.W., Department of Zoology, 2538 The Mall, Edmondson 152, University of Hawaii, Honolulu, HI 96822, USA. - **Batrachoididae, Holocentridae.**
- Harold, A.S., Grice Marine Biological Laboratory, College of Charleston, 205 Fort Johnson, Charleston, SC 29412. - **Astronesthidae, Chauliodontidae, Gonostomatidae, Malacosteidae, Melanostomiidae, Idiacanthidae, Phosichthyidae, Sternoptychidae, Stomiidae.**
- Harrison, I.J., Department of Ichthyology, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024, USA. - **Mugilidae.**
- Heemstra, P.C., J.L.B. Smith Institute of Ichthyology, Private Bag 1015, Grahamstown, 6140, South Africa. - **Caproidae, Drepanidae, Ephippidae, Grammicolepididae, Macruricyttidae, Parazenidae, Pentacerotidae, Scombroptidae, Serranidae, Zeidae.**
- Hensley, D.A., Department of Marine Sciences, University of Puerto Rico, Mayagüez, Puerto Rico 00680, USA. - **Bothidae, Citharidae, Paralichthyidae, Pleuronectidae, Psettodidae.**
- Hodgson, G., Institute for the Environment and Sustainable Development, Research Centre, Hong Kong University of Science and Technology, Clearwater Bay, Kowloon, Hong Kong, China. - **Corals.**
- Hulley, P.A., South African Museum, P.O. Box 61, 8000 Cape Town, South Africa. - **Myctophidae, Neoscopelidae.**
- Hutchins, B.J., Department of Aquatic Zoology, Western Australian Museum, Francis Street, Perth, Western Australia 6000, Australia. - **Arripidae, Enoplosidae, Gobiesocidae, Molidae, Monacanthidae.**
- Ivantsoff, W., School of Biological Sciences, Macquarie University, North Ryde, NSW 2109, Australia. - **Atherinidae, Dentatherinidae, Isonidae, Pseudomugilidae, Telmatherinidae.**
- Iwamoto, T., Department of Ichthyology, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118, USA. - **Bathygadidae, Bregmacerotidae, Macrouridae, Moridae.**
- Johnson, G.D., Division of Fishes, NHB WG 12, Smithsonian Institution, Washington, DC 20560, USA. - **Anomalopidae.**
- Kailola, P.J., 19 Walkers Avenue, Newnham, Tas 7248, Australia. - **Ariidae.**

- Kinze, C.C., SCIGTAS Institute of Marine Science, Burapha University Saen Suk, 20131 Chonburi, Thailand. - **Marine mammals.**
- Kishimoto, H., Institute of Oceanic Res. and Development, Tokai Univ., Orido, Shimizu, Shizuoka 424, Japan. - **Uranoscopidae.**
- Knapp, L.W., Division of Fishes, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, USA. - **Platycephalidae.**
- Kottelat, M., Case postale 57, 2952 Cornol, Switzerland. - **Monodactylidae, Scatophagidae.**
- Larson, H.K., Museums and Art Galleries of the Northern Territory, P.O. Box 4646, Darwin, NT 0801, Australia. - **Centropomidae, Clinidae, Eleotridae, Gobiidae, Kraemeriidae, Microdesmidae, Schindleriidae.**
- Last, P.R., CSIRO, Division of Marine Research, GPO Box 1538, Hobart, Tas 7001, Australia. - **Batoid fishes, Amarsipidae, Ariommatidae, Bramidae, Leptoscopidae, Nomeidae, Stromateidae, Tetragonuridae.**
- Leis, J.M., Section of Fishes, Division of Vertebrate Zoology, and Centre for Biodiversity and Conservation Research, Australian Museum, 6 College Street, Sydney South, NSW 2000, Australia. - **Diodontidae, Lactariidae.**
- Markle, D.F., Department of Wildlife and Fisheries, Oregon State University, Corvallis, OR 97331, USA. - **Alepocephalidae.**
- Matsuura, K., Fish Section, National Science Museum, 3-23-1 Hyakunin-cho, Shinjuku-ku, Tokyo 169, Japan. - **Balistidae, Ostraciidae, Tetraodontidae, Triacanthidae, Triacanthodidae, Triodontidae.**
- Manning, R.B., IZ-NHB 163, Smithsonian Institution, Washington, DC 20560, USA. - **Stomatopods.**
- McCosker, J.E., California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118, USA. - **Muraenidae, Ophichthidae.**
- McDowall, R.M., National Institute of Water and Atmospheric Research, P.O. Box 8602, Christchurch, New Zealand. - **Centrolophidae.**
- McGrouther, M.A., Fish Section, Australian Museum, 6 College St, Sydney NSW 2000, Australia. - **Hoplichthyidae.**
- McKay, R.J., Museum of North-Western Queensland, P.O. Box 280, Mount Isa, Qld 4825, Australia. - **Glaucosomatidae, Haemulidae, Sillaginidae.**
- Miclat, E.F.B., Marine Science Institute, University of the Philippines, U.P. P.O. Box 1, Diliman, 1101 Quezon City, Philippines. - **Marine turtles.**
- Mooi, R., Milwaukee Public Museum, 800 West Wells Street, Milwaukee, WI 53233-1478, USA. - **Chiasmodontidae, Leptobramidae, Notograptidae, Pempheridae, Plesiopidae.**
- Moore, J.A., National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543, USA. - **Ateleopodidae, Melamphaidae, Trachichthyidae.**
- Moteki, M., Laboratory of Ichthyology, Tokyo University of Fisheries, 4-5-7 Konan, Minato-ku, Tokyo 108, Japan. - **Bramidae.**
- Munroe, T.A., National Marine Fisheries Service National Systematics Laboratory, National Museum of Natural History, Washington, DC 20560-0153, USA. - **Chirocentridae, Clupeidae, Cynoglossidae, Engraulidae, Pristigasteridae, Soleidae.**
- Murdy, E.O., Division of International Programs, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230, USA. Present address: Tokyo Regional Office, National Science Foundation, 1-10-5, Akasaka, Minato-ku, Tokyo 107, Japan. - **Eleotridae, Gobiidae.**
- Nakamura, I., Fisheries Research Station, Kyoto University Maizuru, Kyoto 625, Japan. - **Gempyliidae, Istiophoridae, Scombrobracridae, Trichiuridae, Xiphiidae.**
- Nelson, J.S., Department of Biological Sciences, University of Alberta, Edmonton, Alberta T6G 2E9, Canada. - **Creediidae, Percophidae, Psychrolutidae, Trichonotidae.**
- Nemeth, D., Coral World, 6450 Coki Point, St. Thomas, USVI 00802, USA. - **Champsodontidae.**
- Ng, P.K.L., School of Biological Sciences, National University of Singapore, Kent Ridge, Singapore 119260, Singapore. - **Crabs.**
- Nielsen, J.G., Zoologisk Museum, Universitetsparken 15, DK-2100 Copenhagen, Denmark. - **Aphyonidae, Bythitidae, Carapidae, Ophidiidae.**
- Niem, V.H., Marine Resources Service, Fishery Resources Division, Fisheries Department, FAO, Viale Terme di Caracalla, 00100 Rome, Italy. - **Sharks (in part), Alepisauridae, Anotopteridae, Aulopidae, Chlorophthalmidae, Evermannellidae, Giganturidae, Ipnopidae, Notosudidae, Omosudidae, Paralepididae, Scopelarchidae.**
- Nizinski, M.S., National Marine Fisheries Service National Systematics Laboratory, National Museum of Natural History, Washington, DC 20560-0153, USA. - **Chirocentridae, Clupeidae, Engraulidae, Pristigasteridae.**
- Norman, M.D., Department of Zoology, University of Melbourne, Parkville, Vic 3052, Australia. - **Cephalopods (Octopodidae, Sepiadiariidae, Sepiolidae).**
- Olney, J.E., Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA 23062, USA. - **Lamprididae, Lophotidae, Radiicephalidae, Regalecidae, Stylephoridae, Trachipteridae, Veliferidae.**
- Palsson, W.A., Washington Department of Fish and Wildlife, 16018 Mill Creek Boulevard, Mill Creek, WA 98012-1296, USA. - **Pegasidae.**
- Parenti, L.R., Division of Fishes, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, USA. - **Adrianichthyidae, Aplocheilidae, Phallostethidae, Poeciliidae.**

- Parin, N.V., P.P. Shirshof Institute of Oceanology, Russian Academy of Sciences, 117851 Pr. Nakhimova 36, Moscow, Russia. - **Exocoetidae, Gempylidae, Scombrolabracidae, Trichiuridae.**
- Paxton, J.R., Fish Section, Australian Museum, 6 College St., Sydney, NSW 2000, Australia. - **Hagfishes, Alepisauridae, Anomalopidae, Anoplogastridae, Anotopteridae, Argentinidae, Aulopidae, Barbourisiidae, Bathyclupeidae, Bathylagidae, Berycidae, Caristiidae, Cetomimidae, Chiasmodontidae, Chlorophthalmidae, Diretmidae, Evermannellidae, Gibberichthyidae, Giganturidae, Ipnopidae, Megalomyceteridae, Melamphaidae, Microstomatidae, Mirapinnidae, Monocentridae, Myctophidae, Neoscopelidae, Notosudidae, Omosudidae, Opisthoproctidae, Paralepididae, Polymixiidae, Rondeletiididae, Scopelarchidae, Trachichthyidae.**
- Paulus, T., DVWK - GFG, Gemeinnützige Fortbildungsgesellschaft für Gewässerpflege mbH, Frauenlobplatz 2, D-55118 Mainz, Germany. - **Syngnathidae.**
- Pietsch, T.W., School of Fisheries, 1140 Boat Street, University of Washington, Box 355100, Seattle, WA 98195-5100, USA. - **Antennariidae, Caulophrynididae, Centrophrynididae, Ceratiidae, Diceratiidae, Gigantactinidae, Himantolophidae, Linophrynididae, Lophichthyidae, Melanocetidae, Neoceratiidae, Oneirodidae, Tetrabrachiidae, Thaumachichthyidae.**
- Poss, S.G., Gulf Coast Research Laboratory, P.O. Box 7000, Ocean Springs, MS 39566-7000, USA. - **Aploactinidae, Bembridae, Caracanthidae, Dactylopteridae, Scorpaenidae.**
- Poutiers, J.M., Laboratoire de Biologie des Invertébrés Marins et Malacologie, Muséum National d'Histoire Naturelle, Ura 699 - CNRS, 55, Rue Buffon, 7500, Paris, France. - **Bivalves, gastropods.**
- Premcharoen, S., Faculty of Liberal Arts and Science, Kasetsart University, Kamphaengsaen Campus, Nakorn Pathom 73140, Thailand. - **Leiognathidae.**
- Pyle, R.L., Ichthyology, B.P. Bishop Museum, 1525 Bernice Street, Honolulu, HI 96817-0916, USA. - **Chaetodontidae, Pomacanthidae.**
- Randall, J.E., 45-1033 Pahuwai Pl., Kaneohe, HI 96744, USA. - **Acanthuridae, Albulidae, Cheilodactylidae, Cirrhitidae, Holocentridae, Mullidae, Pinguipedidae, Serranidae, Zanclidae.**
- Rasmussen, A.R., Zoologisk Museum, Universitetsparken 15, DK-2100 Copenhagen, Denmark. - **Sea snakes.**
- Reid, A.L., Museum of Victoria, Natural Sciences, Invertebrate Zoology, 328 Swanston St. Melbourne, Australia 3000, Australia. - **Cephalopods (Sepiadariidae, Sepiidae, Sepiolidae).**
- Richards, W.J., Southeast Fisheries Science Center, NOAA, 75 Virginia Beach Drive, Miami, FL 33149, USA. - **Triglidae.**
- Rosenzweig, P.A., Wildlife Management International Pty. Ltd., P.O. Box 530, Sanderson, Nt 0812, Australia. - **Estuarine crocodiles.**
- Russell, B.C., Museums and Art Galleries of the Northern Territory, P.O. Box 4646, Darwin, NT 0801, Australia. - **Bathysauridae, Nemipteridae, Synodontidae.**
- Sakai, K., Nature Conservation Division, Environment Department, Ishikawa Prefectural Government, 2-1-1 Hirosaka, Kanazawa 920, Japan. - **Kyphosidae.**
- Sasaki, K., Department of Biology, Faculty of Science, Kochi University, Akebono, Kochi 780, Japan. - **Sciaenidae.**
- Sazonov, Y.I., Zoological Museum, Moscow State University, Herzen St 6, Moscow K-9, Russia 103009. - **Alepocephalidae, Platytroctidae.**
- Senou, H., Kanagawa Prefectural Museum, Naku-ku, Yokohama, Kanagawa 231, Japan. - **Mugilidae, Sphyrnaeidae.**
- Smith, D.G., Division of Fishes, National Museum of Natural History, Washington, DC 20560, USA. - **Albulidae, Anguillidae, Chlopsidae, Colococongridae, Congridae, Cyematidae, Derichthyidae, Elopidae, Eurypharyngidae, Halosauridae, Lipogenidae, Megalopidae, Monognathidae, Moringuidae, Muraenesocidae, Muraenidae, Myrocongridae, Nemichthyidae, Nettastomidae, Notacanthidae, Ophichthidae, Saccopharyngidae, Serrivomeridae, Synaphobranchidae.**
- Smith-Vaniz, W.F., U.S. Geological Survey, Biological Resources Division, 7920 NW 71st Street, Gainesville, FL 32653-3071, USA. - **Carangidae, Cepolidae, Opisthognathidae.**
- Springer, V.G., Museum of Natural History, MRC 159 Washington, DC 20560, USA. - **Blenniidae, Pholidichthyidae.**
- Starnes, W.C., North Carolina State Museum of Natural Sciences, P.O. Box 29555, Raleigh, NC 27626, USA. - **Priacanthidae.**
- Thiesfeld, K.G., Department of Fisheries, Humboldt State University, Arcata, California 95521, USA. - **Aulostomidae, Centriscidae, Fistulariidae, Macrorhamphosidae, Solenostomidae.**
- Trono, G.C., Jr., Marine Science Institute, University of the Philippines, U.P. P.O. Box 1, Diliman, 1101 Quezon City, Philippines. - **Seaweeds.**
- Vari, R.P., Division of Fishes, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, USA. - **Terapontidae.**
- Westneat, M.W., Department of Zoology, Field Museum of Natural History, Roosevelt Rd at Lakeshore, Chicago, IL 60605, USA. - **Labridae.**
- Williams, J.T., Division of Fishes, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, USA. - **Tripterygiidae.**
- Wongratana, T., Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand. - **Chirocentridae, Clupeidae, Engraulidae, Pristigasteridae.**
- Woodland, D., Zoology Department, University of New England, Armidale NSW 2351, Australia. - **Gerreidae, Leiognathidae, Menidae, Siganidae.**

Table of Contents

	Page
INTRODUCTION	1
SEAWEEDS	19
General Remarks	20
Glossary of Technical Terms	20
Key to Divisions	25
Keys to Genera and Common and Economically Important Species Occurring in the Area	25
List of Families and Common and Economically Important Species Occurring in the Area	35
References	37
Class CHLOROPHYTA	38
Order ULVALES	38
Ulvaceae	38
Order SIPHONOCLEDALES	41
Valoniaceae	41
Order BRYOPSIDALES	42
Caulerpaceae	42
Codiaceae	49
Halimedaceae	52
Udoteaceae	54
Order DASYCLADALES	58
Dasycladaceae	58
Polyphysaceae	60
Class PHAEOPHYTA	61
Order DICTYOTALES	61
Dictyotaceae	61
Order SCYTOSIPHONALES	65
Scytosiphonaceae	65
Order FUCALES	66
Sargassaceae	66
Class RHODOPHYTA - Subclass FLORIDEOPHYSIDAE	76
Order NEMALIALES	76
Helminthocladiaceae	76
Order BONNEMAISONIALES	77
Bonnemaisoniaceae	77
Galaxauraceae	78
Order GELIDIALES	79
Gelidiaceae	79
Order CYPTONEMIALES	80
Cryptonemiaceae	80
Order CORALLINALES	82
Corallinaeaceae	82
Order GIGARTINALES	83
Rhizophyllidaceae	83
Gracilariaceae	84
Solieriaceae	90
Order CERAMIALES	96
Rhodomelaceae	96
CORALS	101
Structure and Terminology	102
Glossary of Technical Terms	103
General Remarks	104
Key to Commonly Traded Species of Scleractinia Occurring in the Area	104
Non-Scleractinian Corals of Interest to Fisheries Occurring in the Area	107
List of Commonly Traded Corals Occurring in the Area	108

	Page
Class ANTHOZOA	109
Order SCLERACTINIA	109
Pocilloporidae	109
Acroporidae	110
Agariciidae	112
Caryophylliidae	113
Faviidae	113
Fungiidae	114
Merulinidae	117
Mussidae	118
Pectiniidae	119
Pocilloporidae	119
Order COENOTHECALIA	121
Helioporidae	121
Order STOLONIFERA	122
Tubiporidae	122
Class HYDROZOA	109
Order MILLEPORINA	122
Milleporidae	122
BIVALVES	123
General Remarks	124
Glossary of Technical Terms	125
Identification Note	127
Key to Families	128
List of Families and Species of Interest to Fisheries Occurring in the Area	136
Arcidae	142
Cucullaeidae	158
Noetiidae	159
Glycymerididae	161
Mytilidae	165
Pinnidae	176
Pteriidae	181
Isognomonidae	190
Malleidae	194
Pectinidae	198
Spondylidae	211
Placunidae	216
Limidae	220
Gryphaeidae	222
Ostreidae	224
Lucinidae	234
Fimbriidae	242
Chamidae	245
Carditidae	248
Cardiidae	250
Hemidonacidae	261
Tridacnidae	263
Mactridae	273
Mesodesmatidae	282
Solenidae	284
Tellinidae	290
Donacidae	299
Psammobiidae	305
Solecurtidae	312
Corbiculidae	315
Veneridae	320

	Page
Glauconomidae	353
Pholadidae	354
Teredinidae	359
Laternulidae	361
GASTROPODS	363
General Remarks	364
Glossary of Technical Terms	365
Identification Note	367
Key to Families	367
List of Families and Species of Interest to Fisheries Occurring in the Area	376
Haliotidae	383
Lottiidae	390
Patellidae	394
Trochidae	399
Turbinidae	409
Neritidae	420
Littorinidae	431
Cerithiidae	437
Potamididae	448
Turritellidae	455
Vermetidae	458
Strombidae	462
Xenophoridae	484
Cypraeidae	486
Ovulidae	507
Naticidae	509
Tonnidae	522
Ficidae	530
Cassidae	532
Ranellidae	538
Personidae	547
Bursidae	549
Muricidae	553
Buccinidae	572
Columbellidae	575
Nassariidae	576
Melongenidae	582
Fasciolaridae	587
Colubrariidae	593
Volutidae	594
Harpidae	599
Turbinelliidae	603
Olividae	607
Mitridae	613
Costellariidae	616
Conidae	618
Turridae	629
Terebridae	632
Architectonicidae	637
Dolabellidae	639
Melampidae	641
Siphonariidae	646
INDEX	649

An Introduction to the Oceanography, Geology, Biogeography, and Fisheries of the Tropical and Subtropical Western and Central Pacific

by K.E. Carpenter

Introduction

The coverage of this identification guide is remarkable both in terms of the area encompassed and the diversity of marine resources. FAO Fishing Area 71 includes large maritime portions of 3 major geopolitical entities: most of Southeast Asia, the northeastern quadrant of Australia, and the South Pacific Islands. For this guide, we expand coverage beyond Fishing Area 71 to include all of the fishing grounds covered by the South Pacific Commission (Fig. 1). The area covered is diverse culturally, politically, and geographically, and includes 32 countries and territories (Fig. 2), 14 major seas and gulfs, and numerous island chains (Fig. 3). In terms of longitudinal coverage, the area is roughly

between 98° E and 122° W, or a total of nearly 40% of the earth's equatorial circumference. This expanded Fishing Area 71 is a nearly complete coverage of 2 natural biogeographic units, the Western Pacific and the Pacific Plate regions, that can be collectively termed the Western Central Pacific (**WCP**). It has the richest diversity of marine species in the world. It does not cover the Hawaiian Islands and Johnston Island, which are clearly tropical western Pacific in their biogeographical affinities. These excluded islands exhibit a high degree of endemism that would substantially increase the species coverage of this guide. In addition, there are already a number of excellent guides that cover the marine flora and fauna of the Hawaiian Islands.

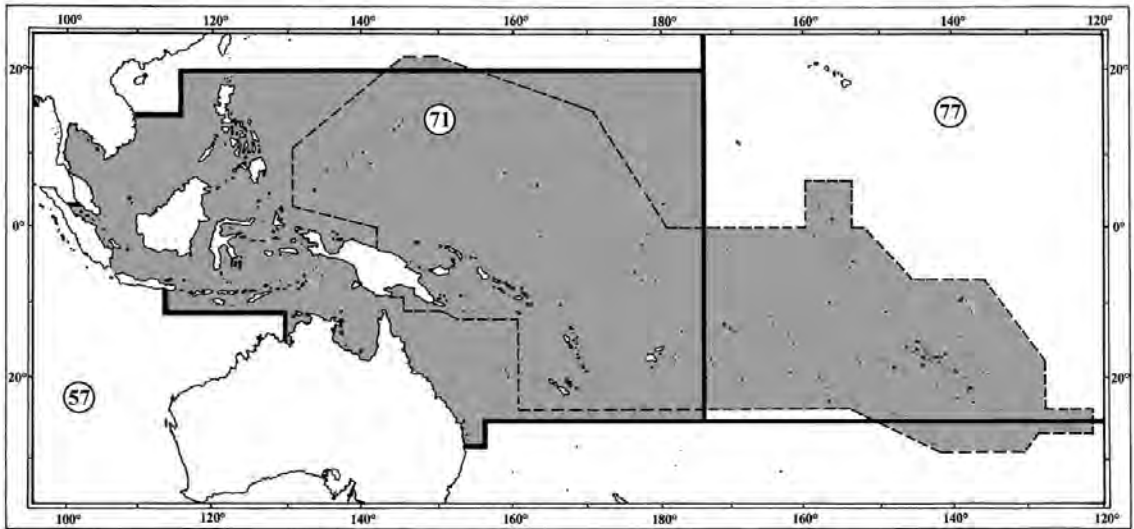


Fig. 1 Area covered by this guide (shaded): FAO Fishing Area 71 plus the South Pacific Commission Area (enclosed by dotted lines)

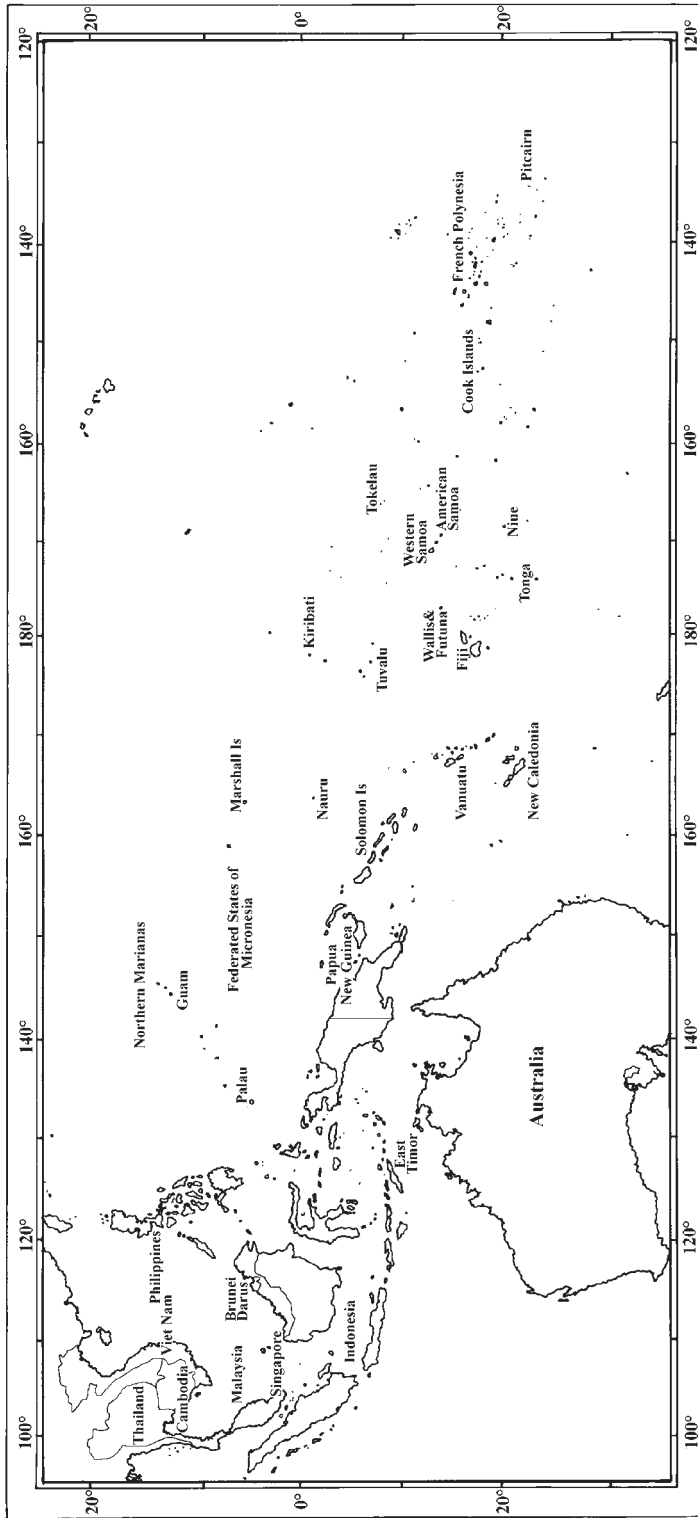


Fig. 2 The countries of the Western Central Pacific

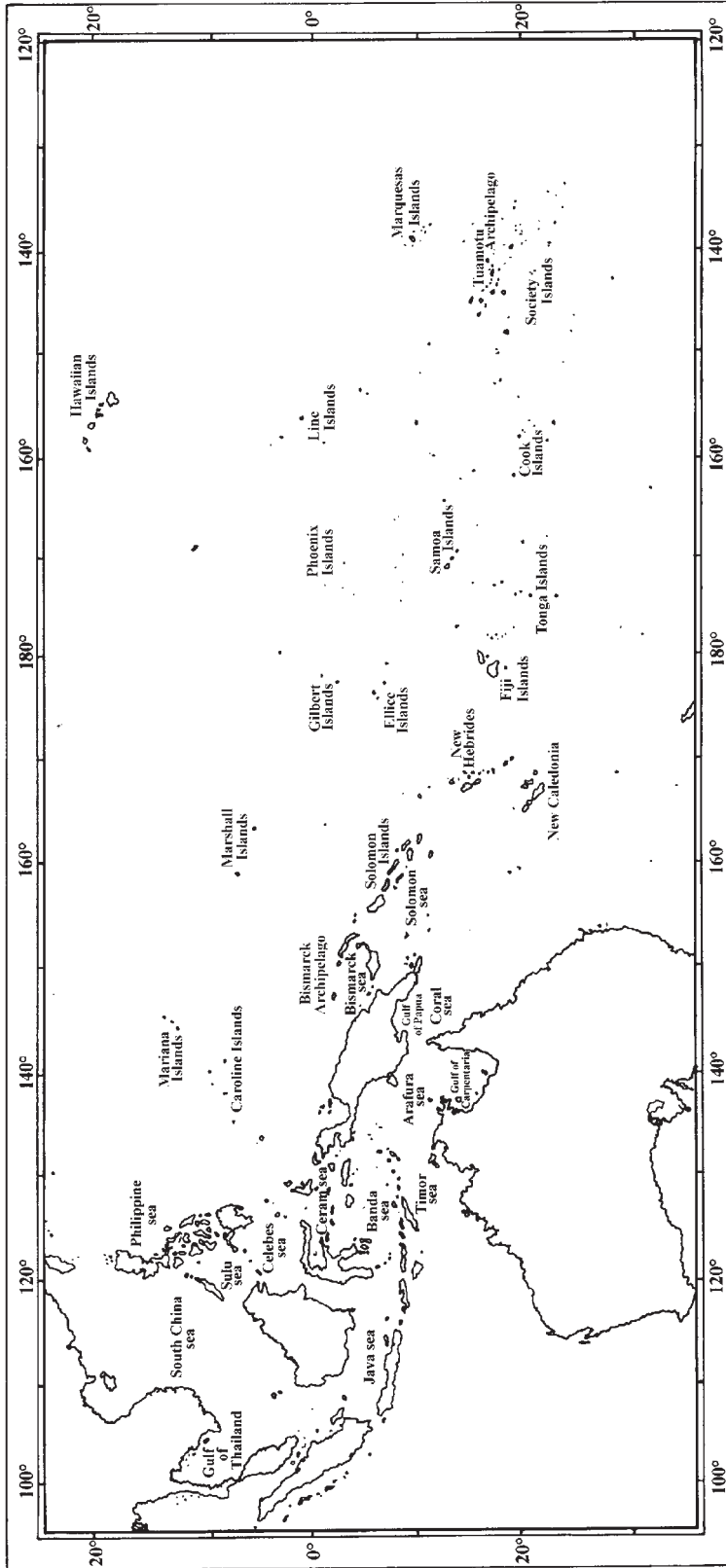


Fig. 3 The major seas, gulfs, and island groups of the Western Central Pacific

Oceanography

Winds and Currents

Two major wind patterns largely influence the currents of the WCP: trade winds and monsoons. Trade winds dominate in the Central Pacific (Fig. 4a) while monsoon patterns dominate the western Pacific. Trade winds are caused by warm air rising above hot equatorial regions which is deflected by the rotation of the earth from west to east. Consequently, air is drawn toward the equator where it is hottest and deflected toward the west because of the earth's rotation. Therefore, trade winds flow from the northeast in the tropical northern hemisphere and from the southeast in the tropi-

cal southern hemisphere. These in turn push water from east to west (Fig. 4b) in 2 huge gyres north and south of the equator. These primary currents are called the North and South Equatorial Currents. They cause water to build up in the western part of the Pacific. To redress this, the Equatorial Counter-current flows eastward inbetween the North and South Equatorial Currents along the equator. As the North Equatorial Current encounters the Philippines, it flows partly into the Celebes Sea, but mostly flows northward and becomes a major warm current, the Kuroshio. In the West, the South Equatorial Current mostly flows southward along the coast of Australia to become the Eastern Australia Current, but it also partially flows into the seas north of Australia.

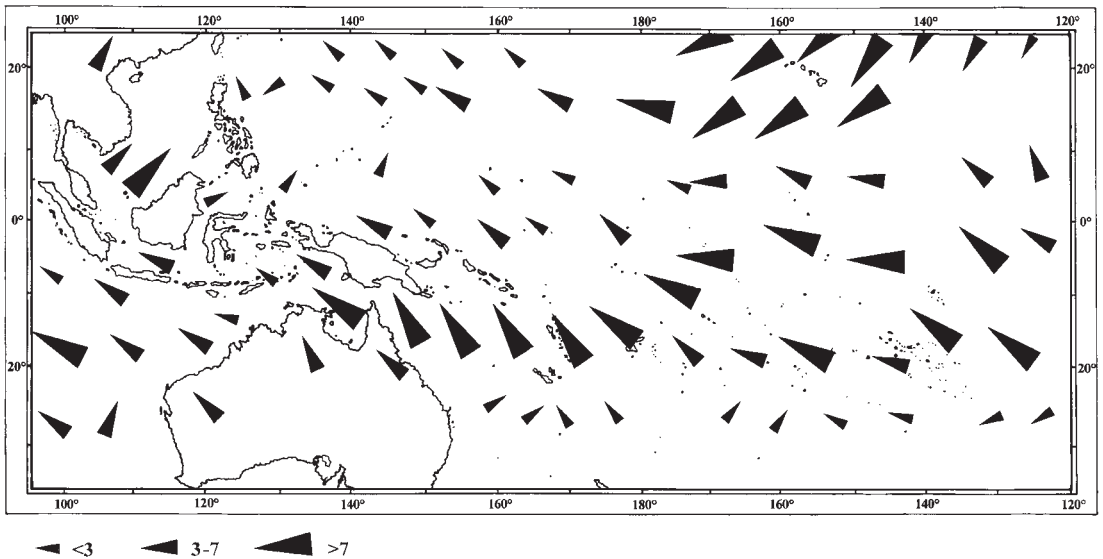


Fig. 4a Major wind patterns in July (meters/second)

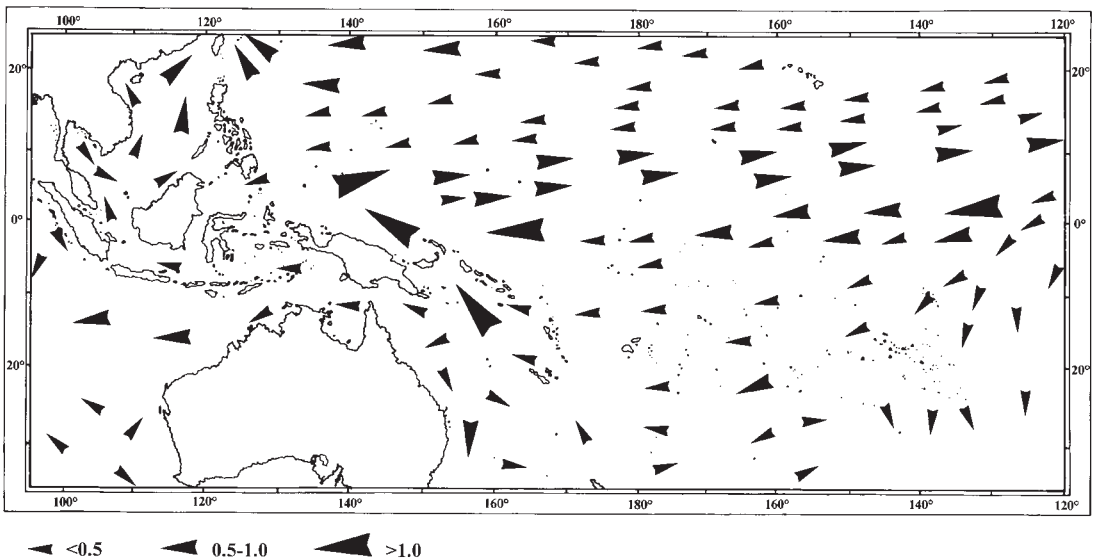


Fig. 4b Ocean currents in July (knots)

In the western Pacific, monsoon winds influence the flow of water around Southeast Asia and northern Australia. From around May to October the Southwest Monsoon is a result of cool ocean air flowing toward the warm Asian continent (Fig. 4a). At this time, air flows in a northeasterly direction over Southeast Asia and in a northwesterly direction over the Australian continent. This pushes water mostly in a westerly direction in the Arafura, Timor, Banda, and Java seas and mostly in a northeasterly direction in the South China Sea (Fig. 4b). From around November to April

the Northeast Monsoon prevails, which is a result of cool continental air flowing toward the relatively warmer Indian Ocean (Fig. 5a). This causes winds to predominately blow toward the south and southwest, around Southeast Asia and northern Australia. The currents subsequently flow in the opposite direction from those of the Southwest Monsoon (Fig. 5b). In the South China Sea flow is predominantly southwest, and in the Java, Banda, Timor, and Arafura seas flow is mostly east.

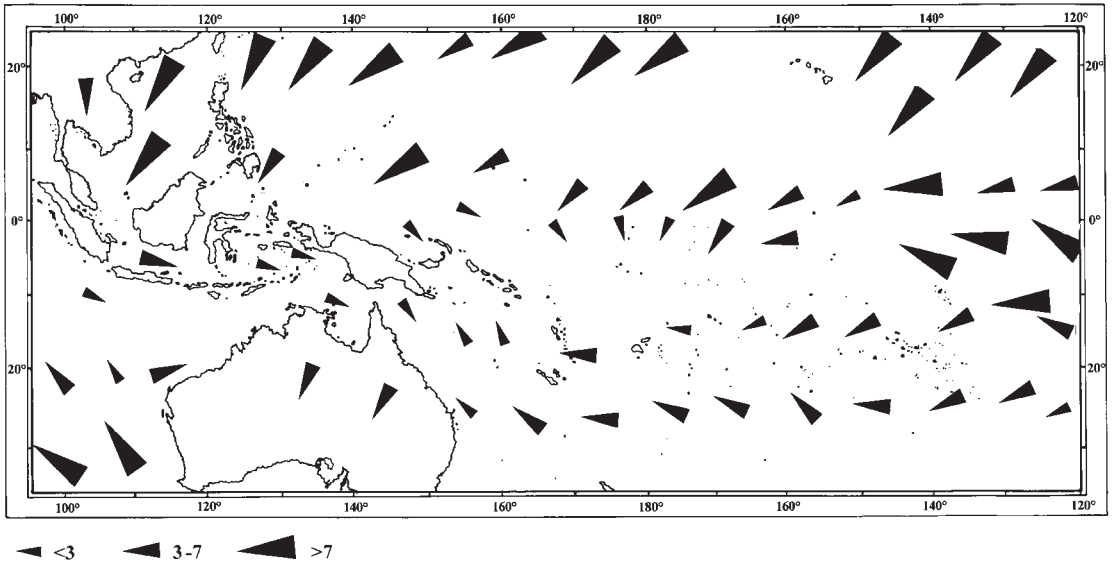


Fig. 5a Major wind patterns in January (meters/second)

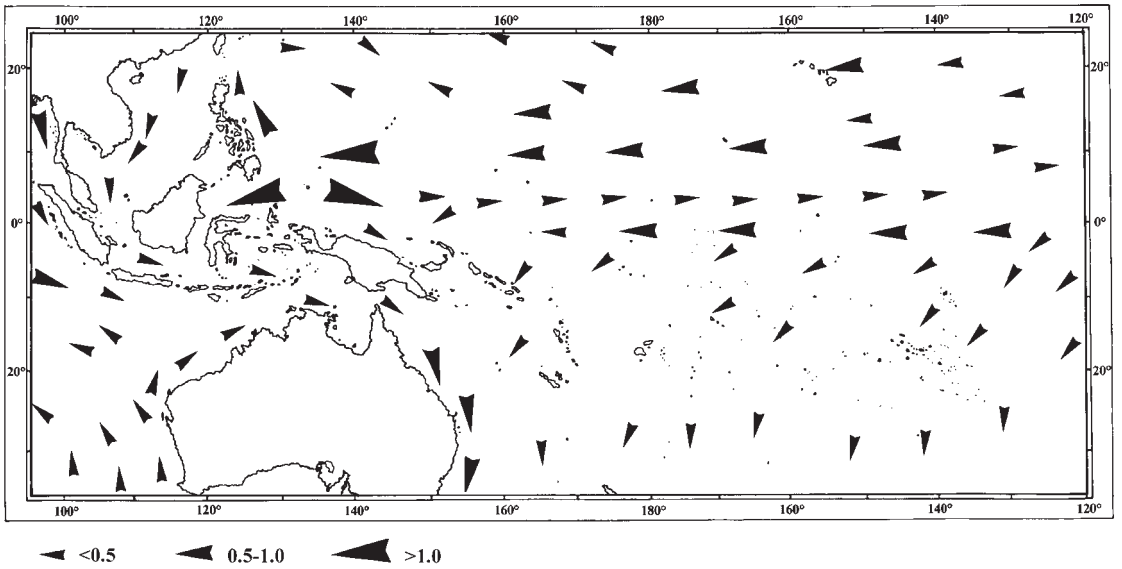


Fig. 5b Major ocean currents in January (knots)

Patterns of Productivity

The great open expanse of the tropical Pacific Ocean is, for the most part, a vast desert in terms of productivity. Its primary production, on the average, is among the lowest of all habitats. Tropical and subtropical open ocean primary productivity is typically around 40 g of Carbon per square meter per year ($\text{gC}/\text{m}^2/\text{yr}$) which is around 1/3 the primary productivity of open ocean temperate regions. This is because the constant warm conditions in the tropics keep a consistent thermal stratification in the upper layer of the ocean throughout the year preventing mixing with lower, cooler, nutrient-rich water. However, in upwelling areas and coastal areas, including waters near oceanic islands, nutrients in upper sunlit layers of the ocean are more plentiful and yearly primary productivity is much

higher (Fig. 6). Along the equator in the Central Pacific is an area of upwelling of nutrient-rich deeper water caused by the diverging flow of the North Equatorial Current and the Equatorial Countercurrent. This area has higher primary productivity than most of the surrounding open ocean. The area around and between northern Australia and Southeast Asia also has a significant inflow of nutrients from terrestrial runoff, and rich, shallow sediments from which nutrients can be drawn. Consequently, the primary production around these areas is high.

The secondary productivity from zooplankton in the Western Central Pacific (Fig. 7) roughly mirrors the pattern of primary productivity. Highest zooplankton production is found in the Southeast Asian, coastal, and Central Pacific upwelling areas.

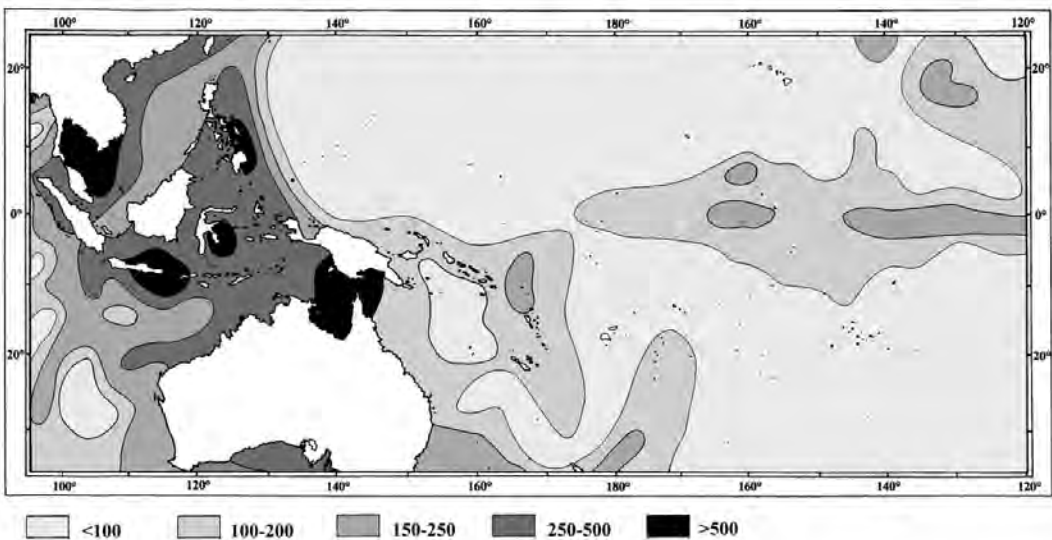


Fig. 6 Primary productivity from phytoplankton ($\text{gC}/\text{m}^2/\text{yr}$) (after FAO, 1981)

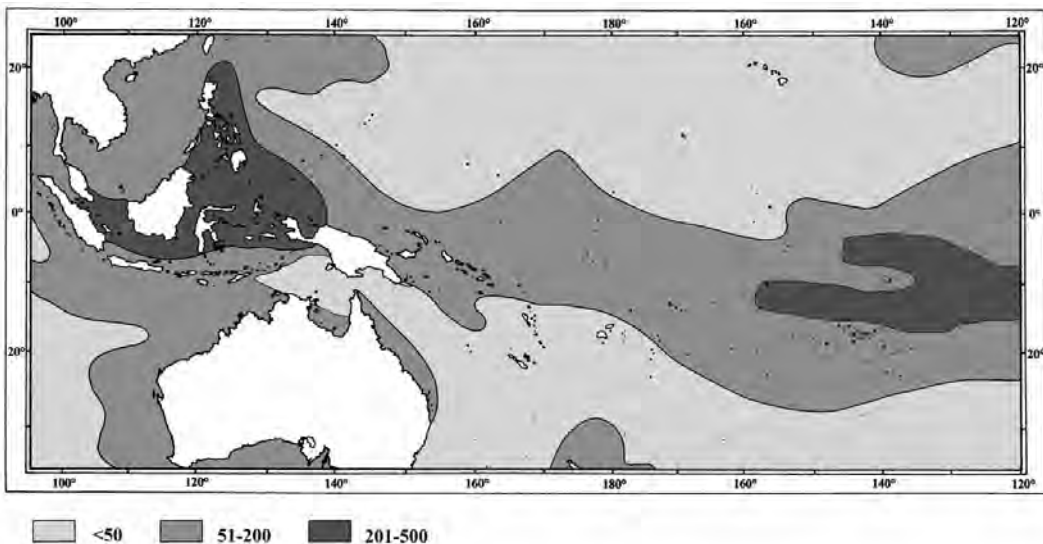


Fig. 7 Secondary productivity from zooplankton (mg/m^3) (after FAO, 1981)

The Western Central Pacific hosts the most extensive tropical continental shelf area (depths shallower than 200 m) of the world (Fig. 8). Continental shelf regions typically support the most highly productive communities. The standing crop of the benthos (Fig. 9) reflects the depth and patterns of phytoplankton and zooplankton production. Nearshore shallow areas typically have greater nutrient availability and support high benthic primary and secondary production. Deeper areas rely on primary production occurring in the upper layers of the ocean. This rain of food from above passes through a number of trophic levels. The deep ocean floor areas are also limited by physical factors such as low temperatures and high pressure. Consequently, annual secondary production is generally lower than in coastal areas.

In contrast to the depauperate open ocean, coastal habitats in the tropics attain very high primary production. The coral reefs, seaweed beds, estuaries, and mangrove swamps that dominate the shorelines of the WCP typically attain primary productivity values of between 800 and 1 000 $\text{gC}/\text{m}^2/\text{yr}$. This is around 20 to 25 times more productive than the tropical open ocean. These habitats are able to attain high productivity, even in oceanic islands surrounded by nutrient poor water by efficiently fixing and recycling nutrients locally within their ecosystems. In addition to high production, these critical coastal habitats are host to an extremely high diversity of marine organisms. The extensive continental shelf area around Southeast Asia is also very productive, attaining primary productivity values over 200 $\text{gC}/\text{m}^2/\text{yr}$. This supports the soft-sediment benthic offshore habitats of the region.

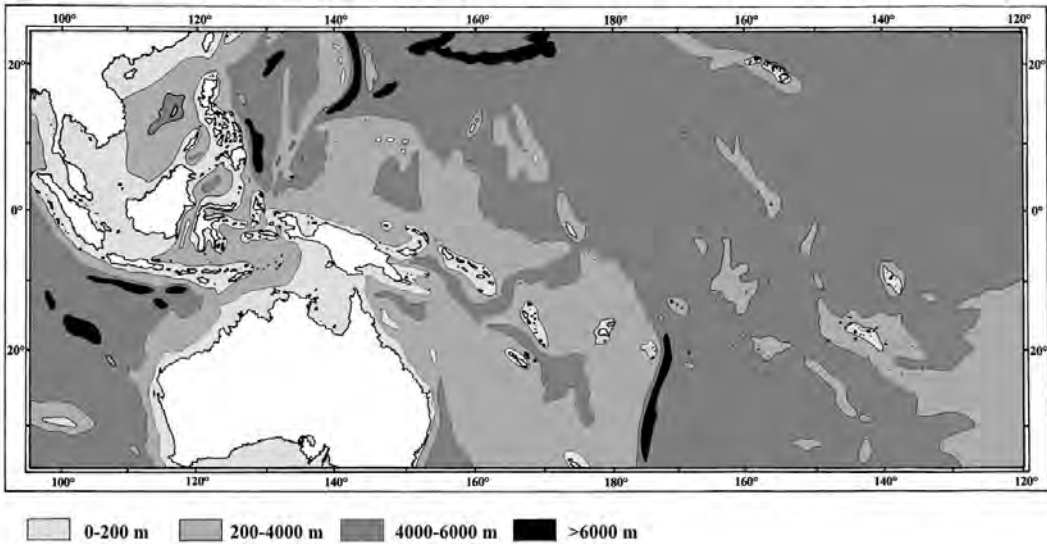


Fig. 8 Depth patterns

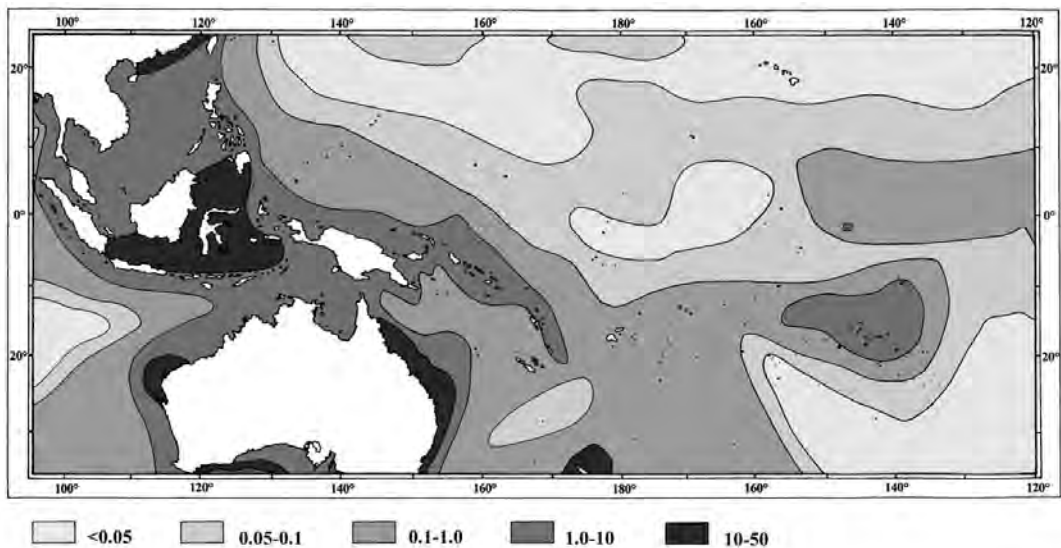


Fig. 9 Benthic standing crop (g/m^2) (after Couper, 1990)

Geology

Four major lithospheric plates dominate the geology of the western and central Pacific (Fig. 10). These include the Pacific, Philippine, Indian-Australian, and Eurasian plates. The Pacific Plate, currently the largest of the earth's lithospheric plates, commenced formation about 190 million years ago (Uyeda, 1977). After the breakup of Gondwanaland this plate greatly expanded westward. It currently moves in a west-northwest direction, although 43 million years ago it moved in a northwest direction. The Pacific Plate collides with and subducts the other 3 plates along its western edge. This area of subduction produces the volcanism that created the characteristic island archipelagoes of the western margin of the Pacific Plate. Subduction also results in a rim of deep trenches along the western margin (Fig. 8). The oldest rocks on the Pacific Plate are along its western edge and are from the upper Jurassic and lower Cretaceous (older rocks existed but have been subducted). The islands on the plate formed by magma welling up from the mantle through fault lines and from mantle "hot spots" onto the ocean floor. Subduction, cooling of the plate from east to west, and convection currents in the mantle all possibly contribute to the deepening of the seafloor toward the western rim. This, and the west-northwesterly movement of the plate ceases islands to sink at the northwestern points of many island chains.

The Philippine Plate originated more than 50 million years ago (Hall, 1996) and is presently moving westward. The western edge of the Philippine Plate is subsiding and is an area of deep trenches, volcanism, and island chain formation on the adjacent Eurasian Plate resulting in many of the Philippine Islands.

The Pacific and Philippine plates bear only islands while the Indian-Australian and Eurasian

Plates bear large continental crusts and associated continental shelves. Relative to 65 million years ago (Fig. 11), the Australian continent has moved a considerable distance northward toward the Eurasian continent. During this time, the Australian continent has traversed the Indian Ocean bringing the Australian-New Guinean land masses close to Southeast Asia. As early as the Jurassic, continental blocks rifted from northern Australia (Audley-Charles, 1988). These blocks collided with, and now contribute to the Laurasian continental crust, including parts of Southeast Asia from southern Tibet to Malaya, parts of Borneo, Sumatra, and islands of West Sulawesi and Banda. Other interpretations of the geological events in this region exist (e.g., Metcalfe, 1988). However, it appears that at least one wave of Gondwana-origin continental crust migrated north and collided with Laurasia in the Southeast Asian region prior to the approach of Australia-New Guinea. The Indian-Australian Plate is subsiding under the Eurasian Plate and along this border trenches, volcanism, and island formation are also contributing to the Indonesian Archipelago. The region between Australia and the Eurasian continent encompasses extensive continental shelves, including the Sunda Shelf on the Eurasian Plate, and the Arafura Shelf on the Indian-Australian Plate.

Biogeography: Distribution and Diversity

The Indo-Pacific Region

Historically, the science of biogeography has gone through a descriptive phase, and a more recent phase centred around a debate on the relative contribution of dispersal versus vicariance. The descriptive phase involved the delineation of areas, called realms, regions, or provinces. Each of these biogeographic areas contains an assemblage of organisms that is distinct, to varying degrees, from assemblages in other areas. Often within each of

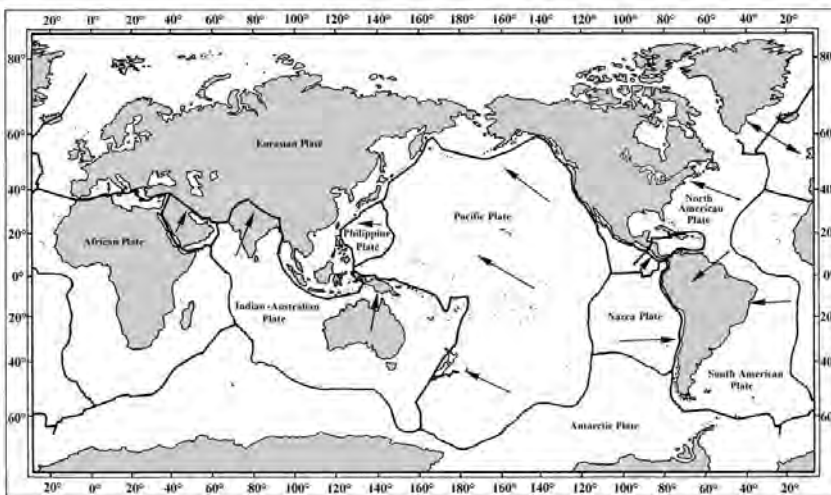


Fig. 10 Major lithospheric plates of the world

the larger biogeographic units are identified subareas of distinct endemism, or areas in which a number of species distributions are restricted. For largely historical reasons, but also because of geology and ecology, the biogeography of the terrestrial and marine regions of the Pacific Ocean were circumscribed differently (Kay, 1980).

The area covered by this guide, the Western Central Pacific, is part of a larger marine biogeographical area called the Indo-Pacific. This larger area includes mostly the tropical and subtropical regions of the Indian Ocean (including the Red Sea and the Persian Gulf) eastward to the central Pacific Ocean through Polynesia to Easter Island. Ekman (1953) distinguished between eastern Pacific and western Pacific faunas and hypothesized the vast ocean expanse between Polynesia and the Americas as the East Pacific Barrier separating the 2 provinces. He named the area we call the Indo-Pacific as the Indo-West Pacific. Current usage (e.g., Myers, 1989) often restricts the term West Pacific to the waters around Southeast Asia eastward to Samoa. The term Central Pacific or Pacific Plate is often used for the central oceanic islands of the Pacific. Springer (1982) presented convincing evidence to recognize the Pacific Plate as a major subregion of the Indo-Pacific. We use the term Western Central Pacific as a practical shorthand to describe the area covered here, that is, the tropical and subtropical West Pacific and Central Pacific (Pacific Plate), minus the Hawaiian Islands.

Vicariance and Dispersal

Much of the discussion in the last 20 years in biogeography has centred around the relative contributions of vicariance or dispersal as causal mechanisms in determining the distributions of organisms. Both are powerful forces in shaping species distributions. Vicariant events in the marine

realm include mostly geotectonic events and the restriction in distributions due to climate and current change. Vicariant events provide a means of dispersion over geologic time through the movement of lithospheric plates. Geotectonic processes also give rise to changes in topographical relief and hence are an important factor in joining and isolating populations geographically. Isolation can result in allopatric speciation, considered the most prevalent speciation mechanism. Therefore, vicariant events are prime factors influencing large-scale, long-term distribution patterns. An example of this can be seen in the distribution of fossils and higher taxonomic categories of many marine groups. Many fossils and current higher-level taxa show a common, tropical cosmopolitan distribution consistent with the existence of the ancient Tethys Sea. This sea began as a large gulf between Laurasia (the ancient continental landmass composed of present day North America and Eurasia) and eastern Gondwana (the ancient continental landmass originally composed of all the present day southern continents plus the Indian subcontinent) prior to the breakup of Pangea more than 180 million years ago. During the Jurassic, which ended around 135 million years ago, northern Laurasia separated from southern Gondwana. At this time, the Atlantic Ocean was formed, and the Tethys Sea became continuous from the Indo-Pacific through to the Caribbean. The marine fauna that existed at this time in the Tethyan Sea was therefore a continuous Indo-Pacific-Caribbean fauna. Around 65 million years ago northeastern Gondwana reunited with Eurasia separating the Indo-Pacific from the Mediterranean and Atlantic. This vicariant event imposed allopatry and subsequent divergence of Atlantic and Indo-Pacific faunas.

Vicariant events also can influence speciation and hence distributions on a smaller scale. Rosen (1984) developed a model that demonstrates the potential influence of vicariance in island chains.



Fig. 11 Position of continents 65 million years ago

Continuous populations on islands close enough for dispersal to predominate can become separated through the formation of barriers. These barriers can be in the form of islands drifting apart or changes in currents such that migration or dispersal between islands is interrupted. This results in allopatry and potential speciation. Hall (1996) shows how a number of the major islands of Southeast Asia have changed position relative to one another considerably in the past 50 million years. Current patterns also presumably changed substantially during the formation of the Indo-Malay-Philippine archipelago.

Climate and sea level change have also been powerful vicariant factors in the western Pacific. McManus (1985) suggested that the lowering of sea level during the Pleistocene would have resulted in a number of effectively isolated marine basins in Southeast Asian seas. Fleminger (1986) showed how a combination of sea level lowering of 100 to 200 m and increased upwelling during the glacial periods of the Pleistocene could have served as a barrier between the western Pacific and Indian oceans. Springer and Williams (1990) further suggest that the lowered temperatures and sea level during the ice ages could have caused many species to become locally extinct in Southeast Asian seas. Current disjunct Indian and Pacific ocean distributions of certain species may have had continuous distributions prior to glacial periods. These species then failed to become reestablished in Southeast Asian seas after glacial periods.

Dispersal in the ocean by migration or current transport can create deviations from distribution patterns originally dictated by vicariant events. These deviations can accumulate with time and become an important factor in modifying vicariant-determined distributions. An example from the western and central Pacific is the presumed conduit of western Pacific

species onto the Pacific Plate (Springer, 1982; Myers, 1989). A tectonic process underlies the formation of a distinct Pacific Plate biota (Springer, 1982) while dispersal through "island hopping" brings western Pacific species onto the plate. Potential conduits predominate from west to east as the island chains of Micronesia, Melanesia, and Polynesia.

Indo-Malay-Philippine Diversity

Vicariance and dispersal have resulted in distinct diversity patterns in the tropical western and central Pacific. The 2 most salient patterns are the high diversity centred on the Indo-Malay-Philippine archipelago and the decrease in diversity from west to east (Fig. 12). Springer (1982) argues that there is a distinct biota associated with the formation of the Pacific Plate, and the abrupt decrease in west to east diversity at the Pacific plate margin is due to an hypothesized ancient barrier at the margin. There is a gradual decline south to southeast onto the Pacific Plate. Higher diversity on the western side of the Pacific Plate is presumably because of encroachment of Philippine Plate, Indian-Australian Plate, and Eurasian Plate species onto the Pacific Plate.

The marine tropical shore fauna diversity centred in Southeast Asia is greater than any on earth. Early attempts to explain this invoked a "centre-of-origin" theory, stating that species-rich areas are sources of new species from which species migrate out to regions of lower diversity. However, evidence for sympatric speciation is scarce and until this theory is recast in a model incorporating allopatric speciation and geological evidence, it will suffer from theoretical weakness. There have been other attempts to explain the high diversity of the Southeast Asian area (e.g., Rosen, 1984; McManus, 1985; Fleminger, 1986; Myers, 1989; Mukai, 1993) and it is likely that a number of explanations will need to be synthesized before a single view is

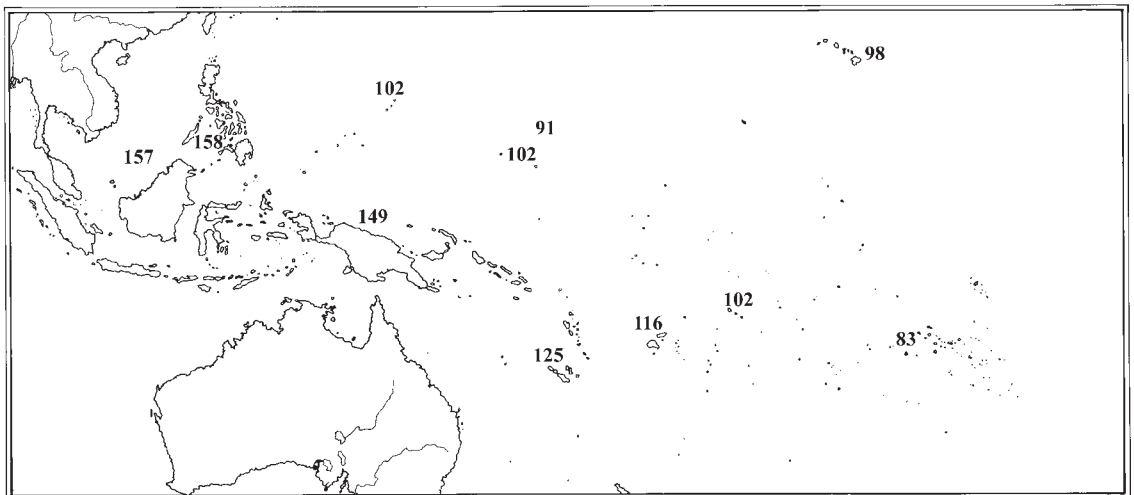


Fig. 12 Numbers of families of shorefishes around the Western Central Pacific (after Springer, 1982)

accepted (Potts, 1985). Presented below are a number of different factors that may contribute to this high diversity. I argue that the high marine diversity can be explained by a combination of the diversity of lithospheric plates bordering the region, the direction of movement of the plates, the sea level lowering events of glacial periods, and that all these factors occur in a tropical area with the largest concentration of equatorial shelf habitat on earth.

Lithospheric plate diversity leads to taxonomic diversity: Southeast Asia is mostly on the Eurasian plate but the area is bordered in close proximity by the Indian-Australian, Pacific, and Philippine plates (Fig. 10). This represents perhaps the greatest concentration of plates in a continuous marine area. If we accept that separate plates spawn separate marine biotas, as is implicit in Springer's (1982) treatise, then simple spillage (dispersal) of different species into Southeast Asian seas from the surrounding plates could serve as a substantial source of diversity. In addition, the concentration of lithospheric plate interfaces in the area also spawns a high number of geotectonic events from interaction between the plates. For example, Hall's (1996) geological reconstruction of Southeast Asia hypothesizes that the major components of the present day Philippine Islands came from at least 4 widely separated origins. These and other associated vicariant events presumably affected both species assemblages and continuity of individual species distributions; the latter potentially leading to subsequent population divergence and speciation. Springer (1982) notes that taxonomic diversity is to a large degree dependent on the number of vicariant events and that more of these events probably occurred in the Southeast Asian area than elsewhere in the Indo-Pacific. While dispersal from adjacent lithospheric plates and tectonic activity may contribute to diversity, other factors may also contribute to the high diversity of Southeast Asian seas.

The tectonic conveyor belt - all roads lead to Southeast Asia: The 3 plates bordering the Southeast Asian leg of the Eurasian Plate are all moving relatively toward Southeast Asia. Subduction zones rim the area on all marine borders. The movement of the plates toward Southeast Asia would tend to "dump" new species into the region like giant conveyor belts after the species have formed on their respective plates (the idea of moving plates acting as conveyor belts or "Noah's Arks" has been used to explain mammalian distributions by McKenna (1973), but has not, to my knowledge been used as an explanation for the high diversity found in Southeast Asian seas). This assumes, at minimum, ability to disperse across the areas of subduction bordering the area. Springer (1982) assumes this ability in recognizing an extended Pacific Plate distribution onto the Philippine Plate for a number of taxa. The pouring of taxa onto the southern leg of the Eurasian Plate could substantially increase diversity in the region particularly at higher taxonomic levels since the geologic time asso-

ciated with transport by the tectonic conveyor should be counted in millions or tens of millions of years. This is illustrated by considering the path of Australia in the past 65 million years (Fig. 11). At the time of the Cretaceous-Tertiary boundary, Australia was still connected to Antarctica far to the south relative to its present location. The 65 million years it spent traveling toward Southeast Asia was a period when the families and genera of many of the dominant nearshore marine taxa such as perciform fishes evolved (Patterson, 1993). If any of these originated on the Australian Plate during this time, they could have contributed to the diversity of Southeast Asian seas via dumping from the tectonic conveyor. Furthermore, if we accept that separate blocks of gondwanan continental crust arrived in the region prior to the arrival of Australia, then 2 or more shipments of potentially differentiated nearshore faunas dumped into the region from the Indo-Australian Plate. The high diversity of shorefish families in Southeast Asia (Fig. 12) supports the notion and geological time frame of the tectonic conveyor idea but further evidence based on phylogenetic relationships is required to test this hypothesis.

Sea level lowering and current upwelling: the key Indian-Pacific Ocean barrier and isolated basins: As mentioned above, Flemming (1986) demonstrated that sea level lowering and current upwelling could have sustained an effective barrier between the Indian and Pacific oceans during Pleistocene glacial periods. This would have separated populations and provided an allopatric mechanism for speciation of the numerous marine forms in the area. After the glacial periods these differentiated sister species could have remixed in the area increasing diversity over previous levels, assuming that some of these sister species were capable of co-existence.

Sea-level lowering in Southeast Asia during the Pleistocene may also have resulted in many isolated seas and bays contributing further to diversity in the region (McManus, 1985). This may have resulted in small isolated populations that could rapidly speciate. Evidence for this is shown by the many Philippine shorefish species that appear to be localized on 1 or 2 islands (Springer, personal communication).

The greatest concentration of amenable tropical shallow-water marine habitats: Appropriate ecological conditions must be present to support high diversity. Ekman (1953) pointed out the existence of a broad shelf area in the tropical zone between Australia and Asia. Indeed, if one were to circumscribe a 15° band on either side of the equator on a map showing the shelf area in relation to land and deep-water areas of the earth, Southeast Asia and northern Australia stand out as having, by far, the largest tropical shelf area on earth. This vast shelf area and the most extensive archipelago in the world, the Indo-Malay-Philippine

archipelago, engenders a wealth of habitats. This includes the most extensive area coverage of coral reef, mangrove, seaweed bed, and tropical estuarine habitat of the world. These shelf and near-shore habitats are the most productive marine habitats. The combination of immense habitat diversity and extent, and high primary and secondary production in Southeast Asian seas (Figs 6, 7, 9) presumably nurtures the existence of high taxonomic diversity by reducing the likelihood of competitive exclusion on a grand scale. Greater resource availability may also support larger populations and reduce the probability of extinction.

The extent of shallow-water habitat in Southeast Asian seas may also influence diversity through an area effect. There is a well-known positive relationship between size of geographic area and the number of species it contains. This presumably influences rates of extinction and speciation. Extinction rates may be lower in areas large enough to harbour large populations. Large areas provide more refuges from localized geological or climatological effects. Large areas may also tend to have a greater number of geological events that could isolate one population from another within the area, promoting speciation. A complex geology, geography, climatological history, and ecological capacity apparently favours a decidedly positive balance between extinction and speciation in Southeast Asian Seas.

Fisheries

Diversity is the keyword in describing the living marine resources of the Western Central Pacific. The extreme numbers of species found and fished in this region is unmatched anywhere on earth. The variety of fishing methods and different modes of utilization is also exceptional. Add to this a vast geographic coverage and a dizzying cultural and economic array, and a description of the fisheries in the WCP becomes difficult, indeed. Some of the important features of the fisheries in the WCP are outlined here.

For the purpose of a fisheries review, the WCP area can be delineated into 3 major geopolitical entities: Southeast Asia, the South Pacific Islands, and Australia. Each of these areas has its own distinct geophysical features, biological makeup, cultural identity (although often highly diverse within a region), economic characteristics, and dominant fisheries. Southeast Asia is characterized by extensive continental shelf area, very high biological productivity, the highest diversity of marine species of anywhere on earth, dense human population particularly in coastal areas, and fisheries dominated by trawling but also supporting a wide diversity of other fishing methods. The South Pacific Islands are characterized by narrow continental shelf and extensive oceanic waters, concentrations of biological productivity and diversity mostly on coral reefs, generally low population

pressure, and foreign industrial tuna and small-scale coastal fisheries. The part of Australia in the WCP is characterized by a large continental shelf in the north and the largest barrier reef in the world, but relatively low fisheries production compared to the size of the Exclusive Economic Zone (EEZ). Australia also has relatively low population pressure and a western culture that engenders an extensive recreational fisheries rivaling commercial fisheries in their total economic impact on the country. Reviews of fisheries resources has been done for Southeast Asia by Morgan and Valencia (1983) and Martosubrotu (1997), for the South Pacific Islands by Wright and Hill (1993), Dalzell et al. (1996), and Majkowski (1997), and for Australia by Kailola et al. (1993). Across these 3 regions are few unifying features in their fisheries. They share many of the same species and similar fishing practices. However, the only really unifying feature of fisheries across the WCP is that very few fisheries are dominated by a single species. Multispecies catches, often in the extreme, characterize the area.

The fisheries production of the WCP is dominated by the landings from Southeast Asian countries (Table 1). Indonesia, Thailand, and the Philippines account for nearly 6.7 million metric tons of landings in 1995 according to the FAO Yearbook Statistics. This represents almost 80% of the landings of those countries bordering the WCP area. These 3 countries account for an estimate of around only 16% of the total Exclusive Economic Zone (EEZ) but about 75% of the population in the WCP. However, it is difficult to estimate EEZ, population, and other country statistics exclusively for the WCP area because a number of the WCP countries border other FAO fishing areas. Aside from FAO fisheries statistics, other statistics are not available for those portions of the country that only border FAO Fishing Area 71. Australia also borders FAO Fishing Areas 81 and 57; Indonesia, Malaysia, and Thailand also border FAO Fishing Area 57, and Viet Nam also borders Fishing Area 61 (although the FAO Fisheries statistics does not break down these landings according to the 2 Fishing Areas for Viet Nam). For the purpose of roughly estimating WCP specific country statistics, other statistics were scaled according to the proportion of fisheries landings recorded in FAO Fishing Area 71, for those countries bordering more than one FAO fishing area (Tables 1 and 2).

In contrast to the high production versus EEZ area for Southeast Asian countries of the WCP area, Australia and the South Pacific Commission (SPC) countries extract a relatively small proportion of fisheries production (Table 2). Southeast Asian countries record roughly over 1 100 t of landings per square kilometer of EEZ per year from the WCP. Australia records roughly around 23 t/km² of EEZ while the SPC countries record around 5 t/km² of EEZ. The latter is an underestimate of total fisheries landings from the area since a number of

Country	Population	Land Area ('000 km ²)	Coastline Length (km)	EEZ Area ('000 km ²)	1995 Fisheries (mt) (FAO Area ^{***})
American Samoa	59 566	194	116	390	175
Australia	18 260 863*	7 617 930*	25 760*	9 000*	41 633 (71) 58 377 (81) 114 186 (57)
Brunei Darus	299 939	5 270	161	24	4 786
Cambodia	10 861 218	176 520	443	56	31 231
Cook Islands	19 561	240	120	1 830	1 114
East Timor**	—	—	—	—	0
Federated States of Micronesia	125 377	702	6 112	2 780	21 145
Fiji	782 381	18 270	1 129	1 290	30 828
French Polynesia	224 911	3 660	2 525	5 030	8 818
Guam	156 974	541	126	218	226
Indonesia	206 611 600*	1 826 440*	54 716*	5 410*	2 620 560 (71) 676 050 (57)
Kiribati	80 919	717	1 143	3 550	24 683
Malaysia	19 962 893*	328 550*	4 675*	224*	609 704 (71) 610 594 (57)
Marshall Islands	58 363	181	370	2 131	260
Nauru	10 273	21	30	320	450
New Caledonia	187 784	18 575	2 254	1 740	4 000
Niue	2 174	260	64	390	115
Northern Marianas	52 284	477	1 482	777	191
Palau	16 952	458	1 519	629	1 450
Papua New Guinea	4 394 537	451 710	5 152	3 120	12 500
Philippines	74 480 848	298 170	36 289	1 786	1 732 890
Pitcairn	56	47	51	800	—
Singapore	3 396 924	622	193	0.3	13 661
Solomon Islands	412 902	27 540	5 313	1 340	46 462
Thailand	58 851 357*	511 770*	3 219*	325*	2 320 663 (71) 901 437 (57)
Tokelau	1 482	10	101	290	200
Tonga	106 466	718	419	700	2 596
Tuvalu	10 146	26	24	900	399
Vanuatu	177 504	14 760	2 528	680	2 600
Viet Nam	73 976 973*	325 360*	3 444*	722*	900 000
Wallis and Futuna	14 659	274	129	300	170
Western Samoa	214 384	2 850	403	120	1 400

Table 1. Major physiographic and economic features in the countries of the Western Central Pacific area.
Population, land area, and coastline length are from the 1997 CIA Factbook. EEZ estimates from country reports.
Fisheries catch is from the 1995 FAO Yearbook of Fishery Statistics.

*Estimates are for the entire country, not just the portions fronting the Western Central Pacific.

**Separate statistics not reported for this country; estimates are mostly included under Indonesia.

***Fishery statistics for FAO areas not covered by this guide are included for countries with catches in areas outside the WCP area to give an idea of relative importance to each country of Fishing Area 71 which is covered in this guide.

Country/Region	Population*	EEZ Area * (*000 km ²)	1995 Fisheries (mt) (Area 71+SPC Area)
Australia	3 469 564*	1 746*	41 633
Southeast Asia	379 626 546*	7 234*	8 233 495
SPC	7 109 655	29 325	159 782
Total			8 434 910

Table 2. Estimated population, Exclusive Economic Zone (EEZ), and fisheries catch for regions of Fishing Area 71 and the South Pacific Commission (SPC)

* Individual estimates for these numbers specifically for Fishing Area 71 are not readily available. For countries that front fishing areas other than Area 71 and the SPC area, these numbers were adjusted based on the proportion of total catch contributed by Fishing Area 71. This is not an accurate estimator for these numbers but gives a rough indication of relative importance of Fishing Area 71.

non-WCP countries operate long distance fleets in the WCP (Table 3). Much of these landings are tuna longline, purse seine, and pole-and-line fisheries that operate in the SPC (Wright and Hill, 1993; Dalzell et al., 1996; and Majkowski, 1997). In addition, a large proportion of the landings in the SPC countries is subsistence level (Majkowski, 1997) that may go unrecorded or underestimated in FAO statistics. The landings from Australian waters is low presumably because of the limited shelf area and low nutrients of Australian waters (Kailola et al., 1993). In contrast, Southeast Asian fishing grounds offer a wealth of highly productive waters with extensive trawlable shelf area.

The fisheries production of the countries in the WCP has shown a steady increase in the last 20 years (Fig. 13). This increase is driven largely by the rapid development of trawl fisheries in Fishing Area 71 (Martosubrotu, 1997) and has continued unabated in the Southeast Asian countries of the WCP area (Fig. 13). Despite this continued increase, there are strong indications of overfishing although the level of knowledge of state of the resources in this area is insufficient (Martosubrotu, 1997). The fisheries production in the SPC countries and Australia has shown a modest increase in the last 20 years (Fig. 14). However, this production has leveled off, particularly in the last 5 years indicating that these resources have reached the limit of exploitation. Catches from industrial local and long distance tuna fleets has also leveled off markedly in the last 5 years in the SPC area (Majkowski, 1997) indicating further that resource limitations have also been reached for tuna fisheries of the WCP.

Of the approximately 1 080 taxonomic statistical categories listed in the 1995 FAO Yearbook of Fishery Statistics (FAO, 1997) about 175 have catches recorded in the WCP area. The most important 50 of these WCP statistical units cover a wide taxonomic range from seaweeds to tunas (Table 4). Over half of these statistical units are species aggregations. This landing data is unfortunately of limited use in biological management of fisheries since species-specific population parameters are required for rigorous management.

These statistical aggregations are necessary largely because of the difficulty in identifying taxonomic units to species level. However, with the availability of this WCP Identification Guide, the ability to identify species accurately will become more practical. This will likely cause an increase in the reporting of numbers of taxonomic units in the future from the WCP - not because a greater diversity of species are being exploited but because our ability to identify species will improve. This phenomenon of more numerous species and taxonomic units being recorded in fisheries statistics has been recorded on a wider scale. The number of overall taxonomic units reported in the FAO Fisheries Yearbook has increased markedly over the past 25 years. This is largely due to our improved ability to identify the organisms being fished. This phenomenon is called the "**Fischer Effect**" after the founder of FAO's Fisheries Department Species Identification and Data Programme, Walter Fischer. His publication series of Identification Sheets, Identification Field Guides, and Species Catalogues have led to an improved ability to identify fisheries resources and hence improve fisheries management capabilities worldwide. The present WCP series intends to contribute to this purpose.

Country	1995 Fisheries Landings (mt)
China Main	8 210
Japan	277 592
Korea Republic	213 720
Russian Federation	4 981
Taiwan Province of China	152 415
USA	153 840
Total	810 758

Table 3. Landings from Fishing Area 71 made by countries not bordering Fishing Area 71. These are mostly purse seine, longline, and pole-and-line tuna catches.

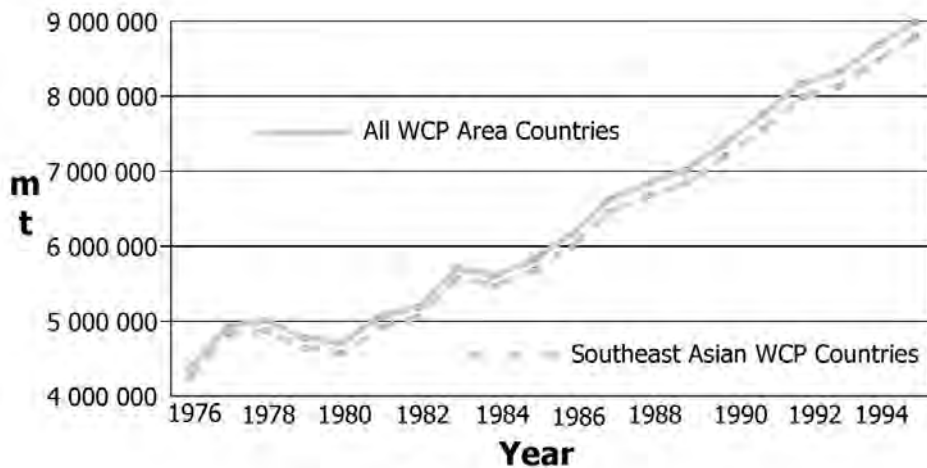


Fig. 13 FAO Fisheries Statistics landings in metric tons for all WCP countries recorded from Fishing Area 71 and the South Pacific Commission area and from the Southeast Asian WCP countries from Fishing Area 71 from 1976 to 1995

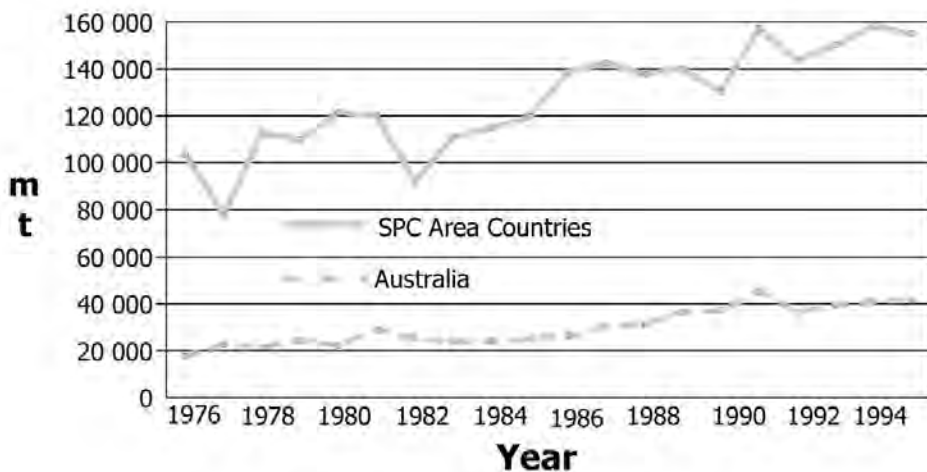


Fig. 14 FAO Fisheries Statistics landings in metric tons for the South Pacific Commission countries and for Australia from Fishing Area 71 from 1976 to 1995

Statistical taxonomic unit (common name)	1995 landings (*000 mt)	Statistical taxonomic unit (common name)	1995 landings (*000 mt)
<i>Decapterus</i> spp (scads)	282	<i>Peneus merguensis</i> (banana prawn)	46
Rhodophyceae (red seaweeds)	245	<i>Thunnus tonggol</i> (longtail tuna)	46
<i>Stolephorus</i> spp. (stolephorus anchovies)	203	Ariidae (sea catfishes nei)	41
<i>Katsuwonus pelamis</i> (Skipjack tuna)	177	<i>Dussumieria acuta</i> (rainbow sardine)	39
Osteichthyes (marine fishes nei)	153	Percoidei (percoids nei)	37
<i>Sardinella</i> spp. (sardinellas)	152	Reptantia (marine crabs nei)	37
Carangidae (carangids nei)	146	Elasmobranchii (sharks, rays, skates, etc.)	37
Natantia (natantian decapods nei)	118	Sergestidae (sergestid shrimps)	37
Engraulidae (anchovies nei)	104	Exocoetidae (flyingfishes)	36
<i>Thunnus albacares</i> (yellowfin tuna)	102	Mugilidae (mullets)	35
Leiognathidae (ponyfishes)	98	<i>Tylosurus</i> spp (needlefishes)	34
<i>Euthynnus affinis</i> (kawakawa)	97	<i>Selar crumenophthalmus</i> (bigeye scad)	33
<i>Sardinella gibbosa</i> (goldstripe sardinella)	96	<i>Caranx</i> spp (jacks, cravalles nei)	31
<i>Auxis</i> spp. (frigate and bullet tunas)	96	Lutjanidae (snappers, jobfishes nei)	31
<i>Loligo</i> spp. (common squids)	94	Caesionidae (fusiliers)	30
Scombroidei (tuna-like fishes nei)	90	Mullidae (surmulletts, goatfishes)	30
<i>Mytilus smaragdinus</i> (green mussel)	87	<i>Rastrelliger brachysoma</i> (short mackerel)	29
<i>Paphia</i> spp (shortneck clams)	83	Rajiformes (skates and rays, nei)	28
<i>Peneus</i> spp (peneus shrimps nei)	79	<i>Metapenaeus</i> spp (metapeneus shrimp nei)	26
<i>Rastrelliger kanagurta</i> (Indian mackerel)	75	Sciaenidae (croakers, drums nei)	26
<i>Nemipterus</i> spp (threadfin breams)	73	<i>Portunus pelagicus</i> (blue swimming crab)	25
Sepiidae, Sepiolidae (cuttlefishes)	51	Serranidae (groupers, seabasses nei)	25
<i>Sardinella lemuru</i> (Bali sardinella)	50	Lutjanus spp (snappers nei)	24
<i>Scomberomorus commersoni</i> (Spanish mack.)	49	<i>Rhopilema</i> spp (jellyfishes)	20
<i>Decapterus russelli</i> (Indian scad)	48	<i>Sphyaena</i> spp (barracudas)	20

Table 4. The 50 most important taxonomic statistical units listed from the WCP in the FAO Fisheries Yearbook and their 1995 landings

Literature cited

- Audley-Charles, M.G. 1988. Evolution of the southern margin of Tethys (North Australian region) from early Permian to late Cretaceous. In *Gondwana and Tethys*, edited by Audley-Charles and Hallam. New York, Oxford Univ. Press, pp. 79-100.
- Couper, A. (ed.). 1990. *The times atlas and encyclopaedia of the sea*. New York, Harper and Row, 272 p.
- Dalzell, P.T., J.H. Adams, and N.V.C. Polunin. 1996. Coastal fisheries in the Pacific Islands. *Ocean. Mar. Biol. Ann. Rev.*, 34:395-531.
- Ekman, S. 1953. *Zoogeography of the sea*. London, Sidgwick and Jackson, Ltd., 417 p.
- Food and Agriculture Organization of the United Nations. 1981. *Atlas of the living resources of the seas*. Rome, FAO, 21 p.
- Food and Agriculture Organization of the United Nations. 1997. *FAO Yearbook, fishery statistics, catches and landings*. Rome, FAO, 714 p.
- Flemming, A. 1986. The Pleistocene equatorial barrier between the Indian and Pacific oceans and a likely cause for Wallace's Line. In *Pelagic biogeography. UNESCO technical papers in marine science*. No. 49, pp. 84-97.
- Hall, R. 1996. Reconstructing Cenozoic SE Asia. In *Tectonic evolution of Southeast Asia*, edited by R. Hall and D. Blundell. Geological Society Special Publication No. 106, pp. 153-184.

- Kailola, P.J., M.J. Williams, P.C. Stewert, R.E. Reichelt, A. McNee, and C. Grieve (eds.). *Australian fisheries resources*. Canberra, Bureau of Resource Sciences and Fisheries Research and Development Corporation, 430 p.
- Kay, E.A. 1980. *Little worlds of the Pacific: an essay on Pacific basin biogeography*. Honolulu, Lyon Arboretum, 40 p.
- Majkowski, J. 1997. South Pacific Islands. In *Review of the state of the world fishery resources: marine fisheries*. Rome, FAO, pp. 106-113.
- Martosubrotu. P. 1997. Western Central Pacific. In *Review of the state of the world fishery resources: marine fisheries*. Rome, FAO, pp. 84-87.
- McKenna, M.C. 1973. Sweepstakes, filters, corridors, Noah's Arks, and beached viking funeral ships in Palaeogeography. In *Implications of continental drift to the earth sciences*. Vol. 1, edited by Tarling and Runcorn, London, Academic Press, pp. 295-308.
- McManus, J. W. 1985. Marine speciation, tectonics, and sea-level changes in south-east Asia. *Proc. Int. Coral Reef. Symp. 5th, 1984*, Vol. 4, pp. 133-138.
- Metcalfe, I. 1988. Origin and assembly of south-east Asian continental terranes. In *Gondwana and Tethys*, edited by Audley-Charles and Hallam. New York, Oxford Univ. Press, pp. 101-118.
- Morgan, J.R. and M.J. Valencia (eds). 1983. *Atlas for marine policy in Southeast Asian seas*. Berkeley, Univ. California Press, 144 p.
- Mukai, H. 1993. Biogeography of the tropical seagrasses in the western Pacific. *Aust. Jour. Mar. Freshwater Res.*, 44:1-17.
- Myers, R.S. 1989. *Micronesian reef fishes*. Guam, Coral Graphics, 298 p.
- Patterson, C. 1993. An overview of early fossil record of acanthomorphs. *Bull. Mar. Sci.*, 52: 29-59.
- Potts, D.C. 1985. Sea-level fluctuations and speciation in Scleractinia. *Proc. Int. Coral Reef. Symp. 5th, 1984*, (4):127-132.
- Rosen, B.R. 1984. Reef coral biogeography and climate the late Cainozoic: just islands in the sun or a critical pattern of islands? In *Fossils and Climate*, edited by Brenchly. New York, John Wiley and Sons, pp. 201-262.
- Springer, V.G. 1982. Pacific Plate biogeography, with special reference to shorefishes. *Smithson. Contr. Zool.*, (465):182 p.
- Springer, V.G. and J.T. Williams. 1990. Widely distributed Pacific Plate endemics and lowered sea-level. *Bull. Mar. Sci.*, 47(3):631-640.
- Uyeda, S. 1977. Some basic problems in the trench-arc back arc system. In *Island arcs, deep sea trenches, and back-arc basins*, edited by M. Talwani and W.C. Pittman III, pp. 1-14.
- Wright, A. and L. Hill (ed.). 1993. *Nearshore marine resources of the South Pacific*. Canada, Institute of Pacific Studies, Suva; Forum Fisheries Agency, Honiara; International Centre for Ocean Development, 710 p.

SEaweEDS

by G.C. Trono, Jr.

GENERAL REMARKS

Seaweeds are the macrobenthic (large and attached) forms of marine algae. Together with the seagrasses, mangroves, and phytoplankton, they comprise the most important primary producers in the marine environment. Their thalloid body comes in a variety of forms, although typically it consists of holdfast, stipe, blade, and reproductive structures. Three major groups are distinguished, based on their dominant photosynthetic pigments. These are the Chlorophyta (green algae) with chlorophylls, the Phaeophyta (brown algae) with carotenoids, and the Rhodophyta (red algae) with phycobilins (phycoerythrin). Since they are photosynthesizers utilizing light as a source of energy, they are generally limited in their vertical distribution to shallow areas of coastal environments, and are found from intertidal to shallow subtidal zones. They inhabit a variety of habitats such as reef flats, sheltered bays and coves, and some may be limited to rocky wave-exposed areas along the shore or on the edge of the reef. Many other species are found growing in intermediate environments on various types of substrates. Although the traditional use of some seaweeds as human food in some Asian countries like Japan, China, Hawaii, and the Philippines dates back many decades, the development and utilization of some species as a fishery resource is quite recent. This is primarily due to the discovery of natural substances in these species, which have very important applications in many industries. The farming of several of these species has proved to be a very productive form of livelihood among coastal populations. The depletion of most of the near shore finfish, crustaceans, and other traditional coastal fishery resources is a contributing factor to the shift in livelihood of some coastal populations from fishing to seaweed farming and gathering of natural stocks of seaweeds. A recent interest in seaweeds is biodiversity prospecting for natural products with bioactive properties. These developments are, however, constrained by the lack of information on the identities of seaweed species. The purpose of the present contribution is to ensure correct identification of the more common or economically important species found in the Western Central Pacific.

GLOSSARY OF TECHNICAL TERMS

Acuminate - provided with sharp points.

Aculeate - sharp pointed tip.

Acute - sharp at the end; ending in a point.

Alternate branching - the branches, leaves, etc. are placed singly at different heights on the axis on opposite sides, or at definite angular distances from one another.

Amorphous - having no definite shape or form.

Anastomose - joined together irregularly to form a network.

Annulate - marked with rings; surrounded by rings or bands.

Antheridia (plural), **antheridium** (singular) - male sex organ containing male motile gametes.

Anticlinial - perpendicular to the circumference.

Apex - the tip or summit.

Apiculate - tipped with a short, abrupt point.

Aplanosporangia - sporangia producing non-motile spores.

Aplanospore - a non-motile spore.

Arcuate - bent or curved like a bow.

Assimilatory filaments - pigmented or photosynthetic filaments.

Attenuate - tapering gradually to a narrow extremity.

Axil - the angle between the upper side of a branchlet (or stem or leaf) and the supporting stem or branch.

Bifurcate - divided or forked into 2 branches.

Bistratose - in 2 parallel layers, one placed on top of the other.

Blade - a broad, thin flat part of the thallus.

Bulbous - bulging, enlarged.

Caespitose - forming dense tufts or clumps.

Calcified - made calcareous or hardened by the deposition of calcium salts.

Capitate - having a globular or spherical head.

Capitulate - resembling a close head of sessile flowers; resembling a flower head.

Carpospore - spore produced by the carposporophyte.

Cervicorn - resembling a deer's horn.

Chloroplast - structure which contains photosynthetic pigments.

Clavate - club-shaped.

Coherent - sticking together.

Complanate - on the same plane; flattened.

Coenocyte - an alga consisting of a multinucleated protoplasm resulting from repeated nuclear division, unaccompanied by cell fission.

Concave - curved like the interior of a circle.

Concentric - having a common centre, as circles or spheres.

Conceptacles - an organ or cavity enclosing reproductive bodies.

Constriction - state of being contracted or shrunk.

Coriaceous - leathery texture.

Corona - a crown of lobes or other structures.

Cortex - the outermost cell layer or tissue of an algal thallus.

Corymbose - resembling a flower cluster that has a flat-topped or convex structure.

Crustose - forming a crust; forming a hard external covering or coating.

Cryptostomata - minute cavities in the outer cortex (in members of the order Fucales), bearing tufts of hairs.

Cuneate - wedge-shaped, broad above, tapering by almost straight lines to the base.

Cuspidate - abruptly acuminate; abruptly tapering to a rigid point.

Cyme, cymose - a type of branching where a pair of laterals arise at the same point in an axis opposite to each other.

Cystocarp - the "fruit" resulting from fertilization in Rhodophyta; in Florideophycidae this consists of gonimoblast filaments and carpospores usually within a pericarp.

Decomound - having divisions which are themselves compound.

Decumbent - reclining on the substrate.

Dentate - toothed, with the teeth sharp and pointed outward.

Determinate branchlets - branchlets with limited growth.

Dichotomous - forked in 2 similar parts.

Digitate - finger-like.

Discoid - having the form of a disc.

Distal - remote from the place of attachment.

Distichous - arranged in 2 rows opposite to each other along an axis, 2 ranked.

Divaricate - branching at wide angles.

Elliptical - having the form of an ellipse.

Emarginate - notched at the apex.

Encrusted - formed into a crust.

Entire - having the margin continuous and not broken by division, teeth or serrations.

Epiphyte - a plant that grows on another plant without being parasitic.

Evesiculate - without a vesicle.

Farinose - covered with a mealy powder.

Fascicled, fasciculate - arranged in small bundles.

Fibrous - consisting of or resembling fibers.

Filiferous - having hairs.

Filiform - thread-like.

Flabellate - fan-shaped.

Foliaceous - leaf-like.

Furcinate - incurved like a pair of pincers.

Fronlose - leafy.

Fuzzy - covered with fibrous or fluffy matter.

Gametangium - an organ or body producing the gametes.

Genicula - the uncalcified joints between segments in a coralline alga.

Glabrous zone - smooth zone, the surface devoid of hairs or pubescence.

Globose - globe-shaped; spherical.

Glomeruliferous - resembling a head-like cluster of flowers (a cyme).

Gonimoblast - filamentous structure producing the carpospores.

Haptera - basal multicellular outgrowths forming a part of a holdfast.

Hapteroid cells - cells modified for attachment.

Holdfast - basal attachment organ of an alga.

Incised - deeply cut.

Indusiate - with a thin outer covering (of a sorus).

Interdichotomy - portion of a branch of segment in between the dichotomies.

Intergenicula - the calcified segments between the uncalcified joints in a coralline alga.

Intertidal - portion of the shore which is alternately covered and exposed during tidal changes.

Isodiametric - having equal diameter throughout.

Lacerate - irregularly divided by deep incisions.

Lanceolate - narrow and tapering toward the apex or each end.

Lateral - pertaining to the side.

Lax - loosely cohering; not compact.

Linear - narrow, short, with the 2 opposite margins parallel.

Lower intertidal - portion of the shore which is exposed only during the lowest low tide.

Lower surface of Padina - associated with the convex surface of the enrolled margin.

Lubricous - slippery.

Mamillate - having a nipple-like structure.

Medulla - the central tissue of an internally differentiated thallus.

Moniliform - consisting of a series of bead-like swellings, alternating with contractions; resembling a string of beads.

Monostromatic - having the cells in a single layer.

Mucronate - abruptly tipped by a small short point.

Muricate - rough with short hard points, like in the shell of *Murex* species.

Nodular - shaped like a tubercle or shaped like a rounded mass or lump.

Notches - indentations; more or less angular cuts.

Obanceolate - broadest above the middle and tapering downward.

Oblong - 2 or 3 times as long as broad and not conspicuously narrowed, the sides nearly parallel.

Obovate - inversely ovate, with the broad end upward and narrow end at the base.

Obpyramidal - inversely pyramidal.

Obscure - not clear.

Obtuse - slightly rounded at the end.

Octagonal - having 8 angles and 8 sides.

Orbicular - circular in outline.

Ostiole - a small opening.

Oval - egg-shaped.

- Ovate** - twice (or less) as long as broad, widest below the middle and more or less narrowed upward.
- Palisade** - a row or layer of elongate cells in the cortex.
- Paniculate** - arranged in a loosely branching flower cluster.
- Papillate** - having the form of a small nipple-like projection.
- Peltate** - having the stalk attached to the lower surface but not at the margin or base.
- Percurrent** - extending throughout the entire length.
- Pericarp** - wall of the cystocarp.
- Pinnate** - feather-like; having parts arranged on each side of a common petiole or axis.
- Pinnule** - one of the pinnately disposed division of a pinnate structure.
- Proliferous** - producing new individuals, organs such as branchlets or leaves, from an organ which in itself is normally ultimate.
- Polyhedral** - many angled cells.
- Polystichous** - in many ranks.
- Prostrate** - lying flat on the ground.
- Proximal** - situated toward the point of origin or attachment.
- Pseudocortex** - false cortex.
- Pyriform** - pear-shaped.
- Racemose** - having the form of a raceme; the organs (receptacles, leaves, etc.) are stalked and attached to a common axis.
- Ramuli** (plural), **ramulus** (singular) - determinate branchlets.
- Receptacle** - the specialized fertile portion of the branches.
- Reniform** - kidney-shaped, broader than long and with a sinus at the base.
- Reticulate** - net-like.
- Rhizoid** - a unicellular or multicellular filament functioning as an organ of attachment.
- Rhizoidal** - resembling rhizoids.
- Rugose** - rough and wrinkled.
- Sagittate** - shaped like an arrow-head.
- Scuttate** - thickened attachment structure (holdfast).
- Secondary pit connection** - cytoplasmic connection between 2 non-related cells after coming in contact with each other; cytoplasmic strand laterally connecting the cortical cells of some species of *Laurencia*.
- Secund** - arranged only on one side of the axis.
- Serrate** - having sharp small teeth that are projected forward.
- Sickle** - curved, hook-like blade mounted in a short handle used for cutting grain grass, etc.
- Sinuate** - distinctly wavy; the margin alternately uneven with concavities and convexities.
- Sorus** - a group or cluster of reproductive organs.
- Spherical** - having the form of a sphere; globular.
- Spongiöse** - without firmness and readily compressible.
- Sporangia** (plural), **sporangium** (singular) - reproductive cell producing spores.
- Steel green** - dark bluish green.
- Stichidium** (singular), **stichidia** (plural) - inflated, expanded or swollen specialized branch bearing the tetrasporangia (in some Florideophycidae).
- Stipe** - the stem-like, usually basal part of the thallus above the holdfast.
- Stipitate** - provided with a stipe.
- Stolon** - a slender branch or shoot growing out from the base of a parent plant and capable of producing another shoot.
- Suborbicular** - somewhat circular.
- Substipitate** - more or less provided with a stipe; stipe not very distinct.
- Substrate** - the base or material on which the seaweed is attached.

Subtidal - portion of the shore which is always submerged, even at the lowest tides.

Subulate - awl-shaped; linear, very narrow, tapering to a very fine point from the broadest base.

Summit - the apex.

Supratidal - portion of the shore above the high tide line wet by waves; spray zone.

Taper - to become gradually slender towards the apex.

Terete - with a circular transverse section.

Tetrachotomous - divided into 4 branches.

Tetrasporic plant - the asexual, diploid thallus among the red algae which produces the tetrasporangia.

Tetrasporangial branchlets - branchlets bearing tetrasporangia.

Thallus - a simple vegetative plant body which is undifferentiated into true leaves, stems, and roots.

Tidepool - a deep or shallow pool in the intertidal zone that remains flooded even during the lowest tide.

Tocopherols - one of several alcohols which compose the reproductive dietary factor known as vitamin E, occurring in wheat-germ oil, lettuce or spinach leaves, egg yolk, etc.

Tortuous - full of twists, turns or bends, twisting winding or crooked.

Trichotomous - type of branching where two main branches are produced opposite to each other at certain points along the main axes.

Triquetrous - having a triangular cross section; three-sided.

Tristichous - arranged in 3 rows or ranks along an axis.

Truncate - square or broad at the end; as if cut off transversely.

Tubercle - a small rounded projection.

Turbinate - inversely conical; bell-shaped.

Turf - forming low dense growth.

Turgid - swollen with air or water; distended.

Undulate - to have a wavy form or surface.

Ungulate - hooflike-shaped.

Uniseriate - in a single series.

Unistratose - in 1 layer.

Upper intertidal - portion of the shore which is exposed during low tide but submerged during high tide.

Upper surface of Padina - associated with the concave surface of the enrolled margin.

Utricle - a small sac-like body, or vesicle-like cell.

Verticils - whorled, several laterals arising from the same point around an axis.

Verticillate - the leaves, branches, hairs, etc. are arranged around a point or an axis.

Vesicle - a bladder-like structure.

Vesiculate - vesicle-like.

Villose - covered with soft hair.

Virgate - shaped like a rod or wand; long, slender and straight.

Whorl - a circular arrangement of equal parts (i.e., leaves, branches, etc.) round a point on an axis.

KEY TO DIVISIONS

- 1. Plant generally green to yellowish green in colour due to the dominance of chlorophyll; cell wall consisting of a pectic outer layer and an inner cellulose layer; sometimes calcified; photosynthetic product is starch **Chlorophyta**
- 2. Plant generally brown to pale brown to reddish brown in colour due to the dominance of xanthophyll pigments; cell wall consisting of cellulose and alginic acid; photosynthetic product is laminarin and mannitol **Phaeophyta**
- 3. Plant generally red to yellowish red to dark greenish red in colour due to the the dominance of r-phycoerythrin; cell wall consisting of a small amount of cellulose and gelatinous or amorphous sulphated galactans such as agar, carrageenan, furcellarin, and others; food reserve is floridian starch **Rhodophyta**

KEYS TO GENERA AND COMMON AND ECONOMICALLY IMPORTANT SPECIES OCCURRING IN THE AREA

A. CHLOROPHYTA

- 1a. Thallus forming fan-shaped blades or segments → 2
- 1b. Thallus not forming fan-shaped blades or segments → 6
- 2a. Thallus consisting of uncalcified fan-shaped blades (Fig. 1) (*Avrainvillea*) *Avrainvillea erecta*
- 2b. Thallus consisting of calcified segments → 3
- 3a. Segments consisting of well-defined medulla and cortex (*Halimeda*) → 4
- 3b. Segments not consisting of well-defined medulla and cortex (*Udotea*) → 5



Fig. 1 *Avrainvillea erecta*

- 4a. Thallus erect; segments large, flat, arranged in one plane; distal margins of segments undulate to irregularly lobed (Fig. 2) *Halimeda macroloba*
- 4b. Thallus forming an amorphous mass; segments small, reniform to discoid; main segment generally ribbed (Fig. 3) *Halimeda opuntia*

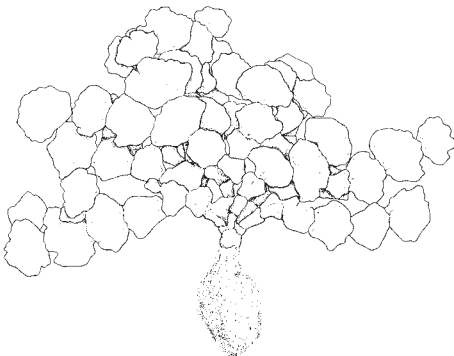


Fig. 2 *Halimeda macroloba*

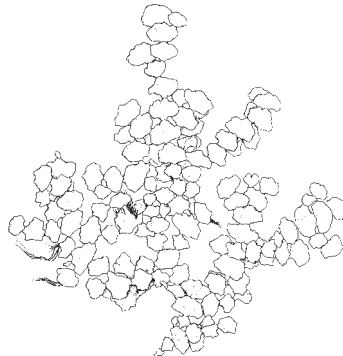


Fig. 3 *Halimeda opuntia*

- 5a. Thallus steel grey in colour, consisting of overlapping flabellate to reniform segments; determinate laterals of blade filaments clavate to bell-shaped at the tips (Fig. 4) . . . *Udotea argentea*
- 5b. Thallus light green, consisting of flabellate to subreniform segments, the surface of the segments divided into distinct concentric zones; determinate laterals of blade filaments much branched and forming many finger-like branchlets (Fig. 5) *Udotea geppii*

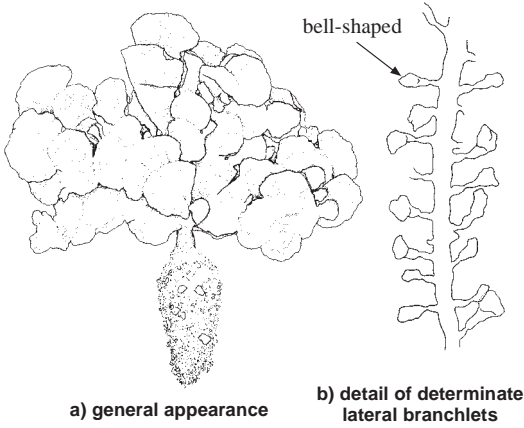


Fig. 4 *Udotea argentea*

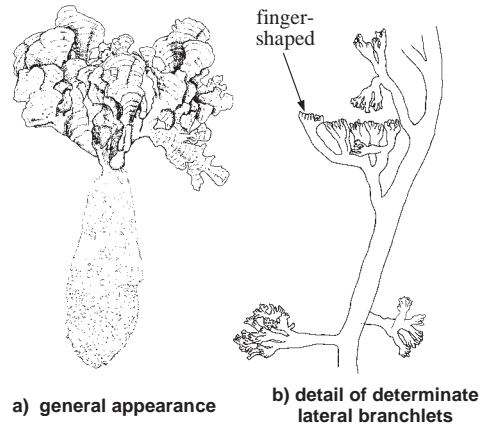


Fig. 5 *Udotea geppii*

- 6a. Thallus of radial symmetry or whorled branching → 7
- 6b. Thallus not of radial symmetry or whorled branching → 11
- 7a. Radial symmetry evident only at the tip of the thallus (Fig. 6) (*Acetabularia*) . . . *Acetabularia major*
- 7b. Radial symmetry evident along most part of the thallus → 8
- 8a. Thallus of free filaments, branching whorled along the main axis (Fig. 7) (*Tydemania*) *Tydemania expeditionis*
- 8b. Thallus clavate, lateral branches compacted to form a pseudocortex → 9
- 9a. Thallus highly calcified (no species included here because of their limited economic importance) *Neomeris*
- 9b. Thallus not highly calcified (*Bornetella*) → 10
- 10a. Thallus green to reddish, cylindrical and clavate (Fig. 8) *Bornetella oligospora*
- 10b. Thallus green, spherical (Fig. 9) *Bornetella sphaerica*

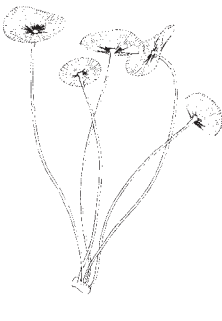


Fig. 6 *Acetabularia major*

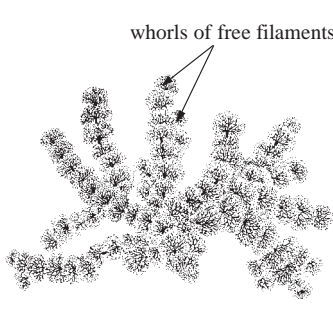


Fig. 7 *Tydemania expeditionis*



Fig. 8 *Bornetella oligospora*

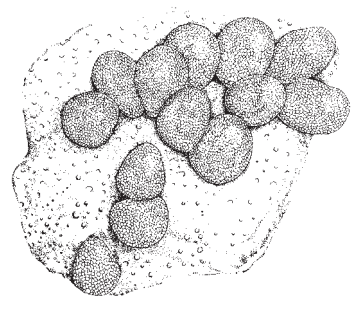


Fig. 9 *Bornetella sphaerica*

- 11a. Thallus composed of large vesicles (Fig. 10) (*Valonia*) ***Valonia aegagropila***
- 11b. Thallus not as above → 12

- 12a. Thallus of parenchyma cells → 13
- 12b. Thallus not as above → 15

- 13a. Thallus expanded into thin blades, consisting of 2 layers of cells (Fig. 11) (*Ulva*) ***Ulva lactuca***
- 13b. Thallus of tubular filaments or branches; walls of tubes consisting of 1 layer of cells (*Enteromorpha*) → 14

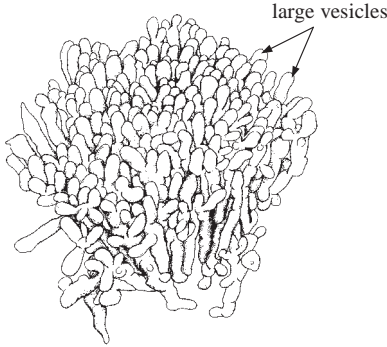
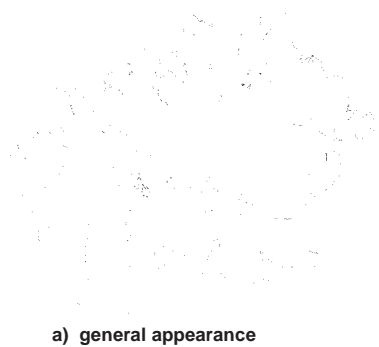
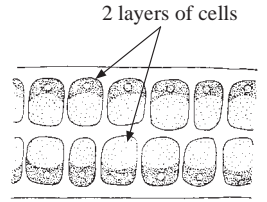


Fig. 10 *Valonia aegagropila*



a) general appearance



b) cross section

Fig. 11 *Ulva lactuca*

- 14a. Thallus forming mats of branched hair-like and hollow filaments (Fig. 12) ***Enteromorpha clathrata***
- 14b. Thallus composed of unbranched tubular branches (Fig. 13) ***Enteromorpha intestinalis***

- 15a. Thallus basically filamentous, pseudo-cortex consisting of utricles (*Codium*) → 16
- 15b. Thallus is a large coenocyte of various forms (*Caulerpa*) → 18



Fig. 12 *Enteromorpha clathrata*



Fig. 13 *Enteromorpha intestinalis*

- 16a. Thallus unbranched, irregularly lumpy to lobed (Fig. 14) ***Codium arabicum***
- 16b. Thallus branched → 17

- 17a. Branches prostrate to decumbent, the segments cylindrical (Fig. 15) ***Codium edule***
- 17b. Branches erect spreading, the segments compressed at the dichotomies (Fig. 16) ***Codium bartlettii***



Fig. 14 *Codium arabicum*



Fig. 15 *Codium edule*

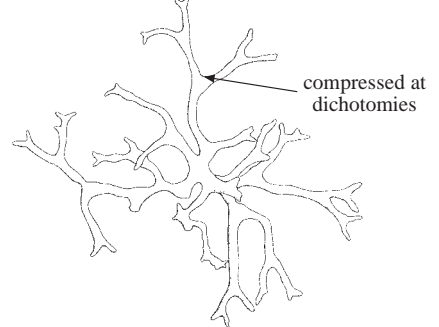


Fig. 16 *Codium bartlettii*

- 18a. Erect branches forming broad flat blades (Fig. 17) *Caulerpa brachypus*
- 18b. Erect branches not as above. → 19

- 19a. Erect branches with spherical to peltate ramuli → 20
- 19b. Erect branches with teeth-like to cylindrical ramuli → 22

- 20a. Ramuli peltate (Fig. 18). *Caulerpa peltata*
- 20b. Ramuli globose → 21

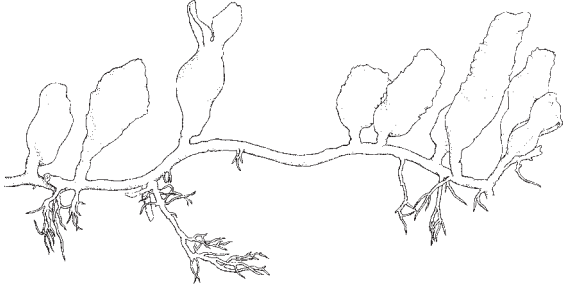


Fig. 17 *Caulerpa brachypus*

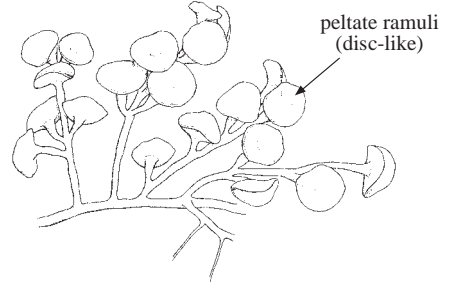


Fig. 18 *Caulerpa peltata*

- 21a. Small globose ramuli densely crowded on the erect branches (Fig. 19). *Caulerpa lentillifera*
- 21b. Large globose ramuli loosely arranged on the erect branches (Fig. 20). *Caulerpa racemosa*



Fig. 19 *Caulerpa lentillifera*

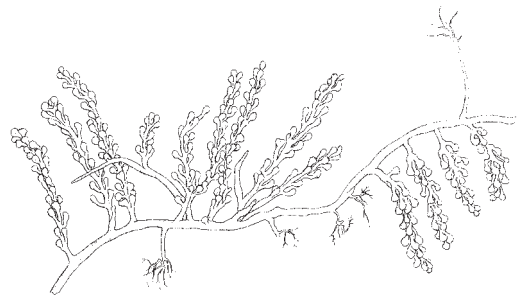


Fig. 20 *Caulerpa racemosa*

- 22a. Cylindrical, short, upcurved teeth-like pinnules distichously arranged on the erect branches (Fig. 21) *Caulerpa cupressoides*
- 22b. Cylindrical to flattened pinnules pinnately arranged on the erect branches to form feather-like blades → 23

- 23a. Pinnules cylindrical (Fig. 22) *Caulerpa sertularioides*
- 23b. Pinnules flattened (Fig. 23) *Caulerpa taxifolia*

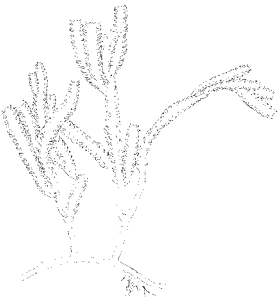


Fig. 21 *Caulerpa cupressoides*

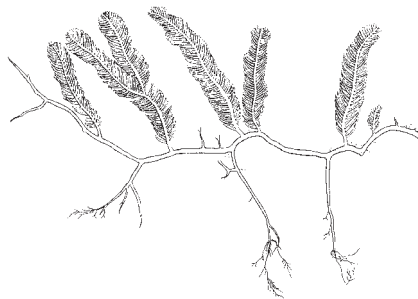


Fig. 22 *Caulerpa sertularioides*

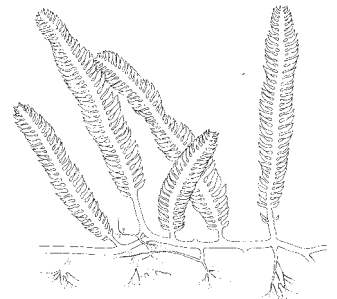


Fig. 23 *Caulerpa taxifolia*

B. PHAEOPHYTA

1a. Thallus fan-shaped or composed of strap-shaped blades → 2

1b. Thallus not as above → 5

2a. Thallus thin, fan-shaped, slightly calcified (Fig. 24) (*Padina*) *Padina minor*

2b. Thallus strap-shaped, dichotomously branched → 3

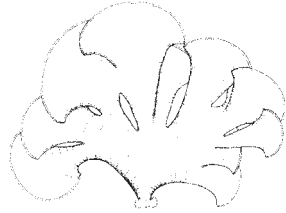


Fig. 24 *Padina minor*

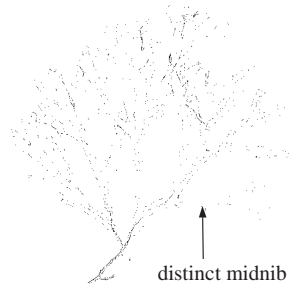


Fig. 25 *Dictyota jamaicensis*

3a. Thallus with midrib and veins (Fig. 25) (*Dictyopteris*) *Dictyopteris jamaicensis*

3b. Thallus without midrib and veins (*Dictyota*) → 4

4a. Thallus regularly dichotomously branched, dichotomies with acute angles, segments linear to narrowly cuneate, apices of terminal segments emarginate (Fig. 26) *Dictyota dichotoma*

4b. Thallus unequally dichotomously branched, segments short, cuneate, apices of terminal segments with a pair of teeth (Fig. 27) *Dictyota mertensii*

5a. Thallus reticulate, net-like (Fig. 28) (*Hydroclathrus*) *Hydroclathrus clathratus*

5b. Thallus branching with distinct blades and stipes → 6

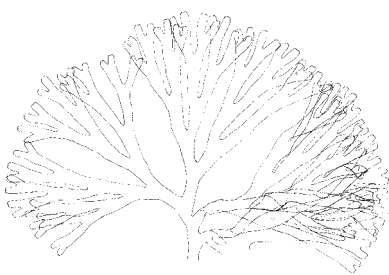


Fig. 26 *Dictyota dichotoma*

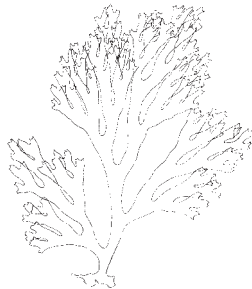


Fig. 27 *Dictyota mertensii*



Fig. 28 *Hydroclathrus clathratus*

6a. Leaves bell-shaped or trigonous in shape (*Turbinaria*) → 7

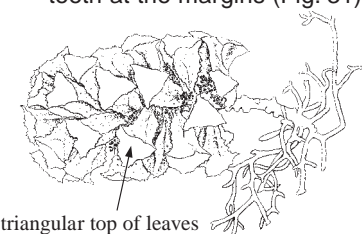
6b. Leaves flat and expanded, with midrib (*Sargassum*) → 9

7a. Leaves trigonous in shape with distinctly triangular top (Fig. 29) *Turbinaria decurrens*

7b. Leaves bell-shaped → 8

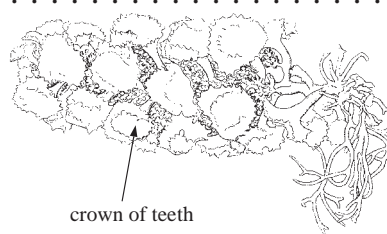
8a. Leaves large, more than 1 cm in length, their distal surface concave in top view with partial or full crown of teeth in the centre (Fig. 30) *Turbinaria ornata*

8b. Leaves small, less than 1 cm in length, their distal top margins expanded with coarse teeth at the margins (Fig. 31) *Turbinaria conoides*



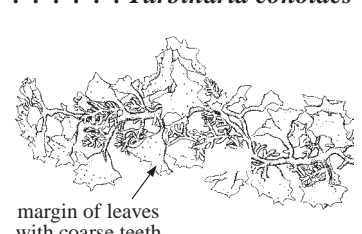
triangular top of leaves

Fig. 29 *Turbinaria decurrens*



crown of teeth

Fig. 30 *Turbinaria ornata*



margin of leaves with coarse teeth

Fig. 31 *Turbinaria conoides*

- 9a. Thallus with branching rhizoidal holdfast; branches rough (muricate), due to presence of many small simple or branched protuberances (Fig. 32) *Sargassum polycystum*
- 9b. Thallus with discoid or scutate holdfast; branches smooth, without protuberances → 10
- 10a. Primary branches distinctly and strongly flattened (Fig. 33) *Sargassum oligocystum*
- 10b. Primary branches generally cylindrical to slightly compressed → 11

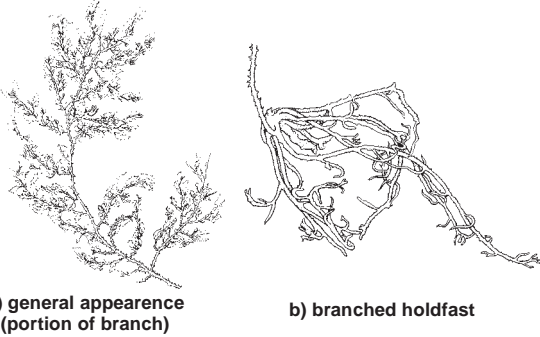


Fig. 32 *Sargassum polycystum*



Fig. 33 *Sargassum oligocystum*

- 11a. Leaves without duplicated margins or blades → 12
- 11b. Leaves with duplicated margins or blades → 13

- 12a. Leaves of terminal branches associated with the distally compressed female receptacular branches and mainly linear, to linear oblanceolate, lumpy due to the elevated cryptostomata (Fig. 34) *Sargassum gracillimum*

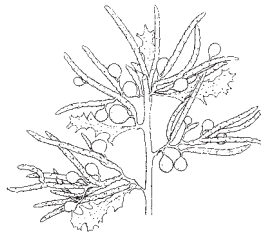


Fig. 34 *Sargassum gracillimum*

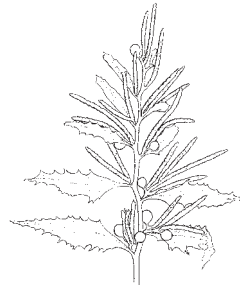


Fig. 35 *Sargassum paniculatum*

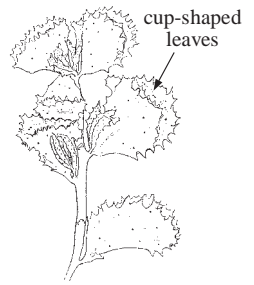


Fig. 36 *Sargassum turbinarioides*

- 12b. Leaves of terminal branches lanceolate with coarsely serrated margins; female receptacular branches compressed to triquetrous or slightly twisted (Fig. 35) *Sargassum paniculatum*

- 13a. Leaves thick, lateral margins serrated; serrations in single or double rows, the distal third of most blades double and expanded into a cup-shaped structure (resembling the leaves of *Turbinaria*) (Fig. 36) *Sargassum turbinarioides*

- 13b. Leaves not as above → 14

- 14a. Leaves horizontally attached, mainly oblong in shape, relatively thick, margin finely dentate, tip obtuse-rounded and mostly with thick duplicate margins; receptacle a compound cyme (Fig. 37) *Sargassum cristaefolium*

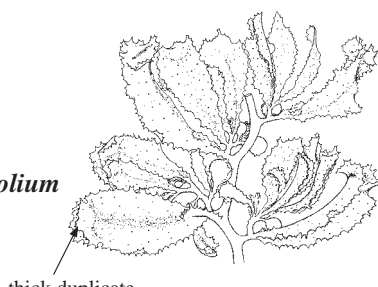


Fig. 37 *Sargassum cristaefolium*

- 14b. Leaves vertically attached, thin, mainly obovate in shape, margin coarsely and irregularly single or double dentate; tips rarely duplicated; receptacle a simple cyme, receptacular branch mainly linear and compressed towards the tip (Fig. 38) *Sargassum crassifolium*

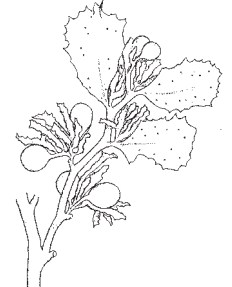


Fig. 38 *Sargassum crassifolium*

C. Rhodophyta

- 1a. Thallus calcified → 2
- 1b. Thallus not calcified → 3
- 2a. Thallus heavily calcified, consisting of flattened segments (Fig. 39) (*Cheilosporum*) *Cheilosporum cultratum*
- 2b. Thallus lightly calcified, not segmented (Fig. 40) (*Liagora*) *Liagora farinosa*

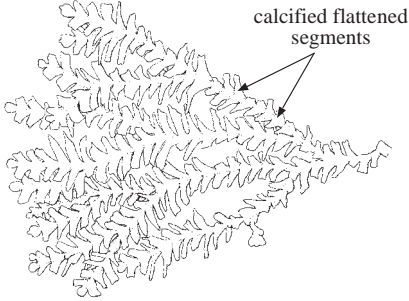


Fig. 39 *Cheilosporum cultratum*



Fig. 40 *Liagora farinosa*

- 3a. Branches compressed, flattened or developed as thin blades → 4
- 3b. Branches not as above → 6
- 4a. Thallus small, determinate branchlets with claw-like tips (Fig. 41) (*Portieria*) *Portieria hornemannii*
- 4b. Thallus large, developed as thin, soft, slimy blade or composed of compressed branches with tips of determinate branchlets simple (*Halymenia*) → 5
- 5a. Thallus a thin, slimy and delicate blade, simple or divided in lobes of irregular size (Fig. 42). *Halymenia dilitata*
- 5b. Thallus much branched, the branches flattened and compressed, the width of the branches becoming narrower toward the apices (Fig. 43) *Halymenia durvilleai*



a) terminal portion of thallus b) general appearance

Fig. 41 *Portieria hornemannii*

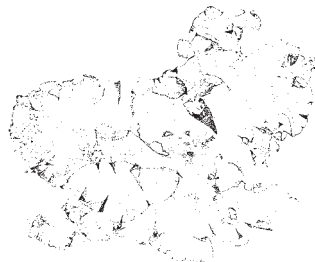


Fig. 42 *Halymenia dilitata*

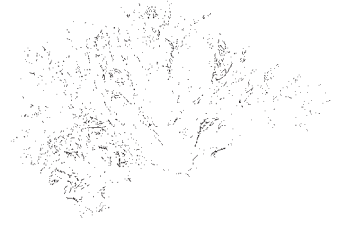


Fig. 43 *Halymenia durvilleai*

- 6a. Branches fleshy, soft or highly cartilaginous → 7
- 6b. Branches not fleshy, but wiry → 22
- 7a. Thallus highly cartilaginous, branches compressed or cylindrical. → 8
- 7b. Thallus fleshy and soft, branches cylindrical. → 12
- 8a. Branches cylindrical in cross section → 9
- 8b. Branches compressed → 11

- 9a. Determinate branchlets large, not in whorls (Fig. 44) *Kappaphycus alvarezii*
- 9b. Determinate branchlets small, arranged in whorls → 10

- 10a. Whorled determinate branchlets are simple spines (Fig. 45) *Euचेuma denticulatum*
- 10b. Whorled determinate branchlets decomposed (Fig. 46) *Euचेuma arnoldii*

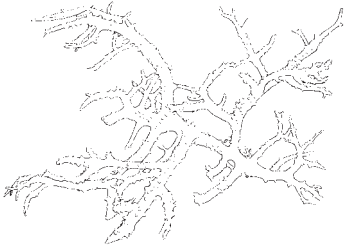


Fig. 44 *Kappaphycus alvarezii*

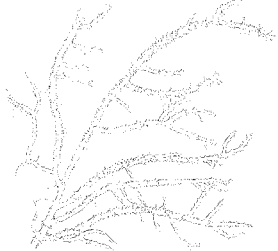


Fig. 45 *Euचेuma denticulatum*



Fig. 46 *Euचेuma arnoldii*

- 11a. Spinose processes both at the margin and the ventral side of the compressed branches (Fig. 47) *Euचेuma gelatinae*

- 11b. Spinose processes limited to the margin of the compressed branches (Fig. 48) *Gracilaria euचेumoides*

- 12a. Determinate branches shaped as fine filaments (Fig. 49) *Asparagopsis taxiformis*

- 12b. Determinate branches not as above → 13

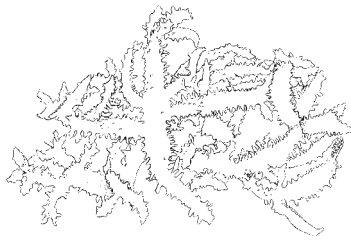


Fig. 47 *Euचेuma gelatinae*

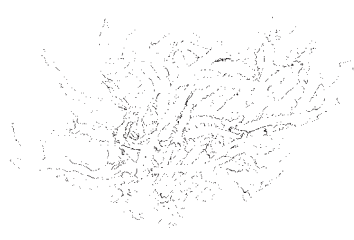


Fig. 48 *Gracilaria euचेumoides*



Fig. 49 *Asparagopsis taxiformis*

- 13a. Determinate branchlets spirally arranged (*Acanthophora*) → 14

- 13b. Determinate branchlets not arranged as above → 15

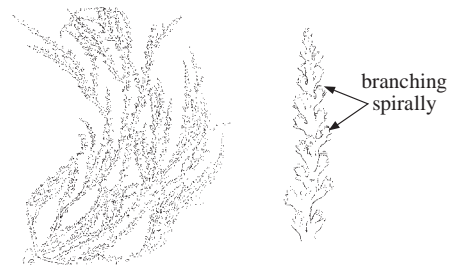
- 14a. Thallus erect, much branched and forming bushy clumps; branching irregular with tendency to become verticillate towards the terminal portion; spines present both at main and determinate branches (Fig. 50) *Acanthophora muscoides*

- 14b. Thallus erect, branching irregular and lax; determinate laterals regularly and spirally arranged along the main axes; spines spirally arranged and limited to the determinate branches (Fig. 51) *Acanthophora spicifera*



a) general appearance b) terminal portion of thallus

Fig. 50 *Acanthophora muscoides*



a) general appearance b) terminal portion of thallus

Fig. 51 *Acanthophora spicifera*

- 15a. Determinate branchlets club-shaped, with apical pits (Fig. 52) (*Laurencia*) *Laurencia papillosa*
- 15b. Determinate branchlets with sharp spinose or blunt apices → 16
- 16a. Tip of determinate branchlets with a single distinct apical cell → 17
- 16b. Tip of determinate branches with a group of apical cells → 18
- 17a. Thallus erect, branches percurrent, with numerous simple to compound spinose determinate branchlets (Fig. 53) *Hypnea boergesii*
- 17b. Thallus decumbent, much branched, forming caespitose clumps; determinate branchlets in the form of coarse spines (Fig. 54) *Hypnea pannosa*

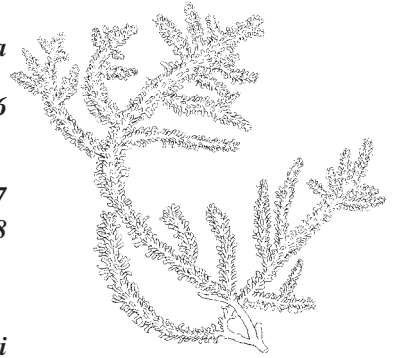


Fig. 52 *Laurencia papillosa*

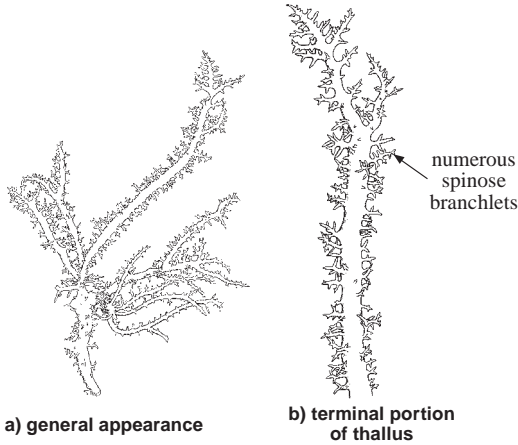


Fig. 53 *Hypnea boergesii*

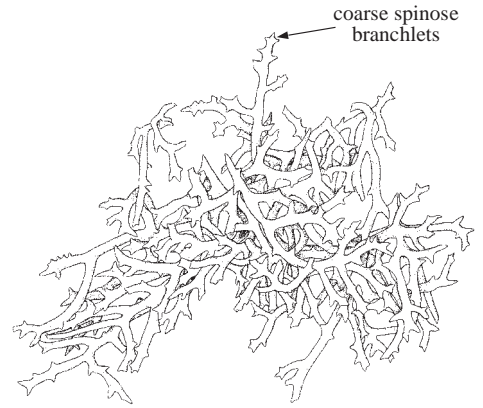


Fig. 54 *Hypnea pannosa*

- 18a. Branches moniliform or divided into club-shaped segments → 19
- 18b. Branches not as above → 20
- 19a. Branches moniliform (Fig. 55) *Scinaia hormoides*
- 19b. Branches composed of club-shaped segments (Fig. 56) *Gracilaria salicornia*

- 20a. Branching dichotomous, tip of branch bifurcate (Fig. 57) *Gracilaria edulis*
- 20b. Branching irregular → 21

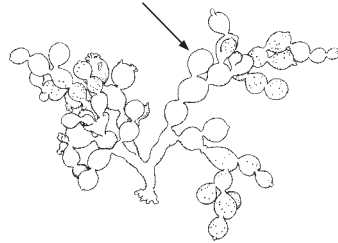


Fig. 55 *Scinaia hormoides*

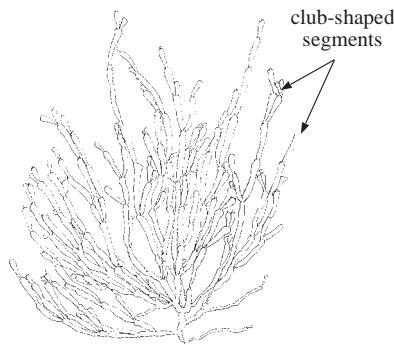


Fig. 56 *Gracilaria salicornia*

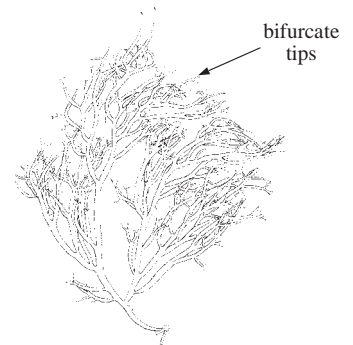


Fig. 57 *Gracilaria edulis*

- 21a. Main branches distinct and percurrent, bearing numerous short secondary branches (Fig. 58) *Gracilaria heteroclada*
- 21b. Main branches not percurrent, lateral branches filiform, distinctly constricted at their base (Fig. 59) *Gracilaria manilaensis*
- 21c. Main branches not percurrent, mainly arcuate bearing short, stubby, coarse spinose determinate branchlets (Fig. 60) *Gracilaria arcuata*

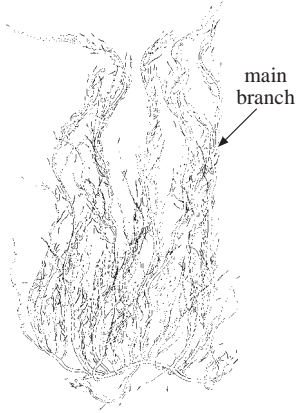


Fig. 58 *Gracilaria heteroclada*

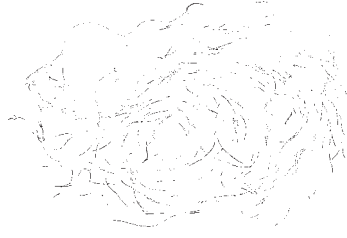


Fig. 59 *Gracilaria manilaensis*

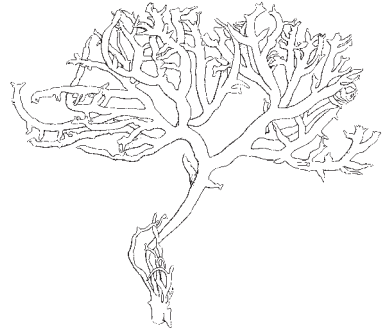


Fig. 60 *Gracilaria arcuata*

- 22a. Determinate branchlets densely and irregularly arranged along the branch axis (Fig. 61) (*Digenea*) *Digenea simplex*
- 22b. Determinate branchlets pinnately arranged along the branch axis (Fig. 62) (*Gelidiella*) *Gelidiella acerosa*

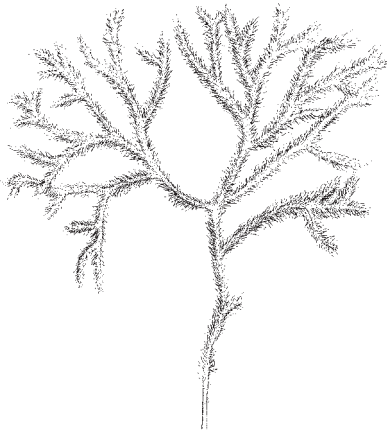



Fig. 61 *Digenia simplex*



Fig. 62 *Gelidiella acerosa*




LIST OF FAMILIES AND COMMON AND ECONOMICALLY IMPORTANT SPECIES OCCURRING IN THE AREA^{1/}

The symbol  is given when species accounts are included.

CHLOROPHYTA (Green algae)

Order ULVALES

Family ULVACEAE

-  *Enteromorpha clathrata* (Roth) Greville, 1830
-  *Enteromorpha intestinalis* (Linnaeus) Nees, 1820
-  *Ulva lactuca* Linnaeus, 1753








Order SIPHONOCLADALES

Family VALONIACEAE

-  *Valonia aegagropila* C. Agardh, 1822

Order BRYOPSIDALES

Family CAULERPACEAE

-  *Caulerpa brachypus* Harvey, 1860
-  *Caulerpa cupressoides* (Vohl) C. Agardh, 1817
-  *Caulerpa lentillifera* J. Agardh, 1837
-  *Caulerpa peltata* Lamouroux, 1809
-  *Caulerpa racemosa* (Forsskål) J. Agardh, 1873
-  *Caulerpa sertularioides* (Gmelin) Howe, 1905
-  *Caulerpa taxifolia* (Vahl) C. Agardh, 1817





Family CODIACEAE

-  *Codium arabicum* Kutzing, 1856
-  *Codium bartlettii* Tseng and Gilbert, 1942
-  *Codium edule* P.C. Silva, 1952

Family HALIMEDACEAE

-  *Halimeda macroloba* Decaisne, 1841
-  *Halimeda opuntia* (Linnaeus) Lamouroux, 1816

Family UDOTEACEAE


-  *Avrainvillea erecta* (Berkeley) A. and E.S. Gepp, 1911
-  *Tydemania expeditionis* Weber-van Bosse, 1901
-  *Udotea argentea* Zanardini, 1858
-  *Udotea geppii* Yamada, 1930

Order DASYCLADALES

Family DASYCLADACEAE

-  *Bornetella oligospora* Solms-Laubach, 1892
-  *Bornetella sphaerica* (Zanard.) Solms-Laubach, 1892





Family POLYPHYSAEAE

-  *Acetabularia major* Martens, 1868

PHAEOPHYTA (Brown algae)

Order DICTYOTALES

Family DICTYOTACEAE

-  *Dictyota dichotoma* (Hudson) Lamouroux, 1809
-  *Dictyota mertensii* (Martius) Kutzing, 1859
-  *Dictyopteris jamaicensis* Taylor, 1960
-  *Padina minor* Yamada, 1925

Order SCYTOSIPHONALES

Family SCYTOSIPHONACEAE

-  *Hydroclathrus clathratus* (C. Agardh) Howe, 1920

^{1/} The classification used follows Silva, P.C., E.G. Meñez and R.L. Moe (1987). Catalog of Benthic Marine Algae of the Philippines. *Smithson. Contrib. Mar. Sci.*, (27):179 p.

Order FUCALES

Family SARGASSACEAE

- ✚ *Sargassum crassifolium* J. Agardh, 1848
- ✚ *Sargassum cristaefolium* C. Agardh, 1820
- ✚ *Sargassum gracillimum* Reinbold, 1913
- ✚ *Sargassum oligocystum* Montagne, 1845
- ✚ *Sargassum paniculatum* J.G. Agardh, 1848
- ✚ *Sargassum polycystum* C. Agardh, 1824
- ✚ *Sargassum turbinarioides* Grunow, 1915
- ✚ *Turbinaria conoides* (J. Agardh) Kuetzing, 1860
- ✚ *Turbinaria decurrens* Bory de Saint Vincent, 1828
- ✚ *Turbinaria ornata* (Turner) J. Agardh, 1848

RHODOPHYTA (Red algae)**Subclass FLORIDEOPHYSIDAE****Order NEMALIALES**

Family HELMINTHOCLADIACEAE

- ✚ *Liagora farinosa* Lamouroux, 1816

Order BONNEMAISONIALES

Family BONNEMAISONIACEAE

- ✚ *Asparagopsis taxiformis* (Delile) Trevisan, 1845

Family GALAXAURACEAE

- ✚ *Scinia hormoides* Setchell, 1914

Order GELIDIALES

Family GELIDIACEAE

- ✚ *Gelidiella acerosa* (Forsskål) Feldmann and Hamel, 1934

Order CRYPTONEMIALES

Family CRYPTONEMIACEAE

- ✚ *Halymenia dilitata* Zanardini, 1851
- ✚ *Halymenia durvillaei* Bory de Saint Vincent, 1828

Order CORALLINALES

Family CORALLINACEAE

- ✚ *Cheilosporum cultratum* (Harvey) Areschoug, 1852

Order GIGARTINALES

Family RHIZOPHYLLIDACEAE

- ✚ *Portieria hornemannii* (Lyngbye) P.C. Silva, 1987

Family GRACILARIACEAE

- ✚ *Gracilaria arcuata* Zanardini, 1860
- ✚ *Gracilaria edulis* (Gmelin) Silva, 1952
- ✚ *Gracilaria eucheumoides* Harvey, 1860
- ✚ *Gracilaria heteroclada* Zhang and Xia, 1988
- ✚ *Gracilaria manilaensis* Yamamoto and Trono, 1994
- ✚ *Gracilaria salicornia* (C. Agardh) Dawson, 1854

Family SOLIERIACEAE

- ✚ *Eucheuma arnoldii* Weber-van Bosse, 1928
- ✚ *Eucheuma denticulatum* (Burman) Collins and Hervey, 1917
- ✚ *Eucheuma gelatinae* (Esper) J. Agardh, 1847

- ✚ *Kappaphycus alvarezii* (Doty) Doty, 1988

Family HYPNEACEAE

- ✚ *Hypnea boergesenii* Tanaka, 1941
- ✚ *Hypnea pannosa* J. Agardh, 1847

Order CERAMIALES

Family RHODOMELACEAE

- ✚ *Acanthophora muscoides* (Linnaeus) Bory de Saint Vincent, 1828
- ✚ *Acanthophora spicifera* (Vahl) Boergesen, 1910
- ✚ *Digenea simplex* (Wulfen) C. Agardh, 1822
- ✚ *Laurencia papillosa* (Forsskål) Greville, 1839

References

- Boergesen, F. 1913. The marine algae of the Danish West Indies, Part 1: Chlorophyceae. *Dansk Botanisk Arkiv*, 1(4):160 p.
- Boergesen, F. 1914. The marine algae of the Danish West Indies, Part 2: Phaeophyceae. *Dansk Botanisk Arkiv*, 2(2):68 p.
- Boergesen, F. 1915. The marine algae of the Danish West Indies, Part 3: Rhodophyceae (1). *Dansk Botanisk Arkiv*, 3:1-80.
- Boergesen, F. 1916. The marine algae of the Danish West Indies, Part 3: Rhodophyceae (2). *Dansk Botanisk Arkiv*, 3:81-144.
- Boergesen, F. 1917. The marine algae of the Danish West Indies, Part 3: Rhodophyceae (3). *Dansk Botanisk Arkiv*, 3:145-240.
- Boergesen, F. 1918. The marine algae of the Danish West Indies, Part 3: Rhodophyceae (4). *Dansk Botanisk Arkiv*, 3:241-304.
- Boergesen, F. 1920. The marine algae of the Danish West Indies, Part 3: Rhodophyceae (6), with Addenda to the Chlorophyceae, Phaeophyceae, and Rhodophyceae. *Dansk Botanisk Arkiv*, 3:369-498.
- Boergesen, F. 1925. Marine algae from the Canary Islands especially from Teneriffe and Gran Canaria, I: Chlorophyceae. Kongelige Danske Videnskabernes Selskab, *Biologiske Meddelelser*, 5(3):123 p.
- Boergesen, F. 1927. Marine algae from the Canary Islands especially from Teneriffe and Gran Canaria, III: Rhodophyceae, Part I: Bangiales and Nematiales. Kongelige Danske Videnskabernes Selskab, *Biologiske Meddelelser*, 6(6):97 p.
- Boergesen, F. 1936. Some marine algae from Ceylon. *Ceylon J. Sci., Bot.*, 12:57-96.
- Boergesen, F. 1940. Some marine algae from Mauritius, I: Chlorophyceae. Kongelige Danske Videnskabernes Selskab, *Biologiske Meddelelser*, 15(4):1-81.
- Boergesen, F. 1942. Some marine algae from Mauritius, III: Rhodophyceae, Part 1. Porphyridiales, Bangiales, Nematiales. Kongelige Danske Videnskabernes Selskab, *Biologiske Meddelelser*, 17(5):63 p.
- Boergesen, F. 1943. Some marine algae from Mauritius, III: Rhodophyceae, Part 2. Gelidiales, Cryptonemiales, Gigartinales. Kongelige Danske Videnskabernes Selskab, *Biologiske Meddelelser*, 19(1):85 p.
- Boergesen, F. 1945. Some marine algae from Mauritius, III: Rhodophyceae, Part 4. Ceramiales. Kongelige Danske Videnskabernes Selskab, *Biologiske Meddelelser*, 19(10):68 p.
- Chapman, V.J. 1970. Seaweeds and their uses. London, England, Methuen and Co., Ltd., 304 p.
- Doty, M.S. 1988. Prodrromus ad systematica Eucheumatoideorum: a tribe of commercial seaweeds related to *Eucheuma* (Solieriaceae, Gigartinales). In *Taxonomy of economic seaweeds with reference to some Pacific And Caribbean species* (Vol. 2), edited by I.A. Abbot. La Jolla, California, California Sea Grant College Program, University of California, pp. 159-207.
- Egerod, L.E. 1952. An analysis of the siphonous Chlorophycophyta with special reference to the Siphonocladales, Siphonales, and Dasycladales of Hawaii. *Univ. Calif. Publ. Bot.*, 25(5):325-454.
- Gepp, A. and E.S. Gepp. 1911. The Codiaceae of the Siboga expedition including a monograph of Flabellarieae and Udoteae. In *Siboga Exped. Monogr.*, (62):150 p.
- Gilbert, W.J. 1942. Notes on *Caulerpa* from Java and the Philippines. *Pap. Mich. Acad. Sci., Arts Lett.*, 27:7-26.
- Gilbert, W.J. 1943. Studies on Philippine Chlorophyceae, I. The Dasycladaceae. *Pap. Mich. Acad. Sci., Arts Lett.*, 28:15-35.
- Gilbert, W.J. 1947. Studies on Philippine Chlorophyceae, III. The Codiaceae. *Bull. Torrey Bot. Club*, 74(2):121-132.
- Hillis, L. 1959. A revision of the genus *Halimeda* (Order Siphonales). *Publ. Inst. Mar. Sci., Univ. Tex.*, 6:321-403.
- Saito, Y. 1969. The algal genus *Laurencia* from the Hawaiian Islands, the Philippine Islands and adjacent areas. *Pac. Sci.*, 23(2):148-160.
- Setchell, W.A. 1914. The *Scinaia* assemblage. *Univ. Calif. Publ. Bot.*, 6(5):79-152.
- Silva, P.C. 1952. *Codium* Stackhouse. In An analysis of the Siphonous Chlorophycophyta with special reference to the Siphonocladales, Siphonales, and Dasycladales of Hawaii by L.E. Egerod. *Univ. Calif. Publ. Bot.*, 25(5):381-395.
- Silva, P.C., E.G. Meñez, and R.L. Moe. 1987. Catalog of the benthic marine algae of the Philippines. *Smithson. Contrib. Mar. Sci.*, (27):179 p.
- Tanaka, T. 1941. The genus *Hypnea* from Japan. *Sci. Pap. Inst. Algol. Res., Fac. Sci., Hokkaido Univ.*, 2(2):227-259.
- Trono, G.C. Jr. 1968. The marine benthic algae of the Caroline Islands: I. Introduction, Chlorophyta and Cyanophyta. *Micronesica*, 4(2):137-206.
- Trono, G.C. Jr. 1969. The marine benthic algae of the Caroline Islands: II. Phaeophyta and Rhodophyta. *Micronesica*, 5(1):27-113.
- Trono, G.C. Jr. 1986. Philippine seaweeds. In *Guide to Philippine flora and fauna* (Vol. 1). Manila, Philippines, Natural Resources Management Center, Ministry of Natural Resources and University of the Philippines, pp. 201-288.
- Trono, G.C. Jr. 1992. The genus *Sargassum* in the Philippines. In *Taxonomy of economic seaweeds with reference to some Pacific and western Atlantic species* (Vol. 3), edited by I.A. Abbott. La Jolla, California, California Sea Grant College Program, University of California, pp. 43-94.
- Trono, G.C. Jr. and Ang Put Jr. 1982. Marine benthic algae from Bugsuk Island and vicinity, Palawan, Philippines. *Kalikasan. Philipp. J. Biol.*, 11(1):1-26.
- Trono, G.C. Jr. and E.T. Ganzon-Fortes. 1988. *Philippine seaweeds*. Manila, Philippines, National Book Store, Inc., 330 p.

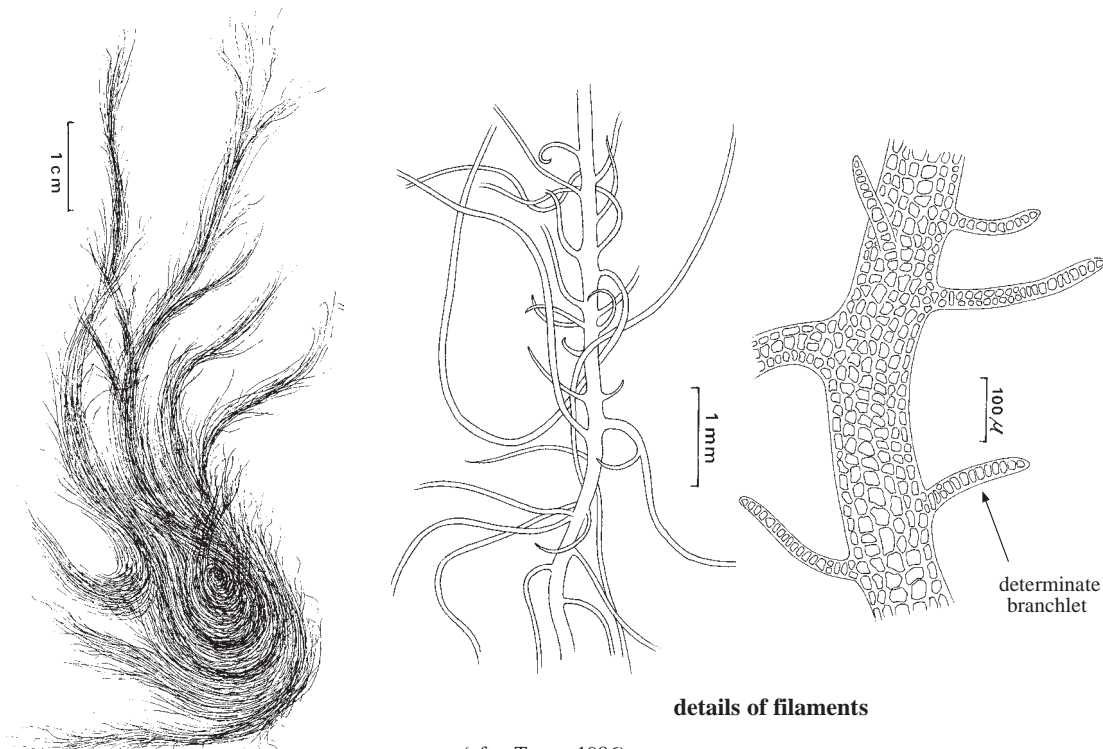
CHLOROPHYTA - Green algae

Order ULVALES

ULVACEAE

Enteromorpha clathrata (Roth) Greville, 1830

FAO names: **En** - Bright green nori; **Fr** - Entéromorpe vert claire; **Sp** - Pelo de piedra verde claro.



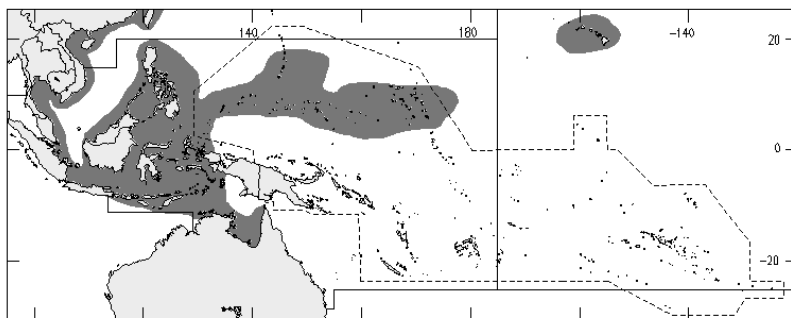
(after Trono, 1986)

Diagnostic characters: Thalli form light green, dense mats consisting of richly branched soft, delicate and hair-like hollow filaments, either attached to solid substrate or floating. Cells 120 to 340 μm in diameter and arranged in longitudinal rows. Determinate branchlets uniseriate at or near their tips.

Size: Thalli up to 20 cm in length.

Habitat, biology, and fisheries: Attached to rocks or other solid substrates in supratidal to upper intertidal areas, or on exposed surfaces; also floating along with other algal species. Used for human consumption (contains vitamin A and vitamin B1), animal feed, fertilizer and has an antibacterial property. Used for human consumption in Zhejiang Province (China), where it is known by the vernacular name Taitiao ("moss stripe"). Also utilized in Japan as garnishing for meats and fish or prepared as salads.

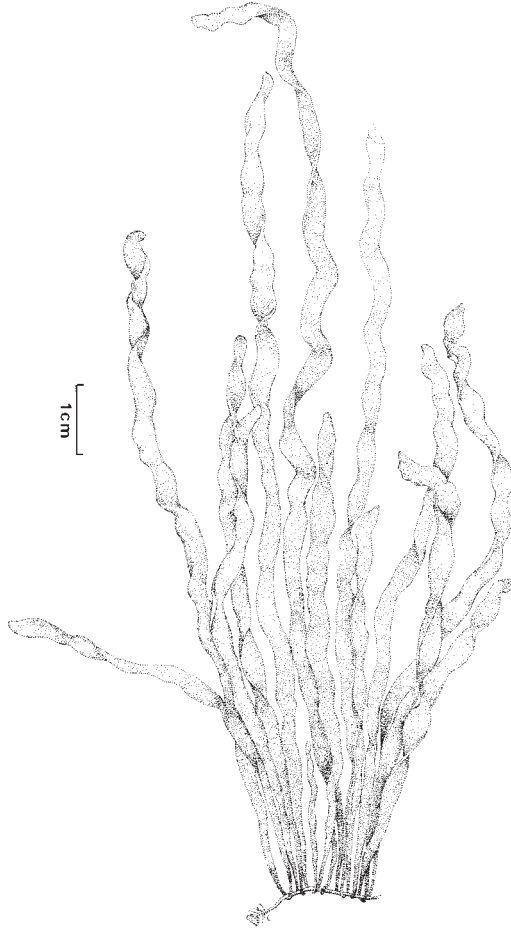
Distribution: Widely distributed in tropical regions, including the Philippines and Viet Nam; common along the coast of China and in Japan.



generalized distribution for *Enteromorpha*

***Enteromorpha intestinalis* (Linnaeus) Nees, 1820**

FAO names: En - Hollow green nori; Fr - Entéromorphe creuse; Sp - Pelo de piedra verde.



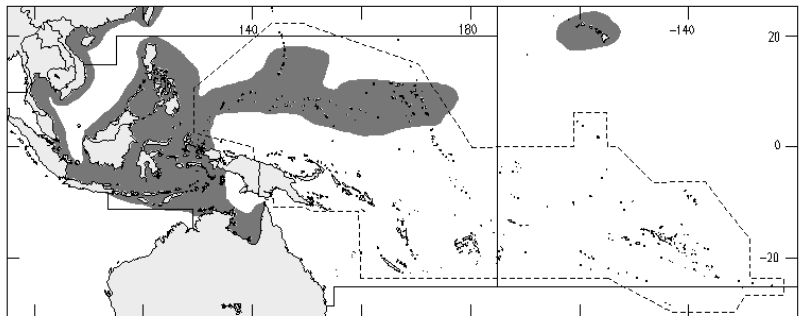
(after Trono, 1986)

Diagnostic characters: Thalli bright to yellowish green. Several unbranched tubular branches arise from a short stipe, attached to rocky substrate by a discoid holdfast. Erect branches tapering below, inflated above and constricted or contorted at certain points. Cells polyhedral in surface view, irregularly arranged and filled with spherical to oval chloroplasts.

Size: Erect branches 6 to 20 cm in height.

Habitat, biology, and fisheries: Grows on rocky substrate in the lower intertidal to shallow subtidal zones or in shallow tidepools exposed to air during low tide. Used for human consumption, a source of Vitamin B1, animal feed, food for milkfish, fertilizer, a source of tocopherol, and has an antibacterial property.

Distribution: Widely distributed in warm waters of the Indo-West Pacific region, including the Philippines, Malaysia, Indonesia, Guam, Borneo, Australia, Micronesia, Marianas, Japan, Viet Nam, and Hawaii.

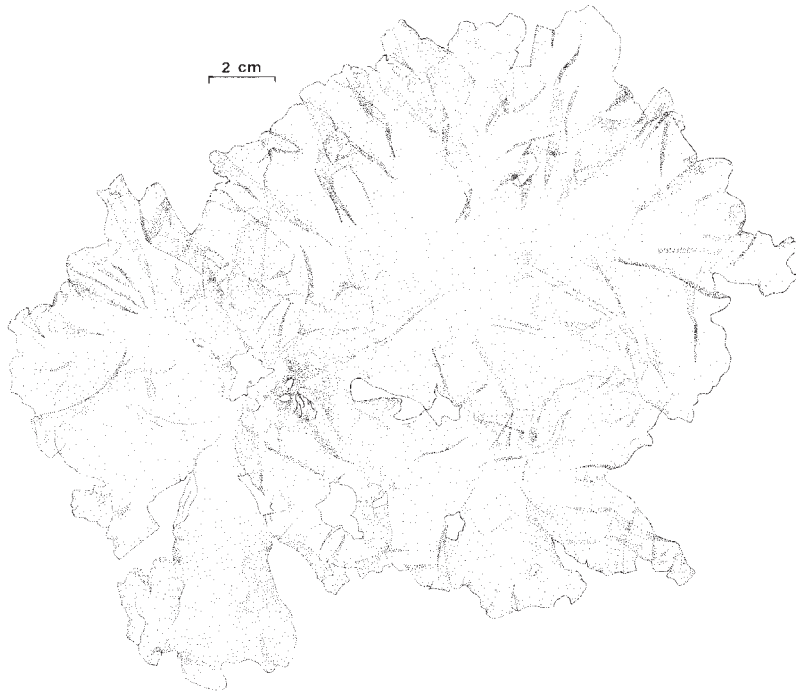


generalized distribution for *Enteromorpha*

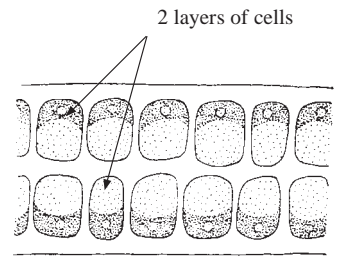
Ulva lactuca Linnaeus, 1753

CH Ulv 1

FAO names: **En** - Sea lettuce; **Fr** - Laitue de mer; **Sp** - Lechuga de mar.



(after Trono, 1986)



cross-section of thallus

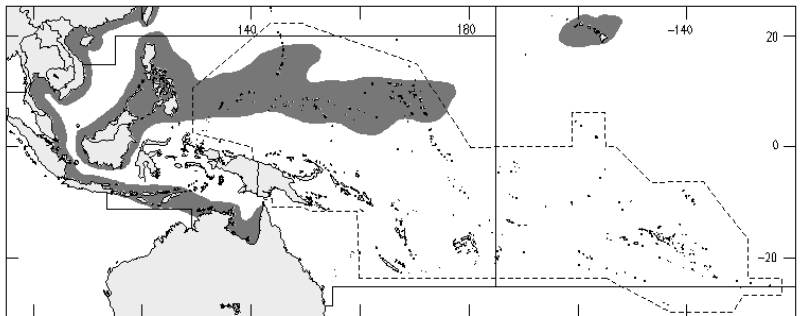
(after Abbott and Hollenberg, 1978)

Diagnostic characters: Thallus grass green, expanded into thin, glossy broad sheets with a lobed or undulating margin. Two layers of cells in cross-section; cells polyhedral in surface view and arranged in rather longitudinal rows.

Size: Blades up to 30 cm in length.

Habitat, biology, and fisheries: Grows in intertidal areas exposed to air during low tides, in shallow water near shores, or attached to other seaweed species such as *Sargassum*. Abundant from November to March. Used as sea vegetables for human consumption, mixed with other vegetables and prepared as salads; also used as medicine and as a source of vitamin E, A, and B1.

Distribution: Widely distributed in tropical waters of the world, including China, the Philippines, Guam, Malaysia, Viet Nam, Indonesia, Japan, Hawaii, and India.

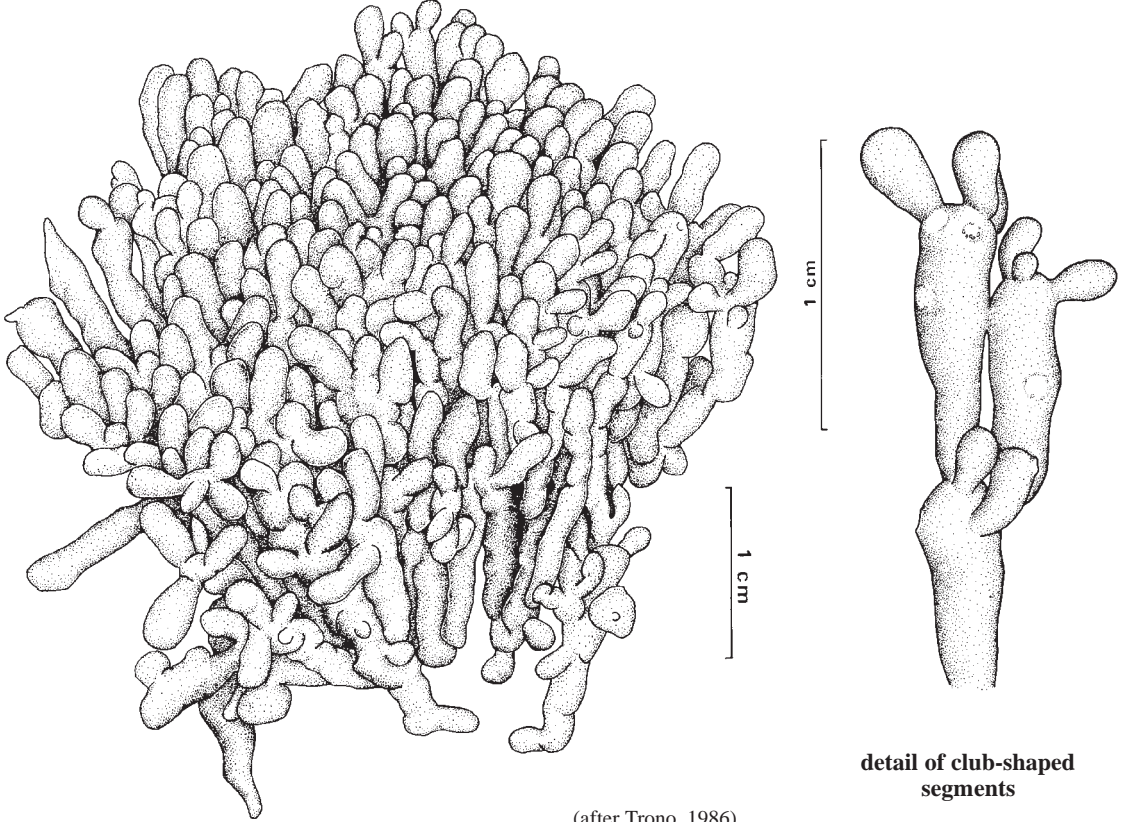


Order SIPHONOCLEDALES

VALONIACEAE

Valonia aegagropila C. Agardh, 1822

FAO names: En - Green sea vesicles.



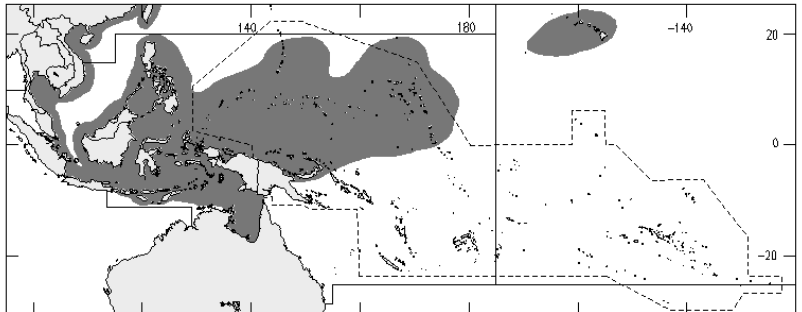
(after Trono, 1986)

Diagnostic characters: Thallus dark olive-green to brown, composed of many shiny, fluid-filled, club-shaped segments, 3 to 13 mm long and 2 to 3.5 mm broad and arranged in tiers with 2 to 5 segments arising from 1 lower segment. Segments loosely or compactly attached to one another by disc-like hapteral extensions.

Size: Clumps of thalli up to 5 cm in diameter.

Habitat, biology, and fisheries: A common species at wave-swept shores, strongly encrusted to rocky substrates. It also grows on reef flats with extreme water movement.

Distribution: A cosmopolitan species; common in warm areas such as the Philippines, Taiwan Province of China, Indonesia, Viet Nam, Guangdong Province (China), and western Pacific islands.

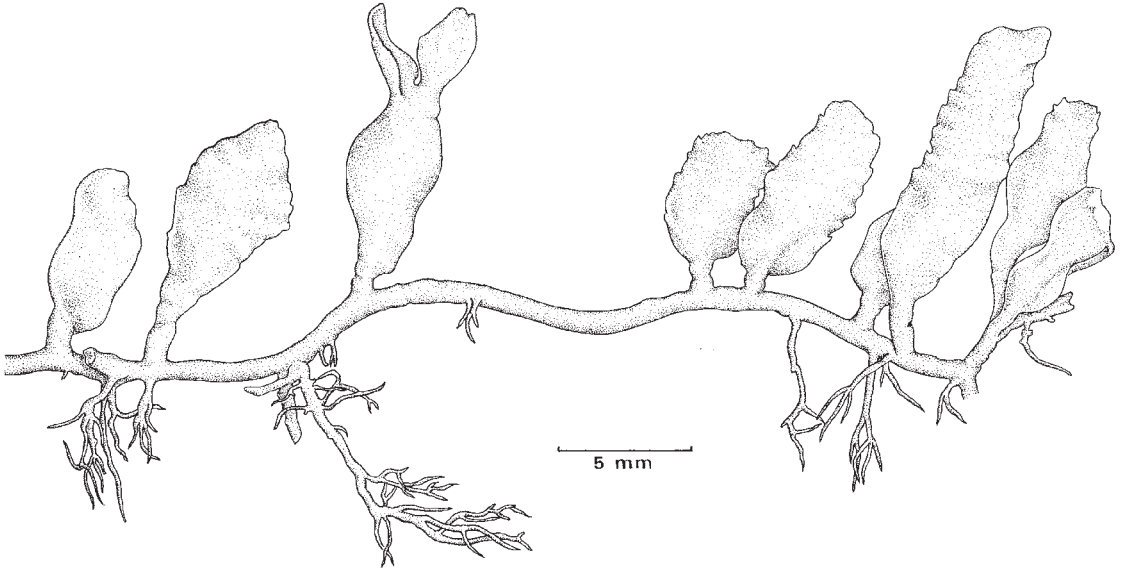


Order BRYOPSIDALES

CAULERPACEAE

Caulerpa brachypus Harvey, 1860

FAO names: En - Sea mustard.



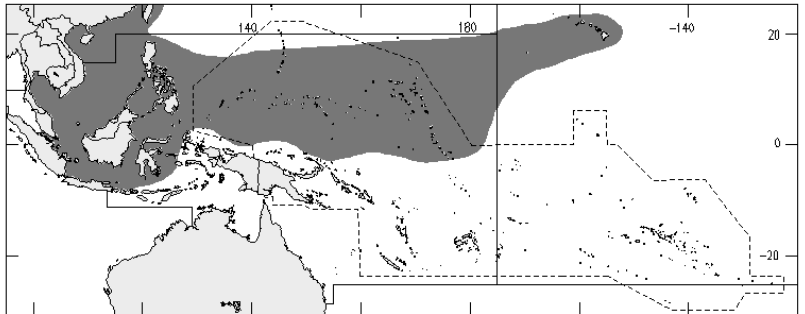
(after Trono, 1986)

Diagnostic characters: Thallus consists of a horizontal branched stolon and erect shortly stipitate blades, 4 to 10 times longer than broad. Apices of blades slightly rounded, emarginate, rarely truncate; the margins often finely to coarsely dentate in their entire length or limited to some parts of the blade; blade unbranched or branched, branching occurs near the base of the blades. Thalli attached to sandy-muddy substrate by a rhizoidal holdfast.

Size: Erect blades up to 3 cm in height.

Habitat, biology, and fisheries: Grows on sand flats or on sandy bottoms with coral rocks, or in tide pools at the open coast. Luxuriant in summer. Used for human consumption and as medicine (antifungal, lowers blood pressure).

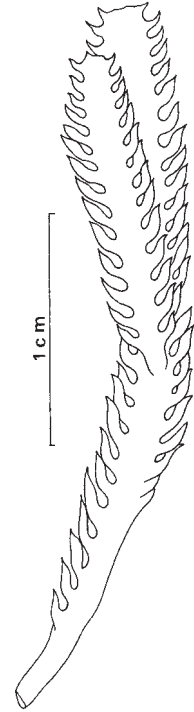
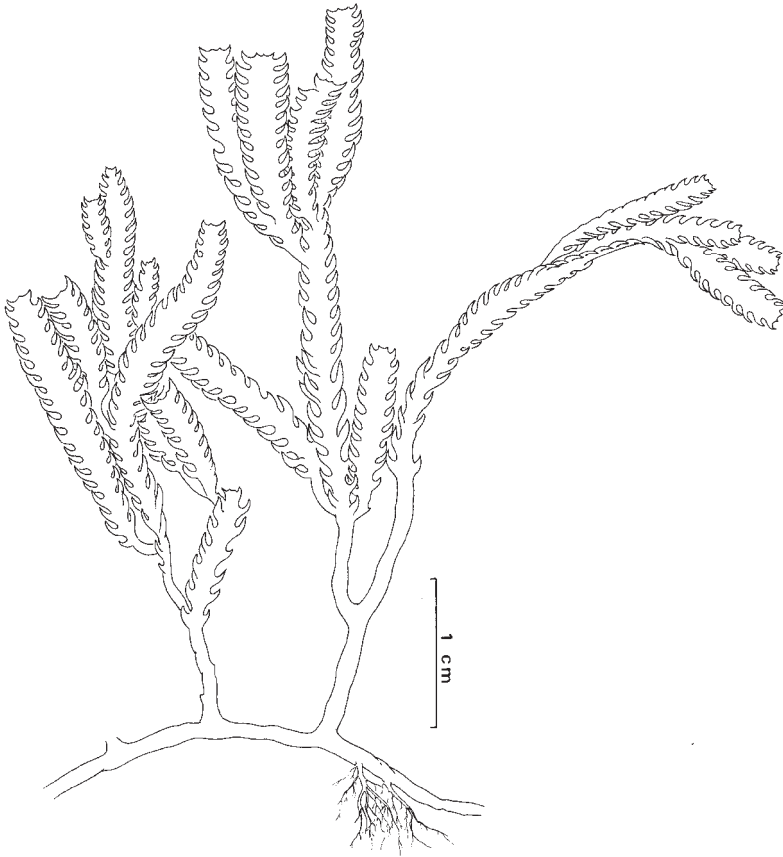
Distribution: Widely distributed in the tropics, including the Philippines, and western Pacific islands.



generalized distribution for *Caulerpa*

Caulerpa cupressoides (Vahl) C. Agardh, 1817

FAO names: En - Toothed stolon.



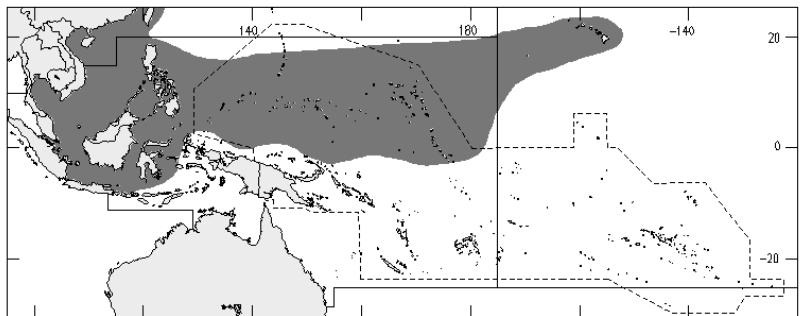
detail of branch
(after Trono, 1986)

Diagnostic characters: Thallus consists of a horizontal branched stolon and feather-like erect branches. Upcurved cylindrical pinnules are pinnately or distichously arranged along the side of the distal portion of branch axes and sometimes tristichously arranged at the lower or basal portion of the erect branches.

Size: Erect branches up to 10 cm in height.

Habitat, biology, and fisheries: A widely distributed species, rather common in tropical areas. Grows on sandy substrate with coral rocks in calm, shallow areas and moderately exposed habitats. It may form large colonies on sandy shallows, attached to shells, stones, and coral fragments or anchored on the sand. While quite able to grow luxuriantly in warm shallow tidepools or lagoons, this species is apparently not adapted to shaded habitats. Used for human consumption and as medicine (antifungal, lowers blood pressure).

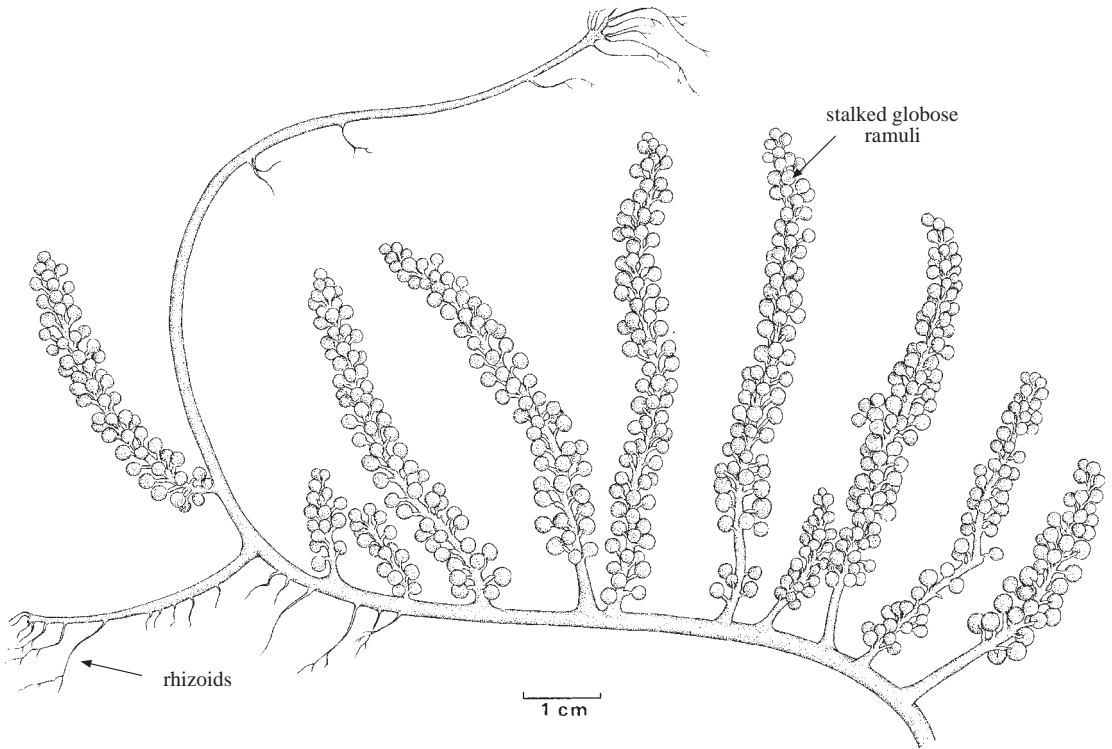
Distribution: Cosmopolitan in tropical and subtropical regions; common in the Indian Ocean, and tropical western Pacific islands.



generalized distribution for *Caulerpa*

Caulerpa lentillifera J. Agardh, 1837

FAO names: En - Small seagrape.



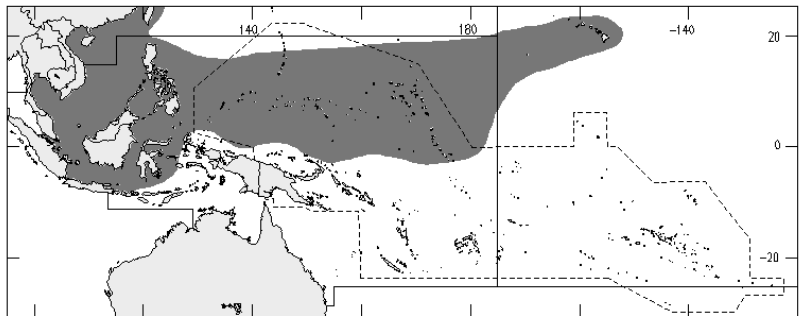
(after Trono, 1986)

Diagnostic characters: Thallus consists of a horizontal branched stolon and erect branches, the latter densely covered by many short ramuli; along almost the entire length of their axes. Each ramulus consisting of a short stalk and a globose tip, 1 to 3 mm in diameter; the distinct constriction between the tip of the stalk and the base of the globose tip is a characteristic of this species.

Size: Erect branches up to 15 cm in height.

Habitat, biology, and fisheries: Commonly grows on shallow, sandy to muddy lagoon and reef flats which are not exposed during low tides and where the water is generally calm. It may form an extensive bed in exceptionally good habitats. Commercially farmed in ponds and lagoons and is the most popular edible species of *Caulerpa*. Growth of natural stocks is seasonal in habitats where water becomes brackish during rainy seasons, or for those cultured in ponds. A highly favoured species for human consumption due to its soft and succulent texture; has a high mineral content (Ca, K, Mg, Na, Cu, Fe, Zn); also used as medicine (antifungal, lowers blood pressure).

Distribution: Widely distributed in tropical areas, including the Red Sea, Madagascar, and the western Pacific from Indonesia to Hawaii.



generalized distribution for *Caulerpa*

***Caulerpa peltata* Lamouroux, 1809**

FAO names: En - Flattop seagrape.



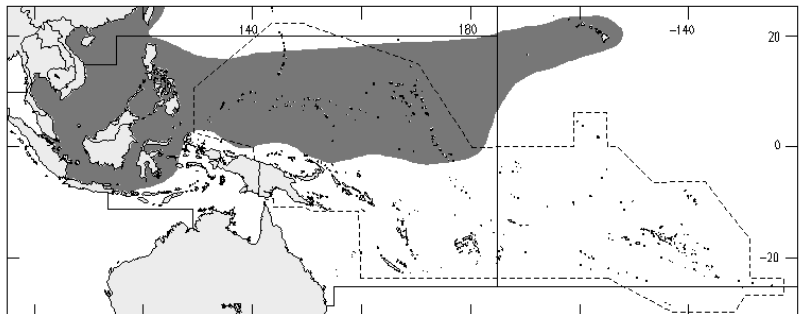
(after Trono, 1986)

Diagnostic characters: Thallus consisting of a horizontal branched stolon and erect branches supporting several short-stalked ramuli, each terminating in a disc. Two forms are recognizable, a more common one with narrow discs, 3 to 9 mm in diameter, and another one with broad discs, 11 to 20 mm in diameter.

Size: Erect branches up to 5 cm in height.

Habitat, biology, and fisheries: Grows in tidepools at a depth of 3 to 6 m, or forming thick carpets on soft muddy substrates in well-protected areas. Seasonality in growth in sandy-muddy habitats appears to be related to the turbidity and salinity of the water. Used as food and as medicine (antifungal, lowers blood pressure).

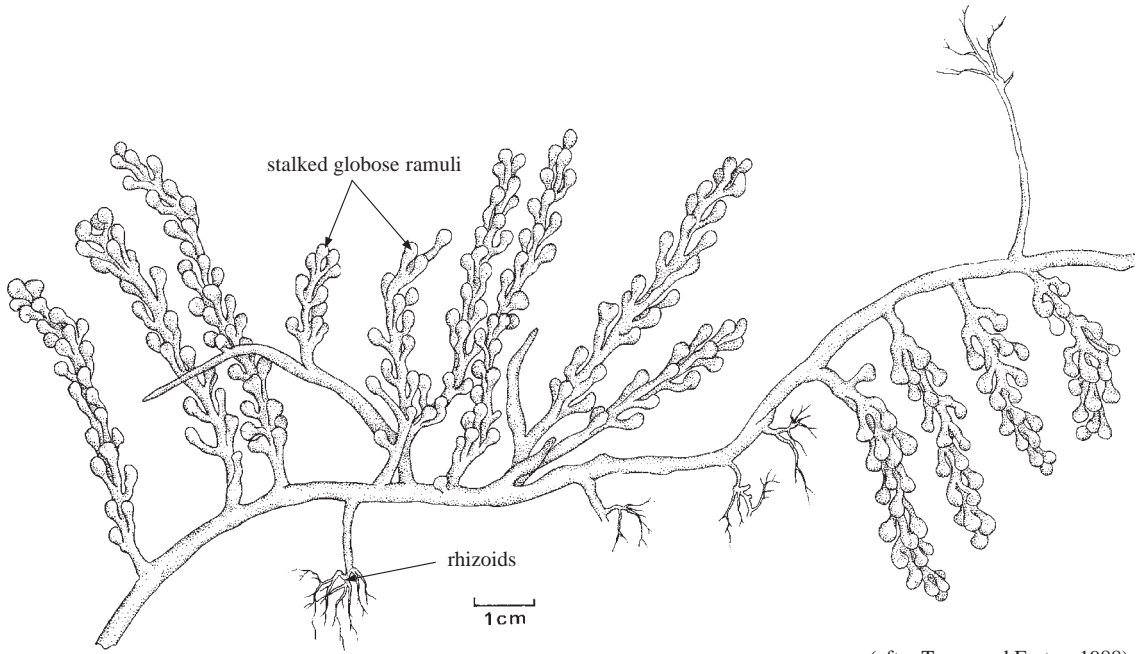
Distribution: Widely distributed in the tropics and reported from Europe, Japan, the Philippines, Viet Nam and Indonesia, to Hawaii; common at coasts of the South China Sea.



generalized distribution for *Caulerpa*

Caulerpa racemosa (Forsskål) J. Agardh, 1873

FAO names: En - Coarse seagrape.



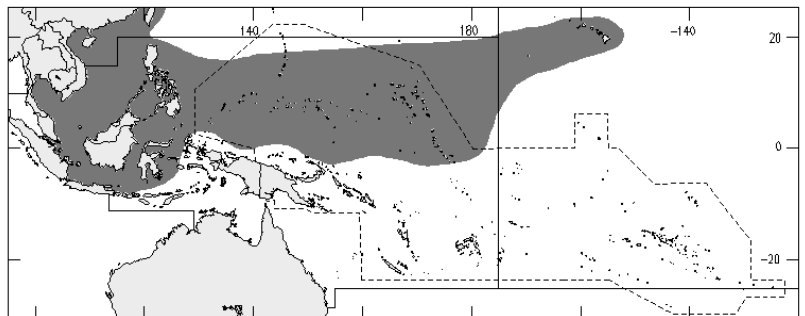
(after Trono and Fortes, 1988)

Diagnostic characters: A highly variable species. The typical *racemosa* variety (see illustration) is characterized by the possession of short erect branches bearing crowded ramuli with short stalks and oval or spherical tips. The arrangement and shape of the ramuli differ among the numerous varieties. The ramuli can be sparse or dense, arranged radially, alternately, pinnately or irregular on the erect branch. The distal portion of the ramuli can be clavate, turbinate, globose truncate, or sometimes discoid. Plants growing on sandy substrate in calm, turbid water of the reef flat tend to have long erect branches densely covered with clavate or capitate ramuli while those growing on rocky-wave exposed portions of the reef possess strong short erect branches which bear crowded ramuli with spherical or globose tips.

Size: Erect branches up to 10 cm in height.

Habitat, biology, and fisheries: Commonly encountered in lower intertidal and upper subtidal areas protected from strong wave action and current on sandy-muddy to rocky-coraline substrates. Used for human consumption; source of caulerpin, a substance with anaesthetic effect; also source of caulerpicin which has a toxic effect; as medicine (antifungal, lowers blood pressure).

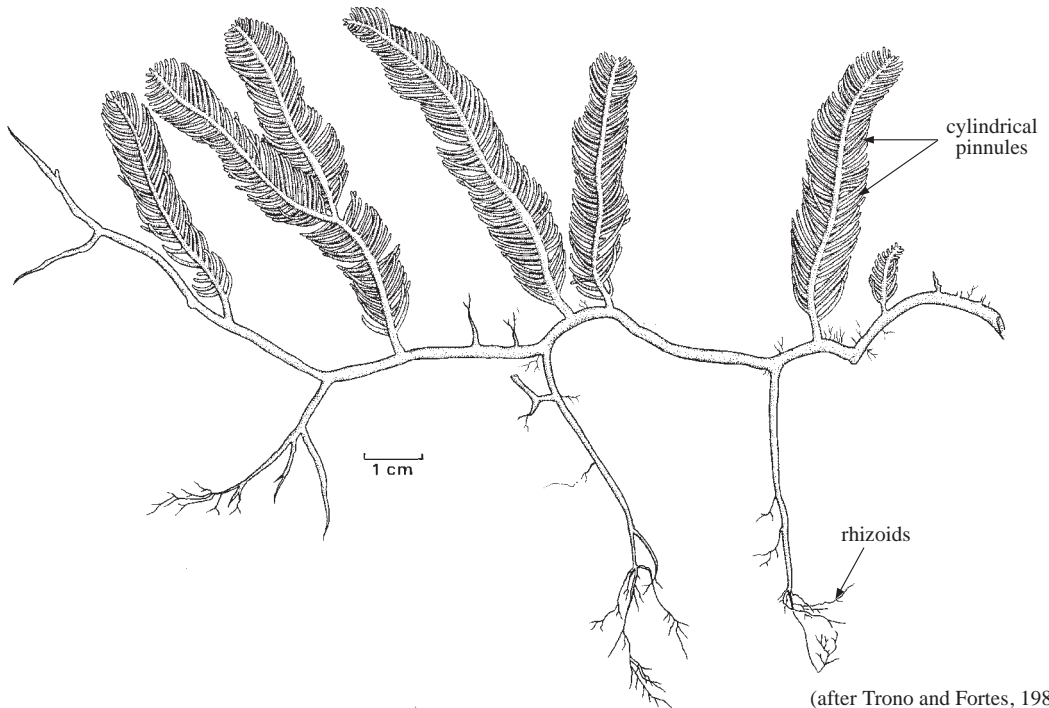
Distribution: Widely distributed in tropical and subtropical regions, including the Philippines, Viet Nam, Singapore, Malaysia, Thailand, Taiwan Province of China, Guangdong Province (China), Indonesia, and western Pacific islands.



generalized distribution for *Caulerpa*

Caulerpa sertularioides (Gmelin) Howe, 1905

FAO names: En - Green sea feather.

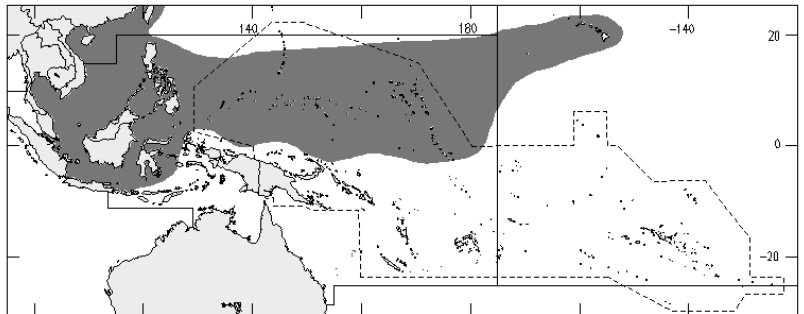


Diagnostic characters: Characterized by the feather-like erect branches. The pinnately arranged pinnules (ramuli) are cylindrical with a mucronate tip.

Size: Erect branches up to 12 cm in height.

Habitat, biology, and fisheries: Grows on sandy to sandy-rocky substrate in calm, shallow and protected areas on reef flats; commonly associated with seagrasses. It has been dredged from a depth of 110 m, but all of the collections seen from depths beyond 3 to 4 m consisted of very depauperate, attenuated individuals. Its economic potential is the same as for *C. brachypus*; a source of sitosterol, caulerpin, and caulerpicin, palmitic acid.

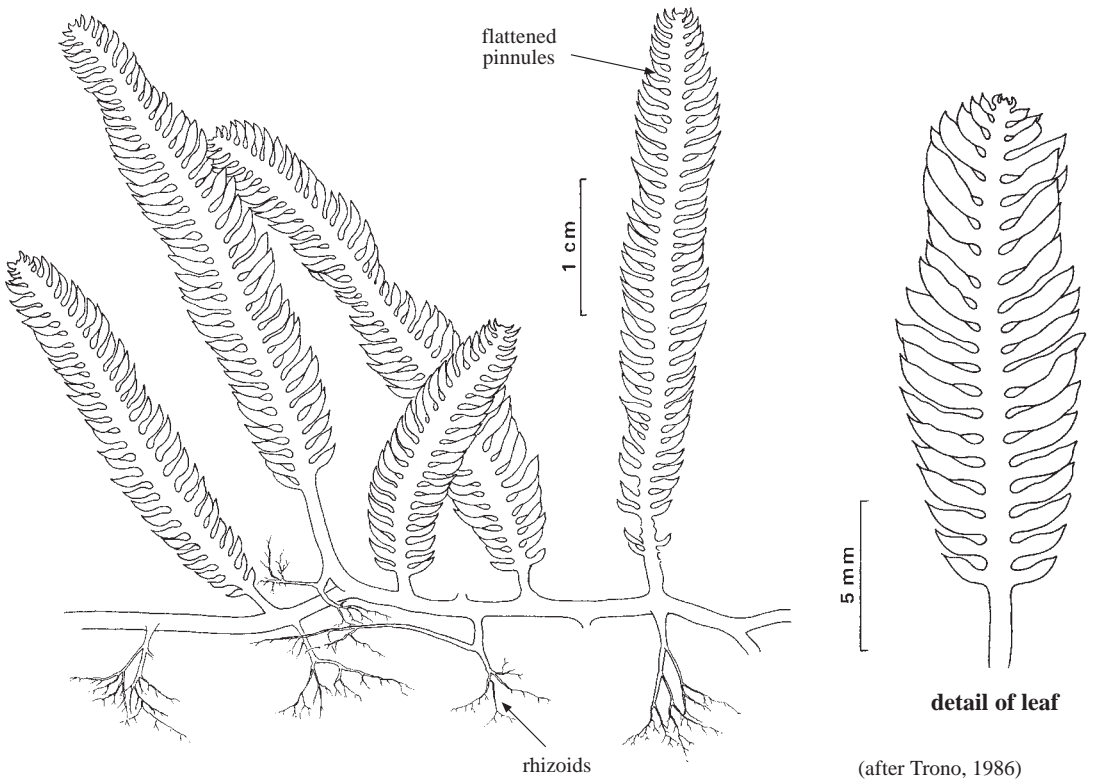
Distribution: Widely distributed in tropical and subtropical areas of the Indian and Pacific Oceans; very common in the Indo-Malayan Archipelago including the Philippines, Taiwan Province of China, and Guangdong Province (China).



generalized distribution for *Caulerpa*

Caulerpa taxifolia (Vahl) C. Agardh, 1817

FAO names: En - Green sea palm.

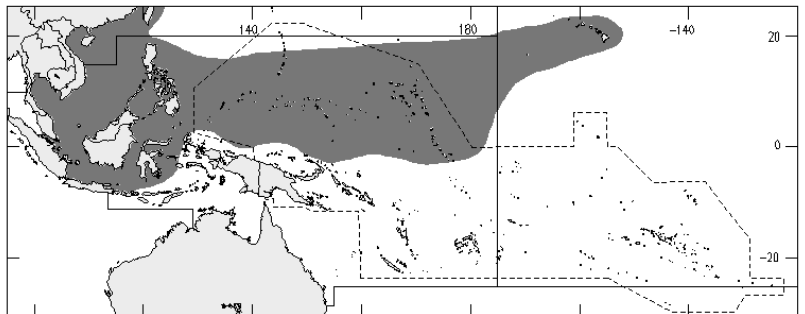


Diagnostic characters: Characterized by the usually unbranched, narrow, feather-like erect branches. The pinnately arranged pinnules (ramuli) are distinctly flattened and sickle-shaped.

Size: Erect branches up to 5 cm in height.

Habitat, biology, and fisheries: Grows on soft to hard, sandy or rocky substrate in calm to moderately exposed habitats. Abundant in quiet waters or in tide pools. Plants of sheltered shores and in shallow water grow on sand, mud, or rocks; sometimes found in moderately exposed situations and dredged to a depth of 30 m on sand and gravel. Used for human consumption and as medicine (antifungal, lowers blood pressure).

Distribution: Widely distributed in tropical seas and common in the Philippines, Indonesia, Malaysia, Viet Nam, Singapore, Celebes, Papua New Guinea, Somalia, Thailand, and western Pacific islands, Japan, Polynesia, Indonesia, and the Indian Ocean.

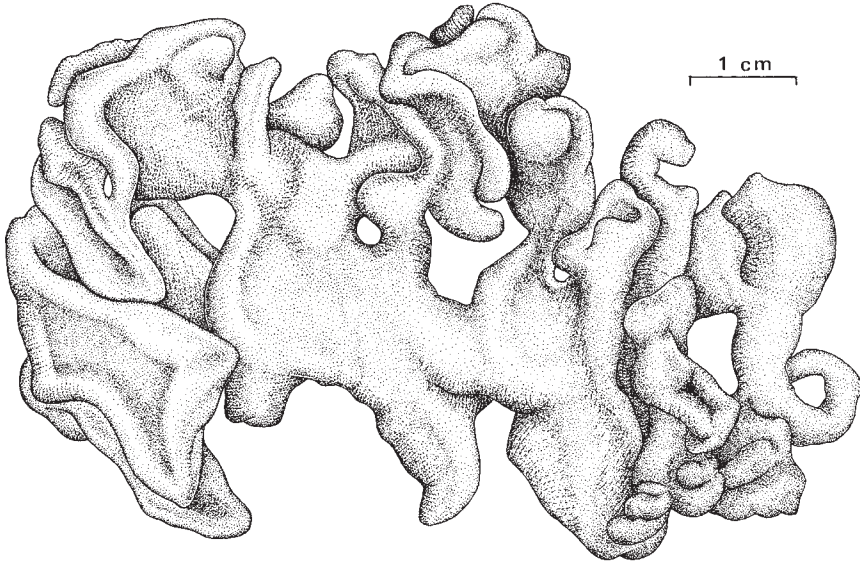


generalized distribution for *Caulerpa*

CODIACEAE

Codium arabicum Kutzing, 1856

FAO names: En - Green sea cushion.

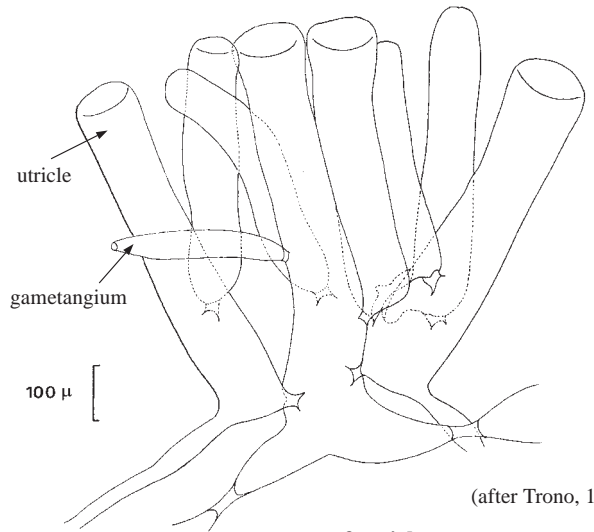


Diagnostic characters: Thallus forming a dark green, amorphous to convoluted spongy mass, composed of central medulla and cortex. Medulla consisting of branched cylindrical filaments, their tips inflated into cylindrical to clavate utricles forming the cortex. Hairs or hair scars occur in 1 to 3 vertical rows, at some distance from the tip of the utricule. Gametangia cylindrical and tapering towards both ends, borne at the side of the proximal portion of the utricule.

Size: Amorphous clumps up to 5 cm in diameter.

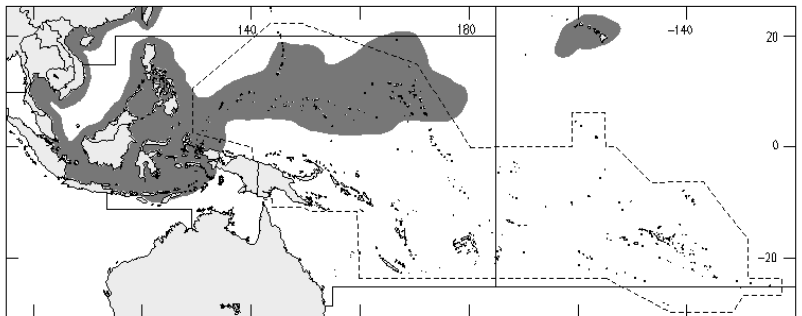
Habitat, biology, and fisheries: Found in lower intertidal to shallow subtidal areas where it grows encrusted on sandy-rocky substrate or epiphytic on stipes of larger seaweeds and midribs of the seagrass *Enhalus*. Used for human consumption and as medicine (antibacterial, antitumor).

Distribution: Commonly found in the tropics and known from the Philippines, Viet Nam, Taiwan Province of China, China and other regions of the Indo-West Pacific.



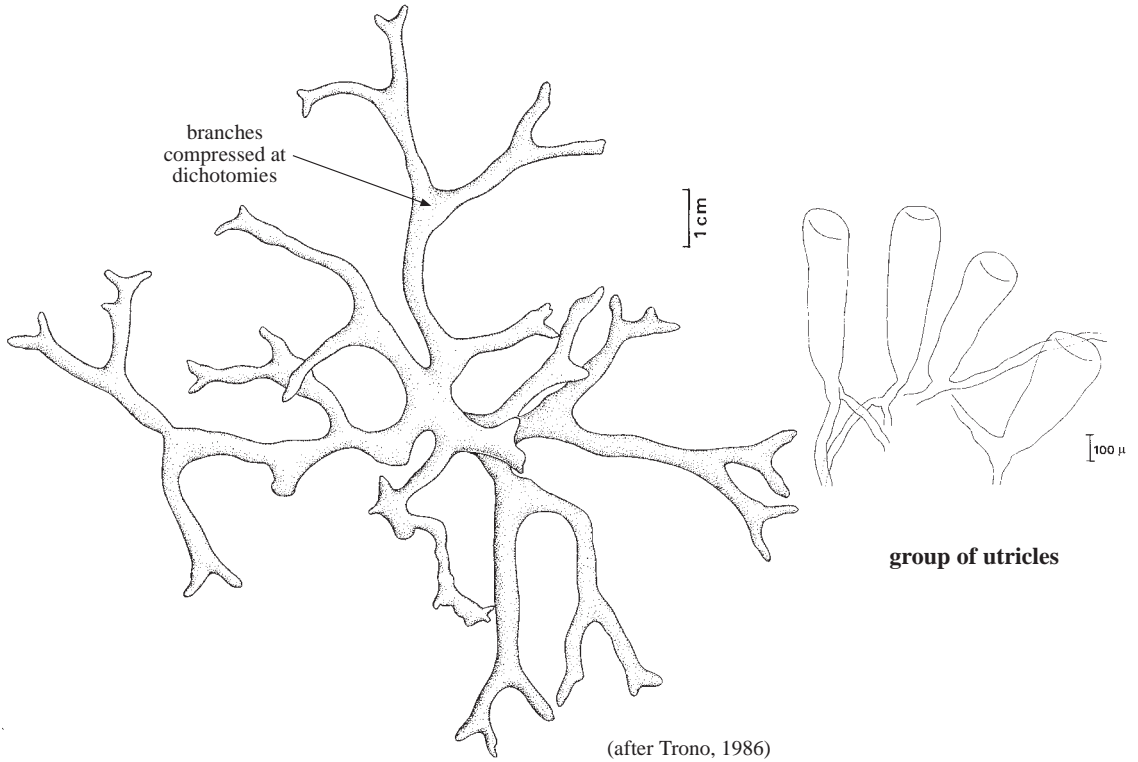
(after Trono, 1986)

group of utricles



Codium bartlettii Tseng and Gilbert, 1942

FAO names: En - Green sea antler.

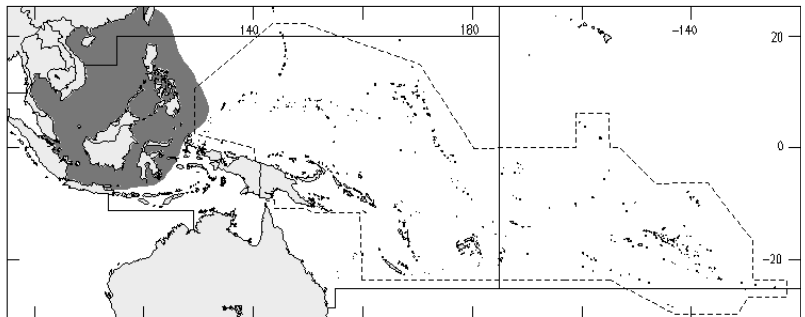


Diagnostic characters: Thalli erect, green to greenish brown in colour. Branching repeatedly subdichotomous-divaricate, forming broad rounded axils (especially at the basal portion of the thallus); one branch of the dichotomy more developed than the other and continuous with the main branch below it. Branches cylindrical-compressed, adhering to each other at some points by cushion-like rhizoidal structures. Medullary filaments cylindrical and branched, giving rise to inflated club-shaped utricles forming the cortex.

Size: Thallus up to 6 cm in height.

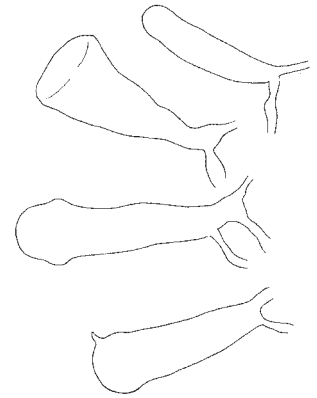
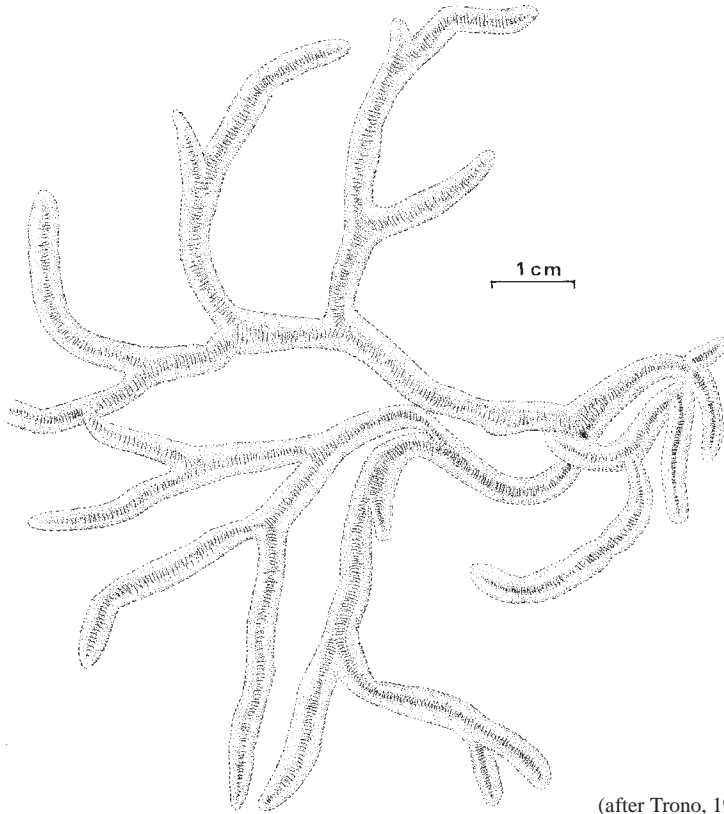
Habitat, biology, and fisheries: Forms loose clumps on sandy-rocky substrates in the lower intertidal and upper subtidal zone of the reef. Used for human consumption and as medicine (antibacterial, antitumor). In Japan, it is dried and preserved in ash or salt. Boiled in water for culinary purposes and put into soups, or alternatively, after washing in water, mixed with soya-bean sauce and vinegar.

Distribution: Limited to the tropics and known from the Philippines, Guangdong Province (China), Mauritius, and the Indo-Malayan Archipelago.

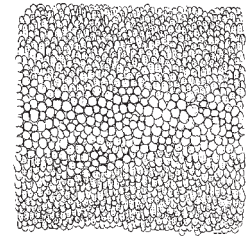


Codium edule P.C. Silva, 1952

FAO names: En - Branched sea cushion.



forms of utricles



x 25

surface view of utricles

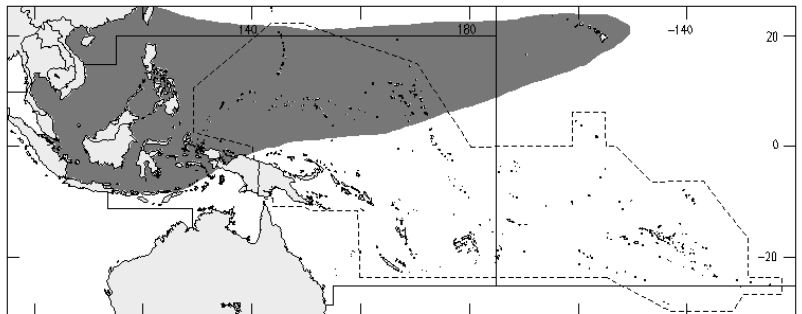
(after Trono, 1986)

Diagnostic characters: Thallus intertwined green to greenish brown, forming a spongy mass. Branches cylindrical, 3 to 7 mm in diameter, attached to one another at any point by small cushion-like rhizoidal structures. Branching dichotomous to subdichotomous, forming angles of more than 45° but less than 90°. Filaments of the medulla 42 to 69 μm wide, separated from the utricles by deep constrictions. Utricles club-shaped, cone-shaped, or cylindrical, slightly tapering towards the base with rounded tips; some utricles with slight swelling just below the apex; utricles 200 to 460 μm in diameter at the thickest portion, and 800 to 1 070 μm in length.

Size: Amorphous clumps up to 5 cm in diameter.

Habitat, biology, and fisheries: Attached to coralline or sand-covered rocks in lower intertidal to subtidal areas at depths of 1.8 to 4.6 m. Used for human food and commonly sold fresh in the markets in Northern Luzon.

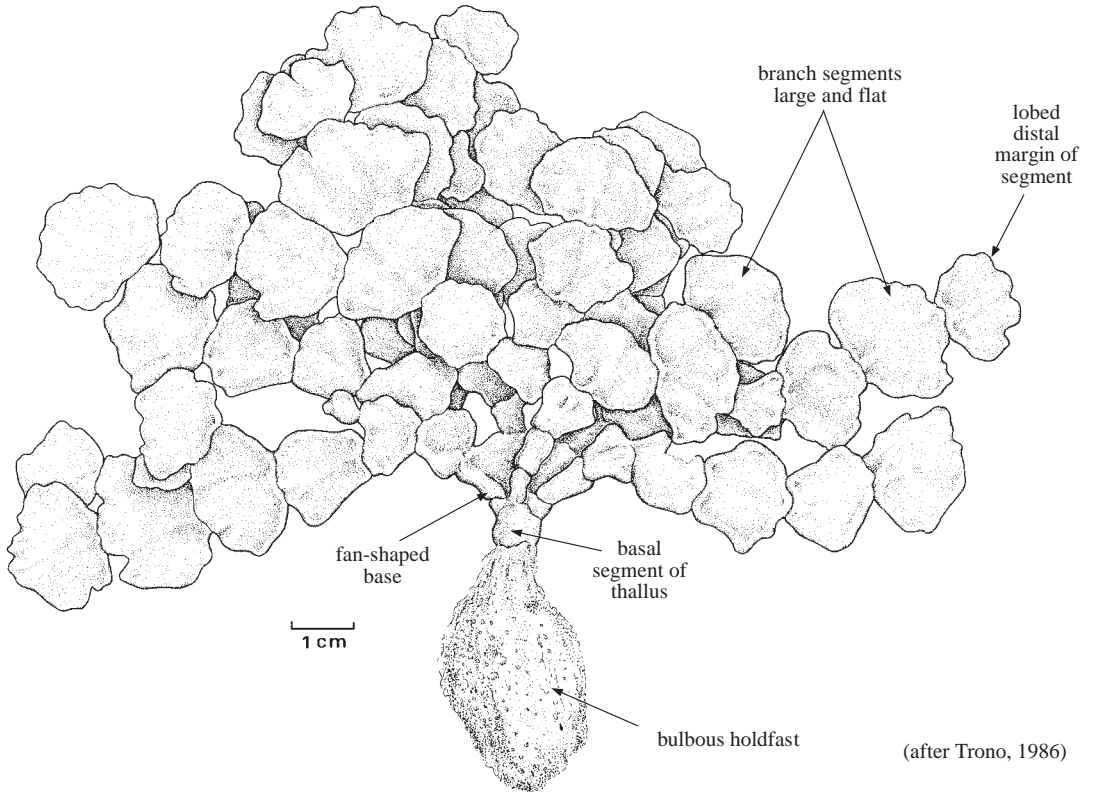
Distribution: Commonly found in the northern Philippines and China; also found in the western Pacific from Indonesia eastward to Hawaii.



HALIMEDACEAE

Halimeda maculoba Decaisne, 1841

FAO names: En - Erect sea cactus; Fr - Monnaie de poseidon; Sp - Tuna del mar.

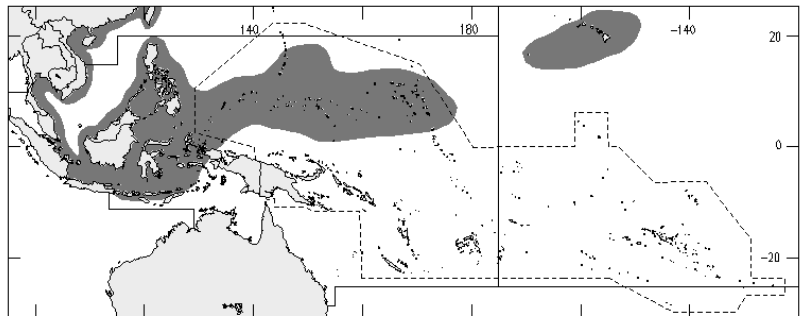


Diagnostic characters: Thalli erect, bright green in colour when fresh and cream or greenish when dried, moderately calcified. Holdfast bulbous. Thallus with a compressed, rectangular to subcuneate basal segment, from which arise in a single plane 2 or more separate segments, altogether forming a somewhat folded, fan-shaped base. Segments of branches distinctly large and flat to compressed, 1 to 3 mm thick, commonly flabellate and occasionally quadrangular, the upper margin entire, undulate or irregularly lobed; largest segment 2.2 cm high and 2.9 cm wide. Cortex consisting of 3 layers of utricles, outermost utricles easily separate upon decalcification; utricles polygonal in surface view, 30 to 60 μm broad and 79 to 136 μm long.

Size: Thallus (excluding holdfast) to about 12 cm in height; holdfast to 4.5 cm in length.

Habitat, biology, and fisheries: Occurs on sand flats or in shallow water, usually in close association with seagrasses and other large macroalgae. Not utilized commercially, although investigations have shown that it is a source of growth regulators (auxin, gibberellin, cytokinin); also possesses antibacterial and antifungal properties.

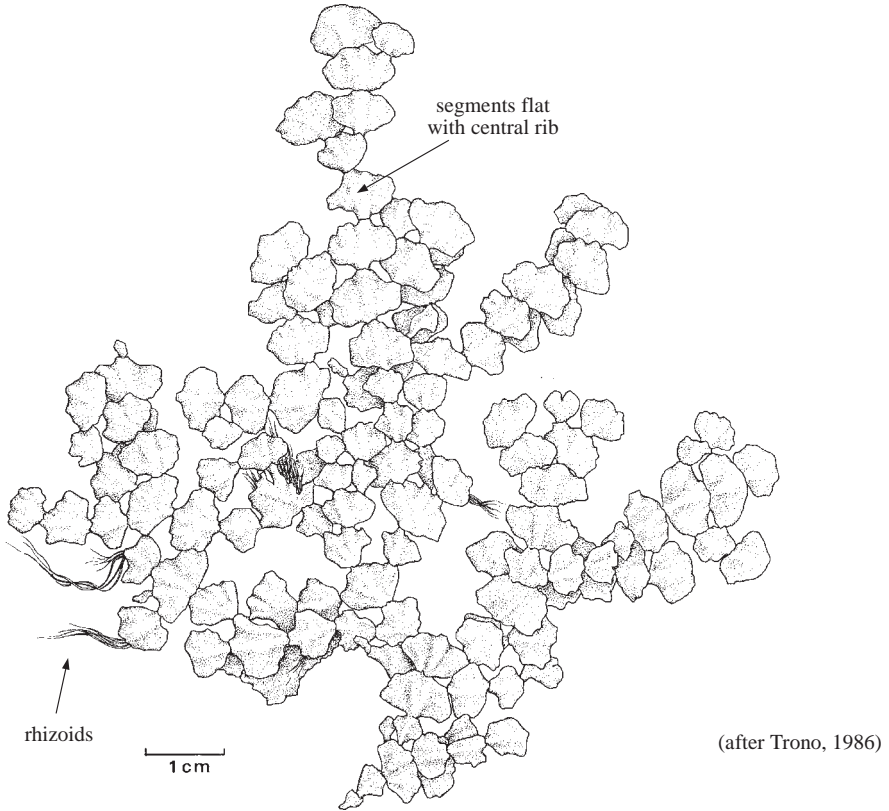
Distribution: Widely distributed in tropical waters of the Indo-West Pacific, including the Philippines, Guam, Malaysia, Hawaii, Indonesia, China, Japan, Viet Nam, and India.



generalized distribution for *Halimeda*

Halimeda opuntia (Linnaeus) Lamouroux, 1816

FAO names: En - Prostrate sea cactus.

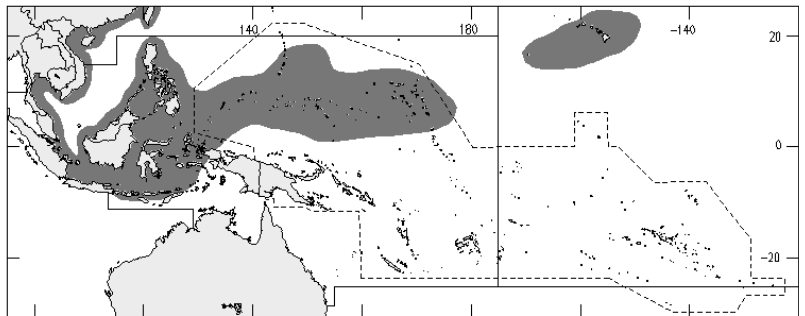


Diagnostic characters: Thalli form greenish to cream amorphous clumps, attached by rhizoids at various points where segments get in contact with the substrate. Branches composed of moderately calcified flat segments with a distinct central rib, generally reniform to flabellate with the upper margin entire, sinuate to deeply lobed, 3 to 8 mm high, 4 to 10 mm wide, and 0.5 to 7 mm thick. Cortex consisting of 5 layers of utricles formed by repeated dichotomies from the medullary filaments; outermost utricles adhere slightly after decalcification, hexagonal in surface view, 23 by 40 to 50 μm in transverse section; secondary utricles about 17 μm wide. Central medullary filaments extend along the segments, terete and trichotomously branched, with evident constrictions at a short distance above the point of branching.

Size: Amorphous clumps up to 15 cm in diameter.

Habitat, biology, and fisheries: Grows in the lower intertidal zone of coral reefs or on dead corals below the low-tide mark in calm shallow waters. Not utilized commercially, although investigations have shown that it is a source of growth regulators (auxin, gibberellin, cytokinin); also possesses antibacterial and antifungal properties.

Distribution: Widely distributed in the tropics, including the Philippines, Japan, Malaysia, Thailand, Indonesia, Guam, Viet Nam, China, Hawaii, and western Pacific islands.

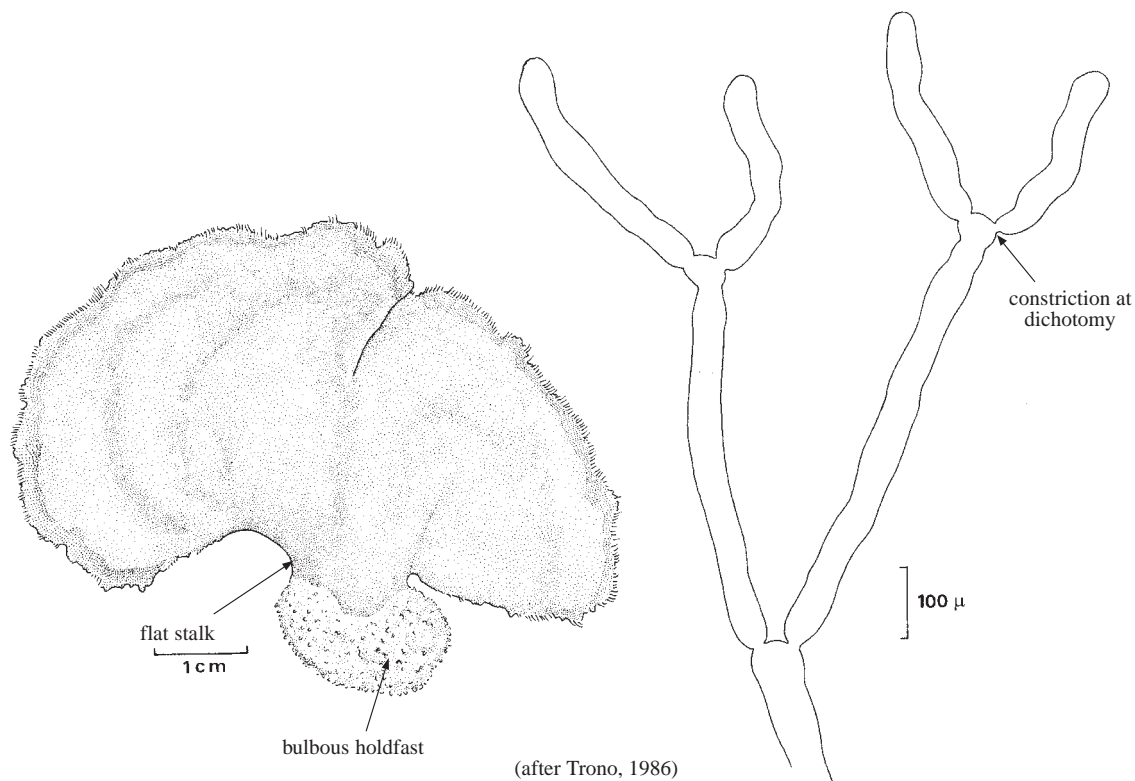


generalized distribution for *Halimeda*

UDOTEACEAE

Avrainvillea erecta (Berkeley) A. and E.S. Gepp, 1911

FAO names: En - Elephant's ear.



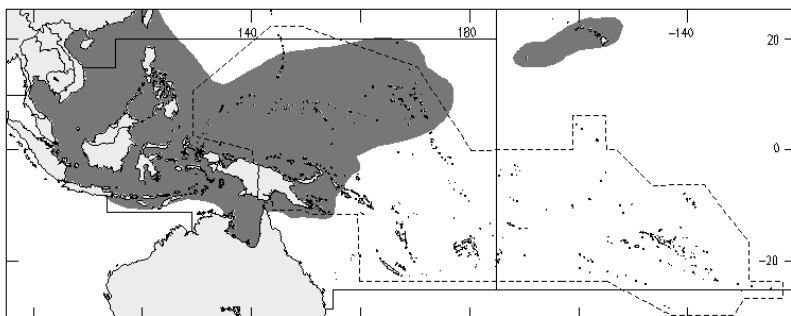
detail of blade-like filaments

Diagnostic characters: Thalli dark green when fresh, generally solitary and anchored in sandy to sandy-muddy substrate by a well-developed bulbous holdfast. Blade flat, flabellate to reniform, with the outer margin entire or finely fibrous, supported by a short, flat stalk; blade-like filaments yellowish orange, cylindrical and 32 to 50 μm in diameter, dichotomously branched and strongly constricted at the dichotomies.

Size: Blade 3 to 6 cm in height.

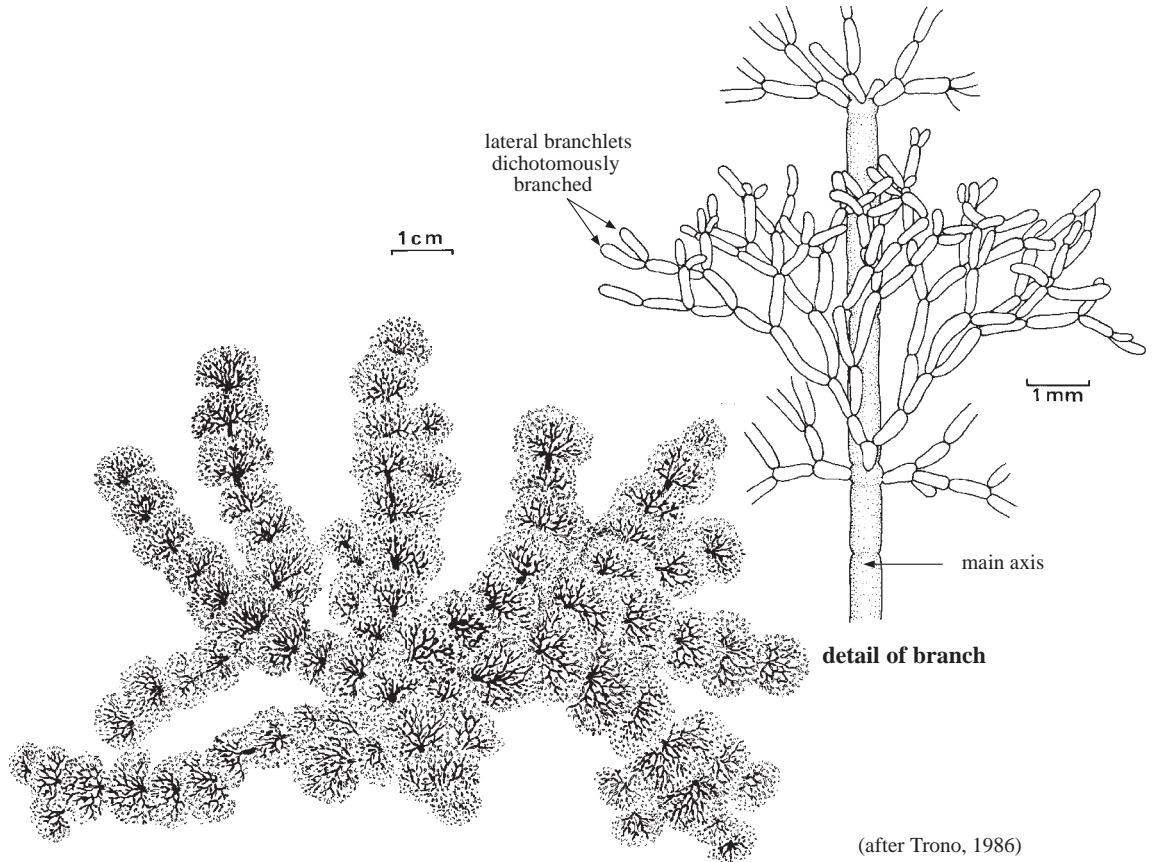
Habitat, biology, and fisheries: Commonly found in the intertidal zone growing on sandy-muddy substrate of reef flats and in shallow protected waters.

Distribution: Common in the tropics and known from New Guinea, Sri Lanka, Japan, the Philippines, Guangdong Province (China), and the Indo-West Pacific region.



Tydemania expeditionis Weber-van Bosse, 1901

FAO names: En - Green sea beads.

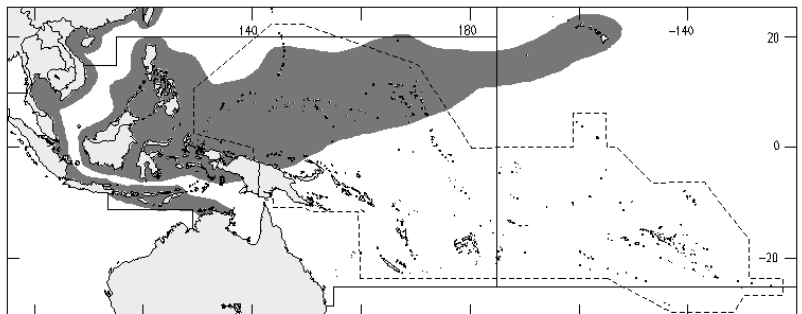


Diagnostic characters: Thallus green, slightly calcified, forming thick clumps on sandy-rocky substrate in subtidal areas. Main branches terete, with successive whorls of glomeruliferous branches along the entire length at intervals of about 1 cm. Each whorl composed of 4 or 5 verticillately arranged lateral branchlets which are dichotomously branched repeatedly (6 to 7 times) in alternate planes, rarely trichotomously branched.

Size: Thallus up to 10 cm in height.

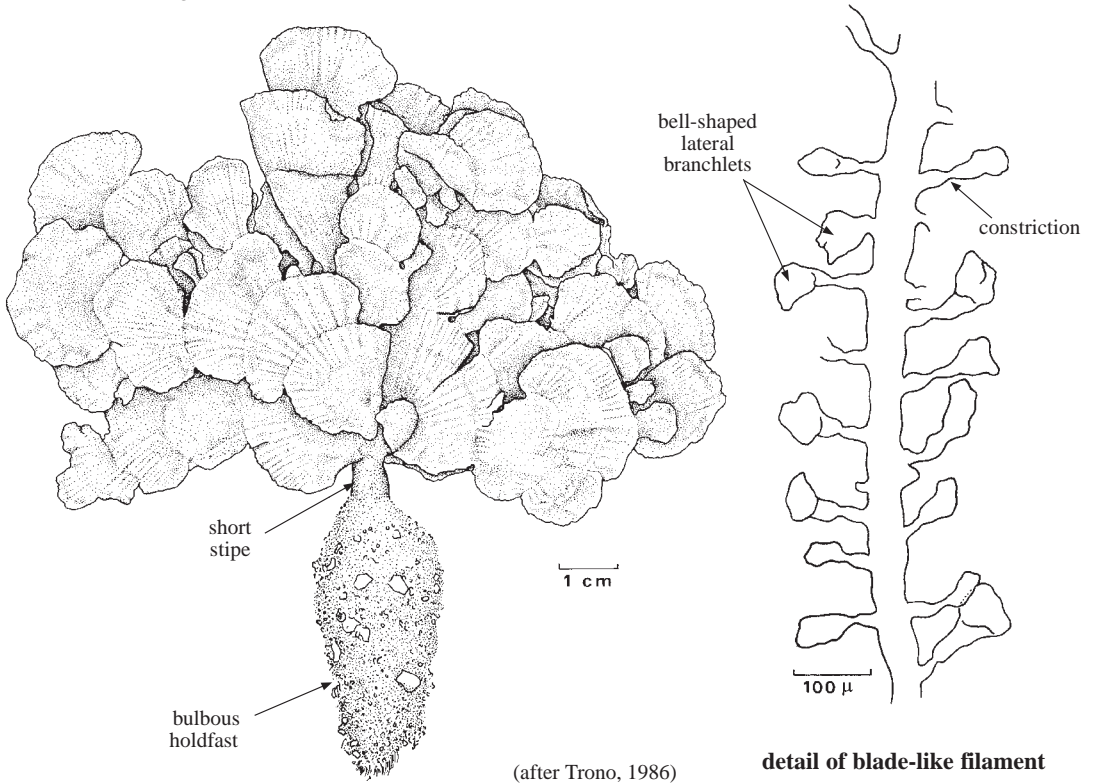
Habitat, biology, and fisheries: Forms clumps in rocky crevices in moderately wave-exposed shallow subtidal areas. Contains norcycloartene triterpenoids.

Distribution: Commonly found in the Indo-West Pacific, including Guangdong Province (Xisha Is., China), Viet Nam, the Indo-Malayan Archipelago, the Philippines, and tropical western Pacific islands to Hawaii.



Udotea argentea Zanardini, 1858

FAO names: En - Large sea fan tail.

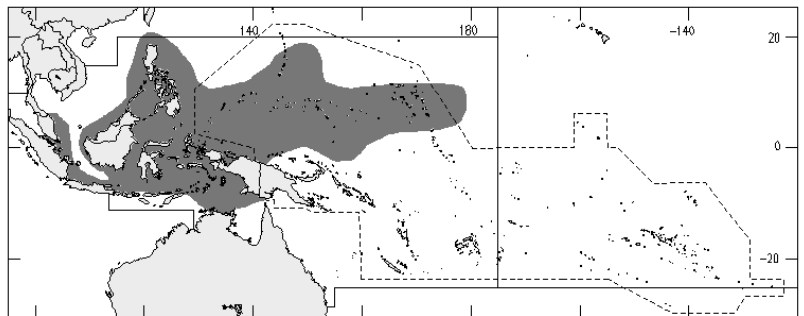


Diagnostic characters: Thallus erect, consisting of a steel green to greyish, fan-shaped frond. Holdfast thick and bulbous. Frond composed of 1 or more series of overlapping flabellate or reniform segments, slightly to moderately calcified and arising from a short, slender stipe. Upper margins of segments finely divided in concentric zones. Blade-like filaments terete, repeatedly dichotomous and 45 to 70 μm in width; constrictions present, of unequal distances above the dichotomies. Determinate lateral branchlets stipitate, pinnately-alternate arranged, constricted at 1/3 to 1/4 of the distance from the main axis of the filament; ends of branchlets inflated and forming club-shaped or narrow bell-like structures.

Size: Thallus (excluding holdfast) up to 11 cm in height; holdfast to about 8 cm in length.

Habitat, biology, and fisheries: Found in shallow areas, growing on hard, sandy, soft sandy or sandy-muddy substrates.

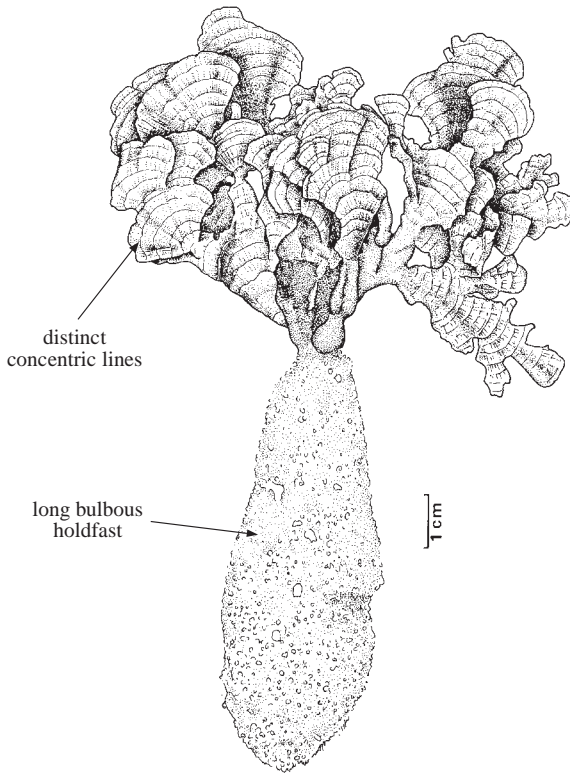
Distribution: Widely distributed in tropical regions; Indo-Malayan Archipelago and western Pacific.



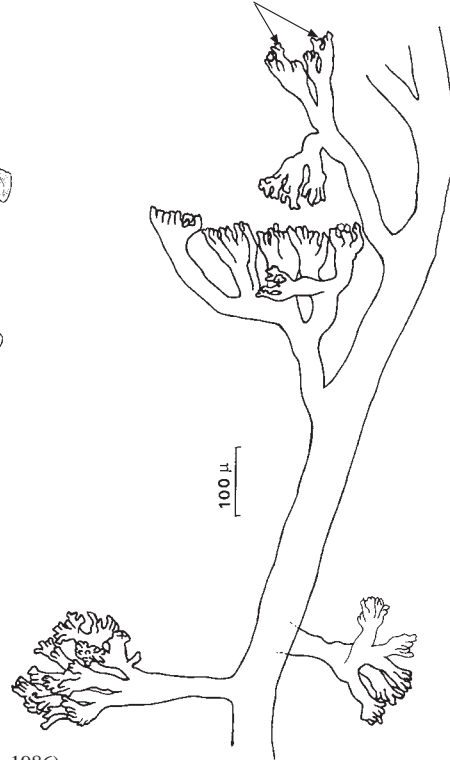
generalized distribution for *Udotea*

***Udotea geppii* Yamada, 1930**

FAO names: En - Small sea fan tail.



terminal portions of branchlets finger-like



(after Trono, 1986)

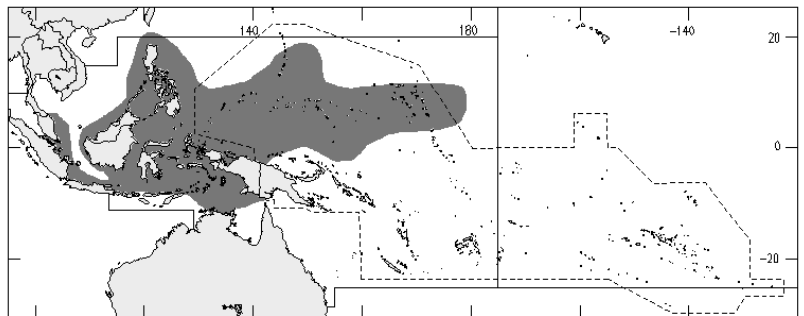
detail of blade-like filament

Diagnostic characters: Thallus erect, light green when fresh, yellowish to greenish white when dried. Holdfast long, thick and bulbous. Frond somewhat flabellate, moderately calcified and composed of many smaller fan-shaped, subreniform and subcuneate blades; basal portion of frond appears to be a fusion of these blades. Upper portions of frond repeatedly and irregularly proliferous; proliferations occur at the upper margins or at the surface of the blades. Surface of blades divided into zones by distinct concentric lines; outer margins generally entire to slightly undulate, erose to lacerate. Blade-like filaments terete, 28 to 33 μm in width. Determinate lateral branchlets paniculate, 85 to 225 μm long, arranged at irregular intervals, their terminal portions compoundly branched and forming finger-like structures.

Size: Thallus (excluding holdfast) up to 6.5 cm in height; holdfast to 8 cm in length.

Habitat, biology, and fisheries: This species grows on shallow reef flats.

Distribution: Common in the Philippines, the Indo-Malayan Archipelago, and other regions of the tropical western Pacific.



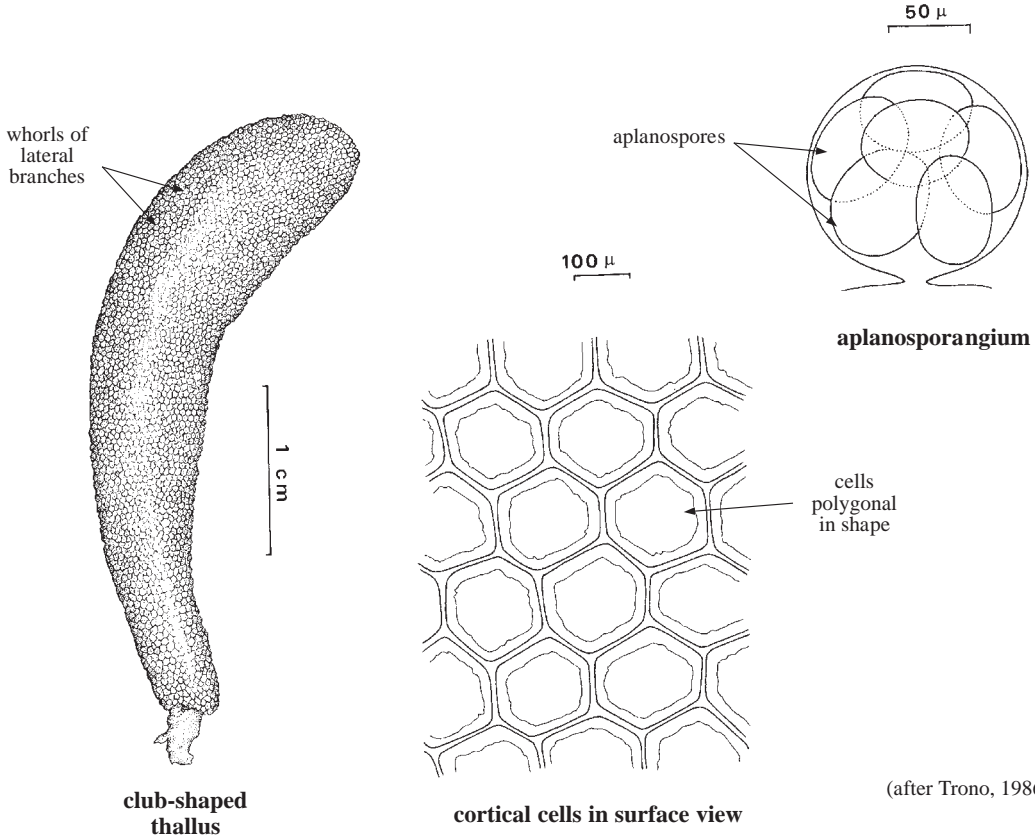
generalized distribution for *Udotea*

Order DASYCLADALES

DASYCLADACEAE

Bornetella oligospora Solms-Laubach, 1892

FAO names: En - Minute sea club.

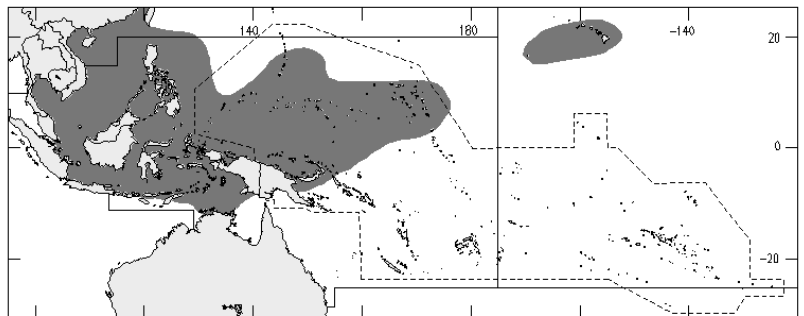


Diagnostic characters: Thallus green to brownish red, usually bent, club-shaped, attached to substrate by a small rhizoidal holdfast. Cross section of thallus shows a cylindrical axial filament extending almost the whole length of the thallus. Successive whorls of lateral branches cover the thallus, each whorl consisting of 24 to 28 primary lateral branches, slightly expanded at their distal ends and giving rise to 4 to 7 short capitate branchlets laterally coherent forming a monostromatic cortex. Cortical cells polygonal in surface view. Each primary lateral branch with 4 or more aplanosporangia, 150 to 190 μ m in diameter and containing 2 to 9 oval or spherical aplanospores, 70 to 80 μ m in diameter.

Size: Thallus up to 5 cm in height.

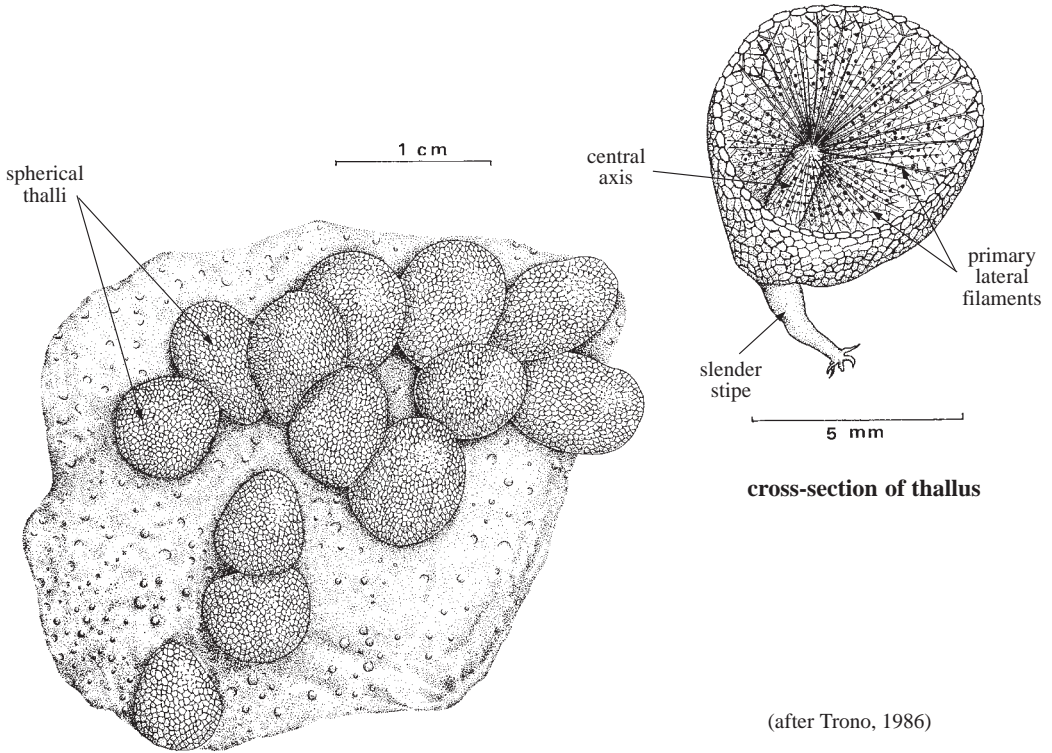
Habitat, biology, and fisheries: Grows in colonies on solid or rocky substrate in midtidal to low intertidal areas.

Distribution: Commonly found in the Philippines, Viet Nam, Indonesia, New Caledonia, Indo-Malayan Archipelago, Taiwan Province of China, Guangdong Province (China), and Hawaii.



***Bornetella sphaerica* (Zanard.) Solms-Laubach, 1892**

FAO names: En - Spherical turtle shell.

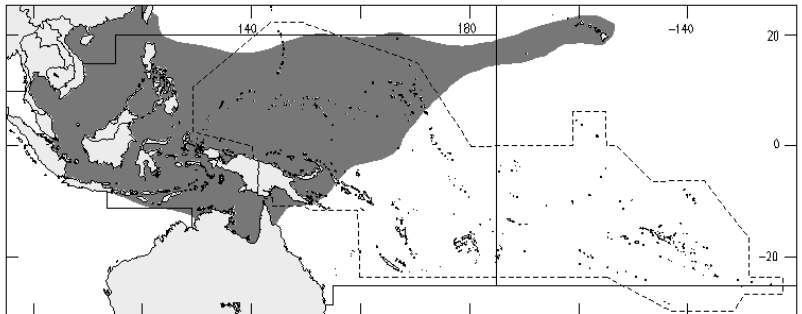


Diagnostic characters: Thallus bright green, spherical to oval and mostly less than 10 mm in diameter, attached to substrate by a disc-like holdfast. Stipe slender and cylindrical, broader at its distal end and continuous with the central axis which extends 1/2 to 2/3 of the length of thallus. Whorls of delicate primary lateral filaments arise from the central axis, bearing many laterally attached aplanosporangia. Primary lateral filaments terminate in a whorl of filiform branches with laterally coherent inflated hexagonal ends, forming a monostromatic cortex.

Size: Thalli 5 to 6 mm in diameter.

Habitat, biology, and fisheries: Forms colonies on rocks or dead coral branches in lower intertidal areas, sometimes exposed during low tide.

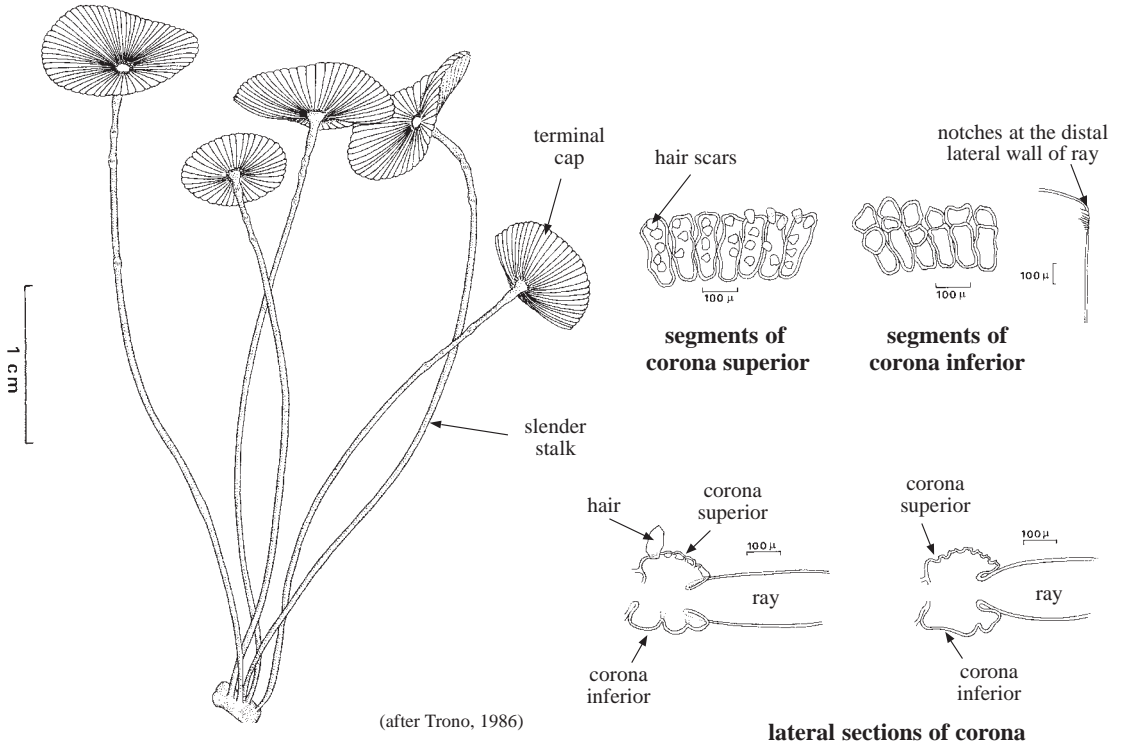
Distribution: Widely distributed in the tropics and known from the Philippines, Japan, Viet Nam, Indo-Malayan Archipelago, New Guinea, Hawaii, Guangdong Province (China) and tropical western Pacific islands.



POLYPHYSACEAE

Acetabularia major Martens, 1868

FAO names: En - Umbrella weed; Fr - Ombrelli de Venus; Sp - Sombrilla de Venus.

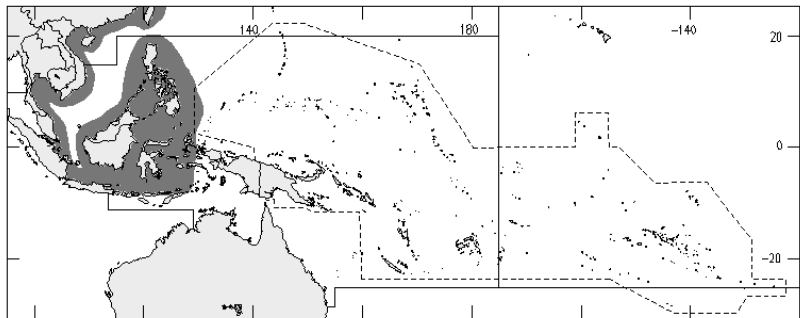


Diagnostic characters: Thalli moderately calcified, consisting of a slender stalk and a terminal cap (up to 18 mm in diameter). Terminal cap made up of 63 to 85 sporangial rays, laterally attached to each other by calcification. Sporangial rays cylindrical-compressed, decreasing in diameter towards the centre of the cap, their terminal wall at the margin of the cap truncate to slightly emarginate. Distinct vertical notches present at the proximal half of the lateral walls of rays. Segments of corona superior 230 to 250 μm long, bearing 6 to 9 hairs or hair scars in an uniseriate row; segments of corona inferior 265 to 280 μm long with rounded, truncate or emarginate outer margins. Spores oval to spherical, up to 98 to 115 μm in diameter.

Size: Thalli up to 6 cm in height; the largest species among the genus *Acetabularia*.

Habitat, biology, and fisheries: Grows in colonies on rocks, shells and dead coral fragments in moderately wave-washed habitats near shores and in shallow waters. Used as medicine for renal troubles.

Distribution: Common in the tropical regions, including the Indo-Malayan Archipelago, Viet Nam, Southern China, and the Philippines.



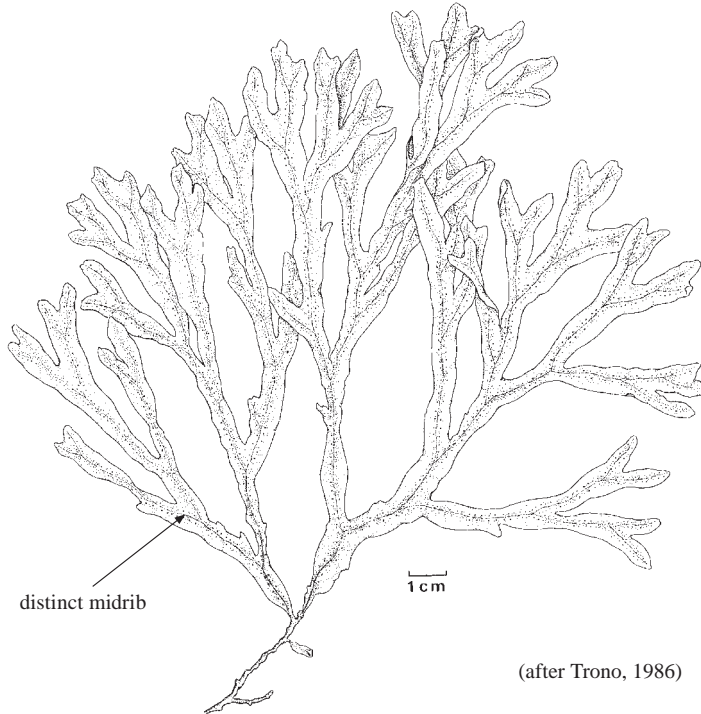
PHAEOPHYTA - Brown algae

Order DICTYOTALES

DICTYOTACEAE

Dictyopteris jamaicensis Taylor, 1960

FAO names: En - Ribbed sea saphir.

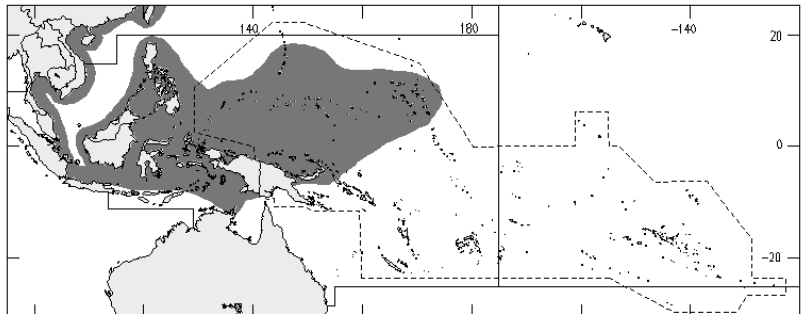


Diagnostic characters: Thalli large, dark brown or yellowish brown, strongly attached to hard substrates by a well-developed discoid holdfast. Branching subdichotomous-divaricate, forming angles of less than 90° , narrowing at the distal portion of the thallus. Branches strap-shaped, 4 to 8 mm across, with a distinct midrib running throughout the entire length. Parallel to the midrib on both sides are sori of hairs. Margin of the blades entire to slightly undulate. Cross-section of a branch shows 2 layers of cells; cells of the midrib polyhedral to quadrangular in surface view.

Size: Thalli up to 25 cm in height.

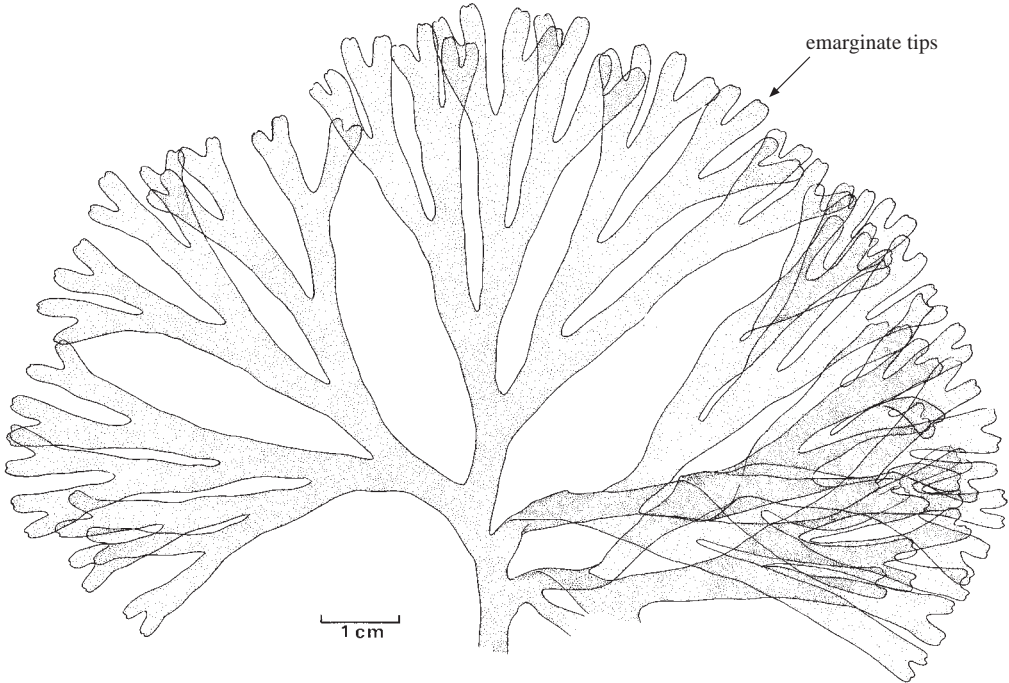
Habitat, biology, and fisheries: Attached to coralline substrate at upper subtidal zones exposed to moderate to strong water movement. Generally limited to rocky, waved-exposed habitats, such as reef crests and slopes. Detached thalli may also be found among drifting seaweeds. Abundant in the Philippines from February to May. Dredged from depths of 33 to 73 m, attached to shells or coral fragments. Used as medicine (antitumor).

Distribution: Widely distributed in the Philippines, the Indo-Malayan Archipelago, Thailand, Viet Nam, south China, and the tropical western Pacific.



Dictyota dichotoma (Hudson) Lamouroux, 1809

FAO names: **En** - Forked ribbons; **Fr** - Rubanier forchu (formerly: Rubanier céruleen); **Sp** - Abanico amarillo.



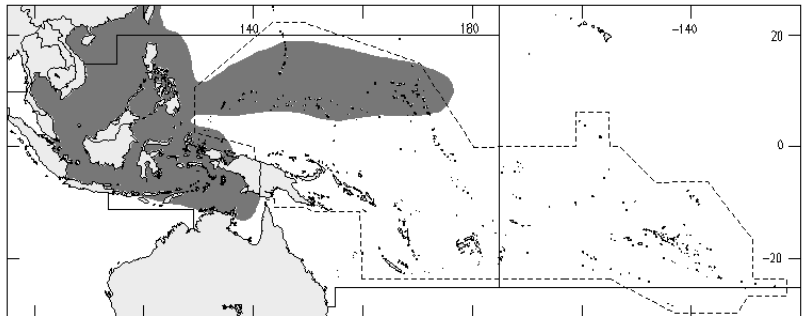
(after Trono, 1986)

Diagnostic characters: Thalli erect, light to dark brown, attached to the substrate by a small discoid holdfast. Branching regularly dichotomous, forming angles of 15° to 35°. Branches strap-shaped, 3 to 6 mm wide, broadest below each fork. Apices of terminal segments emarginate. Blade margin entire with occasional short stubby spines. Cross-section of a branch shows 3 layers of cells, consisting of a middle layer of large, rectangular cells, and bounded on the upper and lower surfaces by a layer of small, cuboidal and pigmented cortical cells.

Size: Thalli up to 14 cm in height.

Habitat, biology, and fisheries: Grows abundantly throughout the year in shallow waters as epiphyte on large seaweeds, particularly *Sargassum*, or on leaves and midribs of seagrasses. Also found on rocks below the low tide mark at calm open coasts and sheltered coasts though some have been reported from a depth of 55 m. The species is notable for the regularity with which it releases its crops of gametes at fortnightly intervals, within about an hour before daybreak shortly after the maximum of spring tides. This phenomenon may not be well defined in localities where the tidal range is slight. A good source for alginate which finds its use in several food products, mainly as emulsifying, stabilizing and gelling agents. These products include frozen food, pastries, dessert, jellies, salad dressings, meat and flavor sauces, beer, fruit juices, and milk shakes.

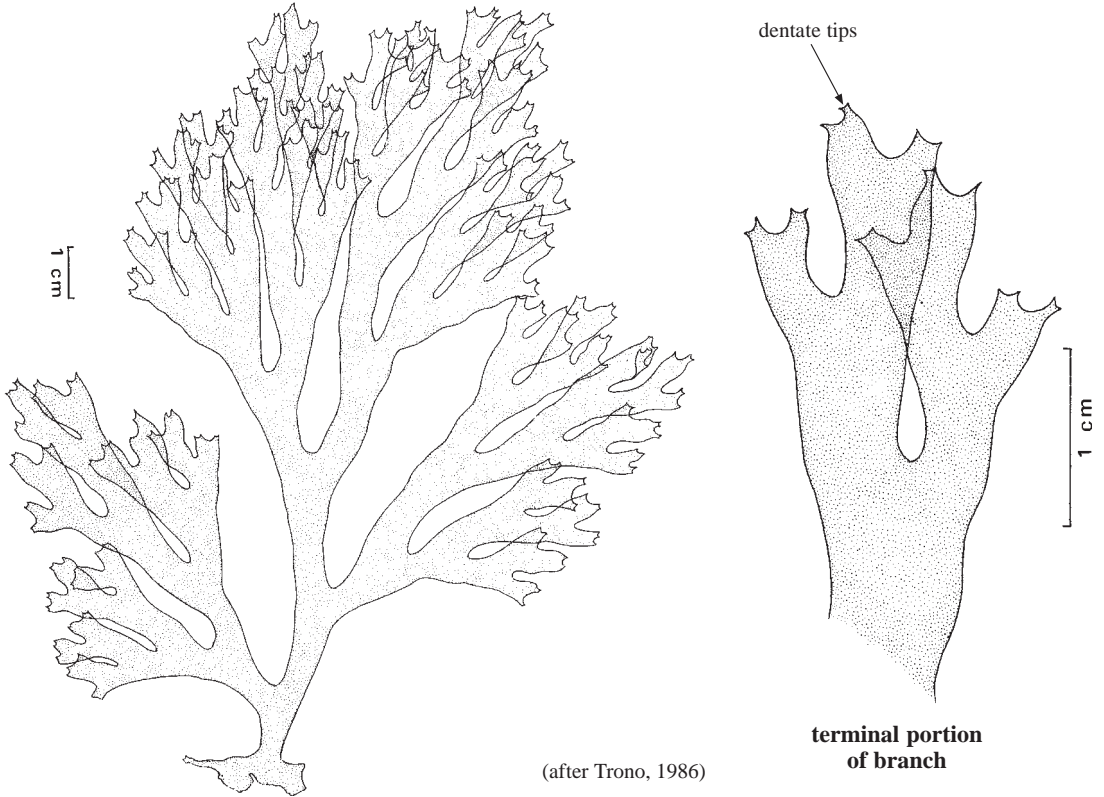
Distribution: Widely distributed in the tropics, including the Philippines, India, Guam, Japan, Thailand, Malaysia, Indonesia, Viet Nam, Sri Lanka, and China.



generalized distribution for *Dictyota*

***Dictyota mertensii* (Martius) Kutzing, 1859**

FAO names: En - Forked ribbons; Fr - Rubanier ceruléen; Sp - Abanico amarillo.

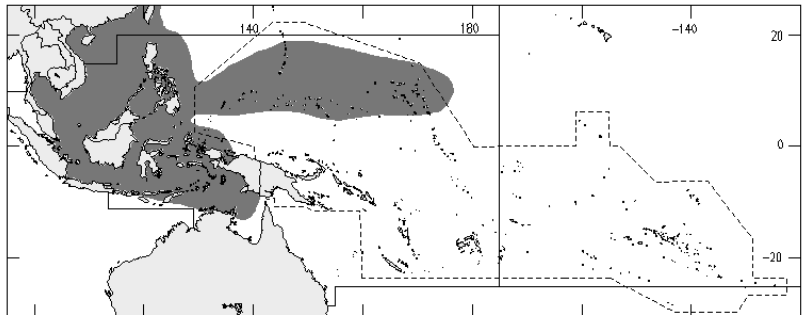


Diagnostic characters: Thalli erect and bushy, greenish brown, attached to the substrate by a discoid holdfast. Branching repeatedly alternate-dichotomous, forming rounded axils. Branches strap-shaped, 2.5 to 10 mm across, broadest just below the forking, narrowest at the terminal portions. Segments between the dichotomies decrease in length from base to the distal end of the thallus. Apices of terminal segments rounded to obtuse when young, dentate or aculeate when mature. Outer margins of blades entire.

Size: Thalli up to 15 cm in height.

Habitat, biology, and fisheries: Locally abundant and grows on rocks in shallow waters with moderate currents from the intertidal and subtidal zone at depths of 15 m; most common at about 2 m depth where the water is clear and unpolluted. This species is a good source of alginate similar to *D. dichotoma*; presence of metabolite dictyol H, a diterpene carbon skeleton.

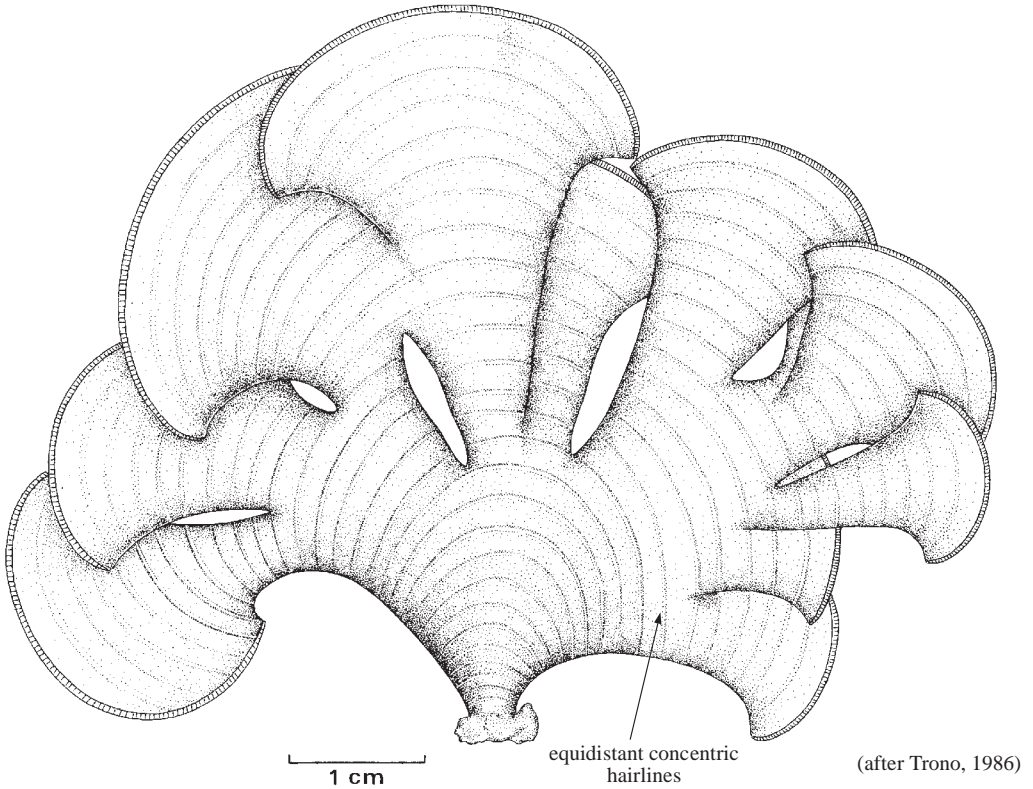
Distribution: Widely distributed in tropical and subtropical waters of the world, including the Philippines, Japan, Indonesia, Malaysia, Hawaii, China, Viet Nam, and Sri Lanka.



generalized distribution for *Dictyota*

Padina minor Yamada, 1925

FAO names: En - Brown sea fan.

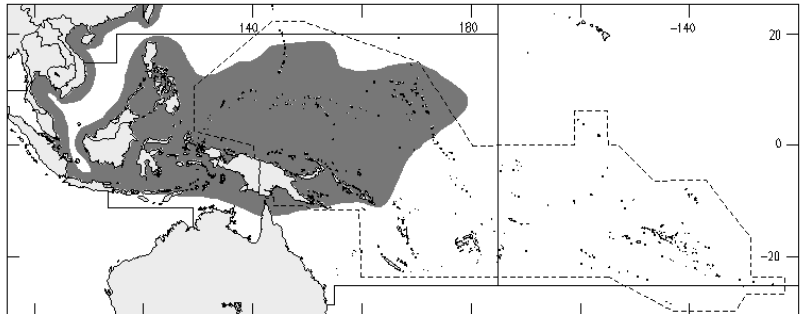


Diagnostic characters: Thalli fan-shaped, yellowish brown to light brown or slightly whitish due to light calcification. Blade entire or divided into lobes, consisting of 2 layers of cells. Lower surface of blade divided into concentric zones by hairlines which are equidistant from each other; non-indusiate reproductive sori also form concentric lines directly above each hairline.

Size: Blade up to 10 cm in height.

Habitat, biology, and fisheries: Attached to solid substrates on reef flats or in the upper subtidal zone, or epiphytic on large macrobenthic algae and seagrass. Grows on inner reef flats and on tidal pools on the outer portions of reef flats; very abundant during the sunny months of the year. A source of algin.

Distribution: Widely distributed in the tropics, including the Philippines, Taiwan Province of China, China, Indo-Malayan Archipelago, southern Japan, Viet Nam, Thailand, Guam, and tropical western Pacific islands.

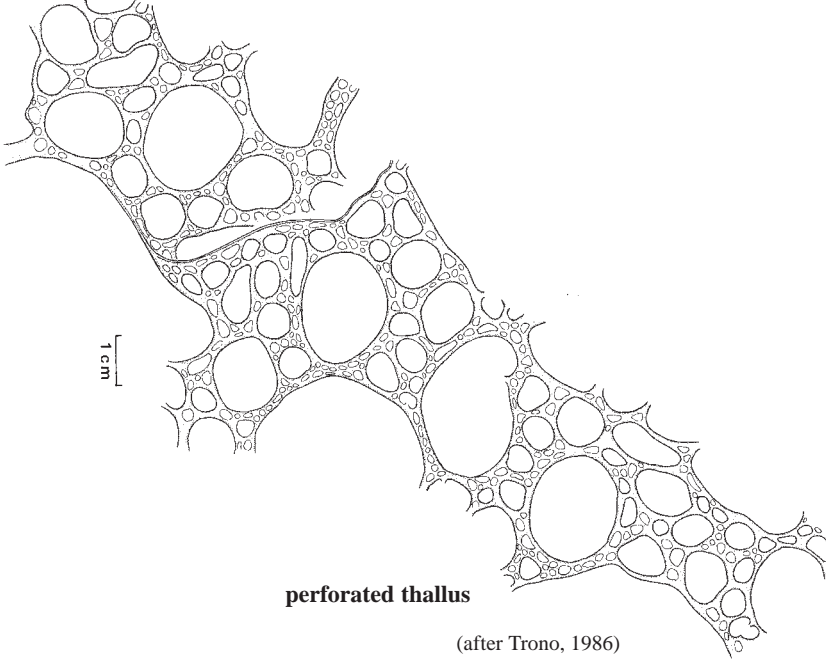


Order SCYTOSIPHONALES

SCYTOSIPHONACEAE

Hydroclathrus clathratus (C. Agardh) Howe, 1920

FAO names: En - Hydroclathrus.

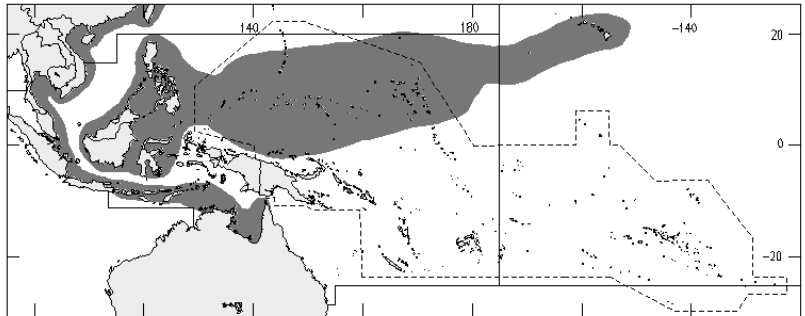


Distribution: Thalli light brown or yellowish brown, characteristically net-like due to numerous perforations which range from 0.5 to 12.0 mm in diameter; in between the holes, the fleshy strands have enrolled margins and vary from 0.5 to 2.5 mm in thickness.

Size: Thalli form extensive mats.

Habitat, biology, and fisheries: A highly seasonal species, abundant only during the summer months; a dominant component of the intertidal seaweed community; forming dense mats on the substrate, growing over and covering other seaweed species. An abundant species during spring and summer months in protected coves, reef flats and bays at the lower littoral zone near the low tide mark. Either attached to rocky substrate, often associated with *Colpomenia sinuosa*, or forming thick piles on sandy bottom, or floating; the floating form is generally bigger and believed to represent older plants. Used for human consumption and prepared as salad mixed with some vegetables after blanching in boiling water for 2 minutes; has some nutritive value (iodine, mannitol, protein, vitamins); contains folic and folinic acids; also used for animal feed and fertilizer; has growth regulator substances similar to auxin, gibberellin, and cytokinin; also contains alginic acid.

Distribution: Very common in tropical waters of the western Pacific, including the Philippines, China, Japan, Indonesia, Malaysia, Guam, and Hawaii.

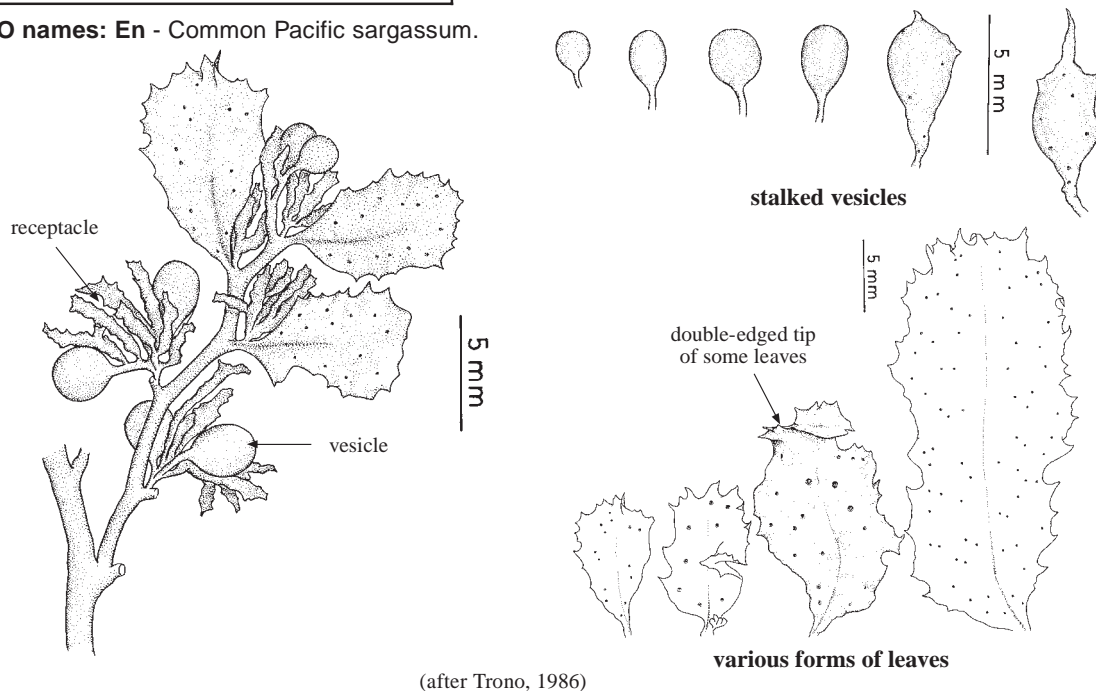


Order FUCALES

SARGASSACEAE

Sargassum crassifolium J. Agardh, 1848

FAO names: En - Common Pacific sargassum.



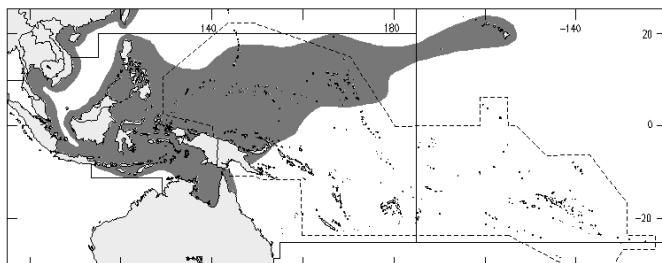
(after Trono, 1986)

Diagnostic characters: Thalli large, yellowish brown, attached to rocky substrates by a conical, discoid holdfast, enlarged at the base, terete at the distal portion. Primary branches slightly compressed; smooth secondary branches irregularly alternate on the primary branch. Leaves of primary and secondary branches vertically attached, elliptical, about twice as long as broad; those of tertiary branches broadly elliptical, slightly longer than broad, tips rounded to obtuse. Midrib of leaves distinct only up to a short distance from the tip. Margin coarsely dentate; some leaves at the upper portion of the thallus with characteristic double-edged outer tips. Thickness of the leaves uniform with only the distal upper tip duplicated into a double-edged margin. Stalked vesicles sparse, spherical to oblong, 7 mm long, sometimes provided with short spines or foliaceous extensions. Receptacles forming condensed cymes, receptacular branches simple or shortly branched at the distal end, compressed to flattened at their distal half with coarse teeth at the margin, slightly twisted.

Size: Thalli up to 45 cm in height.

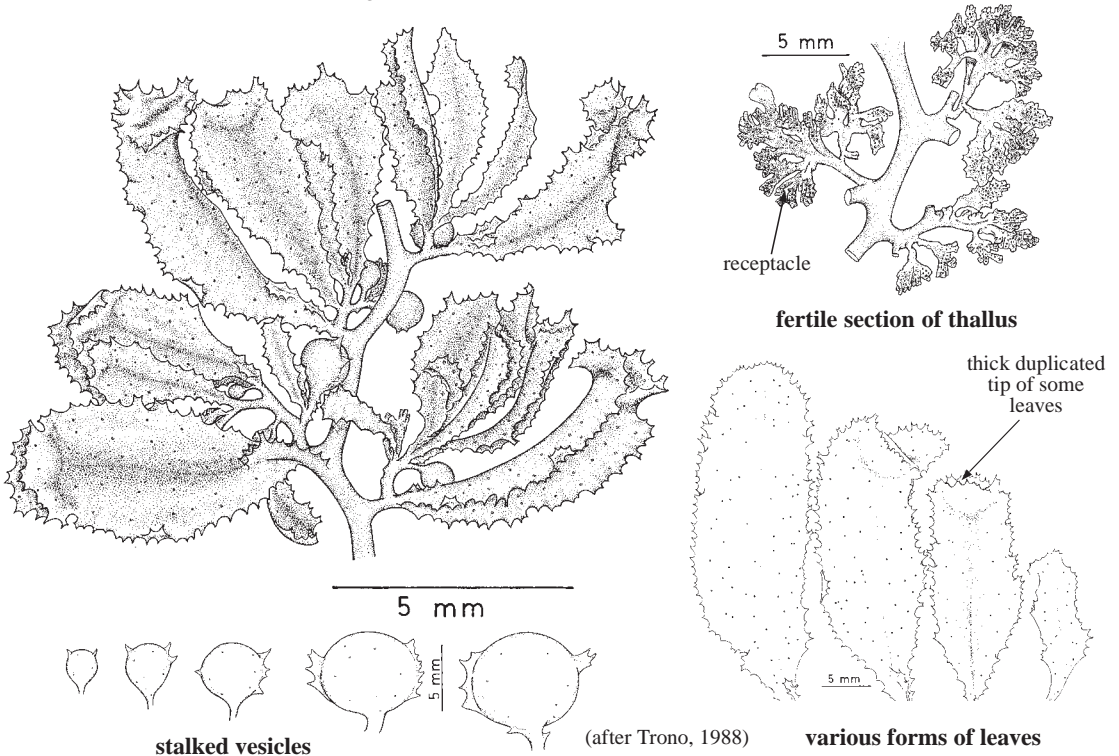
Habitat, biology, and fisheries: Found on coralline rocks in wave-exposed low intertidal to shallow subtidal areas. Shows an intra-annual pattern of variation in standing crop in the Philippines, standing crop is lowest in the period from February to May and highest in November to January. An important source of alginate which finds its use in several food products, mainly as emulsifying, stabilizing and gelling agents. The products include frozen food, pastries, desserts, jellies, salad dressings, ice creams, meat and flavor sauces, beer, fruit juices, and milk shakes; contains iodine, protein, vitamin C, and minerals (Ca, K, Mg, Na, Cu, Zn, S, P, Mn); used as medicine for goiter and other glandular troubles; antibacterial, antitumor; source of tannins and phenols; also used for animal feed and fertilizer.

Distribution: Widely distributed in the tropics, including the Philippines, India, Guam, Japan, Malaysia, Indonesia, Viet Nam, Sri Lanka, and China.

generalized distribution for *Sargassum*

***Sargassum cristaefolium* C. Agardh, 1820**

FAO names: En - Double-bladed sargassum.

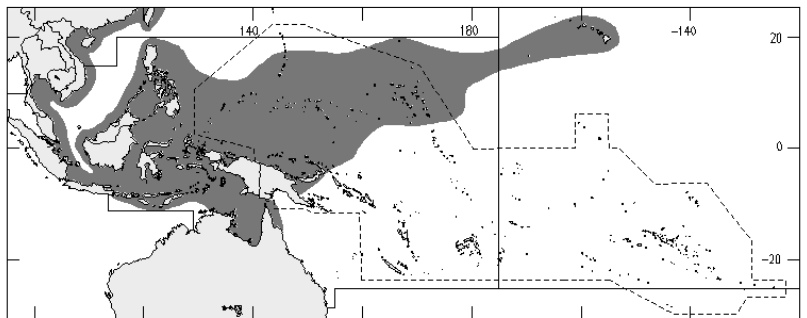


Diagnostic characters: Thalli large, dark brown, attached to rocks by a discoid holdfast; a short (less than 1 cm) and slender stem, giving rise to 1 or 2 main somewhat compressed and smooth primary branches. Branchlets bearing leaves and vesicles alternately arranged on the primary branches; leaves generally oblong (2.5 to 3.5 cm long) and obovate (2.0 to 3.0 cm long), with coarsely toothed outer margins, cryptostomata scattered on both surfaces; distal portions of some leaves with thick duplicate margins. Vesicles sparse, pedunculate, attached to the stalk of the leaves, elliptical to spherical, 4 to 11 mm in diameter, with isolated lateral teeth or ridges, sometimes with foliaceous extensions. Receptacles forming simple to compound cymes with short stalks; receptacular branches once or twice branched, compressed to flattened at their distal portions with teeth at tips and margins.

Size: Thalli up to 50 cm in height.

Habitat, biology, and fisheries: Found on coralline rocks in wave-exposed low intertidal to shallow subtidal areas. Shows an intra-annual pattern of variation in standing crop similar to *S. crassifolium*. Its standing crop is lowest in the period from February to May and highest from November to January. This species may form dense stands and is therefore considered as a good biomass source for biogas production. Its economic potential is the same as in *S. crassifolium*. It is used as fertilizer, as human food, animal fodder and medicine; also a very good source of alginate which has various uses in the food industry; possesses growth regulator substances similar to auxin, gibberellin, and cytokinin.

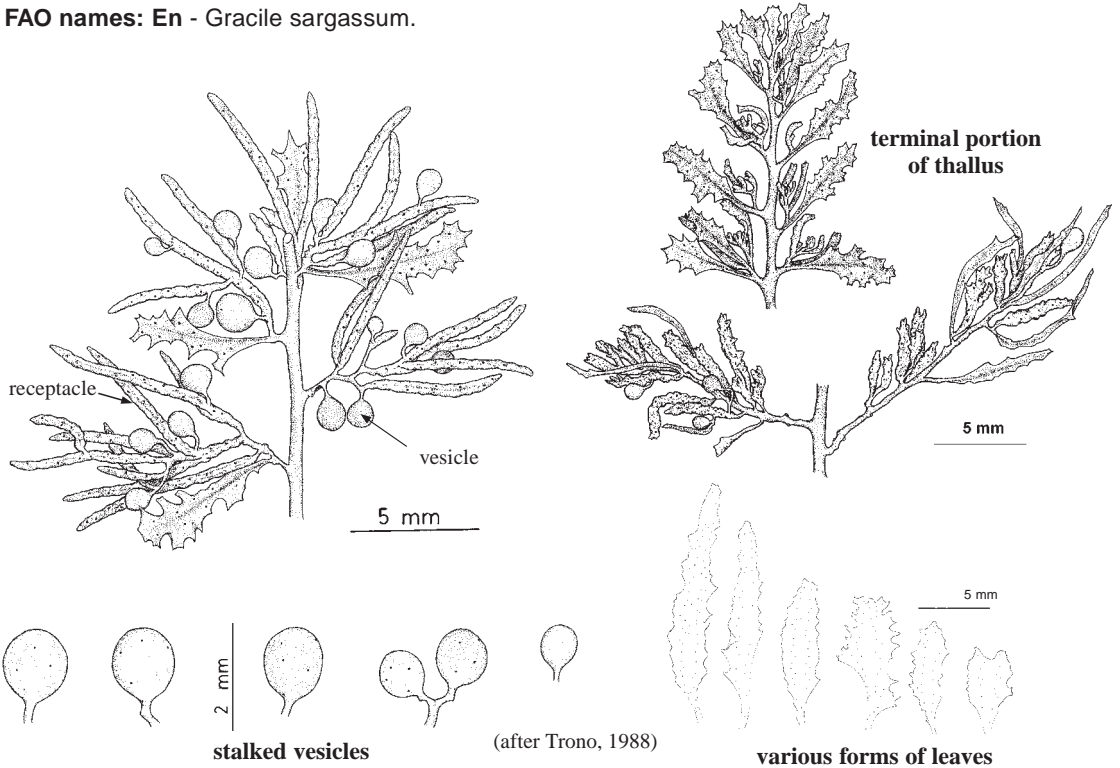
Distribution: Widely distributed in the tropics, including the Philippines, India, Guam, Japan, Malaysia, Indonesia, Viet Nam, Sri Lanka, and China.



generalized distribution for *Sargassum*

Sargassum gracillimum Reinbold, 1913

FAO names: En - Gracile sargassum.

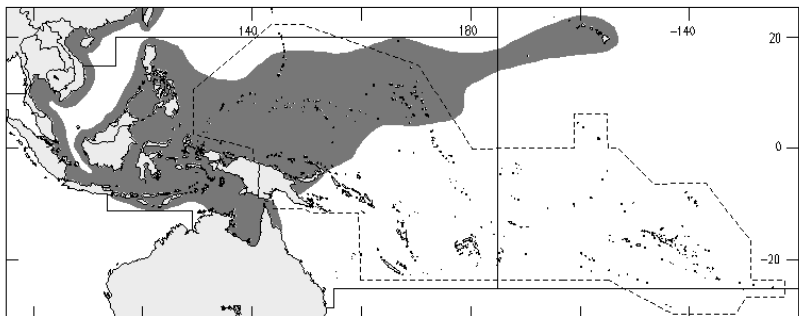


Diagnostic characters: Holdfast small, discoid; stem very short, mostly less than 1 cm long, terete. Primary branches crowded at tip of stem, appearing almost sessile on holdfast; filiform, terete. Secondary and terminal branches terete, slightly to irregularly lumpy near their bases because of leaf scars, which are arranged alternately along primary branches at irregular intervals, farther apart near base and closer and crowded toward distal ends. Leaves on primary and secondary branches on younger thalli relatively longer than those at distal portions, generally obovate-oblongate, up to 12 mm long, 4 mm wide; base asymmetrical, acuminate to long and narrow, segment gradually grading, giving the leaf a long-stalked appearance; margin of basal half of leaf generally entire, distal half coarsely and irregularly serrate; tip acute, obtuse to rounded; midrib apparent but disappearing below tip; cryptostomata distinctly elevated, scattered. Leaves of terminal branches and those associated with receptacles generally linear to linear-oblongate, appearing lumpy because of elevated cryptostomata; margin entire or with few teeth; midrib not apparent; cryptostomata on leaves and floats marked by presence of hairs originating from opening (ostiole). Vesicles small, mainly obovate to sometimes oblong-obovate, less than 2 mm long, 1.5 mm wide, slightly compressed in some, lumpy in appearance because of presence of elevated cryptostomata; stalk short, less than 1/2 the length of vesicle; attached at base of receptacle or arising directly from the receptacular branch (zygocarpic); those attached to tip of receptacular branch appear long-stalked. Plant dioecious, zygocarpic; receptacles in dense panicles. Male receptacular branches terete, distinctly warty, simple or branched, up to 10 mm long. Female receptacular branches simple or branched, highly warty, terete near base and slightly compressed toward distal ends, with or without teeth.

Size: Primary branches up to 50 cm in length.

Habitat, biology, and fisheries: Its economic potential is the same as in *S. crassifolium*.

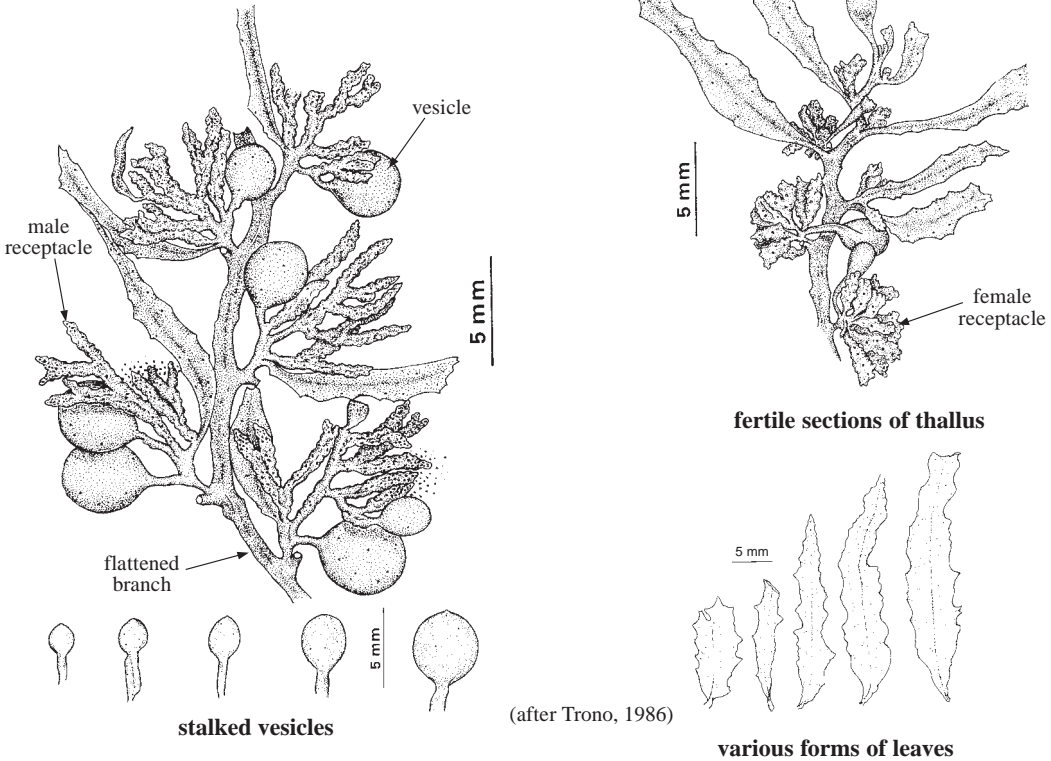
Distribution: Widely distributed in the Philippines, Indonesia, Guangdong Province (China), Hong Kong (China), Indian Ocean and other parts of the Indo-West Pacific.



generalized distribution for *Sargassum*

Sargassum oligocystum Montagne, 1845

FAO names: En - Flat-stemmed sargassum.

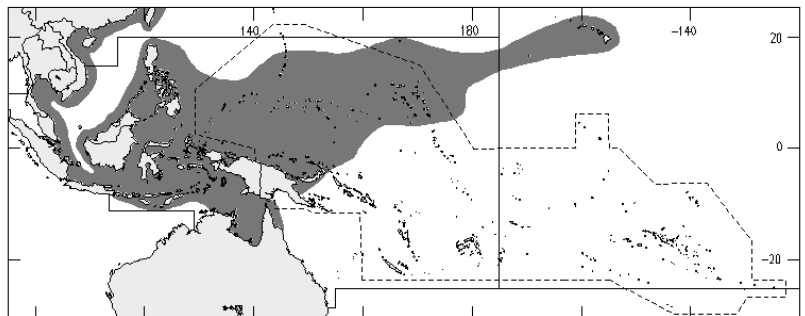


Diagnostic characters: Holdfast small, discoid; stem short, about 5 mm long, cylindrical to slightly compressed, brownish, finely villous, simple or sometimes branched. Primary branches smooth and strongly flattened, especially at basal portions, 3 to 4 mm at broadest portions. Secondary laterals distichous, alternately arranged along primary branches, up to 18 cm long. Leaves of vegetative materials large, linear-lanceolate, up to 7 cm long, 1.2 cm wide, with very short stalks; those of fertile materials much smaller and reduced, especially toward apical portions, linear to linear-lanceolate. Base of leaves acute to cuneate; margin irregularly serrate-dentate; apex mainly obtuse to acute, those of the smaller leaves mainly acute; midrib distinct almost up to apex. Cryptostomata slightly elevated and scattered on blade, those on small leaves at terminal branches with tendency to form rows along both sides of midrib; those on female receptacles more numerous and distinctly elevated, giving the receptacles a lumpy appearance. Vegetative plants with larger vesicles, 1 to 5 mm wide; those of fertile materials smaller and variable in size, the larger ones 4 to 5 mm long and 2 to 3 mm wide, smaller ones 1.5 mm long and 1 mm wide; most vesicles with cylindrical stalks, mainly 1 mm long, those on female plants longer (up to 4 mm) and stalks flattened; apices of vesicles mainly plain or occasionally with teeth or spines. Plants dioecious. Male receptacles paniculate; receptacular branches up to 3 times unequally dichotomously branched, branches terete but highly warty. Female receptacles form dense cymes; receptacular branches simple or shortly branched, almost of same length, apices slightly compressed, margins and tips with few teeth or spines.

Size: Primary branches up to 80 cm in length.

Habitat, biology, and fisheries: Its economic potential is the same as for *S. crassifolium*.

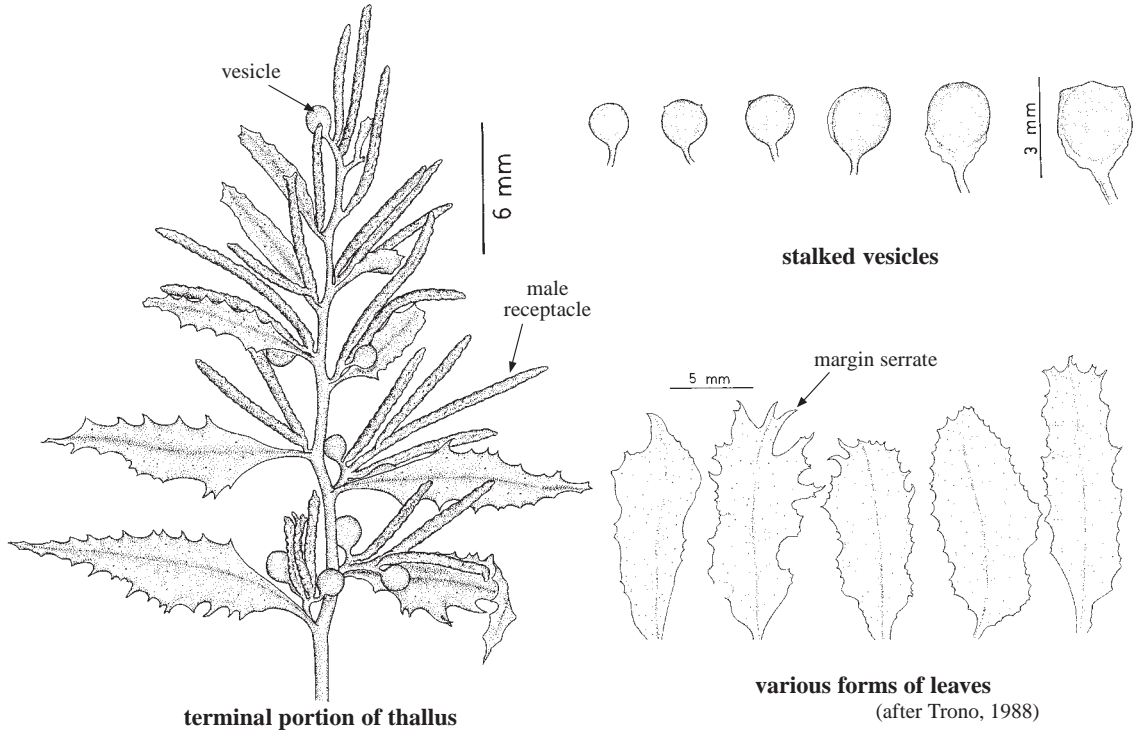
Distribution: Widely distributed in the Philippines, Indonesia, Guangdong Province, (China), Hong Kong (China), Indian Ocean, and other parts of the Indo-West Pacific.



generalized distribution for *Sargassum*

Sargassum paniculatum J.G. Agardh, 1848

FAO names: En - Serrate sargassum.

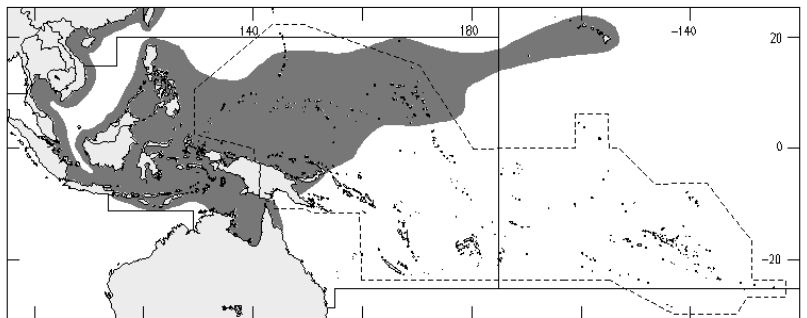


Diagnostic characters: Holdfast shield-shaped to discoid, massive in some where 2 or more thalli arise from a fused holdfast; stem up to 25 mm long, cylindrical, warty. Primary branches terete, smooth. Secondary branches terete, alternately attached irregularly on the primary branch, smooth. Leaves of secondary branches of vegetative thallus mainly ovate-lanceolate to oblong to linear-lanceolate; base unequal; margin generally serrate, entire in some; apex generally obtuse to acute; midrib distinct but disappearing near apex; cryptostomata numerous and scattered. Leaves in fertile materials mainly linear to linear-lanceolate, some linear-ob lanceolate, up to 40 mm long and 4 to 5 mm wide; base acute, slightly unequal; margin dentate-serrate, entire in some; apex narrowly acute; midrib distinct. Cryptostomata sparse in leaves of primary laterals, sparse and scattered in leaves of secondary laterals, but distinct and with tendency to be arranged in rows in narrow leaves of terminal branches. Vesicles numerous, spherical or obovate, blunt; base plain or ear-like or with narrow extended margin; mainly small in fertile materials; racemose; vesicles 1 to 2 mm long, with very short stalks, 1 or less than 1 mm long. Plant dioecious. Male receptacles racemose, up to 15 mm long, pinched in here and there, 0.3 to 0.5 mm in diameter (in dried material) with blunt tip. Female receptacles racemose; receptacular branches compressed to triquetrous, with edges or margins finely serrate to dentate, up to 6 mm or sometimes longer, sometimes slightly twisted.

Size: Primary branches up to 80 cm (rarely to 175 cm) in length.

Habitat, biology, and fisheries: Found on coralline substrate in the low intertidal zone, exposed to air only during extremely low tides. Its economic potential is the same as for *S. crassifolium*.

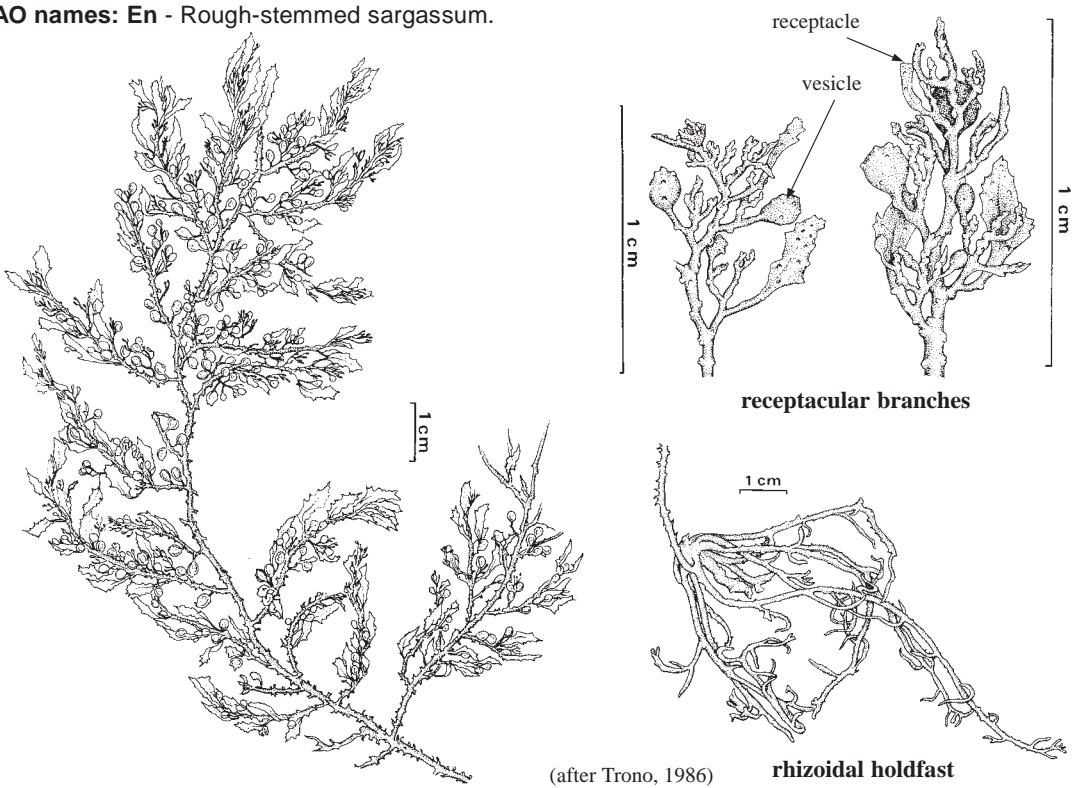
Distribution: Widely distributed in the tropical warm waters of the western Pacific including Philippines, China, Japan, Indonesia, Malaysia, and Guam.



generalized distribution for *Sargassum*

***Sargassum polycystum* C. Agardh, 1824**

FAO names: En - Rough-stemmed sargassum.

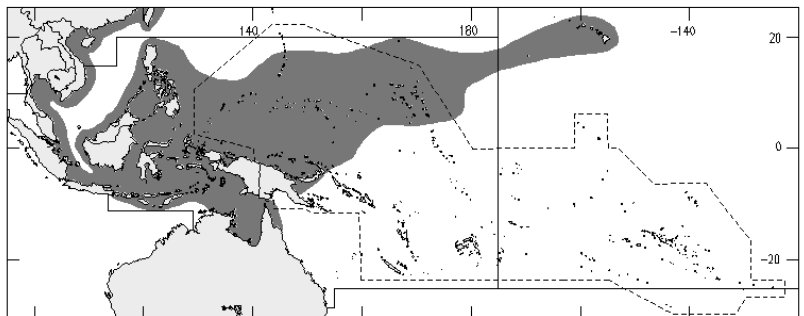


Diagnostic characters: Thalli large, dark brown to yellowish brown, attached to rocks by a coarse branching holdfast; stem short cylindrical. Primary branches terete, bearing irregularly alternate secondary branches with numerous simple and Y-shaped proliferations. Mature thalli with fewer and smaller oblanceolate leaves, 7 to 15 mm long and 1.5 to 4 mm wide, with coarsely dentate or serrated margins; midrib prominent up to near the apex. Cryptostomata scattered on the surface of leaves. Stalked vesicles ovate or spherical, numerous; vesicles attached to the secondary, tertiary and terminal branches either singly or in clusters, 1.0 to 2.5 mm in diameter, bearing few cryptostomata and/or teeth-like structures. Plant dioecious. Male receptacles racemose-paniculate, receptacular branches terete, warty. Female receptacles small, cymose; receptacular branches short, dense, compressed, simple or forked with teeth or spines at margins.

Size: Thalli up to 40 cm in height.

Habitat, biology, and fisheries: Usually thrives in inner reef areas on coarse, sandy coralline substrate, not exposed to strong water turbulence. Used as fertilizer, as human food, fodder and medicine; contains auxin-like substance; controls heavy metal (Pb, Cd) pollution; usually collected from drifting materials, sometimes used fresh or dried or burnt and the ash utilized as fertilizer on soils; also a source of alginate; may form dense stands and is therefore considered as a good biomass source for biogas production.

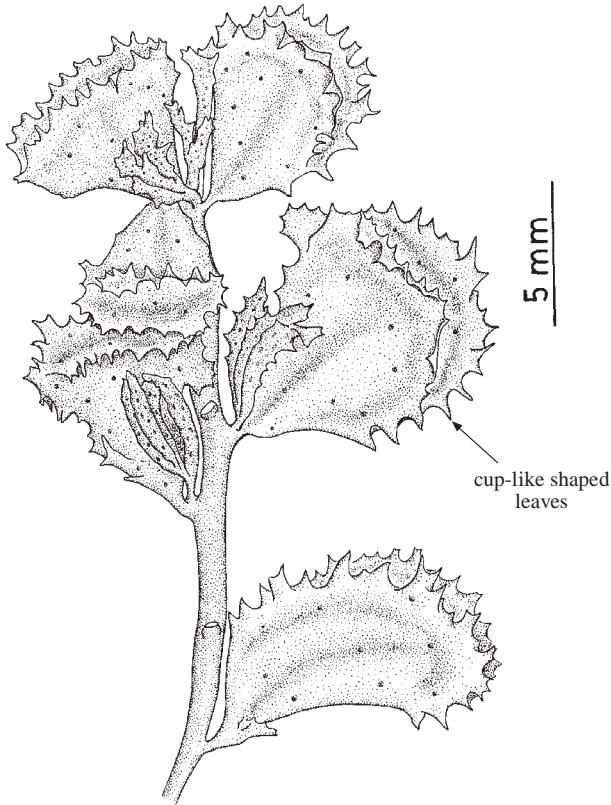
Distribution: Common in tropical warm waters of the western Pacific, including the Philippines, China, Japan, Indonesia, Malaysia, and Guam.



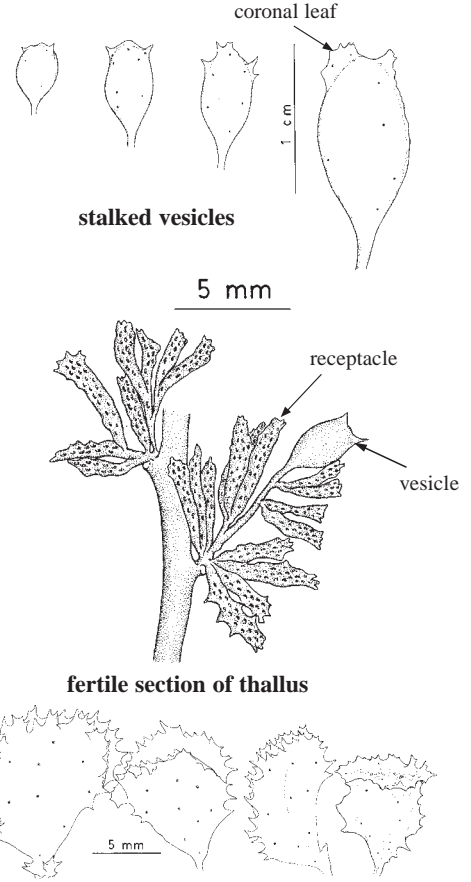
generalized distribution for *Sargassum*

Sargassum turbinarioides Grunow, 1915

FAO names: En - Bell-bladed sargassum.



(after Trono, 1988)

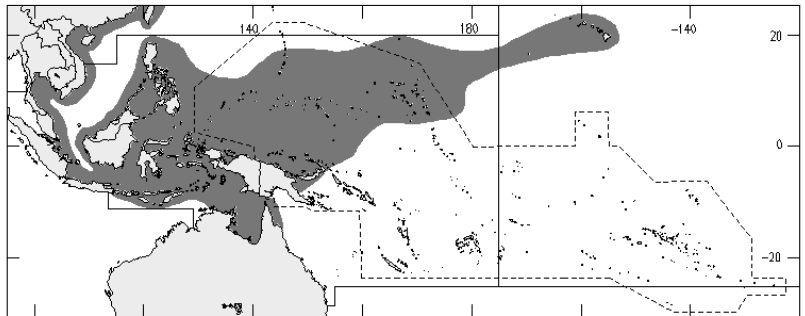


Diagnostic characters: Holdfast small, discoid; stem short, cylindrical, large at base, slightly tapered to tip, smooth or partly smooth and slightly warty. Primary branches smooth, slightly compressed near base, becoming cylindrical toward upper portions. Leaves coriaceous, obovate, 10 mm long, 8 mm wide; stalk very short, almost sessile, with coarse teeth; base (thick) acute, slightly asymmetrical in some; margin coarsely serrate, serrations arranged in single or double rows; distal third of most leaves expanded into a cup-like structure of mainly elliptical to oblong shape when viewed from top view of leaf, resembling the leaf structure of *Turbinaria*; midrib not apparent even at base. Cryptostomata scattered, very apparent, and slightly elevated. Vesicles numerous, some enlarged, up to 12 mm long, 6 mm wide, generally elliptical-oblong or slightly oblong-obovate; stalk very short, less than 1/4 length of vesicle; vesicles irregularly lumpy because of cryptostomata; some vesicles slightly ribbed with or without coronal leaf, those without coronal leaf with a row of coarse spines on upper half. Receptacles irregularly cymose with short, once or twice branched; receptacular branches terete at lower half, slightly compressed toward distal half, with occasional teeth along the margin.

Size: Primary branches up to 50 cm in length.

Habitat, biology, and fisheries: Its economic potential is the same as for *S. crassifolium*.

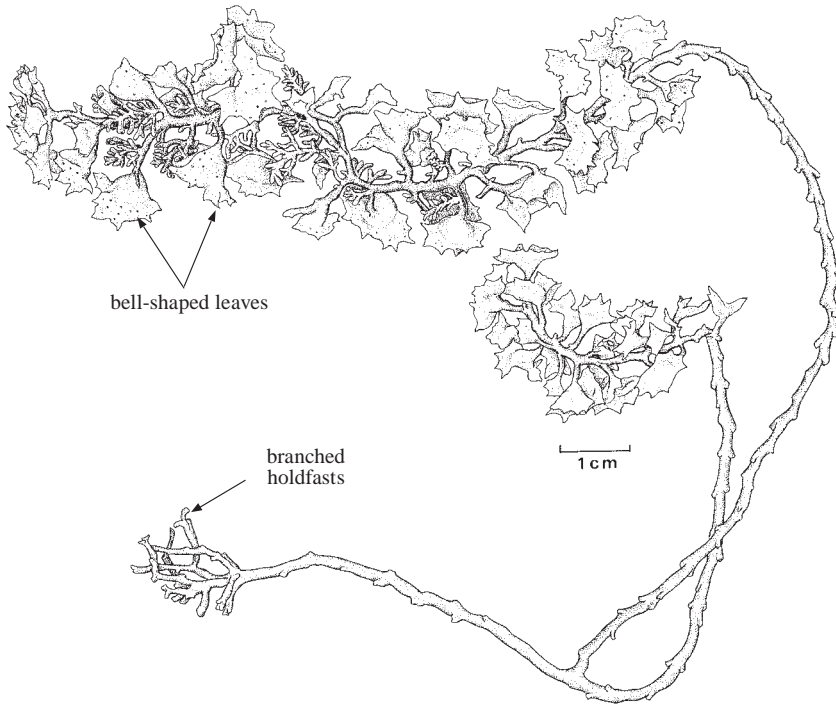
Distribution: Widely distributed in the Philippines, Viet Nam, and New Caledonia and elsewhere in the Indo-Pacific.



generalized distribution for *Sargassum*

***Turbinaria conoides* (J. Agardh) Kuetzing, 1860**

FAO names: En - Sea bell.



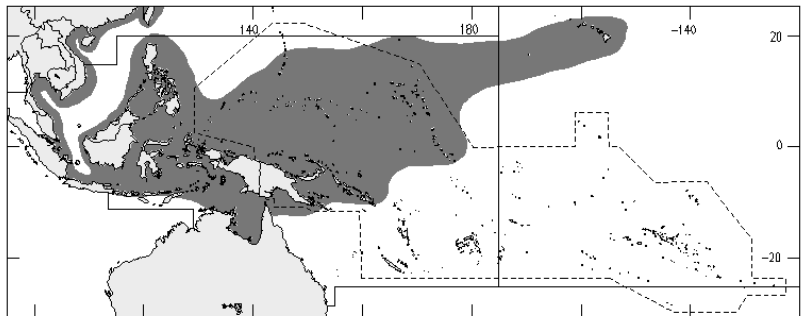
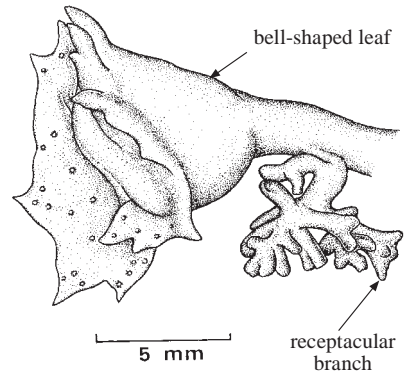
(after Trono, 1986)

Diagnostic characters: Thalli erect, yellowish brown to dark brown in colour, attached by coarse branched holdfasts to rocky substrate, forming thick, huge colonies. Axes terete, muricate at the basal portion. Leaves are 6 to 12 mm long, consisting of a stalk, small vesicles and an expanded distal marginal blade outlined by coarse teeth; leaves triangular in outline or irregularly rounded in surface view; 3.5 to 9.0 mm across, sometimes deeply cut on one side, the cut often reaching the vesicle. Receptacular clusters 3 to 10 mm long, generally shorter and attached to the stalk of the leaves at 1/4 the distance from the main axis. This species is easily distinguished by its lax branched thalli, numerous branches, and small turbinate leaves with a length of about 1 cm or less.

Size: Thalli up to 1.5 m in height.

Habitat, biology, and fisheries: Thrives mostly on sandy coralline bottoms on reef portions which are not exposed to excessive water turbulence; usually in shallow lagoons or tidepools in subtidal habitats protected from strong wave action. Used for human consumption, fertilizer; contains minerals (Ca, K, Mg, Na, Cu, Fe, Zn); source of algin; also used as insect repellent; source of tannins and phenols.

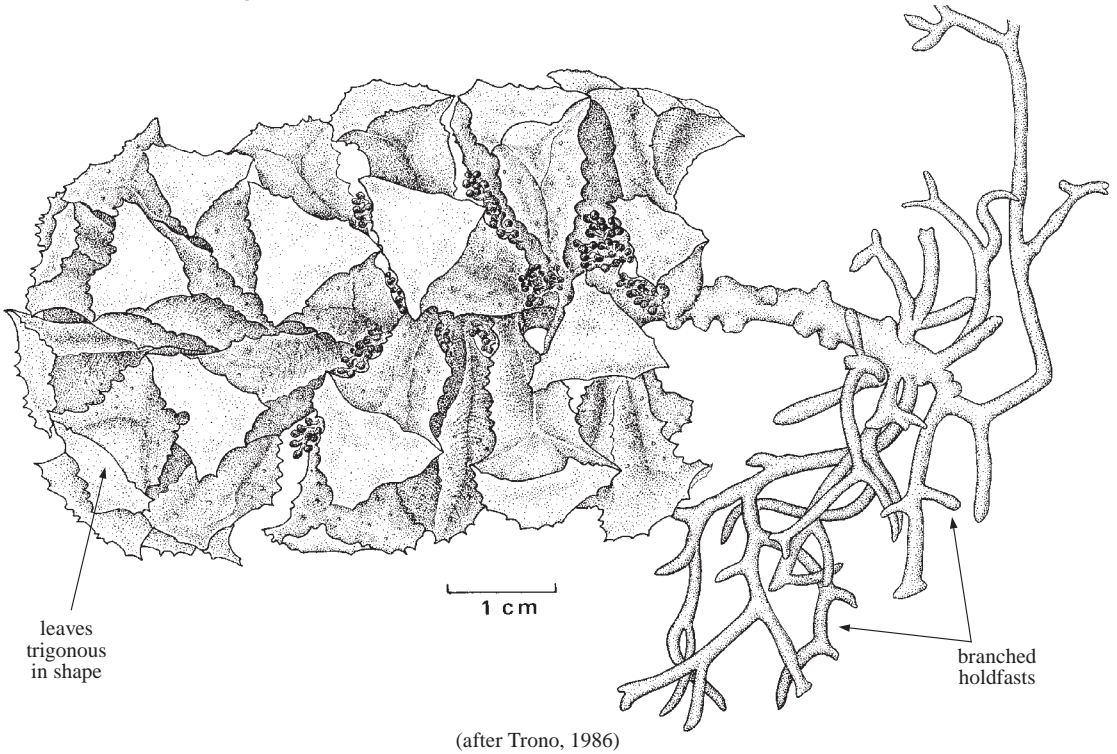
Distribution: Widely distributed in the warm waters of the tropics, including the Philippines, Guam, Japan, Indo-Malayan Archipelago, Viet Nam, and China.



generalized distribution for *Turbinaria*

Turbinaria decurrens Bory de Saint Vincent, 1828

FAO names: En - Triangular sea bell.

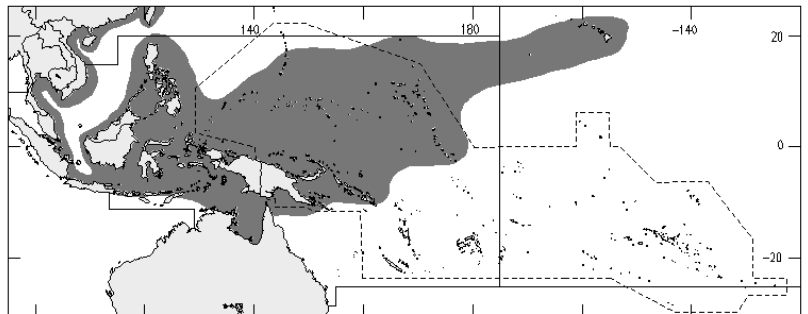
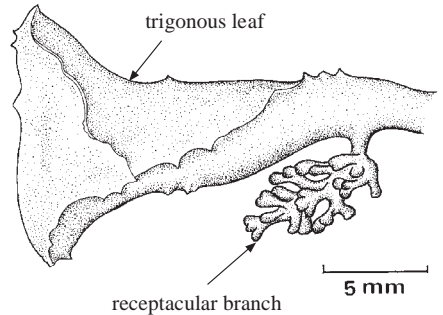


Diagnostic characters: Thalli erect, tough, dark to yellowish brown, with coarse, branched holdfasts; leaves fleshy, 11 to 17 mm long, obpyramidal in lateral view, due to prominent trigonous leaf-like extensions which extend from the terminal portion of the leaf to the stalk. Leaves characteristically triangular in surface view, often with a concave surface; outer margin finely toothed to entire; cross-section of leaves triangular with or without a large central vesicle. Paniculate receptacular branches about 8 mm long, attached at the base of the leaf stalk. This species is distinct from other members of *Turbinaria* because of its triquetrous leaves.

Size: Thalli up to 10 cm in height.

Habitat, biology, and fisheries: Usually occurs from lower intertidal to upper subtidal areas, strongly attached to rocks in wave-exposed habitats. Used for human consumption, fertilizer, source of alginate, and as insect repellent.

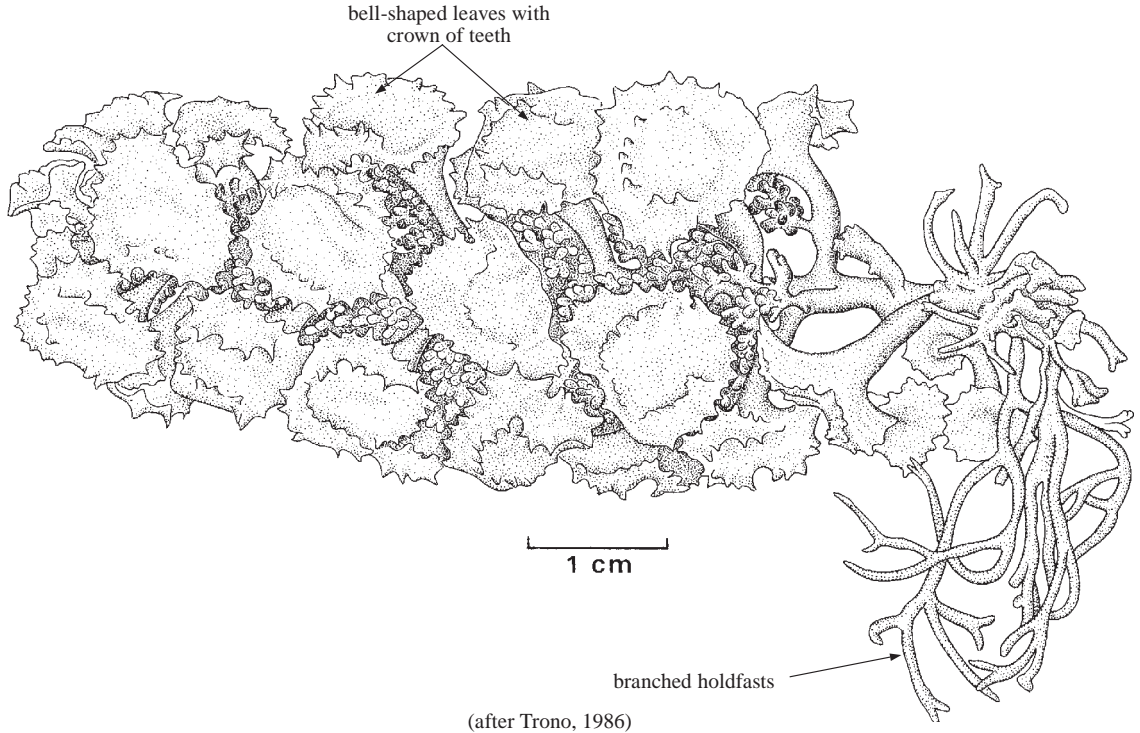
Distribution: Widely distributed in the tropical waters of the Southeast Asia region and found in the Philippines, Borneo, Guam, Malaysia, Indonesia, Japan, and China.



generalized distribution for *Turbinaria*

***Turbinaria ornata* (Turner) J. Agardh, 1848**

FAO names: En - Crowned sea bell.

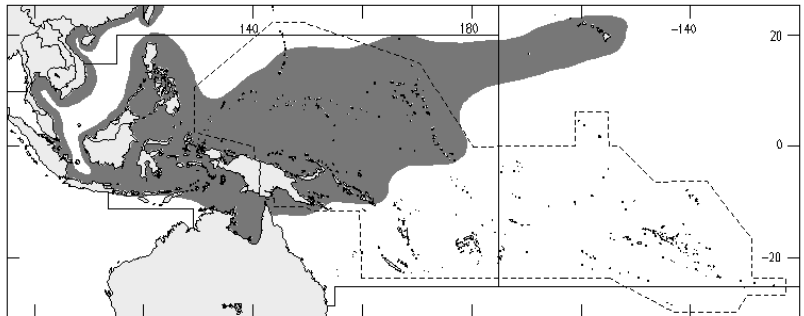
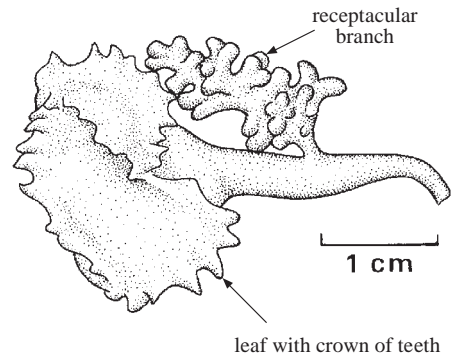


Diagnostic characters: Thalli erect and tough, dark brown, attached to rocky substrate by coarse branched holdfasts. Alternating turbinate, fleshy leaves with a terete stalk, crowded along the erect axis; distal end of leaves expanded to form a somewhat circular and fleshy marginal blade, outlined by sharp and coarse teeth; centre of blade concave and conspicuously surrounded, partially or fully, by a crown of teeth; single vesicles may be found at the depressed centre, usually among the leaves at the upper portion of the thallus. Receptacular branches racemose, 5 to 7 mm long, attached to the stalk of the leaves, about 1/3 the distance from the base, their distal portions irregularly forked.

Size: Thalli up to 17 cm in height.

Habitat, biology, and fisheries: Thrives mostly on rocky reef areas exposed to strong water turbulence, also on coralline rocks in calmer waters, commonly partially exposed during very low tides. Used for human consumption, fertilizer, source of algin, tannins and phenols, and as insect repellent.

Distribution: Widely distributed in the warm waters of the tropics, including the Philippines, India, Guam, Japan, Malaysia, Indonesia, Viet Nam, and China.



generalized distribution for *Turbinaria*

RHODOPHYTA - Red algae

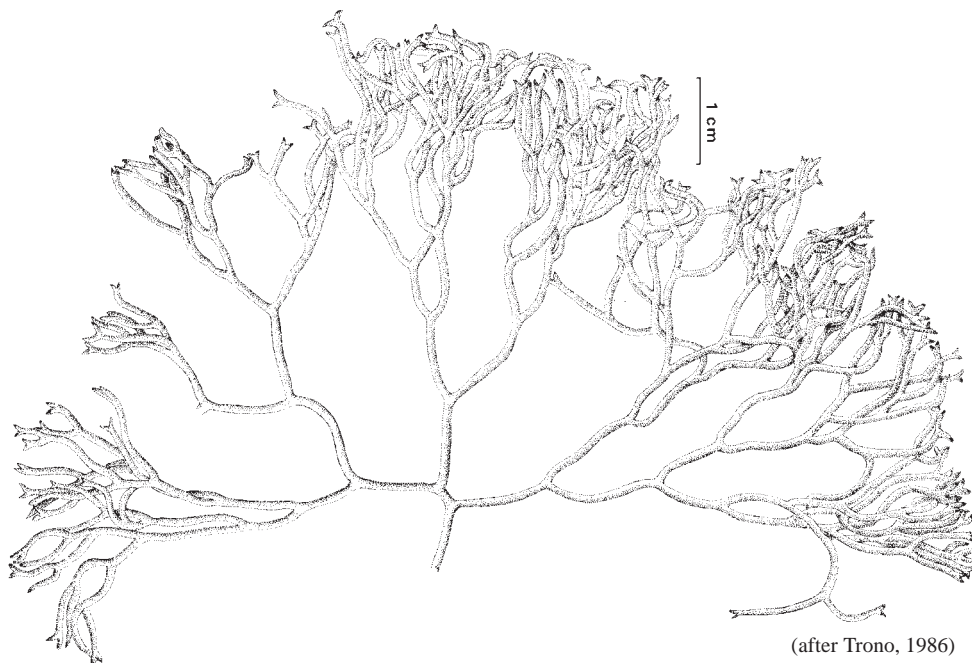
Subclass FLORIDEOPHYSIDAE

Order NEMALIALES

HELMINTHOCLADIACEAE

Liagora farinosa Lamouroux, 1816

FAO names: En - Slimy liagora.



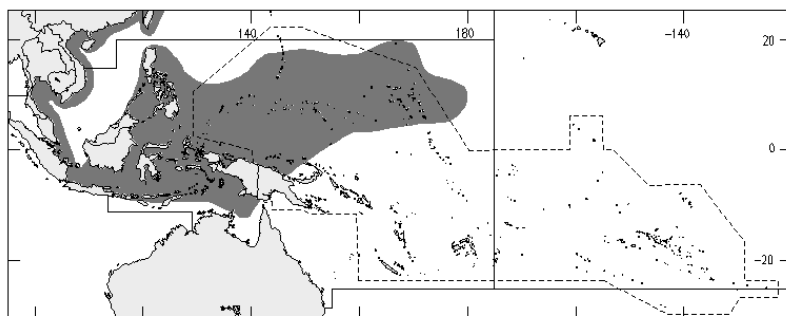
Diagnostic characters: Thallus soft and lubricous, pinkish in colour, lightly calcified, farinous and attached by a small discoid holdfast. Branches numerous, terete, about 1.5 mm in diameter. Branching basically dichotomous, interdichotomal segments decreasing towards the terminal portion of the thallus. Apices of branches fork into very short acute terminal branchlets. Assimilatory filaments terete, about 445 μm long and 30 μm broad; the cells nearly moniliform throughout. Antheridia borne in capitate clusters at the tips of the assimilatory filaments.

Size: Thalli to about 13 cm in height.

Habitat, biology, and fisheries:

Found in shallow water, growing on rocks or old corals in moderately sheltered locations. Utilized for human consumption.

Distribution: Commonly found in tropical and subtropical areas, including the Philippines, Viet Nam, Thailand, the Indo-Malayan Archipelago, and China.

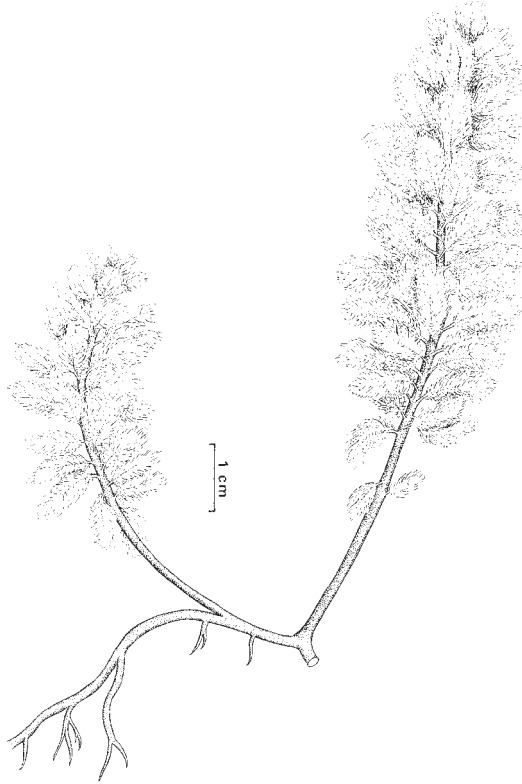


Order BONNEMAISONIALES

BONNEMAISONIACEAE

Asparagopsis taxiformis (Delile) Trevisan, 1845

FAO names: En - Red sea plume.



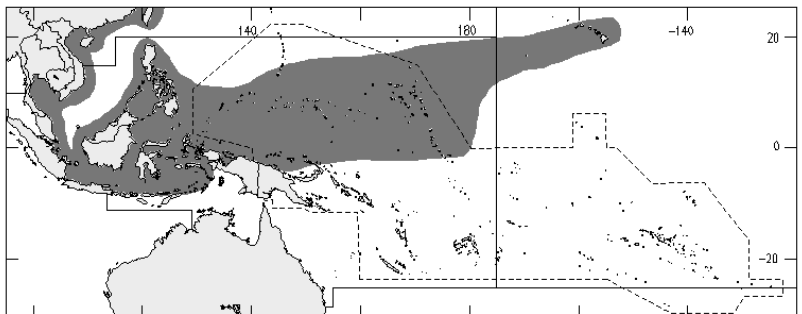
(after Trono, 1986)

Diagnostic characters: Thalli erect, greenish to red in colour, feathery or plumose, arising from a creeping stolon and attached by rhizoids to solid substrates. Central axis terete, bearing plumose branches at its upper 1/2 to 2/3 portion; the plumose branches are composed of numerous fine and delicate determinate branchlets which are densely disposed around an axis. Cystocarps subspherical or ovate, bright red in colour and borne at the apices of the short branchlets.

Size: Thalli up to 13 cm in height.

Habitat, biology, and fisheries: Grows on solid substrates on reef or rocky shores exposed to moderately strong water movement. Utilized for human consumption and animal feed; source of protein and used as medicine (antibiotic, antimicrobial).

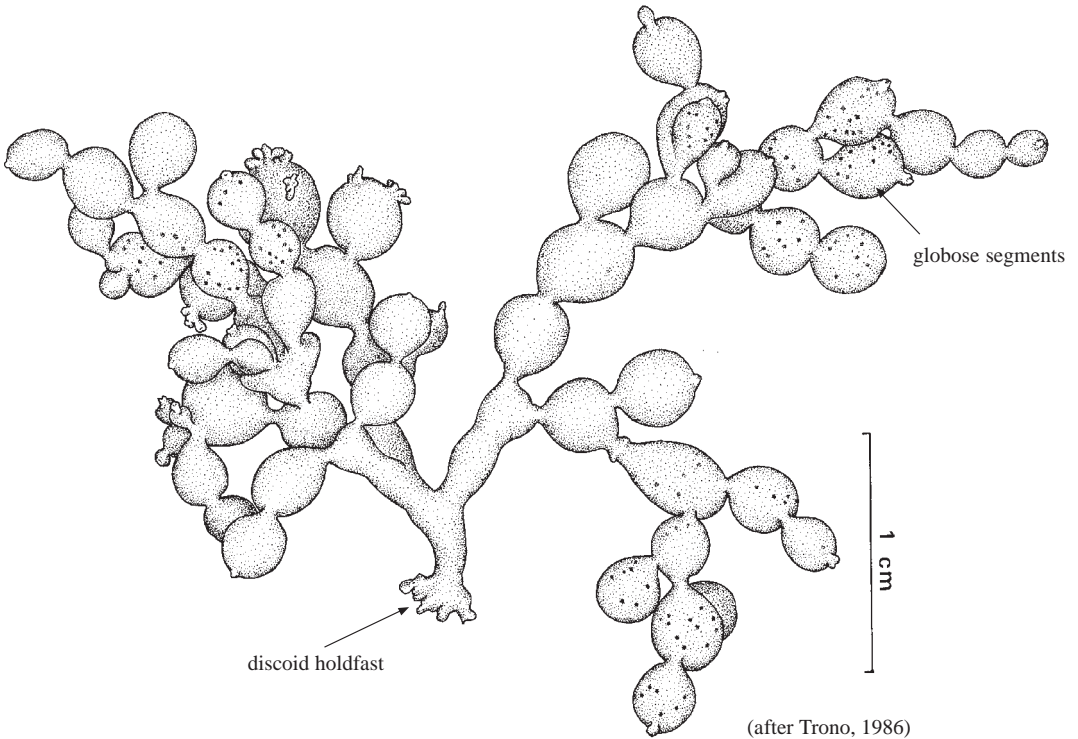
Distribution: Tropical to subtropical in distribution and found in the Indo-Malayan Archipelago, the Philippines, Thailand, China, Taiwan Province of China, Viet Nam, and western Pacific islands.



GALAXAURACEAE

Scinaia hormoides Setchell, 1914

FAO names: En - Moniliform sea moss.

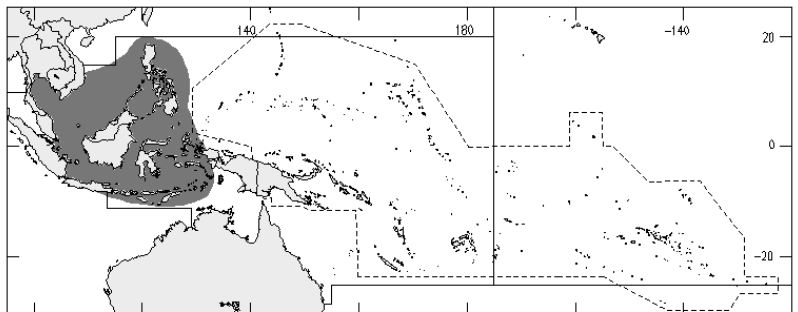


Diagnostic characters: Thalli erect, red to deep purple in colour, attached by a small discoid holdfast. Stipe short and hard texture giving off branches which are deeply constricted at regular intervals giving rise to vesicular, globose segments (moniliform), 5 mm broad and 7 mm long. Cross-section of a segment shows a medulla of loose strands of slender non-pigmented medullary filaments and a cortex of 2 layers of cells, the outer epidermal layer made up of firmly coherent non-pigmented cells, the inner layer consisting of ovoid to elongate pigmented cells.

Size: Thalli up to 7 cm in height.

Habitat, biology, and fisheries: Grows in rocky wave-exposed areas of reef or rocky shores. Utilized for human consumption, obtained from natural stocks; also a good source of agar.

Distribution: Reported from the Philippines, Indonesia, and Malaysia.

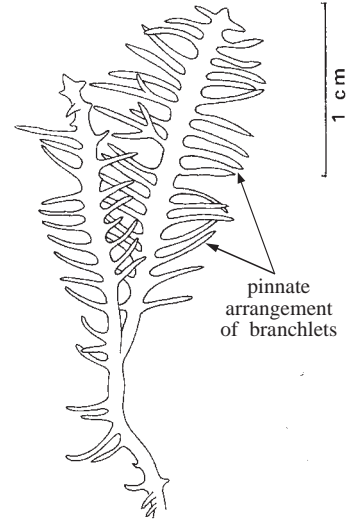


Order GELIDIALES

GELIDIACEAE

Gelidiella acerosa (Forsskål) Feldmann and Hamel, 1934

FAO names: **En** - Chaffweed; **Fr** - Menue paille marine; **Sp** - Pajilla marina.



(after Trono, 1986)

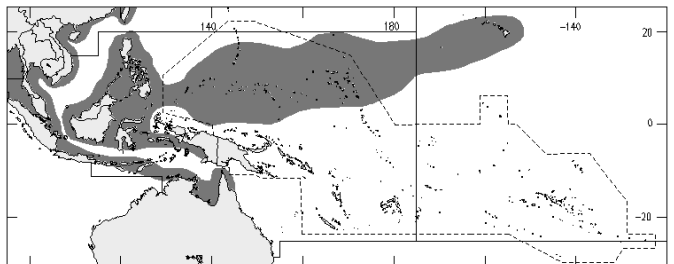
terminal portion of branch

Diagnostic characters: Thalli form wiry mats or clumps attached by rhizoids arising from creeping stolons. Colour yellow-brown to greenish brown when inhabiting tidepools or upper intertidal areas with clear and shallow water, and reddish to purple in shaded upper subtidal and lower intertidal areas. Branches erect, decumbent or prostrate, composed of a terete to compressed central axis and pinnately arranged, filiform lateral branchlets (ramuli) which are upcurved and acuminate, 1 to 6 mm long, and generally decrease in length towards the distal portion of the axes. Few lateral branchlets may develop that give rise to second degree ramuli. In fertile plants, swollen stichidia are formed at the apices of the lateral branchlets.

Size: Branches up to 9 cm in length.

Habitat, biology, and fisheries: Inhabits shallow waters of the intertidal and upper subtidal zones. Grows in exposed or shaded areas, attached to calcareous substrates such as coralline rocks, rocks covered by crustose algae, and on sandstones or shells of molluscs. Also found in tidepools with relatively high changes in water temperature, pH, salinity and degree of exposure to air are influenced by tide. Used for human consumption and prepared as salad, dessert gel, or agar jelly. One of the most important raw materials for the manufacture of agar used in pharmaceutical industries, paints, varnishes, electric bulbs, and photographic films; also an important ingredient in milk products, jams, marmalades, and ice cream; used as culture medium in bacteriology, agar plates in electrophoresis, and other laboratory uses.

Distribution: Mostly tropical in distribution. Found in the Red Sea, on the eastern and western sides of the Pacific Ocean, the Gulf of Mexico, the Caribbean Sea and other parts of the Atlantic Ocean; also in the southern part of Japan, the Indian Ocean, the Indo-Malayan Archipelago, the South China Sea, the Philippines, and Viet Nam.

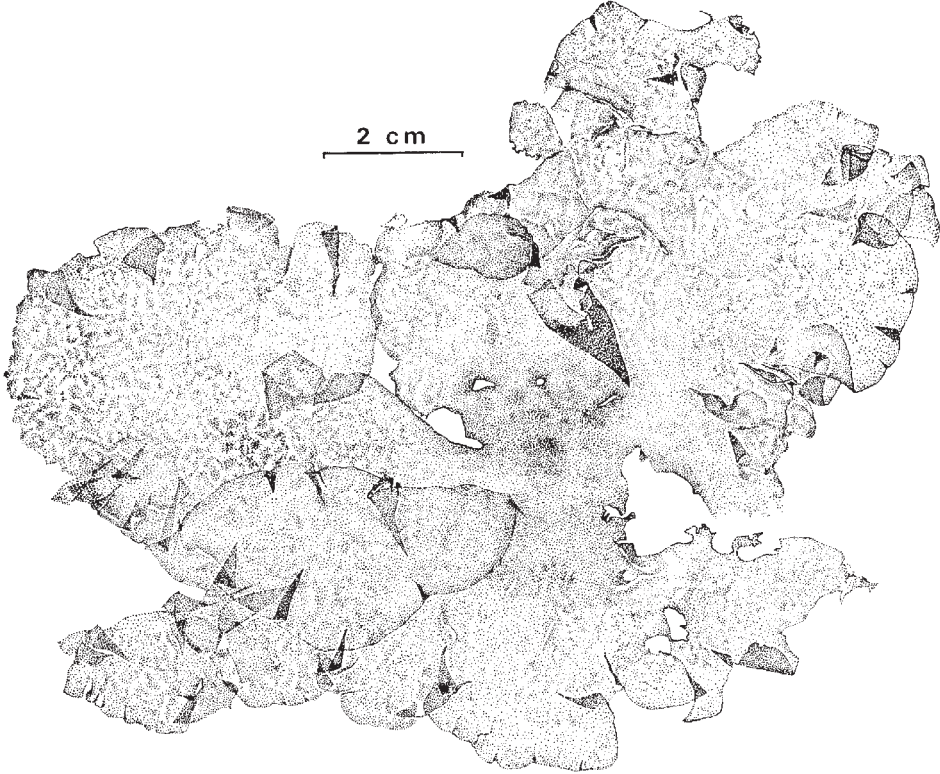


Order CRYPTONEMIALES

CRYPTONEMIACEAE

Halymenia dilitata Zanardini, 1851

FAO names: En - Red sea lettuce.

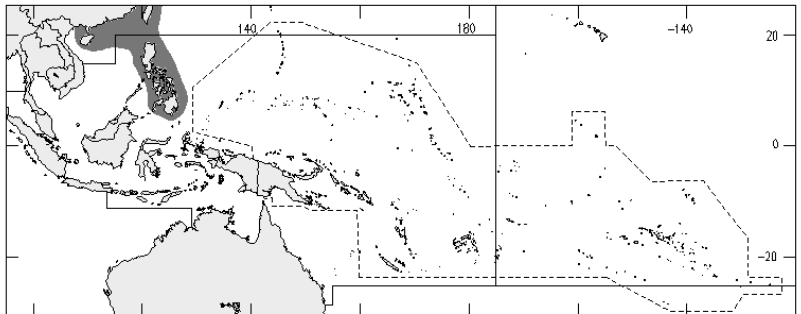


Diagnostic characters: Thalli very delicate, thin, bright red to orange-red. Blade whole or lobed, margin ruffled; cross-section of the blade shows a medulla consisting of thin cylindrical branched filaments and ganglion-like cells. Cortex made of branched anticlinally arranged filaments consisting of pigmented cells.

Size: Thalli up to 20 cm in length.

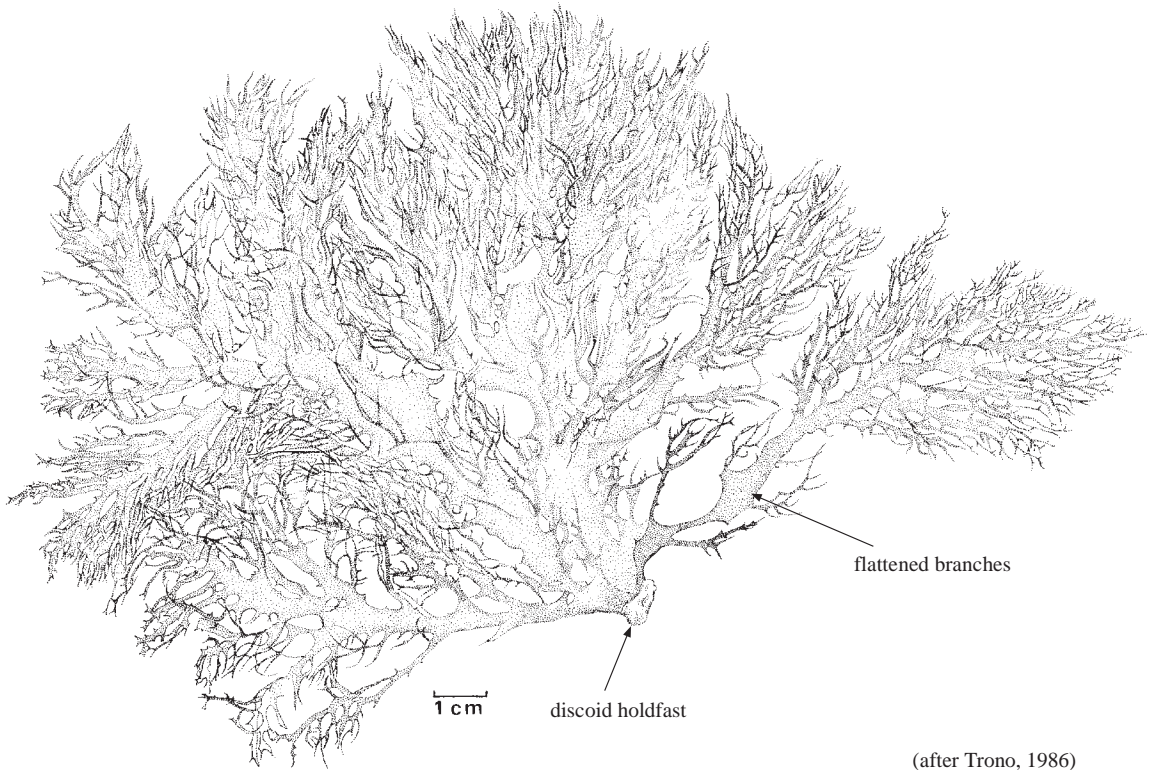
Habitat, biology, and fisheries: Attached to rocky substrate in lower intertidal shaded areas or in upper subtidal zones exposed to moderate water movement. Utilized for human consumption and a source of carrageenan.

Distribution: Reported from the Philippines, China, and Taiwan Province of China.



Halymenia durvillaei Bory de Saint Vincent, 1828

FAO names: En - Branched halymenia.



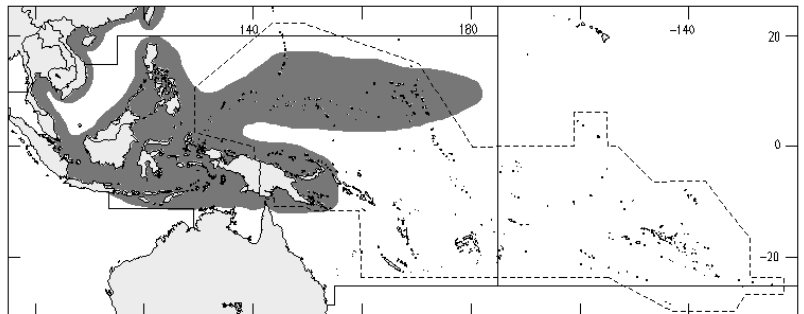
(after Trono, 1986)

Diagnostic characters: Thalli large and bushy, red-orange or purple in colour, soft cartilaginous and slimy when fresh, attached to rocky substrates by a discoid holdfast. Stipe short, supporting 2 to 4 main axes which are 5 to 15 mm wide, branching pinnately-alternately 4 to 5 times. Branches flattened, their diameter decreases with the increasing degree of branching. Ultimate branchlets slender and linear with acuminate tips, sometimes forcipate. Margins of the fronds serrate, surfaces of the axis provided with few spine-like projections. Cross-section of frond shows ganglion-like cells in the medulla connecting the other cells. Cortex consisting of more than 5 layers of very small ovoid or elongated pigmented cells.

Size: Thalli to about 35 cm in height.

Habitat, biology, and fisheries: Commonly found attached to rocks in lower intertidal to upper subtidal areas which are moderately exposed to wave action. Utilized for human consumption and a source of carrageenan.

Distribution: Distributed in the western Pacific and Indo-Malayan Archipelago, including Thailand, Viet Nam, southern China, Taiwan Province of China, and the Philip-pines.

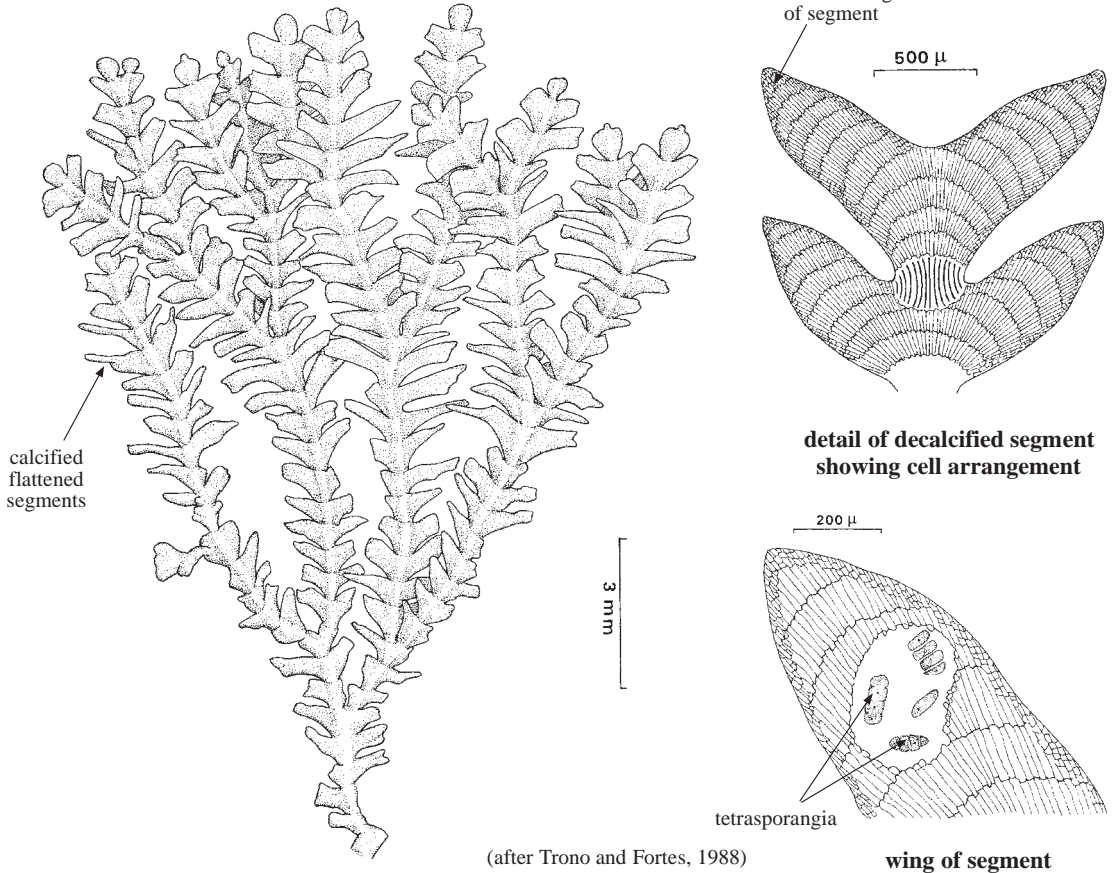


Order CORALLINALES

CORALLINACEAE

Cheilosporum cultratum (Harvey) Areschoug, 1852

FAO names: En - Calcified sea moss.



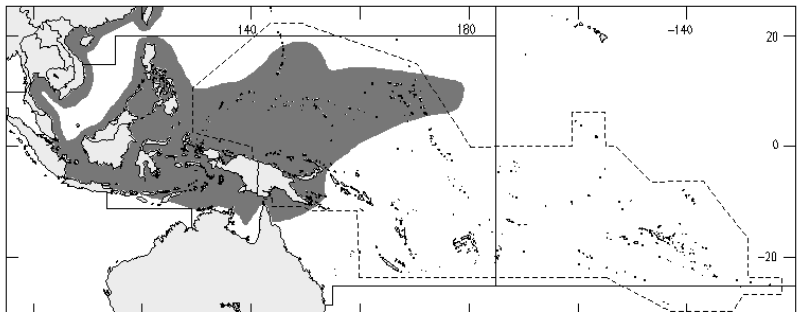
Diagnostic characters: Thalli highly calcified, pinkish to greyish in colour, forming di- to trichotomous decumbent branches. Branches compressed to flattened, 1.0 to 3.0 mm wide, composed of sagittate segments with a prominent midrib, and wing-like lateral extensions which are mostly broadly spinose, gradually or abruptly tapering to acute or acuminate outer tips; some segments have broader wings with truncate, undulate, or toothed outer tips; segments may bear 1 or 2 conceptacles with sharp, horn-like acutely filiform or mucronate processes.

Size: Thalli up to 3 cm in length.

Habitat, biology, and fisheries:

Grows on rocks or in pools in the midlower intertidal zone; forms clumps in shallow subtidal areas of wave-swept shores.

Distribution: Mainly distributed in the tropical western Pacific and found in South Africa, China, Taiwan Province of China, Viet Nam, Indo-Malayan Archipelago, Thailand, and the Philippines.

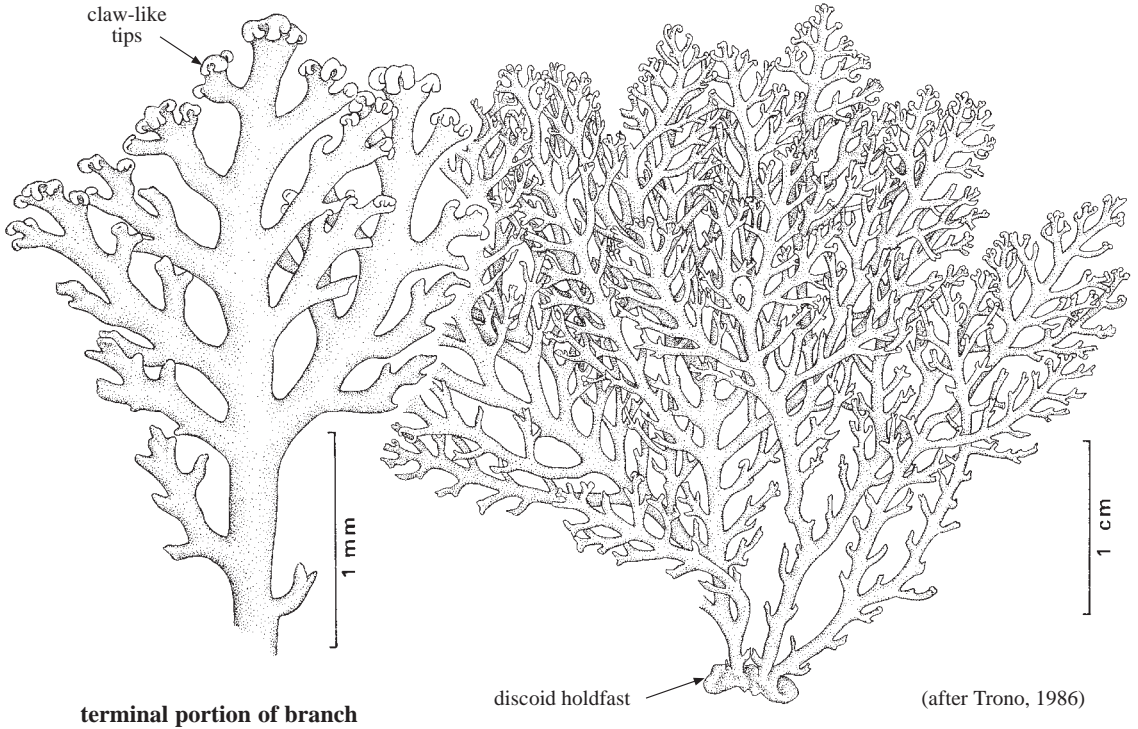


Order GIGARTINALES

RHIZOPHYLLIDACEAE

Portieria hornemannii (Lyngbye) P.C. Silva, 1987

FAO names: En - Clawed sea moss.

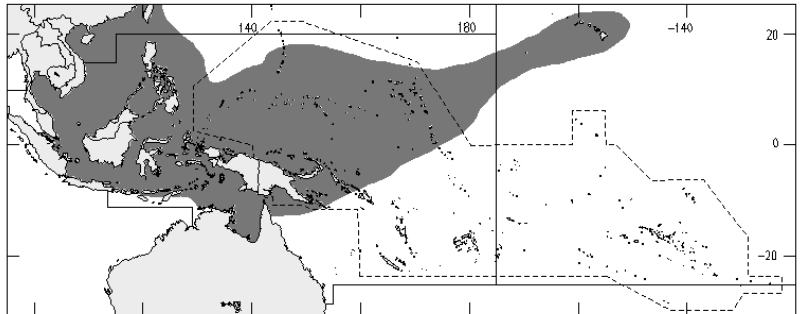


Diagnostic characters: Thalli small, bright orange to red and composed of erect, overlapping fronds that arise from a small discoid holdfast. Branching in 1 plane, irregularly pinnate-alternate, forming rounded axils. Diameter of the primary branches not exceeding 7 mm. Tips of the terminal branches at the distal portion of the thallus slightly expanded with enrolled tips. Basal lateral branchlets provided with simple acute teeth.

Size: Thalli about 5.5 cm in height.

Habitat, biology, and fisheries: Attached to rocks or dead corals in upper to lower subtidal areas exposed to moderate to strong water movement. Source of carrageenan.

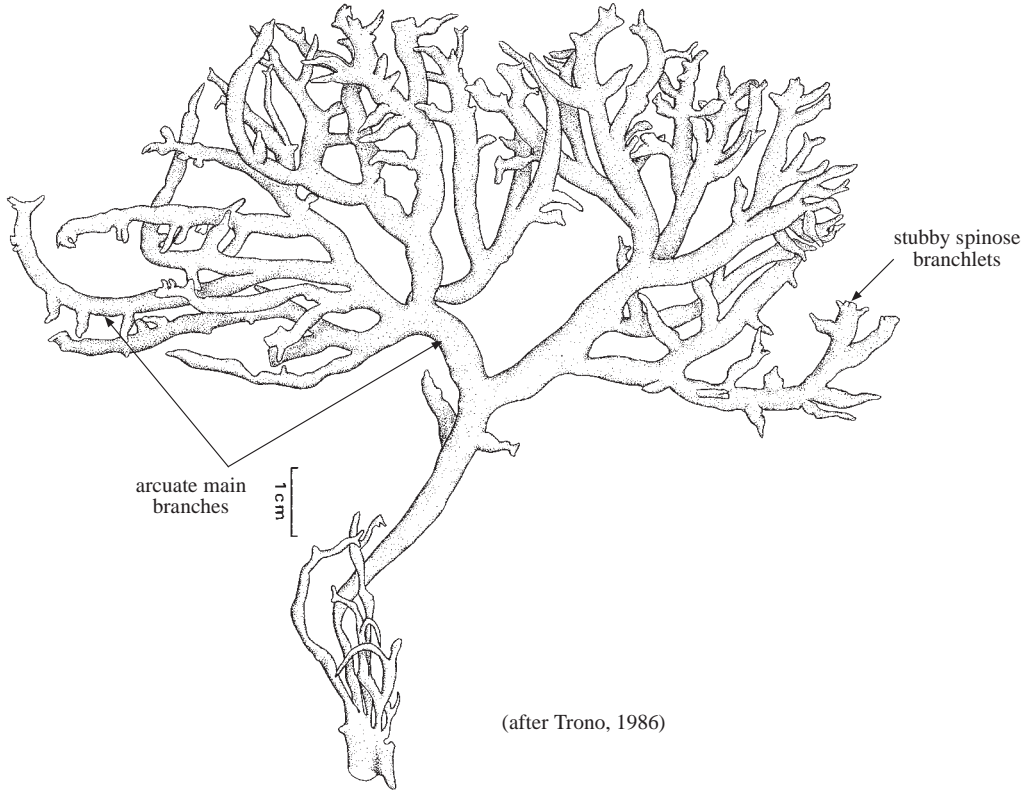
Distribution: Reported from the Philippines, China (Guangdong Province), and other parts of the Indo-West Pacific.



GRACILARIACEAE

Gracilaria arcuata Zanardini, 1860

FAO names: En - Arcuate gracilaria.

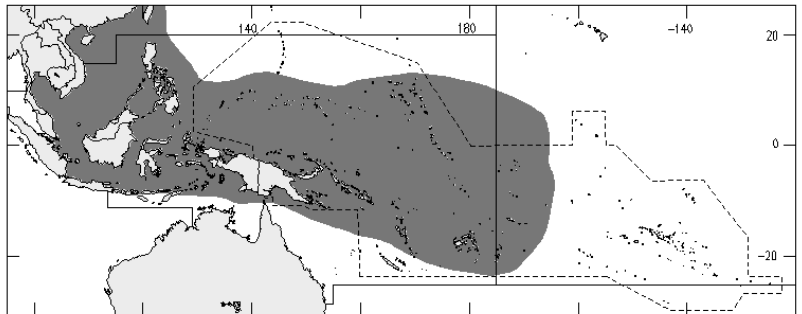


Diagnostic characters: Thalli erect, cartilaginous, greenish purple, with a discoid holdfast. Primary and secondary branches prominent, mostly arcuate, terete throughout, slightly constricted at the base. Branching on the main axes generally secund. Terminal branches giving rise to 2 or 3 short, stubby, spinose branchlets at their distal portions.

Size: Thalli up to 10 cm in height.

Habitat, biology, and fisheries: Grows in shallow subtidal areas attached to coral rocks and fragments, and shells; utilized for human consumption and a source of agar; used in wastewater purification, contains growth regulator substances similar to auxin, gibberellin, and cytokinin; also used as manure for coconuts and coffee bushes in Hainan, India, and Sri Lanka.

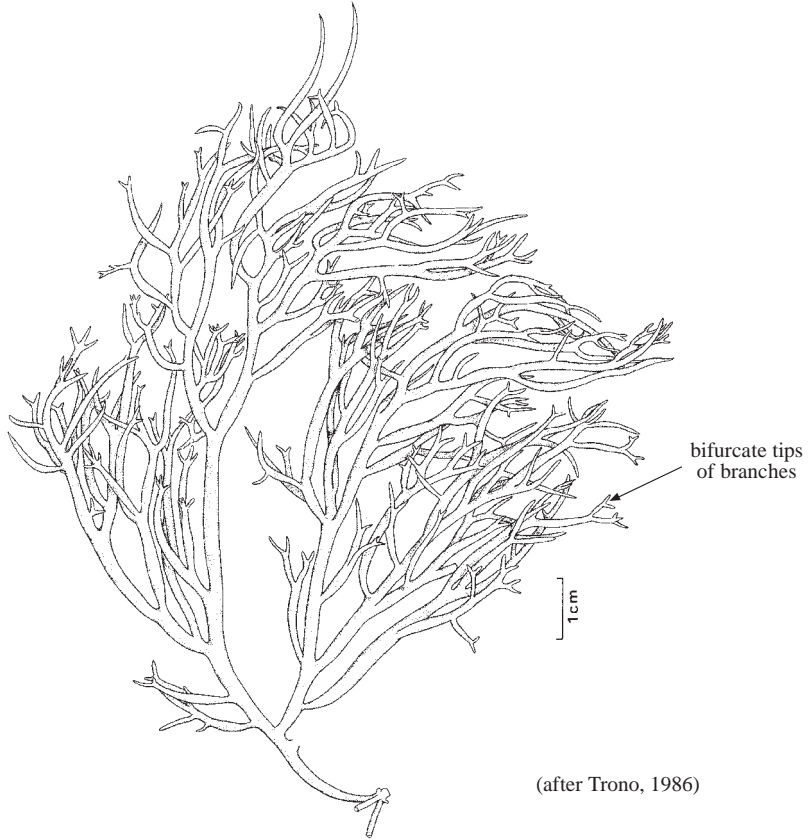
Distribution: Mainly tropical in distribution and found in China, Japan, Korea, Indonesia, the Philippines, Tonga Is., Samoa, Sri Lanka, Mauritius, the Red Sea, and Mediterranean coasts.



generalized distribution for *Gracilaria*

Gracilaria edulis (Gmelin) Silva, 1952

FAO names: En - Dichotomously branched gracilaria.

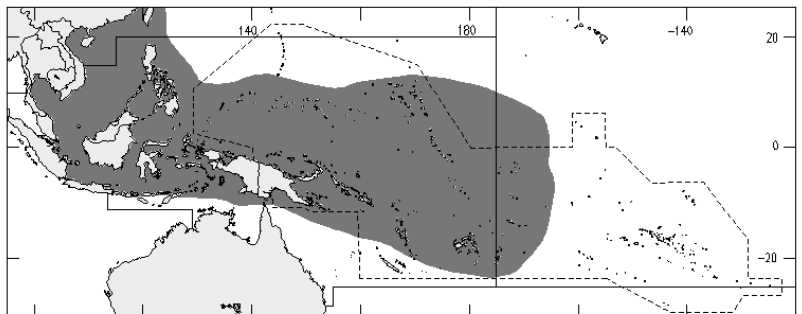


Diagnostic characters: Thalli erect, cartilaginous, greenish brown to dark brown, or purple in colour, attached by a small discoid holdfast. Branching basically repeatedly dichotomous and divaricate. Branches terete, 1.5 to 2.2 mm in diameter, tapered and characteristically bifurcate at the terminal portions.

Size: Thalli up to 14 cm in height.

Habitat, biology, and fisheries: Forms clumps in sandy-muddy or rocky intertidal areas, in dense tufts when growing on fish cages, and in loose fastigate tufts on rocks in clear water. Utilized for human consumption and as a source of agar; used as manure for coconuts and coffee bushes in Hainan, India, and Sri Lanka.

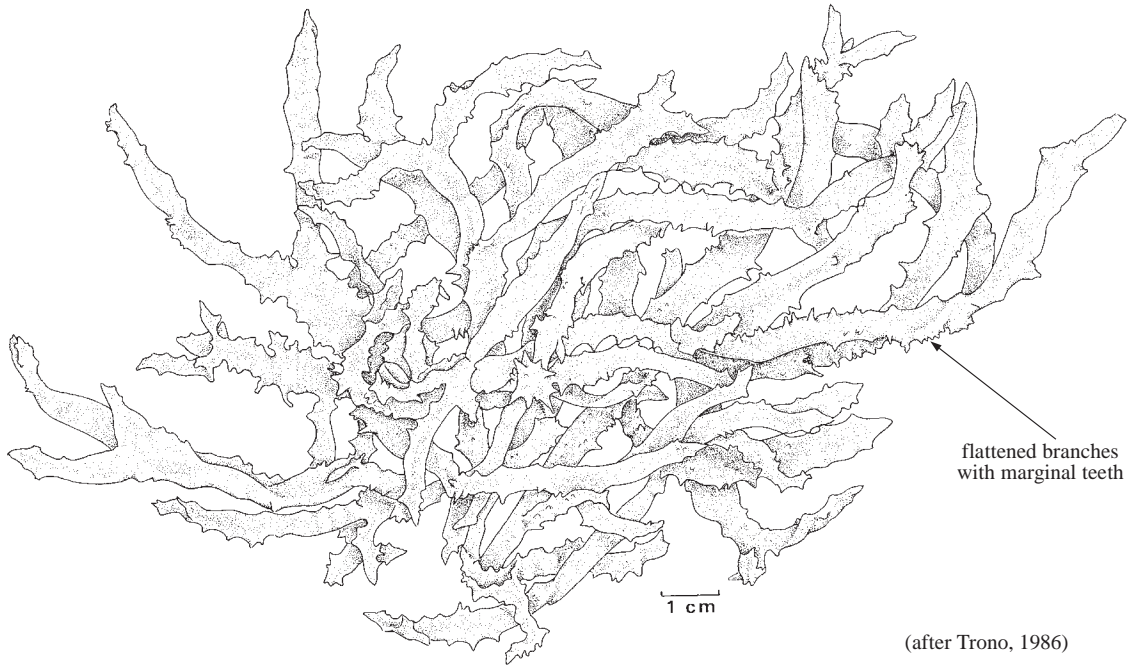
Distribution: Reported in the western Pacific from Singapore, Thailand, Malaysia, and the Philippines; also in the Indian Ocean.



generalized distribution for *Gracilaria*

Gracilaria eucheumoides Harvey, 1860

FAO names: En - Prostrate gracilaria.

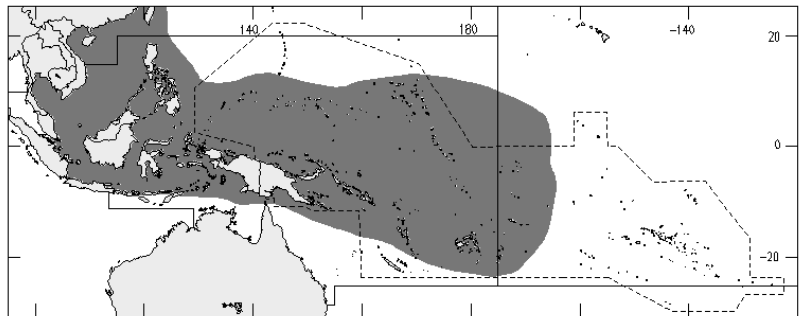


Diagnostic characters: Thalli greenish brown to purple in colour, forming loose or thick prostrate clumps on rocky substrates attached by means of hapters. Branches distinctly compressed, up to 1 cm wide, branching irregular. Margin of the flattened branches with coarse teeth or short spines.

Size: Thalli up to 12 cm in length.

Habitat, biology, and fisheries: Grows strongly attached to rocks or coral fragments in lower intertidal to upper subtidal areas, exposed to moderate or strong water turbulence. Economically important as source of agar and for human consumption (salad or stew mixed with vegetables); used as manure for coconuts and coffee bushes in Hainan, India, and Sri Lanka.

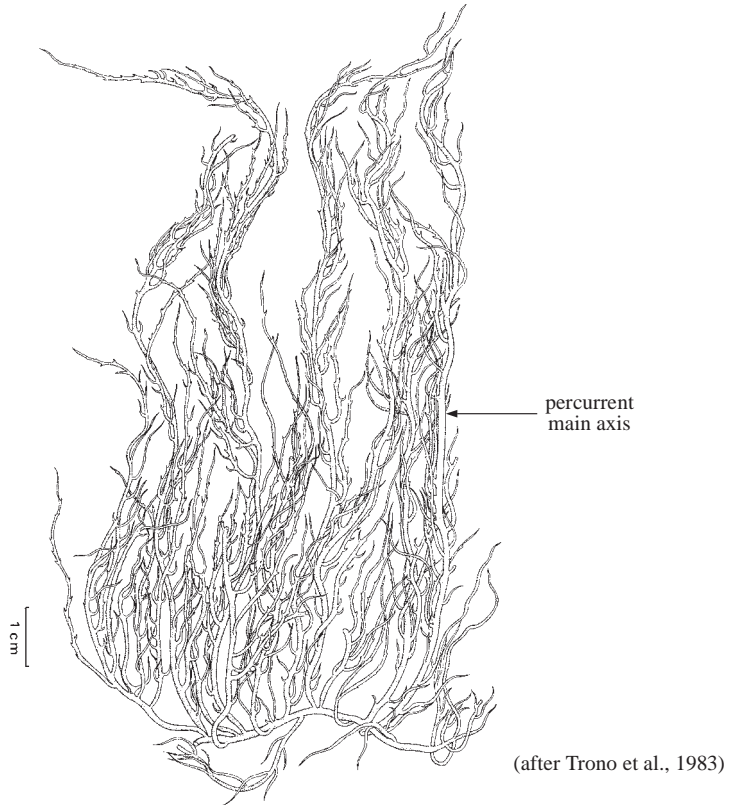
Distribution: Widespread in the tropics, including Japan, Australia, China, Indonesia, Philippines, and Morocco.



generalized distribution for *Gracilaria*

***Gracilaria heteroclada* Zhang and Xia, 1988**

FAO names: En - Percurrent gracilaria.

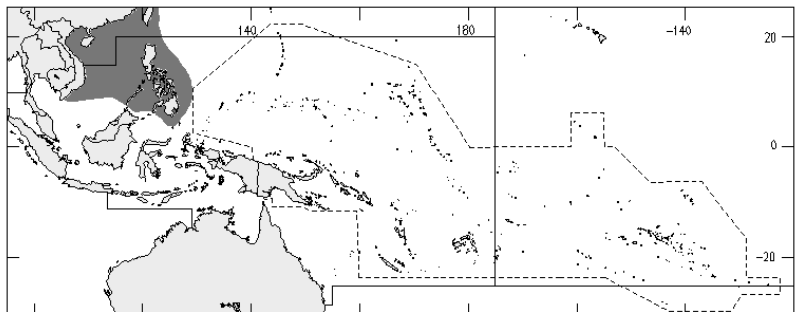


Diagnostic characters: Thalli erect, brittle when fresh, dark brown to purple and sometimes olive green in colour, purple to black when dried. Main branches percurrent with many spinose determinate branchlets. Branchlets distinctly smaller in diameter than main axes; branch bases not constricted. Cortex thin, composed of 1 or 2 layers of regularly spherical to oval cells. Medullary cells large, thin-walled, 4.25 to 9.5 μm thick; transition of cell size from medulla to cortex abrupt. Cystocarp rostrate, hemispherical, somewhat embedded and unconstricted at the base. Pericarp thin, with 6 to 8 layers of cells, 65 to 137 μm thick. Nutritive filaments absent. Carpospores 23 to 38 μm in diameter, centre of gonimoblast composed of small ovoid cells; carpospore initials elongated. Spermatangia superficial, on elongated outer cortical cells. Tetraspores broad and rounded.

Size: Thalli up to 60 cm in height.

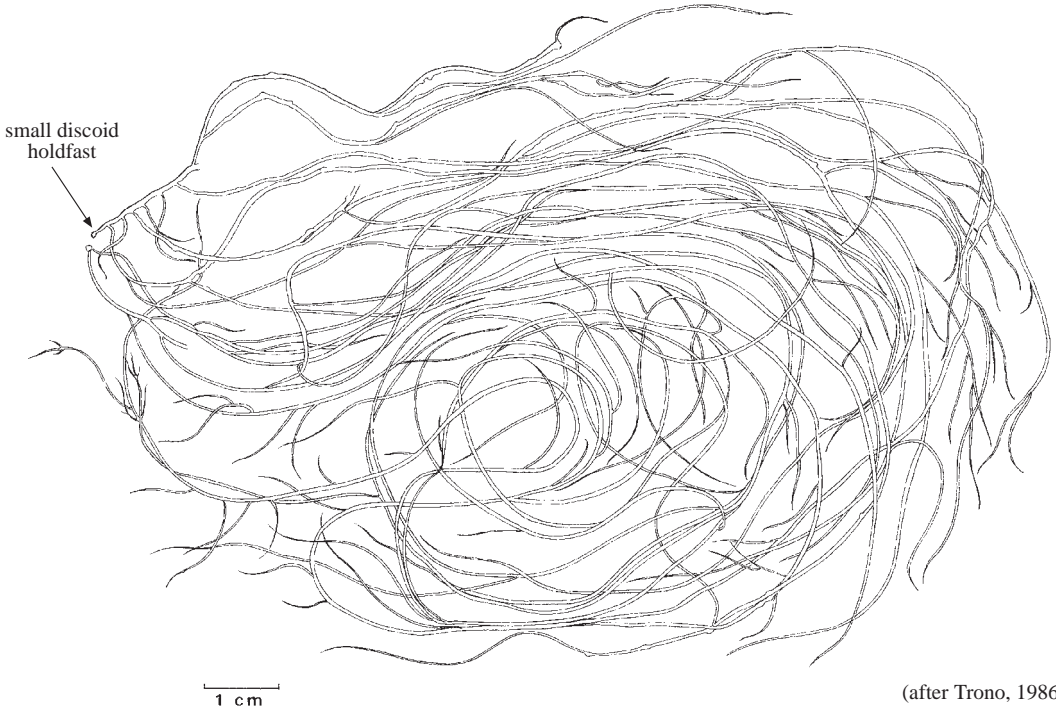
Habitat, biology, and fisheries: Grows on shells or gravel on mud flats and in tidepools, or canals in midtidal to low intertidal areas. Utilized for human consumption and a source of agar.

Distribution: Reported from China, the Philippines, and Viet Nam.



Gracilaria manilaensis Yamamoto and Trono, 1994

FAO names: En - Filiform sea moss.

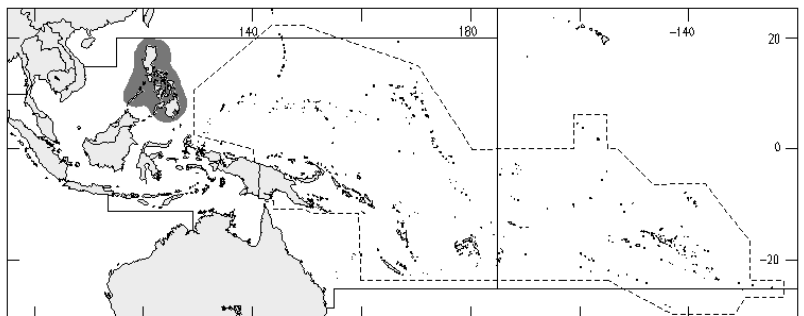


Diagnostic characters: Thalli reddish brown to purple in colour, erect, loosely branched, attached to shells and debris by a very small discoid holdfast. Branches 0.8 to 1.9 mm in diameter, terete throughout, slender, gradually tapering towards filiform apices, distinctly constricted at the base; soft and easily broken when fresh. Cortex composed of 1 or 2 layers of spherical to cuboidal cells, 9×4.75 to 13×8.25 μm in size. Medullary cells large, 52 to 746 μm in diameter; cell walls 3 to 4.5 μm thick; cell size transition from medulla to cortex abrupt. Cystocarps semi-globose, unconstricted at the base and distributed on more mature branches, 0.8 to 0.9 mm in diameter. Pericarp consisting of 6 to 10 layers of cells, 103 to 188 μm thick; outermost cells round to oval and anticlinally arranged, inner layers periclinally arranged, becoming flattened towards the gonimoblast. Nutritive filaments abundant between pericarp and gonimoblast. Carpospores 15 to 20 μm in diameter, gonimoblast centre composed of few large parenchyma cells. Spermatangial cavities oval, cup-shaped to deep oval (verrucosa type) and 36.5 to 104 μm deep. Tetraspores prominent, sometimes protruding from the cortex, 26.26×18 to 39.25×31.75 μm in size.

Size: Thalli up to 54 cm in length.

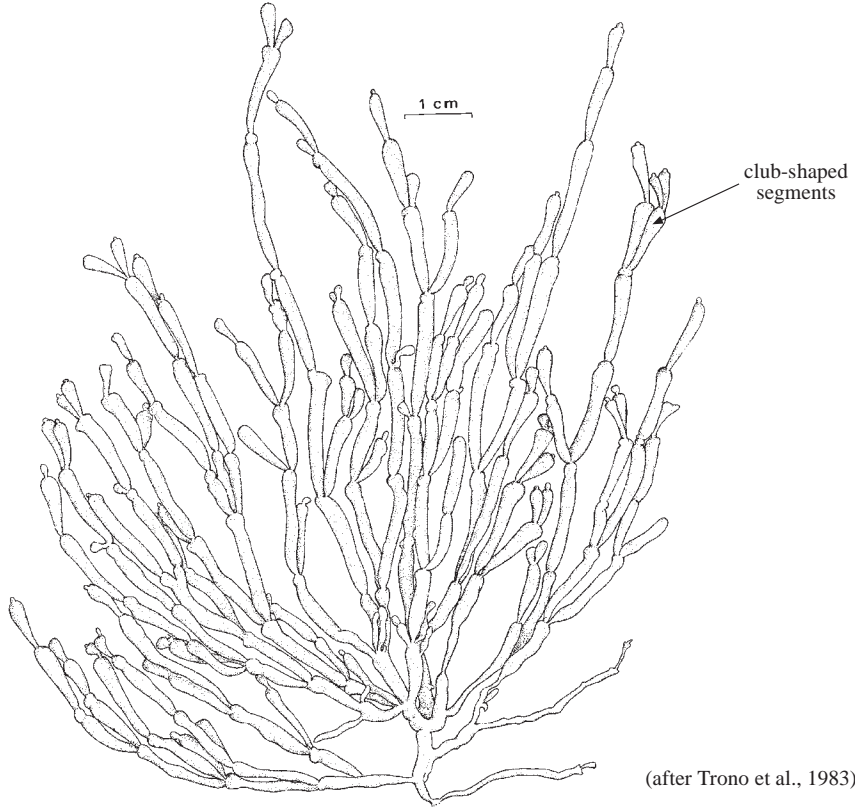
Habitat, biology, and fisheries: Grows attached to pebbles, shells and stones on muddy bottoms in shallow nutrient-rich water. Utilized for human consumption and raw material for agar manufacture.

Distribution: Endemic to the Philippines.



***Gracilaria salicornia* (C. Agardh) Dawson, 1854**

FAO names: En - Segmented gracilaria.

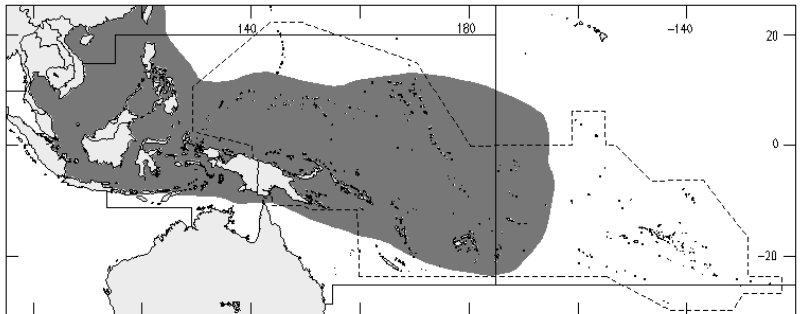


Diagnostic characters: Two forms are distinguished, depending on the type of habitat. In areas where the water is clear, calm, and exposed to full sunlight, the thalli are bright orange with branching dichotomous to tetrachotomous divaricate; branches distinctly divided into terete, subclavate to clavate segments, swollen at the distal end and constricted at the base. In areas where the water is turbid and the movement is moderate to strong, thalli are dark green to greenish brown, forming prostrate clumps on the substrate; branching irregularly subdichotomous to trichotomous to alternate; branches not distinctly divided into clavate segments except at the terminal portions and are shorter.

Size: Thalli up to 8 cm in height.

Habitat, biology, and fisheries: Attached to solid substrate such as coral fragments, shells, pebbles, stones, rocks, gravel, or mangrove roots, in clear to turbid waters. Usually found in protected portions of reef flats not exposed to the full impact of wave action. Utilized for human consumption and a source of agar, but its agar is of poor quality; also used as manure for coconuts and coffee bushes in Hainan, India, and Sri Lanka.

Distribution: Mainly tropical in distribution and found in China, Taiwan Province of China, Viet Nam, Singapore, the Philippines, Malaysia, India, Thailand, and western Pacific islands.

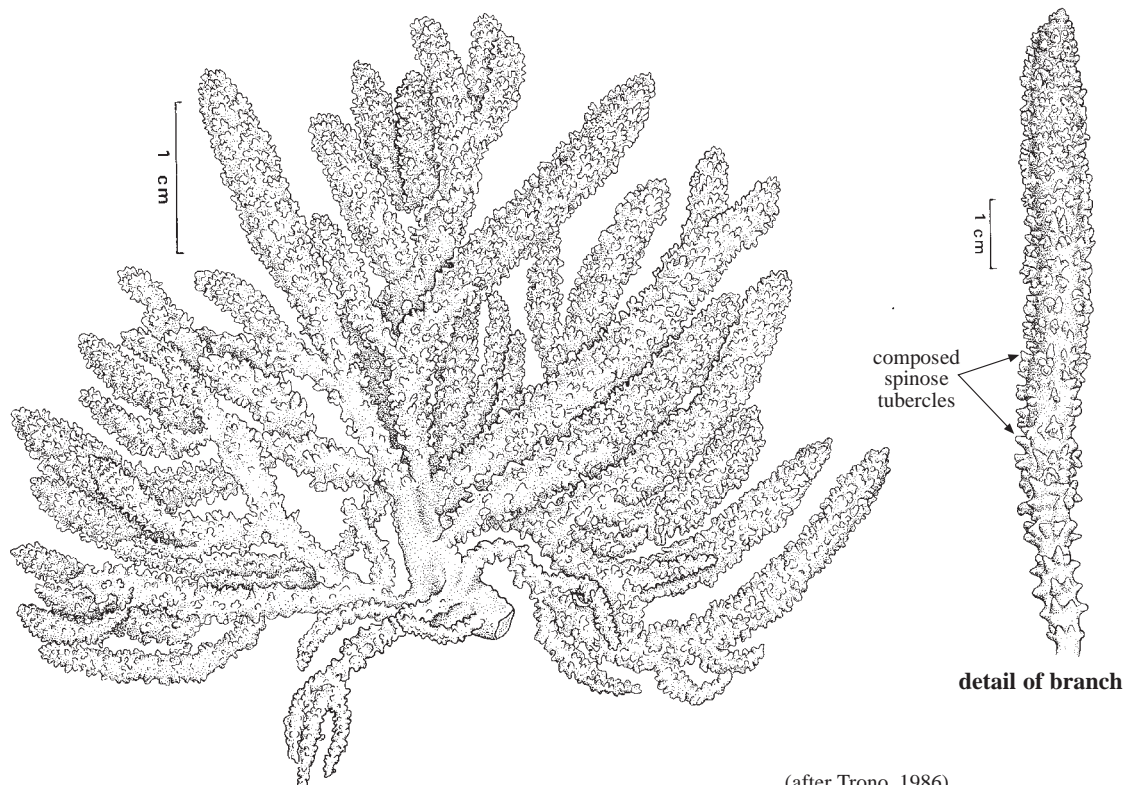


generalized distribution for *Gracilaria*

SOLIERIACEAE

Eucheuma arnoldii Weber-van Bosse, 1928

FAO names: En - Mottled sea club.

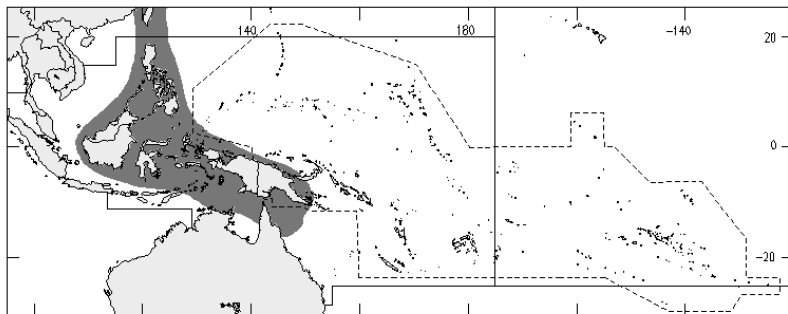


Diagnostic characters: Thalli form thick clumps, consisting of many clavate branches with slightly acute apices. Branches are densely covered with simple or compound spinose tubercles, regularly arranged into distinct "nodes" and "internodes", forming verticils at the "nodes"; the verticils overlap at the distal portion of the branches so that the verticillate arrangement is obscured. Cross-section of a branch reveals a medulla composed of large rounded cells interspersed with smaller cells. Cortical cells very small, ovoid or elongated.

Size: Thalli up to 15 cm in height.

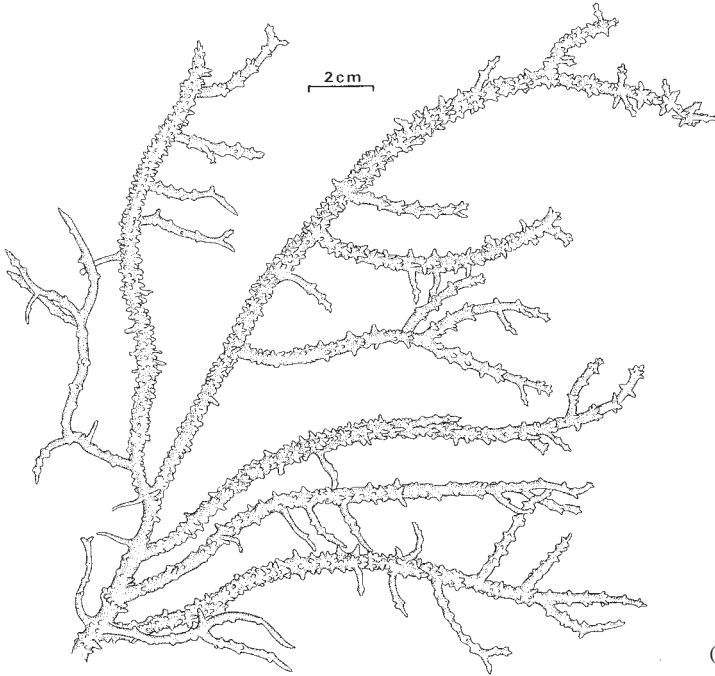
Habitat, biology, and fisheries: Grows on living corals, algal limestones or basalt substrates in close association with live hard and soft corals in lower intertidal to upper subtidal reef areas where the current is swift and the water free from silt. It is easily mistaken for a live coral because of its close resemblance to corals of the genus *Acropora*. Used for human consumption; source of carrageenan.

Distribution: Widely distributed in the Philippines and known from northern Queensland to the southern Ryukyu Islands, Taiwan Province of China, and the Indo-Malayan Archipelago.



Eucheuma denticulatum (Burman) Collins and Hervey, 1917

FAO names: En - Spiny eucheuma.



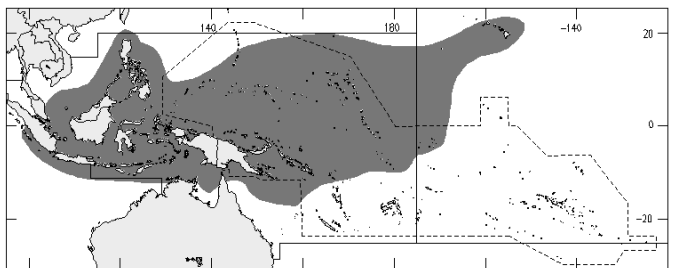
(after Trono et al., 1983)

Diagnostic characters: Thalli consist of many terete branches, tapering to acute tips, densely covered with 1 to 8 mm long spinose determinate branchlets arranged in whorls, forming distinct "nodes" and "internodes" at the distal portions of the branches. Cross-section of a branch reveals a dense core of thick-walled and very small rhizoidal cells.

Size: Thalli up to 30 cm in height.

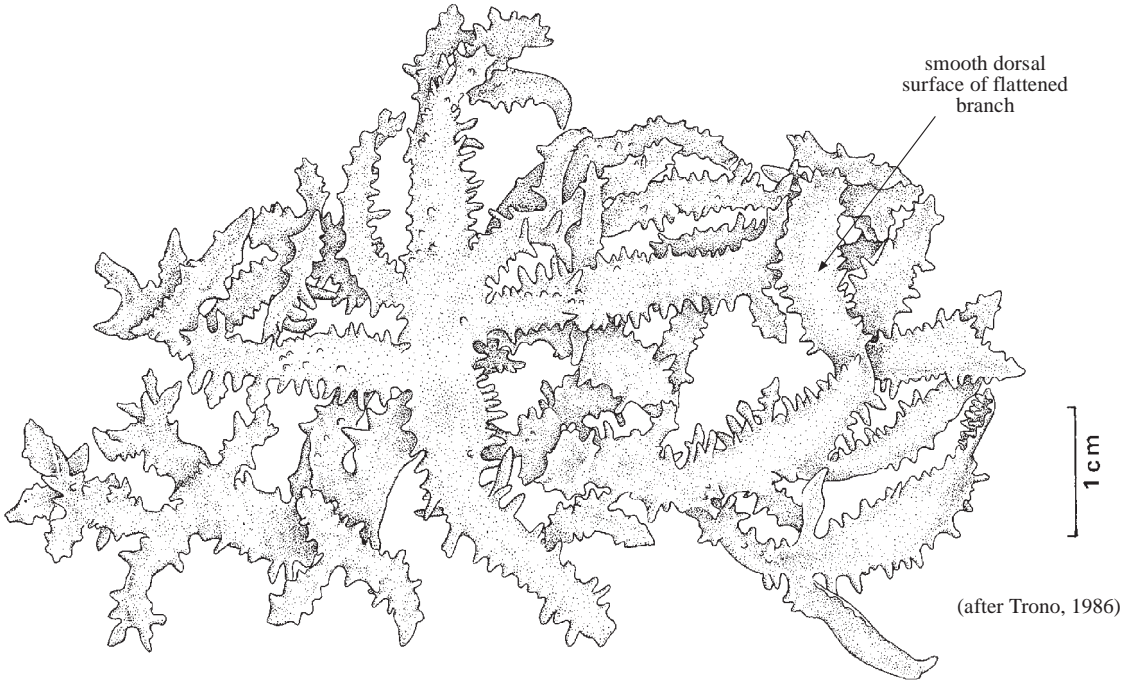
Habitat, biology, and fisheries: This species can form a dominant component of the algal community. Thrives very well on sandy-coraline to rocky substrate in areas constantly exposed to moderate to strong water currents. It is commonly found growing strongly attached to coraline gravelly-rocky or coarse sandy-rocky substrate at the intertidal to the upper (shallow) subtidal zone on the reefs exposed to moderate wave action or strong tidal currents where it may form thick clumps or beds. The fusion of branches upon coming in contact with each other and their ability to form secondary holdfasts at tips of branches results in the formation of thick and strongly attached clumps or carpet-like beds which are able to withstand moderate to strong water movement. Has never been reported from calm or protected habitats. Its relative growth rate is 3.5% per day. Principal source of phycocolloid carrageenan (iota); controls heavy metal pollution (Pb, Cd); used as a manure, in industrial products and processes; used in pet foods where it is produced, granulated or hydrated gel components in the formulations; also used for human consumption and prepared as stew mixed with vegetables, eaten fresh, or blanched with boiling water and mixed with solid garnishings, or made into "Eucheuma candy" by cooking in water with sugar and flavouring added and allowed to gel; used as garnishes for other dishes such as fish.

Distribution: From Mozambique northward to Djibouti, where it has been introduced eastward across the Indian Ocean to Australia, Indonesia, eastern Malaysia, the Philippines, and the related major island groups in the western tropical Pacific to New Caledonia. Recently, this species has been transported by humans farther eastward into the Pacific as far as Hawaii and Pohnpei (Federated States of Micronesia), and Christmas Island in easternmost Kiribati.



Eucheuma gelatinae (Esper) J. Agardh, 1847

FAO names: En - Prostrate eucheuma.

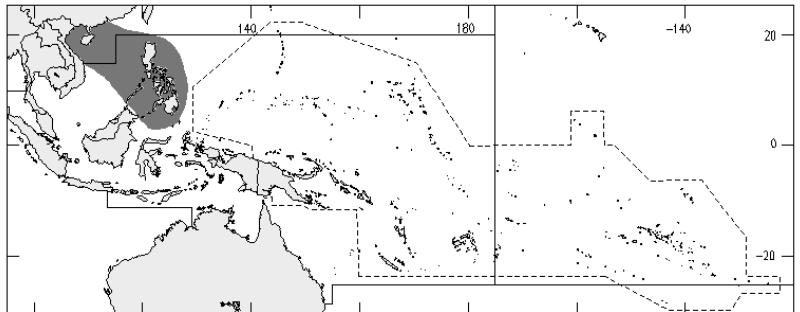
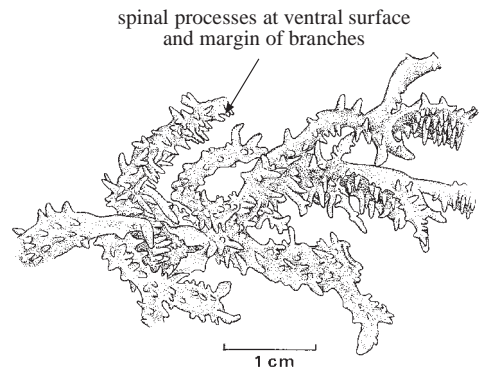


Diagnostic characters: Thalli prostrate, attached to rocky substrate by well-developed haptera which arise from the bottom surface of the branches. Branching irregular, the branches flattened and segmented, with numerous spinose processes limited to their margins and ventral surface. Compacted thick-walled rhizoidal filaments are present at the centre of the medulla.

Size: Thalli up to 14 cm in length.

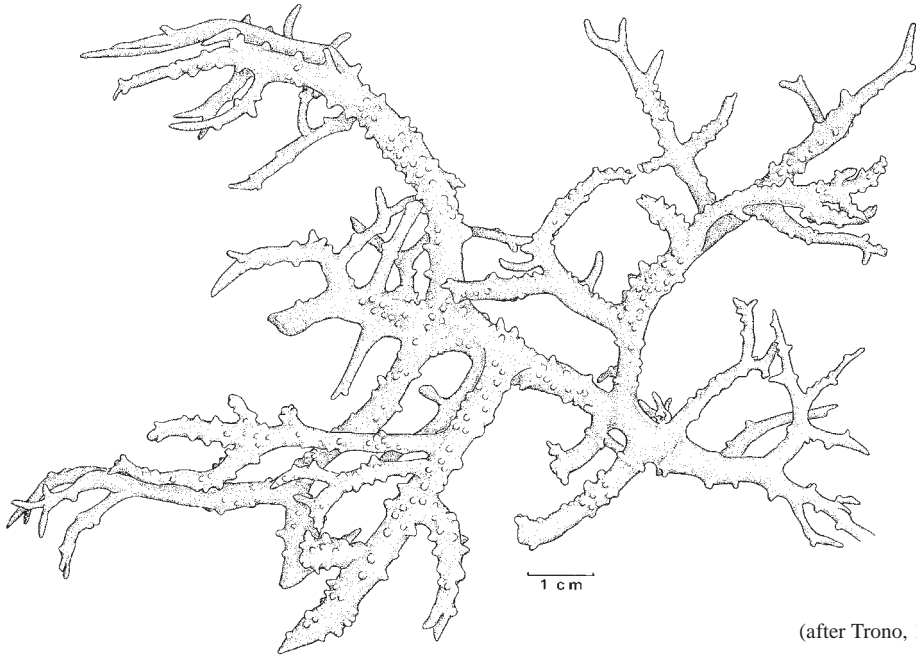
Habitat, biology, and fisheries: Grows on intertidal areas strongly attached to rocky or coralline substrate near reef margins exposed to strong wave action or currents. Usually forms belts parallel to the reef margin at 0.3 m above to average low tide levels. Used for human consumption; source of carrageenan.

Distribution: Restricted to the tropics and known from the Philippines and southern China. Many, if not most of the records of this species in the literature are incorrect.



***Kappaphycus alvarezii* (Doty) Doty, 1988**

FAO names: En - Elkhorn sea moss.



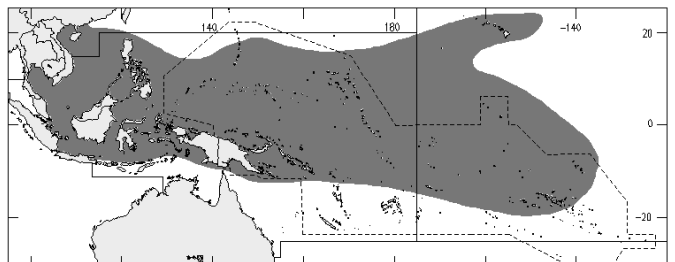
(after Trono, 1986)

Diagnostic characters: Thalli erect, loosely branched, robust, cartilaginous and range from dark greenish brown to deep purple in colour. Main axes cylindrical throughout, 1.5 to 6 mm in diameter when dried. Lateral ultimate branches arranged secundly to alternately on the axes; they are terete, attenuated to acute or spinose tips varying in length from 1 to 17 mm and 1 to 2 mm in diameter near their bases. Cross-section of a branch shows a medulla composed of small thick-walled cells interspersed among large parenchymatous cells at the centre. Cortical cells very small.

Size: Thalli up to 30 cm in height.

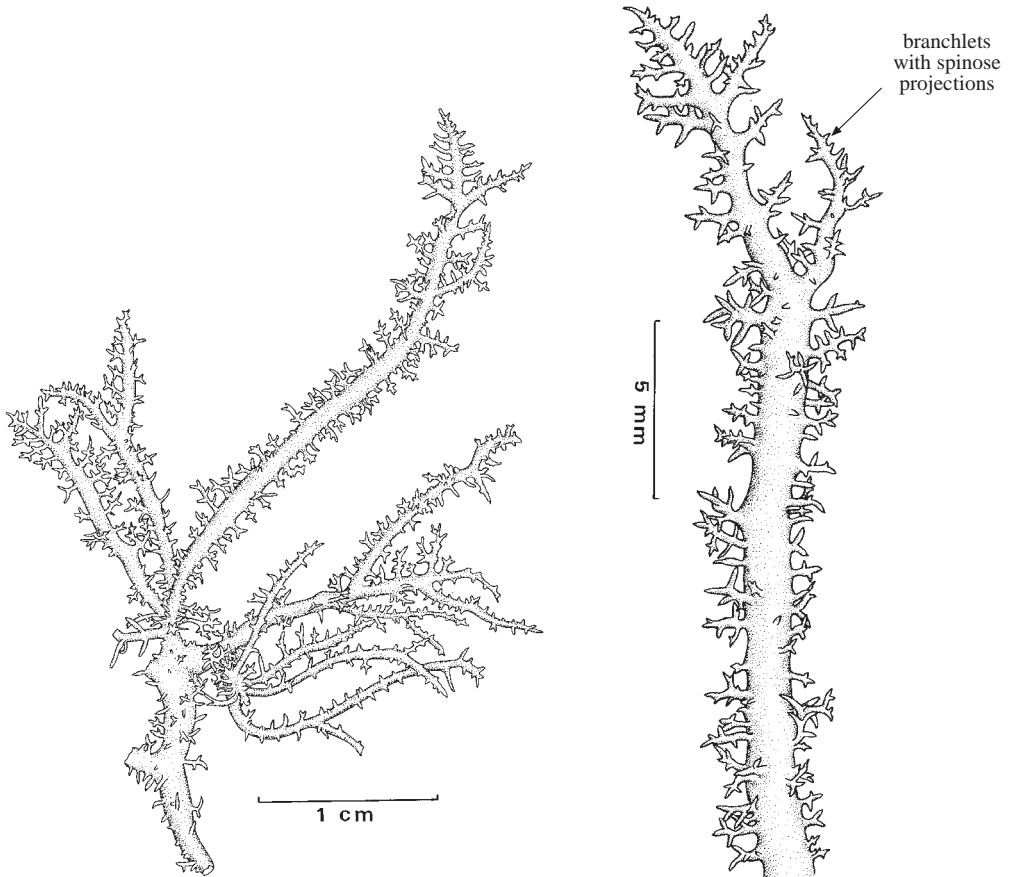
Habitat, biology, and fisheries: This species is commercially farmed and forms the bulk of the dried "Euचेuma" exported abroad. It is used as raw material for the manufacture of carrageenin. First discovered on the reef flats of easternmost Sabah and the southwesternmost part of Sulu Archipelago. Principal raw material in the production of kappa-carrageenan and widely used in seaweed farming. Utilized directly for human food. It is first blanched in boiling water to remove the pigmented portion of the branches as well as to soften it partly, mixed with sliced tomatoes and onions. A sweet sour dressing made of vinegar, salt and sugar is generally used as seasoning; also used in the making of jelly-type desserts. The seaweed is first soaked in light alkali solution to remove the pigments, rinsed thoroughly in fresh water and dried. The dried materials are then boiled until the seaweed is dissolved to form a thick fluid. Sugar and flavouring are added, mixed thoroughly and placed in containers to gel. In the northern Philippines this seaweed is dried and re-soaked in seawater and dried several times to remove the pigments. The materials are washed thoroughly with fresh water to remove the salt before boiling these to a thick fluid consistency. This is set to gel when sugar and flavourings are added. It is a source of minerals (Ca, K, Mg, Na, Cu, Fe, Mn), and controls heavy metal pollution (Pb, Cd). Principal raw material in the production of kappa-carrageenan and widely used in seaweed farming.

Distribution: This species has been transported to Hawaii, where it was successfully grown, and thence to island groups of the western Pacific, such as, Guam, Micronesia, Christmas Island, Fanning, Tarawa and other atolls of Karibati, Fiji, Tonga, and French Oceania. It has been transported to Southern China, Indonesia and also to Southern Africa.



Hypnea boergesenii Tanaka, 1941

FAO names: En - Tufted sea moss.



(after Trono and Fortes, 1988)

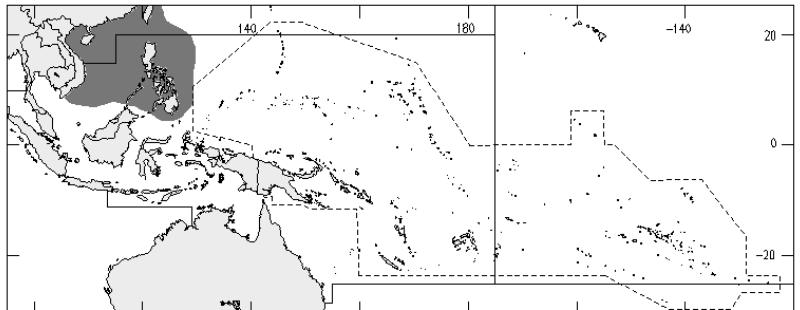
terminal portion
of branch

Diagnostic characters: Thalli form dense tufts, composed of somewhat erect branches, brownish green, always associated with other species of algae. Main axes percurrent, terete, tapering towards the apices, 410 to 800 μm in diameter, proliferous at the upper portion. Branches densely clothed with short lateral branchlets which are 150 to 300 μm apart but slightly farther at the terminal portions; lateral branchlets may be simple and acuminate or compound, bifurcate or beset with short spinose projections.

Size: Thalli to about 13 cm in height.

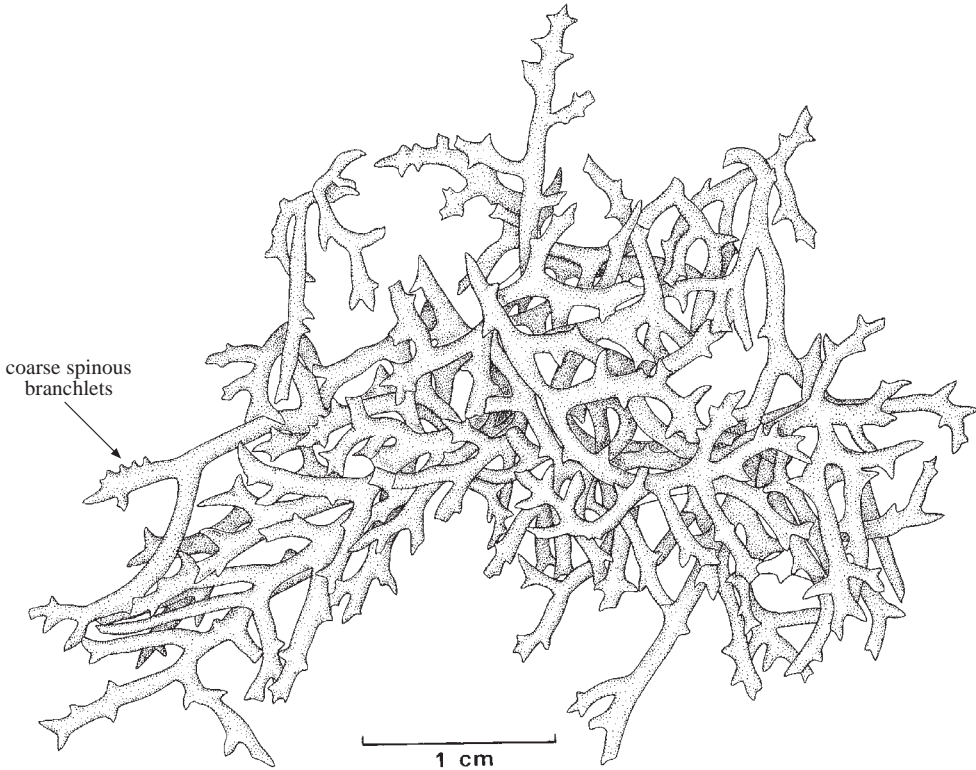
Habitat, biology, and fisheries: This species inhabits lower intertidal to shallow subtidal areas exposed to moderate to strong wave action. Utilized for human consumption; contains protein and is used for carrageenan, fertilizer, animal feed, and as medicine (antitumor); also used as coconut manure in Brazil and West Indies.

Distribution: Tropical to subtropical in distribution, including the Philippines, Taiwan Province of China, Viet Nam, and Guangdong Province (China).



***Hypnea pannosa* J. Agardh, 1847**

FAO names: En - Tattered sea moss; Fr - Houlette déguénilée; Sp - Cayado andrajoso.



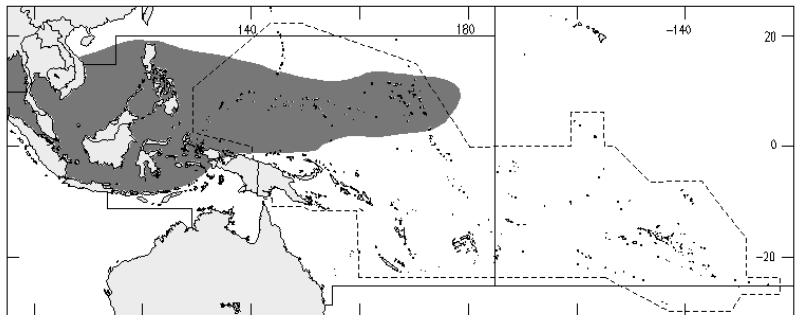
(after Trono and Fortes, 1988)

Diagnostic characters: Thalli prostrate, greenish to purple, forming thick clumps of intricating branches on rocky substrate. Branches terete to slightly compressed, 1.5 to 3 mm broad. Branching irregularly alternate to opposite, forming wide angles and rounded axils. Branches divided into short stubby spines at the terminal portion; the short ultimate branchlets are characteristically stout, stubby, and spinose.

Size: Thalli up to 8 cm in height.

Habitat, biology, and fisheries: This species grows well in rocky habitats exposed to moderate wave action, usually lodged between coral rocks in subtidal areas. Utilized for human consumption; contains protein and is a source of carrageenan; also suitable as fertilizer and used as coconut manure in Brazil and West Indies, and also as animal feed and medicine (antitumor).

Distribution: Widely distributed in the tropical Indian Ocean and the eastern and western central Pacific including Thailand, the Indo-Malayan Archipelago, the Philippines, China, Viet Nam, and tropical Pacific islands.

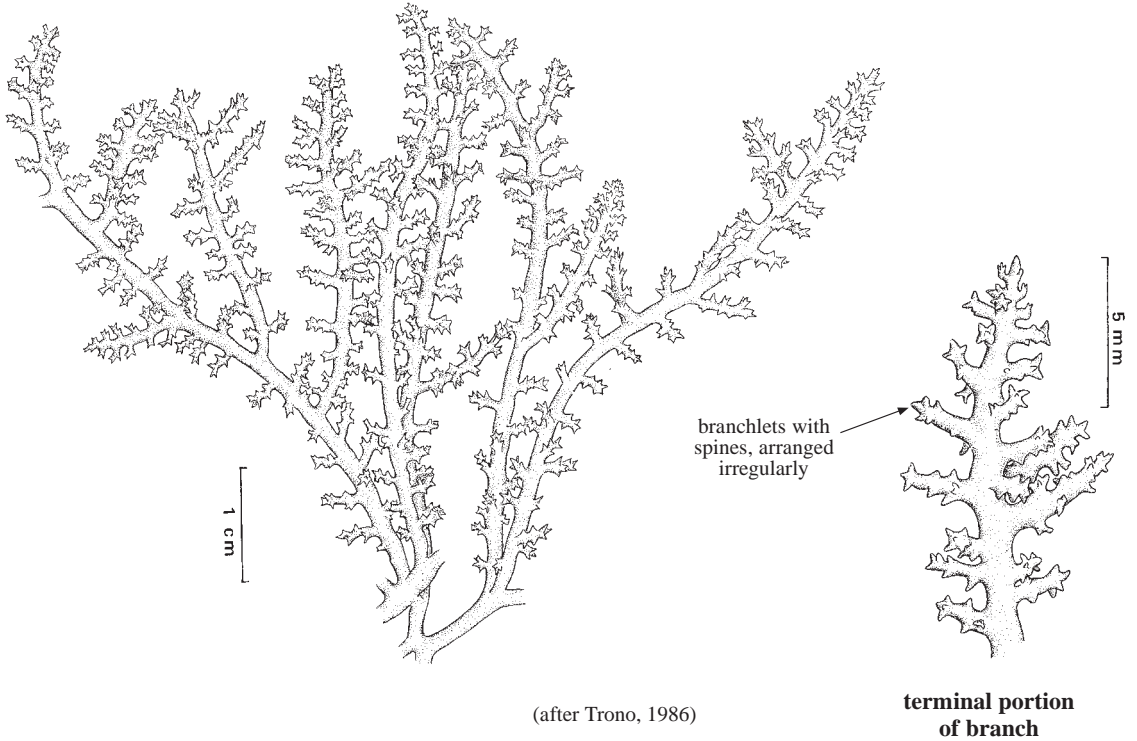


Order CERAMIALES

RHODOMELACEAE

Acanthophora muscoides (Linnaeus) Bory de Saint Vincent, 1828

FAO names: En - Purple spiny sea moss.

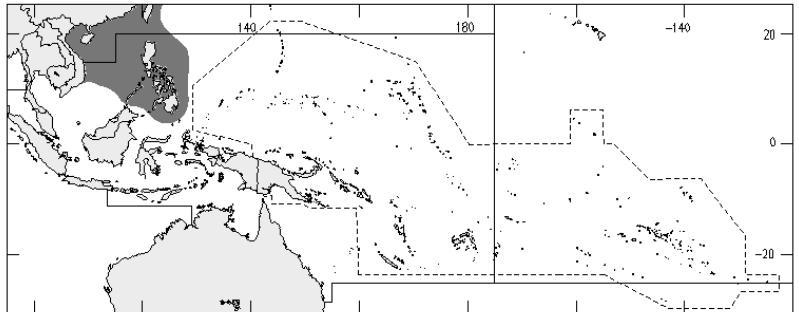


Diagnostic characters: Thalli erect, may form reddish to purplish bushy clumps. Branches terete throughout, attenuating to acute tips. Branching irregular, with the tendency to become verticillate at the terminal portion. Very short simple or compound spinose branchlets are irregularly disposed on the determinate branches, occasionally also on the main axis, and usually bear hairs or trichoblasts.

Size: Thalli up to 10 cm in height.

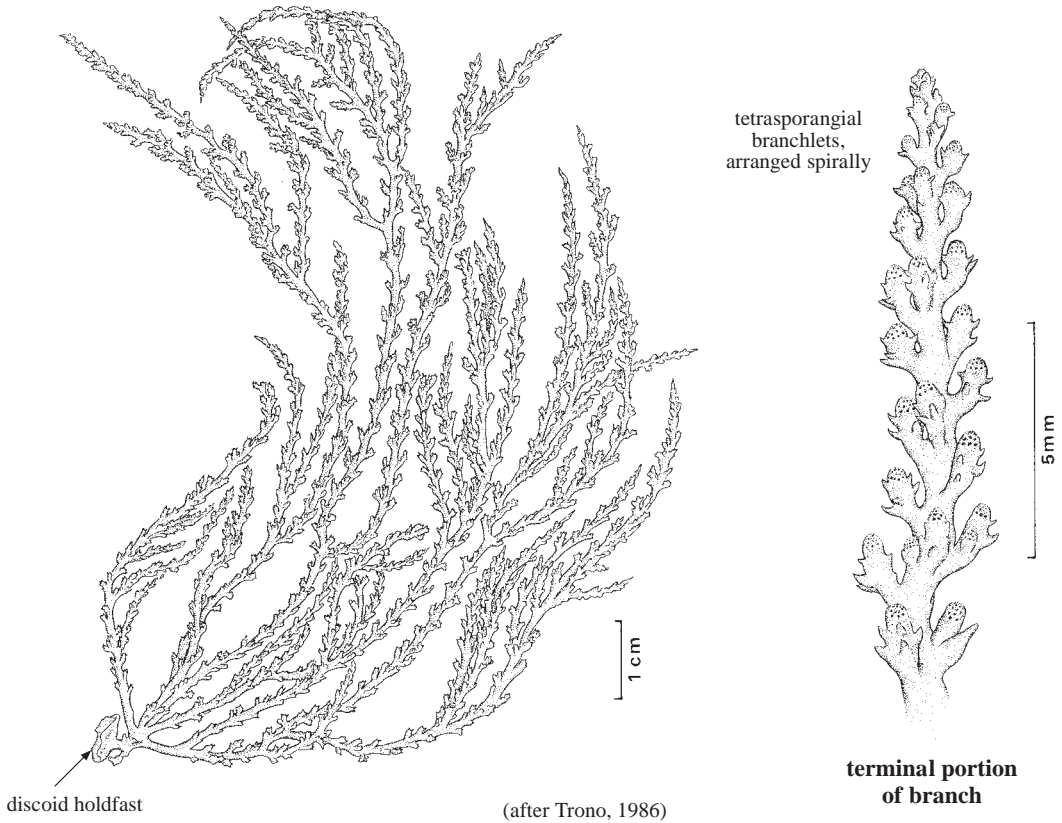
Habitat, biology, and fisheries: Limited to portions of the reef which are protected from strong wave action; attached to sandy-coraline to rocky substrates. Source of carrageenan and antibiotics.

Distribution: Generally distributed in tropical and subtropical areas, including China, the Philippines, Florida, Mexico, Cuba, Jamaica, Hispaniola, Costa Rica, Panama, Colombia, and Brazil.



Acanthophora spicifera (Vahl) Boergesen, 1910

FAO names: En - Erect sea moss.

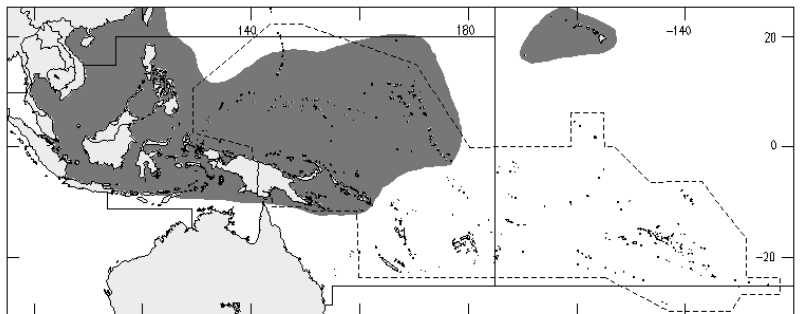


Diagnostic characters: Thalli erect, loosely branched, greenish brown to purple, with a small discolored holdfast. Branches terete throughout, slightly attenuated towards the acute tips. Spinous projections, a characteristic of this genus, are densely borne on the spirally arranged determinate branchlets.

Size: Thalli to about 15 cm in height.

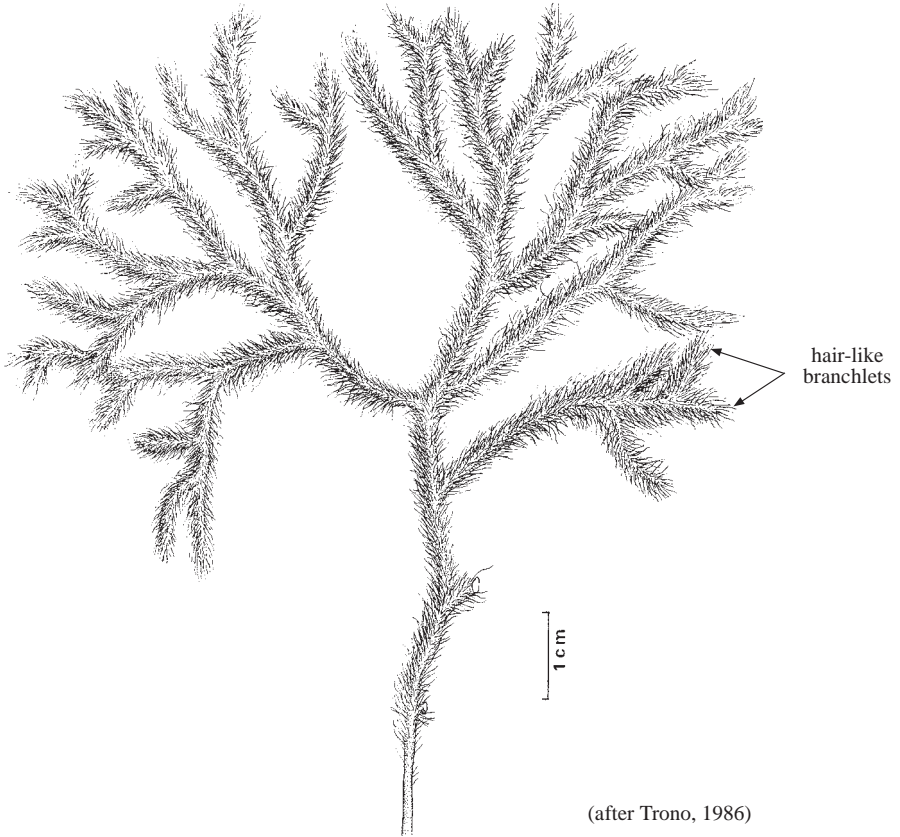
Habitat, biology, and fisheries: Abundant growth occurs in sandy-rocky areas at the lower intertidal zone where the plants are sometimes exposed to air during very low tides; found up to the upper subtidal zone and in tidepools. Widespread and often very common in shallow water, either in exposed situations with strong currents or sheltered at places where it is frequently heavily epiphytized. Source of lambda-carageenan and antibiotics; also utilized for human consumption.

Distribution: Widely distributed in tropical and subtropical areas, including the western North Atlantic (Florida to Brazil), Indo-Malayan Archipelago, the Philippines, Japan, Taiwan Province of China, and China (Fujian, and Guangdong Province), and tropical western Pacific islands, including Guam and Hawaii.



Digenea simplex (Wulfen) C. Agardh, 1822

FAO names: **En** - Red seabroom; **Fr** - Plumet de Nérée; **Sp** - Hisopo de mar.

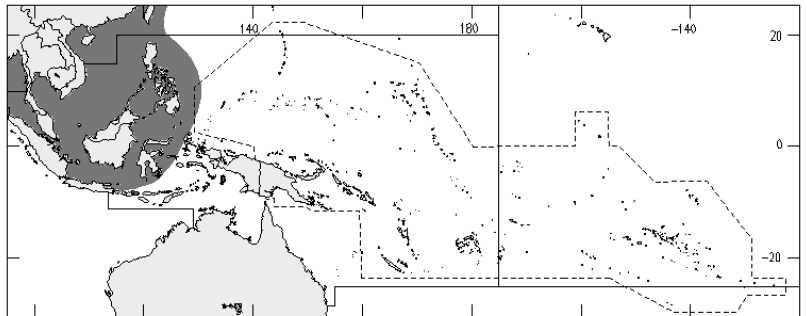


Diagnostic characters: Thalli erect, dull brownish red. Branches densely clothed with hair-like determinate branchlets, especially at the upper half portion of the thallus. Branching of the main axis basically dichotomous but may become irregular due to the production of adventitious laterals. Determinate branchlets uncorticated and consisting of a distinct axial cell surrounded by nine pericentral cells.

Size: Thalli up to 9 cm in height.

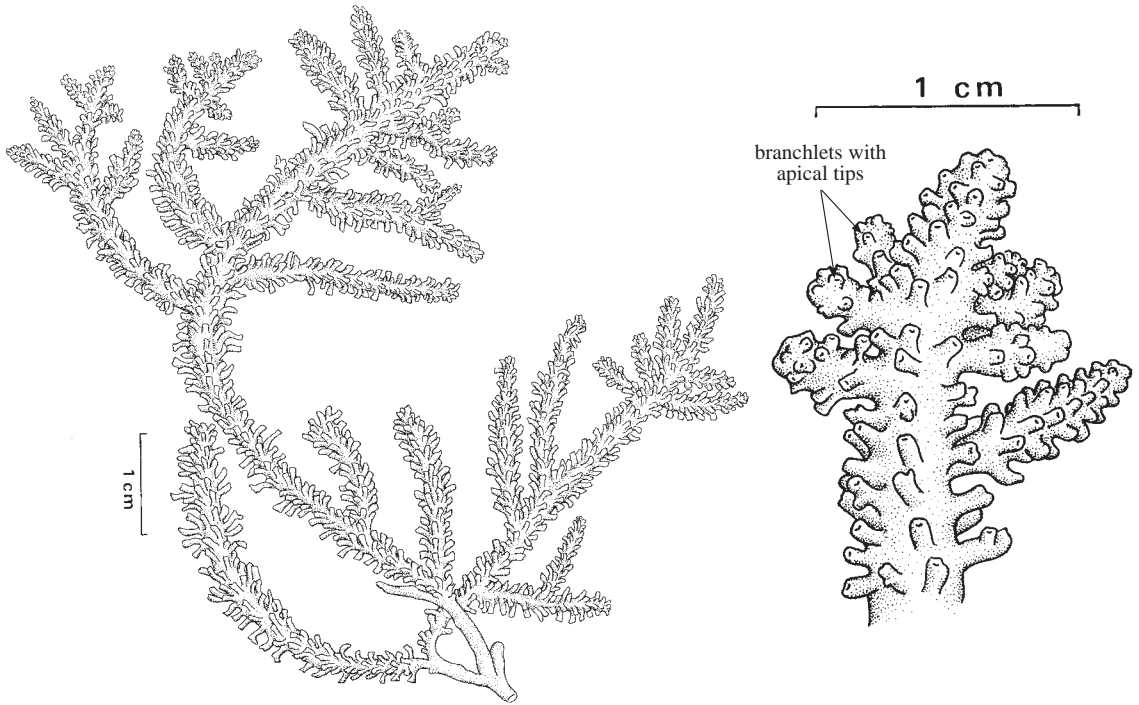
Habitat, biology, and fisheries: Common and often abundant in the intertidal belt, down to depths of 20 m. Also grows in calm bays and in open lagoons. Source of agar, used as medicine (anthelmintic, vermifuge, laxative); source of kainic and α -allokainic acids. Contains kainic acid, a vermifuge or anthelmintic against the parasitic round worm (*Ascaris*), the whip worm (*Trichuris*), and tapeworm (*Taenia*).

Distribution: Found in tropical to subtropical areas of the world, including the Caribbean Sea, South China Sea, Indian Ocean, the Philippines, Pratas Island (China), and southern Japan (Kyushu).



Laurencia papillosa (C. Agardh) Greville, 1839

FAO names: En - Pepper dulse; Fr - Laurencia poivrée; Sp - Laurencia picante.



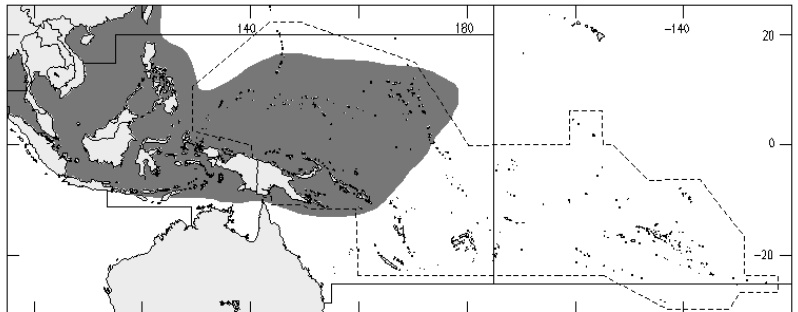
(after Trono, 1986)

Diagnostic characters: Thalli cartilaginous, dark brown to purple, composed of erect and decumbent branches arising from discoid holdfasts or rhizoidal branches. Branching irregular, the branches terete, densely covered with short determinate branchlets which can be simple and cylindrical, bilobed to trilobed, to 2.8 mm long, not more than 1 mm in diameter. Determinate branchlets with distinct apical pit and radially arranged in longitudinal rows on the secondary and tertiary branches, irregular on the lower portion of the thallus, decreasing in length from the base to the tips of the branches. Cross-section of determinate branchlets shows elongate cortical cells, arranged into palisades and not projecting beyond the surface of the branch; secondary pit connections are absent.

Size: Thalli up to 10 cm in height.

Habitat, biology, and fisheries: Limited to the inner intertidal portions of the reef, growing abundantly on rocky or sandy-coraline substrates, slightly exposed to air during low tide. Utilized for human consumption, source of lambda carrageenan, fish bait, and as medicine due to its antifungal, antibacterial, and antibiotic properties.

Distribution: Mainly tropical in distribution and known from Indonesia, Malaysia, Taiwan Province of China, Viet Nam, western Pacific islands, and the Indian Ocean.



CORALS

by G. Hodgson

STRUCTURE AND TERMINOLOGY

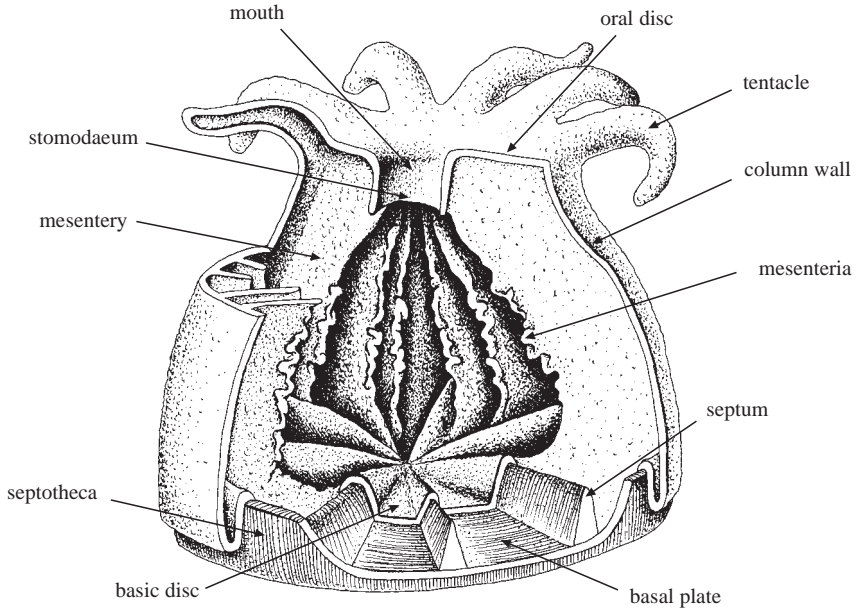


Fig. 1 relationship between polyp and skeletal elements in scleractinian corals

(after Wells, 1956)

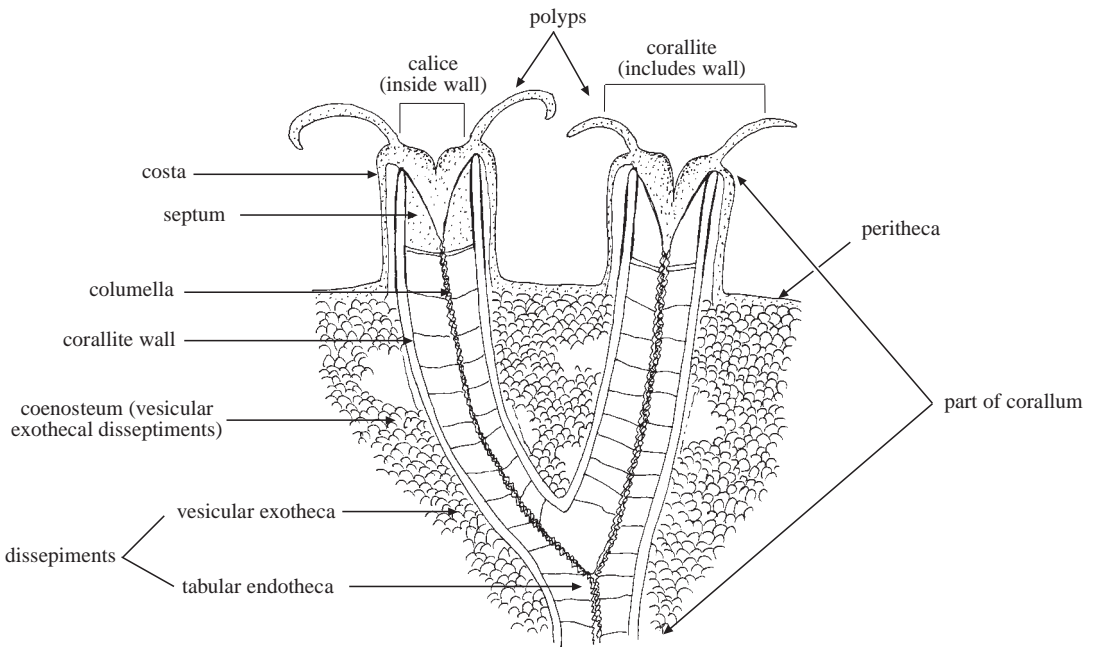


Fig. 2 skeletal structures in scleractinian corals

(after Wells, 1956)

GLOSSARY OF TECHNICAL TERMS

Anastomose - branches joining together to become one.

Axial corallite - corallite at tip of branch (Fig. 3).

Calice - the area inside the corallite walls (Fig. 2).

Ceriod - walls of adjacent corallites confluent (Fig. 4; see **plocoid**).

Colline - a wall or ridge between a series of corallites.

Corallite - the skeletal cup that holds the polyp (includes walls; Fig. 2).

Costae - the ridges on the underside of solitary corals and the ridges that are continuous with the septa and extend beyond the corallite walls out onto the peritheca.

Echinulate - with small spines (Fig. 5).

Flabelloid - small at the base and expanding as it grows upwards.

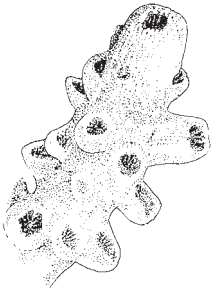


Fig. 3 axial and radial corallites

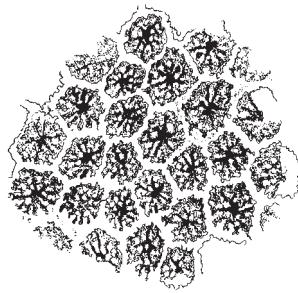


Fig. 4 ceriod corallite organization

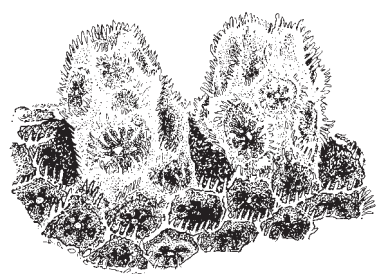


Fig. 5 echinulate surface

Hispidose - surface covered with small papillae.

Meandroid - corallites in long rows with walls between parallel rows.

Peritheca - area outside corallite (Fig. 2).

Petalloid - tear-drop shaped (Fig. 6).

Phaceloid - growth form characterized by clusters of branches that increase in diameter as they grow.

Plocoid - peritheca separates walls of adjacent corallites (Fig. 7).

Ramose - irregular branching.

Septa - the lamellae inside the corallite (Fig. 2).

Septocostae - ridge-like extensions of septa extending onto the skeleton past the corallite wall (Fig. 2).

Verrucae - wart-like bumps (Fig. 8).

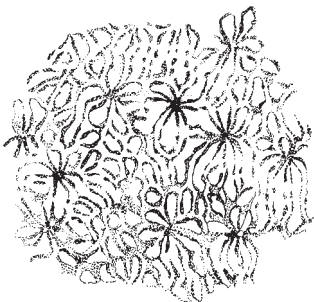


Fig. 6 petaloid corallite organization

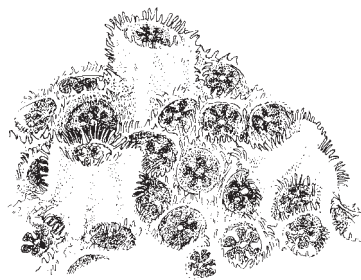


Fig. 7 plocoid corallite structures

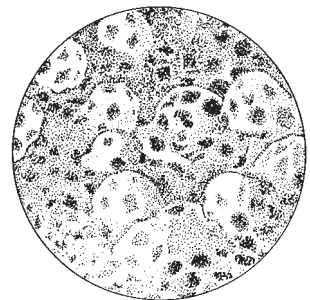


Fig. 8 surface with verrucae

GENERAL REMARKS

The order Scleractinia (formerly Madreporaria), commonly known as the stony or hard corals, consists of 16 families. Scleractinian corals have a calcium carbonate skeleton and their structure is usually arranged with a hexamerall symmetry (Figs 1 and 2). Corals grow in tropical and subtropical seas throughout the world, often forming large coral reefs that extend to a maximum depth of about 60 m.

The area of highest coral diversity extends from the central Philippines to the Banda Sea. Nearly 500 species have been reported from the Philippines. Moving eastward across the Pacific, this number gradually decreases with only 15 reef-building (hermatypic) species found along the eastern border of the Pacific Ocean (not including the Galapagos Islands). Moving westward from the Philippines, diversity also decreases.

From 1990 to 1995, the reported yearly production of all scleractinian corals in the Western Central Pacific ranged from about 3 000 to 7 000 t (FAO Yearbook of Fishery Statistics). Of the 500 scleractinian species found in the area, probably about 100 are commercially exploited. But of these, only about 24 corals are regularly harvested and these are treated in this field guide. In addition to the scleractinians, 3 reef-building organisms (blue coral, fire coral, and organ-pipe coral) that superficially resemble hard corals have been included as they are harvested and traded as corals. These 3 organisms, however, are not in the order Scleractinia.

International trade in corals is subject to CITES restrictions. All species of scleractinians, black coral, blue coral, fire coral, and organ-pipe coral are listed as level 2 in Appendix II. CITES signatory countries can only accept importation of corals accompanied by a valid export permit from the country of origin. Importation of coral to the USA is also controlled by the Lacey Act which prohibits import from a country where export is illegal.

It is likely that a minor coral fishery to serve the curio trade exists in all countries located within the western Central Pacific. Major coral fisheries are found in the Philippines, Indonesia, Sri Lanka, Fiji, Australia and New Caledonia with the major market being the USA. A small export market for corals has developed recently in the health-care industry for bone graft implants.

**KEY TO COMMONLY TRADED SPECIES OF SCLERACTINIA
OCCURRING IN THE AREA**

- 1a. Colony branching or solitary → 2
- 1b. Colony neither branching nor solitary → 9
- 2a. Colony branching → 3
- 2b. Colony solitary → 8
- 3a. Colony not covered with verrucae → 4
- 3b. Colony covered with verrucae → 5
- 4a. Colony branches have axial corallites → 6
- 4b. Colony branches do not have axial corallites → 7
- 5a. Verrucae intergrade in size with branches (Fig. 9) *Pocillopora damicornis*
- 5b. Verrucae smaller than branches (Fig. 10) *Pocillopora verrucosa*
- 6a. Growth form table-shaped (Fig. 11) *Acropora hyacinthus*
- 6b. Growth form not table-shaped → 10

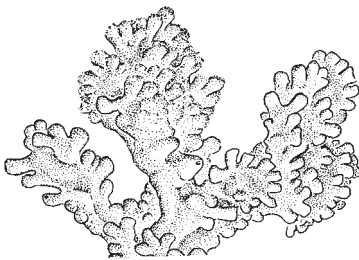


Fig. 9 *Pocillopora damicornis*

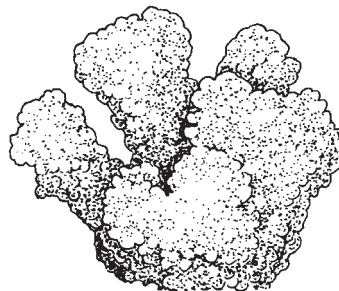


Fig. 10 *Pocillopora verrucosa*

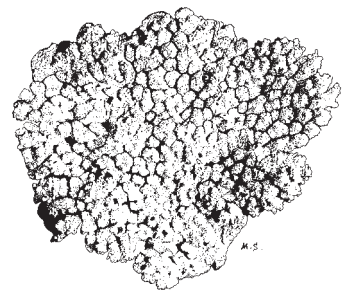


Fig. 11 *Acropora hyacinthus*

- 7a. Branches pointed (Fig. 12) *Seriatopora hystrix*
- 7b. Branches blunt-tipped. → 17
- 8a. Colony circular → 13
- 8b. Colony elongate. → 14
- 9a. Growth form massive → 18
- 9b. Growth form not massive → 19
- 10a. Branches columnar (Fig. 13) *Acropora palifera*
- 10b. Branches not columnar → 11
- 11a. Branches are short, stout fingers (Fig. 14) *Acropora humilis*
- 11b. Branches are not short, stout fingers. → 12

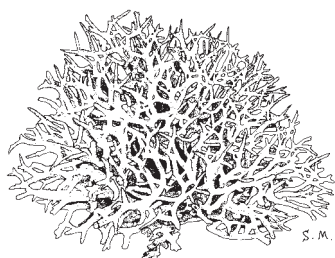


Fig. 12 *Seriatopora hystrix*



Fig. 13 *Acropora palifera*



Fig. 14 *Acropora humilis*

- 12a. Growth form arborescent (Fig. 15) *Acropora formosa*
- 12b. Growth form hispidose (Fig. 16) *Acropora florida*
- 13a. Multiple corallites (Fig. 17) *Halomitra pileus*
- 13b. A single corallite. → 15



Fig. 15 *Acropora formosa*



Fig. 16 *Acropora florida*

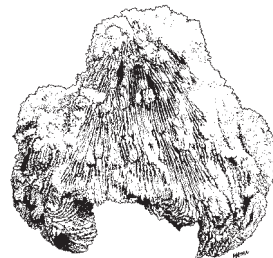


Fig. 17 *Halomitra pileus*

- 14a. Multiple corallites (Fig. 18) *Polyphyllia talpina*
- 14b. Single corallite (Fig. 19). *Fungia echinata*
- 15a. Costae poorly developed (Fig. 20) *Fungia paumotensis*
- 15b. Costae well developed → 16



Fig. 18 *Polyphyllia talpina*

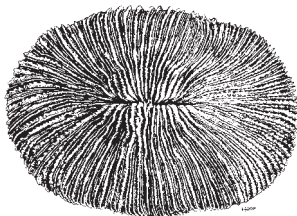


Fig. 19 *Fungia echinata*

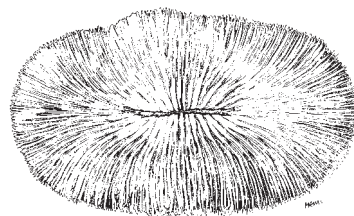


Fig. 20 *Fungia paumotensis*

- 16a. Higher order septa bear large, triangular dentations (Fig. 21) *Fungia danae*
- 16b. Higher order septa do not bear large triangular dentations (Fig. 22). *Fungia fungites*

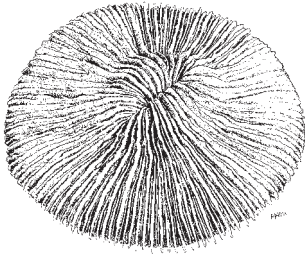


Fig. 21 *Fungia danae*

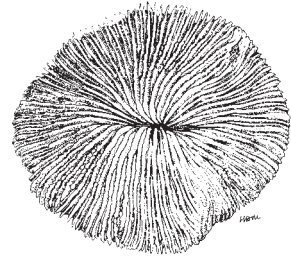


Fig. 22 *Fungia fungites*

- 17a. Branches more than 8 mm in diameter, irregularly branching (Fig. 23) *Stylophora pistillata*
- 17b. Branches less than 8 mm in diameter, regularly branching (Fig. 24) *Seriatopora caliendrum*

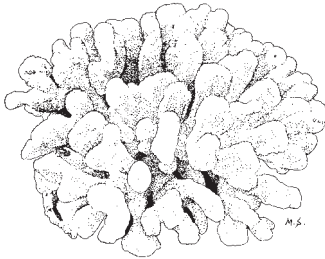


Fig. 23 *Stylophora pistillata*

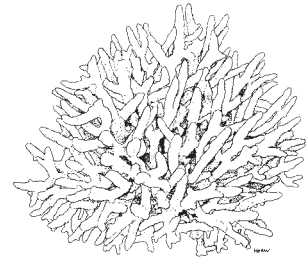


Fig. 24 *Seriatopora caliendrum*

- 18a. Corallite arrangement meandroid (Fig. 25) *Platygyra daedalea*
- 18b. Corallites plocoid (Fig. 26) *Favia fавus*

- 19a. Growth form flabelloid → 20
- 19b. Growth form not flabelloid → 21

- 20a. Septal margins smooth, not dentate (Fig. 27) *Euphyllia glabrescens*
- 20b. Septal margins rough, highly dentate → 22

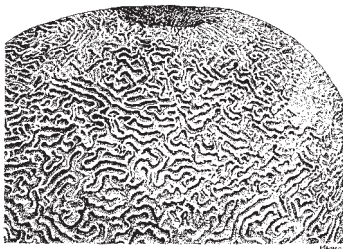


Fig. 25 *Platygyra daedalea*

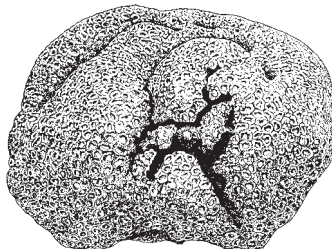


Fig. 26 *Favia fавus*

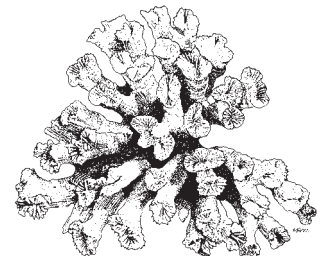


Fig. 27 *Euphyllia glabrescens*

21a. Corallites meandroid (Fig. 28) *Merulina ampliata*
 21b. Corallites not meandroid → 23

22a. Corallites often in series more 3 (Fig. 29) *Lobophyllia hemprichii*
 22b. Corallites often in series less than 3 (Fig. 30) *Lobophyllia corymbosa*

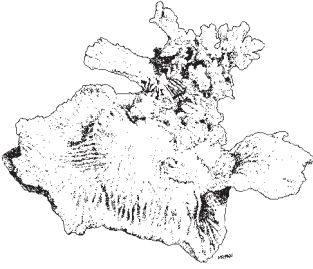


Fig. 28 *Merulina ampliata*

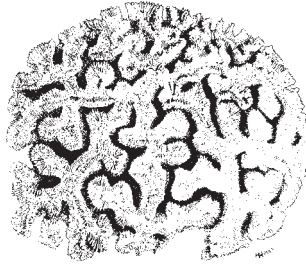


Fig. 29 *Lobophyllia hemprichii*

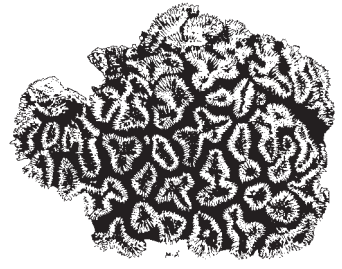


Fig. 30 *Lobophyllia corymbosa*

23a. Corallites less than 3 mm in diameter, no collines (Fig. 31) *Pavona decussata*
 23b. Corallites more than 3 mm in diameter, large vertical collines (Fig. 32) *Pectinia lactuca*

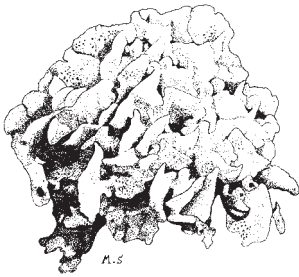


Fig. 31 *Pavona decussata*



Fig. 32 *Pectinia lactuca*

**NON-SCLERACTINIAN CORALS OF INTEREST TO FISHERIES
 OCCURRING IN THE AREA**

The 3 non-scleractinian corals depicted in this field guide are not included in the above key. They are easily distinguished from all other corals as follows:

- 1) *Heliopora* is the only “coral” with a blue skeleton (Fig. 33).
- 2) *Tubipora* is the only “coral” with a red skeleton (Fig. 34).
- 3) *Millipora* has no corallites, but rather tiny pin holes (Fig. 35).

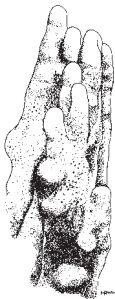


Fig. 33 *Heliopora coerulea*



Fig. 34 *Tubipora musica*



Fig. 35 *Millipora platyphylla*

LIST OF COMMONLY TRADED CORALS OCCURRING IN THE AREA

The symbol ☼ is given when species accounts are included.

Class ANTHOZOA

Order SCLERACTINIA

Family ACROPORIDAE

- ☼ *Acropora florida* (Dana, 1846)
- ☼ *Acropora formosa* (Dana, 1846)
- ☼ *Acropora humilis* (Dana, 1846)
- ☼ *Acropora hyacinthus* (Dana, 1846)
- ☼ *Acropora palifera* (Lamarck, 1816)

Family AGARICIIDAE

- ☼ *Pavona decussata* (Dana, 1846)

Family CARYOPHYLLIIDAE

- ☼ *Euphyllia glabrescens* (Chamisso and Eysenhardt, 1821)

Family FAVIIDAE

- ☼ *Favia favius* (Forsskål, 1775)
- ☼ *Platygyra daedalea* (Ellis and Solanader, 1786)

Family FUNGIIDAE

- ☼ *Fungia danai* Edwards and Haime, 1851
- ☼ *Fungia echinata* Verrill, 1864
- ☼ *Fungia fungites* (Linnaeus, 1758)
- ☼ *Fungia paumotensis* Stutchbury, 1833
- ☼ *Halomitra pileus* (Linnaeus, 1758)
- ☼ *Polyphyllia talpina* Lamarck, 1801

Family MERULINIDAE

- ☼ *Merulina ampliata* (Ellis and Solander, 1786)

Family MUSSIDAE

- ☼ *Lobophyllia corymbosa* (Forsskål, 1775)
- ☼ *Lobophyllia hemprichii* (Ehrenberg, 1834)

Family PECTINIIDAE

- ☼ *Pectinia lactuca* (Pallas, 1766)

Family POCILLOPORIDAE

- ☼ *Pocillopora damicornis* (Linnaeus, 1758)
- ☼ *Pocillopora verrucosa* (Ellis and Solander, 1786)
- ☼ *Seriatopora caliendrum* Ehrenberg, 1834
- ☼ *Seriatopora hystrix* Dana, 1846
- ☼ *Stylophora pistillata* Esper, 1797

Order COENOTHECALIA

Family HELIOPORIDAE

- ☼ *Heliopora coerulea* (Pallas, 1766)

Order STOLONIFERA

Family TUBIPORIDAE

- ☼ *Tubipora musica* Linnaeus, 1758

Class HYDROZOA

Order MILLEPORINA

Family MILLEPORIDAE

- ☼ *Millepora platyphylla* Hemprich and Ehrenberg, 1834

References

- Birkeland, C. 1997. *Life and death on coral reefs*. Chapman and Hall, New York, USA.
- Gosliner, T.M., D.W. Behrens, and G.C. Williams. 1996. *Coral reef animals of the Indo-Pacific*. Sea Challengers, Monterey, California, USA.
- Mather, P. and I. Bennet. 1993. *A coral reef handbook*. Surrey Beatty and Sons Pty Ltd., Chipping Norton, New South Wales, Australia.
- Veron, J.E.N. et al. 1976-1984. *Scleractinia of eastern Australia*. Parts I-VI. Australian Institute of Marine Science, Townsville, Australia.
- Veron, J.E.N. 1986. *Corals of Australia and the Indo-Pacific*. University of Hawaii Press. Honolulu, Hawaii, USA.

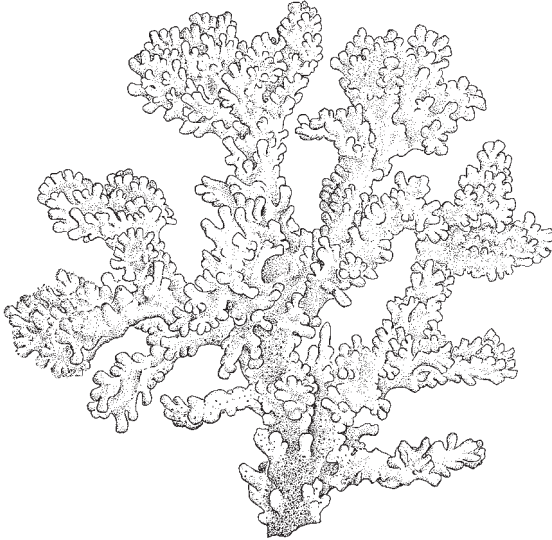
Class ANTHOZOA

Order SCLERACTINIA

POCILLOPORIDAE

Pocillopora damicornis (Linnaeus, 1758)

FAO names: **En** - Cauliflower coral; **Fr** - Corail choufleur; **Sp** - Coral coliflor.



detail of branch



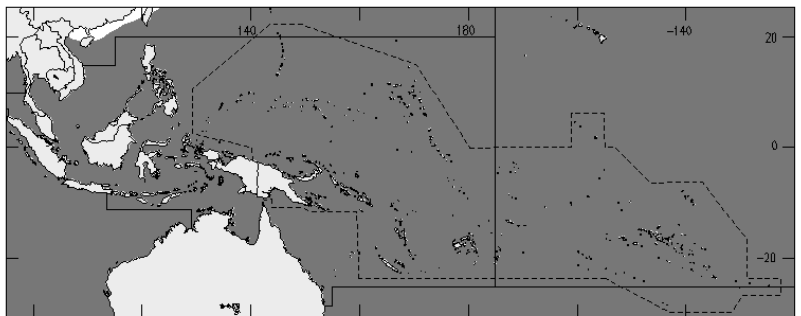
tip of branch

Diagnostic characters: Colonies ramose, covered with verrucae; corallites plocoid, less than 1 mm across, found both on verrucae and in between. Tendency of corallites to become cerioid near branch tips. Septa poorly developed, in 2 cycles, may be reduced to a row of spines. Peritheca echinulate. Columella free. Thickness of branches may vary with exposure to water movement and depth. Colonies growing in shallow water or exposed to wave action tend to have thick sturdy branches. Colonies from deep calm waters tend to have thin fragile branches. **Colour:** mottled brown in life.

Size: Colonies less than 30 cm in diameter.

Habitat, biology, and fisheries: Found in mono-specific stands or multi-species reefs throughout its range from near the surface to a maximum depth of 20 m. A common species, relatively tolerant of sedimentation and low salinity as long as there is adequate water motion. Colonies reproduce by fragmentation and by sexual reproduction (broadcast spawning). The most commonly harvested species in the area. Like other coral species it is collected to be used directly as construction material, to make lime, which is used to make concrete, and to sell as curios. Live corals are collected for sale to the aquarium trade. There are no reports of direct consumption as food. Although most species in the area have probably been the subject of occasional harvesting and trade, no production data are available for individual species.

Distribution: East to Hawaii and Panama, south to Lord Howe Island, west to Red Sea, and north to Japan.

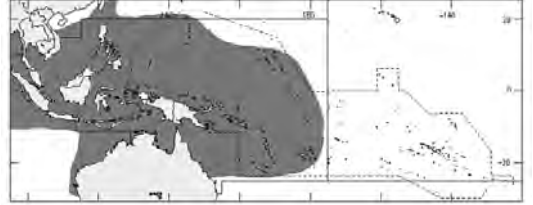
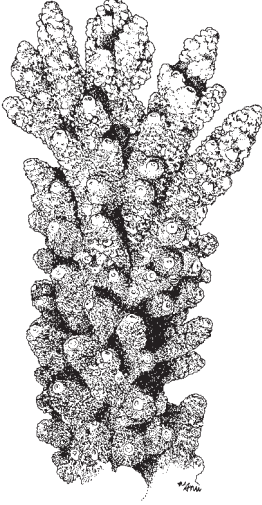


ACROPORIDAE

Acropora florida (Dana, 1846)

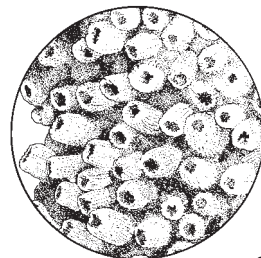
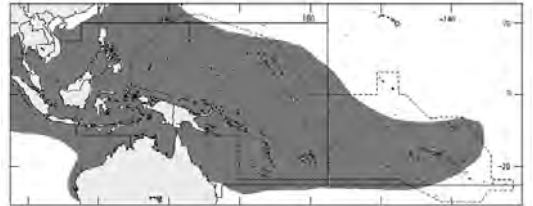
En - Branch coral.

This hispidose branching coral forms colonies up to several metres in diameter and is common at shallow to intermediate depths throughout its range. It has stout branches up to 25 cm thick that appear “knobby” on the upper surface due to secondary branchlets of even height. West to Thailand, north to Taiwan Province of China, east to Marshall Islands, and south to Capricorn Group (Great Barrier Reef, Australia).

*Acropora formosa* (Dana, 1846)

En - Staghorn coral.

This is the classic “staghorn” coral, with arborescent growth form and branches usually less than 50 cm in length. Colonies are composed of smooth appearing, straight branches less than 20 mm thick; branching is irregular such that colonies form thickets which often dominate large areas of lagoon in shallow and intermediate depths. West to Thailand, north to Taiwan Province of China, east to French Polynesia, and south to Capricorn Group (Great Barrier Reef).

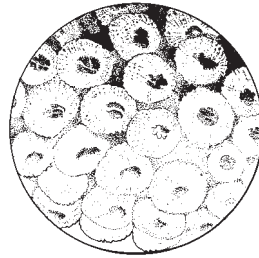
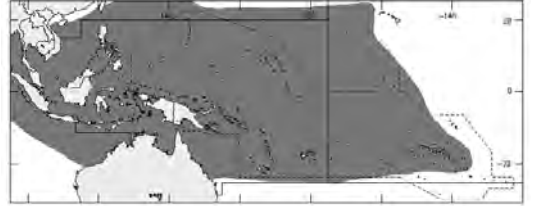
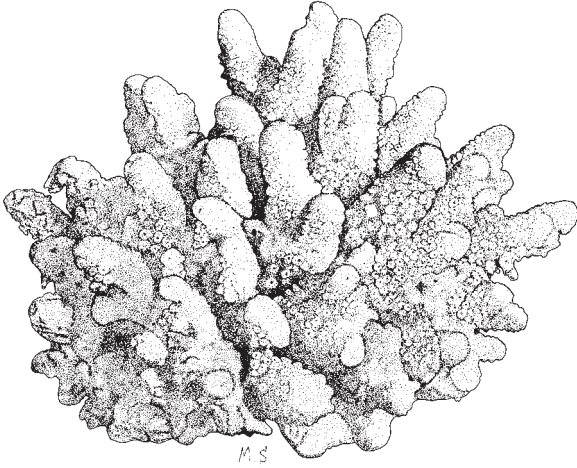


detail of corallites

***Acropora humilis* (Dana, 1846)**

En - Finger coral.

A corymbose growth form distinguishes this species. Individual branches form fat fingers, 10 to 25 mm in diameter and less than 200 mm in length, with little secondary branching. Radial corallites are arranged in lines giving the branches a well-groomed appearance. Branch tips (axial corallites) are wide and rounded. Due to solid construction, this species is found on exposed reefs throughout its range in shallow to intermediate depths. West to Thailand, north to Taiwan Province of China, east to French Polynesia, and south to Capricorn Group (Great Barrier Reef).

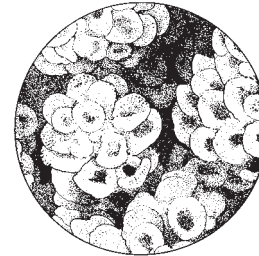
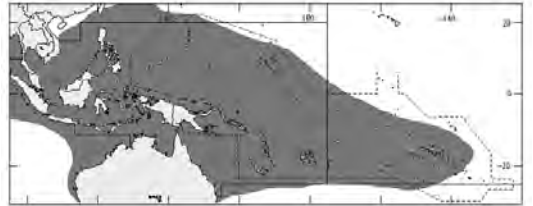
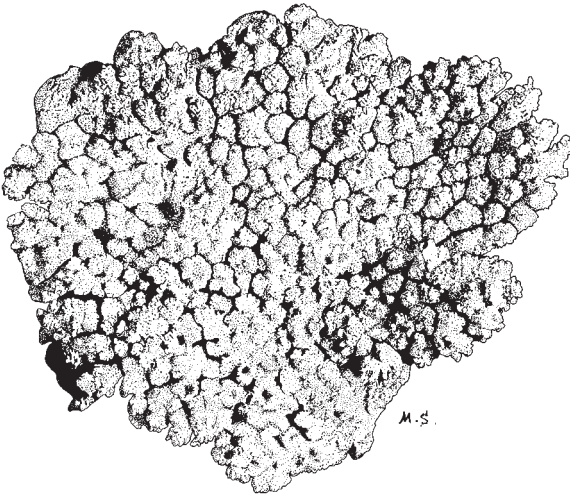


detail of corallites

***Acropora hyacinthus* (Dana, 1846)**

En - Brush coral.

This is the classic "table" coral, with long-lived colonies forming tables several metres in diameter. The coral is supported by a central stalk; the main branches anastomose in the horizontal plane, while secondary branchlets all grow vertically to the same height, forming a flat surface. Common at shallow to intermediate depths throughout its range. West to Thailand, north to Taiwan Province of China, east to French Polynesia and Pitcairn Island, and south to Solitary Island (Australia).

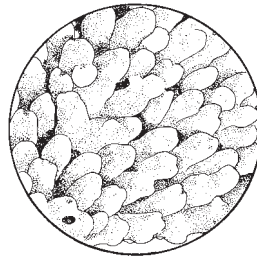
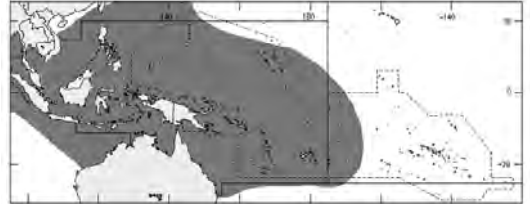
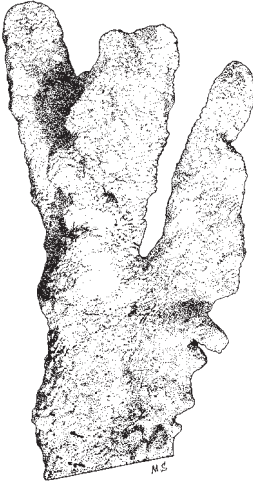


detail of corallites

Acropora palifera (Lamarck, 1816)

En - Catch bowl coral.

Colonies are formed of thick encrustations that develop stout (usually less than 100 mm diameter), vertical, irregularly shaped branches, depending on exposure to wave action. May dominate wave-washed communities due to its solid construction. Axial corallites are difficult to distinguish due to the large area of branch tip. Many colonies consist of less than 12 main branches. Common in shallow to intermediate depths. West to Thailand, north to Taiwan Province of China, east to Marshall Islands, and south to Lord Howe Island (Australia).



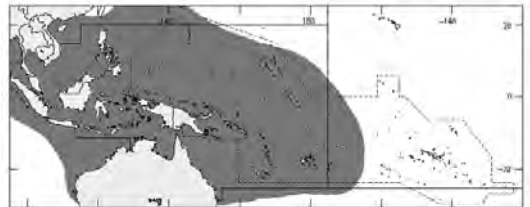
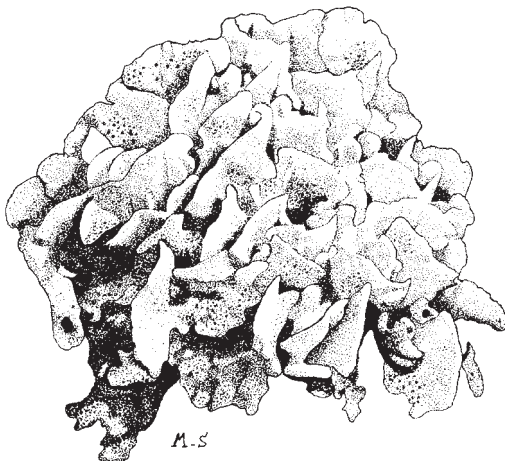
detail of corallites

AGARICIIDAE

Pavona decussata (Dana, 1846)

En - Cactus coral.

Common in shallow to intermediate depths and may form colonies several metres in diameter and in height. Small colonies are encrusting, and larger ones develop vertical plates that anastomose to form an interlocking matrix. The sides and edges of the plates are quite smooth. Individual corallites are tiny, superficial and run in irregular rows. West to Thailand, south to New South Wales (Australia), north to southern Japan, and east to Samoa.

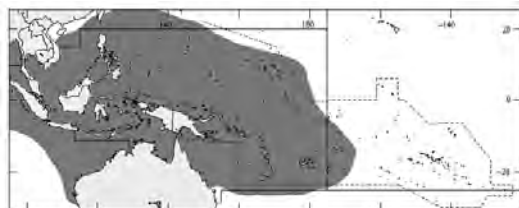
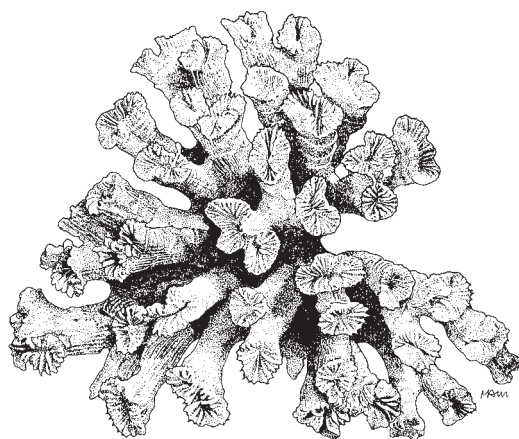


CARYOPHYLLIIDAE

Euphyllia glabrescens (Chamisso and Eysenhardt, 1821)

En - Brain trumpet coral.

Forms dome-shaped colonies usually less than 1 m in diameter with large phaceloid corallites less than 30 mm in diameter. When alive, the several centimetres long, unbranched, brown tentacles easily distinguish this species. May be common in protected lagoons and on reef slopes. West to Thailand, north to Taiwan Province of China, east to Samoa, and south to Capricorn Group (Great Barrier Reef).

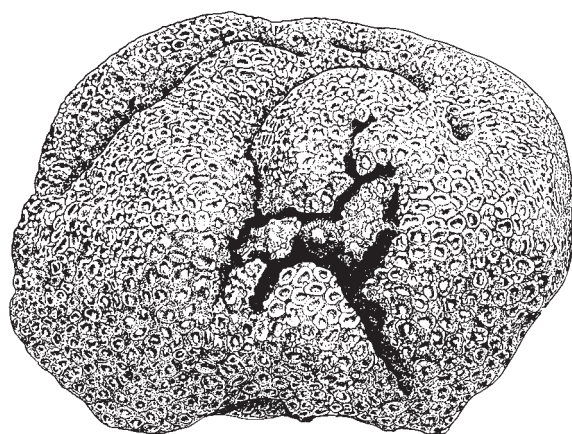


FAVIIDAE

Favia fava (Forsskål, 1775)

En - Head coral.

The head coral is one of numerous species so-called due to their rounded massive shape, similar to a human head. Corallites are evenly distributed, plocoid, exsert, circular or slightly oval, 10 to 20 mm in diameter, and usually separated from each other by a few millimetres. Colonies grow to about 1 m diameter and are found at all depths. Widespread Indo-Pacific.

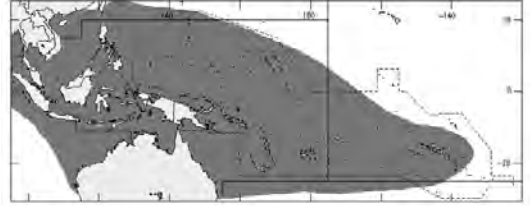
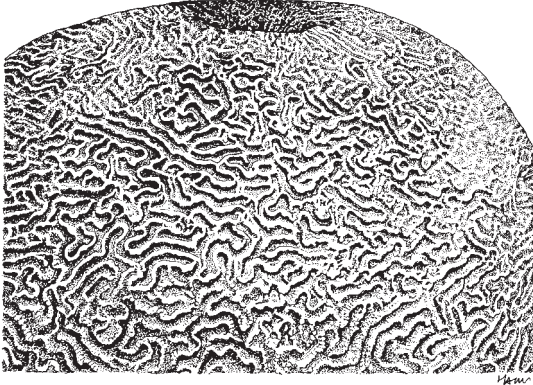


detail of corallites

Platygyra daedalea (Ellis and Solanader, 1786)

En - Brain coral.

This is the most common of several massive (mound-forming) species with a surface that resembles the maze-like pattern of a mammal brain. The valleys are typically 20 to 30 mm long and 5 to 6 mm wide. Colonies commonly grow to 1 m diameter or more and are found at all depths. Found throughout the Indo-Pacific.

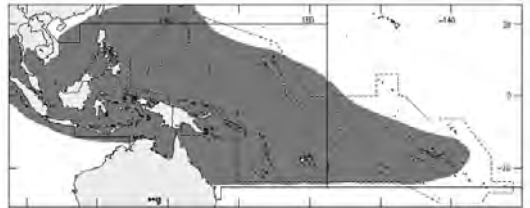
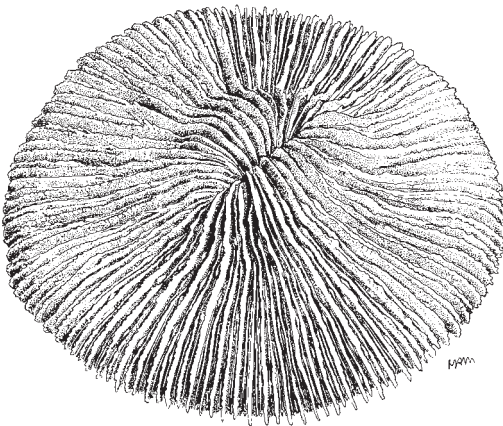


FUNGIIDAE

Fungia danai Edwards and Haime, 1851

En - Spiny mushroom coral.

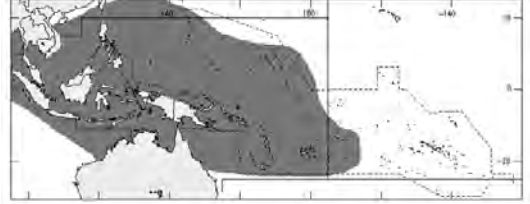
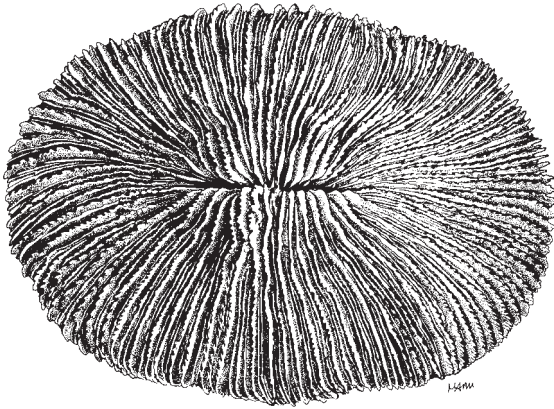
This species is similar in size and shape to *Fungia fungites* and is found in the same biotopes. It is distinguished by highly exsert septa of lower orders and distinctive triangular dentations (lobes) on higher order septa that rise to the level of the lower order septa. The lower surface shows a similar difference in the height of costae of higher and lower orders. Common in central Indo-Pacific.



***Fungia echinata* Verrill, 1864**

En - Rough feather coral.

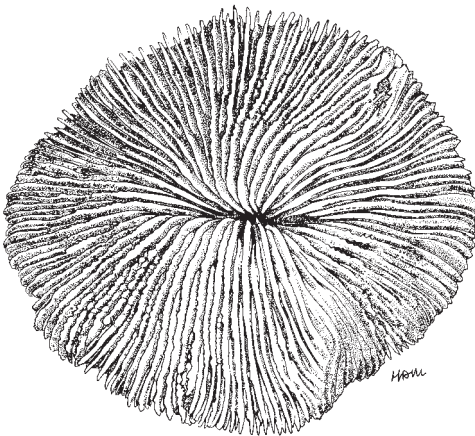
A solitary, free-living species often found in large aggregations at intermediate depths on reef slope benches. The coral is moderately elongate (length to width ratio between 1.5 and 3 to 1) and may reach 1 m in length. Both upper and lower surfaces are very rough due to septal and costal dentations. Common in Indo-Pacific. Also known as *Ctenactis echinata*.



***Fungia fungites* (Linnaeus, 1758)**

En - Common mushroom coral.

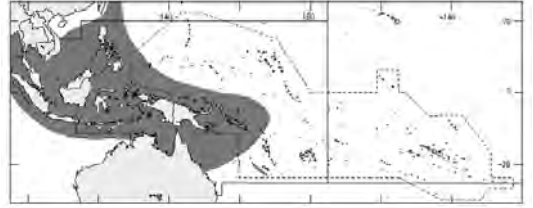
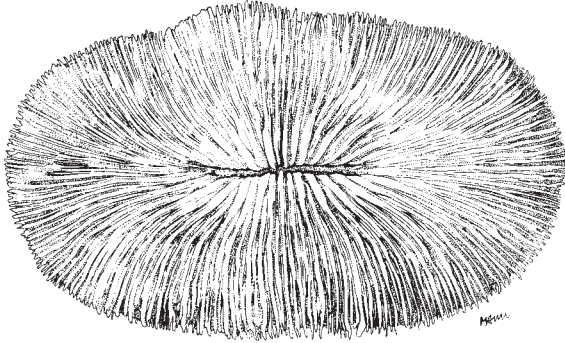
Like *Fungia echinata*, this solitary free-living coral is found at intermediate depths on reef slopes. The coral is circular in outline, up to 30 cm in diameter. The upper surface is fairly rough due to moderate to deeply incised septal dentations on most septocostae, and the lower surface is rough due to costal spines. Very common throughout central Indo-Pacific.



***Fungia paumotensis* Stutchbury, 1833**

En - Elongate mushroom coral.

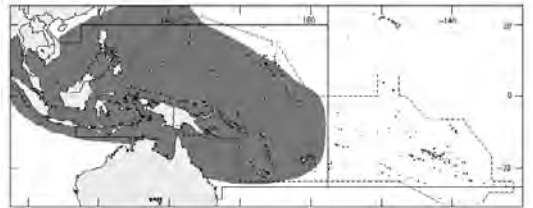
Specimens of this species are elongate (up to 25 cm x 13 cm), thick, and heavy, and may have an elevated central portion (tentacular lobe). The septa are neatly arranged, subequal and have very fine dentations giving the coral a smooth appearance. The underside is covered with short equal septocostae, also creating a smooth appearance, and the attachment scar is often not discernable. Found throughout central Indo-Pacific.



***Halomitra pileus* (Linnaeus, 1758)**

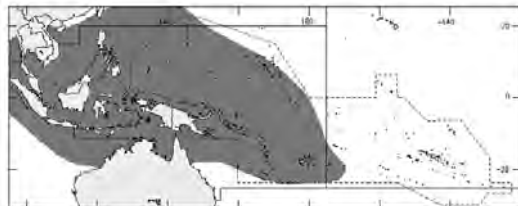
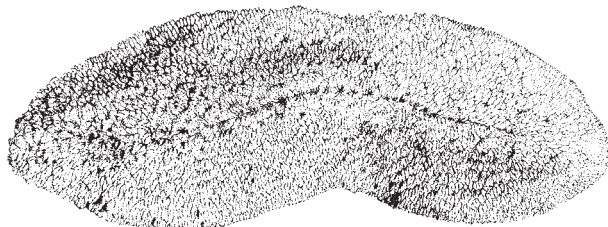
En - Bowl coral.

In situ, this species resembles an upside-down salad bowl, up to 60 cm in diameter and 1 to 1.5 cm thick. The septa generally run uninterrupted the entire distance from the primary corallite to the margin. Primary septa are much more exsert than secondaries, and both are strongly dentate. Corallites are irregularly distributed, but may form lines parallel to the margin. Each corallite is marked by a small mound of highly exsert septa, therefore the colony surface is rough. The underside is comparatively smooth with regularly exsert costae and low spines. Widely distributed throughout central Indo-Pacific.



Polyphyllia talpina* Lamarck, 1801*En** - Feather coral.

Solitary, unattached coral found at all depths. The elongate colony has a thin furrow created by a series of corallites that run along the central axis. Colonies have a slightly rough surface, but appear neat due to the regular arrangement of petaloid septa, and may reach 75 cm in length. East to Tonga, south to central Great Barrier Reef, west to Madagascar, and north to Japan.

**MERULINIDAE*****Merulina ampliata* (Ellis and Solander, 1786****En** - Merulina coral.

Common at shallow to intermediate depths. Colonies form encrusting plates (up to 1 m diameter) which may develop short (10 cm), gnarled, vertical branches, particularly in shallow water. Corallites are arranged in near parallel rows that meander slightly. The walls are almost the same width as the corallites. Septa are continuous over walls between adjacent corallites. West to Thailand, south to Lord Howe Island (Australia), north to southern Japan, and east to Kiribati.

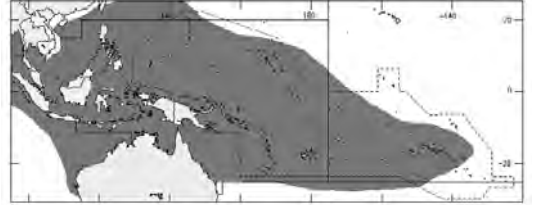
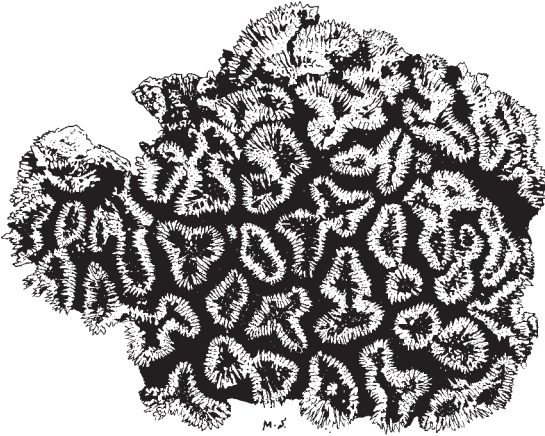


MUSSIDAE

Lobophyllia corymbosa (Forsskål, 1775)

En - Brain root coral.

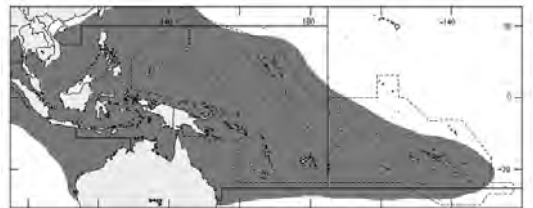
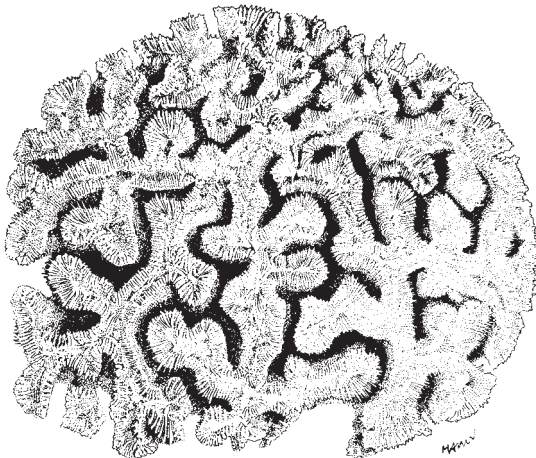
The 2 species of *Lobophyllia* depicted here form distinctive hemispherical colonies up to 1 m or more in diameter. In contrast to the following species the corallites of *L. corymbosa* do not form long meanders but rather are mono- to tri-centric and often smaller in diameter. West to Thailand, south to Lord Howe Island (Australia), north to southern Japan, and east to French Polynesia.



Lobophyllia hemprichii (Ehrenberg, 1834)

En - Largebrain root coral.

This second species of *Lobophyllia* is very similar to the first in overall growth form. The corallites are phaceloid, separated except at the base and form long meanders 1 to 5 cm in width. The septa and costae are covered with exsert, sharp dentations. The most common member of this genus in the Indo-West Pacific.



PECTINIIDAE

Pectinia lactuca (Pallas, 1766)

En - Lettuce coral.

Common from below the reef flat to the limit of coral growth. Colonies form large plates covered with thin, high collines that form radiating valleys. The plates may be more than 1 m in diameter while the collines may reach several centimetres in height. Corallites are widely spaced with septocostae continuous between them. West to Thailand, south to central Great Barrier Reef, north to southern Japan, and east to Vanuatu.

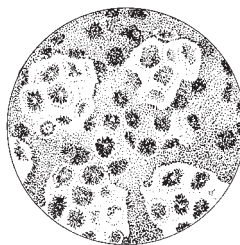
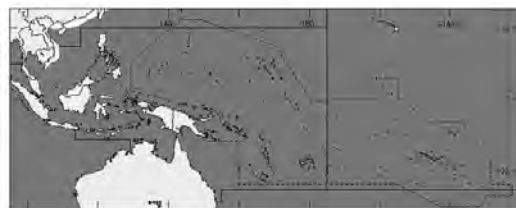
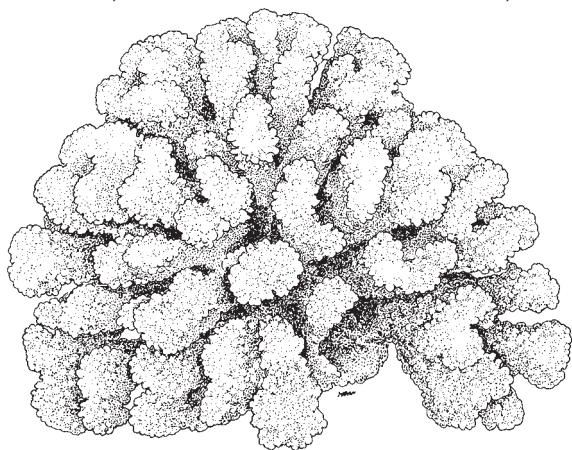


POCILLOPORIDAE

Pocillopora verrucosa (Ellis and Solander, 1786)

En - Rasp coral; **Fr** - Corail lime; **Sp** - Coral raspa.

Found from the reef flat to a depth of 25 m. Colonies irregularly branching (ramose), less than 30 cm in diameter, covered with verrucae; corallites plocoid, about 1 mm across, found both on verrucae and in between. Stout branches usually more than 10 mm in diameter, but this varies with exposure to water movement and depth. Colonies growing in shallow water or exposed to wave action tend to have thick sturdy branches while those from deep calm waters tend to have thinner branches. Colour is mottled light brown in life and skeleton usually has reddish brown patches after cleaning. This species and *Pocillopora damicornis* are the 2 most commonly exploited corals in the area. East to Hawaii and Panama, south to southern Great Barrier Reef, west to Red Sea, and north to Japan.

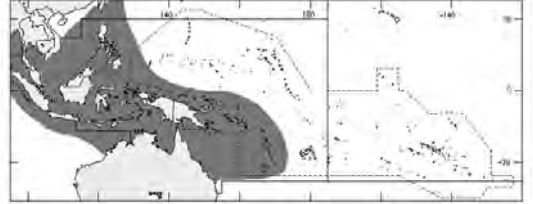
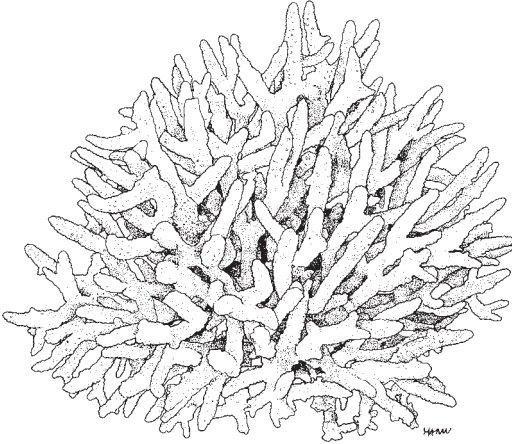


detail of corallites

Seriatopora caliendrum Ehrenberg, 1834

En - Birdsnest coral.

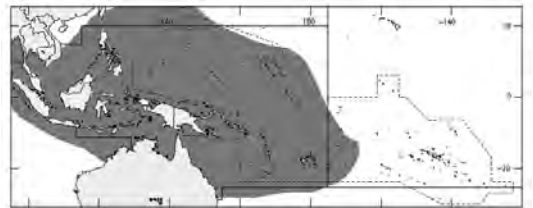
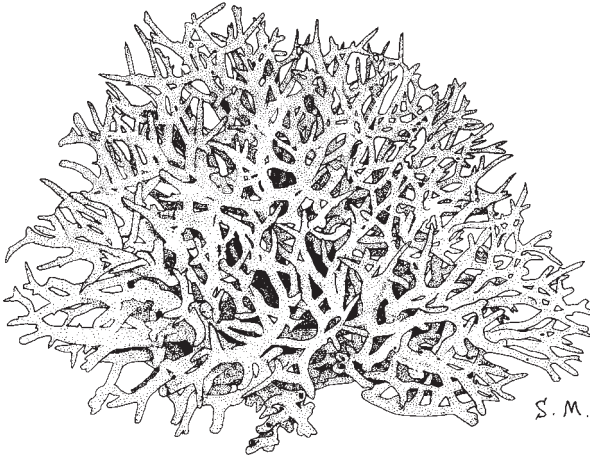
This species is very similar to *Seriatopora hystrix* in preferred habitat, colony size, growth form, and general appearance. The major differences are that the branches are somewhat stouter, and this thickness extends almost to the blunt branch tips, whereas in *S. hystrix*, branch diameter tends to decrease with distance, with branch tips forming fairly sharp points. Upon close inspection, the corallites are usually hooded, giving the branches a rough appearance. Red Sea and East Africa to Vanuatu.



Seriatopora hystrix Dana, 1846

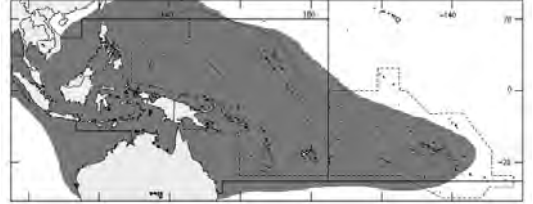
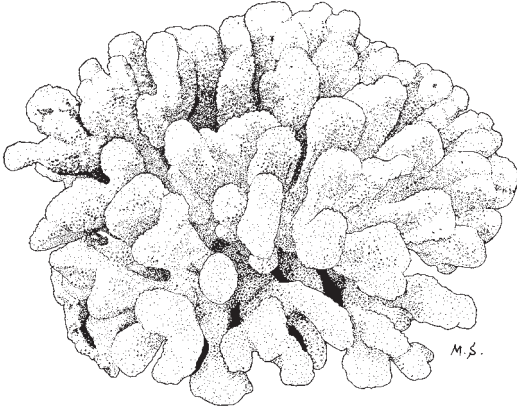
En - Thin birdsnest coral.

A fragile, weedy species often found in dense thickets in a depth range of about 6 to 20 m. Individual colonies (up to 30 cm diameter) are formed of thin branches (2 to 5 mm diameter) which frequently bifurcate and anastomose. Corallites are tiny, superficial, and form rows running from the tip to the base of the branch. Common throughout the Indo-Pacific region.

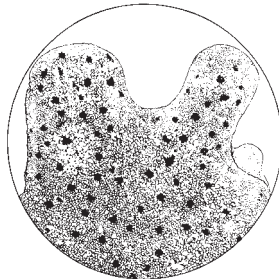
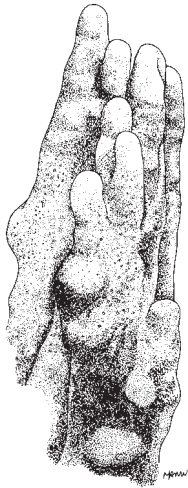


Stylophora pistillata* Esper, 1797*En** - Smooth cauliflower coral.

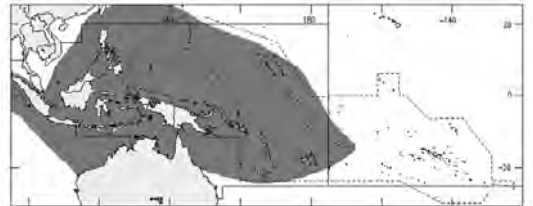
Common from the reef flat to intermediate depths. A ramose coral, up to 50 cm in diameter, with smooth rounded branches growing from a common origin. Upon close inspection, a small half-hood can be seen on one side of each corallite. Shows a high degree of variation in branch thickness depending upon depth and degree of exposure, with more delicate forms found in deeper, more protected biotopes. West to Africa, south to Lord Howe Island (Australia), east to French Polynesia, and north to Japan.

**Order COENOTHECALIA****HELIOPORIDAE*****Heliopora coerulea* (Pallas, 1766)****En** - Blue coral.

Most common in shallow water. Forms large colonies, more than 1 m in diameter, that may be massive, or most commonly, composed of vertical branches or folia. The surface appearance is very smooth, and the color in life is a distinctive grey-brown with white tips. The entire skeleton is blue and therefore this species is commonly exploited for decorative uses. West to Red Sea, north to southern Japan, east to Samoa, and south to New Caledonia.



detail of corallites



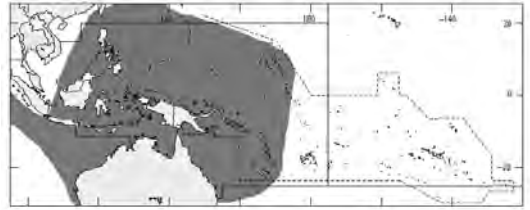
Order STOLONIFERA

TUBIPORIDAE

Tubipora musica Linnaeus, 1758

En - Organpipe coral.

Common from the reef flat to intermediate depths. Colonies form mounds up to 50 cm diameter that may dominate large patches of reef. The colonies are composed of thin tubes (the "organ pipes"), 2 mm diameter in length, cemented together by horizontal plates at intervals of several centimetres. In life, the corals have white polyps that may cover the corallum. The skeleton is deep red, widely prized for aquarium displays. West to Red Sea, north to Japan, east to Vanuatu, south to Houtman Abrolhos Islands.



Class HYDROZOA

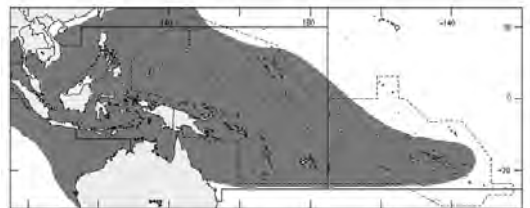
Order MILLEPORINA

MILLEPORIDAE

Millepora platyphylla Hemprich and Ehrenberg, 1834

En - Wello fire coral.

Most common in shallow to intermediate depths. Forms large colonies, commonly 2 to 3 m in diameter and composed of anastomosed vertical plates, which may reach 2 m in height. In life, colonies have a characteristic light brown color, with white growing edges. If touched, a sharp sting can be felt when coming into contact with soft skin. West to Red Sea, north to Japan, east to Marquesas, and south to Houtman Abrolhos Islands.



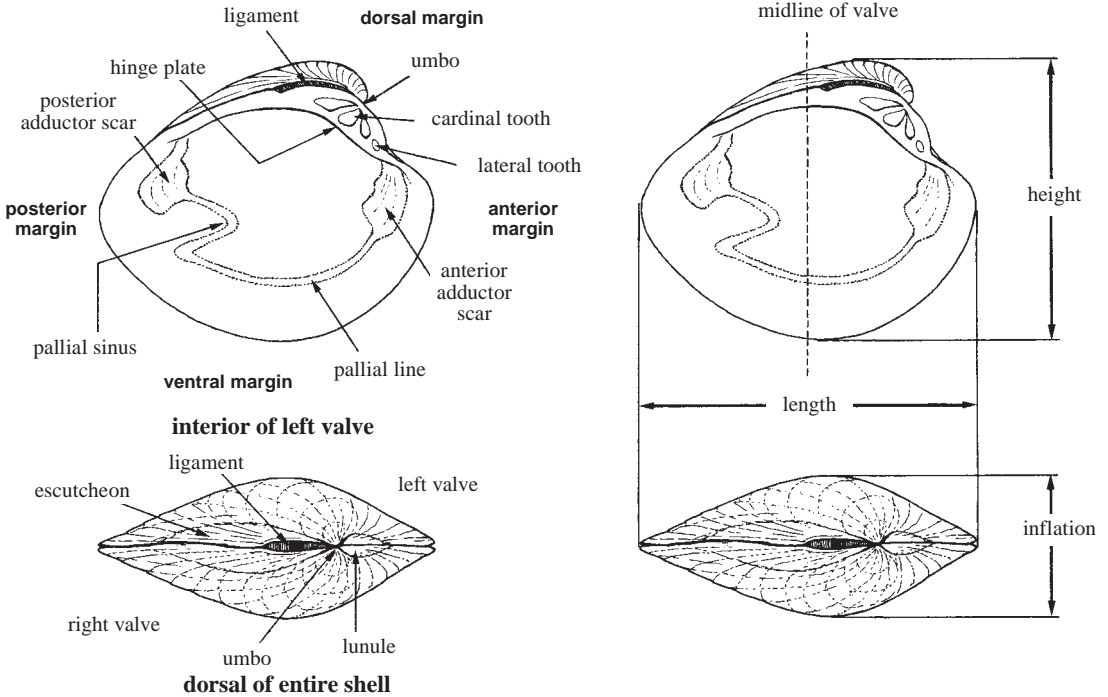
BIVALVES

(Acephala, Lamellibranchia, Pelecypoda)

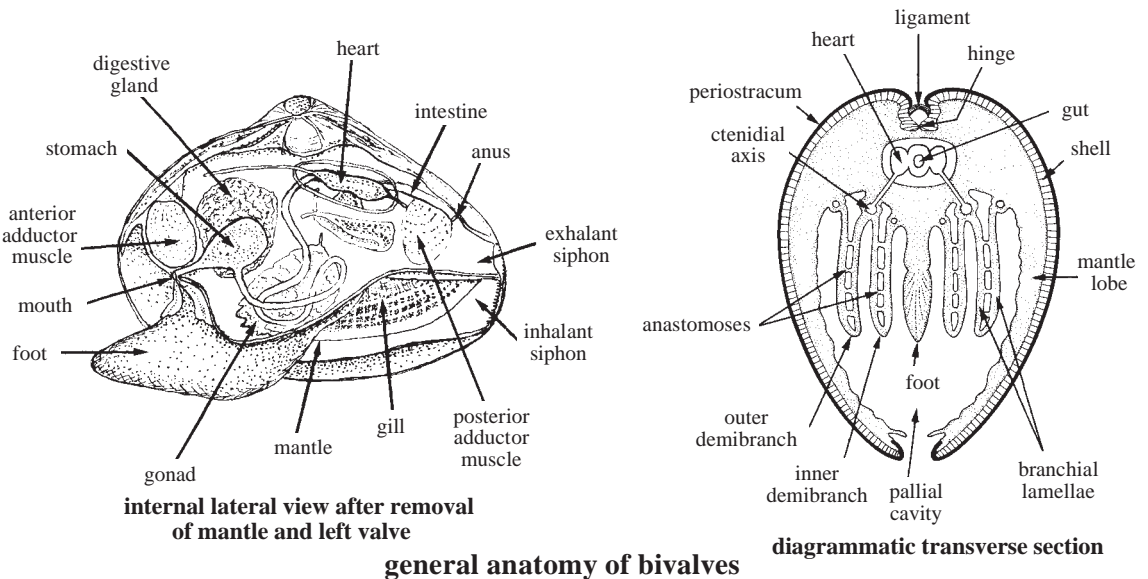
by J.M. Poutiers

GENERAL REMARKS

Bivalves are aquatic molluscs that show a fundamental bilateral symmetry. Their characteristic shell is composed of **2 calcified valves** lying on the right and left sides of the body. Both valves are typically equally convex (**equivalve shell**), but they may differ in size and shape (**inequivalve shell**) as a result of an alteration of bilateral symmetry. Valves are articulated along a marginal process of the dorsal side called the **hinge**, and are connected by an elastic and poorly calcified structure, the **ligament**. Under the action of the ligament, the 2 valves tend to open along their anterior, posterior and mainly ventral margins. They are closed by the pulling action of 1 or 2 (sometimes 3) **adductor muscles**. These are fixed to the inner side of valves by areas leaving well-defined imprints, the **adductor muscle scars**.



main features of a bivalve shell



internal lateral view after removal of mantle and left valve

general anatomy of bivalves

diagrammatic transverse section

The soft, unsegmented body of bivalves is laterally compressed, but has neither a head (**Acephala**) nor a masticatory apparatus. It is covered by the **mantle**, an overgrowing sheet of tissue composed of 2 lobes, each one lining and secreting the respective valve. **Pallial lobes** are fused dorsally with the visceral mass, and enclose ventrally a rather wide pallial cavity communicating with the outside. They are tightly attached to the interior of valves along a well-defined **pallial line**, close to the ventral margin of the shell. The mantle-lobe margins may be somewhat fused, forming 2 siphons posteriorly through which water is taken in (ventral, inhalant siphon) or expelled (dorsal, exhalant siphon). The **foot**, a muscular ventral structure, is sometimes hatchet-shaped (Pelecypoda) and enables a burrowing locomotion or a fixation to hard substrates by means of elastic filaments (**byssus**). Many bivalves exhibit a pair of respiratory lamellous gills (Lamellibranchia), whose activity produces a complex system of currents largely concerned with the collection of food. Most forms of bivalves are microphagous and feed either on plankton or organic matter suspended in water (suspension-feeders), or on food collected on the substrate floor (deposit-feeders). However, a few species have evolved specialized feeding strategies (carnivores, xylophages).

In the majority of bivalves, sexes are separate and reproductive cells are released into the water where fertilization occurs; larvae have a relatively long free-swimming planktonic life, followed by a metamorphosis leading to the definitive benthonic mode of life. However, some species may exhibit various forms of hermaphroditism, and fertilization may occur in the pallial cavity, sometimes with protection of eggs or larvae in a "brooding chamber". The planktonic larval stage may be reduced or totally absent, and then young hatch directly as benthic organisms.

The biodiversity of the malacological fauna in the Western Central Pacific is probably the greatest in the world, but no reliable estimate of the bivalve diversity is presently available. However, a recent evaluation of the nearby Japanese fauna may give an idea of the rich biodiversity in the area. Japanese bivalves comprise about 1 600 species of marine and brackish-water species allocated to 92 families, compared to a total of 10 000 species in the world. For the present contribution, 189 species belonging to 35 families have been selected, mainly on the basis of size, abundance, distribution, and commercial interest. Only those species that are known to be used as food are included in this guide but, in view of the paucity of detailed informations on fisheries in many places, many other species are probably collected locally in the area. In order to select these species, the author has largely used his "Annotated list of marine and brackish-water species of interest to fisheries" (1992, FAO unpublished report) that has been circulated for improvement among specialists as a basis for the FAO Species Catalogue, "Bivalves of the World" (in preparation). He had the opportunity to study specimens collected in local markets of the Philippine Archipelago by Prof. V. Storch, Ruprecht-Karls-Universität (Heidelberg, Germany), thanks to courtesy of Drs R. von Cosel and R. Janssen, Senckenberg Museum (Frankfurt am Main, Germany). He has also gathered a considerable amount of information on the species exploited in the central and northern Philippines during a workshop in support of the present field guide which was held in October 1995 in the Philippines, organized by FAO, MSI (Marine Science Institute, University of the Philippines), and ICLARM (International Centre for Living Aquatic Resources Management). Useful remarks have been made on the Pectinidae by Dr H.H. Dijkstra, Zoölogisch Museum (Amsterdam, the Netherlands), and on the Glycymerididae and Veneridae by Dr A. Matsukuma, Kyushu University (Fukuoka, Japan).

In the Western Central Pacific, a large variety of species is traditionally collected by coastal populations for personal consumption. In the past, fishing effort and aquaculture have concentrated on a limited number of bivalve species, but now an increasing number of species tends to be exploited and aquaculture experiments are attempted in various places in order to counteract the depletion of natural beds by overexploitation or pollution.

GLOSSARY OF TECHNICAL TERMS

Accessory plate - calcareous and periostracal structure covering the soft parts in the Pholadidae, in addition to the shell valves.

Adductor muscle - muscle connecting the 2 valves of a shell, tending to draw them together.

Apophysis - finger-like shelly structure to which the foot muscles are attached in the Pholadidae and Teredinidae.

Branchial - pertaining to the gills.

Branchial lamella - (see gill).

Byssus - clump of horny threads spun by the foot, by which a bivalve can anchor to a hard substrate.

Cardinal area - surface of the shell extending between umbo and hinge margin.

Cardinal tooth - (see tooth).

Chomata - marginal crenulations in Ostreidae and Gryphaeidae, occurring all around the inner side of valves or only near the hinge, composed of small tubercles or ridgelets on the right valve, and corresponding pits on the left valve.

Commissure - line of junction of the valves.

Concentric - parallel to lines of growth.

Cruciform muscles - crossed muscles connecting valves and serving to retract the siphons, leaving 2 small scars near the posteroventral end of pallial line in some bivalves (e.g., Tellinidae).

Ctenidial axis - (see gill).

Ctenolium - a row of small teeth on lower side of byssal notch in some Pectinidae.

Demibranch - (see gill).

Denticle - a small tooth.

Ear - lateral expansion of the dorsal part of a shell.

Equilateral - the condition of a valve when growth on either side of umbo is symmetrical.

Equivalve - the condition of a shell when valves are of the same shape and size.

Escutcheon - differentiated area extending along dorsal margin of valves, behind the umbones.

Eulamellibranchiate type - gill demibranchs composed of 2 lamellae. Branchial filaments and lamellae always connected by tissular junctions (e.g., Veneridae).

Filibranchiate type - gill demibranchs composed of 2 lamellae. In addition to the ciliary junctions between branchial filaments, anastomosed tissular junctions may unite lamellae of each demibranch (e.g., Mytilidae, Pectinidae).

Foot - mobile and extensible muscular organ, used for locomotion or for attachment to substrate by means of byssal threads.

Gape - opening or gap remaining between margins of valves, when shell is closed.

Gill - respiratory organ generally composed of 2 thin leaf-like structures (demibranches) suspended to a dorsal axis (ctenidial axis); each demibranch may be either simple or bent back upon itself and then formed of 2 sheets (branchial lamellae). A lamella is constituted of many ciliated filaments parallel to each other and interconnected by more or less complex junctions. Four main types of gill structures are currently recognized among bivalves: the protobranchiate, filibranchiate, eulamellibranchiate, and septibranchiate types (see these terms).

Growth marks - (see sculpture).

Hinge - structures in the dorsal region of the shell, along which the valves meet, and that function in the opening and closing of the shell.

Hinge line - shell margin adjacent to the hinge.

Hinge plate - infolding of dorsal shell margin bearing hinge teeth and sockets, and lying in each valve in a plane parallel to that of junction of valves.

Imbricate - overlapping like tiles or shingles on a roof.

Inequilateral - the condition of a valve when growth on either side of umbo is assymmetrical.

Inequivalve - the condition of a shell when valves are not alike in shape or size.

Keel - a prominent, angular ridge.

Lamellate - with thin, flattened plates.

Lateral tooth - (see tooth).

Lenticular - shaped like a biconvex lens.

Ligament - horny, elastic structure joining the 2 valves dorsally.

Ligamental area - part of cardinal area occupied by the ligament.

Lunule - differentiated area extending along dorsal margin of valves, just in front of umbones.

Mantle - fleshy sheet surrounding vital organs and composed of 2 lobes, one lining and secreting each valve.

Muscle scar - impression marking the place of attachment of a muscle inside the shell.

Nacreous - pearly, often with multi-coloured hues, as in mother-of-pearl.

Nymph - narrow platform extending behind umbo along dorsal margin, to which the external ligament is attached.

Opisthogyrate - the condition of a shell when umbones are directed posteriorly.

Orbicular - disk-shaped, nearly circular.

Orthogyrate - the condition of a shell when umbones are perpendicular to the hinge line (directed neither anteriorly nor posteriorly).

Pallet - small paddle-shaped or feather-like calcareous and periostracal structure, a pair of which closes the burrow opening when siphons are retracted in the Teredinidae.

Pallial - pertaining to the mantle.

Pallial line - a line near internal margin of valve, marking the site of attachment of the mantle edge.

Pallial sinus - posterior indentation of pallial line, marking the site of attachment of muscles allowing siphons to retract within the shell.

Pedal - pertaining to the foot.

Periostracum - layer of horny material covering the shell.

Plicate - folded or ridged.

Porcelaneous - with translucent, porcelain-like appearance.

Prosogyrate - the condition of a shell when umbones are directed anteriorly.

Protobranchiate type - gill demibranchs simple, formed of leaf-like filaments loosely connected by sparse ciliary junctions.

Radial - diverging from umbo, like the spokes of a wheel.

Rostrate - with a beak-like projection (rostrum).

Sculpture - relief pattern developed on the outer surface of the shell; sculpture is overlain by concentric growth marks corresponding to various positions of shell margins during growth.

Scabrous - rough, file-like.

Scale - localized projection on the outer surface of shell, commonly situated on a rib.

Septibranchiate type - gills absent, replaced by a muscular horizontal partition (the "septum") pierced by small pores. This structure enables a carnivorous nutrition and is encountered in a group of predominantly deep-sea bivalves (e.g., Cuspidariidae).

Siphons - extensible, tube-like projections of the posterior marginal region of mantle, forming 2 openings for water inflow (inhalant siphon) and outflow (exhalant siphon).

Socket - recess of the hinge plate, for reception of a tooth of opposite valve.

Tooth - shelly projection from the hinge, received in socket of opposite valve; cardinal teeth are close to umbo, whereas lateral teeth are set apart from these, anteriorly or posteriorly.

Umbo (pl. umbones) - the first formed part of a valve, usually above the hinge.

Umbonal reflection - expansion of the internal dorsal margin which is folded over the umbones in Pholadidae and Teredinidae.

Valve - one of the main shelly halves of a bivalve.

IDENTIFICATION NOTE

An illustrated key to families of those species included in this guide is included here. After a family is determined by using this key, the user should turn to the descriptive accounts of families and species. Each section on a family includes, in addition to a diagnosis of the family, a key to the species. Furthermore, there are detailed accounts for the most important species given, and abbreviated accounts for species of secondary interest.

For a correct identification of a bivalve species, it is necessary to orientate the shell properly and to distinguish the right valve from the left valve. The area where the mantle lobes are fused together with the visceral mass is considered as dorsal. It is about the same to consider that the hinge and umbones occupy a dorsal position. The anterior margin is then relatively close to the mouth, and the posterior margin close to the anus (see also figures on page 124).

In a bivalve shell it is useful to remember that:

- the pallial sinus, when present, is posterior;
- the centre of adductor scar is posterior in species with only one adductor muscle;
- the external ligament, when stretching along one side of the umbones, is posterior to them.

However, these simple rules do not apply to all species, and sometimes other criteria must be used. In such cases, appropriate features of orientation are depicted in the family or species accounts of this guide.

KEY TO FAMILIES

Remarks on key characters: features used in this key only apply to species included in this guide; they do not consider a few exceptions within the families, the inclusion of which would make the key too complex for general use.

- 1a.** Only 1 adductor muscle scar in each valve → **2**
1b. Two (sometimes 3) adductor muscle scars in each valve → **6**
- 2a.** Interior of shell partly nacreous, with a non-nacreous border developed at least ventrally . . **Figure A**
2a. Interior of shell, if nacreous, without a non-nacreous border → **3**
- 3a.** Dorsal margin drawn out into ear-shaped or wing-shaped lateral expansions **Figure B**
3b. Dorsal margin not drawn out into such expansions → **4**
- 4a.** Ligament mainly internal **Figure C**
4b. Ligament only external → **5**
- 5a.** Hinge with teeth **Figure D**
5b. Hinge without teeth **Figure E**
- 6a.** Shell with calcareous accessory plates or tube and pallets; a finger-like apophysis projecting from the umbonal cavity in each valve **Figure F**
6b. Shell without calcareous accessory plates or tube and pallets; no finger-like apophysis projecting in either valve → **7**
- 7a.** Anterior and posterior adductor scars very unequal, the anterior one always small **Figure G**
7b. Anterior and posterior adductor scars not very unequal → **8**
- 8a.** Hinge with numerous alternating small teeth and sockets, all or part of them transverse to dorsal margin. **Figure H**
8b. Hinge not as above → **9**
- 9a.** Internal ligament present → **10**
9b. Internal ligament absent → **11**
- 10a.** Hinge without teeth **Figure I**
10b. Hinge with well-developed teeth **Figure J**
- 11a.** Hinge teeth and corresponding sockets more or less parallel to dorsal margin. **Figure K**
11b. Hinge teeth and corresponding sockets not parallel to dorsal margin. → **12**
- 12a.** Shell more than twice longer than high, widely gaping anteriorly and posteriorly. **Figure L**
12b. Shell not as above → **13**
- 13a.** Anterior adductor scar elongate, with an oblique ventral lobe detached from pallial line . . **Figure M**
13b. Anterior adductor scar, if elongate, not with an oblique ventral lobe detached from pallial line → **14**
- 14a.** Hinge with 3 cardinal teeth, at least in the left valve **Figure N**
14b. Hinge with no more than 2 cardinal teeth in either valve → **15**

- 15a. Pallial line with a sinus **Figure O**
- 15b. Pallial line without a sinus → **16**

- 16a. Main sculpture of radial ribs **Figure P**
- 16b. Main sculpture concentric; radial ribs, when present, crossed by stronger concentric ridges . . **Figure Q**

Note: the following figures contain all families included in this contribution, plus those quoted as similar to the treated families. These similar families are marked with an asterisk (*).

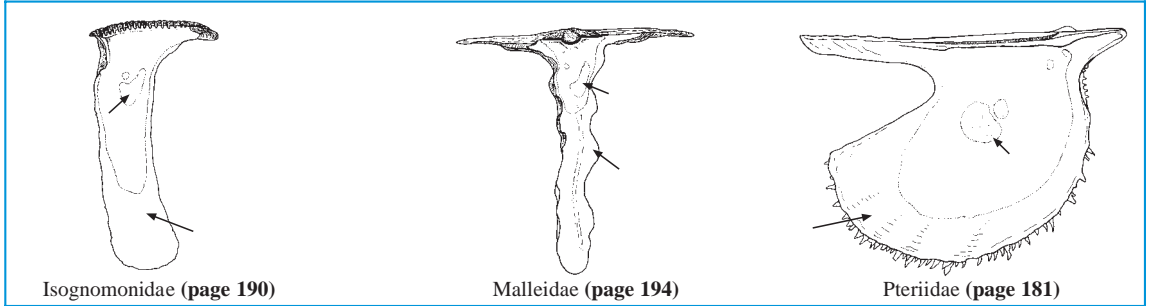


Figure A

Figure A:

Isognomonidae: shell compressed, with a straight dorsal margin, slightly inequivalve. Ligament external, set in a series of transverse grooves along the dorsal margin. Hinge without teeth. Interior partly nacreous. Only 1 adductor muscle scar, with a well-developed pedal retractor scar. Pallial line without a sinus.

Malleidae: shell compressed, irregular in form, more or less elongate dorsoventrally. Dorsal margin often produced at both ends into long, wing-like ears. Ligament set on a transverse median groove. Hinge without teeth. Interior partly nacreous. Only 1 adductor muscle scar, usually with a well-developed pedal retractor scar. Pallial line without a sinus.

Pteriidae: dorsal margin often produced at each end into a wing-like ear, sometimes very long behind. Shell slightly inequivalve. Right valve with a byssal notch anteriorly. Hinge toothless or with denticles. Interior brilliantly nacreous. Only one adductor muscle scar. Pallial line without a sinus.

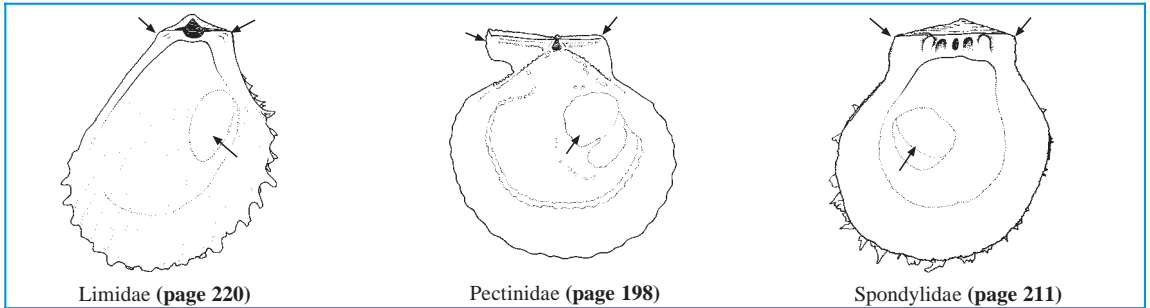


Figure B

Figure B:

Limidae: shell equivalve, higher than long, inequilateral, extended obliquely in an anteroventral direction. Dorsal margin with 2 small ears. Trigonal cardinal area with a median ligamental groove. Hinge toothless. A single adductor muscle scar. Pallial line without a sinus.

Pectinidae: shell more or less inequivalve, ovate to subcircular with a straight dorsal margin forming wing-like ears. A byssal notch and a ctenolium at right valve. Ligament internal, in a small trigonal pit pointing under the umbones. Hinge without teeth. A single adductor muscle scar. Pallial line without a sinus.

Spondylidae: shell stout, usually inequivalve and cemented to substrate by the right valve. Hinge line straight. A trigonal cardinal area, higher in the right valve than in the left. Ligament internal. Hinge with 2 strong teeth and 2 deep sockets in each valve, symmetrically arranged in relation to the internal ligament. A single adductor muscle scar. Pallial line without a sinus.

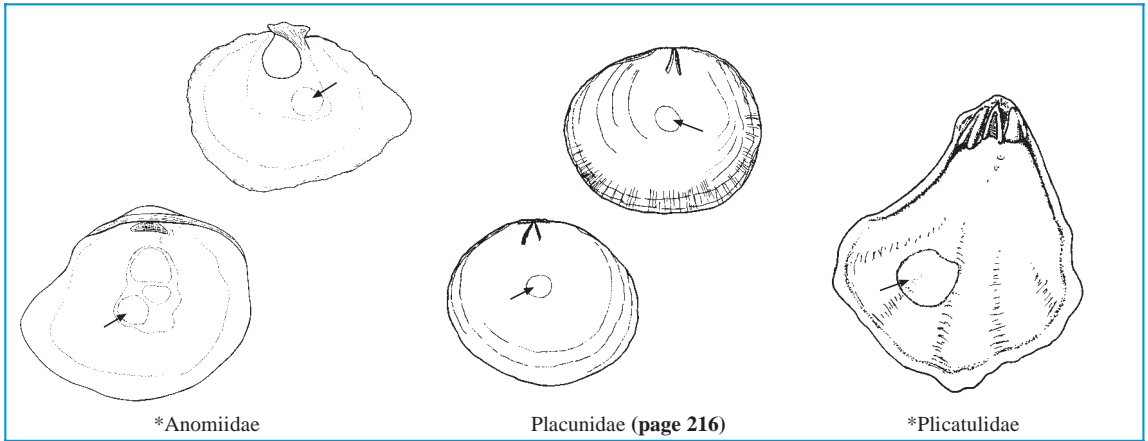


Figure C

Figure C:

***Anomiidae:** shell inequivalve, often irregular, adhering to substrate by means of a calcified byssus passing through a hole-like embayment of right valve. Ligament internal. Hinge without teeth. Central area of the interior thickened, with 1 or 2 retractor muscle scars in left valve, in addition to the single adductor scar. No pallial sinus.

Placunidae: shell thin, rounded to saddle-shaped, very compressed laterally, slightly inequivalve. Ligament internal, forming an inverted V-shaped structure. Hinge without teeth. A single adductor muscle scar. Pallial line without a sinus.

***Plicatulidae:** shell slightly inequivalve, cemented to substrate by the right valve. Cardinal area small. Ligament internal. Hinge with 2 crenulated teeth and 2 sockets in each valve, symmetrically arranged in relation to the internal ligament. A single adductor muscle scar. No pallial sinus.

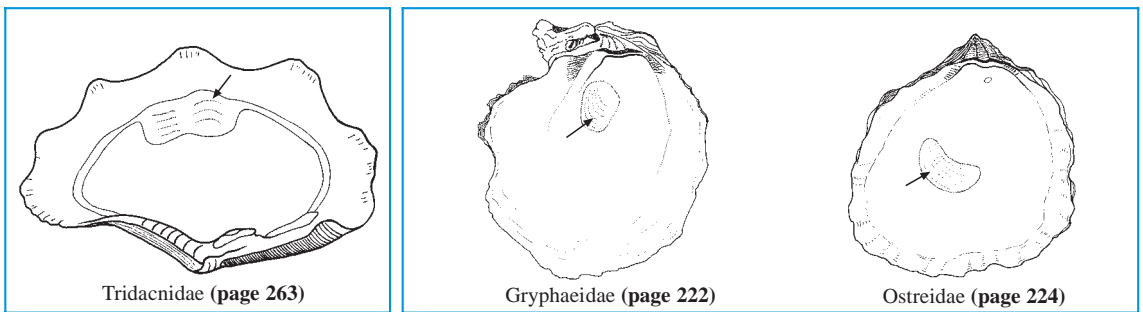


Figure D

Figure E

Figure D:

Tridacnidae: shell equivalve, thick, heavy and often very large, with strongly scalloped free margins. Umbones ventral, free margins of the valves dorsal-most in position. Byssal gape, when developed, internally plicate. Outer surface with strong radial folds. Ligament external. Hinge with ridge-like cardinal and lateral teeth. A single adductor muscle scar, associated with a pedal retractor scar, submedian in position. Pallial line without a sinus.

Figure E:

Gryphaeidae: shell more or less inequivalve, cemented to substrate by the left valve, with a microscopic vesicular structure. Ligamental area with a shallow median groove. Hinge without teeth. A single adductor muscle scar, closer to the hinge. Internal margins with long, branched, sinuous chomata.

Ostreidae: shell inequivalve, cemented to substrate by the left valve, right valve quite flat. Ligamental area with a shallow median groove and 2 lateral thickenings. Hinge without teeth. A single adductor muscle scar, median in position or nearer to the ventral margin. Internal margins smooth or with simple short chomata.

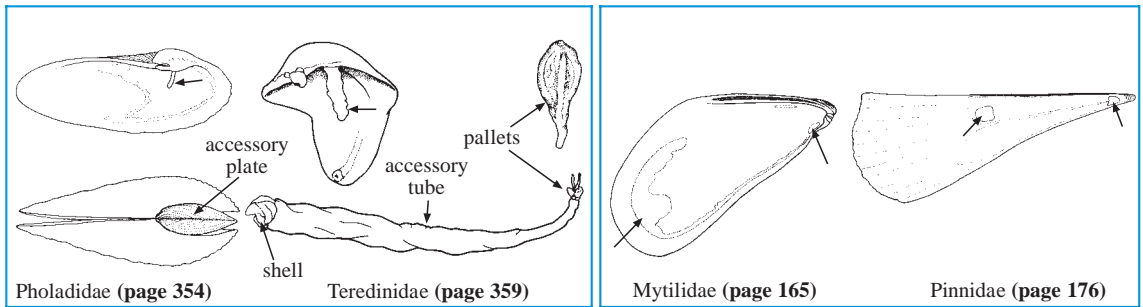


Figure F

Figure G

Figure F:

Pholadidae: shell subequivalve, gaping. Dorsal margin forming an umbonal reflection. A number of accessory calcareous plates about the main shell. Ligament reduced. Hinge without teeth. A finger-like internal apophysis. Three adductor muscle scars. Pallial line deeply sinuated.

Teredinidae: shell reduced, equivalve, widely gaping. Anteroventral margin with a deep, right-angled notch. Dorsal margin forming an umbonal reflection. Ligament reduced. Hinge without teeth. A finger-like internal apophysis. An internal umbonoventral ridge, with a knob at both ends. Three adductor muscle scars. Accessory calcareous tube lining burrow long, closed by a pair of pallets.

Figure G:

Mytilidae: shell equivalve and very inequilateral, with a byssal gape. Umbones at or near anterior end. Periostracum prominent. Ligament external, deep-set, supported by a whitish ridge. Hinge teeth absent or reduced. Adductor muscle scars unequal, the anterior one small to absent. Pallial line without a sinus. Inner side with an extensive nacreous layer.

Pinnidae: shell brittle, equivalve, subtrigonal, ventrally and posteriorly gaping; very inequilateral, pointed in front. Anterior end eroded and internally closed by small transverse partitions. Ligament linear. Hinge without teeth. Interior with a thin nacreous layer, restricted to the anterior half. Two unequal adductor muscle scars.

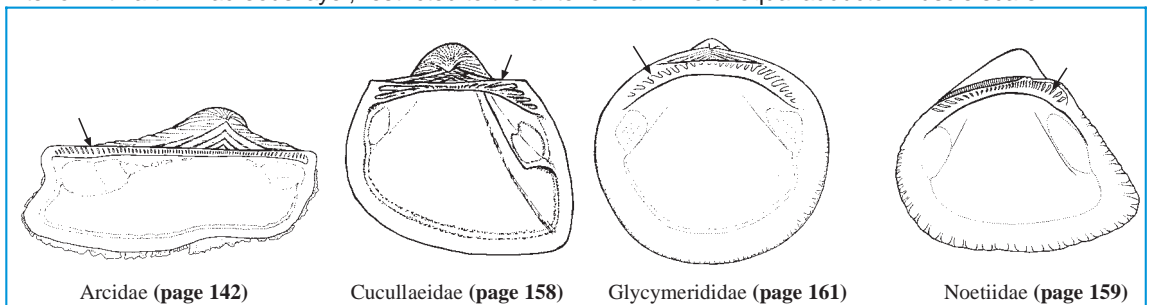


Figure H

Figure H:

Arcidae: shell equivalve or slightly inequivalve, mostly longer than high, more or less inequilateral. Umbones prosogyrate, on top of a wide cardinal area. Ligament external, often with V-shaped grooves. Hinge elongate, almost straight, with numerous small transverse teeth. Two subequal adductor muscle scars. Pallial line without a sinus.

Cucullaeidae: shell inflated, inequilateral, slightly inequivalve. Umbones subcentral, on top of a trignonal cardinal area with chevron-shaped grooves and external ligament. Hinge elongate, straightish, with a series of transverse teeth, and subhorizontal teeth at both ends. Two subequal adductor muscle scars, inner margin of posterior scar on a projecting shelf. Pallial line without a sinus.

Glycymerididae: shell equivalve, closed, subequilateral, rounded in outline. Submedian umbones, on top of a trignonal cardinal area engraved by tent-shaped grooves and covered with external ligament. Hinge arched, bearing a series of teeth diverging outwards. Two subequal adductor muscle scars, their inner margin with a radial ridge. Pallial line without a sinus.

Noetiidae: shell equivalve, generally inequilateral and longer than high. Umbones often opisthogyrate, set apart by a trignonal cardinal area. Ligament external, with oblique grooves and transverse striations. Hinge elongate, straightish, with numerous small transverse teeth. Two subequal adductor muscle scars with a ridge or a shelf along 1 or both scars. Pallial line without a sinus.

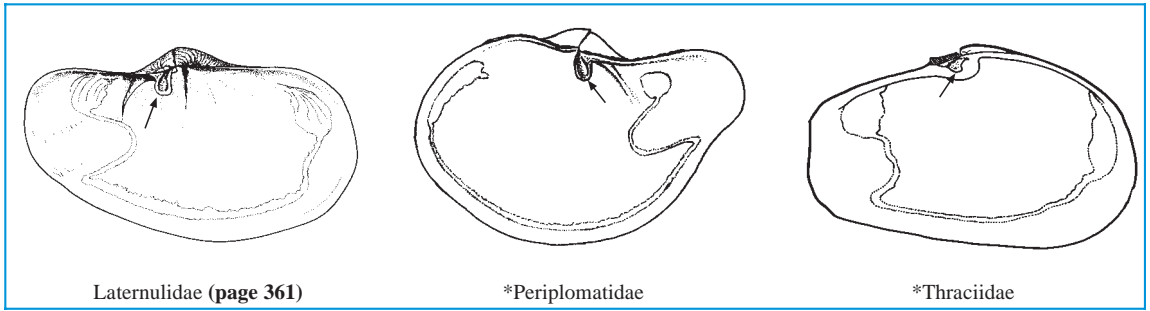


Figure I

Figure I:

Laternulidae: shell thin and brittle, elongate-ovate, truncate to rostrate posteriorly, gaping, subequivalve. Umbones with an obvious median slit. Outer surface finely granulated. Internal ligament attached on protruding spoon-like pits, each supported by an oblique radial ridge. Hinge without teeth. Interior subnacreous. Two adductor muscle scars. Pallial line with a broad sinus.

***Periplomatidae:** shell rounded, subrostrate posteriorly, gaping, markedly inequivalve. Umbones with an obvious median slit. Outer surface finely granulated. Internal ligament attached on protruding spoon-like pits, each supported by an oblique buttress. Hinge without teeth. Interior subnacreous. Two adductor muscle scars. Pallial line with a rather deep sinus.

***Thraciidae:** shell thin, elongate-ovate, truncate posteriorly, usually closed, subequivalve. Umbones without an obvious median slit. Outer surface finely granulated. Internal ligament attached on trigonal pits, not protruding ventrally nor supported by oblique buttresses. Hinge without teeth. Interior not nacreous. Two adductor muscle scars. Pallial line with a broad sinus.

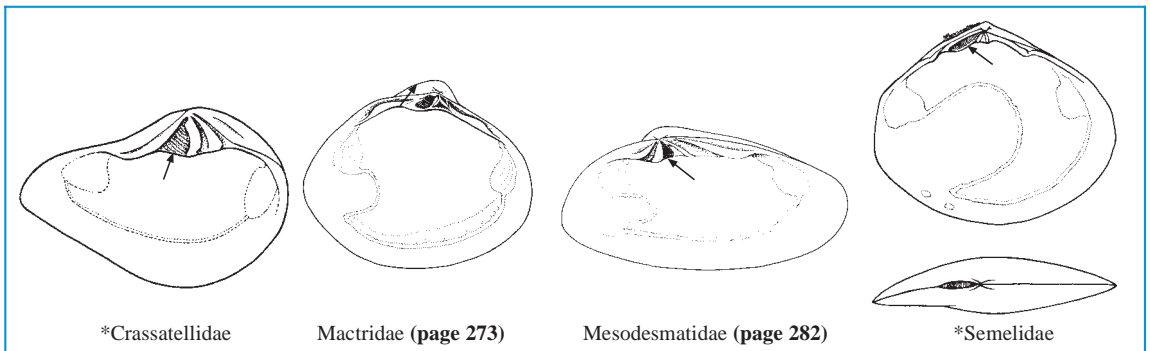


Figure J

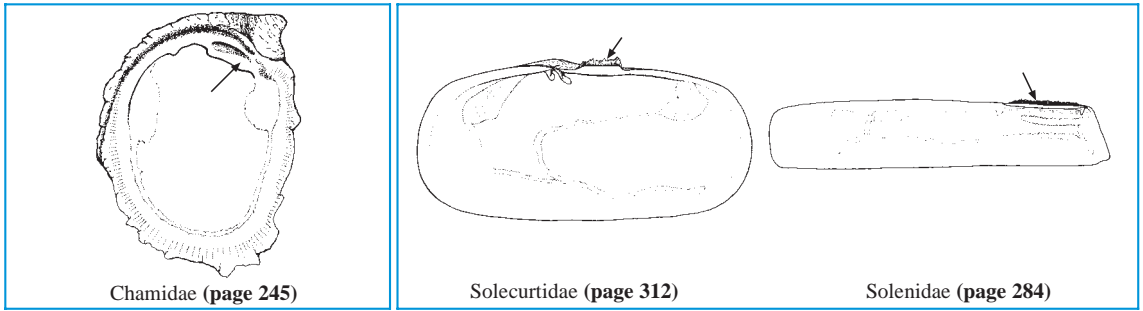
Figure J:

***Crassatellidae:** shell thick, equivalve. Umbones prosogyrate to orthogyrate. Sculpture mainly concentric. Lunule and escutcheon distinct. Internal ligament in a pit of hinge plate. Hinge with 2 cardinal teeth and lateral teeth. Two adductor muscle scars. Pallial line without a sinus.

Mactridae: shell equivalve. Umbones prosogyrate. Internal ligament well developed, in a trigonal pit of hinge plate. Hinge characteristic, with 2 cardinal teeth and lateral teeth; cardinal teeth of the left valve forming an inverted V-shaped process. Two adductor muscle scars. Pallial line with a well-developed sinus.

Mesodesmatidae: shell inequilateral, subtrigonal to wedge-shaped. Umbones opisthogyrate. Internal ligament in a deep pit of hinge plate. One or 2 cardinal teeth and lateral teeth. Two adductor muscle scars. Pallial line with a short sinus.

***Semelidae:** shell rather compressed, often slightly inequivalve, with a rightwards flexure posteriorly. Internal ligament in a small pit of hinge plate. Hinge with 2 cardinal teeth and lateral teeth. Two adductor muscle scars. Pallial line with a deep sinus. Cruciform muscles leaving small paired scars near pallial line.



Chamidae (page 245)

Figure K

Solecurtidae (page 312)

Solenidae (page 284)

Figure L

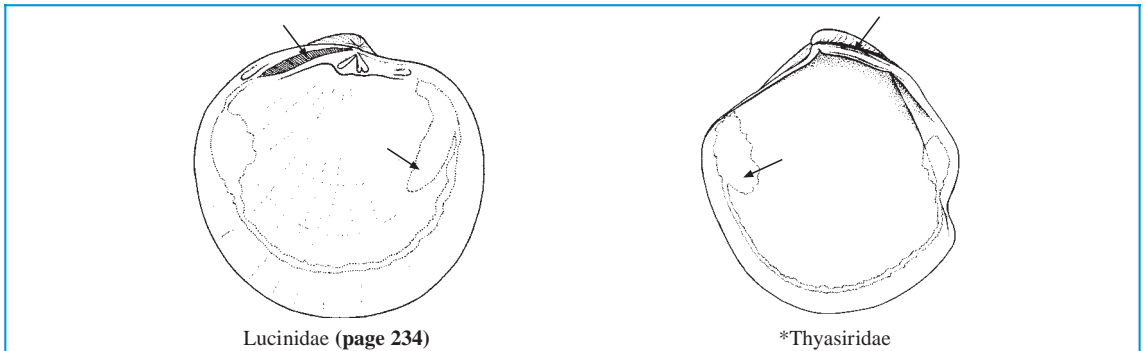
Figure K:

Chamidae: shell thick, strongly inequivalve and inequilateral; very variable in shape, cemented to substrate by either the left or the right valve. Umbones prosogyrate, low, spirally wound. Ligament external. Hinge with large, curved teeth and corresponding sockets, more or less parallel to dorsal margin. Two subequal adductor muscle scars. Pallial line without a sinus.

Figure L:

Solecurtidae: shell equivalve, elongate-quadrate, widely gaping at both ends. Umbones subcentral. Ligament external, on projecting nymphs. Two cardinal teeth in either valve. Two adductor muscle scars. Pallial sinus deep.

Solenidae: shell equivalve, with a narrowly elongate shape, gaping at both ends. Umbones more or less near the anterior end. Ligament external. Hinge feeble. Two adductor muscle scars, the anterior one larger. Pallial sinus relatively shallow.



Lucinidae (page 234)

*Thyasiridae

Figure M

Figure M:

Lucinidae: shell equivalve, lenticular, slightly inequilateral. Ligament more or less deeply sunken in posterodorsal margin. Two cardinal teeth and lateral teeth in either valve, sometimes reduced to absent. Two adductor muscle scars, the anterior narrowly elongate with an oblique ventral lobe detached from pallial line. No pallial sinus.

*Thyasiridae: shell equivalve, thin, trigonal, inequilateral. Posterior part of valves set off by 1 or more deep radial furrows or folds. Ligament marginal. Hinge teeth obsolete to absent. Two adductor muscle scars, the anterior elongate, with an oblique ventral lobe detached from pallial line. No pallial sinus.

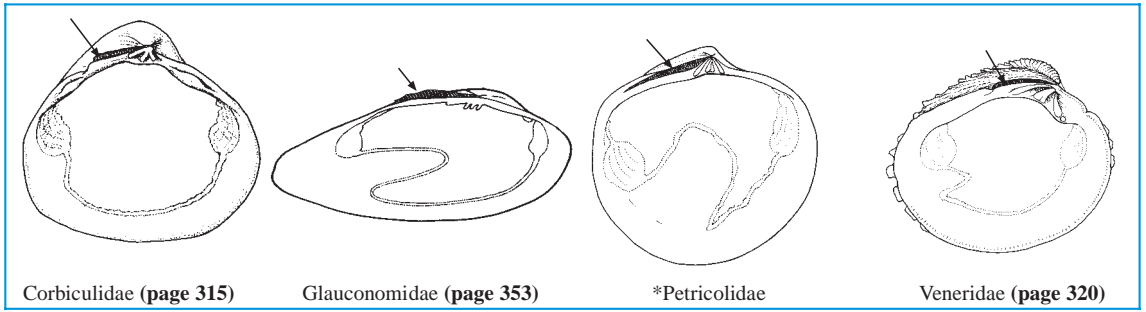


Figure N

Figure N:

Corbiculidae: shell equivalve, solid, umbones prosogyrate. No lunule nor escutcheon. Periostracum conspicuous. Ligament external. Three diverging cardinal teeth in each valve, and strong anterior and posterior lateral teeth. Two adductor muscle scars. Pallial sinus reduced to absent.

Glauconomidae: shell equivalve, gaping posteriorly, inequilateral. No lunule nor escutcheon. A conspicuous, greenish periostracum. Ligament external. Three cardinal teeth in each valve, lateral teeth wanting. Two adductor muscle scars. Pallial sinus deep and narrow.

***Petricolidae:** shell equivalve, inequilateral, with prosogyrate umbones. No lunule nor escutcheon. Three cardinal teeth in left valve and only 2 in right valve; lateral teeth wanting. Two adductor muscle scars. Pallial sinus deep.

Veneridae: shell mostly solid, equivalve, inequilateral, with prosogyrate umbones. Lunule and/or escutcheon usually present. Ligament external. Three cardinal teeth in each valve, anterior lateral teeth sometimes present. Two adductor muscle scars. Pallial sinus usually present.

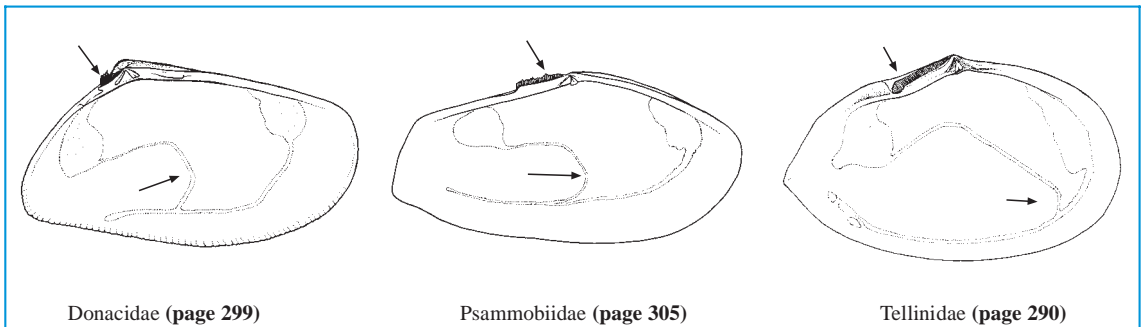


Figure O

Figure O:

Donacidae: shell equivalve, trigonal to wedge-shaped, with a shorter posterior end. Umbones opisthogyrate. Ligament external. Two small cardinal teeth and lateral teeth. Two adductor muscle scars. Pallial sinus deep. Cruciform muscle scars obscure.

Psammobiidae: shell ovate to subelliptical or trapezoidal, somewhat gaping. Ligament external, on projecting nymphs. Two small cardinal teeth in either valve; lateral teeth absent. Two adductor muscle scars. Pallial sinus deep. Cruciform muscle scars often obscure.

Tellinidae: shell rather thin and compressed, often slightly inequivalve, with a rightwards flexure on posterior end. Ligament external. Two small cardinal teeth in either valve; lateral teeth often present. Two adductor muscle scars. Pallial sinus deep. Cruciform muscles leaving small paired scars near pallial line.

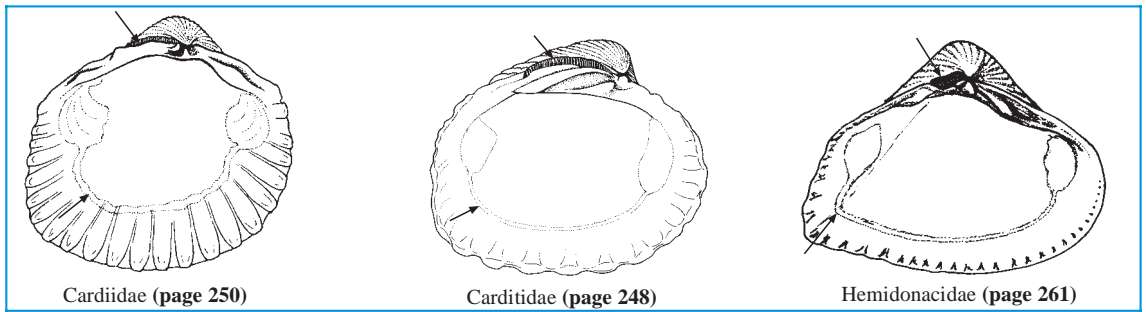


Figure P

Figure P:

Cardiidae: shell equivalve, inflated, oval to subquadrate, sometimes heart-shaped. Umbones prominent. External sculpture mostly radial. Ligament external. Hinge characteristic, with teeth curving outwards; 2 cardinal teeth and lateral teeth in each valve; cardinal teeth cruciform in arrangement. Two adductor muscle scars. Pallial line without a sinus.

Carditidae: shell equivalve, stout and inflated, inequilateral. Exterior mostly with radial ribs. Ligament external. Two cardinal teeth, unequal and with fine transverse striations; lateral teeth frequently reduced to absent. Two adductor muscle scars. Pallial line without a sinus.

Hemidonacidae: shell equivalve, subtrigonal to wedge-shaped and transversely elongate, more or less inequilateral. Outer surface with smooth radial ribs, often reduced on the anterior part of shell. Ligament external. Two cardinal teeth and elongate lateral teeth in each valve. Two adductor muscle scars. Pallial line without a sinus.

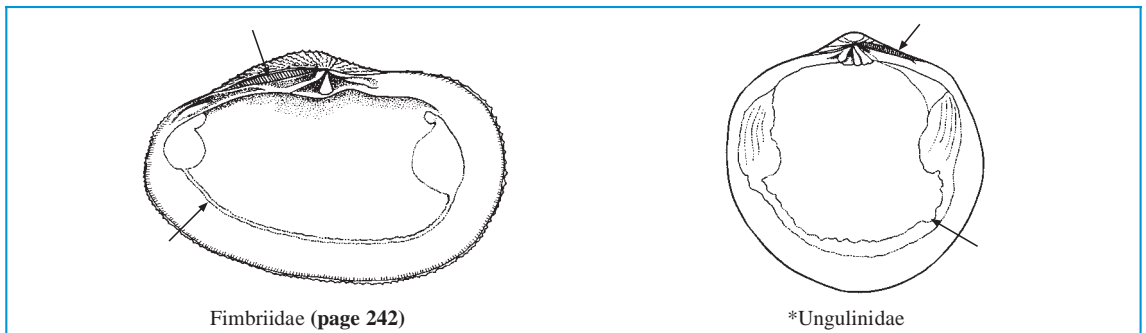


Figure Q

Figure Q:

Fimbriidae: shell equivalve, inflated, thick, transversely elliptical. Lunule lanceolate, escutcheon narrow. Outer surface with latticed sculpture, concentric ribs more prominent. Ligament marginal. Two massive cardinal teeth, one nearby anterior lateral tooth, and one long, remote posterior lateral tooth in each valve. Two adductor muscle scars. Pallial line devoid of sinus.

***Ungulinidae:** shell equivalve, lenticular, slightly inequilateral. Ligament external, not sunken in a marginal groove. Two cardinal teeth in either valve, lateral teeth reduced to absent. Two adductor muscle scars, the anterior elongate but without an oblique ventral lobe detached from pallial line. No pallial sinus.

**LIST OF FAMILIES AND SPECIES OF INTEREST TO FISHERIES
OCCURRING IN THE AREA**

The symbol  is given when species accounts are included.


ARCIDAE

-  *Anadara antiquata* (Linnaeus, 1758)
-  *Anadara ferruginea* (Reeve, 1844)
-  *Anadara granosa* (Linnaeus, 1758)
-  *Anadara nodifera* (Martens, 1860)
-  *Arca avellana* Lamarck, 1819
-  *Arca navicularis* Bruguière, 1789
-  *Arca ventricosa* Lamarck, 1819
-  *Barbatia foliata* (Forsskål, 1775)
-  *Barbatia fusca* (Bruguière, 1789)
-  *Scapharca cornea* (Reeve, 1844)
-  *Scapharca globosa* (Reeve, 1844)
-  *Scapharca inaequalis* (Bruguière, 1789)
-  *Scapharca indica* (Gmelin, 1791)
-  *Scapharca pilula* (Reeve, 1843)
-  *Trisidos semitorta* (Lamarck, 1819)
-  *Trisidos tortuosa* (Linnaeus, 1758)



CUCULLAEIDAE

-  *Cucullaea labiata* (Lightfoot, 1786)











NOETIIDAE

-  *Estellacar olivacea* (Reeve, 1844)





GLYCYMERIDIDAE

-  *Glycymeris reevei* (Mayer, 1868)
-  *Tucetona pectunculus* (Linnaeus, 1758)




MYTILIDAE

-  *Arcuatula arcuatula* (Hanley, 1843)
-  *Lithophaga teres* (Philippi, 1846)
-  *Modiolus aratus* (Dunker, 1857)
-  *Modiolus auriculatus* (Krauss, 1848)
-  *Modiolus metcalfei* (Hanley, 1843)
-  *Modiolus philippinarum* (Hanley, 1843)
-  *Musculista senhousia* (Benson, 1842)
-  *Perna viridis* (Linnaeus, 1758)
-  *Septifer bilocularis* (Linnaeus, 1758)
-  *Stavelia subdistorta* (Récluz, 1852)

PINNIDAE

-  *Atrina pectinata* (Linnaeus, 1767)
-  *Atrina vexillum* (Born, 1778)
-  *Pinna bicolor* Gmelin, 1791
-  *Pinna muricata* Linnaeus, 1758

PTERIIDAE

-  *Pinctada maculata* (Gould, 1850)
-  *Pinctada margaritifera* (Linnaeus, 1758)
-  *Pinctada maxima* (Jameson, 1901)

- 🐚 *Pinctada radiata* (Leach, 1814)
- 🐚 *Pteria avicular* (Holten, 1802)
- 🐚 *Pteria penguin* (Röding, 1798)

ISOGNOMONIDAE

- 🐚 *Isognomon ehippium* (Linnaeus, 1758)
- 🐚 *Isognomon isognomum* (Linnaeus, 1758)
- 🐚 *Isognomon perna* (Linnaeus, 1767)

MALLEIDAE

- 🐚 *Malleus albus* Lamarck, 1819
- 🐚 *Malleus malleus* (Linnaeus, 1758)
- 🐚 *Malleus regula* (Forsskål, 1775)

PECTINIDAE

- 🐚 *Amusium japonicum* (Gmelin, 1791)
- 🐚 *Amusium pleuronectes* (Linnaeus, 1758)
- 🐚 *Annachlamys flabellata* (Lamarck, 1818)
- 🐚 *Bractechlamys vexillum* (Reeve, 1853)
- 🐚 *Chlamys senatoria* (Gmelin, 1791)
- 🐚 *Chlamys squamata* (Gmelin, 1791)
- 🐚 *Decatopecten amiculum* (Philippi, 1851)
- 🐚 *Decatopecten radula* (Linnaeus, 1758)
- 🐚 *Gloripallium pallium* (Linnaeus, 1758)
- 🐚 *Minnivola pyxidata* (Born, 1778)
- 🐚 *Volachlamys singaporina* (Sowerby, 1842)

SPONDYLIDAE

- 🐚 *Spondylus barbatus* Reeve, 1856
- 🐚 *Spondylus butleri* Reeve, 1856
- 🐚 *Spondylus imperialis* Chenu, 1843
- 🐚 *Spondylus squamosus* Schreibers, 1793
- 🐚 *Spondylus versicolor* Schreibers, 1793

PLACUNIDAE

- 🐚 *Placuna ehippium* (Philipsson, 1788)
- 🐚 *Placuna placenta* (Linnaeus, 1758)

LIMIDAE

- 🐚 *Acesta rathbuni* (Bartsch, 1913)
- 🐚 *Lima vulgaris* (Link, 1807)

GRYPHAEIDAE

- 🐚 *Hyotissa hyotis* (Linnaeus, 1758)

OSTREIDAE

- 🐚 *Alectryonella plicatula* (Gmelin, 1791)
- 🐚 *Crassostrea gigas* (Thunberg, 1793)
- 🐚 *Crassostrea iredalei* (Faustino, 1932)
- 🐚 *Dendostrea folium* (Linnaeus, 1758)
- 🐚 *Lopha cristagalli* (Linnaeus, 1758)
- 🐚 *Planostrea pestigris* (Hanley, 1846)
- 🐚 *Saccostrea cucullata* (Born, 1778)

LUCINIDAE

- 🐚 *Anodontia edentula* (Linnaeus, 1758)
- 🐚 *Austriella corrugata* (Deshayes, 1843)
- 🐚 *Codakia interrupta* (Lamarck, 1816)
- 🐚 *Codakia punctata* (Linnaeus, 1758)
- 🐚 *Codakia tigrina* (Linnaeus, 1758)
- 🐚 *Epicodakia bella* (Conrad, 1837)

FIMBRIIDAE

- 🐚 *Fimbria fimbriata* (Linnaeus, 1758)
- 🐚 *Fimbria soverbii* (Reeve, 1842)

CHAMIDAE

- 🐚 *Chama lazarus* Linnaeus, 1758
- 🐚 *Chama pacifica* Broderip, 1834
- 🐚 *Chama savignyi* Lamy, 1921

CARDITIDAE

- 🐚 *Beguina semiorbiculata* (Linnaeus, 1758)
- 🐚 *Cardites bicolor* (Lamarck, 1819)

CARDIIDAE

- 🐚 *Corculum cardissa* (Linnaeus, 1758)
- 🐚 *Fragum fragum* (Linnaeus, 1758)
- 🐚 *Fragum hemicardium* (Linnaeus, 1758)
- 🐚 *Fragum unedo* (Linnaeus, 1758)
- 🐚 *Fulvia papyracea* (Bruguère, 1789)
- 🐚 *Plagiocardium pseudolatum* (Voskuil and Onverwagt, 1991)
- 🐚 *Trachycardium angulatum* (Lamarck, 1819)
- 🐚 *Trachycardium orbita* (Sowerby, 1833)
- 🐚 *Trachycardium rugosum* (Lamarck, 1819)
- 🐚 *Trachycardium subrugosum* (Sowerby, 1840)
- 🐚 *Vepricardium asiaticum* (Bruguère, 1789)
- 🐚 *Vepricardium sinense* (Sowerby, 1841)

HEMIDONACIDAE

- 🐚 *Hemidonax donaciformis* (Bruguère, 1792)

TRIDACNIDAE

- 🐚 *Hippopus hippopus* (Linnaeus, 1758)
- 🐚 *Hippopus porcellanus* Rosewater, 1982
- 🐚 *Tridacna crocea* Lamarck, 1819
- 🐚 *Tridacna derasa* (Röding, 1798)
- 🐚 *Tridacna gigas* (Linnaeus, 1758)
- 🐚 *Tridacna maxima* (Röding, 1798)
- 🐚 *Tridacna squamosa* Lamarck, 1819

MACTRIDAE

- 🐚 *Mactra achatina* Holten, 1802
- 🐚 *Mactra cuneata* Gmelin, 1791
- 🐚 *Mactra luzonica* Reeve, 1854
- 🐚 *Mactra maculata* Gmelin, 1791
- 🐚 *Mactra mera* Reeve, 1854
- 🐚 *Mactra violacea* Gmelin, 1791
- 🐚 *Meropesta capillacea* (Reeve, 1854)
- 🐚 *Meropesta pellucida* (Gmelin, 1791)

MESODESMATIDAE

- 🐚 *Atactodea striata* (Gmelin, 1791)

SOLENIDAE

- 🐚 *Pharella acutidens* (Broderip and Sowerby, 1828)
- 🐚 *Pharella javanica* (Lamarck, 1818)
- 🐚 *Siliqua winteriana* Dunker, 1852
- 🐚 *Solen grandis* Dunker, 1861
- 🐚 *Solen lamarckii* Deshayes, 1839
- 🐚 *Solen roseomaculatus* Pilsbry, 1901

TELLINIDAE

- 🐚 *Apolymetis ephippium* (Spengler, 1798)
- 🐚 *Tellina foliacea* Linnaeus, 1758
- 🐚 *Tellina linguafelis* Linnaeus, 1758
- 🐚 *Tellina palatam* (Iredale, 1929)
- 🐚 *Tellina remies* Linnaeus, 1758
- 🐚 *Tellina scobinata* Linnaeus, 1758
- 🐚 *Tellina staurella* Lamarck, 1818
- 🐚 *Tellina timorensis* (Lamarck, 1818)
- 🐚 *Tellina virgata* Linnaeus, 1758

DONACIDAE

- 🐚 *Donax cuneatus* Linnaeus, 1758
- 🐚 *Donax deltoides* Lamarck, 1818
- 🐚 *Donax faba* Gmelin, 1791
- 🐚 *Donax incarnatus* Gmelin, 1791
- 🐚 *Donax scortum* (Linnaeus, 1758)

PSAMMOBIIDAE

- 🐚 *Asaphis violascens* (Forsskål, 1775)
- 🐚 *Gari elongata* (Lamarck, 1818)
- 🐚 *Gari squamosa* (Lamarck, 1818)
- 🐚 *Gari togata* (Deshayes, 1855)
- 🐚 *Gari truncata* (Linnaeus, 1767)
- 🐚 *Soletellina diphos* (Linnaeus, 1771)

SOLECURTIDAE

- 🐚 *Azorinus abbreviatus* (Gould, 1861)
- 🐚 *Solecortus divaricatus* (Lischke, 1869)

CORBICULIDAE

- 🐚 *Batissa violacea* (Lamarck, 1806)
- 🐚 *Polymesoda bengalensis* (Lamarck, 1818)
- 🐚 *Polymesoda erosa* (Lightfoot, 1786)
- 🐚 *Polymesoda expansa* (Mousson, 1849)

VENERIDAE

- 🐚 *Anomalocardia squamosa* (Linnaeus, 1758)
- 🐚 *Circe scripta* (Linnaeus, 1758)
- 🐚 *Cyclina sinensis* (Gmelin, 1791)
- 🐚 *Gafrarium dispar* (Dillwyn, 1817)
- 🐚 *Gafrarium divaricatum* (Gmelin, 1791)
- 🐚 *Gafrarium pectinatum* (Linnaeus, 1758)
- 🐚 *Gafrarium tumidum* (Röding, 1798)
- 🐚 *Gomphina aequilatera* (Sowerby, 1826)
- 🐚 *Katelsia hiantina* (Lamarck, 1818)
- 🐚 *Katelsia japonica* (Gmelin, 1791)
- 🐚 *Katelsia marmorata* (Lamarck, 1818)
- 🐚 *Lioconcha castrensis* (Linnaeus, 1758)
- 🐚 *Lioconcha ornata* (Dillwyn, 1817)
- 🐚 *Marcia opima* (Gmelin, 1791)
- 🐚 *Meretrix lyrata* (Sowerby, 1851)
- 🐚 *Meretrix meretrix* (Linnaeus, 1758)
- 🐚 *Paphia gallus* (Gmelin, 1791)
- 🐚 *Paphia semirugata* (Philippi, 1847)
- 🐚 *Paphia textile* (Gmelin, 1791)
- 🐚 *Paphia undulata* (Born, 1778)
- 🐚 *Periglypta clathrata* (Deshayes, 1854)
- 🐚 *Periglypta puerpera* (Linnaeus, 1758)
- 🐚 *Periglypta reticulata* (Linnaeus, 1758)
- 🐚 *Pitar citrinus* (Lamarck, 1818)
- 🐚 *Pitar pellucidus* (Lamarck, 1818)
- 🐚 *Placamen tiara* (Dillwyn, 1817)
- 🐚 *Ruditapes philippinarum* (Adams and Reeve, 1850)
- 🐚 *Ruditapes variegatus* (Sowerby, 1852)
- 🐚 *Sunetta menstrualis* (Menke, 1843)
- 🐚 *Sunetta truncata* (Deshayes, 1853)
- 🐚 *Tapes belcheri* Sowerby, 1852
- 🐚 *Tapes dorsatus* (Lamarck, 1818)
- 🐚 *Tapes literatus* (Linnaeus, 1758)

GLAUCONOMIDAE

- 🐚 *Glaucanome virens* (Linnaeus, 1767)

PHOLADIDAE

- 🐚 *Barnea dilatata* (Souleyet, 1843)
- 🐚 *Barnea manilensis* (Philippi, 1847)
- 🐚 *Martesia striata* (Linnaeus, 1758)
- 🐚 *Pholas orientalis* Gmelin, 1791

TEREDINIDAE

- 🐚 *Bactronophorus thoracites* (Gould, 1856)
- 🐚 *Lyrodus pedicellatus* (Quatrefages, 1849)

LATERNULIDAE

- 🐚 *Laternula truncata* (Lamarck, 1818)

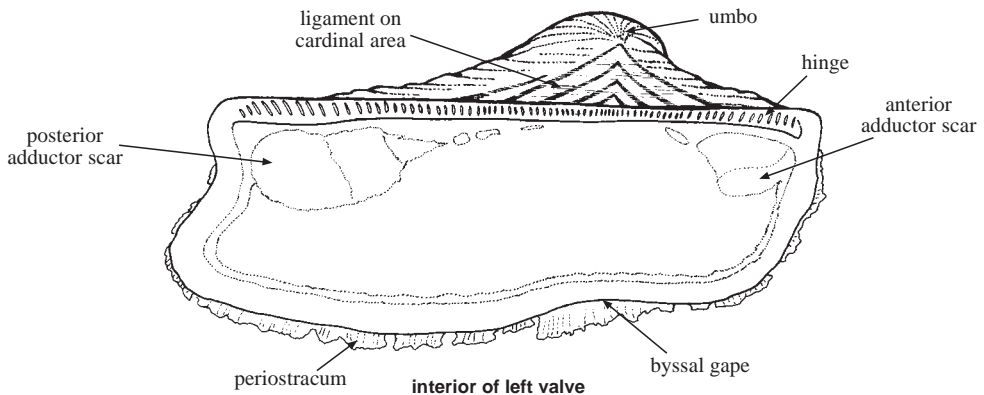
References

- Abbott, R.T. 1991. *Seashells of Southeast Asia*. Thornhill, Tynron, 145 p.
- Boss, K.J. 1982. Mollusca. *In* *Synopsis and classification of living organisms. Vol.1*, edited by S.P. Parker. New York, Mc Graw-Hill, pp. 945-1166.
- Cernohorsky, W.O. 1972. *Marine shells of the Pacific. Volume II*. Sydney, Pacific Publications, 411 p.
- Dharma, B. 1992. *Siput dan Keran Indonesia. Indonesian Shells II*. Wiesbaden, Hemmen, 135 p.
- Franc, A. 1960. Classe des Bivalves. Bivalvia Linné, 1758; Acephala Link, 1807; Lamellibranchiata Blainville, 1814; Pelecypoda Goldfuss, 1820. *In* *Traité de Zoologie. Anatomie, systématique, biologie. Tome V (Deuxième Fascicule)*, edited by P.P. Grassé. Paris, Masson, pp. 1845-2133.
- Habe, T. 1964. *Shells of the Western Pacific in color Vol.II*. Osaka, Hoikusha, 233 p.
- Habe, T. 1965. *New illustrated encyclopedia of the fauna of Japan. [II]. Mollusca*. Tokyo, Hokuryukan, 332 p.
- Habe, T. 1977. *Systematics of mollusca in Japan. Bivalvia and Scaphopoda*. Tokyo, Hokuryukan, 372 p.
- Habe, T. and S. Kosuge. 1966. *Shells of the world in colour. Vol.II. The tropical Pacific*. Osaka, Hoikusha, 193 p.
- Kira, T. 1962. *Shells of the Western Pacific in color. Vol.I*. Osaka, Hoikusha, 224 p.
- Lamprell, K. and T. Whitehead. 1992. *Bivalves of Australia. Volume 1*. Bathurst, Crawford House Press, 182 p.
- Moore, R.C. (ed.). 1969-1971. *Treatise on invertebrate paleontology. Part N. Volumes 1 to 3. Mollusca 6. Bivalvia*. Geological Society of America, Boulder and University of Kansas, Lawrence, 224 p.
- Okutani, T. and T. Habe. 1975. *Gakken illustrated nature encyclopedia. The mollusks of Japan II (Bivalves, Snails, Squids, Octopuses, etc.)*. Tokyo, Gakken, 294 p.
- Salvat, B. and C. Rives. 1975. *Coquillages de Polynésie*. Papeete, Editions du Pacifique, 392 p.
- Springsteen, F.J. and F.M. Leobrera. 1986. *Shells of the Philippines*. Manila, Carfel Seashell Museum, 377 p.
- Vaught, K.C. 1989. *A classification of the living mollusca*. Melbourne, American Malacologists, 195 p.

ARCIDAE

Ark shells

Diagnostic characters: Shell solid, **equivalve or slightly inequivalve**, in the latter case left valve somewhat overlapping right; roughly quadrate to ovate in shape and **mostly longer than high, more or less inequilateral**. A byssal gape sometimes developed on ventral margin. **Umboes** in front of the midline, **prosogyrate, on top of a wide cardinal area**. **Ligament external**, stretching across the cardinal area, **often with V-shaped grooves**. Outer surface of shell with radial ribs, often crossed by concentric sculpture. Periostracum well developed, often thick and fibrous, lamellate to hairy. **Hinge elongate, almost straight** to slightly arched, **with numerous small transverse teeth** which increase in size towards anterior and posterior ends. Interior of shell porcelaneous. **Two subequal adductor muscle scars**. **Pallial line without a sinus**. Internal margins of valves smooth to strongly crenulated. Gills of filibranchiate type, without interlamellar junctions. Blood of red colour, due to the presence of the respiratory pigment haemoglobin. Siphons absent. Foot stout, deeply grooved, mostly byssiferous, at least in young stages. Mantle widely open, with compound eyes covered by periostracum on margins.



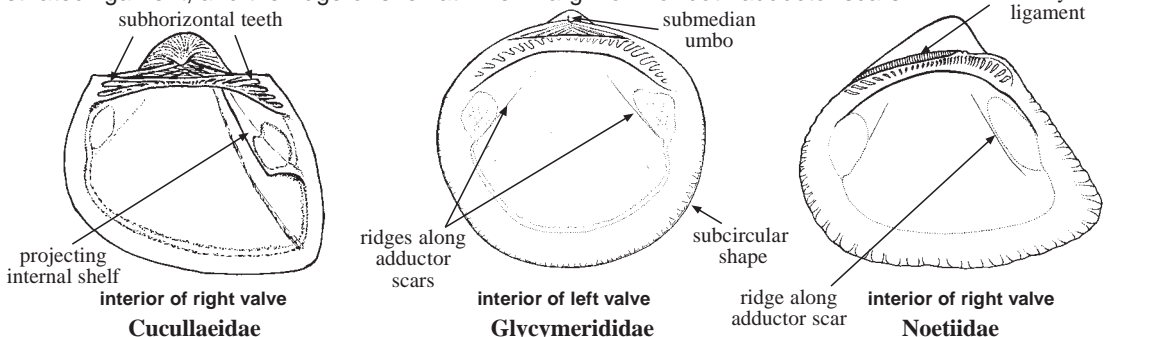
Habitat, biology, and fisheries: Sedentary animals, living attached to the substrate by means of their fringe-like byssus and sometimes nestling in rock crevices, or unattached and often more or less buried in soft bottoms. The presence of haemoglobin enables them to colonize habitats of low oxygen concentration. Sexes generally separate. Pelagic larval stage relatively long. Arcidae are actively collected for food in the area; species of *Anadara* or *Scapharca* represent major commercial species, often cultivated and collectively known as “blood cockles”.

Similar families occurring in the area

Cucullaeidae: very similar to Arcidae in shell shape, but recognizable by the submedian umbones, the strongly projecting shelf on anterior side of posterior adductor scar, and the elongated, subhorizontal teeth at both ends of the hinge.

Glycymerididae: shell equilateral or nearly so, subcircular in shape; umbones submedian; dental series of the hinge generally strongly arched ventrally; a radial ridge along inner margin of the adductor scars, always stronger at front of the posterior scar.

Noetiidae: shell very similar to Arcidae in general shape and hinge characters; differ by the transversally striated ligament, and the ridge or shelf at inner margin of 1 or both adductor scars.



Key to species of interest to fisheries occurring in the area

- 1a. Posterior part of the shell twisted towards the left (Fig. 1a, b) → 2
- 1b. Posterior part of the shell not twisted towards the left → 3
- 2a. Shell relatively inflated and slightly twisted (Fig. 1a) *Trisidos semitorta*
- 2b. Shell relatively compressed and strongly twisted (Fig. 1b) *Trisidos tortuosa*

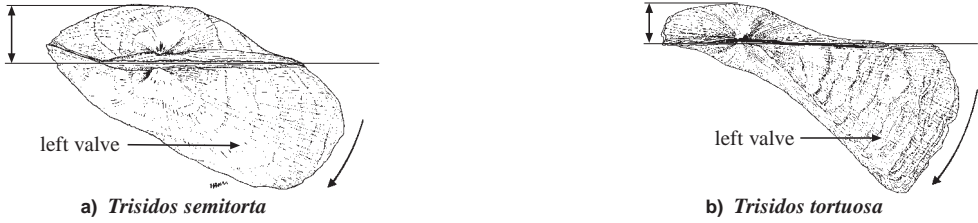


Fig. 1 dorsal view

- 3a. Ventral margin with a byssal gape; inner, ventral margin smooth, sometimes a little affected by the external ribs (Fig. 2) → 4
- 3b. Ventral margin without a byssal gape; inner, ventral margin with strong crenulations corresponding with the external ribs (Fig. 3) → 8
- 4a. Ligamental area wide and almost flat, meeting the commissural plane of valves nearly at right angle (Fig. 4a) → 5
- 4b. Ligamental area narrow and slanting to commissural plane of valves (Fig. 4b) → 7

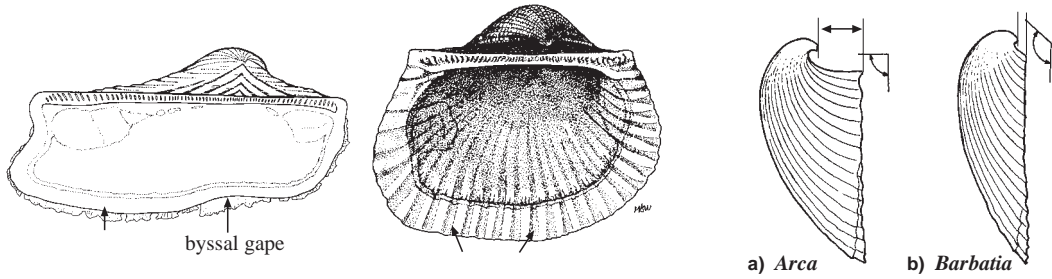


Fig. 2

Fig. 3

Fig. 4 anterior view

- 5a. Umbonoventral keel sharply angulated; outer surface of shell without undulating brown stripes (Fig. 5) *Arca avellana*
- 5b. Umbonoventral keel more or less rounded; outer surface of shell with undulating brown stripes (Fig. 7) → 6
- 6a. Umbones very prominent, close to anterior end of shell which is obtusely angulated; radial ribs relatively fine (Fig. 6) *Arca ventricosa*
- 6b. Umbones moderately prominent, distant from anterior end of shell which is somewhat acutely angulated; radial ribs relatively coarse (Fig. 7) *Arca navicularis*

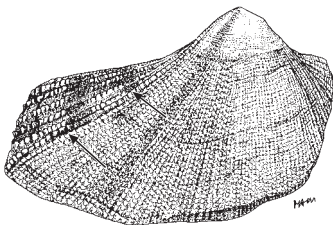


Fig. 5 Arca avellana (exterior)

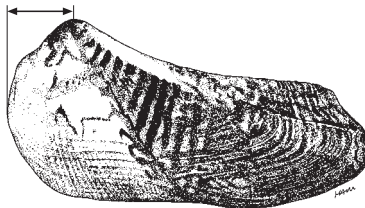


Fig. 6 Arca ventricosa (exterior)

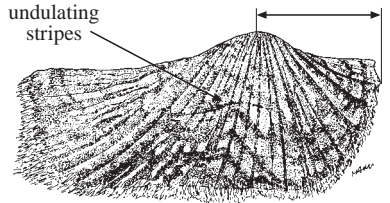


Fig. 7 Arca navicularis (exterior)

- 7a. Outer surface of shell dark brown, often with 2 or 3 pale bands radiating from the umbones (Fig. 8) *Barbatia fusca*
- 7b. Outer surface of shell whitish (Fig. 9) *Barbatia foliata*
- 8a. Shell slightly inequivalve, left valve overlapping right valve (Fig. 10) → 9
- 8b. Shell equivalve, valves exactly meeting on margins → 13

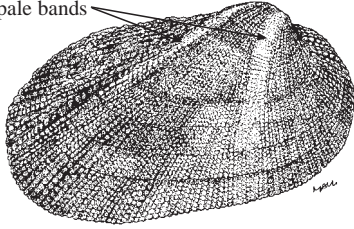


Fig. 8 *Barbatia fusca* (exterior)

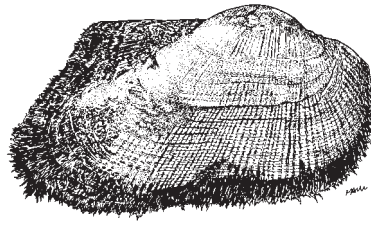


Fig. 9 *Barbatia foliata* (exterior)

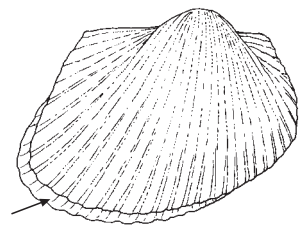
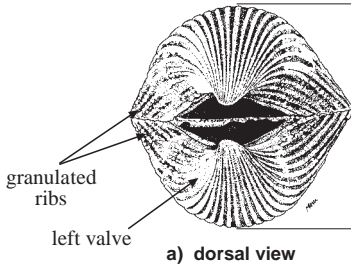


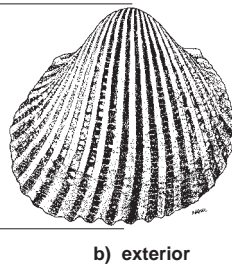
Fig. 10 *Scapharca*

- 9a. Shell spherically inflated, with height as great as inflation; radial ribs granulated on both valves (Fig. 11) *Scapharca pilula*
- 9b. Shell transversally elongated, with height greater than inflation; radial ribs granulated on left valve only, or smooth on both valves → 10
- 10a. Shell compressed laterally; ribs interstices narrow (Fig. 12) *Scapharca indica*
- 10b. Shell inflated; ribs interstices relatively wide → 11



a) dorsal view

Fig. 11 *Scapharca pilula*



b) exterior

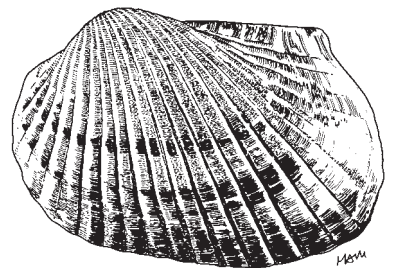


Fig. 12 *Scapharca indica* (exterior)

- 11a. Radial ribs smooth on both valves (Fig. 13) *Scapharca globosa*
- 11b. Radial ribs granulated on left valve → 12
- 12a. About 28 radial ribs (26 to 30) at each valve; shell frequently tinged bluish green posteriorly (Fig. 14) *Scapharca cornea*
- 12b. About 33 radial ribs (30 to 36) at each valve; shell not tinged bluish green posteriorly (Fig. 15) *Scapharca inaequalvis*

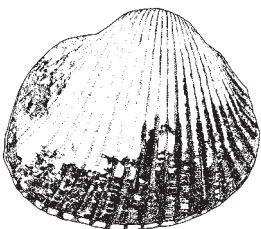


Fig. 13 *Scapharca globosa* (exterior)

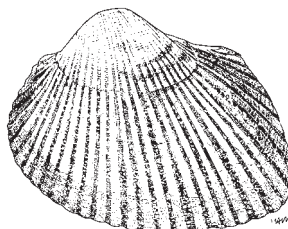


Fig. 14 *Scapharca cornea* (exterior)

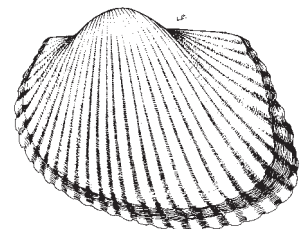


Fig. 15 *Scapharca inaequalvis* (exterior)

- 13a. Ribs strongly rugose on both valves → 14
- 13b. Ribs at most slightly granulated → 15

- 14a.** Shell slightly longer than high, with strongly protruding umbones; about 18 radial ribs (15 to 20) at each valve (Fig. 16) *Anadara granosa*
- 14b.** Shell markedly longer than high, with moderately protruding umbones; about 21 radial ribs (19 to 23) at each valve (Fig. 17) *Anadara nodifera*

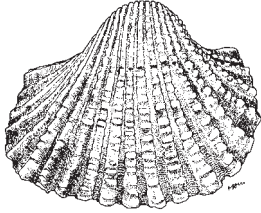


Fig. 16 *Anadara granosa* (exterior)

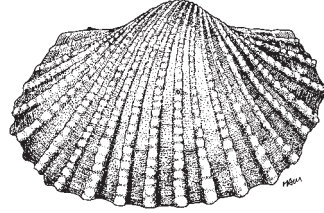


Fig. 17 *Anadara nodifera* (exterior)

- 15a.** About 40 radial ribs (35 to 44) at each valve; radial ribs with a narrow median groove on top (most visible on anterior ribs of mature specimens) (Fig. 18) *Anadara antiquata*
- 15b.** About 28 radial ribs (27 to 29) at each valve; radial ribs without a narrow median groove on top (Fig. 19) *Anadara ferruginea*

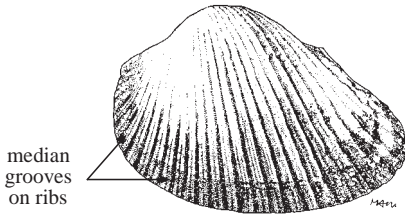


Fig. 18 *Anadara antiquata* (exterior)

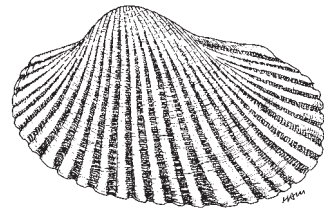


Fig. 19 *Anadara ferruginea* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Anadara antiquata* (Linnaeus, 1758)
- 🐚 *Anadara ferruginea* (Reeve, 1844)
- 🐚 *Anadara granosa* (Linnaeus, 1758)
- 🐚 *Anadara nodifera* (Martens, 1860)
- 🐚 *Arca avellana* Lamarck, 1819
- 🐚 *Arca navicularis* Bruguière, 1789
- 🐚 *Arca ventricosa* Lamarck, 1819
- 🐚 *Barbatia foliata* (Forsskål, 1775)
- 🐚 *Barbatia fusca* (Bruguière, 1789)
- 🐚 *Scapharca cornea* (Reeve, 1844)
- 🐚 *Scapharca globosa* (Reeve, 1844)
- 🐚 *Scapharca inaequalis* (Bruguière, 1789)
- 🐚 *Scapharca indica* (Gmelin, 1791)
- 🐚 *Scapharca pilula* (Reeve, 1843)
- 🐚 *Trisidos semitorta* (Lamarck, 1819)
- 🐚 *Trisidos tortuosa* (Linnaeus, 1758)

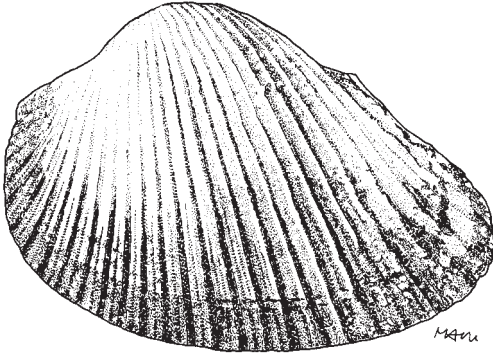
References

- Habe, T. 1964. Notes on strange ark shell *Trisidos* Röding. *Bull. natn. Sci. Mus.*, 7(3):255-257.
- Habe, T. 1965. The arcid subfamily Anadarinae in Japan and its adjacent areas (Mollusca). *Bull. Natn. Sci. Mus.*, 8(1):71-85.
- Lamy, E. 1907a. Révision des *Arca vivants* du Muséum d'Histoire Naturelle de Paris. *J. Conchyl.*, 55(1):1-111.
- Lamy, E. 1907b. Révision des *Arca vivants* du Muséum d'Histoire Naturelle de Paris (Suite). *J. Conchyl.*, 55(3):199-307.
- Morton, B.S. 1983. The biology and functional morphology of the twisted ark *Trisidos semitorta* (Bivalvia: Arcacea) with a discussion on shell "torsion" in the genus. *Malacologia*, 23(2):375-396.

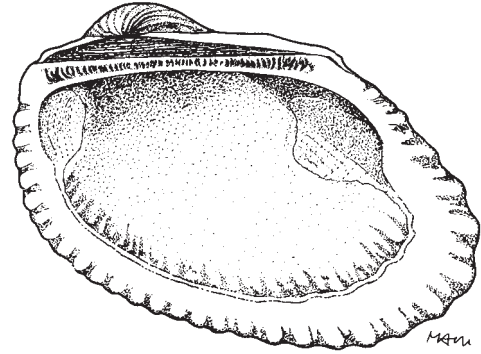
Anadara antiquata (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Anadara maculosa* (Reeve, 1844); *A. scapha* (Meuschen, 1781) (Invalid name); *A. vetula* Dall, Bartsch, and Rehder, 1938 / None.

FAO names: En - Antique ark; Fr - Arche antique.



exterior of left valve
(after Habe, 1965)



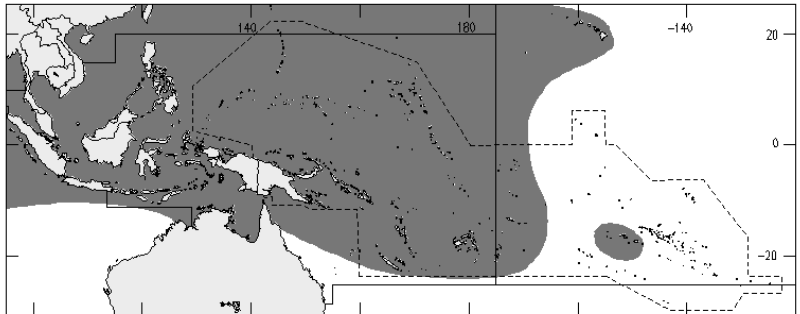
interior of right valve
(after Habe, 1977)

Diagnostic characters: Shell equivalve, solid, inequilateral, **obliquely ovate and elongate in outline, with an extended posteroventral part.** Umbones much inflated, situated rather forwards, cardinal area narrow and elongate. **About 40 radial ribs** (35 to 44) at each valve; ribs usually **with a narrow median groove on top**, most visible towards the anterior ventral margin of valves in mature specimens. **Periostracum** coarse and **velvety**, often eroded on umbones. Internal margins with strong crenulations corresponding with the external radial ribs. **No byssal gape.** **Colour:** **outside of shell greyish white, often stained darker grey** on umbonal and posterior areas; **periostracum dark brown.** Inner side white, sometimes light yellow in the umbonal cavity.

Size: Maximum shell length 10.5 cm, commonly to 7 cm.

Habitat, biology, and fisheries: On muddy bottoms. Intertidal and sublittoral to a depth of 25 m. Locally collected for food in many areas. Important commercial species in Indonesia, based on the exploitation of natural beds.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea to eastern Polynesia; north to southern Japan and Hawaii, and south to northern Australia and New Caledonia.

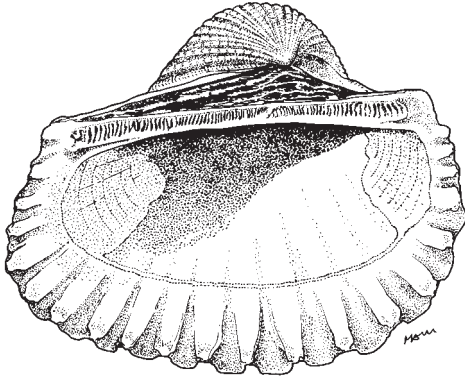


Anadara granosa (Linnaeus, 1758)

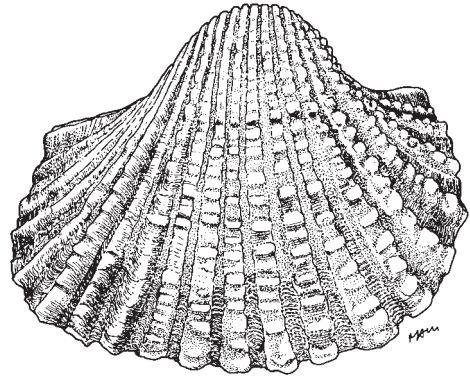
BLC

Frequent synonyms / misidentifications: *Anadara bisenensis* Schrenck and Reinhardt, 1938; *Arca granosa* Linnaeus, 1758; *Tegillarca granosa* (Linnaeus, 1758) / None.

FAO names: **En** - Granular ark (formerly reported as "blood cockle"); **Fr** - Arche granuleuse; **Sp** - Arco del Pacifico occidental.



interior of left valve



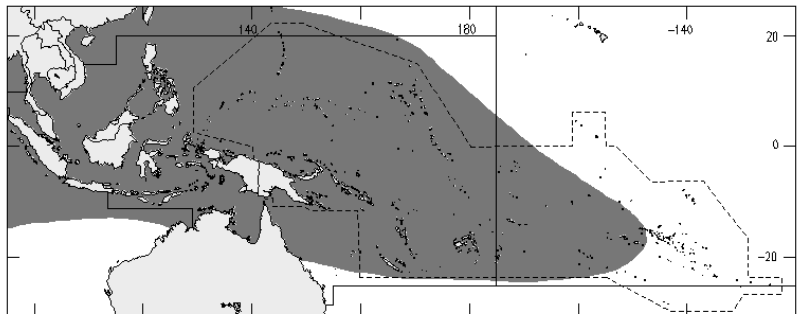
exterior of right valve

Diagnostic characters: **Shell equivalve**, thick and solid, ovate, **strongly inflated, slightly longer than high** and feebly inequilateral. Umbones strongly protruding, cardinal area rather large. **About 18 radial ribs** (15 to 20) with wide interstices at each valve; ribs stout and distinctly rugose, bearing regular, often rectangular nodules. **Periostracum rather thin and smooth**. Internal margins with strong crenulations corresponding with the external radial ribs. **No byssal gape**. **Colour:** outside of shell white under the **yellowish brown periostracum**. Inner side white, often tinged light yellow towards the umbonal cavity.

Size: Maximum shell length 9 cm, commonly to 6 cm.

Habitat, biology, and fisheries: On muddy bottoms, mainly in protected bays and estuaries, or in mangroves. Often occurring in dense populations. Intertidal and shallow subtidal waters. Actively exploited or cultivated in many areas of the Indo-West Pacific, this species represents the most important commercial ark. From 1990 to 1995, FAO's Yearbook of Fishery Statistics reports a range of yearly production from around 12 300 to 22 600 t of *Anadara granosa* in the Western Central Pacific (Malaysia, Thailand). The name "blood cockle", often used for this species and for other large species of *Anadara* and *Scapharca*, is due to the respiratory pigment haemoglobin colouring its tissues.

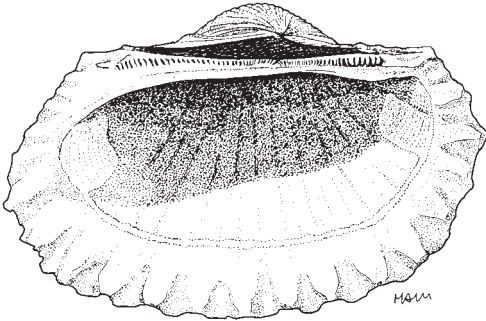
Distribution: Widespread in the Indo-West Pacific, from East Africa to Polynesia; north to Japan and south to northern and eastern Australia.



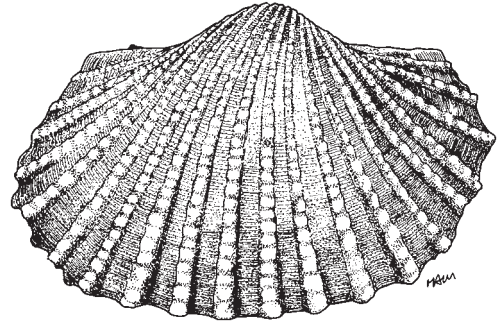
Anadara nodifera (Martens, 1860)

Frequent synonyms / misidentifications: *Tegillarca nodifera* (Martens, 1860) / None.

FAO names: En - Nodular ark; Fr - Arche noduleuse.



interior of left valve



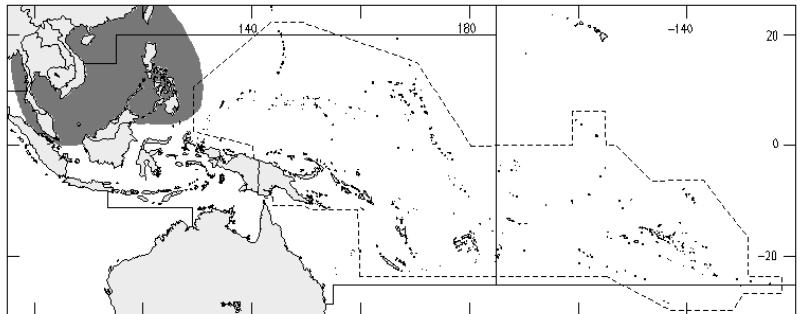
exterior of right valve

Diagnostic characters: Shell **equivalve, moderately inflated** and solid, oblong ovate and **distinctly longer than high**. Umbones moderately protruding, cardinal area rather narrow. **About 21 radial ribs** (19 to 23) at each valve; ribs quite narrow and sharp, **distinctly rugose**, bearing regular rounded nodules on top. **Periostracum** rather thin and **smooth**. Internal margins with strong crenulations corresponding with the external radial ribs. **No byssal gape**. **Colour:** outside of shell white under the **medium brown periostracum**. Inner side milky white.

Size: Maximum shell length 6 cm, commonly to 4 cm.

Habitat, biology, and fisheries: On mud and sand bottoms. Intertidal and shallow sublittoral waters to a depth of 10 m. Local exploitation and aquaculture in Thailand.

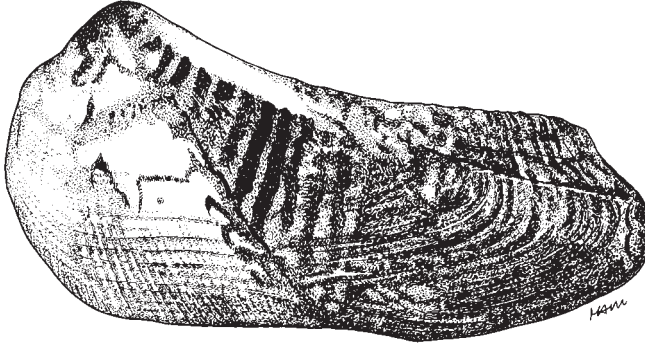
Distribution: Eastern Indian Ocean to tropical West Pacific, from Myanmar to the Philippines; north to East China Sea and south to Malaysia.



***Arca ventricosa* Lamarck, 1819**

Frequent synonyms / misidentifications: *Arca truncata* (Sowerby, 1839) / *Arca zebra* (Swainson, 1833).

FAO names: En - Ventricose ark; Fr - Arche ventrue.



exterior of left valve

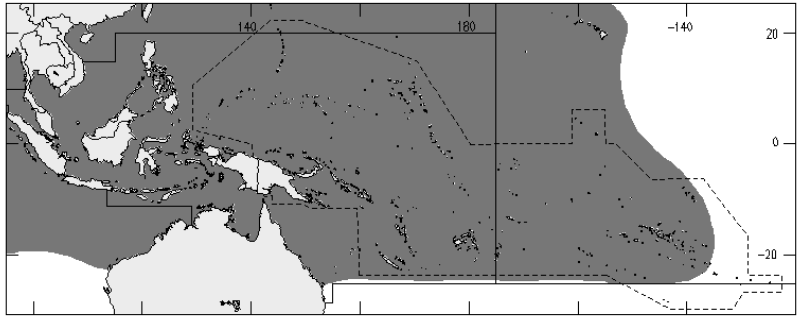
(after Kira, 1962)

Diagnostic characters: Shell **equivalve**, thick and inflated, **very inequilateral**, posteriorly expanded. Shape somewhat irregular, **elongate rectangular** in outline, **with strongly protruding umbones anteriorly** and a broad rounded keel from umbones to posteroventral margin. Posterior margin obliquely truncate, **ventral margin** slightly sinuous **with a well-developed byssal gape**. **Cardinal area** wide and flattish, **meeting the commissural plane** nearly **at right angle**. Outer sculpture of **numerous fine radial riblets** **crossed by irregular growth marks**, and a few larger radial ribs on posterodorsal slope. Periostracum coarsely pilose, mainly persisting towards shell margins. Hinge straight very long and narrow. Internal margins smooth. **Colour:** outside of shell often encrusted with marine growths; **posterior half dark brown**, **anterior half** creamy white **with zebra-like brown stripes**. Inner side more or less strongly tinged with dark brown.

Size: Maximum shell length 9 cm, commonly to 7 cm.

Habitat, biology, and fisheries: Fixed on rocks, corals, or under stones. Littoral and sublittoral waters to a depth of 20 m. Collected for food in Indochina and the Philippines. Locally collected for shellcraft.

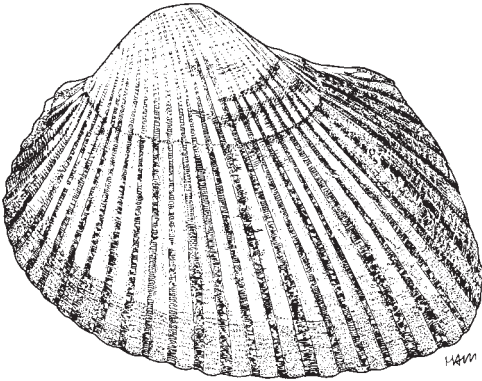
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea to eastern Polynesia; north to Japan and Hawaii, and south to Queensland and New Caledonia.



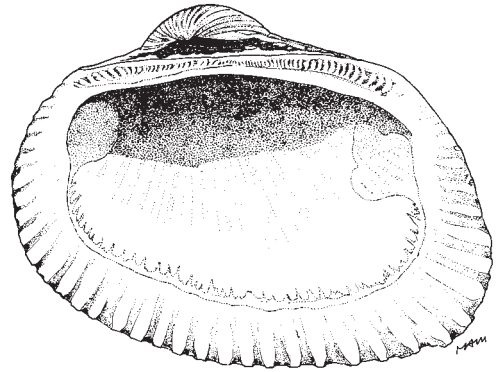
Scapharca cornea (Reeve, 1844)

Frequent synonyms / misidentifications: *Anadara cornea* (Reeve, 1844) / *Scapharca subcrenata* (Lischke, 1869).

FAO names: En - Corneous ark; Fr - Arche cornée.



exterior of left valve



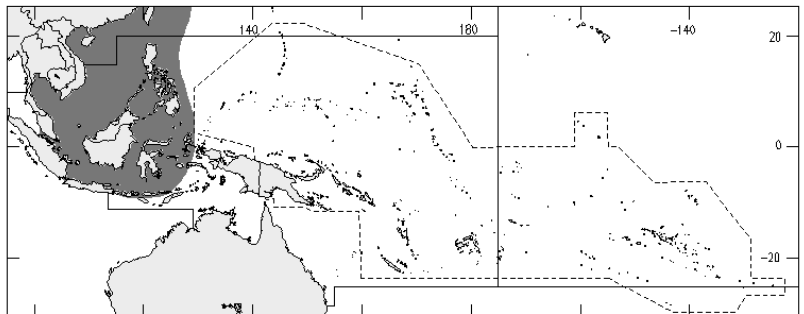
interior of right valve

Diagnostic characters: Shell thick and solid, inflated, inequilateral, somewhat transversally elongate in shape and with height greater than inflation, roughly quadrate to subtrapezoidal in outline; slightly inequivalve, left valve slightly overlapping right valve along posteroventral margin. Anterior margin rounded, ventral margin widely convex and meeting the oblique posterior margin at a blunt angle. Umbones moderately prominent, situated well anterior to midline of valves. Posterodorsal slope flattened to slightly concave toward posterior end of dorsal margin, set off by a broad rounded ridge radiating from the umbones to posteroventral end of shell. Cardinal area rather narrow and elongated. About 28 radial ribs (26 to 30) at each valve, as wide as the interstices, mainly granulated on left valve. Periostracum well developed, concentrically striated, scaly to spiky in the interstices of ribs. Internal margins with strong crenulations corresponding with the external radial ribbing. No byssal gape. Colour: outside of shell white, frequently tinged deep bluish green posteriorly; periostracum dark greyish brown. Interior whitish.

Size: Maximum shell length 6 cm, commonly to 4 cm.

Habitat, biology, and fisheries: On sand and mud bottoms. Littoral and sublittoral to depth of about 20 m. Rather common in local markets of the Philippine Islands. Outside the area, this species is harvested in Japan, as the closely related *Scapharca subcrenata*.

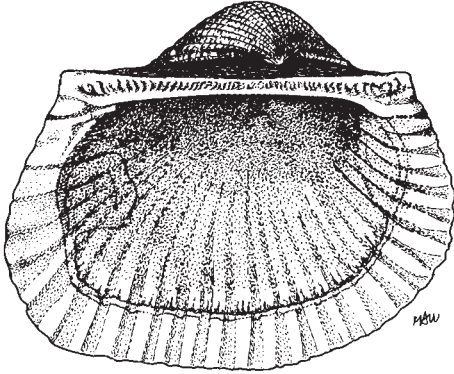
Distribution: Restricted to the tropical western Pacific, from Thailand to the Philippines; north to Japan and south to Indonesia.



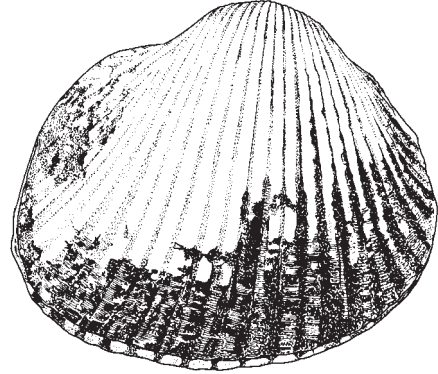
Scapharca globosa (Reeve, 1844)

Frequent synonyms / misidentifications: *Anadara binakayanensis* (Faustino, 1932); *A. globosa* (Reeve, 1844); *A. ursus* Tanaka, 1959 / *Arca cepoides* Reeve, 1844; *Scapharca inaequivalvis* (Bruguière, 1789).

FAO names: En - Globose ark; Fr - Arche globuleuse.



interior of left valve
(after Faustino, 1932)



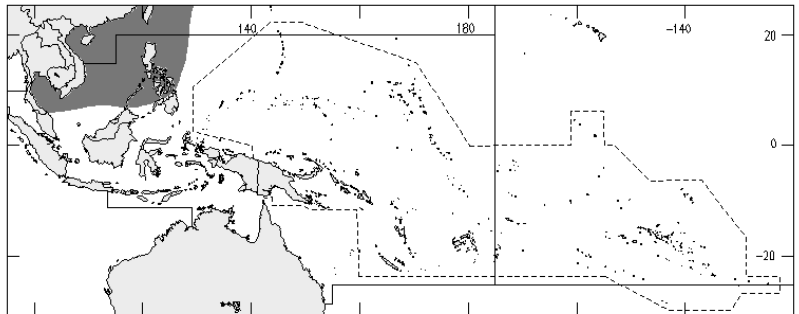
right side view of entire shell
(after Habe, 1965)

Diagnostic characters: Shell rather thin but solid, **strongly inflated**, oval subquadrate in shape with rounded ventral margin, **almost as high as long**; **slightly inequivalve**, left valve overlapping the right valve on ventral and posterior margins. Cardinal area moderately large. **About 34 radial ribs** (32 to 36) at each valve; ribs stout and flat, larger than the interstices, **smooth on both valves**. **Periostracum coarse** and concentrically striated, easily detached, forming rows of foliations in the interstices of ribs. Internal margins with strong crenulations corresponding with the external radial ribs. **No byssal gape**. **Colour:** **outside** of shell **white under the dark brown periostracum**. Inner side bluish white.

Size: Maximum shell length 11.5 cm, commonly to 8 cm.

Habitat, biology, and fisheries: On fine muddy-sand bottoms, in bays and coastal lagoons. Littoral and sublittoral to a depth of 20 m. Commonly collected and cultivated together with *Scapharca inaequivalvis* in the Philippines and Japan.

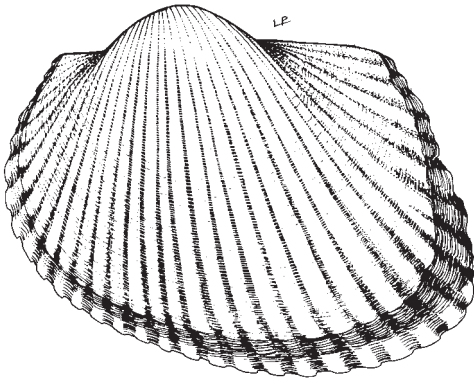
Distribution: Tropical West Pacific, in Thailand, Indochina, China, Taiwan Province of China, and the Philippines to Japan.



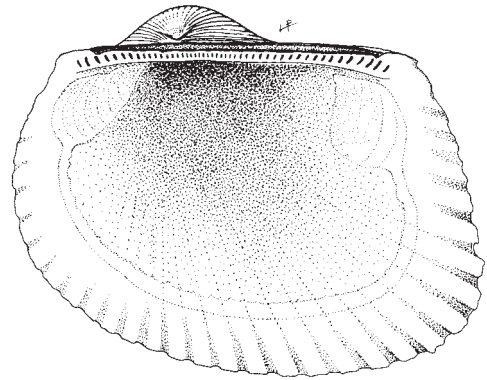
Scapharca inaequalvis (Bruguière, 1789)

Frequent synonyms / misidentifications: *Anadara inaequalvis* (Bruguière, 1789) / *Scapharca cornea* (Reeve, 1844).

FAO names: En - Inequivalve ark; Fr - Arche inéquivalve.



exterior of left valve



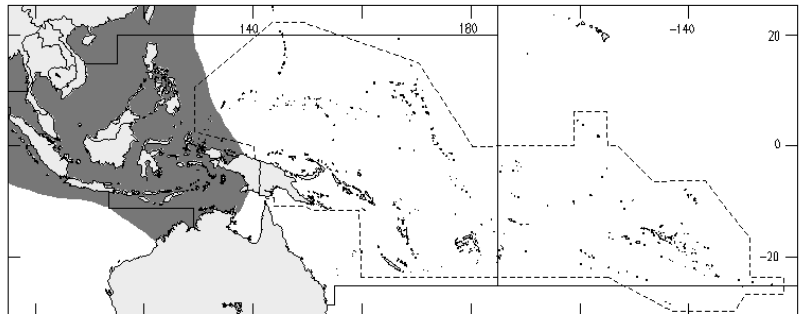
interior of right valve

Diagnostic characters: Shell thick and solid, inflated, inequilateral, roughly quadrate in shape with arcuate ventral margin and obliquely truncate posterior margin; slightly inequivalve, left valve distinctly overlapping the right valve ventrally and posteriorly. Cardinal area rather long and narrow. **About 33 radial ribs** (30 to 36) at each valve; ribs as wide as the interstices, granulated on left valve. Periostracum well developed. Internal margins with strong crenulations corresponding with the external radial ribs. **No byssal gape.** **Colour:** outside of shell white under the blackish brown periostracum. Inner side whitish.

Size: Maximum shell length 9.5 cm, commonly to 8 cm.

Habitat, biology, and fisheries: On fine muddy-sand bottoms, in bays and coastal lagoons. Exploited for food and cultivated together with *Scapharca globosa* in Japan and the Philippines.

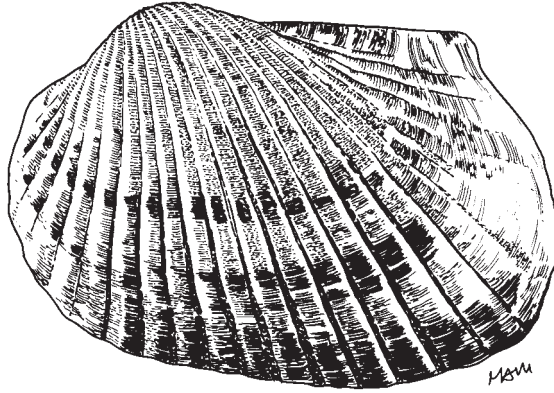
Distribution: Central Indian Ocean to western Pacific, from India and Sri Lanka to Indonesia; north to Japan and south to northern Australia. Also present in the Mediterranean and Black Sea.



Scapharca indica (Gmelin, 1791)

Frequent synonyms / misidentifications: *Anadara chalcantum* (Reeve, 1844); *A. gubernaculum* (Reeve, 1844); *A. indica* (Gmelin, 1791); *A. japonica* (Reeve, 1844) / None.

FAO names: En - Rudder ark; Fr - Arche gouvernail.



exterior of left valve

(after Habe, 1965)

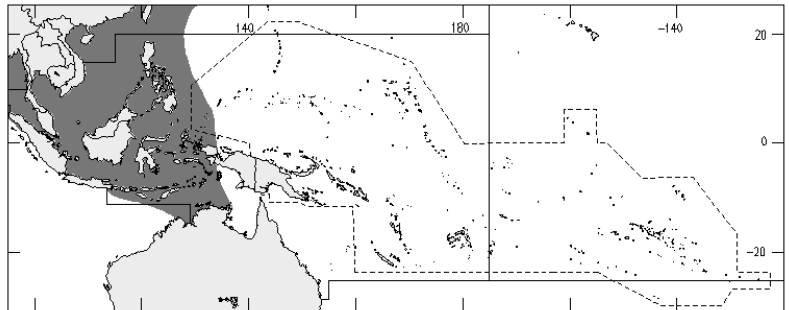
Diagnostic characters: Shell solid, laterally compressed and subrectangular in shape, very inequilateral, much longer than high and wider posteriorly; slightly inequivalve, left valve somewhat overlapping the right valve on posteroventral margin. Umbones small and situated anteriorly, cardinal area long and narrow. About 28 radial ribs (25 to 33) at each valve; ribs low and flat, wider than the interstices, slightly granulated on the anterior part of left valve. Periostracum coarse, concentrically striated. Internal margins with crenulations corresponding with the external radial ribs. No byssal gape. **Colour:** outside of shell whitish under the blackish brown periostracum. Inner side white, often tinged pale grey at periphery.

Size: Maximum shell length 5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: On sand and mud bottoms. Littoral and sublittoral to a depth of 25 m. Locally exploited in the Philippines. Important commercial species in Indonesia, where it is harvested from natural beds.

Distribution: Indo-West Pacific, from the northern part of the Indian Ocean and the Persian Gulf to the Philippines and eastern Indonesia; north to Japan and south to northern Australia.

Remarks: This species is considered to have a wide range, but the relationship between the Indian Ocean and West Pacific forms is insufficiently known.

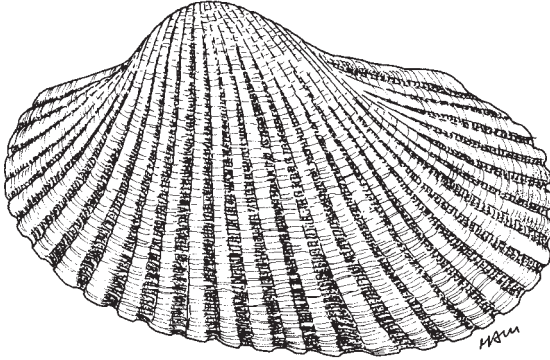


***Anadara ferruginea* (Reeve, 1844)**

Frequent synonyms / misidentifications: *Diluvarca ferruginea* (Reeve, 1844); *Anadara tricenicosta* (Nyst, 1848) / None.

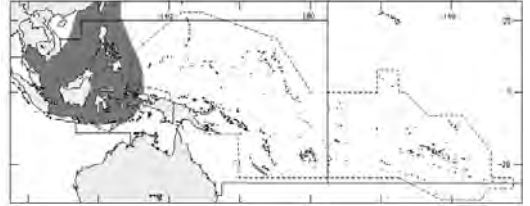
En - Rusty ark; **Fr** - Arche rouillée.

Maximum shell length 8 cm, commonly to 6 cm. On sublittoral sand and mud bottoms, at depths from 5 to 120 m; most frequently between 10 and 60 m. Occasionally collected in fish trawl nets when abundant. Tropical West Pacific, in Thailand, Malaysia, Indonesia, Philippines, South and East China seas, and Taiwan Province of China to Japan.



exterior of left valve

(after Habe, 1977)

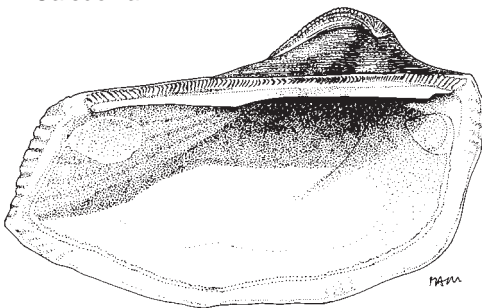


***Arca avellana* Lamarck, 1819**

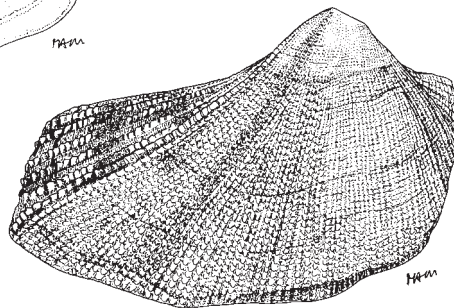
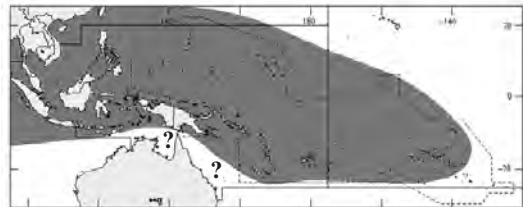
Frequent synonyms / misidentifications: *Arca arabica* Philippi, 1847; *A. cuneata* Reeve, 1844; *A. maculata* (Sowerby, 1833) / None.

En - Hazelnut ark; **Fr** - Arche noisette.

Maximum shell length 7 cm, commonly to 4 cm. Byssally attached on rocks, corals, or under boulders on sand, from low tide pools to a depth of about 80 m. Locally collected for food in the Philippines, where the shell is also used for shellcraft. Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan and south to New Caledonia.



interior of left valve



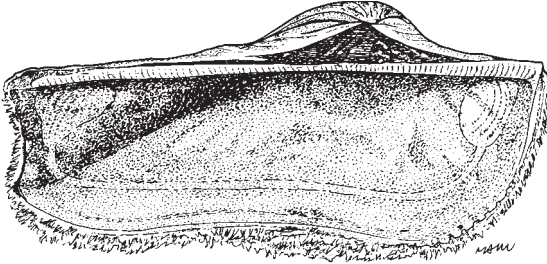
exterior of right valve

Arca navicularis Bruguière, 1789

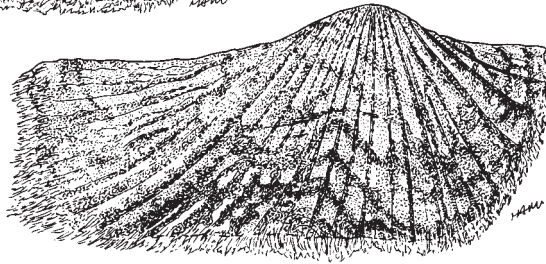
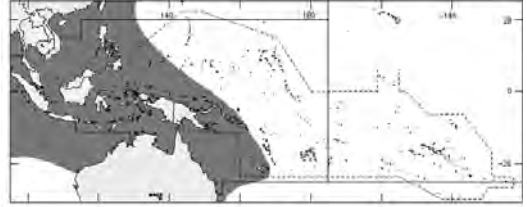
Frequent synonyms / misidentifications: None / *Arca noae* Linnaeus, 1758.

En - Indo-Pacific ark; **Fr** - Arche navicule.

Maximum shell length 6 cm, commonly to 4.5 cm. Attached to rocks intertidally and in shallow sublittoral waters to a depth of 20 m. Locally collected by coastal populations (Indochina, Philippines) for subsistence. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea to Melanesia; north to Japan and south to New South Wales and New Caledonia.



interior of left valve



exterior of right valve

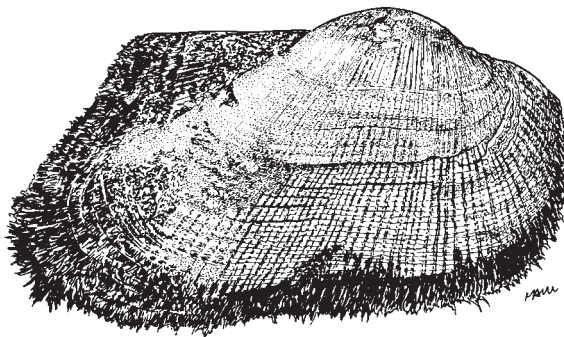
(after Abbott and Dance, 1983)

Barbatia foliata (Forsskål, 1775)

Frequent synonyms / misidentifications: *Barbatia decussata* (Sowerby, 1833); *B. lima* (Reeve, 1844); *B. trapezina* (Lamarck, 1819); *B. velata* (Sowerby, 1843) / *Barbatia helblingi* (Bruguière, 1789) (= *Barbatia candida* (Helbling, 1779)).

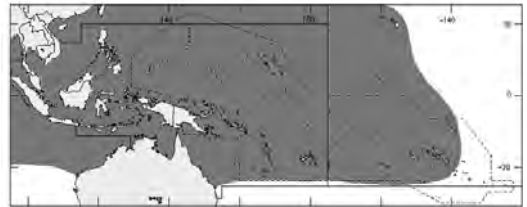
En - Decussate ark; **Fr** - Arche croisée.

Maximum shell length 7.5 cm, commonly to 5 cm. Attached by byssus among rocks, underside of coral slabs, or nestling in crevices. Littoral and sublittoral to a depth of 20 m. Locally collected for food in the Philippines and marketed fresh or salted. Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and Hawaii, and south to Queensland.



exterior of right valve

(after Dance, 1993)

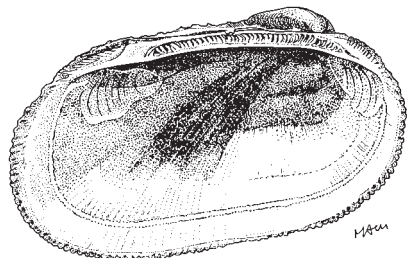


***Barbatia fusca* (Bruguère, 1789)**

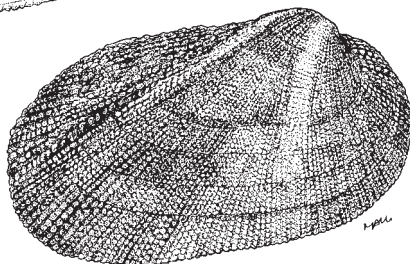
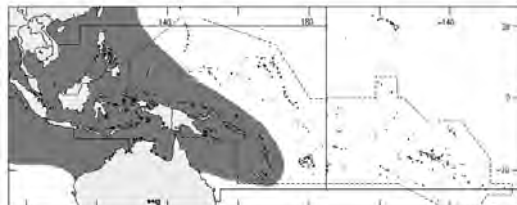
Frequent synonyms / misidentifications: *Barbatia amygdalumtostum* (Röding, 1798); *B. bicolorata* (Dillwyn, 1817) / None.

En - Almond ark; **Fr** - Arche bicolore.

Maximum shell length 6 cm, commonly to 4.5 cm. Attached to rocks in coral reef areas, or under stones on muddy bottoms. Littoral and sublittoral to a depth of 25 m. Collected for food in the Philippines; shell used in local lime industry. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf to Melanesia; north to Japan and south to New Caledonia.



interior of left valve



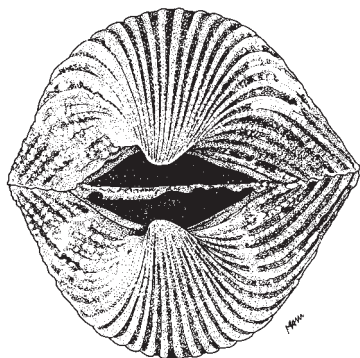
exterior of right valve

***Scapharca pilula* (Reeve, 1843)**

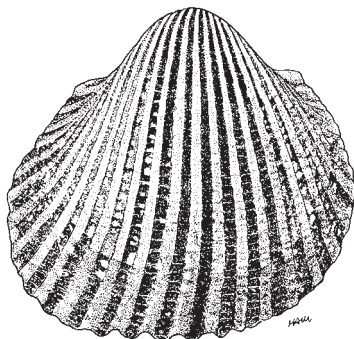
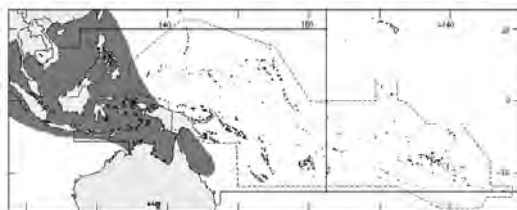
Frequent synonyms / misidentifications: *Anadara pilula* (Reeve, 1843); *Potiarca pilula* (Reeve, 1843) / None.

En - Pill ark; **Fr** - Arche pilule.

Maximum shell length 4 cm, commonly to 3 cm. On sand and mud bottoms. Littoral and sublittoral to a depth of 30 m. Harvested for food in Indonesia. Central Indian Ocean to tropical western Pacific, from India and Sri Lanka to the Philippines and Papua New Guinea; north to Taiwan Province of China and south to Queensland.



dorsal view of entire shell



exterior of right valve

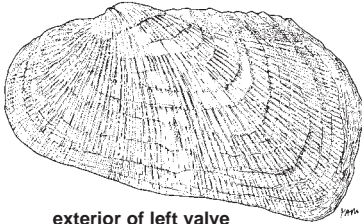
(after Habe, 1965)

***Trisidos semitorta* (Lamarck, 1819)**

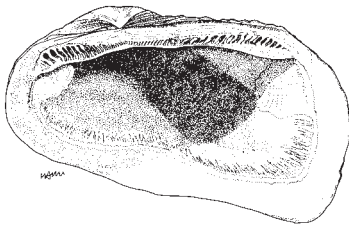
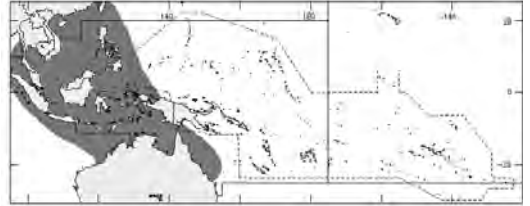
Frequent synonyms / misidentifications: None / None.

En - Half-propellor ark; **Fr** - Arche semitorte.

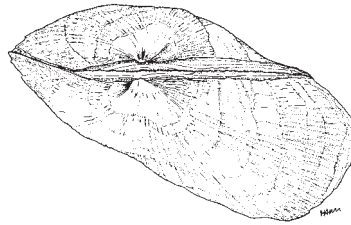
Maximum shell length 8 cm, commonly to 7 cm. Half-buried in sand and gravel bottoms under the influence of currents, with the twisted posterior end of shell lying horizontally on the surface. The posterior surface of the left valve, which slightly projects above the sand surface, is often extensively eroded or damaged and colonized by other sessile organisms. Juvenile specimens are byssally attached inside empty shells of the species and other bivalves, to ensure protection against predators and water movement. Littoral and sublittoral to a depth of 30 m. Artisanal exploitation in Thailand. Eastern Indian Ocean to tropical western Pacific, from Thailand and western Indonesia to the Philippines; north to Taiwan Province of China and south to Queensland.



exterior of left valve



interior of right valve



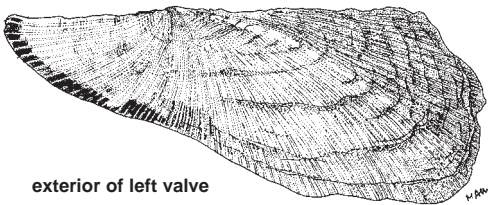
dorsal view of entire shell

***Trisidos tortuosa* (Linnaeus, 1758)**

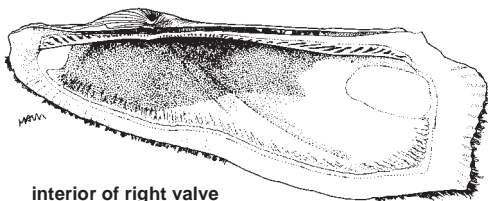
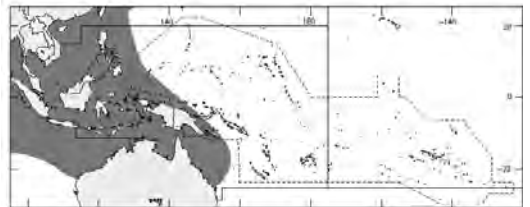
Frequent synonyms / misidentifications: *Trisidos yongei* Iredale, 1939 / None.

En - Propellor ark; **Fr** - Arche hélice.

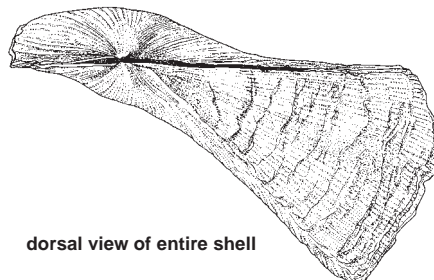
Maximum shell length 8.5 cm, commonly to 7.5 cm. Half-buried in muddy fine to medium sand bottoms, with abundant fragmental shell material, and subject to the effects of currents and wave action. Littoral and sublittoral to a depth of 50 m. Artisanal exploitation in Thailand. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea and the Persian Gulf to Papua New Guinea; north to Japan and south to Queensland.



exterior of left valve



interior of right valve



dorsal view of entire shell

CUCULLAEIDAE

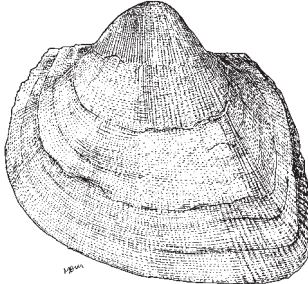
Cucullaeid ark shells

A single species occurring in the area.

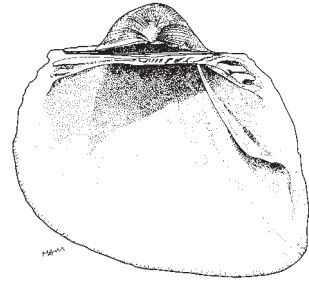
Cucullaea labiata (Lightfoot, 1786)

Frequent synonyms / misidentifications: *Cucullaea auriculifera* Lamarck, 1801; *C. cucullata* (Röding, 1798); *C. granulosa* Jonas, 1846; *C. labiosa* of Authors (spelling error); *C. vaga* Iredale, 1930 / None.

FAO names: En - Hooked ark; Fr - Arche lippue.



exterior of left valve



interior of right valve

Diagnostic characters: Shell relatively thin but solid, inflated, inequilateral, roughly quadrate to subtrigonal in shape, with a rounded umbo-ventral keel and an obliquely truncated posterior margin; slightly inequivalve, left valve somewhat projecting beyond right along posterior and ventral margins. Umbones subcentral, prominent, on top of a well-developed trigonal cardinal area which is engraved by oblique, chevron-shaped grooves and covered with a black external ligament. Outer sculpture of numerous radial riblets and concentric threads forming a fine reticulation. Periostracum conspicuous, velvety. Hinge elongate, straightish dorsally and weakly arched ventrally, bearing a series of transverse, diverging outward teeth, and rather long, subhorizontal teeth at both ends, at least in adults. Interior of shell porcelaneous. Two subequal adductor muscle scars; inner margin of posterior scar on a projecting shelf. Pallial line without a sinus. Internal margins with a fine crenulation becoming obsolete in old individuals. **Colour:** outside of shell purple tan, with a yellowish periostracum. Inner side white, more or less strongly tinged with dark reddish brown posteriorly.

Similar species occurring in the area

Arcidae: umbones generally in front of the midline; hinge teeth all transverse and diverging outward; no ridge or shelf at inner margin of posterior adductor scar.

Noetiidae: hinge characters as in the Arcidae; ligament transversally striated; inner marginal ridge or shelf of adductor scars present but not projecting.

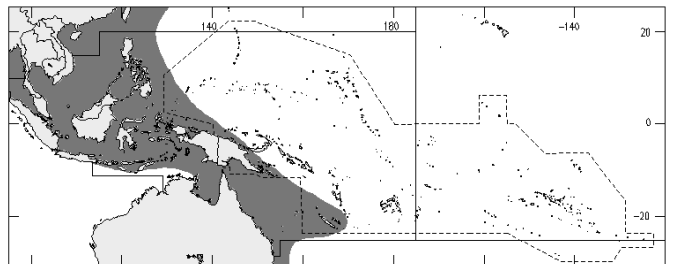
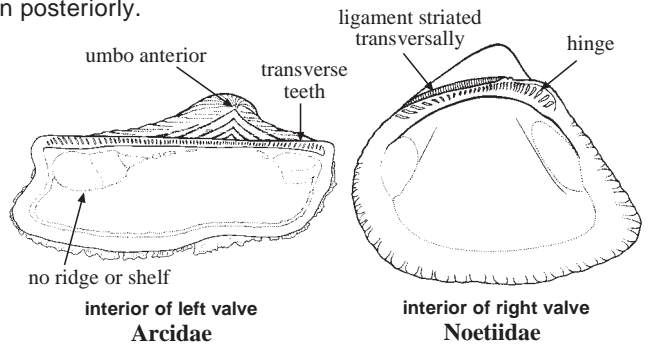
Size: Maximum shell length 10 cm, commonly to 6 cm.

Habitat, biology, and fisheries: On sandy to muddy bottoms offshore, from depths between 5 and 252 m; most commonly found between 15 and 150 m. Often collected in Thailand.

Distribution: Indo-West Pacific, from northwestern Indian Ocean, the Seychelles and Mauritius Island, to Papua New Guinea and Loyalty Islands; north to Japan and south to southern New South Wales.

References

- Habe, T. 1964. Notes on the Genus *Cucullaea* Lamarck (Mollusca). *Bull. natn. Sci. Mus.*, 7(3):259-261.
Nicol, D. 1950. Recent species of the prionodont pelecypod *Cucullaea*. *J. Wash. Acad. Sci.*, 40(10):338-343.

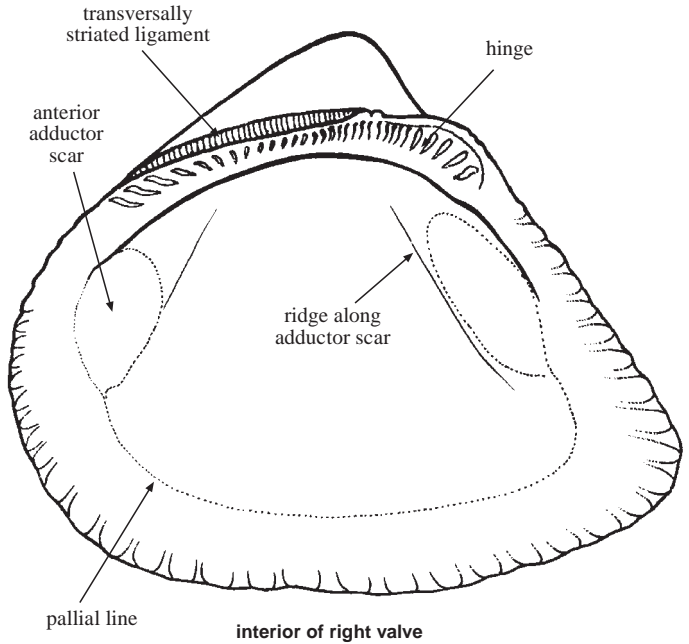


NOETIIDAE

Noetid ark shells (Noetiid)

Diagnostic characters: Shell solid, **deiquivalve**, subtrigonal, trapezoidal to elliptical in shape, **generally inequilateral and longer than high**. **Umboes often opisthogyrate, set apart from dorsal margin by a trigonal cardinal area**. **Ligament external, stretching across the cardinal area, with oblique grooves and transverse striations**. Outer surface with radial sculpture. Periostracum conspicuous, generally pilose. **Hinge elongate, straightish to slightly arched, with numerous small transverse teeth** which somewhat increase in size towards anterior and posterior ends. Interior of shell porcelaneous. **Two subequal adductor muscle scars, with a ridge or a shelf present along the inner margin of one or both scars**. **Pallial line without a sinus**. Internal margins of valves smooth or crenulated. Gills of filibranchiate type. Foot stout, grooved, often byssiferous. Mantle widely open, with marginal eyes covered by periostracum.

Habitat, biology, and fisheries: Sedentary animals, with habitat and mode of life very similar to Arcidae.

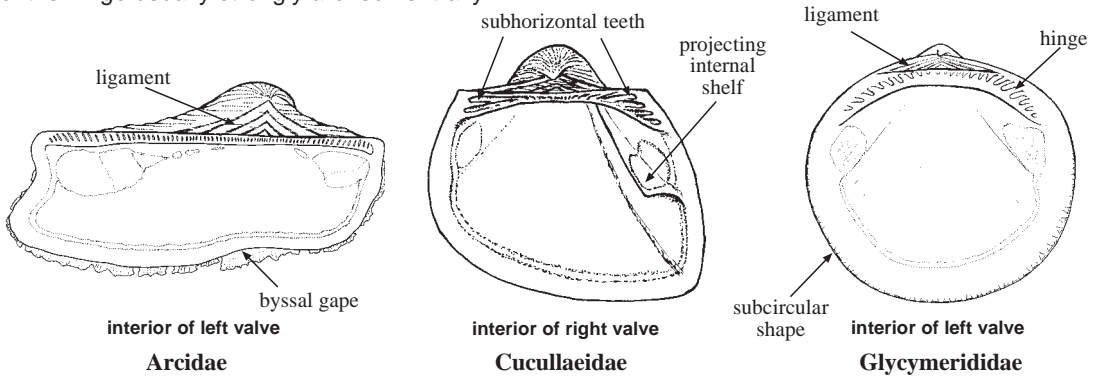


Similar families occurring in the area

Arcidae: ligament without transverse striations; no ridge or shelf on inner margin of adductor muscle scars; a ventral byssal gape sometimes present.

Cucullaeidae: teeth subhorizontal at both ends of the hinge; a strong projecting shelf on anterior side of the posterior adductor scar.

Glycymerididae: shell subcircular in shape; external ligament without transverse striations; dental series of the hinge usually strongly arched ventrally.



Reference

Oliver, P.G. 1987. *Estellacar* Iredale, *Rectangularca* Eames and the systematic position of *Barbatia pectunculiformis* Dunker (Bivalvia, Arcoidea, Noetiidae). *J. Conch.*, 32(5):279-288.

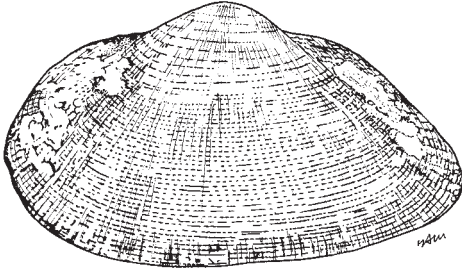
A single species of interest to fisheries occurring in the area

***Estellacar olivacea* (Reeve, 1844)**

Frequent synonyms / misidentifications: *Estellarca olivacea* (Reeve, 1844); *Striarca olivacea* (Reeve, 1844) / *Estellacar galactodes* (Benson, 1842); *E. saga* Iredale, 1939.

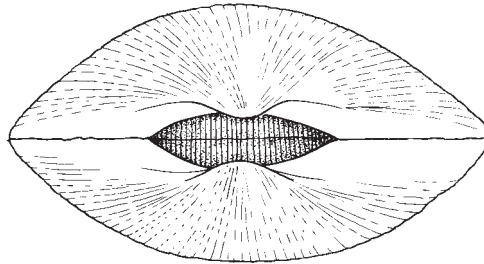
En - Olive ark; **Fr** - Arche olive.

Maximum shell length 3.5 cm, commonly to 3 cm. In muddy bottoms, often near mangroves. Low tide level to a depth of 20 m. Artisanal exploitation in the Philippines. Common in local markets; used for food and shellcraft. Distribution imperfectly known, because of confusion with other species of the genus. Indian Ocean (India) and western Pacific, from Japan and China to the Philippines and northern Australia.



exterior of left valve

(after Habe, 1977)



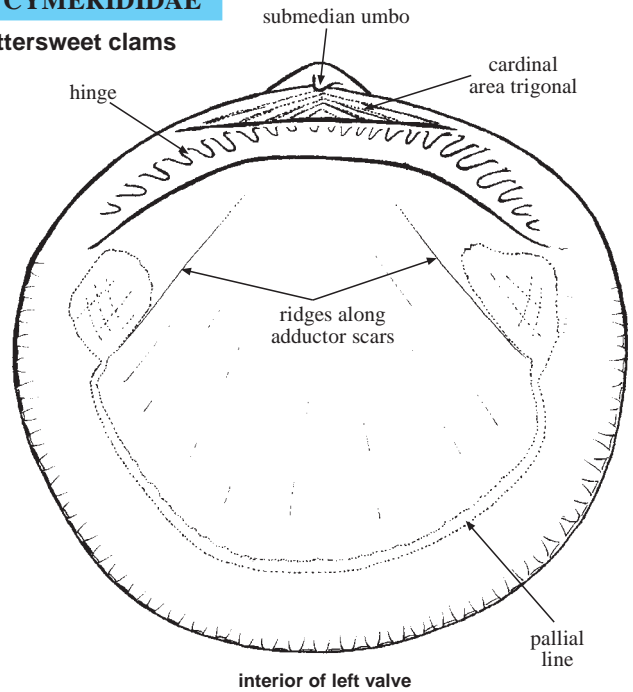
dorsal view of entire shell

GLYCYMERIDIDAE

Bittersweet clams

Diagnostic characters: Shell equivalve, closed, solid, subequilateral, rounded, more or less circular to oval-subquadrate in outline; anterior side usually more evenly rounded than posterior one which is often somewhat narrowed and angulated. Submedian orthogyrate, slightly prosogyrate or opisthogyrate umbones situated on top of a well-defined trigonal cardinal area which is deeply engraved by oblique or tent-shaped grooves and covered with a dark brown external ligament. External surface quite smooth, only striated radially and concentrically, or with radial ribs. Periostracum thick and densely set with fine hair, or thin to almost absent. Hinge plate broad and strongly arched, bearing a series of teeth diverging outwards which diminish in size medially and distally along the anterodorsal and posterodorsal margins. Internal surface porcelaneous. Two subequal adductor muscle scars, their inner margin with a radial ridge always stronger at front of the posterior scar. Pallial line without a sinus. Internal margins crenulated. Filibranchiate type gills, with smooth branchial sheets. Siphons and byssus absent, the latter at least in the adult. Foot large, hatchet-shaped, deeply grooved ventrally. Mantle widely open, with compound marginal eyes covered by the periostracum.

Habitat, biology, and fisheries: Shallow burrowers of soft bottoms often containing a coarse fraction, slowly ploughing through the substrate with the anterior end foremost, and binding the sand with mucus from the foot. Filter-feeding species. Able to colonize habitats of low oxygen concentration thanks to the presence of the respiratory pigment haemoglobin in the blood. Locally exploited by coastal people in the area. The 2 species included here appear frequently in the markets of the central Philippines.

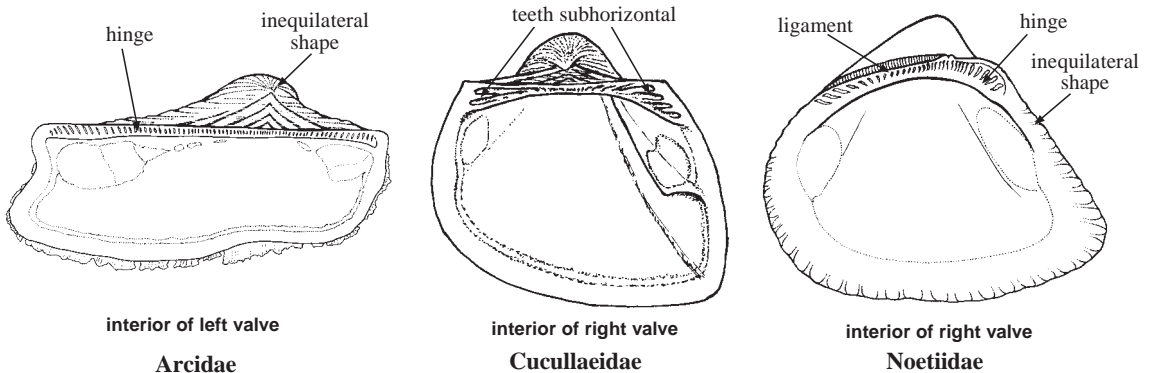


Similar families occurring in the area

Arcidae: shell inequilateral, often larger than high; a ventral byssal gape may be present; dental series of the hinge straight to slightly arched; no radial ridge along the inner margin of adductor muscle scars.

Cucullaeidae: shell inequilateral, slightly inequivalve, left valve somewhat projecting beyond right valve along posterior and ventral margins; hinge teeth elongated and subhorizontally arranged at both ends.

Noetiidae: shell inequilateral, often longer than high; hinge as in Arcidae; ligament transversally striated.



Key to species of interest to fisheries occurring in the area

- 1a. External sculpture strong, with well-developed radial ribs; periostracum inconspicuous (Fig. 1) *Tucetona pectunculus*
- 1b. External sculpture weak, with very low, rounded radial undulations and fine grooves; periostracum velvety (Fig. 2) *Glycymeris reevei*



Fig. 1 *Tucetona pectunculus* (exterior)

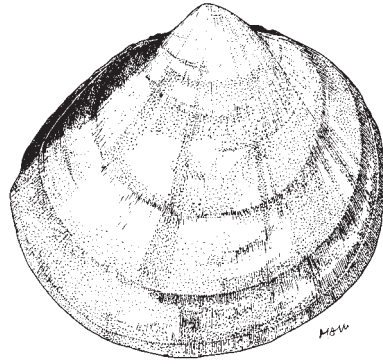


Fig. 2 *Glycymeris reevei* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Glycymeris reevei* (Mayer, 1868)
- 🐚 *Tucetona pectunculus* (Linnaeus, 1758)

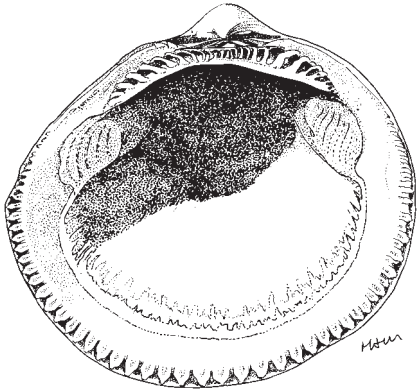
References

Lamy, E. 1912. Révision des *Pectunculus* vivants du Muséum d'Histoire naturelle de Paris. *J. Conchyl.*, 59(2):81-156.
 Matsukuma, A. 1986. Cenozoic Glycymeridid bivalves of Japan. *Palaeont. Soc. Japan spec. Pap.*, 29:77-94.

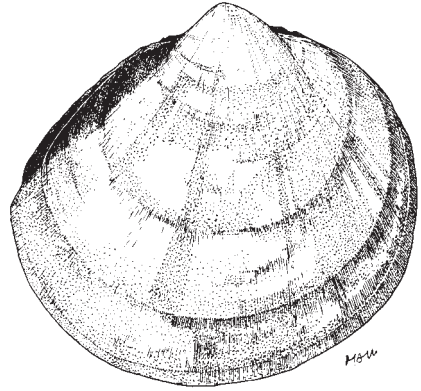
***Glycymeris reevei* (Mayer, 1868)**

Frequent synonyms / misidentifications: *Glycymeris fringila* (Angas, 1872); *G. hanleyi* (Angas, 1879); *Veletuceta cotinga* Iredale, 1939 / None.

FAO names: En - Reeve's bittersweet; Fr - Amande de Reeve.



interior of left valve



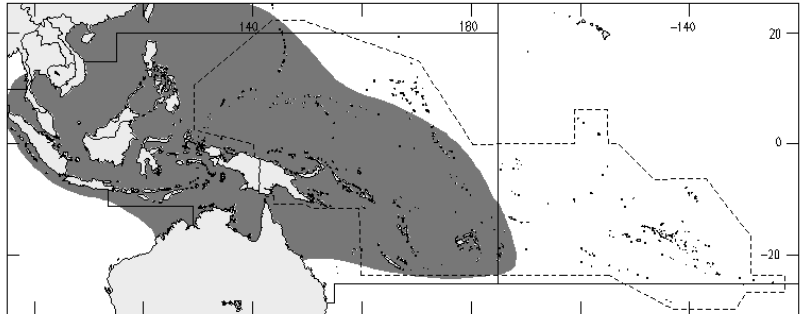
exterior of right valve

Diagnostic characters: Shell rounded-subquadrate in outline, moderately inflated, slightly inequilateral, with rounded anterior and obtusely pointed posterior margin. Umbones not very prominent, slightly opisthogyrate and in front of midline of valves. External sculpture weak, with very low, rounded radial undulations and fine grooves, crossed by numerous, small concentric marks. Periostracum conspicuous, densely set with fine and short, dark brown hair. **Colour:** outside of shell brown, with irregular whitish flecks on the umbones and posterior third of valves. Posterodorsal margin often more or less tinged blackish brown. Interior white, variably tinged with purplish brown posteriorly.

Size: Maximum shell length 7.5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: In sublittoral muddy-sand bottoms, from depths of 5 to 50 m. Commonly marketed in the central Philippines, often mixed with other bivalve species.

Distribution: Western Pacific, from Indonesia to Tonga Islands; north to Japan, and south to central Queensland and New Caledonia.



Tucetona pectunculus (Linnaeus, 1758)

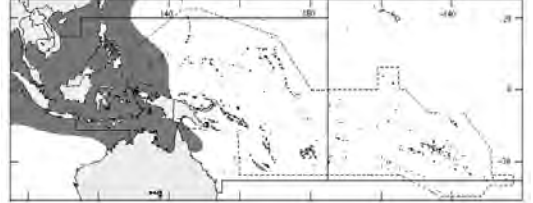
Frequent synonyms / misidentifications: *Glycymeris amboinensis* (Gmelin, 1791); *G. pectiniformis* (Lamarck, 1819); *G. pectunculus* (Linnaeus, 1758); *Tucetona extra* Iredale, 1939 / None.

En - Comb bittersweet; **Fr** - Amande pétoncle.

Maximum shell length 5.5 cm, commonly to 4.5 cm. In sand and gravel or coral sand bottoms. Littoral to a depth of 20 m. Frequent in the local markets of the central Philippines, where it is often sold together with other bivalve species. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea to Indonesia and Palau Islands; north to southern Japan and south to northern Queensland.



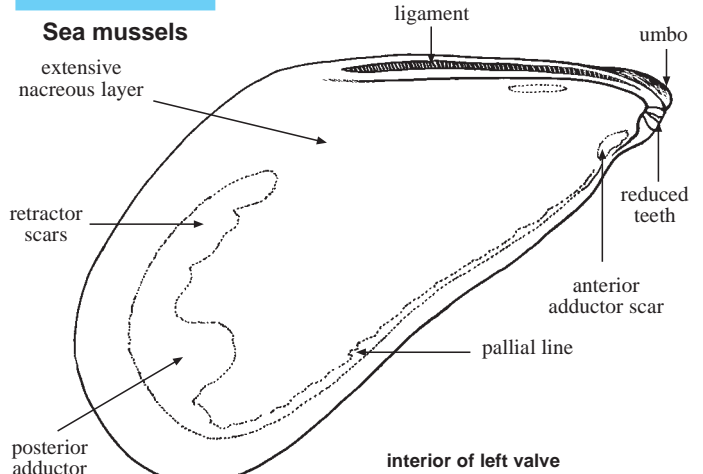
exterior of left valve
(after Habe, 1964)



MYTILIDAE

Sea mussels

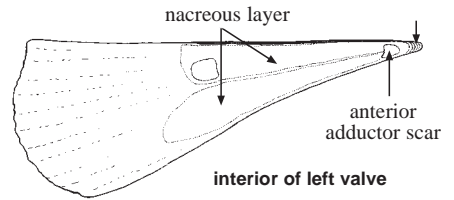
Diagnostic characters: Shell **Dequivalve and very inequilateral**, generally elongate-ovate, subtrigonal or cylindrical, often **with a narrow byssal gape** at ventral margin. **Umbones** prosogyrate, **at or near anterior end** of shell. Outside quite smooth or radially ribbed; sculpture often stronger on posterodorsal and anterior areas, reduced on ventral median area. **Periostracum** usually **prominent**, smooth, lamellate or hairy. **Ligament external**, often **deep-set** along posterior dorsal margin, **supported by a calcified whitish ridge** which may be compact or finely pitted. **Hinge teeth absent or reduced**; small marginal crenulations sometimes present behind and/or along the ligament. **Adductor muscle scars unequal, the anterior one small to sometimes absent** in the adult; posterior adductor scar large, often more or less confluent with pedal or byssal retractor scars. **Pallial line without a sinus**. **Inner side of shell with an extensive nacreous layer**. Internal margins smooth or crenulated. Gills of filibranchiate type, branchial sheets smooth and often rather unequal. Foot elongated and grooved, with a well-developed byssus. Siphons short to absent. Mantle with special glands in boring forms.



Habitat, biology, and fisheries: Sedentary animals, mainly attached to hard substrates by their well-developed byssus, sometimes nestlers, coral and rock borers, or associated with ascidians. Many species of this family are collected in the area for human consumption, food for animals, or as baits. Some mytilids represent nowadays major commercial species and aquaculture has strongly developed in many regions to keep up with increasing demand.

Similar families occurring in the area

Pinnidae: shell often very large, flexible, gaping at posterior end; pointed anterior end closed by a series of small transverse partitions; hinge always without teeth; internal nacreous layer restricted to the anterior half of shell.



Pinnidae

Key to species of interest to fisheries occurring in the area

- 1a. Shell shape subcylindrical; outer surface with fine transverse striations on ventral median area (Fig. 1) ***Lithophaga teres***
- 1b. Shell with a different shape, more or less triangular in outline; outer surface without transverse striations on ventral median area → 2

- 2a. Outer surface with dense radial riblets, slightly diverging on posterodorsal area; anterior adductor scar set on a shelly ledge above the umbonal cavity (Fig. 2) ***Septifer bilocularis***

- 2b. Outer surface without dense radial riblets (a few riblets may be present near anterior end of shell); anterior adductor scar not set on a shelly ledge. → 3

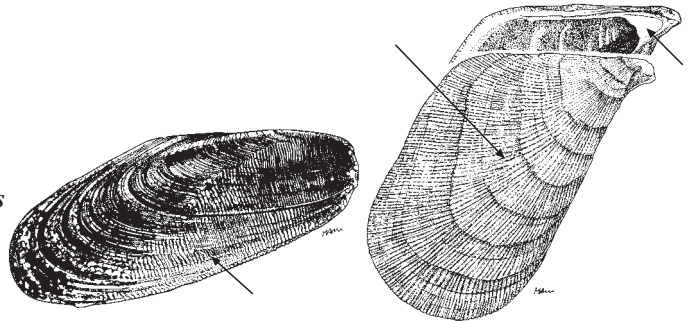


Fig. 1 *Lithophaga teres* (exterior)

Fig. 2 *Septifer bilocularis*

- 3a. Hinge line with a few small teeth under the umbones (1 tooth in right valve, and 2 in the left); anterior adductor scar absent (Fig. 3) *Perna viridis*
- 3b. Hinge line without teeth, or with small crenulations under the umbones and behind the ligament; anterior adductor scar present → 4
- 4a. Hinge line with small crenulations (Fig. 4a) → 5
- 4b. Hinge line smooth, without crenulations (Fig. 4b) → 6

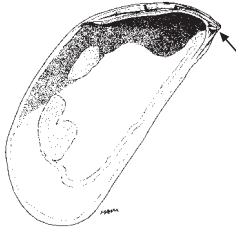


Fig. 3 *Perna viridis* (interior)

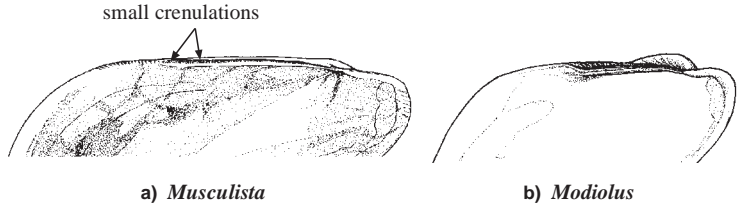


Fig. 4 hinge area of left valve

- 5a. Shell relatively long, with a broad and rounded keel radiating towards posteroventral end of valves; ventral margin concave (Fig. 5) *Arcuatula arcuatula*
- 5b. Shell relatively short, without a rounded radial keel; ventral margin straightish (Fig. 6) *Musculista senhousia*
- 6a. Shell attaining 20 cm in length; shape somewhat inequivalve, one valve slightly overlapping the other valve ventrally; periostracal hairs branched (Fig. 7) *Stavelia subdistorta*
- 6b. Shell not exceeding 13 cm in length; shape equivalve; periostracal hairs, when present, not branched → 7

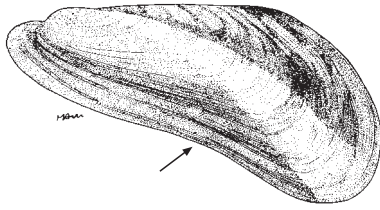


Fig. 5 *Arcuatula arcuatula* (exterior)

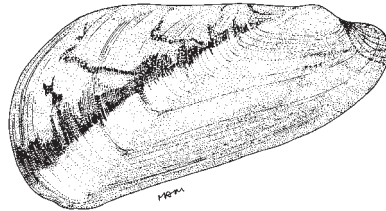


Fig. 6 *Musculista senhousia* (exterior)

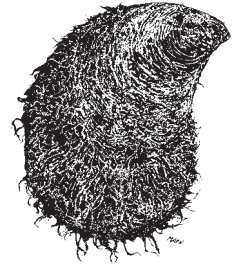


Fig. 7 *Stavelia subdistorta* (exterior)

- 7a. Anterior margin of valves very short, clearly not extending forwards beyond the umbones; posterodorsal margin raised into an ear-like hump, set off by a broad and rounded keel radiating towards posteroventral end of valves (Fig. 8) *Modiolus auriculatus*
- 7b. Anterior margin of valves clearly extending forwards beyond the umbones; posterodorsal margin not raised into an ear-like hump, nor set off by rounded radial keel → 8
- 8a. Anterior margin protruding well beyond the umbones; posterodorsal angle rounded (Fig. 9) *Modiolus philippinarum*

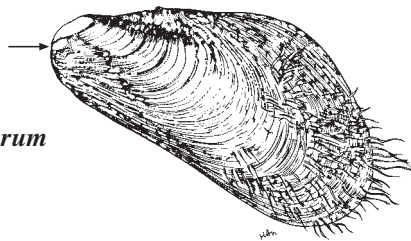


Fig. 8 *Modiolus auriculatus* (exterior)

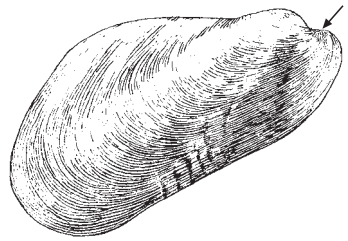


Fig. 9 *Modiolus philippinarum* (exterior)

- 8b. Anterior margin slightly protruding beyond the umbones; posterodorsal angle rather sharp → 9

- 9a. Outside of shell nearly smooth throughout; periostracal hairs developed on posterior half of valves (Fig. 10) *Modiolus metcalfei*
- 9b. Outside of shell with concentric grooves, most visible on posterior half of valves; periostracal hairs not developed (Fig. 11) *Modiolus aratus*

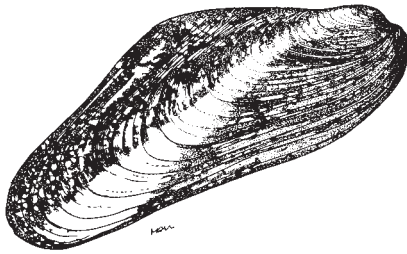


Fig. 10 *Modiolus metcalfei* (exterior)

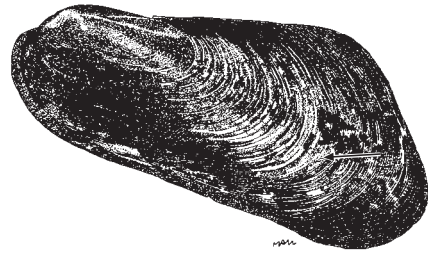


Fig. 11 *Modiolus aratus* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Arcuatula arcuatula* (Hanley, 1843)
- 🐚 *Lithophaga teres* (Philippi, 1846)
- 🐚 *Modiolus aratus* (Dunker, 1857)
- 🐚 *Modiolus auriculatus* (Krauss, 1848)
- 🐚 *Modiolus metcalfei* (Hanley, 1843)
- 🐚 *Modiolus philippinarum* (Hanley, 1843)
- 🐚 *Musculista senhousia* (Benson, 1842)
- 🐚 *Perna viridis* (Linnaeus, 1758)
- 🐚 *Septifer bilocularis* (Linnaeus, 1758)
- 🐚 *Stavelia subdistorta* (Récluz, 1852)

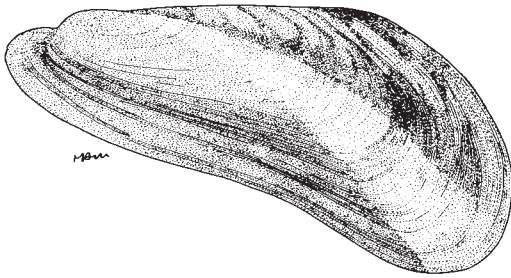
References

- Lamy, E. 1936a. Révision des Mytilidae vivants du Muséum national d'Histoire naturelle de Paris. *J. Conchyl.*, 80(1):66-102.
- Lamy, E. 1936b. Révision des Mytilidae vivants du Muséum national d'Histoire naturelle de Paris (Suite). *J. Conchyl.*, 80(2):107-198.
- Lamy, E. 1936c. Révision des Mytilidae vivants du Muséum national d'Histoire naturelle de Paris (Suite). *J. Conchyl.*, 80(3):229-295.
- Lamy, E. 1937a. Révision des Mytilidae vivants du Muséum national d'Histoire naturelle de Paris (Suite). *J. Conchyl.*, 80(4):307-363.
- Lamy, E. 1937b. Révision des Mytilidae vivants du Muséum national d'Histoire naturelle de Paris (Suite). *J. Conchyl.*, 81(1):5-71.
- Lamy, E. 1937c. Révision des Mytilidae vivants du Muséum national d'Histoire naturelle de Paris (Suite). *J. Conchyl.*, 81(2):99-132.
- Lamy, E. 1937d. Révision des Mytilidae vivants du Muséum national d'Histoire naturelle de Paris (Fin). *J. Conchyl.*, 81(3):169-197.
- Lee, S.Y. and B.S Morton. 1985. The Hong Kong Mytilidae. In *Proceedings of the second international workshop on the malacofauna of Hong Kong and Southern China, Hong Kong, 1983*, edited by B.S. Morton and D. Dudgeon. Hong Kong, Hong Kong University Press, pp. 49-76.
- Siddall, S.E. 1980. A clarification of the genus *Perna* (Mytilidae). *Bull. Mar. Sci.*, 30(4):858-870.
- Wilson, B.R. 1979. A revision of Queensland lithophagine mussels (Bivalvia, Mytilidae, Lithophaginae). *Rec. Aust. Mus.*, 32(13):435-489.
- Yamamoto, G. and T. Habe. 1958. Fauna of shell-bearing mollusks in Mutsu Bay. Lamellibranchia (1). *Bull. Mar. Biol., Stn Asamushi Tohoku Univ.*, 9(1):1-20.

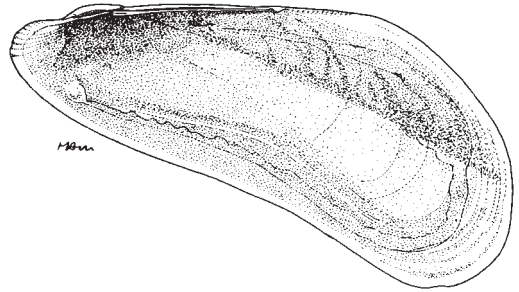
Arcuatula arcuatula (Hanley, 1843)

Frequent synonyms / misidentifications: *Modiola arcuatula* Hanley, 1843; *Musculista arcuatula* (Hanley, 1843) / *Arcuatula* and *Musculista* spp.

FAO names: En - Arcuate mussel; Fr - Modiolaire arquée.



exterior of left valve



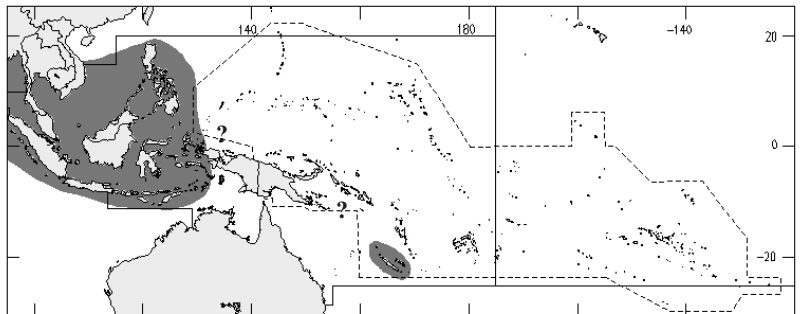
interior of right valve

Diagnostic characters: Shell rather small, thin and fragile, somewhat translucent, roughly elongate trapeziform in outline, with a very long and rather narrow shape. Anterior margin of valves quite short and sharply rounded, clearly extending forwards beyond the umbones. Ventral margin very long and broadly concave medially. A broad and rounded keel, radiating obliquely towards posteroventral end of valves and bordered anteriorly by a wide and shallow depression determining the situation of ventral margin. Outer surface of valves smoothish, with only fine concentric growth lines and a few small radial grooves in front of the umbones. Periostracum smooth and shiny, translucent, closely applied to shell surface. Hinge line with very small crenulations, mainly appearing behind the ligamental margin. Anterior adductor scar present. Internal margins very thin and smooth, undulate anteriorly in relation to the outer radial sculpture. **Colour:** outer coloration variable, light tan to olive-green or brown, often paler on the keel, with a median radial band and sometimes irregular transverse stripes of purplish brown on posterodorsal slope. Interior slightly pearly, pale bluish grey with the outer colour pattern showing through.

Size: Maximum shell length 5 cm, commonly to 3 cm.

Habitat, biology, and fisheries: On soft bottoms, often occurring gregariously. Intertidal and shallow subtidal waters. Commonly collected for food in Indonesia and cultivated in Thailand.

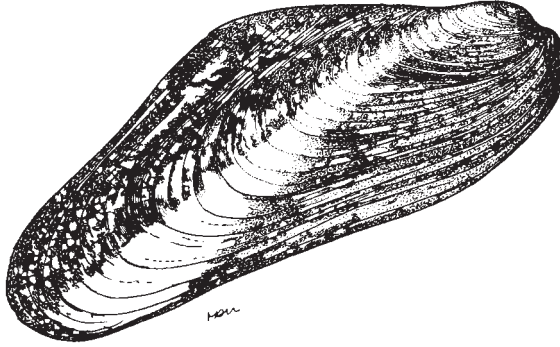
Distribution: Indo-West Pacific, from northwestern Indian Ocean, including the Red Sea, to Indonesia; north to Viet Nam and south to New Caledonia. Exact distribution of this species is not known, because of confusions with other related mytilid species.



Modiolus metcalfei (Hanley, 1843)

Frequent synonyms / misidentifications: None / None.

FAO names: En - Yellowbanded horse mussel; Fr - Modiole à bande jaune.



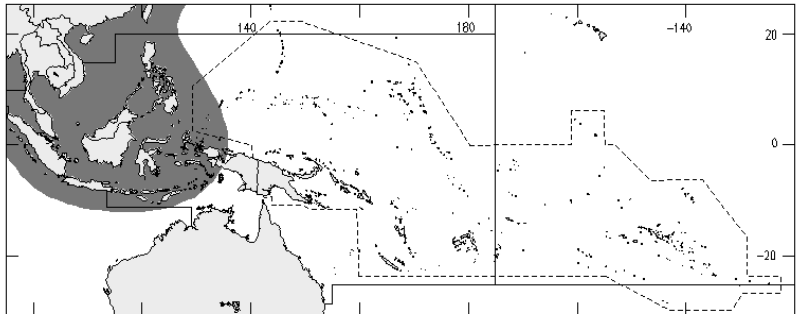
exterior of right valve

Diagnostic characters: Shell rather inflated, **roughly triangular** and elongate-ovate in outline. **Anterior margin** short, **slightly protruding** anteriorly **beyond the umbones**. **Posterodorsal margin** straightish, **forming a rather sharp angle with the produced**, roundly wedge-shaped **posterior margin**. Ventral margin long and nearly straight in the posterior 2/3, recurved anteriorly. **Outer surface smoothish**, with only fine concentric growth marks, frequently eroded towards the umbones. **Periostracum hairs** not branched, **developed on posterior half of valves**. **Hinge line smooth**, without teeth or crenulations. Anterior adductor scar present. Internal margins smooth. **Colour:** **outside** of shell **dull olive-brown**, often **with a median yellowish radial band**. Interior pearly, pale greyish blue to purple.

Size: Maximum shell length 8 cm, commonly to 6 cm.

Habitat, biology, and fisheries: Attached to pebbles or to mangrove prop roots, on muddy bottoms of sheltered bays, especially in areas under the influence of fresh-water supply. Littoral and sublittoral to a depth of about 25 m. Locally exploited in many areas from natural stocks. This is a commercially important species in the Philippines and Taiwan Province of China.

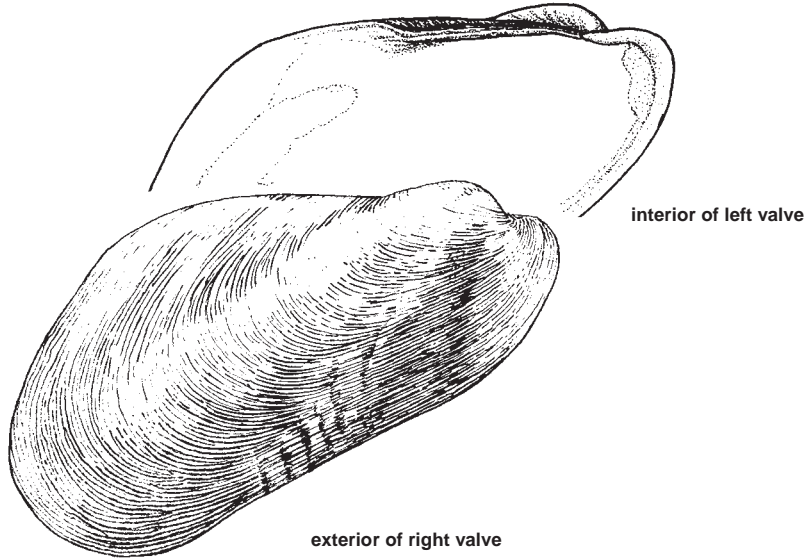
Distribution: Widespread in the Indo-West Pacific, from East Africa to the Philippines; north to Japan and south to Indonesia.



Modiolus philippinarum (Hanley, 1843)

Frequent synonyms / misidentifications: None / None.

FAO names: En - Philippine horse mussel; Fr - Modiole des Philippines.

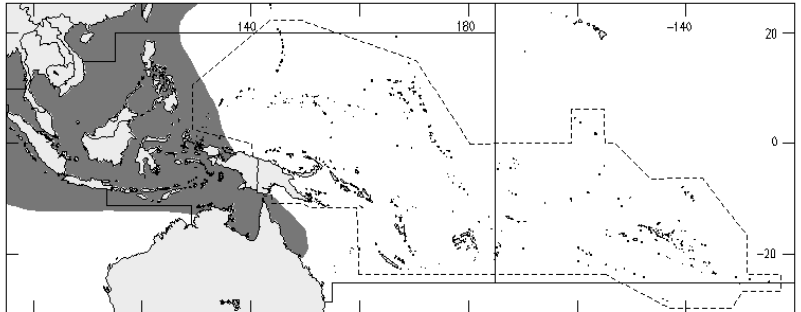


Diagnostic characters: Shell relatively thin but solid, **swollen**, elongate-ovate and **roughly trapeziform** in outline. **Anterior margin** short, **protruding anteriorly well beyond the inflated umbones**. **Postero-dorsal margin** long, oblique in relation to ventral margin, slightly arched, **forming an obtuse and rounded angle with the broadly rounded posterior margin**. Ventral margin long and slightly sinuous, with a shallow concavity at about midlength of shell. Outer surface sculptured with numerous concentric growth marks. Periostracum generally smooth. **Hinge line smooth**, without teeth or crenulations. Anterior adductor scar present. Internal margins smooth. **Colour:** **outside of shell yellowish brown**. Interior pearly and off-white to purplish red.

Size: Maximum shell length 13 cm, commonly to 8.5 cm.

Habitat, biology, and fisheries: On muddy and gravely mud flats. Littoral and sublittoral to a depth of 40 m. Collected for food in many areas. Marketed notably in Malaysia and the Philippines. Some experiments on the artificial establishment of this species have been carried out in Malaysia to develop its culture.

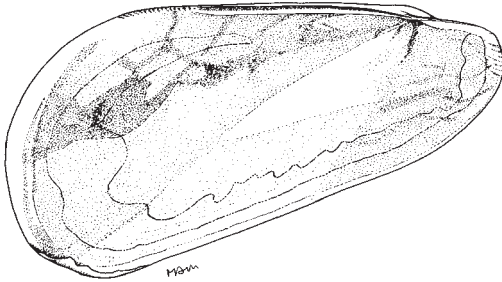
Distribution: Widespread in the Indo-West Pacific, from eastern Africa, including Madagascar and the Red Sea, to eastern Indonesia; north to Japan and south to Queensland.



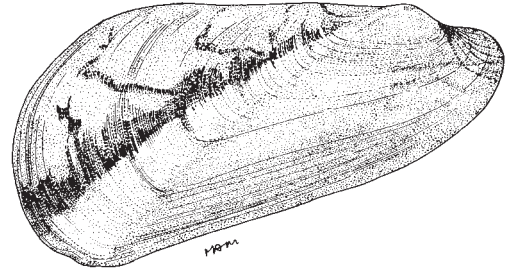
Musculista senhousia (Benson, 1842)

Frequent synonyms / misidentifications: *Brachidontes senhousia* (Benson, 1842); *Modiolus senhousia* (Benson, 1842); *Musculus senhousia* (Benson, 1842); *M. senhousii*, *senhauseni*, *senhausenii*, *senhausi*, *senhausia*, *senhousea*, *senhousei*, *senhousi*, *senhusi* (Spelling errors) / *Arcuatula* and *Musculista* spp.

FAO names: En - Senhouse horse mussel; Fr - Modiolaire de Senhouse.



interior of left valve



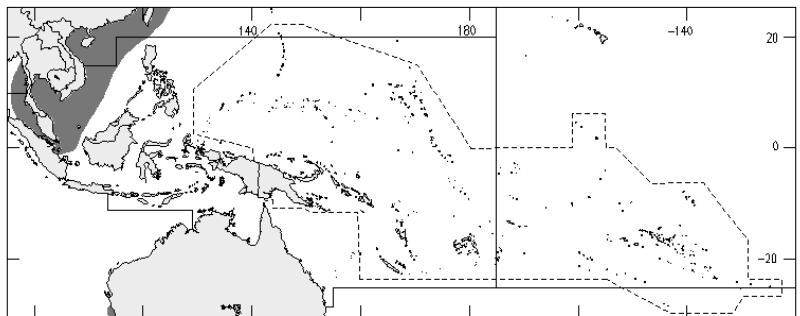
exterior of right valve

Diagnostic characters: Shell small-sized, thin and fragile, somewhat translucent, roughly trigonal ovate in outline, with a moderately long and rather high shape. Anterior margin of valves rather short and rounded, clearly extending forwards beyond the umbones. Ventral margin long and straightish. Outer surface of valves smoothish, with numerous concentric growth lines and a few small radial grooves in front of the umbones. Periostracum smooth and shiny, transparent, closely applied to shell surface and sometimes abraded from the umbones. Hinge line with very small crenulations in front of the umbones, along and a short way behind the ligamental margin. Anterior adductor scar present. Internal margins very thin and smooth, undulate anteriorly in relation to the outer radial sculpture. **Colour:** outside of shell glossy, yellowish green to olive-brown, typically patterned with about 15 narrow, tenuous, reddish brown stripes on posterodorsal slope (one of which is larger and darker), and a number of irregular transverse bands of the same colour. Interior slightly pearly, with the outer colour pattern more or less showing through.

Size: Maximum shell length 3.5 cm, commonly to 2.5 cm.

Habitat, biology, and fisheries: On soft and hard bottoms such as reef platform, intertidally and subtidally to a depth of about 20 m. This opportunistic species is characterized by its fast growth rate and high productive capacity, together with the unique feature to colonize both hard and soft substrates. On hard bottoms, individuals are often nestling among tufts of algae or other colonial mytilids. On soft-bottom areas, they can live byssally attached to various objects such as wharf pilings, boat hulls or eelgrass, or weave their byssal threads into an all-enclosing nest, forming large, dense mats with a maximum recorded density of 2 600 specimens per m². Colonies tending to fluctuate widely and unpredictably in time, even completely disappearing within a few months. They rapidly change sandy bottoms into mud flats through a copious retention of silt and mucous-bound faeces and pseudofaeces, then eliminating other infaunal species of bivalves. A popular and inexpensive food in China and Thailand, also used to feed poultry, shrimp, and fish.

Distribution: Exact distribution not known because of frequent confusion with other related species of Mytilidae. Eastern Indian Ocean and western Pacific, from western Thailand to Indonesia and Singapore; north to northern Japan and the Okhotsk Sea. Also introduced in widely scattered areas of the world (often with the cupped oyster *Crassostrea gigas*): southwestern Australia, northern New Zealand, western coast of the United States of America (Washington and California), northeastern Atlantic (France) and the Mediterranean Sea.

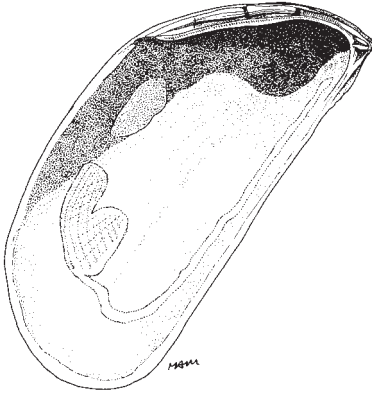


Perna viridis (Linnaeus, 1758)

MUG and MSV

Frequent synonyms / misidentifications: *Mytilus smaragdinus* Chemnitz, 1785 (Invalid name); *M. viridis* Linnaeus, 1758 / None.

FAO names: En - Asian brown mussel (formerly reported as "brown mussel"); Fr - Moule verte asiatique.



interior of left valve



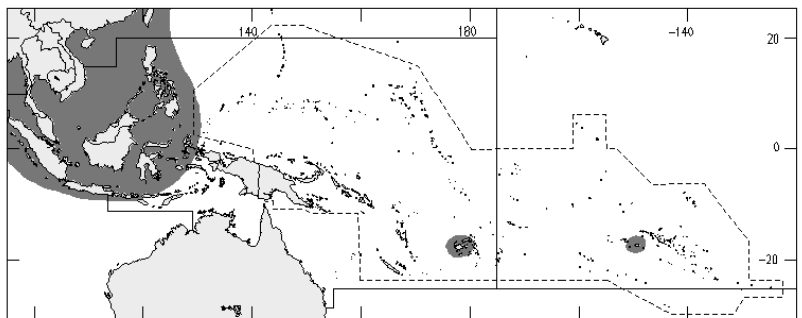
exterior of right valve

Diagnostic characters: **Shell elongate**, roughly **trigonal-ovate** in outline, swollen and pointed anteriorly, rounded and compressed posteriorly. **Umbones terminal and sharply tapering**, rather incurved. Anterior margin reduced. Ventral margin long and often somewhat concave. Outer surface nearly smooth apart from concentric growth marks and faint radial lines. **Periostracum** rather **thick and smooth**, adherent. **Ligamental ridge finely pitted**. Hinge with 1 small tooth in right valve and 2 in the left. **Anterior adductor scar absent** in adult specimens. Posterior retractor scars large, confluent with the posterior adductor scar. **Anterior retractor scar separated**, elongate-ovate in shape, situated a short way to posterior end of ligament. Internal margins smooth. **Colour:** outside of shell whitish under a bright **periostracum** which is **dark brownish green anteriorly** and olive-green to bright **green posteriorly**. Interior an iridescent pale bluish green, with a vivid green margin of periostracum.

Size: Maximum shell length 16.5 cm, commonly to 8 cm.

Habitat, biology, and fisheries: Byssally attached to various hard objects or substrates. Littoral and sublittoral to a depth of 20 m. Intense exploitation from natural beds and aquaculture in many areas. This is the economically most important species of Mytilidae in China, Taiwan Province of China, and southeast Asian countries such as India, Myanmar, Thailand, Singapore, Indonesia, and the Philippines. Also introduced for culture in Fiji Islands and eastern Polynesia. From 1990 to 1995, the reported yearly production of this species in the Western Central Pacific ranged from around 61 700 to 97 300 t (FAO Yearbook of Fishery Statistics). These figures comprise the production of "*Mytilus viridis*" from Malaysia and Singapore and also production reported under the name "*Mytilus smaragdinus*" from the Philippines and Thailand; they all refer to the same species.

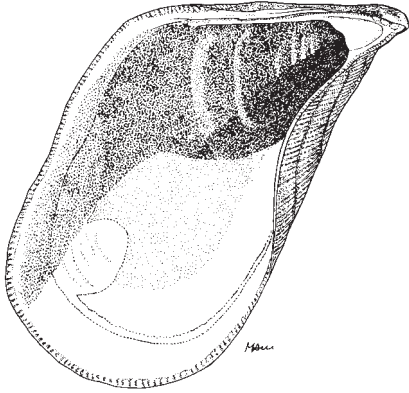
Distribution: Northwestern Indian Ocean to the tropical western Pacific, from the Persian Gulf to the Philippines; north to East China Sea and Taiwan Province of China, and south to Indonesia.



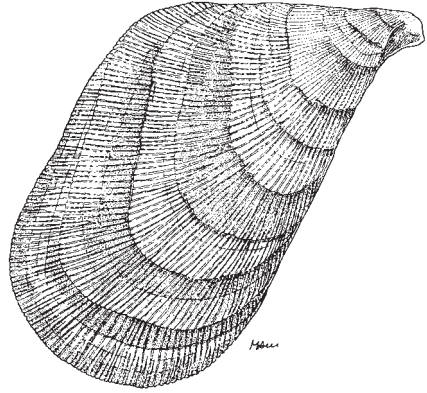
Septifer bilocularis (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Mytilus nicobaricus* Chemnitz, 1785 (Invalid name); *Septifer pilosus* (Reeve, 1858) / None.

FAO names: En - Box mussel; Fr - Septifère commun.



interior of left valve



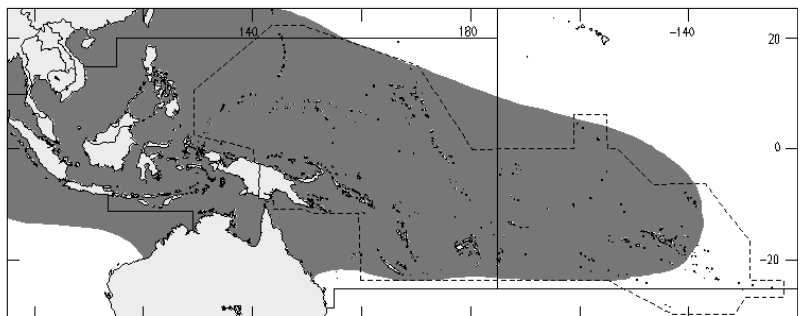
exterior of right valve

Diagnostic characters: Shell thick, elongate, variable in shape, **roughly trigonal-ovate or trapezoidal** in outline, markedly swollen and pointed anteriorly, rounded and somewhat compressed posteriorly. **Umboes terminal**, prominent, **sharply tapering and ventrally recurved**. Anterior margin reduced. Ventral margin long and usually broadly concave. Posterodorsal area somewhat expanded and laterally compressed. **Outer surface** of valves covered with numerous, **densely set radial riblets slightly diverging on posterodorsal and posteroventral areas**. Periostracum strong, tightly applied to shell. Hinge with a few small denticles under the umbo of each valve. **A strong shelly ledge above the umbonal cavity, supporting the anterior adductor scar** and expanded dorsally as a low ridge along the ligament. **Internal margins** finely **crenulated** throughout. **Colour:** exterior of shell deep **green**, becoming brownish and paler towards the umboes. Interior bluish grey to purplish brown, white on the umbonal area.

Size: Maximum shell length 5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: Attached to rocks, dead corals or the underside of stones, sometimes occurring in dense colonies. Littoral and sublittoral to a depth of about 15 m. Locally collected for food and marketed in the Philippines, together with other mytilid species. Shell used as raw material for shellcraft.

Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, the Red Sea and Persian Gulf, to eastern Polynesia; north to Japan and south to Queensland and New Caledonia.

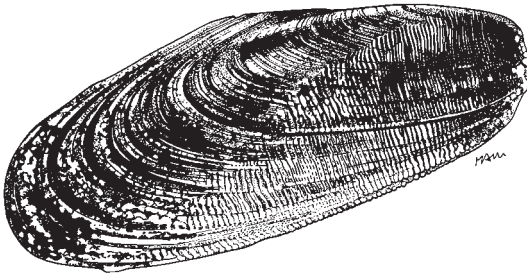


Lithophaga teres (Philippi, 1846)

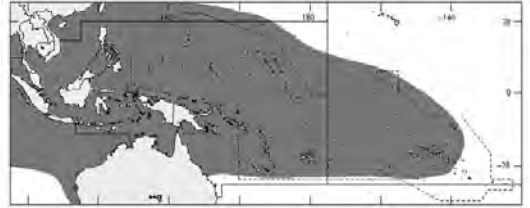
Frequent synonyms / misidentifications: *Lithophaga erythraensis* (Jousseume, 1888) / None.

En - Cylinder date mussel; **Fr** - Datte de mer polie.

Maximum shell length 7.5 cm, commonly to 5 cm. Boring in soft rocks and dead coral or lithothamnion. Littoral and sublittoral to a depth of at least 66 m. Sometimes found burrowing in massive coral heads, but the burrow opening is always located in those portions which lack living polyps. Only occasionally marketed in the Philippines, because it is not easy to collect. An important commercial species in Taiwan Province of China. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan and south to southwestern Australia, Queensland, and New Caledonia.



exterior of right valve

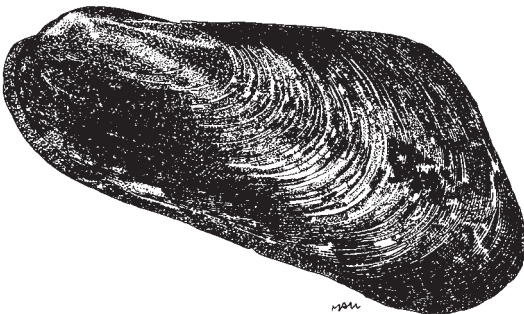


Modiolus aratus (Dunker, 1857)

Frequent synonyms / misidentifications: *Modiolus arata* (Dunker, 1857) / *Modiolus metcalfei* (Hanley, 1843).

En - Furrowed horse mussel; **Fr** - Modiole sillonnée.

Maximum shell length 5 cm, commonly to 4 cm. Often occurring gregariously, both on hard and soft substrates, and producing large quantities of byssal threads that generally enclose various small hard objects. Littoral and sublittoral to a depth of about 30 m. Frequently marketed in the central Philippines, often mixed with the box mussel *Septifer bilocularis*. Exact distribution not known, because of persistent confusion with other species of Mytilidae such as *Modiolus elongatus* (Swainson, 1821) or *Modiolus metcalfei* (Hanley, 1843). Indo-West Pacific, probably from Madagascar to the Philippines; north to China and south to northern Australia.



left side view of entire shell

(after Habe and Kosuge, 1966)

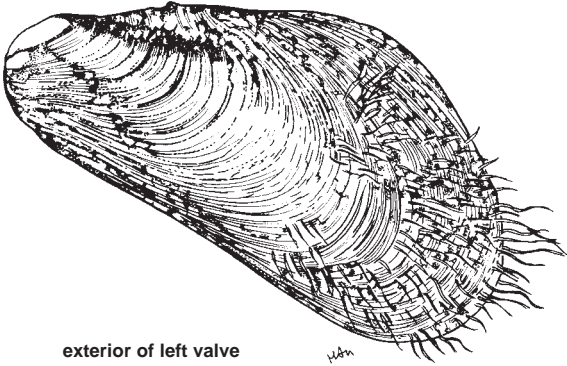


Modiolus auriculatus (Krauss, 1848)

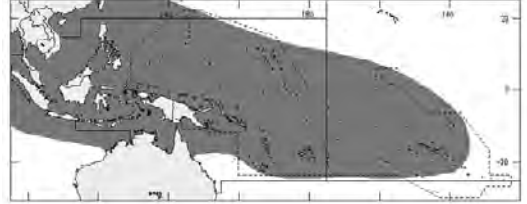
Frequent synonyms / misidentifications: *Modiolus agripetus* (Iredale, 1939); *M. auriculata* Krauss, 1848 / *Modiolus tulipa* (Lamarck, 1819) = *M. americanus* (Leach, 1815).

En - Eared horse mussel; **Fr** - Modiole auriculée.

Maximum shell length 7.5 cm, commonly to 6 cm. Attached to rocks and in crevices. Littoral and sublittoral to a depth of 25 m. The species is known to be collected for food at least in Fiji Islands. Outside the area, it is exploited in Madagascar and Sri Lanka. Widespread in the Indo-West Pacific, from East and South Africa, including the Red Sea, to eastern Polynesia; north to Japan and south to northern Australia.



exterior of left valve



Stavelia subdistorta (Récluz, 1852)

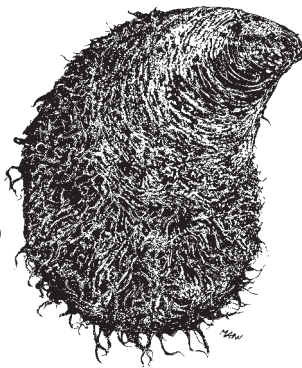
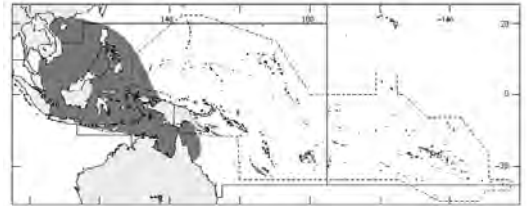
Frequent synonyms / misidentifications: *Stavelia horrida* (Dunker, 1856); *S. torta* (Reeve, 1857) / None.

En - Distorted mussel; **Fr** - Modiole tordue.

Maximum shell length 20 cm, commonly to 16 cm. On mud and sand bottoms. Littoral and sublittoral to a depth of 25 m. Collected in Viet Nam for subsistence. Restricted to the tropical western Pacific, from South China Sea to northern Queensland.



exterior of left valve
(periostracum removed)
(after Springsteen and Leobrera, 1986)

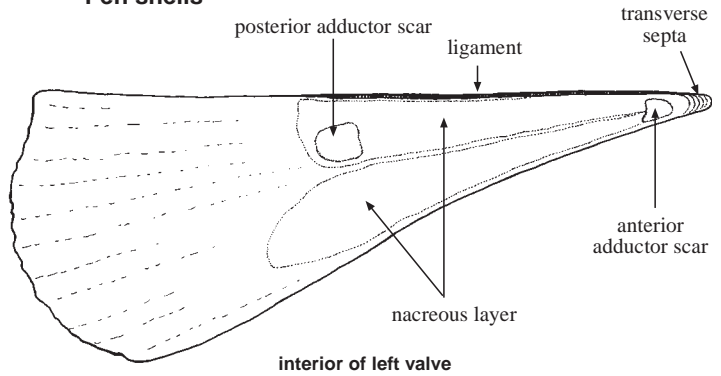


exterior of right valve
(after Habe and Kosuge, 1966)

PINNIDAE

Pen shells

Diagnostic characters: Shell large and brittle, equivalve, laterally compressed, subtrigonal in outline, ventrally and posteriorly gaping; very inequilateral, pointed in front, wide and flexible behind. Umbones at anterior end which is eroded and internally closed by a series of small transverse partitions. Outer sculpture mainly composed of radial ribbing, smoothish or provided with imbricated scales or spines, and often crossed by concentric undulations ventrally. Periostracum usually absent. Ligament

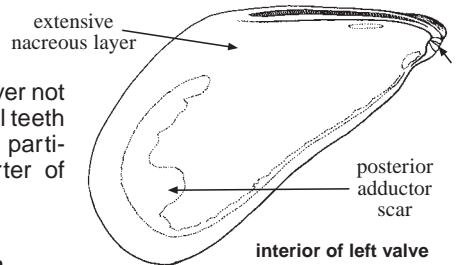


linear, recessed in a narrow groove along dorsal margin. Hinge without teeth. Interior of shell with a thin nacreous layer which is restricted to the anterior half of valves. Two unequal adductor muscle scars, the anterior relatively small and placed in the anterior angle of shell, the posterior large and situated about midlength. No pallial sinus. Internal margins thin, smoothish, reflecting the external sculpture. Gills of eulamellibranchiate type, with folded branchial sheets. Foot conical, elongate and grooved, with a profuse silky byssus. Siphons absent. Mantle widely open, papillate on margins.

Habitat, biology, and fisheries: Sessile animals, living generally partly embedded in heterogenous soft bottoms, with the narrow anterior tip of shell downwards, and attached to various hard elements of the substrate by means of long byssal threads. The posterior gape of the flexible shell can be closed by contraction of the adductor muscles. In relation to their vertically embedded mode of life, the Pinnidae have developed several unique anatomical features: a pair of special gutter-shaped canals inside the mantle lobes, to remove rapidly sediment material from the anterior portion of the mantle cavity, and a protrusible pallial organ above the posterior adductor muscle, to clear away debris from the posterior part of the shell. Sexes separate. Free-swimming larval stage present. Pinnidae have a noticeable economic importance in the western Pacific. They are actively collected for food in Japan and surrounding areas, as well as in Polynesia and several other Indo-Pacific island groups. In Polynesia, shells are carved to form decorative ornaments, and entire valves of large specimens are sometimes used as plates by native populations.

Similar families occurring in the area

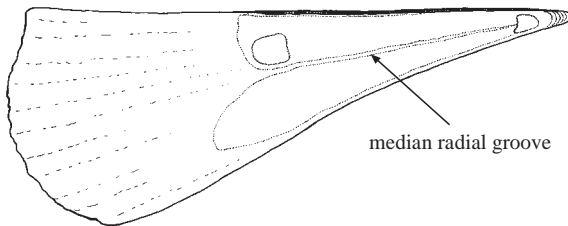
Mytilidae: stiff shell, without posterior gape; internal nacreous layer not restricted to the anterior half of shell; hinge sometimes with small teeth or crenulations; anterior end always without internal transverse partitions; posterior adductor scar situated in the posterior quarter of valves.



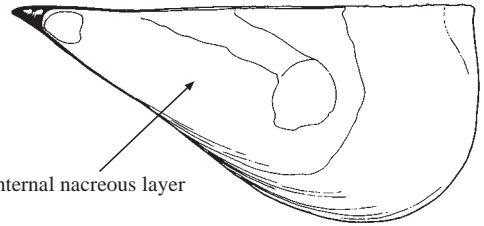
Mytilidae

Key to species of interest to fisheries occurring in the area

- 1a. Outer surface of valves with a median radial keel, at least for the young stages of growth; internal nacreous layer divided in 2 lobes by a median radial groove (Fig. 1a) → 2
- 1b. Outer surface of valves without a median radial keel, even for the young stages of growth; internal nacreous layer undivided (Fig. 1b) → 3



a) *Pinna*



b) *Atrina*

Fig. 1 inner surface

- 2a. Posterior margin of shell squarely truncate; posterior adductor scar often extending onto ventral lobe of nacreous area (Fig. 2) *Pinna muricata*
- 2b. Posterior margin of shell arcuate or broadly rounded (Fig. 3); posterior adductor scar never extending onto ventral lobe of nacreous area *Pinna bicolor*

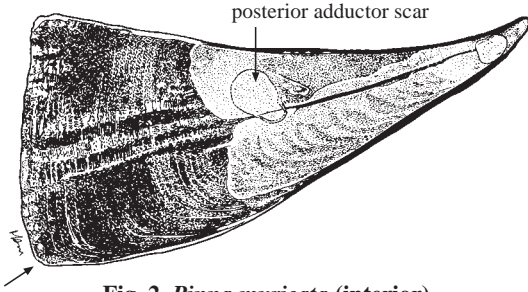


Fig. 2 *Pinna muricata* (interior)

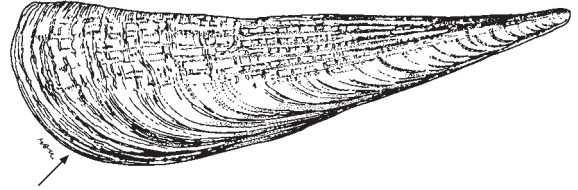


Fig. 3 *Pinna bicolor* (exterior)

- 3a. Posterior adductor scar completely enclosed within the nacreous area (Fig. 4) . . . *Atrina pectinata*
- 3b. Hind margin of posterior adductor scar slightly protruding beyond the nacreous area *Atrina vexillum*

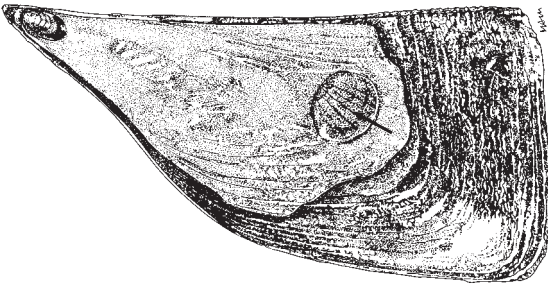


Fig. 4 *Atrina pectinata* (interior)

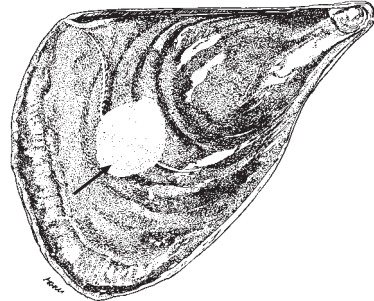


Fig. 5 *Atrina vexillum* (interior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Atrina pectinata* (Linnaeus, 1767)
- 🐚 *Atrina vexillum* (Born, 1778)
- 🐚 *Pinna bicolor* Gmelin, 1791
- 🐚 *Pinna muricata* Linnaeus, 1758

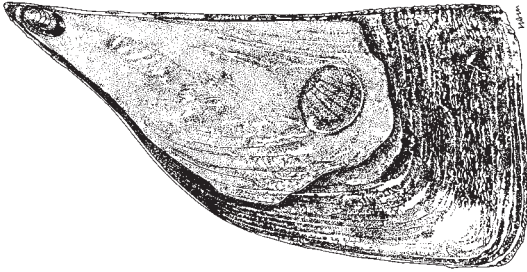
Reference

Rosewater, J. 1961. The family Pinnidae in the Indo-Pacific. *Indo-Pac. Moll.*, 1(4):175-226.

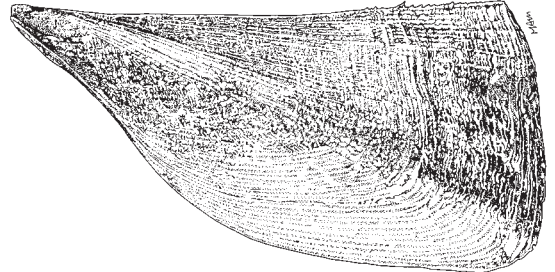
Atrina pectinata (Linnaeus, 1767)

Frequent synonyms / misidentifications: *Pinna chemnitzii* Hanley, 1858; *P. japonica* Reeve, 1858; *P. lischkeana* Clessin, 1891; *P. lurida* Reeve, 1858; *P. pectinata* Linnaeus, 1767 / *Pinna pectinata* "Linnaeus" Hanley, 1855 = *Atrina fragilis* (Pennant, 1777).

FAO names: En - Comb pen shell; Fr - Jambonneau pectiné.



interior of left valve



exterior of right valve

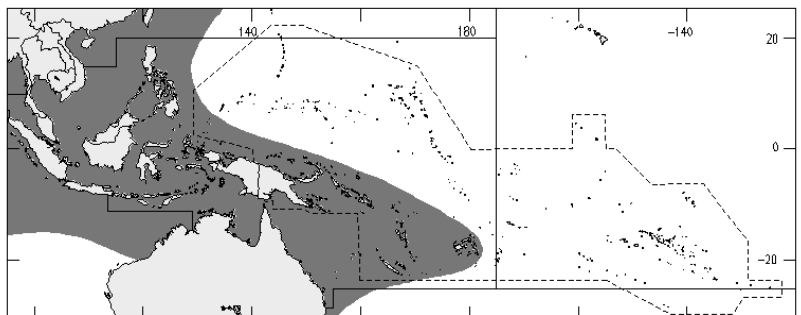
(after Lamprell and Whitehead, 1992)

Diagnostic characters: Shell reaching a large size, usually rather thin, fragile, moderately inflated and triangularly wedge-shaped in outline, with a highly variable sculpture. Dorsal margin nearly straight or slightly concave, posterior margin generally truncate. Ventral margin widely convex posteriorly, straightish to shallowly depressed anteriorly. Outer surface of valves with 15 to 30 radial ribs which may be smooth to densely set with short, open spines. Dorsalmost radial rib frequently with a series of short and sharp spines protruding along the dorsal margin of shell. Inner surface of shell with shallow grooves corresponding to the external radial ribs. Internal nacreous layer rather thin, undivided, occupying the anterior 2/3 to 3/4 of valves. Posterior adductor scar completely enclosed within the nacreous area. **Colour:** outside of shell slightly shiny, translucent olivaceous tan, often tinged with darker purplish brown or grey toward the umbones. Interior similarly coloured, iridescent on nacreous area.

Size: Maximum shell length 37 cm, commonly to 26 cm.

Habitat, biology, and fisheries: In sand or muddy sand with shells, with the ventral (open) portion of the shell facing towards the current. From low intertidal areas to depths of about 20 m. Tolerant to wide ranges of temperature (from 1° to 39°C) and to low-salinity water. Collected in many areas for food and fertilizer, this species is frequently used commercially in the northern part of its range (Japan, Taiwan Province of China) where it reaches a larger size. There it is planted intertidally and actively cultivated for subsequent harvest. In the Philippines, the shucked soft parts are often sold in the markets, and the posterior adductor muscle is sometimes sold separately.

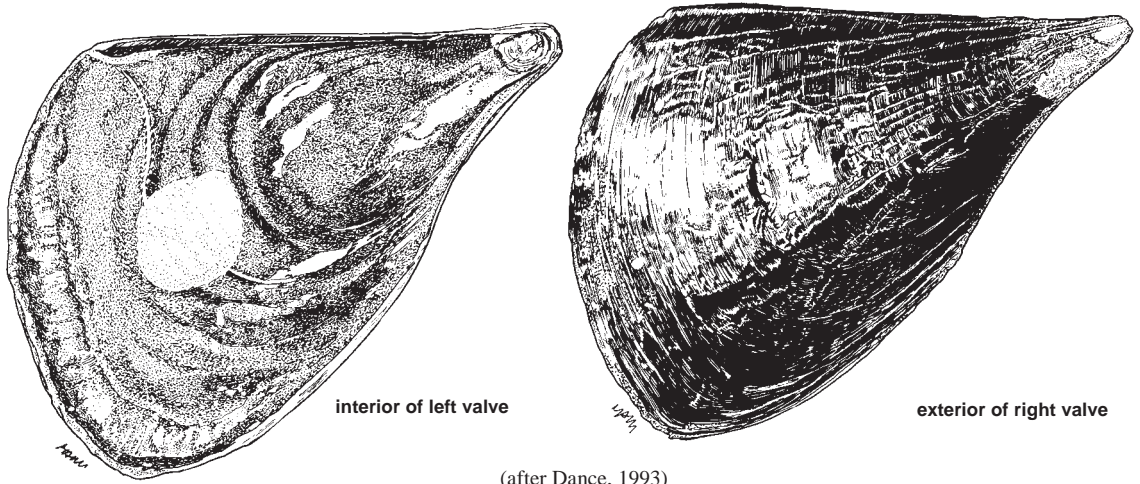
Distribution: Widely distributed in the Indo-West Pacific, from southeastern Africa to Melanesia and New Zealand; north to Japan and south to New South Wales. New Zealand populations are generally considered a distinct subspecies under the name *Atrina pectinata zelandica* (Gray, 1835).



Atrina vexillum (Born, 1778)

Frequent synonyms / misidentifications: *Pinna nigra* Chemnitz, 1785 (Invalid name); *P. vexillum* Born, 1778 / None.

FAO names: En - Flag pen shell; Fr - Jambonneau noir.



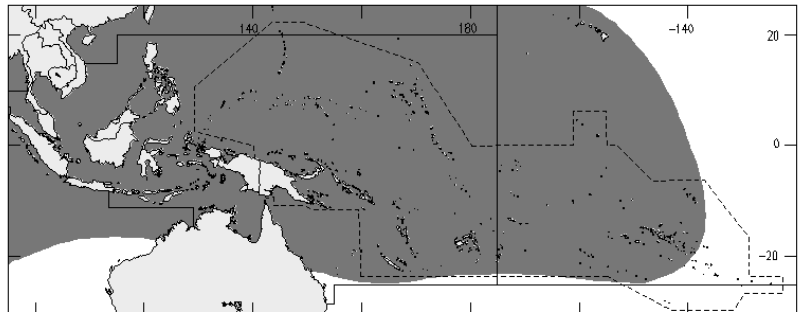
(after Dance, 1993)

Diagnostic characters: Shell reaching a very large size, **thick and solid, inflated**, variable in shape from **triangular to hatchet-shaped or subglobular**. Dorsal margin usually nearly straight, posterior margin broadly oval to somewhat truncate in outline. **Ventral margin** broadly convex posteriorly and concave near the umbones, **often strongly lobate** in medium-sized and large specimens. Outside of valves with **10 to 17 main radial ribs, often bearing scale-like spines**, and with weaker interstitial riblets. **Internal nacreous layer moderately strong, undivided**, occupying the anterior half or 2/3 of valves. **Hind margin of posterior adductor scar slightly protruding beyond the nacreous area** (protrusion of adductor scar more developed in mature specimens). **Colour:** **outside of shell dark reddish brown to nearly black**, usually **dull**. Shell material semitranslucent, appearing a rich reddish purple when viewed with transmitted light. Interior dark brown to black, iridescent on nacreous area.

Size: Maximum shell length 48 cm, commonly to 30 cm.

Habitat, biology, and fisheries: In sandy-mud bottoms, or in sandy eel-grass patches on reefs sublittorally, from depths of 1 to about 35 m. Because it attains a large size, this common species is probably one of the most economically important members of the family in the Indo-West Pacific. The large posterior adductor muscle is highly prized as food, and the black shell carved by natives in Polynesia to make decorative ornaments or plates. Beautiful but very fragile black pearls are sometimes produced by the animal.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and Hawaii, and south to Queensland and New Caledonia.

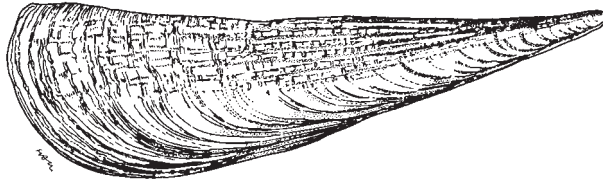


Pinna bicolor Gmelin, 1791

Frequent synonyms / misidentifications: *Pinna atropurpurea* Sowerby, 1825 / *Pinna deltodes* Menke, 1843.

En - Bicolor pen shell; **Fr** - Jambonneau bicolore.

Maximum shell length 50 cm, commonly to 40 cm. Embedded in muddy sand and reef flats, in littoral and adjacent subtidal shallow waters to depths of about 10 m. Planktonic larval stage probably short, hence a range restricted to the shores of continental areas and adjacent islands. Species of minor economic importance, locally collected for subsistence purposes. Indo-West Pacific, from East and southeast Africa, including Madagascar, Mauritius Island, the Red Sea and the Persian Gulf, to New Caledonia; north to Japan and south to South Australia. Generally absent from oceanic islands of the central Indian Ocean and the tropical West Pacific, but sporadically found in Hawaii.



exterior of right valve

(after Habe, 1977)

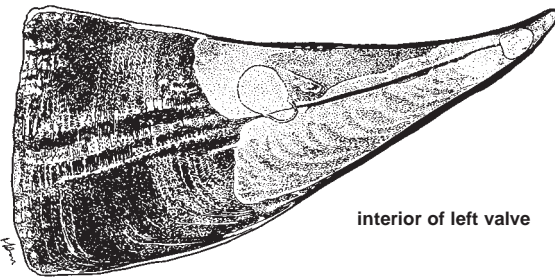


Pinna muricata Linnaeus, 1758

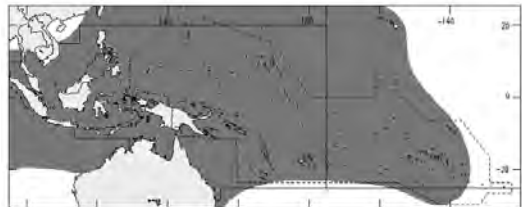
Frequent synonyms / misidentifications: *Pinna exquisita* Dall, Bartsch, and Rehder, 1938; *P. hawaiiensis* Dall, Bartsch, and Rehder, 1938; *P. philippinensis* Reeve, 1858; *Quantulopinna delsa* Iredale, 1939; *Q. muricata* (Linnaeus, 1758) / None.

En - Prickly pen shell; **Fr** - Jambonneau épineux.

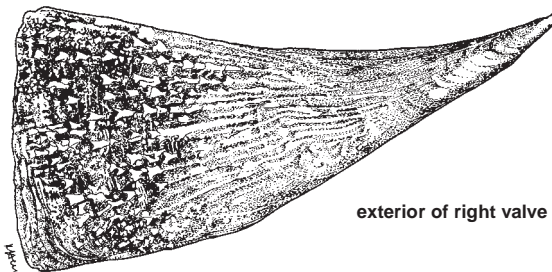
Maximum shell length 31 cm, commonly to 15 cm. In various soft bottoms (silty mud, sand, sandy gravel), among rocks, in eel-grass flats or in sandy patches of coral reefs, from low tide levels to a depth of about 40 m. Occasionally collected for food by coastal populations. Widespread in the Indo-West Pacific, from eastern Africa, including South Africa, Madagascar, the Red Sea and the Gulf of Oman, to eastern Polynesia; north to southern Japan and south to New South Wales.



interior of left valve



(after Rosewater, 1961)

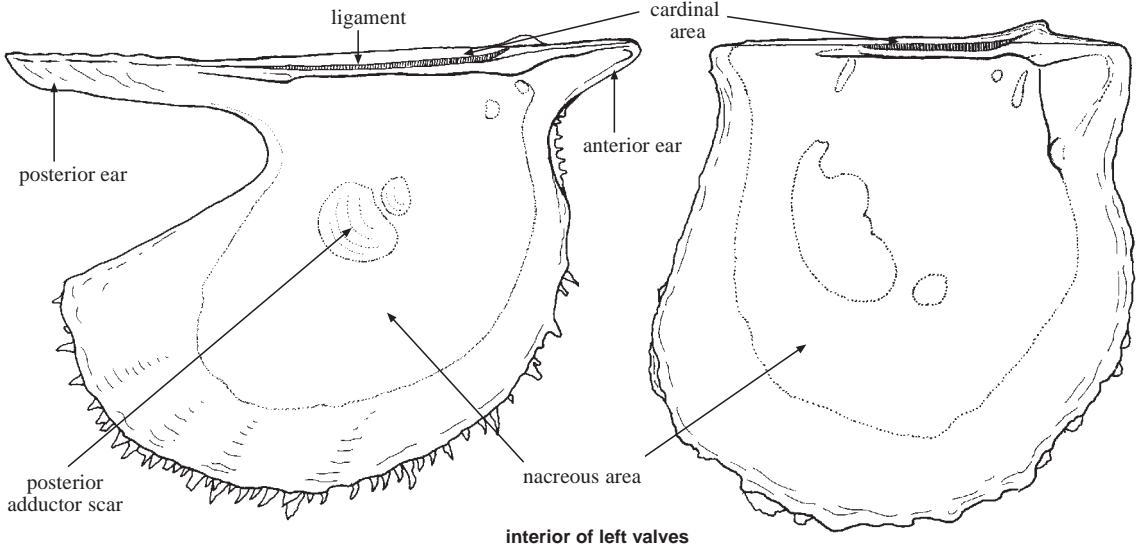


exterior of right valve

PTERIIDAE

Pearl oysters

Diagnostic characters: Shell somewhat compressed, obliquely ovate to suborbicular in outline, with a straight dorsal margin often produced at each end into a wing-like ear, trigonal in front and sometimes very long behind. Shell slightly inequivalve, with left valve a little more inflated than right valve which is provided with a strong byssal notch anteriorly. Outer surface of shell often scaly or lamellate. Umbones small, prosogyrate, in front of midlength of valves. A narrow cardinal area in each valve, with the external ligament more or less stretching along under and behind the umbo. Hinge narrow and elongate, toothless or with 1 or 2 denticles near the umbo and a lamellate process posteriorly. Interior of shell partly nacreous, often with a wide non-nacreous margin ventrally. Only 1 large and subcentral, posterior adductor muscle scar usually present in the adult. Pallial line without a sinus. Gills of filibranchiate type, with folded or smooth branchial sheets. Foot small, grooved, with a well-developed byssus. Siphons absent. Mantle lobes free, with marginal tentacles.



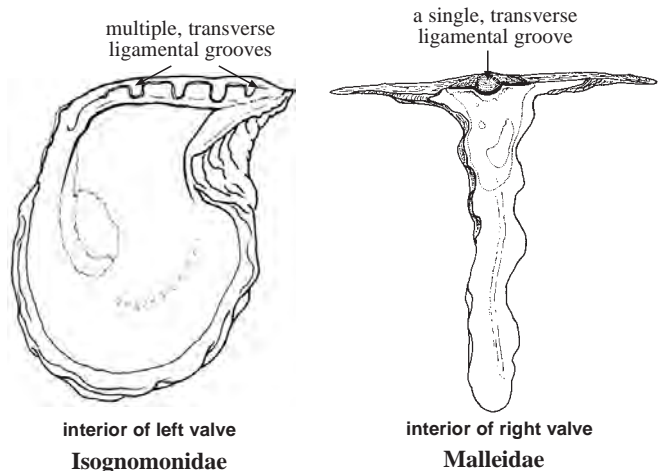
interior of left valves
examples showing diversity in shape

Habitat, biology, and fisheries: Pteriidae live attached by their strong byssus to various substrates (rocks, pebbles, shells, aquatic plants, alcyonarians, etc.), mainly in warm, tropical to subtropical and relatively shallow waters. They may occur in dense colonies. The Pteriidae are important economic bivalves in the Indo-West Pacific. They are actively exploited since ancient times for their ability to produce pearls. Some species are intensely cultivated for pearl production and their shell used as a source of mother-of-pearl for the industry. The soft parts are also consumed by native coastal populations in many parts of the area.

Similar families occurring in the area

Isognomonidae: cardinal area with a series of transverse ligamental grooves.

Malleidae: cardinal area relatively wide, with a single transverse central groove for the ligament; shell often with a long, non-nacreous ventral to posteroventral expansion; dorsal margin of shell sometimes produced into very long wing-like expansions at both ends.



interior of left valve
Isognomonidae

interior of right valve
Malleidae

Key to species of interest to fisheries occurring in the area

- 1a. Shell obliquely ovate in outline; posterior ear drawn out into a wing-like expansion (Fig. 1a) → 2
- 1b. Shell subcircular to subquadrate in outline; posterior ear ill-defined, not forming a wing-like expansion (Fig. 1b) → 3

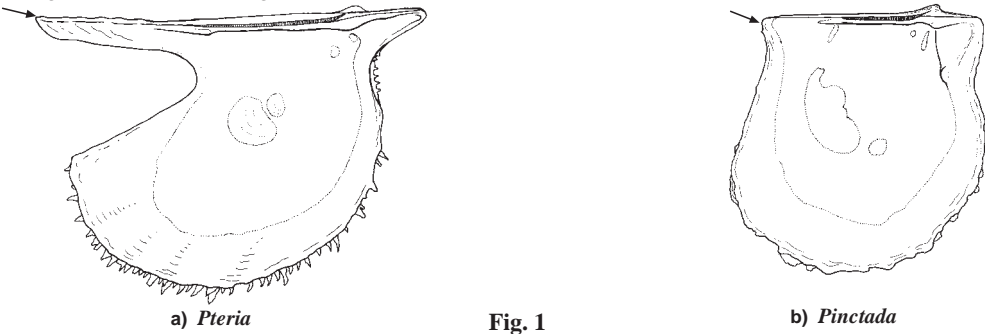


Fig. 1

- 2a. Shell colour plain black; outline initially narrowly oblique, later greatly expanding ventrally; non-nacreous internal margin relatively wide (Fig. 2) *Pteria penguin*
- 2b. Shell colour dark brown, with a few yellowish radial rays; outline obliquely oval and rather narrow; non-nacreous internal margin reduced (Fig. 3) *Pteria avicular*

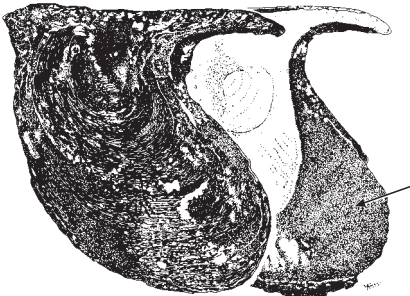


Fig. 2 *Pteria penguin*

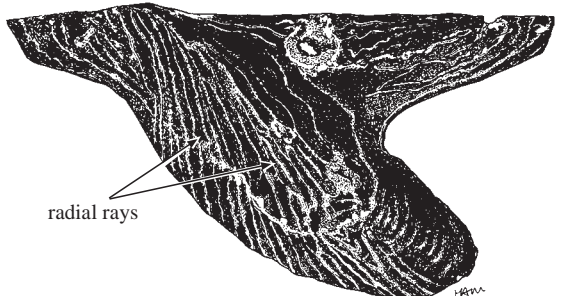


Fig. 3 *Pteria avicular* (exterior)

- 3a. Shell rather thick and large (reaching 20 cm in height or more), subcircular in outline; anterior margin markedly protruding beyond the tip of anterior ear; hinge toothless (Fig. 4a) → 4
- 3b. Shell rather thin and small (not exceeding 9 cm in height), subquadrate in outline; anterior margin protruding only slightly or not at all beyond the tip of anterior ear; hinge with 2 small teeth in each valve (Fig. 4b) → 5

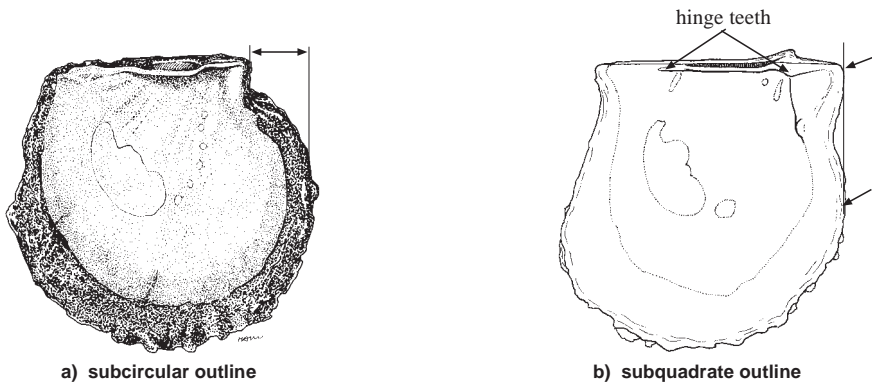


Fig. 4 interior of left valve

- 4a. Outer surface uniformly fawn, sometimes with radial stripes of darker spots in the unbonal region; nacreous area with a golden border (Fig. 5); non-nacreous margin horny. *Pinctada maxima*
- 4b. Outer surface dark greyish brown or green, with radial stripes of white to yellowish spots (Fig. 6); nacreous area with a darker border; non-nacreous margin very dark *Pinctada margaritifera*

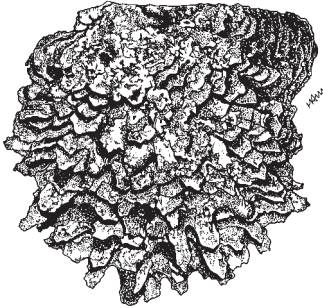


Fig. 5 *Pinctada maxima* (exterior)

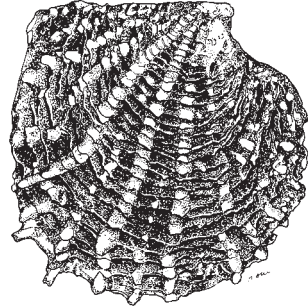


Fig. 6 *Pinctada margaritifera* (exterior)

- 5a. Nacreous area with golden tint; non-nacreous margin with white porcelaneous patches (Fig. 7) *Pinctada maculata*
- 5b. Nacreous area silvery, without golden tint; non-nacreous margin without white porcelaneous patches (Fig. 8) *Pinctada radiata*



Fig. 7 *Pinctada maculata* (interior)

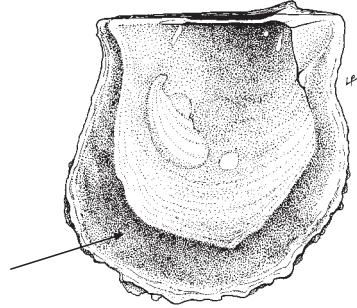


Fig. 8 *Pinctada radiata* (interior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Pinctada maculata* (Gould, 1850)
- 🐚 *Pinctada margaritifera* (Linnaeus, 1758)
- 🐚 *Pinctada maxima* (Jameson, 1901)
- 🐚 *Pinctada radiata* (Leach, 1814)
- 🐚 *Pteria avicular* (Holten, 1802)
- 🐚 *Pteria penguin* (Röding, 1798)

References

Alagarwami, K. (ed.). 1987. Pearl culture. *Cent. Mar. Fish. Res. Inst. Bull.*, 39:1-136.

Hynd, J.S. 1955. A revision of the Australian pearl-shells, Genus *Pinctada* (Lamellibranchia). *Aust. J. Mar. Freshw. Res.*, 6(1):98-137.

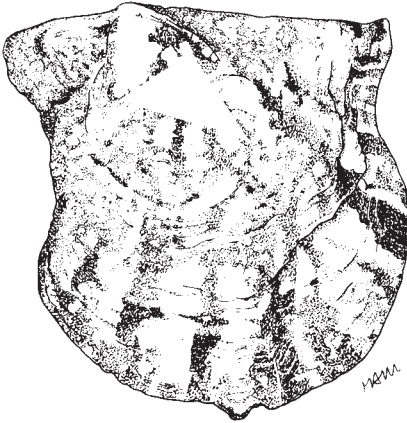
Ranson, G. 1961. Les espèces d'huîtres perlières du genre *Pinctada*. (Biologie de quelques-unes d'entre elles). *Mem. Inst. R. Sci. Nat. Belg.*, (2)67:1-95.

Shirai, S. 1994. *Pearls and Pearl Oysters of the world*. Okinawa, Marine Planning, 108 p.

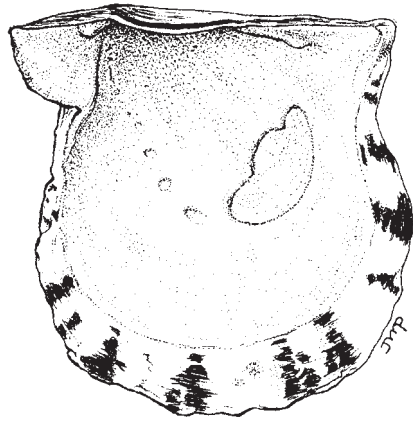
Pinctada maculata (Gould, 1850)

Frequent synonyms / misidentifications: *Pinctada panasesae* (Jameson, 1901); *P. pitcairnensis* (Jameson, 1901); *Pteria maculata* (Gould, 1850) / None.

FAO names: En - Spotted pearl oyster; Fr - Pintadine tachetée.



exterior of left valve
(after Kira, 1962)



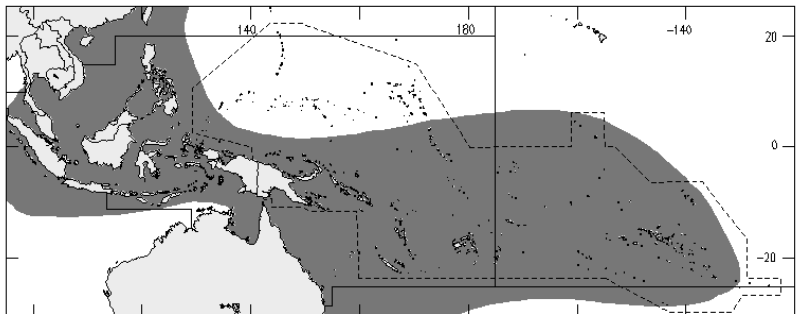
interior of right valve

Diagnostic characters: Shell rather thin and small, subquadrate in outline, with a short and ill-defined posterior ear which is not drawn out into a wing-like process. Anterior margin protruding only slightly or not at all beyond the tip of anterior ear. Outer surface of shell, when not worn, covered with numerous, flattened and brittle, imbricating concentric scales bearing slender, radially projecting spines, especially toward the margins. Hinge line with 2 small teeth on each valve: 1 rounded anterior tubercle just in front of the umbo, and 1 slightly slanting posterior ridge behind the ligamental area. Parallel accessory ridges sometimes developed on both valves, so that the posterior teeth appear double. **Colour:** outside of shell with a variable coloration, usually white to tan with a number of purple, or brown to black radiating bands and sometimes a superimposed pattern of finely wavy concentric lines of reddish brown. Internal nacreous area with pale yellow to deep orange-gold tint. Non-nacreous margin with white porcelaneous patches, generally alternating with irregular, dark purplish brown or black blotches.

Size: Maximum shell height 6 cm, commonly to 5 cm.

Habitat, biology, and fisheries: Byssally attached to rocks, the underside of stones or coral pieces. Littoral and sublittoral to a depth of about 20 m. Extremely common in some shallow water Polynesian lagoons. This species can give regular but rather small yellow pearls. Locally exploited for its edible meat, golden nacreous shell and, sometimes, for pearls (Philippines, western Polynesia).

Distribution: Western Pacific and adjacent areas of the eastern Indian Ocean, from Cocos (Keeling) Islands to eastern Polynesia; north to Japan and south to northern New South Wales, Kermadec, Norfolk and Lord Howe islands.



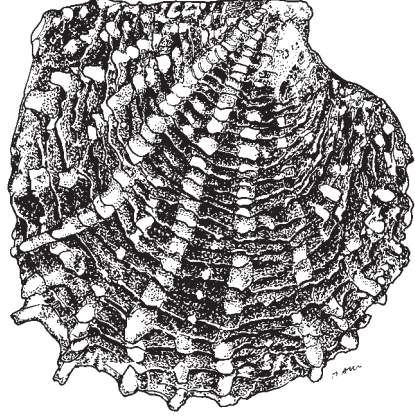
Pinctada margaritifera (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Meleagrina margaritifera* (Linnaeus, 1758); *Pinctada nigromarginata* (Saville-Kent, 1890) / None.

FAO names: En - Blacklip pearl oyster; Fr - Pintadine à lèvres noire.



interior of left valve



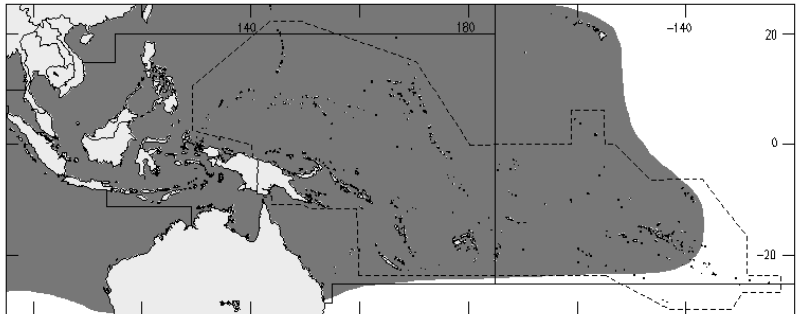
exterior of right valve

Diagnostic characters: Shell rather thick and large (attaining 25 cm in length), subcircular in outline, with a short and ill-defined posterior ear which is not drawn out into a wing-like process. Anterior margin markedly protruding beyond the tip of anterior ear. Outer surface of valves, when not worn, with densely set, flattened, imbricating concentric scales and moderately long, parallel-sided and flattened spines with tapering or rounded ends; spines lying relatively flat on surface of valves, arranged in radial rows and often strongly projecting on shell margins. Hinge completely devoid of teeth. Colour: outside of shell dark greyish brown or green to nearly black in ground colour, with radial stripes of white or yellowish markings corresponding to the basal portion of old flattened spines. Internal nacreous area silvery, with a darker smoky hue and a hint of red and green iridescence on border. Non-nacreous area very dark.

Size: Maximum shell height 25 cm, commonly to 13 cm.

Habitat, biology, and fisheries: On various bottoms, byssally attached to hard substrates at least in the young stages. Mainly in clear water under the influence of currents. Often in dense colonies. Littoral and sublittoral to a depth of 20 m. This large-sized, edible species is commonly used for the mother-of-pearl industry and pearl trade in many areas of the Indo-West Pacific. It produces highly prized dark pearls, which are collected both from natural banks and by aquaculture.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and the Hawaii, and south to southern Queensland.



Pinctada maxima (Jameson, 1901)

Frequent synonyms / misidentifications: None / *Meleagrina margaritifera* (Linnaeus, 1758)

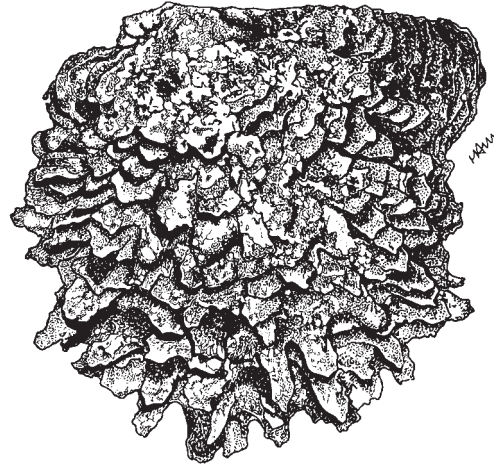
FAO names: En - Goldlip pearl oyster; Fr - Pintadine à lèvres dorées.

Diagnostic characters: Shell rather thick and large to very large (attaining 30 cm in length), subcircular in outline, with a short and ill-defined posterior ear which is not drawn out into a wing-like process. Anterior margin markedly protruding beyond the tip of anterior ear. Outer surface of valves, when not worn, covered with flattened, imbricating concentric scales bearing large and irregular, flat spines with blunt ends, roughly arranged in radial rows and projecting at shell margins. Hinge completely devoid of teeth. **Colour:** outside of shell uniformly fawn, sometimes with radial stripes of darker spots in umbonal region; then, ground colour in that region green, dark brown, or purple. Internal nacreous area highly lustrous, silvery with a variably extended golden border. Non-nacreous margin clear, of a plain horny colour.

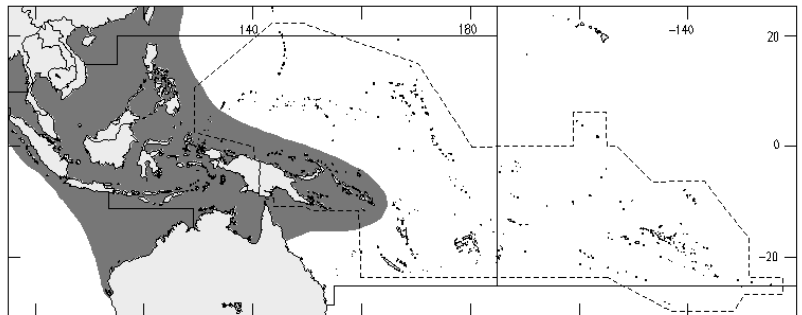
Size: Maximum shell height 30 cm, commonly to 20 cm.

Habitat, biology, and fisheries: On various bottoms, byssally attached to hard substrates or objects, at least in the young stages. Mainly in clear water under the influence of currents. Often in dense colonies. Littoral and sublittoral to a depth of 60 m; most common sublittorally, from depths of 5 to 30 m. This large-sized, edible species is abundantly used for the mother-of-pearl industry and pearl trade and has a great economic importance in many areas. Cultivated in China, Thailand, New Guinea, and the Philippines.

Distribution: Eastern Indian Ocean to the tropical western Pacific, from Nicobar and Andaman Islands to Melanesia; north to Japan and south to Queensland.



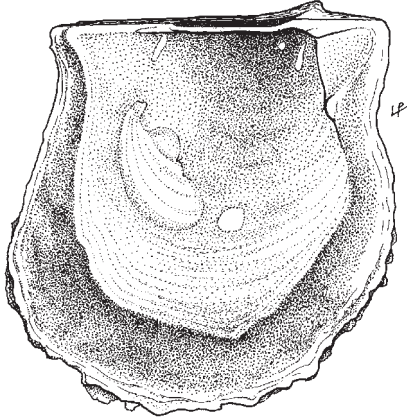
exterior of left valve
(after Habe and Kosuge, 1966)



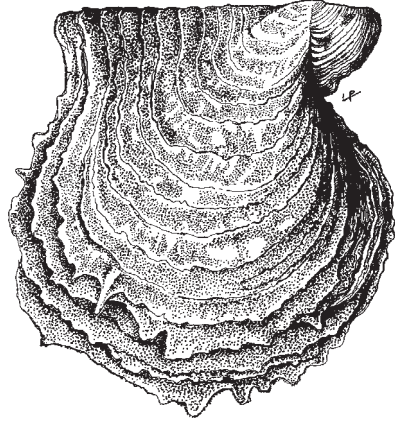
Pinctada radiata (Leach, 1814)

Frequent synonyms / misidentifications: *Pinctada aerata* (Reeve, 1857); *P. fucata* (Gould, 1850); *P. lacunata* (Reeve, 1857); *P. martensii* (Dunker, 1872); *P. perviridis* (Reeve, 1857); *P. vulgaris* of authors (? not of Schumacher, 1817) (A deleted, dubious name) / *Pinctada imbricata* (Röding, 1798).

FAO names: En - Rayed pearl oyster; Fr - Pintadine radiée; Sp - Pintadina radiada.



interior of left valve



exterior of right valve

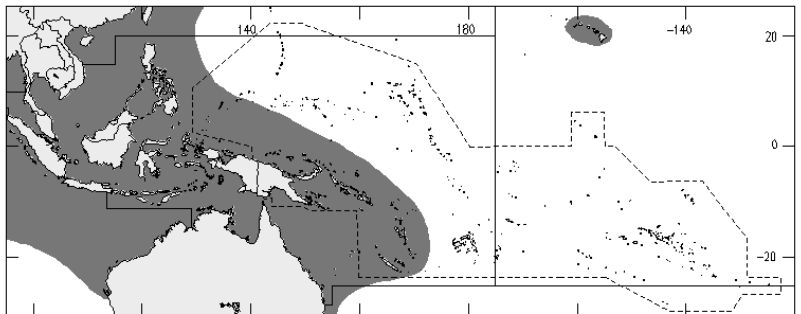
Diagnostic characters: Shell rather thin and small to medium sized, relatively inflated, subquadrate in outline, with a short and ill-defined posterior ear which is not drawn out into a wing-like process. Dorsal margin relatively long, anterior margin protruding only slightly or not at all beyond the tip of anterior ear. Outer surface of shell, when not worn, with densely set, appressed and flattened, imbricating concentric scales and moderately small, radially projecting spines mostly preserved towards the margins. Hinge line with 2 small teeth in each valve: 1 rounded anterior tubercule just in front of the umbo, and 1 posterior ridge, situated behind the ligamental area and almost parallel to dorsal margin. A small accessory ridge sometimes present above the posterior tooth of right valve. **Colour:** outside of shell variable, uniform or with darker markings or radial rays, mostly of reds and browns, but sometimes of green and bronze coloration. Internal nacreous area highly iridescent. Non-nacreous margin glossy, light brown with dark brown or reddish blotches corresponding to the main external rays.

Size: Maximum shell height 9.5 cm, commonly to 6 cm.

Habitat, biology, and fisheries: Byssally attached to rocks, dead corals and various submerged objects, often forming large natural banks. On soft bottoms, they aggregate to one another. Littoral, sublittoral and shelf zone, from low tide levels to a depth of about 150 m. Most common on sublittoral bottoms, from depths of 5 to 25 m. Collected in many areas of the Indo-West Pacific for its edible muscle, nacreous shell and ability to develop pearls, this species is a major economic species for pearl production in India, Sri Lanka, Myanmar, China, and Japan where it is also actively cultivated.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to Melanesia and Hawaii; north to Japan and south to northern Victoria.

Remarks: There has been much confusion about the taxonomy of this important economic species, and there is still no general agreement among authors about the correct scientific name. In areas where it is intensively fished or cultivated, it has been generally known as *Pinctada fucata* (India), *P. vulgaris* (Sri Lanka) and *P. martensii* or *P. fucata martensii* (Japan). It appears, however, that *P. radiata* must be used as the oldest available name.



Pteria penguin (Röding, 1798)

Frequent synonyms / misidentifications: *Magnavicula penguin* (Röding, 1798); *Pteria lotorium* (Lamarck, 1819) / *Pteria macroptera* (Lamarck, 1819).

FAO names: En - Penguin wing oyster; Fr - Avicule épaisse.

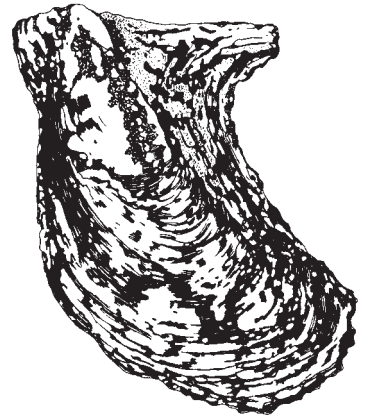


exterior of left valve

(after Okutani and Habe, 1975)



interior of right valve



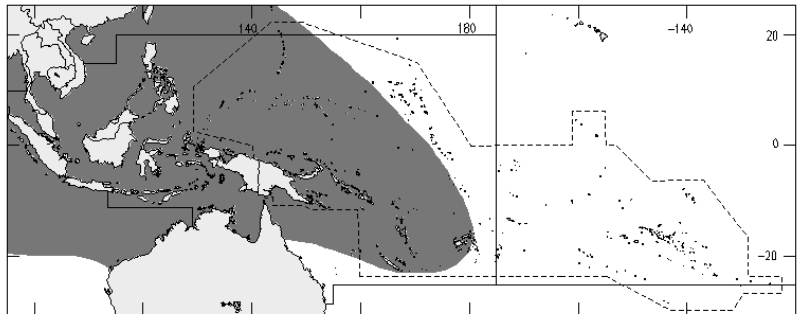
exterior of left valve
(mature specimen with shortened
posterior wing)
(after Habe, 1969)

Diagnostic characters: Shell solid, reaching a very large size, obliquely ovate in outline, with posterior ear drawn out into a narrow, more or less elongated, wing-like expansion; slightly inequivalve, left valve a little more inflated and with a weak rounded fold radiating from umbo to posteroventral end of shell. Outline of shell variable, initially narrowly oblique, later greatly expanding ventrally and almost as high as long, or even higher than long in larger specimens and with the posterior ear relatively short. Interior of shell with a wide non-nacreous margin ventrally. **Colour:** outside of shell plain dark brown to black. Interior silvery and brilliantly nacreous, with a broad, posteroventrally expanded, glossy black margin.

Size: Maximum shell length 30 cm, commonly to 20 cm.

Habitat, biology, and fisheries: Byssally attached to rocks, corals, gorgonians and other hard objects. Littoral and sublittoral, from low tide levels to a depth of 35 m. Collected for food and pearl trade. Aquaculture in Thailand and in the central Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa and the Red Sea to Fiji Islands; north to southern Japan and south to northern Queensland.

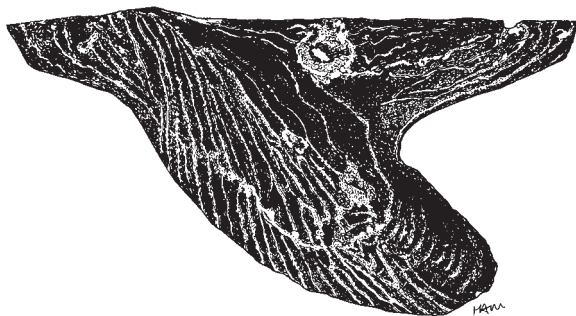


Pteria avicular (Holten, 1802)

Frequent synonyms / misidentifications: *Pteria cypsellus* (Dunker, 1872); *P. peasei* (Dunker, 1872) / None.

En - Swift wing oyster; **Fr** - Avicule martinet.

Maximum shell length 13 cm, commonly to 10 cm. Byssally attached to colonial coelenterates and other hard substrates. Littoral and sublittoral to a depth of 30 m. Collected for food and pearl trade. This is a major cultivated species in southern China. Eastern Indian Ocean to the tropical western Pacific, from Myanmar to the Philippines; north to Japan and south to northern Australia.



exterior of left valve
(after Kira, 1962)

ISOGNOMONIDAE

Tree oysters

Diagnostic characters: Shell compressed, elongate ovate to rounded and often irregular in outline, with a straight dorsal margin and narrow cardinal area; usually slightly inequivalve, right valve somewhat flatter than the left and with a narrow byssal gape anteriorly, commissural plane sometimes undulating. Outer surface of shell smoothish, with concentric lamellar processes or irregular undulations, radial sculpture slight to absent. Umbones small, prosogyrate, near the anterior end. Ligament external, set in a series of transverse grooves along the dorsal margin. Hinge narrow, without teeth. Interior of shell partly nacreous, with a more or less developed dark, non-nacreous border ventrally. Only 1 large, arcuate, posterior adductor muscle scar, with a well-developed posterior pedal retractor scar next to it or fused with it. Pallial line without a sinus. Gills of filibranchiate type, with smooth branchial sheets. Foot small, subcylindrical, grooved, with a strong byssus. Siphons absent. Mantle lobes free, with short marginal tentacles.

Habitat, biology, and fisheries: Sedentary animals, living attached by their byssal threads to various hard substrates, forming often dense colonies in tropical shallow waters. Collected for food by coastal populations. Marketed in Thailand. Used as a substitute of oysters in some areas.

Similar families occurring in the area

Malleidae: a single, transverse ligamental groove on cardinal area.

Pteriidae: cardinal area without a series of transverse grooves; ligament external, stretching along the cardinal area behind the umbones.

Key to species of interest to fisheries occurring in the area

- 1a. Shell relatively high and narrow in outline, with a strong posteroventral elongation; dorsal margin relatively long, expanded posteriorly (Fig. 1) . . . *Isognomon isognomum*
- 1b. Shell irregularly rounded in outline, without a posteroventral elongation; dorsal margin relatively short, not expanded posteriorly (Figs 2 and 3) . . . → 2
- 2a. Outer surface with radial ribbing (Fig. 2) *Isognomon perna*
- 2b. Outer surface without radial ribbing (Fig. 3) *Isognomon ephippium*

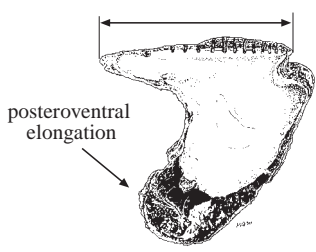
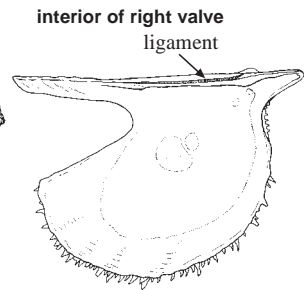
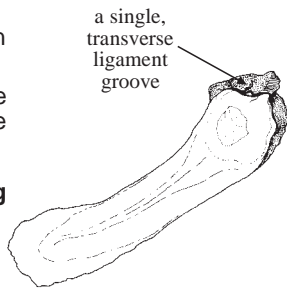
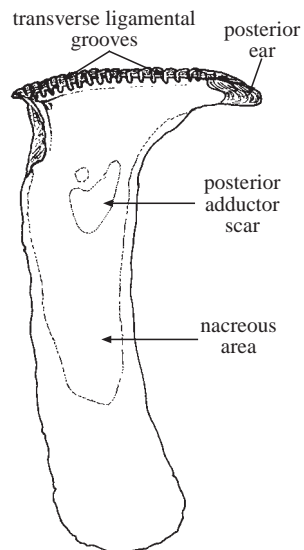


Fig. 1 *I. isognomum* (interior)

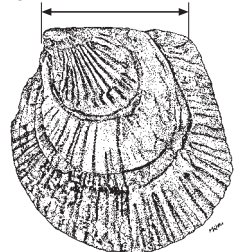


Fig. 2 *I. perna* (exterior)

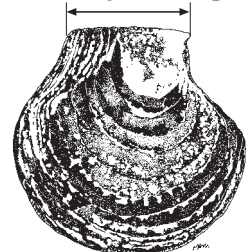


Fig. 3 *I. ephippium* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Isognomon ephippium* (Linnaeus, 1758)
- 🐚 *Isognomon isognomum* (Linnaeus, 1758)
- 🐚 *Isognomon perna* (Linnaeus, 1767)

Reference

Yonge, C.M. 1968. Form and habit in species of *Malleus* (including the "hammer oysters") with comparative observations on *Isognomon isognomum*. *Biol. Bull.*, 135(2):378-405.

Isognomon ephippium (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Melina ephippium* (Linnaeus, 1758) / None.

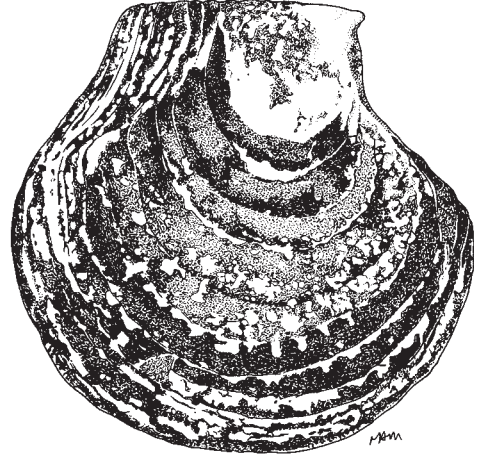
FAO names: En - Saddle tree oyster; Fr - Ostrège miellée.

Diagnostic characters: Shell variable, **irregularly rounded** in outline, with height about equal to length. **Dorsal margin** straight and **relatively short, not expanded posteriorly** in a wing-like ear. **Anterior margin** sharply sinuous dorsally, ventrally strongly convex and **extending well forward of umbones**. Posterior margin slightly concave, forming an obsolete angulation with the rounded ventral margin. Umbones small, pointing at anterior end of dorsal margin. Outer surface covered with concentric lamellar processes, with a very low radial ridge ending at posteroventral angulation. Ligamental area with a dozen transverse grooves. **Nacreous area** of the inner side of shell **surrounded by a broad, non-nacreous margin**. **Colour: outside of shell horny to purplish brown**. Interior nacreous, with a broad dark brown margin.

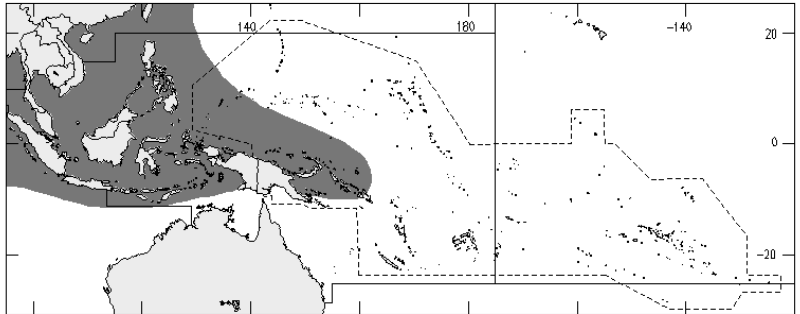
Size: Maximum shell length 14 cm, commonly to 10 cm.

Habitat, biology, and fisheries: Attached to rocks and other hard substrates, in marine and brackish-water areas. Common in muddy estuaries and mangroves where it attaches on prop roots. Littoral and shallow subtidal levels. Regularly collected for food and marketed in Thailand.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, to Melanesia; north to Japan and south to Indonesia.



exterior of right valve
(after Habe and Ito, 1965)



Isognomon isognomum (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Isogonum isognomum* (Linnaeus, 1758) / None.

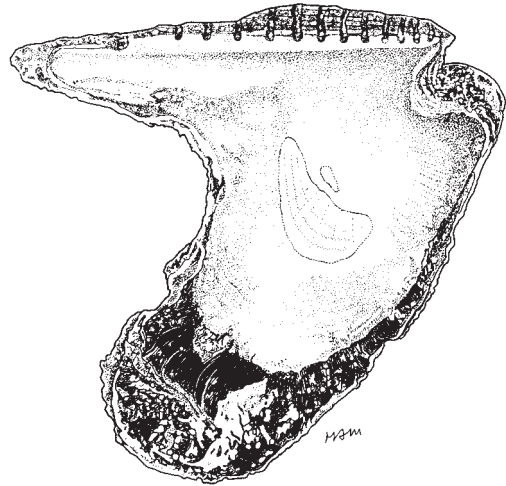
FAO names: En - Wader tree oyster; Fr - Ostrège cuissarde.

Diagnostic characters: Shell relatively high and narrow in outline, with undulating commissure and strong posteroventral elongation. Shape often very irregular, due to the confined space in which the shell grows and to the effect of repair. **Dorsal margin long** and straight to slightly arched, **more or less strongly expanded posteriorly** in a wing-like ear that increases with growth and may attain a size double the length of shell. **Anterior margin** elongated, markedly sinuous dorsally and **extending a little or not at all forward of umbones**. Posterior margin concave near the posterior ear, then more or less parallel to anterior margin. Ventral margin roughly rounded. Umbones small, pointing at anterior end of dorsal margin. Outer surface with irregularly concentric lamellate processes, often encrusted with marine growths and corroded towards the umbones. Ligamental area with numerous transverse grooves (more than 20 in large specimens). **Nacreous area** of the inner side of shell more or less **expanded ventrally**, its margin often poorly defined. **Colour: outside** of shell **bluish or brownish purple to almost black**, often paler to whitish umbonally. Interior porcelaneous and similarly coloured on non-nacreous area; nacreous area much paler, with bluish purple hue.

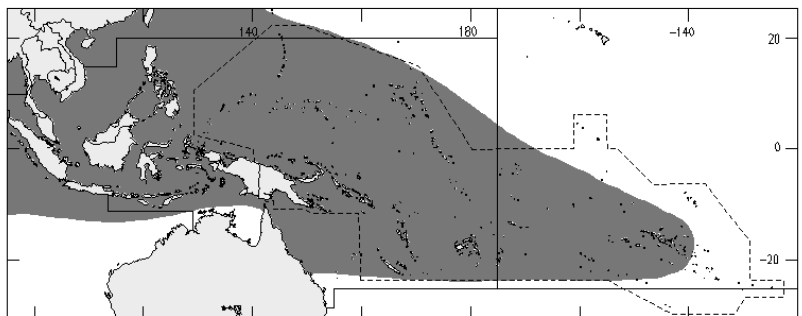
Size: Maximum shell height 15 cm, commonly to 10 cm.

Habitat, biology, and fisheries: Byssally attached to hard substrates, with the shell vertically disposed and the dorsal margin lying on the rock surface, or to boulders and corals. Often occurs in dense colonies (maximum recorded density of about 870 individuals/m²), sometimes forming mixed natural beds with *Malleus regula*. Littoral and sublittoral to a depth of 20 m. Regularly collected for food and marketed in Thailand.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea to eastern Polynesia; north to southern Japan and south to Queensland.



interior of left valve
(after Abbott, 1991)

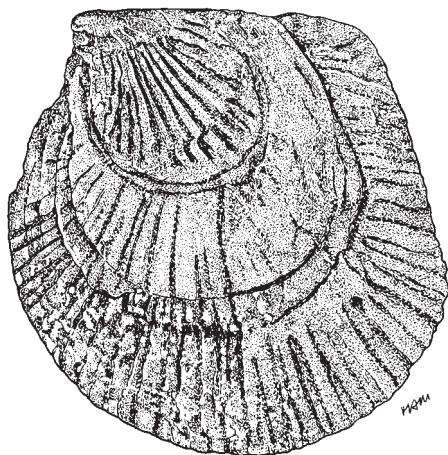


Isognomon perna (Linnaeus, 1767)

Frequent synonyms / misidentifications: *Melina perna* (Linnaeus, 1767); *Perna sulcata* Lamarck, 1819 / *Isognomon legumen* (Gmelin, 1791).

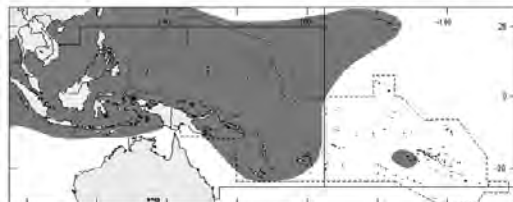
En - Rayed tree oyster; **Fr** - Ostrège sillonnée.

Maximum shell height 7.5 cm, commonly to 4 cm. Byssally attached to rocks, on reef flats or to the underside of boulders, on sand and gravel bottoms. Littoral and sublittoral to a depth of 20 m. Locally collected for food in Indonesia. Widespread in the Indo-West Pacific, from eastern and southern Africa, including Madagascar, to western Polynesia; north to Japan and Hawaii, and south to New Caledonia. Also recorded from the Society Islands, eastern Polynesia.



exterior of left valve

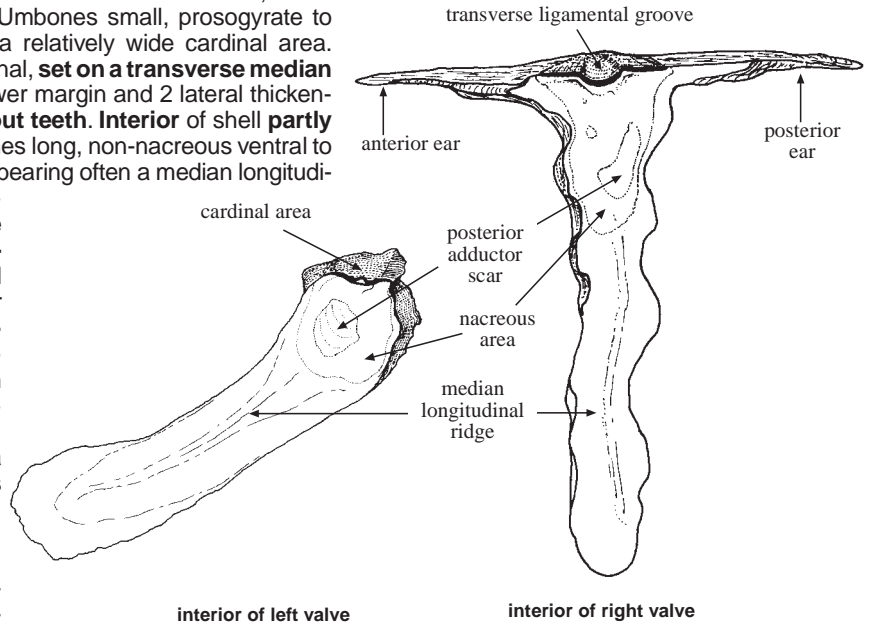
(after Habe, 1964)



MALLEIDAE

Hammer oysters

Diagnostic characters: Shell somewhat compressed, irregular in form and more or less strongly **Delongate dorsoventrally. Dorsal margin straightish, often produced at both ends into long, wing-like ears.** Shell subequivalve to inequivalve, with left valve somewhat more inflated than right valve. Commissural plane sometimes undulating. Anterior byssal notch variably developed to absent, stronger in right valve. Outer surface often with irregular concentric lamellations, radial sculpture fine to absent. Umbones small, prosogyrate to opisthogyrate, on top of a relatively wide cardinal area. **Ligament external to internal, set on a transverse median groove** with projecting lower margin and 2 lateral thickenings. **Hinge narrow, without teeth. Interior of shell partly nacreous,** with a sometimes long, non-nacreous ventral to posteroventral expansion bearing often a median longitudinal ridge. **Only 1 large posterior adductor muscle scar, usually with a well-developed posterior pedal retractor scar** next to it or fused to it. **Pallial line without a sinus.** Gills of filibranchiate type, with smooth branchial sheets. Foot divided into 2 unequal parts, grooved, with or without a byssus in the adult. Siphons absent. Mantle lobes free, with marginal tentacles.



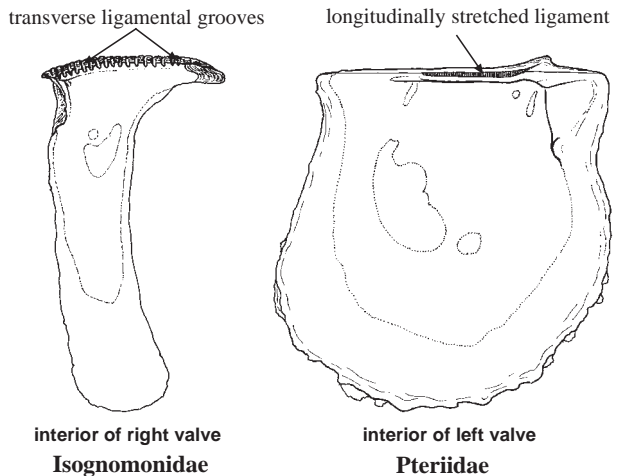
examples showing diversity of shape

Habitat, biology, and fisheries: Sedentary animals, living byssally attached to various hard substrates, or free and either partly buried in soft bottoms or embedded in sponges. Gregarious and frequently occurring mixed with Isognomonidae, at intertidal and shallow sublittoral depths. Collected for food and to make lime in the Philippines and Indonesia.

Similar families occurring in the area

Isognomonidae: a series of transverse, ligamental grooves along the dorsal margin.

Pteriidae: ligament external, stretching along the cardinal area behind the umbones; non-nacreous internal margins not drawn out into a long, posteroventral expansion.



Key to species of interest to fisheries occurring in the area

- 1a. Dorsal margin distinctly bialate, with long anterior and posterior ears (Fig. 1) → 2
- 1b. Dorsal margin not alate, with small ears (Fig. 2) *Malleus regula*

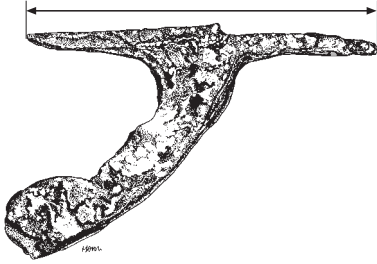


Fig. 1 *Malleus malleus* (exterior)

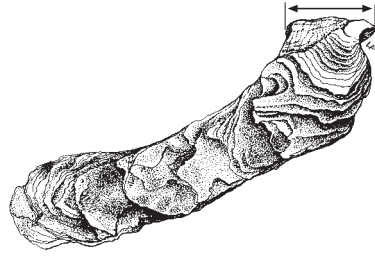


Fig. 2 *Malleus regula* (exterior)

- 2a. Outer surface of shell dark coloured; a small byssal notch present at the base of anterior ear of each valve; posterior pedal retractor scar well developed (Fig. 3) *Malleus malleus*
- 2b. Outer surface of shell pale coloured; byssal notch and posterior pedal retractor scar absent in the adult (Fig. 4) *Malleus albus*

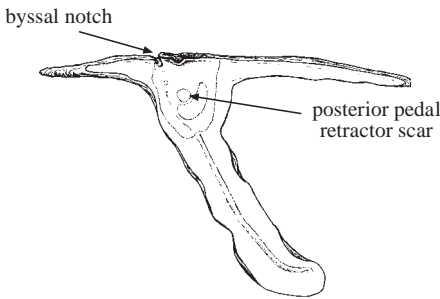


Fig. 3 *Malleus malleus* (interior)

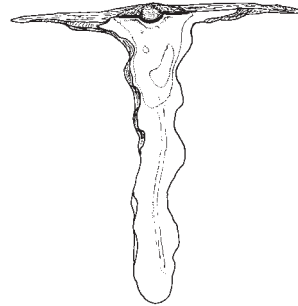


Fig. 4 *Malleus albus* (interior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Malleus albus* Lamarck, 1819
- 🐚 *Malleus malleus* (Linnaeus, 1758)
- 🐚 *Malleus regula* (Forsskål, 1775)

Reference

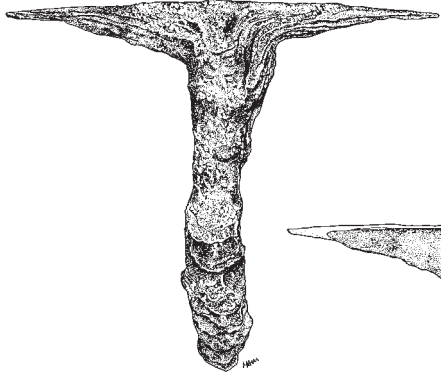
Yonge, C.M. 1968. Form and habit in species of *Malleus* (including the "hammer oysters") with comparative observations on *Isognomon isognomon*. *Biol. Bull.*, 135(2):378-405.

Malleus albus Lamarck, 1819

Frequent synonyms / misidentifications: *Margaritifera bipennis* Humphrey, 1797 / None.

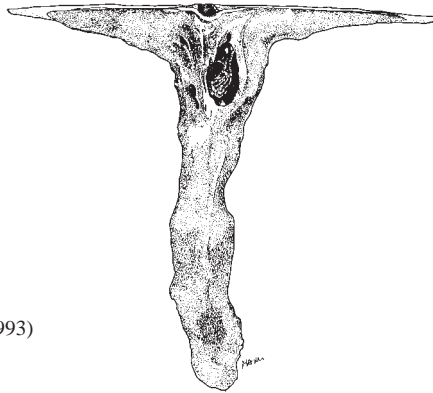
En - White hammer oyster; **Fr** - Marteau blanc.

Maximum shell height 25 cm, commonly to 15 cm. Free-living in muddy-sand bottoms, anchored in the substrate by means of the long anterior and posterior extensions of dorsal margin and with the ventral third of shell projecting. Sublittoral, from depths of 1 to 25 m. Often occurs in large colonies. Locally collected in Indonesia and the Philippines. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Solomon Islands; north to Japan and south to Queensland.

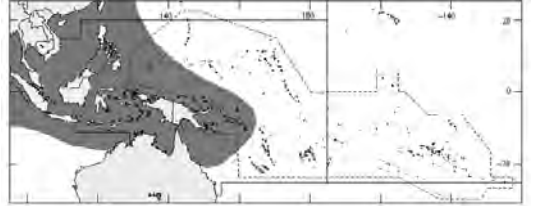


exterior of left valve

(after Dance, 1993)



interior of right valve

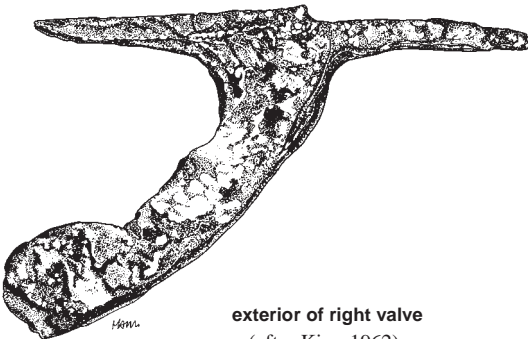


Malleus malleus (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Malleus vulgaris* Lamarck, 1799 / None.

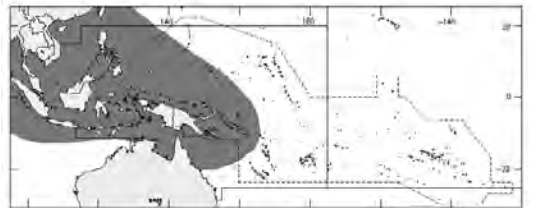
En - Black hammer oyster; **Fr** - Marteau noir.

Maximum shell height 25 cm, commonly to 18 cm. Byssally attached to hard objects, on reef flats, coarse coral sand or eelgrass areas. The shell is vertically disposed and partly buried in sediment, with the long dorsal ears acting as an anchor and the ventral quarter of valves exposed. Sublittoral, from depths of 1 to 15 m. Often occurring in large colonies. Locally collected in Indonesia and the Philippines. The shell is used to make lime and for shellcraft. Widespread in the Indo-West Pacific, from East Africa, including the Persian Gulf, to Melanesia; north to Japan and south to Queensland.



exterior of right valve

(after Kira, 1962)

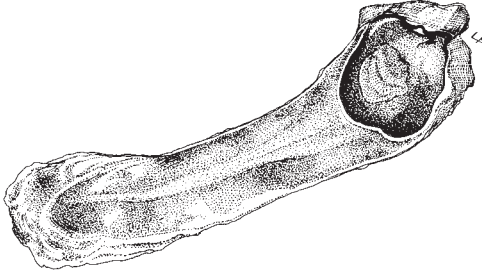


Malleus regula (Forsskål, 1775)

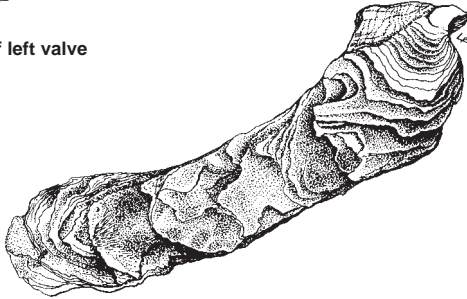
Frequent synonyms / misidentifications: *Fundella lioyi* de Gregorio, 1884; *Malleus decurtatus* Lamarck, 1819; *M. tigrinus* Reeve, 1858; *Malvifundus regulus* (Forsskål, 1775) / None.

En - Straight hammer oyster; **Fr** - Marteau droit.

Maximum shell height 12 cm, commonly to 8 cm. Attached by their strong byssus to hard substrates where mud occurs, with the shell vertically disposed and the dorsal margin lying on the rock surface, or to the underside of ledges and boulders. Often in dense colonies (maximum recorded density of 870 individuals / m²), sometimes forming mixed natural beds with *Isognomon isognomum*. Littoral and sublittoral to a depth of about 20 m. Locally collected at low tide by coastal people when abundant. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Melanesia; north to South China and Taiwan Province of China and south to Indonesia. Also in south and eastern parts of the Mediterranean.



interior of left valve

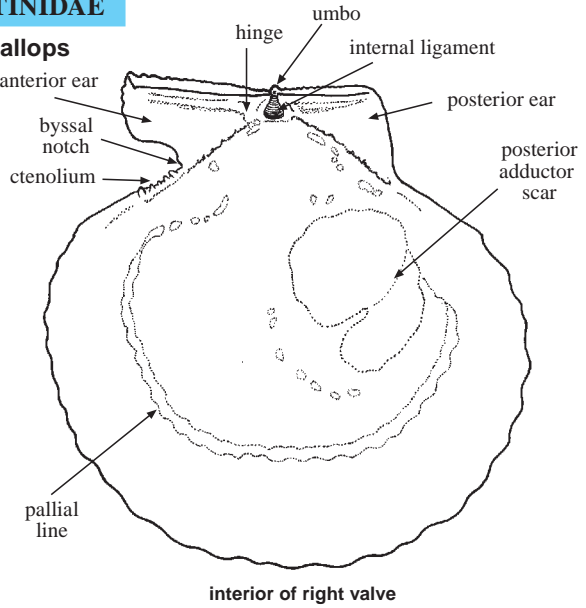


exterior of right valve

PECTINIDAE

Scallops

Diagnostic characters: Shell more or less inequivalve, usually with one valve more convex than the other; ovate to subcircular in outline with median low, orthograte umbones and a straight dorsal margin forming wing-like ears at both ends. Anterior ears generally well developed, often with a byssal notch and a ctenolium at right valve. Outer surface smooth or with mostly radial sculpture. One or both valves often brightly coloured. Periostracum absent. Ligament mostly internal, in a small trigonal pit pointing under the umbones; external ligament thin, stretching along the hinge line. Hinge without teeth, or with faint marginal ridges. Interior of shell porcelaneous, sometimes with a subnacreous appearance. A single, asymmetrical, (posterior) adductor muscle scar. Pallial line without a sinus. Internal margins generally undulate or crenulate. Gills of filibranchiate type, with folded or smooth branchial sheets. Foot reduced. Byssus persistent or disappearing with growth. No siphons. Mantle margins free, with eyes and short tentacles.

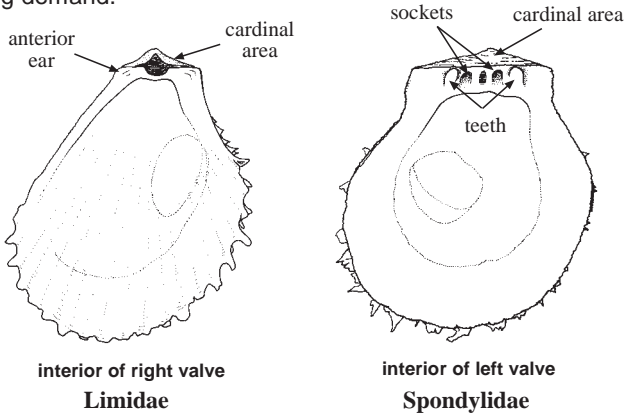


Habitat, biology, and fisheries: Well represented in the warm, tropical to subtropical shallow waters of the Indo-Pacific, either by byssally attached species living among corals, and by free-living species capable of swimming by clapping the valves together, particularly as an escape from predators. Pectinidae are actively exploited within the area. A few species represent important commercial species in the scallop market which is characterized by an increasing demand.

Similar families occurring in the area

Limidae: shell inequivalve, often drawn out anteroventrally; anterior ears generally reduced; a wide trigonal cardinal area, with a median ligamental groove, between umbones and dorsal margin.

Spondylidae: shell cemented to substrate by right valve; a large cardinal area between umbones and dorsal margin, generally bigger in the right valve than in the left; hinge with 2 strong teeth and 2 deep sockets, symmetrically arranged in relation to the internal ligament.



Key to species of interest to fisheries occurring in the area

- 1a. Shell nearly smooth externally, but with distinct internal radial ribs (Fig. 1a) → 2
- 1b. Shell with distinct radial ribs externally and internally (Fig. 1b) → 3

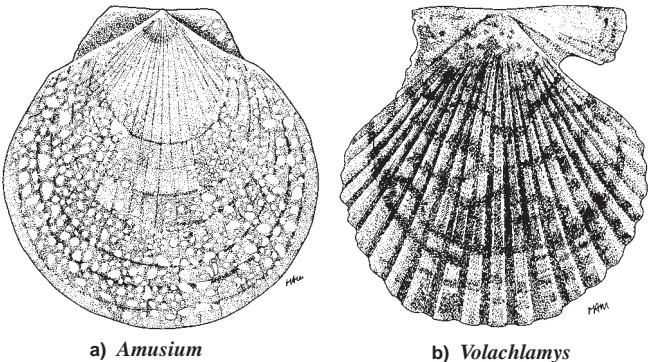


Fig. 1

- 2a. Shell medium sized (attaining commonly 8 cm in length); right (lower) valve with 22 to 34 internal radial ribs (Fig. 2) *Amusium pleuronectes*
- 2b. Shell large sized (commonly exceeding 10 cm in length); right (lower) valve with 42 to 54 internal radial ribs (Fig. 3) *Amusium japonicum*

- 3a. Right (lower) valve convex, left (upper) valve nearly flat to somewhat concave (Fig. 4a) *Minnivola pyxidata*

- 3b. Both valves convex (Fig. 4b) → 4

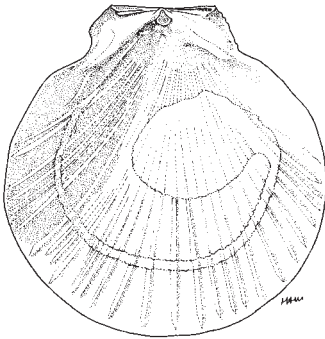


Fig. 2 *Annachlymys flabellata* (interior of right valve)

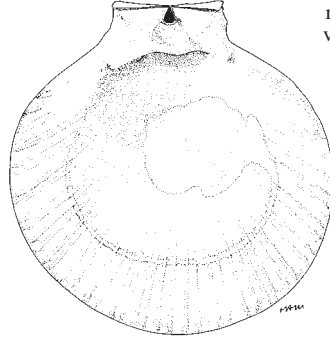


Fig. 3 *Amusium japonicum* (interior of right valve)

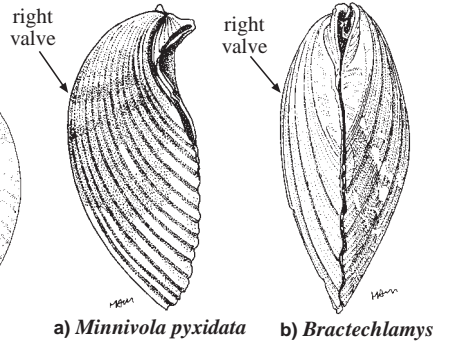


Fig. 4 anterior view
a) *Minnivola pyxidata* b) *Bractechlamys*

- 4a. Radial ribs densely sculptured with numerous, strongly projecting concentric lamellae (Fig. 5) *Gloripallium pallium*

- 4b. Radial ribs with a different sculpture; concentric elements, if present, relatively fine and low, or scattered → 5

- 5a. Ears markedly unequal in size, the posterior ones much shorter than the anterior. → 6

- 5b. Ears about the same size → 7

- 6a. Each valve with 7 to 10 strong, prominently scaled, radial ribs, interspersed with smaller ribs (Fig. 6) *Chlamys squamata*

- 6b. Each valve with 20 to 26 radial ribs, all about the same size and evenly sculptured (Fig. 7) *Chlamys senatoria*

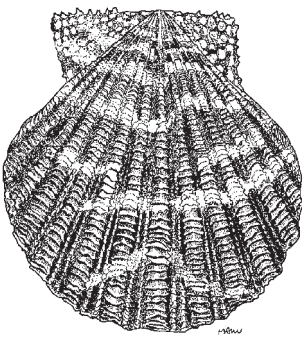


Fig. 5 *Gloripallium pallium* (exterior)

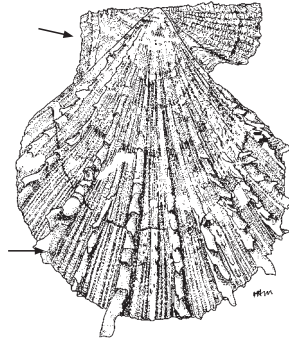


Fig. 6 *Chlamys squamata* (exterior)

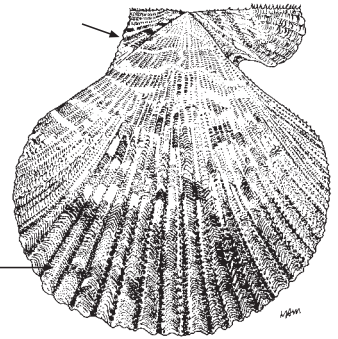


Fig. 7 *Chlamys senatoria* (exterior)

- 7a. Shell subcircular in outline; ribs without radial sculpture → 8

- 7b. Shell elongate-ovate in outline; ribs radially striate → 9

- 8a. Shell relatively large (up to 10 cm long), with 18 to 20 radial ribs on each valve; byssal notch of right valve obsolete (Fig. 8) *Annachlamys flabellata*
- 8b. Shell relatively small (up to 6 cm long), with 20 to 23 radial ribs on each valve; byssal notch of right valve deep (Fig. 9) *Volachlamys singaporina*

- 9a. Radial threads on ribs or interspaces strongly scabrous; shell higher than long →10
- 9b. Radial threads on ribs or interspaces finely lamellous; shell nearly as long as high (Fig. 10) *Decatopecten amiculum*

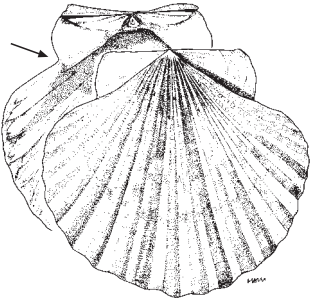


Fig. 8 *Annachlamys flabellata*

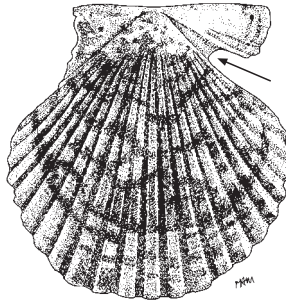


Fig. 9 *Volachlamys singaporina*
(exterior)

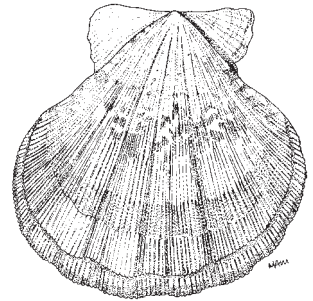


Fig. 10 *Decatopecten amiculum*
(exterior)

- 10a Ears with distinct radial ridges; left (upper) valve whitish, with concentric patterns of brown blotches and spots (Fig. 11) *Decatopecten radula*
- 10b. Ears with obsolete radial ridges (more distinct on right anterior ear); left (upper) valve yellow, orange or brown, with whitish blotches (Fig. 12) *Brachteclamys vexillum*

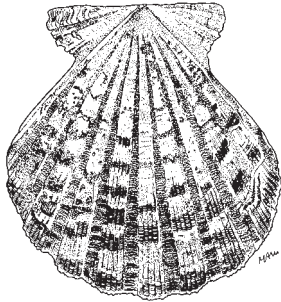


Fig. 11 *Decatopecten radula*
(exterior)

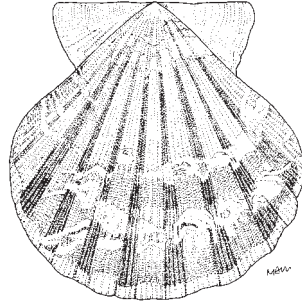


Fig. 12 *Brachteclamys vexillum*
(exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Amusium japonicum* (Gmelin, 1791)
- 🐚 *Amusium pleuronectes* (Linnaeus, 1758)
- 🐚 *Annachlamys flabellata* (Lamarck, 1819)
- 🐚 *Bractechlamys vexillum* (Reeve, 1853)
- 🐚 *Chlamys senatoria* (Gmelin, 1791)
- 🐚 *Chlamys squamata* (Gmelin, 1791)
- 🐚 *Decatopecten amiculum* (Philippi, 1851)
- 🐚 *Decatopecten radula* (Linnaeus, 1758)
- 🐚 *Gloripallium pallium* (Linnaeus, 1758)
- 🐚 *Minnivola pyxidata* (Born, 1778)
- 🐚 *Volachlamys singaporina* (Sowerby, 1842)

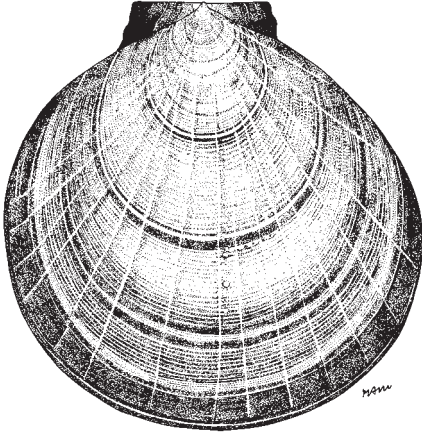
References

- Habe, T. 1964. Notes on the species of the genus *Amusium* (Mollusca). *Bull. Natn. Sci. Mus.*, 7(1):1-5.
- Dijkstra, H.H. 1991. A contribution to the knowledge of the pectinacean mollusca (Bivalvia: Propeamussiidae, Entoliidae, Pectinidae) from the Indonesian Archipelago. *Zool. Verh.*, 271:1-57.
- Dijkstra, H.H., B. Richer De Forges, J. Clavier, and Y. Lefort. 1989. Pectinidés des fonds meubles dans les lagons de N. Calédonie et de Chesterfield. 1^{ère} partie. *Rossiniana*, 45:21-24.
- Dijkstra, H.H., B. Richer De Forges, J. Clavier, and Y. Lefort. 1990a. Pectinidés des fonds meubles dans les lagons de N. Calédonie et de Chesterfield. 2^{ème} partie. *Rossiniana*, 46:3-10.
- Dijkstra, H.H., B. Richer De Forges, J. Clavier, and Y. Lefort. 1990b. Pectinidés des fonds meubles dans les lagons de N. Calédonie et de Chesterfield. 3^{ème} partie. *Rossiniana*, 47:3-9.
- Rombouts, A. 1991. *Guidebook to Pecten shells. Recent Pectinidae and Propeamussiidae of the world*. Oegsteest, Universal Book Services and Backhuys, 157 p.
- Shumway, S.E. (ed.). 1991. Scallops: biology, ecology and aquaculture. *Dev. Aquacult. Fish. Sci.*, 21:I-XX, 1-1095.
- Waller, T.R. 1972. The Pectinidae (Mollusca: Bivalvia) of Eniwetok Atoll, Marshall Islands. *Veliger*, 14(3):221-264.

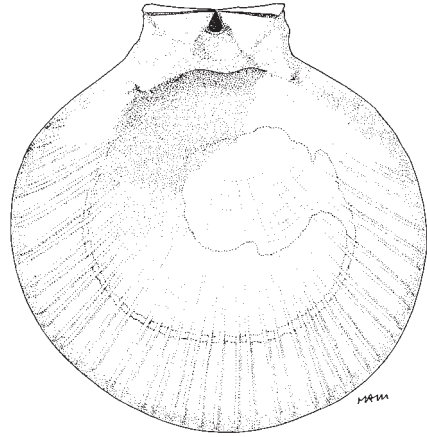
Amusium japonicum (Gmelin, 1791)

Frequent synonyms / misidentifications: *Amusium balloti* (Bernardi, 1861); *A. japonicum formosum* Habe, 1964; *A. japonicum taiwanense* Dijkstra, 1988 / None.

FAO names: En - Saucer scallop; Fr - Peigne lisse de Nouvelle-Calédonie.



exterior of left valve



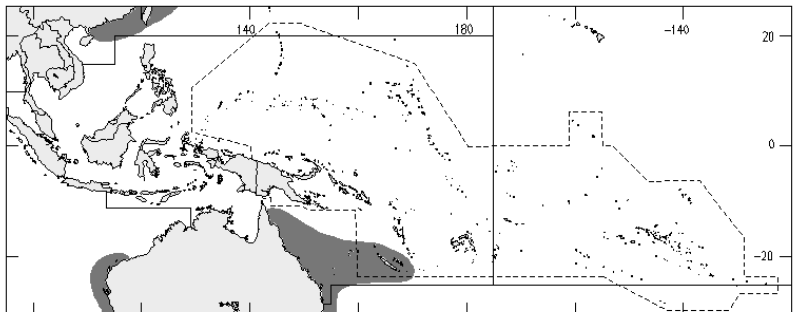
interior of right valve

Diagnostic characters: Shell thin, medium to large sized (commonly exceeding 10 cm in length), laterally compressed, almost circular in outline, gaping anteriorly and posteriorly. Both valves somewhat convex, the right (lower) valve only a little more inflated and larger than the left (upper) valve. Ears small, subequal in size and shape, with the right anterior ear faintly sinuated at anteroventral margin and devoid of ctenolium. Surface of left valve with 2 broad and very shallow depressed areas radiating from the umbo to anteroventral and posteroventral margins. Outside of shell polished and nearly smooth, with many very fine, concentric and radial lines. Interior of both valves with distinct radial ribs, usually in pairs, much narrower than the flat interspaces and becoming obsolete on umbonal area. Right valve with 42 to 54 internal radial ribs (46 to 54 in the typical subspecies *A. japonicum japonicum*, and 42 to 48 in the southern *A. japonicum balloti*). **Colour:** outside of left valve reddish brown, with variable shades along the concentric growth marks; outer colour pattern of subspecies *balloti* also with small, yellowish and dark brown spots along radial lines on umbonal area and often with a few irregular, larger dark spots towards periphery. Interior of left valve glossy white, with yellowish or pinkish margins and sometimes with a brown blotch under the hinge. Right valve white to pale yellow externally and internally; subspecies *balloti* with an additional external brown scattering along some concentric growth marks.

Size: Maximum shell length 14 cm, commonly to 11 cm.

Habitat, biology, and fisheries: On sandy to muddy bottoms of lagoons, often associated with brown seaweeds. Sublittoral, mainly from shallow waters to about 30 m, but also deeper to more than 80 m. Sexes separate. Spawning occurs in the cool season, from June to November. Growth is relatively rapid (about 7 to 8 cm in the first year), but the number of individuals reaching a 3 or 4 years age is small, because of a high rate of natural mortality. Can actively swim by clapping the valves when disturbed, with a speed of about 2 knots and for a distance of some 10 m. Economically important species, commercially trawled in New Caledonia, central Queensland and the southern half of Western Australia. Hatchery culture in Western Australia and Queensland.

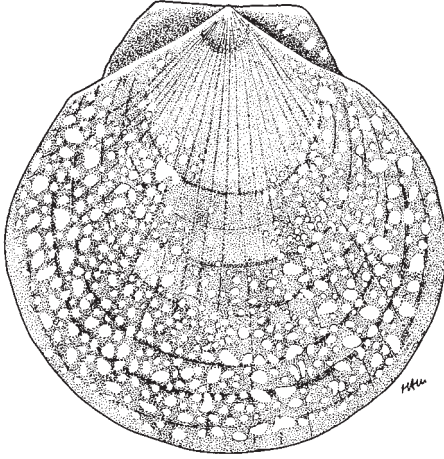
Distribution: Restricted to the Western Pacific; from China to Japan (typical subspecies), and from southern and eastern Australia to New Caledonia (subspecies *balloti*).



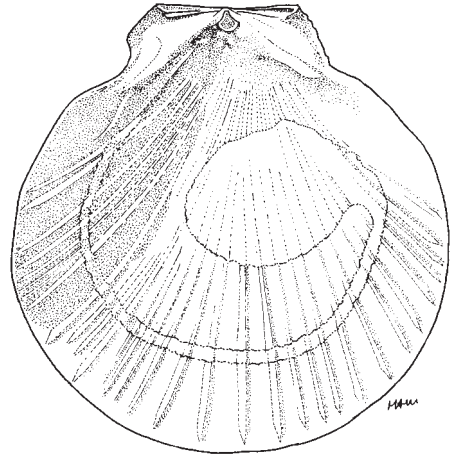
Amusium pleuronectes (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Amusium pleuronectes australiae* Habe, 1964 / None.

FAO names: En - Asian moon scallop; Fr - Peigne lisse asiatique.



exterior of left valve



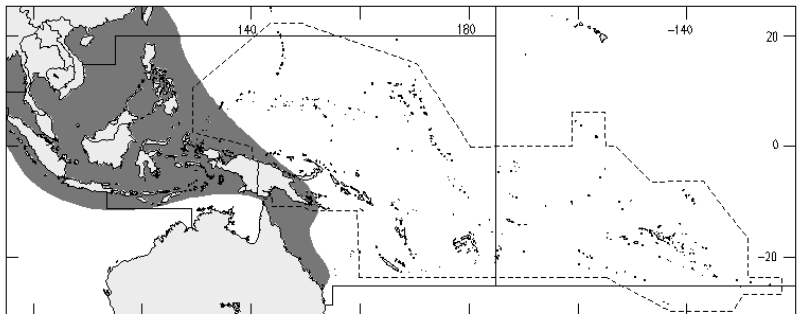
interior of right valve

Diagnostic characters: Shell thin, medium sized (commonly attaining 8 cm in length), laterally compressed, almost circular in outline, gaping anteriorly and posteriorly. Both valves somewhat convex, the right (lower) valve only a little more inflated and larger than the left (upper) valve. Ears moderately small, subequal in size and shape, with the right anterior ear slightly sinuated anteroventrally and devoid of ctenolium. Surface of left valve with 2 broad and very shallow depressed areas radiating from the umbo to anteroventral and posteroventral margins. Outside of shell polished and nearly smooth, with only many faint concentric and radial lines. Interior of both valves with distinct radial ribs, usually in pairs, much narrower than the flat interstices and becoming obsolete on umbonal area. Right valve with 22 to 34 internal radial ribs (usually 26 to 34 in the typical subspecies *Amusium pleuronectes pleuronectes*, and 22 to 24 in the southern subspecies *A. pleuronectes australiae*). Colour: outside of left valve with light to deep pinky brown of varying shades along concentric growth marks, and with darker radial lines and tiny white dots on umbonal area. Interior of left valve whitish, often with a pinkish hue on margins and central area, and with a brown blotch under the hinge. Right valve white externally and internally.

Size: Maximum shell length 10 cm, commonly to 8 cm.

Habitat, biology, and fisheries: On sand and mud bottoms. Sublittoral, from depths of 10 to 80 m. Active local exploitation in Thailand. This species is commercially fished in Taiwan Province of China.

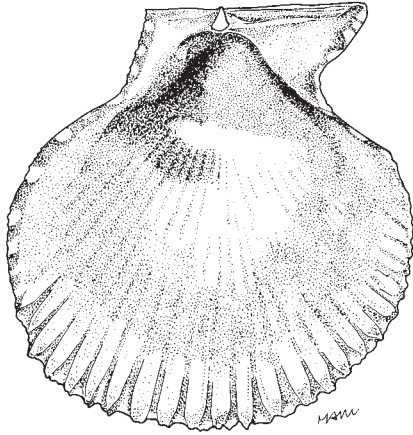
Distribution: Eastern Indian Ocean and tropical western Pacific, from Myanmar and Indonesia to Papua New Guinea; north to Taiwan Province of China and southern Japan, and south to Queensland.



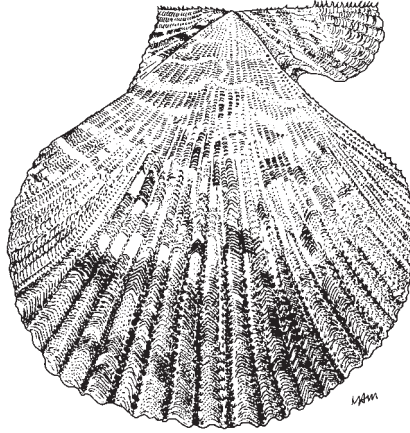
Chlamys senatoria (Gmelin, 1791)

Frequent synonyms / misidentifications: *Mimachlamys senatoria* (Gmelin, 1791); *Pallium senatoris* Chemnitz, 1784 (Invalid name); *Pecten aurantius* Lamarck, 1819 / *Chlamys nobilis* (Reeve, 1852).

FAO names: En - Senatorial scallop; Fr - Pétoncle sénateur.



interior of left valve



exterior of right valve



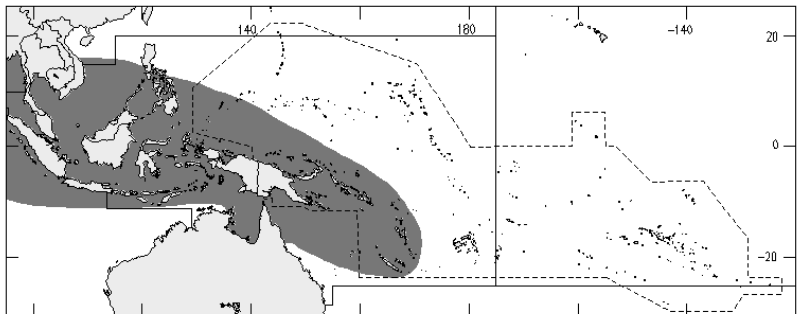
detail of outer sculpture

Diagnostic characters: Shell solid, medium sized, **higher than long and rounded-ovate** in outline. **Both valves convex and subequal**, the right (lower) valve a little flatter than the left (upper) valve. **Ears markedly unequal in size**, the anterior ones more than twice the length of the posterior ones. **Ventral side of right anterior ear with a deep byssal notch and a ctenolium**. Main sculpture of each valve of **20 to 26 rounded radial ribs** with relatively fine and densely set **transverse scales**. Interspaces about as broad as the ribs, often with fine secondary radial threads, and with microscopic lines, obliquely diverging on anterior and posterior sides of valves. Ears strongly ribbed, the dorsalmost rib of right anterior ear somewhat protruding and adorned with erect spines. Interior shiny, with low, rounded radial ribs corresponding to the outer sculpture. **Colour:** **outside of shell variable**, dull **purple, brown or orange**, frequently **variegated with paler blotches**. Interior similarly coloured, suffused with white on hinge and umbonal cavity.

Size: Maximum shell height 8 cm, commonly to 6 cm.

Habitat, biology, and fisheries: On sandy or muddy-sand bottoms with gravel, coral rubble, shell debris or rocks. Attached by its byssus to hard elements, even in the adult stages. Local exploitation, where it is abundant. Recreationally fished in New Caledonia.

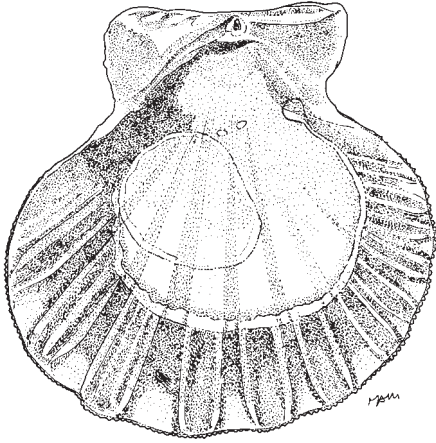
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to Melanesia; north to the Philippines and south to Queensland and New Caledonia.



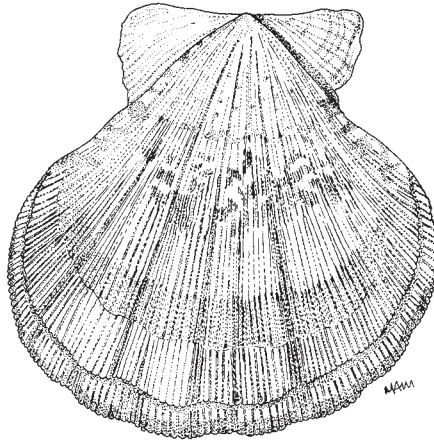
Decatopecten amiculum (Philippi, 1851)

Frequent synonyms / misidentifications: *Comptopallium amiculum* (Philippi, 1851); *Pecten flabelloides* Reeve, 1852 / None.

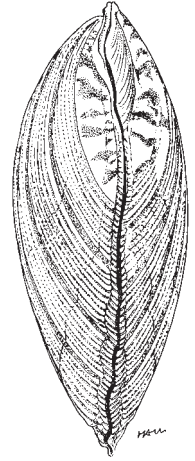
FAO names: En - Cloak scallop; Fr - Pétoncle mantelet.



interior of left valve



exterior of right valve



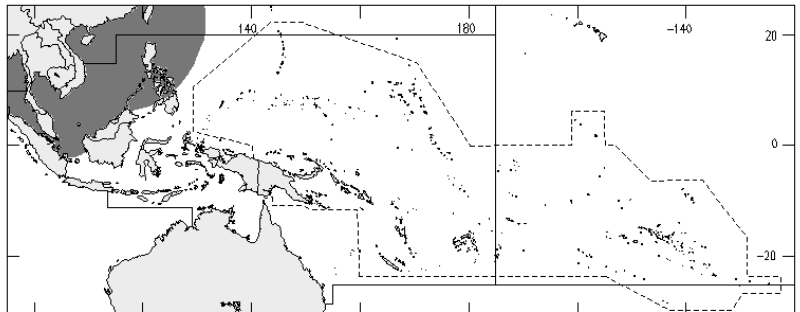
anterior view
of entire shell

Diagnostic characters: Shell solid, small, nearly as long as high, inequivalve, the outline somewhat elongate dorsally and subcircular ventrally. Both valves convex, the right (lower) valve more inflated than the left (upper) valve which is moderately flattened towards the umbo. Ears small, subequal in size and shape. Right anterior ear with an obsolete anteroventral byssal notch, devoid of ctenolium. Outer sculpture of each valve with about 9 to 11 rounded radial folds, with numerous, much smaller, secondary radial riblets that are finely lamellous on ribs or interspaces; transverse lamellous sculpture delicate and easily eroded on top of ribs. Hinge line short, about 1/3 to 1/2 of shell length, with rather strong oblique ridges and pits on either side of the internal ligament. Interior of valves shiny, with a flattened radial sculpture corresponding with the outer folds. **Colour:** outside of shell off-white to beige, variously mottled with chestnut brown, tan or reddish purple, mainly on the left valve which is more vividly coloured than the often nearly uniform cream right valve. Interior whitish, frequently tinged with dark brown on hinge areas and broad rims, in 1 or both valves.

Size: Maximum shell height 6 cm, commonly to 5 cm.

Habitat, biology, and fisheries: Lying free on sandy bottoms. Intertidal and sublittoral to a depth of 25 m. Common in Thailand where it is locally exploited.

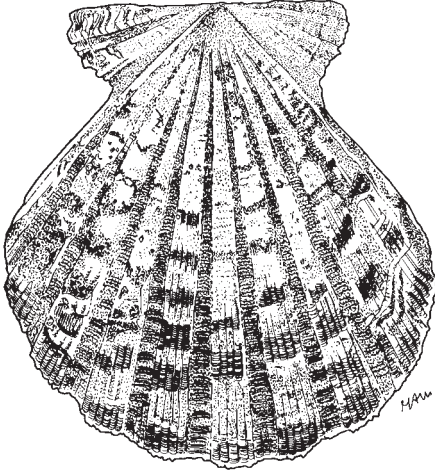
Distribution: Indo-West Pacific, from East Africa, including Madagascar, the Red Sea, to the Philippines; north to southern Japan and south to the Malay Peninsula.



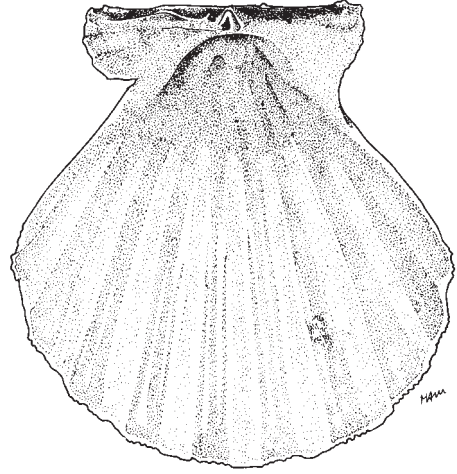
Decatopecten radula (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Comptopallium pauciplicatum* Iredale, 1939; *C. radula* (Linnaeus, 1758); *C. radula griggi* (Webb, 1957); *Pecten argenteus* Reeve, 1853 / None.

FAO names: En - Flatribbed scallop; Fr - Pétoncle râpe.



exterior of left valve



interior of right valve

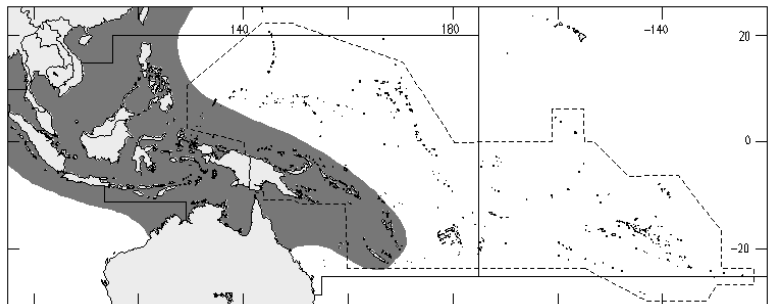
(after Lamprell and Whitehead, 1992)

Diagnostic characters: Shell solid, medium sized, higher than long, elongate-ovate in outline. Both valves convex, the right (lower) valve more inflated than the left (upper) valve. Ears subequal in size and shape. Right anterior ear with a slight byssal notch anteroventrally, devoid of ctenolium. Outer sculpture of about 10 or 11 rounded radial folds (9 to 13) on each valve, with numerous, much smaller, secondary radial riblets that are set with densely and finely imbricated transverse scales, giving a rather strongly scabrous aspect. Surface of ears with distinct radial ridges (more developed on right anterior ear). Hinge line quite long, about 2/3 of shell length, with shallow marginal ridges. Interior of valves shiny, with a flattened radial sculpture corresponding with the outer folds. **Colour:** outside of shell off-white to cream, with variable, dull brown concentric mottling on left valve, mainly on top of the main radial ribs. Interior satin white, with dark brown on the hinge line.

Size: Maximum shell height 9.5 cm, commonly to 7 cm.

Habitat, biology, and fisheries: Attached to rock, coral and other hard objects. Common on coarse sand, in coral reef areas. Intertidal and shallow subtidal waters, to a depth of 20 m. Locally exploited where abundant. Of potential commercial value in New Caledonia.

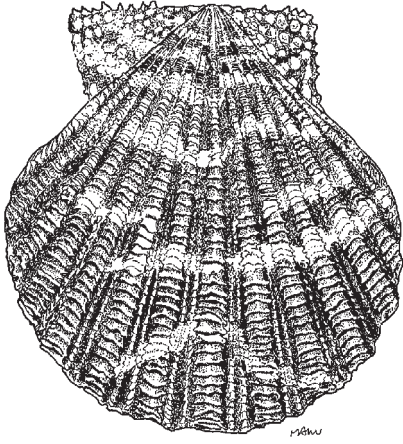
Distribution: Indo-West Pacific, from India to Melanesia; north to Japan and south to Queensland and New Caledonia.



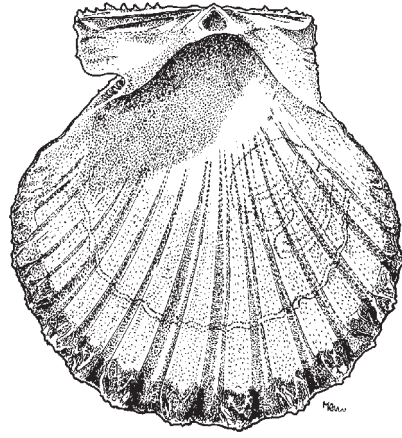
Gloripallium pallium (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Chlamys pallium* (Linnaeus, 1758); *Cryptopecten pallium* (Linnaeus, 1758); *Pecten novaeguinae* Tenison-Woods, 1878; *P. speciosus* Reeve, 1853 / None.

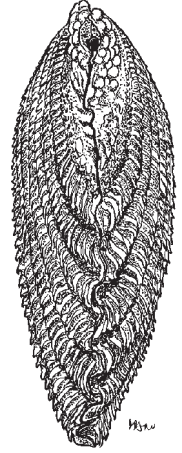
FAO names: En - Royal cloak scallop; Fr - Pétoncle manteau.



exterior of left valve



interior of right valve



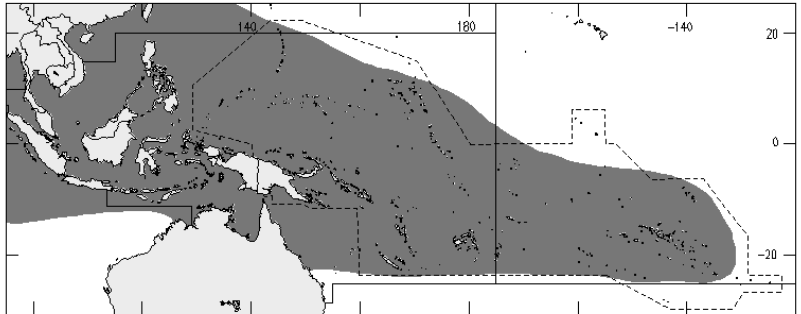
anterior view of entire shell

Diagnostic characters: Shell solid, medium sized, about as long as high and subcircular in outline. Both valves subequal and moderately convex. Ears unequal in size, the anterior ones about 1.5 times longer than the posterior. Byssal notch of the right anterior ear moderately deep and with a ctenuolium. Outer surface of each valve with about 13 strongly sculptured radial folds (12 to 15). Radial ribs densely set with numerous, strongly projecting concentric lamellae tending to split in 3 towards periphery of shell. Ribs interspaces with fine secondary radial threads bearing minute scales, generally 2 per interspace. Surface of ears radially ridged, with many strongly projecting scales or nodes. Dorsalmost ridge of right anterior ear somewhat protruding and adorned with erect spines. Interior of valves with low radial sculpture corresponding with the outer folds. **Colour:** outside of shell variable, often very brilliant in colour, from light red to orange or deep purple brown, generally whitish on umbonal area and with wavy, roughly concentric bands or blotches in lighter colours. Interior glossy white, with margins the same colour as the exterior.

Size: Maximum shell height 11 cm, commonly to 8.5 cm.

Habitat, biology, and fisheries: Attached by its byssus under coral heads and rocks. Frequently encrusted by sponges, bryozoans, algae, and other marine growths. Able to swim actively for some distance when detached. Common in the intertidal and shallow subtidal zones to a depth of 5 m, but also deeper to about 20 m. Collected for food and shell trade.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, Mauritius and Réunion islands, and the Gulf of Aden, to eastern Polynesia; north to Japan and south to Queensland and New Caledonia.

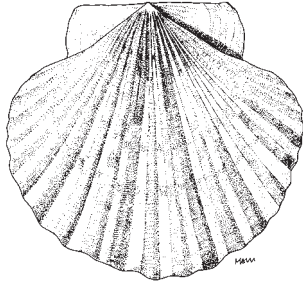


***Annachlamys flabellata* (Lamarck, 1819)**

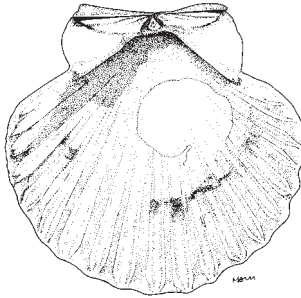
Frequent synonyms / misidentifications: *Aequipecten flabellatus* (Lamarck, 1819); *Annachlamys kuhnoltzi* (Bernardi, 1860); *A. leopardus rena* Iredale, 1939; *A. melica* Iredale, 1939; *Chlamys leopardus* (Reeve, 1853) / None.

En - Leopard scallop; **Fr** - Pétoncle léopard.

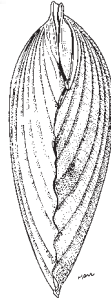
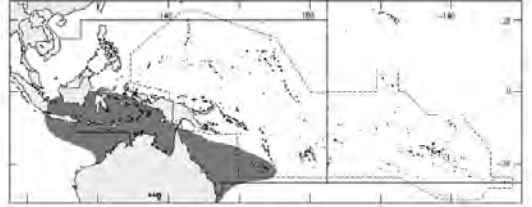
Maximum shell length 10 cm, commonly to 8 cm. On sandy bottoms. Sublittoral, from shallow waters to depths of about 125 m. Locally collected by recreational fishermen in Australia and New Caledonia. Of potential interest where abundant. Western Pacific, from Indonesia to Australia and New Caledonia.



exterior of left valve



interior of right valve



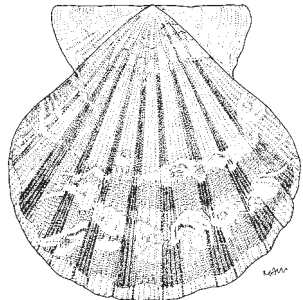
anterior view of entire shell

***Bractechlamys vexillum* (Reeve, 1853)**

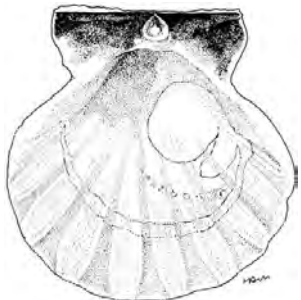
Frequent synonyms / misidentifications: *Bractechlamys evecta* Iredale, 1939; *Comptopallium vexillum* (Reeve, 1853); *Semipallium vexillum* (Reeve, 1853) / *Chlamys distans* (Lamarck, 1819).

En - Distant scallop; **Fr** - Pétoncle étendard.

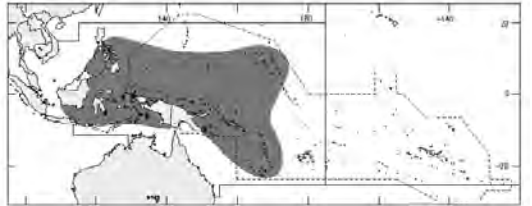
Maximum shell height 6 cm, commonly to 4.5 cm. Lying free on fine sand, silt or mud bottoms, commonly in association with marine grasses, coral rubble, and rocks. Sublittoral, from shallow subtidal waters to depths of about 55 m. Able to swim about in a jerky motion when disturbed. Occurs frequently in fairly large numbers. Locally collected for food, and probably of commercial interest. Tropical West Pacific, from Indonesia, the Philippines, and Marshall Islands to New Caledonia.



exterior of left valve



interior of right valve



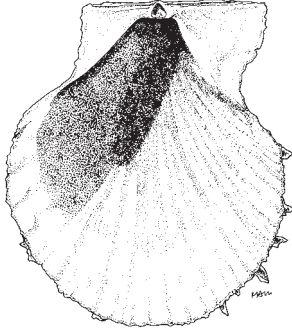
anterior view of entire shell

***Chlamys squamata* (Gmelin, 1791)**

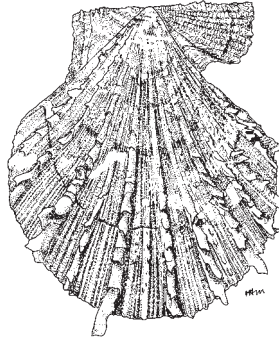
Frequent synonyms / misidentifications: *Azumapecten squamatus* (Gmelin, 1791); *Scaeoclamys squamata* (Gmelin, 1791) / *Pecten rastellum* Lamarck, 1819.

En - Scaly Pacific scallop; **Fr** - Pétoncle écailléux.

Maximum shell height 7.5 cm, commonly to 5 cm. Attached to hard objects, on various soft to hard bottoms. Sublittoral, from depths of 1 to 50 m. Occasionally collected for food. East Indian Ocean and tropical West Pacific, from Myanmar and Thailand to the Philippines; north to Japan and south to Malaysia.



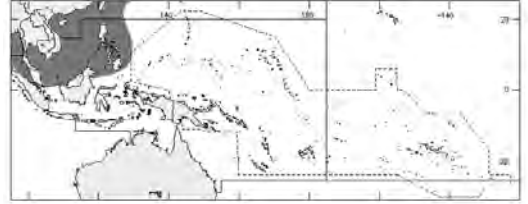
interior of left valve



exterior of right valve



anterior view of entire shell

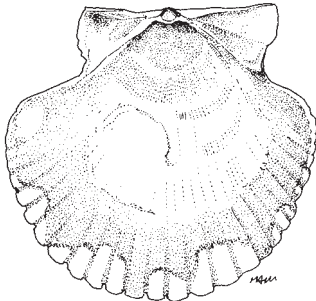


***Minnivola pyxidata* (Born, 1778)**

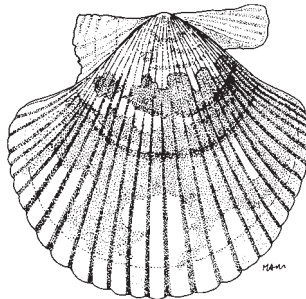
Frequent synonyms / misidentifications: *Pecten crebricostatus* Philippi, 1844; *P. pyxidatus* Born, 1778 / None.

En - Box scallop; **Fr** - Coquille Saint-Jacques pyxide.

Maximum shell length 5 cm, commonly to 3.5 cm. On sandy bottoms. Gregarious. Sublittoral and shelf zones, from depths of 5 to 100 m. Incidental catch of shrimp trawlers. Indian Ocean and tropical western Pacific, from Madagascar and Sri Lanka to Indonesia; north to China and Taiwan Province of China, and south to Queensland.



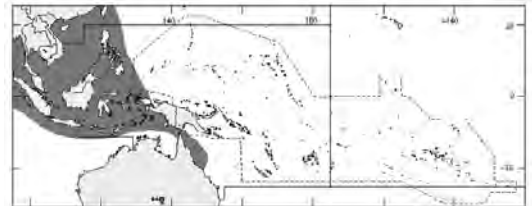
interior of left valve



exterior of right valve



anterior view of entire shell

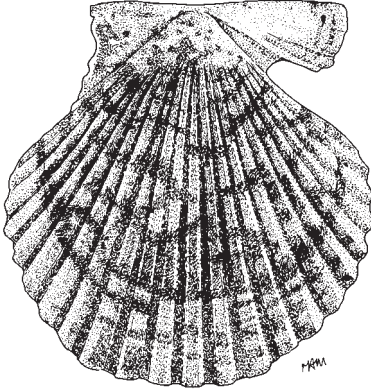


Volachlamys singaporina (Sowerby, 1842)

Frequent synonyms / misidentifications: *Chlamys singaporina* (Sowerby, 1842); *Pecten cumingii* Reeve, 1853 / *P. tranquebaricus* Gmelin, 1791.

En - Singapore scallop; **Fr** - Pétoncle de Singapour.

Maximum shell length 6 cm, commonly to 3.5 cm. On sandy bottoms with shell debris or coral rubble. Intertidal and shallow subtidal zones to a depth of 10 m. Locally collected for food. Eastern Indian Ocean and tropical West Pacific, from Myanmar and Indonesia to the Philippines; north to the South China Sea and south to Queensland.



exterior of right valve

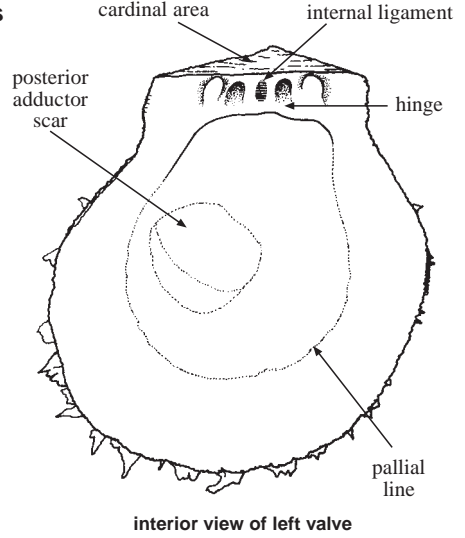
(after Abbott and Dance, 1983)



SPONDYLIDAE

Thorny oysters

Diagnostic characters: Shell stout, highly variable in shape but generally subequilateral, rounded and higher than long; usually inequivalve and cemented to substrate by the right (lower) valve, which is then higher and more convex than the left (upper) valve. Hinge line straight, with a small, more or less equal ear on either side of the median, orthograte umbo. Outer surface with more or less spinose to scaly irregular radial ribs, often brightly coloured (at least at the left valve). Umbones on top of a trigonal cardinal area, which is usually higher in the right valve than in the left valve. Ligament mainly internal, lodged in a deep median pit of the hinge plate. Hinge stout, with 2 strong curved teeth and 2 deep sockets in each valve, symmetrically arranged in relation to the internal ligament. Interior of shell porcelaneous. A single, rounded (posterior) adductor muscle scar. Pallial line without a sinus. Gills of filibranchiate type, with folded branchial sheets. Foot reduced, without a byssus in the adult. Siphons absent. Mantle widely open, with marginal tentacles and eyes.



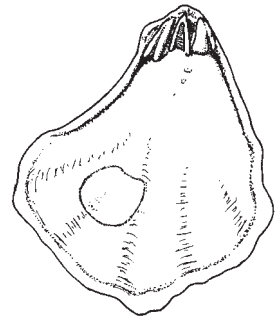
Habitat, biology, and fisheries: Sedentary animals, living mainly in relatively shallow waters in coralline areas, generally strongly cemented to hard substrates by their right valve. Suspension filter-feeders. Sexes separate, or hermaphrodites. Free-swimming larval stage present. A temporary, postlarval attachment by means of a byssus occurs before the cementation to the substrate by the right valve. Locally collected for food in some areas, Spondylidae are nowadays mainly exploited for their shell which is used as a source of lime or in shellcraft.

Similar families occurring in the area

Plicatulidae: hinge with 2 subequal ridges on either side of the triangular internal ligament.

Key to species of interest to fisheries occurring in the area

- 1a. Shell equivalve, without an attachment area on right valve (Fig. 1) *Spondylus imperialis*
- 1b. Shell more or less inequivalve, with an attachment area on right valve → 2
- 2a. Left valve with about 20 radial ribs, more or less the same size → 3
- 2b. Left valve with 5 to 8 main radial ribs, separated by smaller secondary ribs → 4
- 3a. Radial ribs relatively fine, bearing thin, sharp spines (Fig. 2). *Spondylus versicolor*
- 3b. Radial ribs relatively thick, bearing strong, flattish spines (Fig. 3) *Spondylus butleri*



Plicatulidae

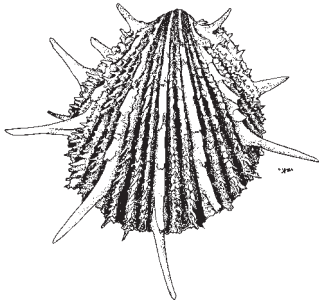


Fig. 1 *Spondylus imperialis*
(exterior of right valve)

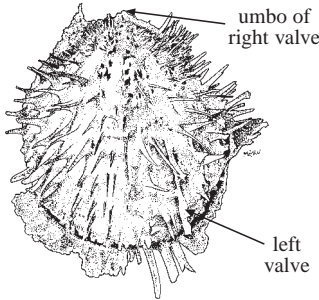


Fig. 2 *Spondylus versicolor*
(exterior)

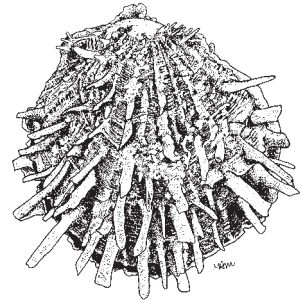


Fig. 3 *Spondylus butleri*
(exterior)

- 4a Main radial ribs with a few, short flattened spines; outer colour usually blackish brown with white ribs and spines (Fig. 4) *Spondylus squamosus*
- 4b. Main radial ribs with numerous short and sharp spines, becoming long, spatulate and densely set towards the margin; outer colour usually pinkish purple with whitish spines (Fig. 5) *Spondylus barbatus*

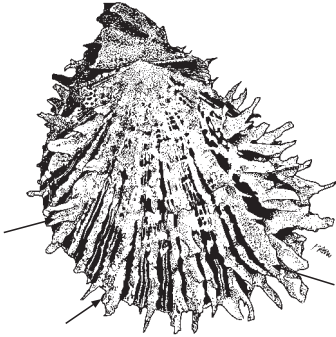


Fig. 4 *Spondylus squamosus* (exterior)

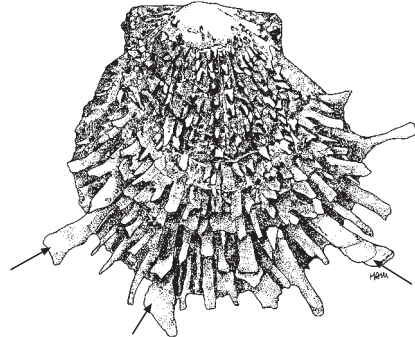


Fig. 5 *Spondylus barbatus* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Spondylus barbatus* Reeve, 1856
- 🐚 *Spondylus butleri* Reeve, 1856
- 🐚 *Spondylus imperialis* Chenu, 1843
- 🐚 *Spondylus squamosus* Schreibers, 1793
- 🐚 *Spondylus versicolor* Schreibers, 1793

References

Lamprell, K. 1987. *Spiny oyster shells of the world. Spondylus*. Brill and Backhuys, Leiden, 84 p.

Zavarei, A. 1973. Monographie des Spondylidae (Lamellibranches) actuels et fossiles. *Contrib. Cent. Etud. Rech. Paléont. Biostratigr.*, 4:1-233.

Spondylus squamosus Schreibers, 1793

Frequent synonyms / misidentifications: *Spondylus ducalis* Röding, 1798; *S. spathuliferus* Lamarck, 1819 / None.

FAO names: En - Ducal thorny oyster; Fr - Spondyle ducal.

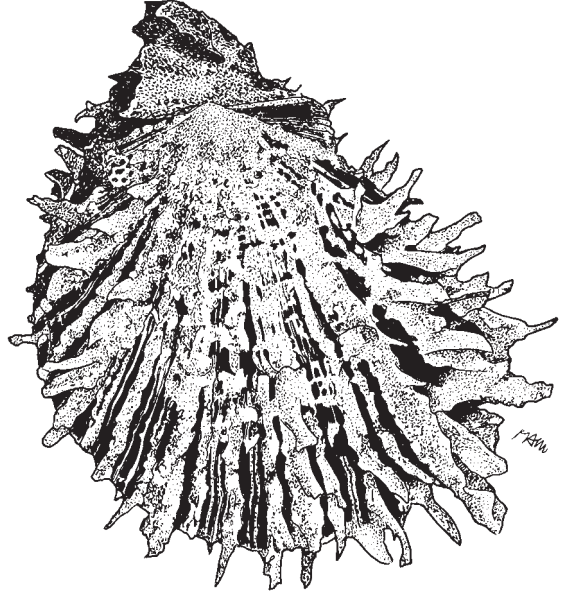
Diagnostic characters: Shell highly variable in shape but **roughly rounded-ovate to elongate-ovate in outline, inequivalve**. Right (lower) valve somewhat more convex and higher than left (upper) valve, with a well-developed cardinal area. Attachment area from moderately big to small, with a discrepant, mainly concentric sculpture. **Outer surface of valves** with low radial undulations forming a series of appressed, rather **broad white ribs bearing generally a few short, flattened** and often arched imbricate **spines**. Interstices of main ribs broad, radially ridged, sometimes with small and sharp fine spines. Main spinose ribs often slightly more numerous on right valve (**8 to 12 ribs on right valve**, instead of **5 to 8 on left valve**). Hinge teeth of right valve more or less bifid on top. Internal margins with crenulations corresponding with the outer radial sculpture.

Colour: outside of shell white to cream, with a few purple to blackish brown blotches on umbonal area and fine, concentrically interrupted, **radial bands** of similar colours on the interstices of the main ribs. Interior whitish, often tinged pale brown on ears and hinge. Internal margins marked with brown and purple on the crenulations.

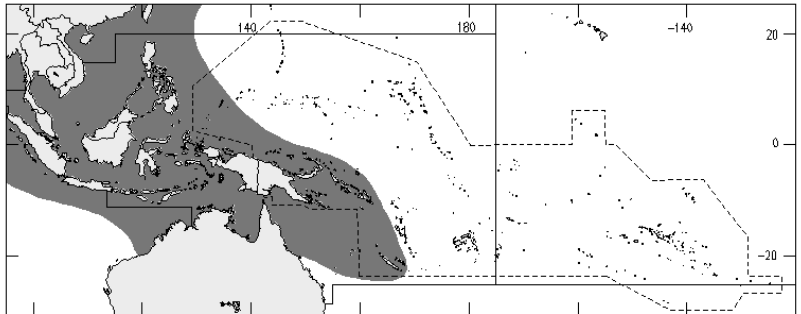
Size: Maximum shell height 10 cm, commonly to 8 cm.

Habitat, biology, and fisheries: Attached to rocks or dead corals. Littoral and sublittoral to a depth of 30 m. Collected for food in Fiji Islands and the Philippines; shell used for shellcraft.

Distribution: Indo-West Paific, from India to Melanesia; north to Japan and south to Queensland and New Caledonia.



left side view of entire shell
(after Habe and Kosuge, 1966)

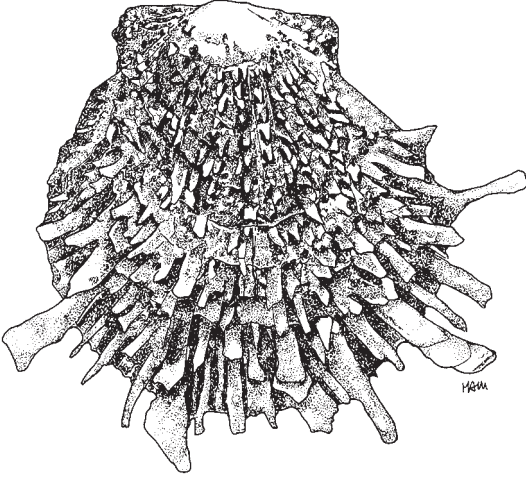


***Spondylus barbatus* Reeve, 1856**

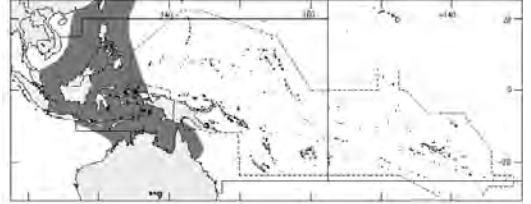
Frequent synonyms / misidentifications: *Spondylus japonicus* Kuroda, 1932; *S. sinensis* Sowerby, 1847 (not Schreibers, 1793) / None.

En - Bearded thorny oyster; **Fr** - Spondyle barbu.

Maximum shell height 11.5 cm, commonly to 8 cm. Attached to rocks, dead corals or shell debris, from lower intertidal zones to a depth of about 50 m. Locally collected in the Philippines and Indonesia. Distribution restricted to the tropical western Pacific, from Indonesia to the Philippines; north to Japan and south to northern Queensland.



exterior of left valve
(after Kira, 1962)

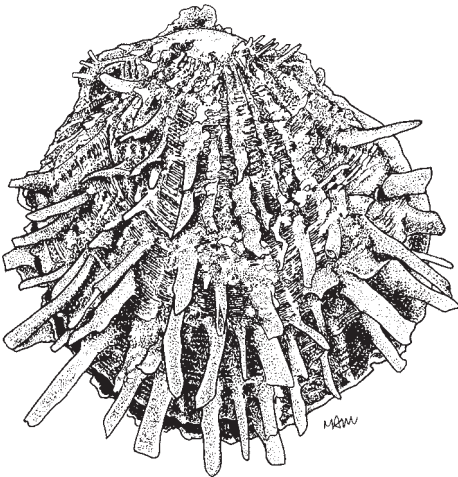


***Spondylus butleri* Reeve, 1856**

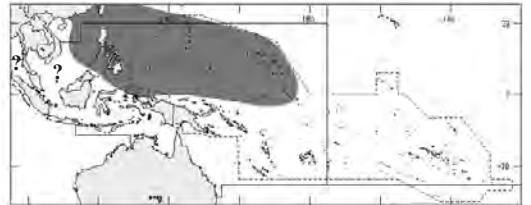
Frequent synonyms / misidentifications: None / *Spondylus longitudinalis* Lamarck, 1819.

En - Butler's thorny oyster; **Fr** - Spondyle de Butler.

Maximum shell height 10 cm, commonly to 8 cm. Attached to rocks or dead corals. Littoral and sublittoral to a depth of 30 m. Collected in the Philippines for food and shell trade. Exact distribution not known because of confusion with other species. Tropical western Pacific, in the Philippines, Micronesia, South and East China seas, and Taiwan Province of China to Japan. Probably also in the Indian Ocean.



left side view of entire shell
(after Lamprell, 1987)

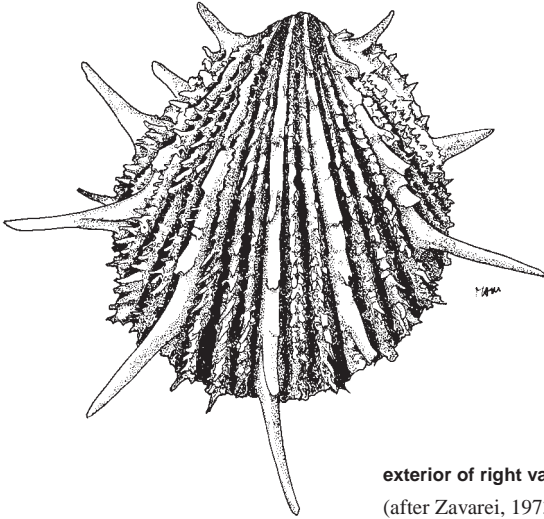


***Spondylus imperialis* Chenu, 1843**

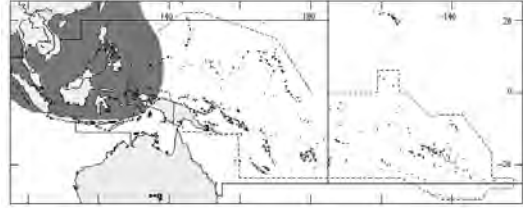
Frequent synonyms / misidentifications: None / *Spondylus ciliatus* Sowerby, 1847.

En - Imperial thorny oyster; **Fr** - Spondyle imperial.

Maximum shell height 13.5 cm, commonly to 8 cm. On soft bottoms with shell debris. Sublittoral, from depths of 10 to 90 m. Occasionally collected in fish trawls, mainly for shell trade. Common in Indonesia. Indo-West Pacific, from India and Sri Lanka to the Philippines; north to Japan and south to Indonesia.



exterior of right valve
(after Zavarei, 1973)

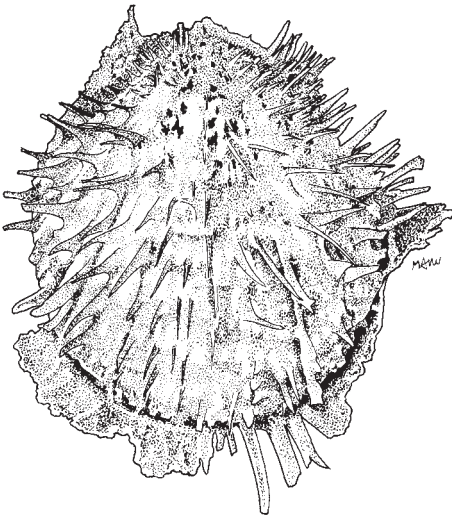


***Spondylus versicolor* Schreibers, 1793**

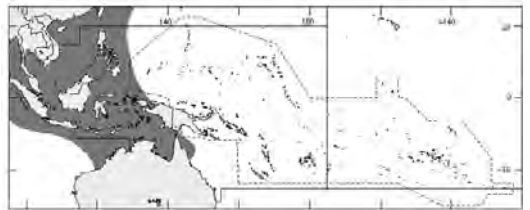
Frequent synonyms / misidentifications: *Spondylus aurantius* Lamarck, 1819 / None.

En - Golden thorny oyster; **Fr** - Spondyle doré.

Maximum shell height 14 cm, commonly to 10 cm. Attached to rocks or dead corals. Littoral and sublittoral to a depth of 25 m. Locally collected for food and shell trade in some areas (Indonesia, Philippines). Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to eastern Indonesia; north to Japan and south to northern Queensland.



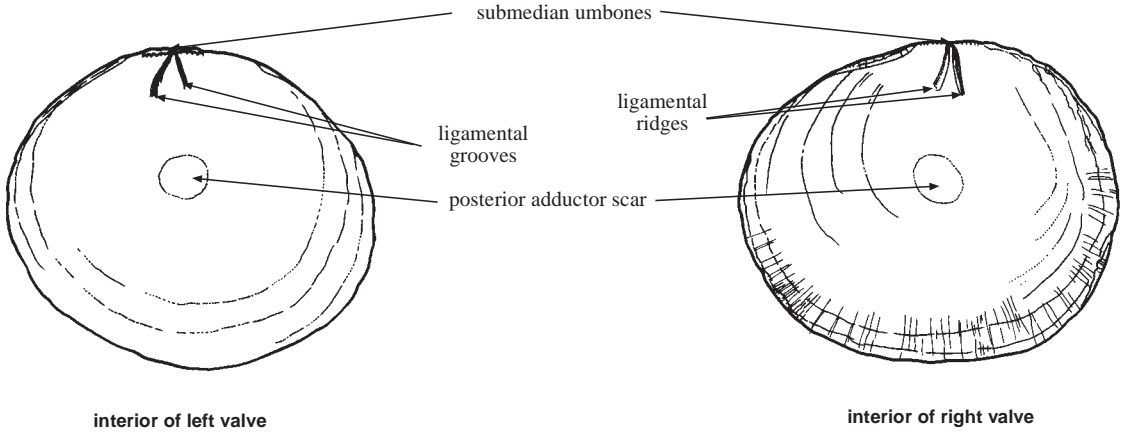
left side view of entire shell
(after Lamprell, 1987)



PLACUNIDAE

Windowpane shells

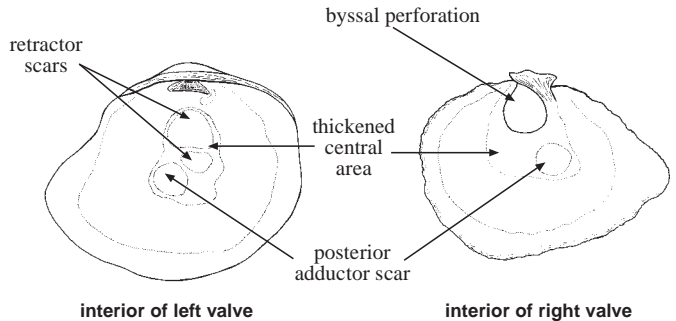
Diagnostic characters: Shell thin and brittle, nearly equilateral, rounded to saddle-shaped, very compressed laterally; slightly inequivalve, right (lower) valve nearly flat or a little concave, left (upper) valve weakly inflated. Umbones low, submedian. Outer surface smoothish, with slightly lamellate lines of growth and sometimes fine radiating threads. Periostracum inconspicuous. Ligament mostly internal, forming an inverted V-shaped structure under the umbones, attached to ridge-like nymphs in the right valve and to corresponding grooves in the left. Hinge line straightish, without teeth. Interior of shell subnacreous. A single, centrally situated, rounded (posterior) adductor muscle scar. Pallial line obscure, without a sinus. Internal margins smooth. Gills of filibranchiate type. Foot long and narrow, cylindrical. Mantle widely open ventrally, with marginal tentacles.



Habitat, biology, and fisheries: Suspension filter-feeding species, living unattached on the surface of muddy flats in shallow water, lying generally on the right valve. Sexes separate. Development with a free-swimming larval stage. Placunidae are extensively collected in the Indo-West Pacific, and cultivated in several areas, for their translucent shell, originally as a substitute of glass in glazing, now mainly for the manufacture of trays, lamp-shades and numerous decorative items. The flesh is often used for food by coastal populations.

Similar families occurring in the area

Anomiidae: shell highly variable and often irregular in shape, closely adhering to substrate by means of a calcified byssus passing through a hole-like embayment of the right valve; central area of the interior thickened, with 1 or 2 muscle scars in left valve, in addition to the single adductor scar.



Anomiidae

Key to species of interest to fisheries occurring in the area

- 1a.** Shell almost circular; ligamental nymphs of right valve gradually diverging from each other, with the posterior ridge longer than the anterior *Placuna placenta*
- 1b.** Shell subquadrate, saddle-shaped; ligamental nymphs of right valve rapidly diverging from each other, with the anterior and posterior ridges nearly equal in length . . . *Placuna ehippium*

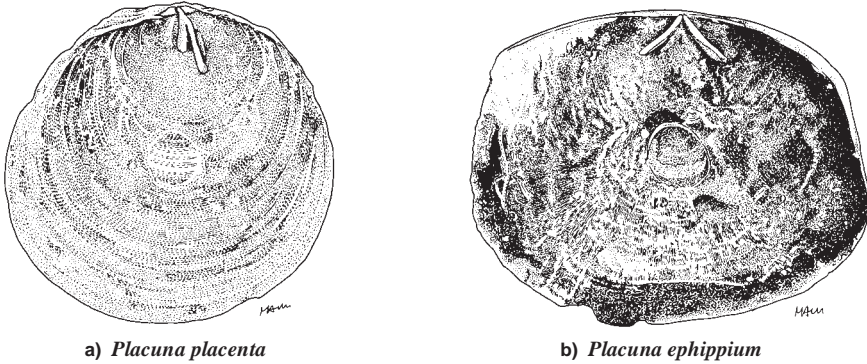


Fig. 1 interior of right valve

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Placuna ehippium* (Philipsson, 1788)
- 🐚 *Placuna placenta* (Linnaeus, 1758)

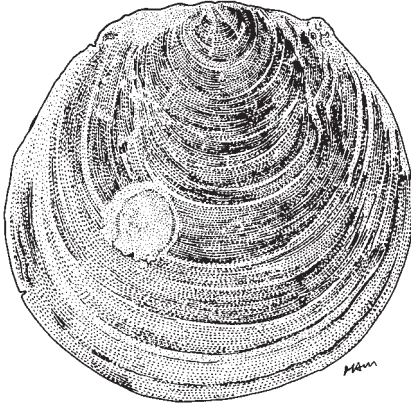
References

- Matsukuma, A. 1987. Studies on the Kawamura collection (Mollusca) stored in the National Science Museum, Tokyo IV. The family Placunidae (Bivalvia) with special reference to their ligament. *Venus*, 45(4):231-244.
- Yonge, C.M. 1977. Form and evolution in the Anomiacea (Mollusca: Bivalvia) *Pododesmus*, *Anomia*, *Patro*, *Enigmonia* (Anomiidae): *Placunanomia*, *Placuna* (Placunidae Fam. Nov.). *Phil. Trans. r. Soc. Lond.*, (B) 276(950): 453-523.

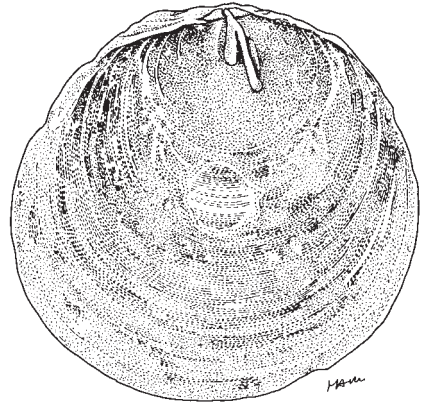
Placuna placenta (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Ehippium transparens* Röding, 1798; *Placenta orbicularis* Philipsson, 1788; *Placuna ovalis* Blainville, 1826 / *Placuna lincolnii* (Gray, 1849).

FAO names: En - Windowpane oyster; Fr - Placune ovale.



exterior of left valve



interior of right valve

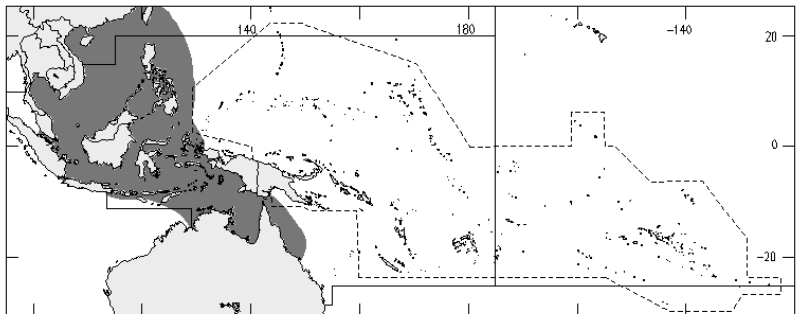
(after Matsukuma, 1987)

Diagnostic characters: Shell thin and more or less translucent, almost circular in outline. Dorsal margin somewhat flattened to widely curved, sometimes faintly protruding anteriorly and posteriorly. Valves **greatly compressed** laterally, the lower (right) valve flat, the upper (left) valve with slight convexity. **Commissural plane flat** (rarely, if at all, subflexuous). **Outer surface nearly smooth**, excepting numerous, minute radiating threads forming tenuous wrinkles on the finely lamellate concentric lines of growth. Hinge line straight and rather short, not raised. External ligament forming a ventrally undulated narrow band on both sides of the umbo. **Right valve nymphs** of internal ligament **gradually diverging from each other, with the posterior ridge distinctly longer than the anterior.** **Interior of shell smooth and glossy**, with only very weak radiating lines. Inner side of anterodorsal and posterodorsal margins often slightly rugose. **Colour:** **outside** of shell **silvery white** with a dull finish, occasionally with pale brown or light purplish rays umbonally. **Interior nacreous white.**

Size: Maximum shell length 18 cm, commonly to 10 cm.

Habitat, biology, and fisheries: Lying on the right valve, often in dense communities, on the surface of soft muddy to sandy-mud bottoms, from low tide levels to a depth of about 100 m. Main natural beds range from 4 to 20 m deep. Abundant in quiet waters of lagoons, protected bays and mangrove areas, or near estuaries. Often living under a thin layer of mud and debris, that camouflages it from predators. Actively collected and often overfished, or commercially cultured for the shells which are used in large quantities for shellcraft. Transparent shells are locally used in some areas as a substitute for window glass in houses. Soft parts are consumed by coastal populations. A major commercial species in the Philippines, where it is collected from natural beds by divers, and farmed in shallow water mud flats enclosed with fences. (Total production of 42.5 billion bivalves in 1977, representing 1635 t). However, production is very erratic because of the conflict between the high demand for young, transparent shells for shellcraft, and the need of older, sexually mature shells to replenish the stocks.

Distribution: Widespread in the tropical Indo-West Pacific, from the Gulf of Aden to eastern Indonesia; north to Taiwan Province of China and south to Queensland.

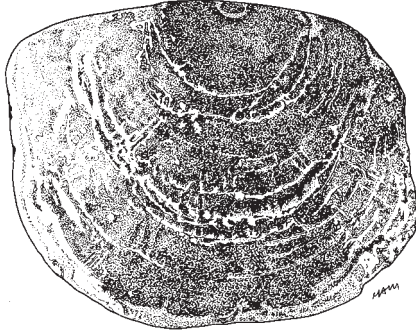


***Placuna ehippium* (Philipsson, 1788)**

Frequent synonyms / misidentifications: *Ehippium angulinum* Chemnitz, 1785 (Invalid name); *E. polonicum* Röding, 1798; *Placenta ehippium* Philipsson, 1788; *Placuna papyracea* Lamarck, 1819; *P. quadrangula* (Philipsson, 1788); *P. sella* (Gmelin, 1791) / None.

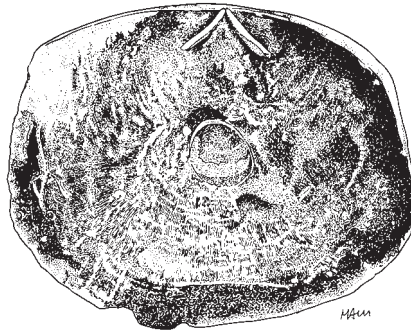
En - Saddle oyster; **Fr** - Placune papier.

Maximum shell length 21 cm, commonly to 13 cm. Lying free on fine soft bottoms with its right valve underneath, in shallow water to a depth of 10 m. Collected for food in Indo-China. The shell is used in local shellcraft. Western Pacific, from Thailand to Indonesia; north to Taiwan Province of China and the Philippines, and south to Northern Territory.



exterior of left valve

(after Matsukuma, 1987)



interior of right valve

LIMIDAE

File shells

Diagnostic characters: Shell equivalve, higher than long, obliquely elongate ovate to subtrigonal in outline, closed or gaping anteriorly and posteriorly; **inequilateral**, frequently more or less **extended obliquely in an anteroventral direction**. Dorsal margin with **2 small ears**, the anterior ones often reduced. Outer surface usually white or cream coloured, typically with radial ribbing. Umbones well separated, each one on top of a **trigonal cardinal area** provided with a shallow **median ligamental groove**. Hinge short and straightish, **toothless**, or with feeble denticles or a few tiny marginal crenulations. Interior of shell porcelaneous. **A single** (posterior) **adductor muscle scar**, generally obscure. **Pallial line without a sinus**. Internal margins smooth to crenulate. Gills of eulamellibranchiate type, with folded branchial sheets. Foot short and thick to long and slender, with or without a byssus. Mantle widely open, fringed with many long and retractable tentacles on margins. Soft parts whitish to yellowish red, or even brilliant red.

Habitat, biology, and fisheries: The Limidae are either attached by a byssus or are free-living animals, depending on the species. They occur in shallow to deep-water habitats, mostly sheltered in rock crevices, under stones and among marine growths, but also in soft substrates, more or less buried or lying on the surface. Some species can build a nest lined with mingled byssal threads. When disturbed, many are capable of swimming by flapping the valves together, expelling jets of water from either side of the hinge, with the commissural plane vertically directed and the pallial tentacles widely spread. To distract a predator, the animal can shed wriggling tentacles. Minor importance to fisheries in most areas. Large specimens of the genus *Acesta* are occasionally caught offshore in prawn trawl nets.

Similar families occurring in the area


Pectinidae: umbones not separated from dorsal margin by a trigonal cardinal area; anterior ears generally well developed, often with a byssal notch and a ctenolium in right valve; ligament mostly internal, fitting in a trigonal pit pointing under the umbones.



Spondylidae: shell inequivalve, cemented to substrate by right valve; cardinal area commonly more developed in right valve than in left; hinge stout, with 2 strong teeth, symmetrically arranged in relation to the internal ligament.

Key to species of interest to fisheries occurring in the area

- 1a. Shell thick and relatively small (not exceeding 9 cm in height); radial sculpture of coarse scaly ribs *Lima vulgaris*
- 1b. Shell thin and relatively big (largely exceeding 9 cm in height); radial sculpture of low smooth riblets *Acesta rathbuni*

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

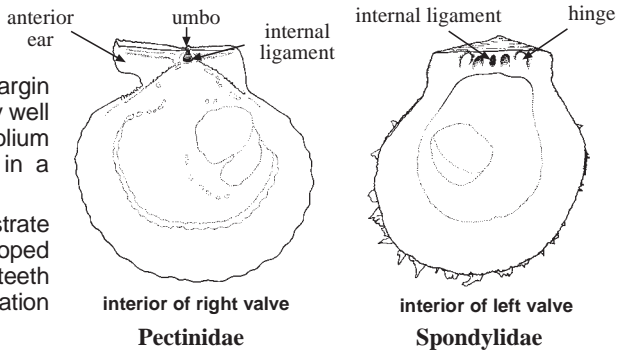
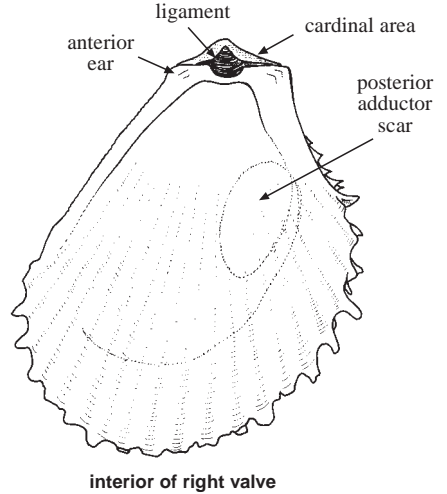
-  *Acesta rathbuni* (Bartsch, 1913)
-  *Lima vulgaris* (Link, 1807)

References

Bartsch, P. 1913. The giant species of the molluscan genus *Lima* obtained in Philippine and adjacent waters. (Scientific results of the Philippine cruise of the Fisheries Steamer "Albatross", 1907-1910. N°26.). *Proc. U. S. Natl. Mus.*, 45(1978):235-240.

Lamy, E. 1930a. Révision des Limidae vivants du Muséum national d'Histoire naturelle de Paris. *J. Conchyl.*, 74(2):89-114.

Lamy, E. 1930b. Révision des Limidae vivants du Muséum national d'Histoire naturelle de Paris (Suite). *J. Conchyl.*, 74(3):169-198.

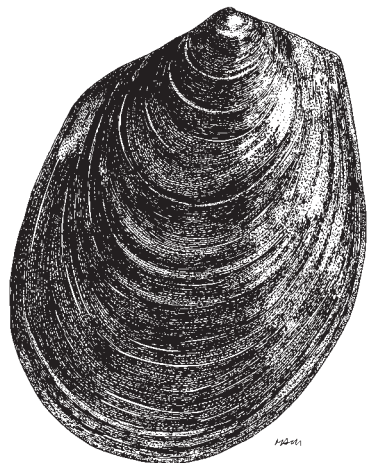


Acesta rathbuni (Bartsch, 1913)

Frequent synonyms / misidentifications: *Lima rathbuni* Bartsch, 1913 / None.

En - Rathbun's giant file shell; **Fr** - Lime géante de Rathbun.

Maximum shell height 21 cm, commonly to 15 cm. On fine sand or mud bottoms, offshore to a depth of 400 m. Occasionally collected in prawn trawl nets. Western Pacific, from the Philippines to Molucca Islands (Indonesia) and northwestern Australia.



exterior of left valve
(after Bartsch, 1913)

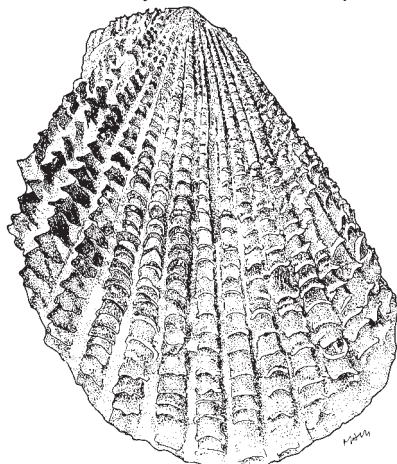


Lima vulgaris (Link, 1807)

Frequent synonyms / misidentifications: *Lima lima vulgaris* (Link, 1807); *L. nipponica* Oyama, 1943; *L. sowerbyi* Deshayes, 1863 (not of Geinitz, 1850) / *Lima lima* (Linnaeus, 1758).

En - Common file shell; **Fr** - Lime commune.

Maximum shell height 9 cm, commonly to 6 cm. Generally attached to rocks, the underside of stones or coral slabs, between tide marks and in subtidal waters to a depth of 20 m. Unattached specimens can actively swim, with the long reddish pallial tentacles widely expanded beyond shell margins. Artisanal exploitation in Philippine Islands, where the shell is also used in making decorative ornaments. Widespread in the Indo-West Pacific, from East and South Africa, including the Red Sea, to eastern Polynesia; north to Japan and south to Australia.



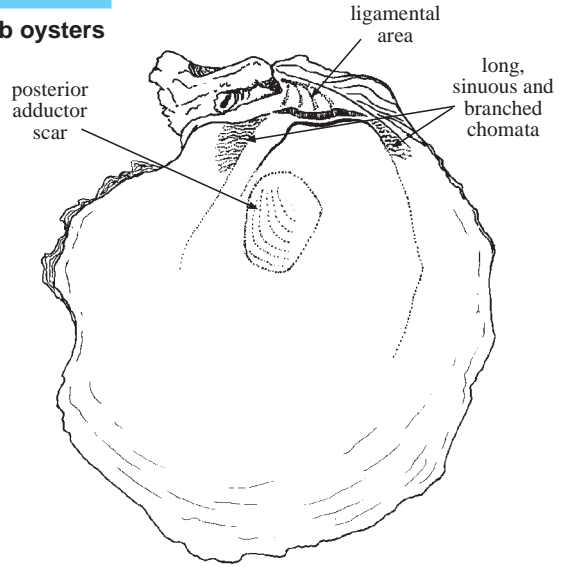
exterior of right valve
(after Dance, 1993)



GRYPHAEIDAE

Honeycomb oysters

Diagnostic characters: Shell solid, often irregularly shaped, **more or less inequivalve, cemented to substrate by the left (lower) valve** which is generally somewhat deeper and larger. Both valves convex and similarly sculptured, with large, irregular radial ribs provided with hollow tubular extensions, or right (upper) valve quite flat, with imbricating thin plates of horny material tending to protrude beyond the shell margin. Shell **with a microscopic vesicular structure**, easily seen under a lens on an eroded part of the shell or along peripheral area of the interior. **Ligamental area with a shallow median groove. Hinge without teeth.** Umbonal cavity generally very shallow. **A single, large and rounded (posterior) adductor muscle scar**, placed **closer to the hinge** than to the ventral margin. Pallial line without a sinus, obscure to absent. Internal periphery of the valves with a slight inframarginal fold or line. Internal margins with **long, branched, sinuous chomata** on either side of the ligamental area. Gills of eulamellibranchiate type. Pallial lobes free, with marginal tentacles.

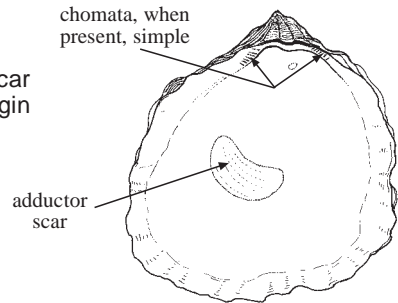


interior of left valve

Habitat, biology, and fisheries: Suspension filter-feeding animals, living cemented to the substrate by the left valve, either in littoral and shallow subtidal levels, or in deeper waters. Sexes separate. Fertilization external, without an incubator stage, yielding free-swimming planktonic larvae. Though they are collected in many areas, Gryphaeidae are generally less prized than species of the related family Ostreidae.

Similar families occurring in the area

Ostreidae: shell structure not vesicular; adductor muscle scar median in position or placed nearer to the ventral shell margin than to the hinge; chomata, if present, short and simple.



interior of left valve

Ostreidae

References

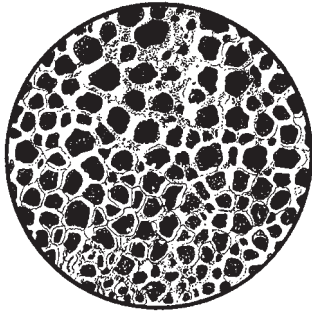
- Harry, H.W. 1985. Synopsis of the supraspecific classification of living oysters (Bivalvia: Gryphaeidae and Ostreidae). *Veliger*, 28(2):121-158.
- Thomson, J.M. 1954. The genera of oysters and the Australian species. *Aust. J. Mar. Freshw. Res.*, 5:132-168.
- Torigoe, K. 1981. Oysters in Japan. *J. Sci. Hiroshima Univ.*, (B1 Zool.) 29(2):291-419.

A single species of interest to fisheries occurring in the area***Hyotissa hyotis* (Linnaeus, 1758)**

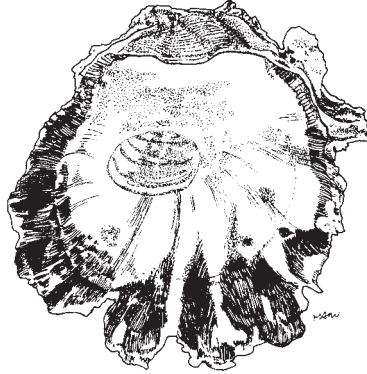
Frequent synonyms / misidentifications: *Ostrea nobilis* Sowerby, 1871; *Pycnodonte hyotis* (Linnaeus, 1758) / *Hyotissa sinensis* (Gmelin, 1791).

En - Honeycomb oyster; **Fr** - Pycnodonte géante.

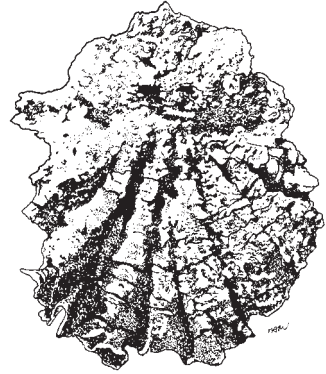
Maximum shell height 30 cm, commonly to 18 cm. Cemented to hard substrates, often in coral reef areas. Mostly in intertidal and shallow subtidal levels to a depth of 5 m, but also to a depth of 50 m. Locally exploited and occasionally marketed in Viet Nam and the Philippines. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and Persian Gulf, to eastern Polynesia; north to Japan and south to Queensland.



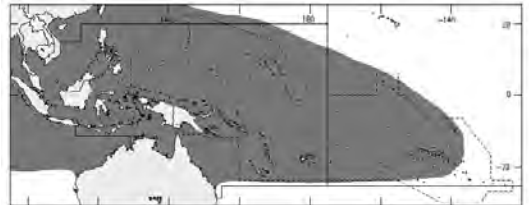
detail of internal margin



interior of left valve



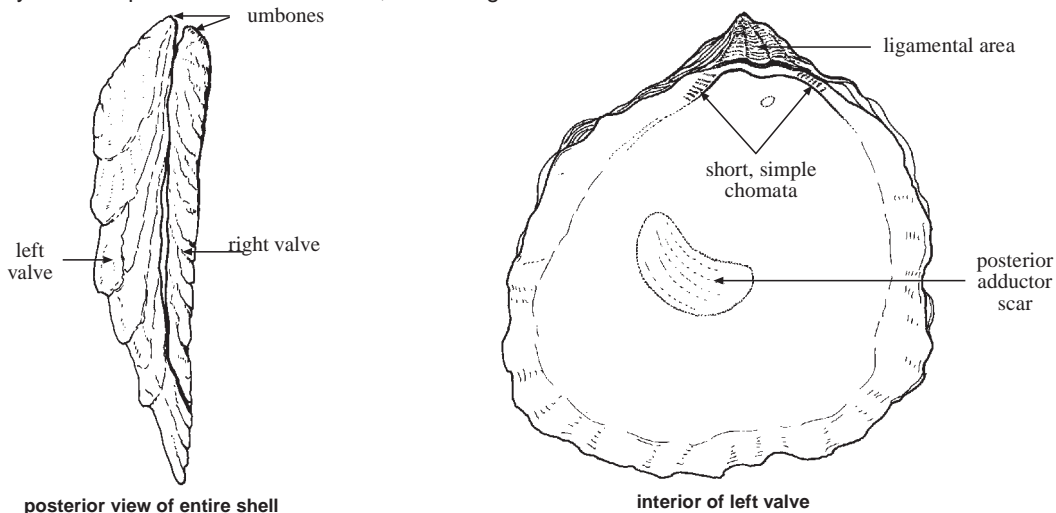
exterior of left valve



OSTREIDAE

Oysters

Diagnostic characters: Shell solid, often irregularly shaped, **inequivalve, cemented to the substrate by the left (lower) valve** which is generally larger and deeper. **Right (upper) valve quite flat**, often with thin, concentrically arranged, imbricating plates of horny material tending to make a protruding fringe beyond the shell margin. Outer surface commonly, at least on left valve, with radial folds or ribs which may affect the shell margin. **Ligamental area with a shallow median groove and two lateral thickenings.** **Hinge without teeth.** A more or less deep umbonal cavity, sometimes present. Interior of shell porcelaneous, sometimes with irregular chalky deposits or with a subnacreous tinge. **A single (posterior) adductor muscle scar**, generally **median in position or nearer to the ventral margin** than to the hinge. Pallial line without a sinus, obscure to absent. **Internal margins smooth or with simple short chomata**, which may be restricted to the hinge surroundings. Gills of eulamellibranchiate type, with folded branchial sheets. Foot and byssus atrophied. Pallial lobes free, with marginal tentacles.



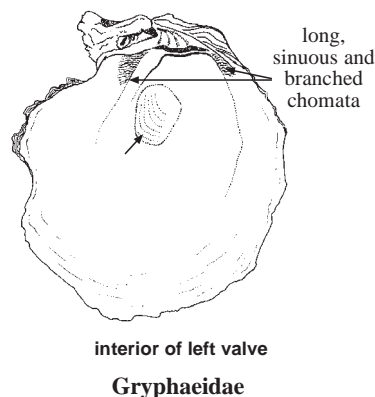
Habitat, biology, and fisheries: Suspension filter-feeding animals, living cemented to the substrate by the left valve, mainly in littoral and shallow subtidal areas. Sexes separate, or changing with age of the specimen. Eggs released and fertilized in water, or fertilized and brooded for some time in the mantle cavity before hatching. The Ostreidae include some of the most important commercial species of bivalves, and are intensively cultured in many parts of the area.

Similar families occurring in the area

Gryphaeidae: shell structure vesicular, distinguishable under a lens on an eroded part of the shell, or along peripheral area of the interior; adductor muscle scar nearer to the hinge than to the ventral margin; chomata long, sinuous, and branched.

Key to species of interest to fisheries occurring in the area

Note: since oysters live attached to hard objects and are often gregarious, morphological features of their shell may be exceedingly variable among individuals, making species identification sometimes very difficult. In the Indo-West Pacific region, many nominal species have been erected in the past, and systematics of the family is still uncertain. The status of a number of these "species" remains problematical, and others are thought to represent only ecophenotypical variations. The following key provides a simplified guide to the main shell features that are easily recognizable in the field. In addition, it includes some diagnostic internal characters that should be carefully examined before completing the identification of a specimen.



- 1a. Surface of both valves roughened by numerous small, low and rounded protuberances, arranged in obscure radial rows; imbricating growth scales absent (Fig. 1a) *Lopha cristagalli*
- 1b. Surface of both valves without small, low and rounded protuberances; imbricating growth scales often present (Fig. 1b) → 2

- 2a. Left valve with recurved spines forming clasping shelly extensions for attachment of shell to extraneous objects (Fig. 2) *Dendostrea folium*
- 2b. Left valve without recurved spines forming clasping shelly extensions → 3

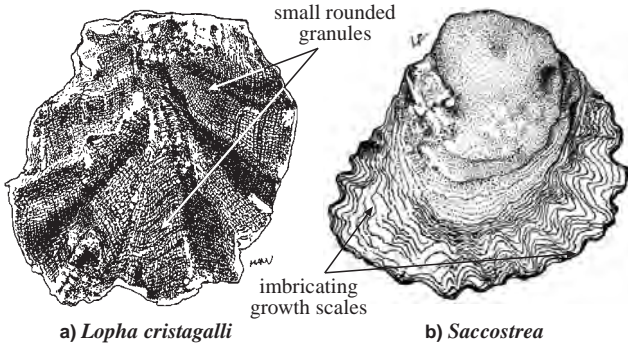


Fig. 1 exterior of right valve

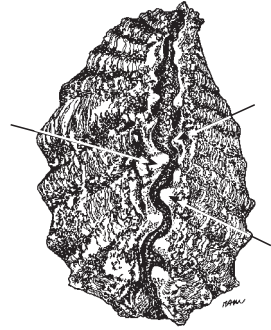


Fig. 2 *Dendostrea folium* (exterior)

- 3a. Chomata present, at least on either side of the ligamental area → 4
- 3b. Chomata completely absent → 6

- 4a. Valve margins strongly plicate; chomata present all around the internal shell margins → 5
- 4b. Valve margins smooth; chomata restricted to the dorsal half of the internal shell margins (Fig. 3) *Planostrea pestigris*

- 5a. Chomata forming 1 row of distant ridgelets in right valve, and corresponding pits in left valve; interior of valves with a crescent-shaped series of small disjunct pallial imprints between the posterior adductor scar and the anterodorsal margin; fingerprint shell structures absent (Fig. 4) *Saccostrea cucullata*
- 5b. Chomata forming 2 to 4 rows of numerous pustules in right valve only; interior of valves without a crescent-shaped series of disjunct pallial imprints; fingerprint shell structures generally present (Fig. 5) *Alectryonella plicatula*

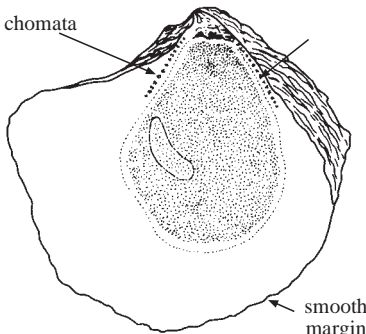


Fig. 3 *Planostrea pestigris* (interior)

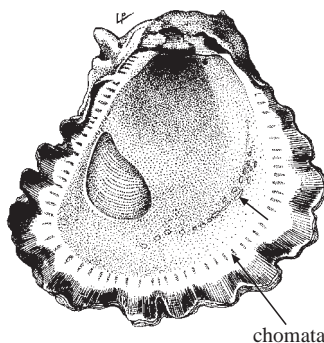


Fig. 4 *Saccostrea cucullata* (interior)

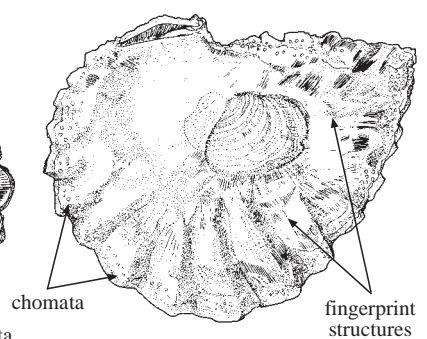


Fig. 5 *Alectryonella plicatula* (interior)

- 6a. Shell large sized, attaining 45 cm in height; posterior adductor scar pale-coloured (white, grey or tinged with pale purple) (Fig. 6) *Crassostrea gigas*
- 6b. Shell medium sized, not exceeding 15 cm in height; posterior adductor scar deep purple brown (Fig. 7) *Crassostrea iredalei*



Fig. 6 *Crassostrea gigas* (interior)

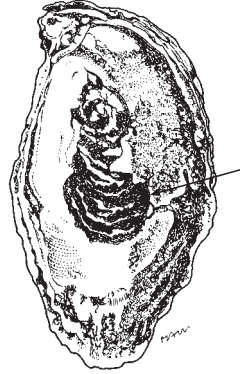


Fig. 7 *Crassostrea iredalei* (interior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Alectryonella plicatula* (Gmelin, 1791)
- 🐚 *Crassostrea gigas* (Thunberg, 1793)
- 🐚 *Crassostrea iredalei* (Faustino, 1932)
- 🐚 *Dendostrea folium* (Linnaeus, 1758)
- 🐚 *Lopha cristagalli* (Linnaeus, 1758)
- 🐚 *Planostrea pestigris* (Hanley, 1846)
- 🐚 *Saccostrea cucullata* (Born, 1778)

References

Harry, H.W. 1985. Synopsis of the supraspecific classification of living oysters (Bivalvia: Gryphaeidae and Ostreidae). *Veliger*, 28(2):121-158.

Morris, S. 1985. Preliminary guide to the oysters of Hong Kong. *Asian Mar. Biol.*, 2:119-138.

Morton, B.S. 1990. Life cycle and sexual strategy of *Saccostrea cucullata* (Bivalvia: Ostreidae) from a Hong Kong mangrove. *Am. Malac. Bull.*, 8(1):1-8.

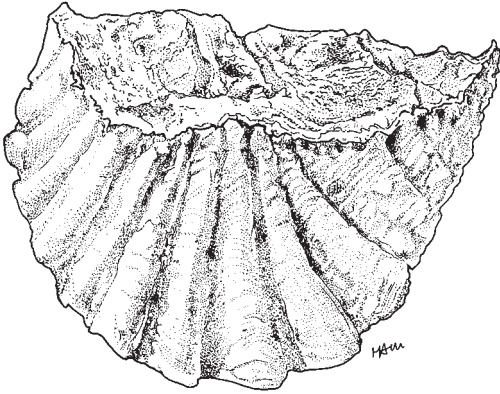
Thomson, J.M. 1954. The genera of oysters and the Australian species. *Aust. Mar. Freshw. Res.*, 5:132-168.

Torigoe, K. 1981. Oysters in Japan. *J. Sci. Hiroshima Univ.*, (B1 Zool.) 29(2):291-419.

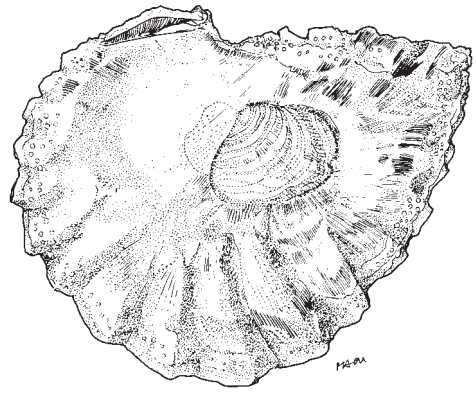
Alectryonella plicatula (Gmelin, 1791)

Frequent synonyms / misidentifications: *Crassostrea plicatula* (Gmelin, 1791); *Ostrea cumingiana* Dunker, 1846; *O. plicata* Chemnitz, 1785 (Invalid name); *Saxostrea cumingiana* (Dunker, 1846) / *Alectryonella haliotidea* (Lamarck, 1819); *Hyotissa hyotis* (Linnaeus, 1758); *Ostrea iridescens* Hanley, 1854 = *Striostrea prismatica* (Gray, 1825).

FAO names: En - Fingerprint oyster; Fr - Huître plicatule.



exterior of left valve



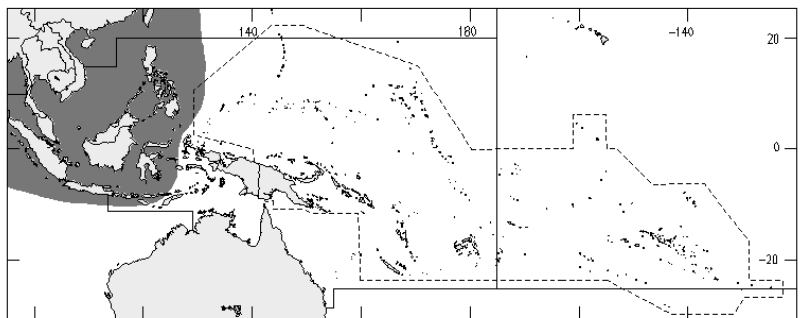
interior of right valve

Diagnostic characters: Shell rather thick and heavy, of moderate size, roughly subcircular to irregularly trigonal in outline. Both valves convex, with the right (upper) valve more flattened, regularly plicate beyond the attachment area of left (lower) valve (and the corresponding area of right valve) by 14 to 28 strong, rounded or somewhat angulate, radial folds ending in a zigzag commissure. Outer surface of valves roughened by closely set, irregular concentric growth marks. Umbonal area sometimes markedly protruding, mostly at the left valve. Umbonal cavity of left valve rather deep. Adductor muscle scar large and somewhat obliquely elongated, rounded posteroventrally and straight to slightly depressed anterodorsally, situated near the posterior margin of shell. Small patches of fingerprint shell structure usually present on internal surface of valves or broken parts of the shell. Chomata forming in right valve 2 to 4 rows of numerous pustules all around the internal margins, and in left valve short transverse pits only present near the ligamental area. **Colour:** outside of shell light to dark greyish brown. Interior glossy white, often largely blotched with hazel to dark brown, especially on muscle scar and ventral margin areas, and with a highly iridescent, submetallic hue which may give the ventral margin a deep bronze appearance.

Size: Maximum shell height 12 cm, commonly to 6 cm.

Habitat, biology, and fisheries: Cemented on various hard substrates or objects. Intertidal and shallow subtidal waters to a depth of 5 m. Collected for food like other oysters in southern Viet Nam and the Philippines. This is a major cultivated species in Fujian Region (China).

Distribution: Widespread in the Indo-West Pacific, from East Africa, including the Persian Gulf, to the Philippines; north to southern Japan and south to Indonesia. Exact distribution not known because of frequent confusion with other species, notably *Hyotissa hyotis* and *Alectryonella haliotidea*.



Crassostrea iredalei (Faustino, 1932)

CSI

Frequent synonyms / misidentifications: *Ostrea iredalei* Faustino, 1932 / None.

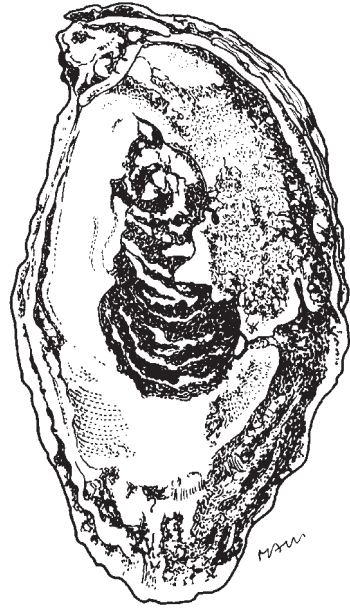
FAO names: En - Philippine cupped oyster; Fr - Huître creuse chausson.

Diagnostic characters: Shell medium sized, usually poorly sculptured, very variable in shape but generally higher than long, roughly rounded, oblique triangular or elongate ovate in outline. Left (lower) valve rather thick but lightweighted, more convex and larger than right (upper) valve, with small to large attachment area. Surface of left valve somewhat lamellate, with a few shallow to indistinct radial furrows that faintly scallop the commissure of valves. Right valve flattish, concentrically lamellate or nearly smooth. A moderately small umbonal cavity present under the hinge of left valve. Adductor muscle scar large, kidney-shaped, somewhat concave anterodorsally and a little nearer to ventral margin than to the hinge. Chomata completely absent from internal margins. Colour: outside of shell dirty white, often flushed with pale greyish brown. Right valve frequently with a few darker purplish grey radial bands in early stages of growth. Interior of valves whitish and shiny, often with irregular areas of chalky white, deep purple-brown on posterior adductor scar.

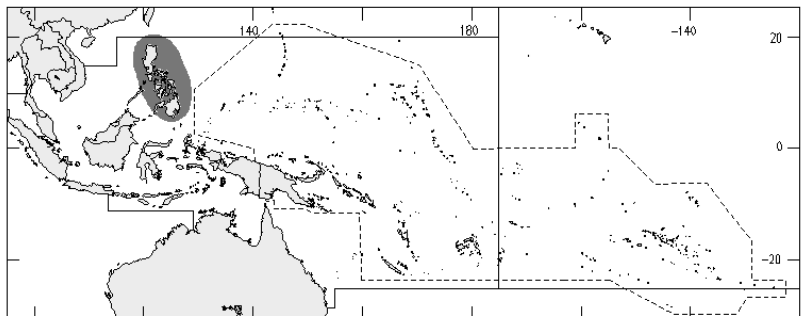
Size: Maximum shell height 15 cm, commonly to 8 cm.

Habitat, biology, and fisheries: Attached to hard objects or growing in bunches, on various soft bottoms, especially in bays and estuaries with somewhat reduced salinity. Intertidal and shallow subtidal water. This is an important commercial species in the Philippines, produced both from wild stocks and aquaculture. From 1990 to 1995, the reported yearly total production of *Crassostrea iredalei* in the Philippines ranged from around 11 800 to 18 600 t (FAO Yearbook of Fishery Statistics). In the same period, the yearly aquaculture production of this species in the Philippines ranged from around 11 700 to 18 300 t (FAO Aquaculture Production Statistics). Landings from wild stocks represent only a small fraction of the total production, but the low price of harvest in areas where natural populations occur, limits development of oyster farming in those areas. Experimentally introduced in Fiji Islands for aquaculture.

Distribution: Restricted to the Philippine Archipelago.



(after Faustino, 1932)
interior of left valve



Dendostrea folium (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Lopha folium* (Linnaeus, 1758); *Ostrea folium* Linnaeus, 1758; *O. (Pretostrea) bresia* Iredale, 1939 / *Dendostrea frons* (Linnaeus, 1758).

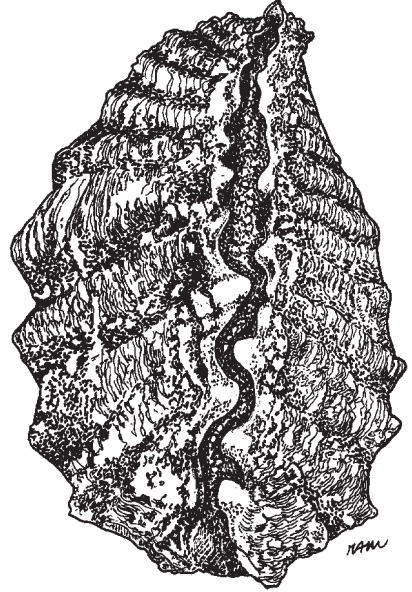
FAO names: En - Leaf oyster; Fr - Huître feuille.

Diagnostic characters: Shell medium sized, **slightly inequivalve**, variable in shape, **irregularly subcircular or dorsoventrally elongate ovate** in outline, **depending on the substrate**. Both valves convex, the right (upper) valve often more flattened than the left (lower) valve in specimens attached to rocks or corals; elongate forms attached to narrow substrates like the stems of gorgonians with prominent submedian ridge on right valve and corresponding groove on left valve, conforming to the shape of the substrate. **Left valve with short recurved spines forming clasping shelly extensions to attach shell to extraneous objects. Valves strongly plicate** beyond the attachment area by up to 15 or more **rounded radial folds that markedly undulate the commissure**. Surface of valves, when not eroded, roughened by low and irregular, concentric growth marks. **Umbonal cavity of left valve shallow**. Adductor muscle scar ovate, somewhat pointing at posterodorsal end and with the anterodorsal margin shallowly concave. **Internal margins of both valves with slightly transverse chomata near the ligamental area, often supplemented in the right valve only by an irregular row of small pustules extending to the ventral margin.** **Colour:** **outside** of shell with different shades of **yellowish brown to purplish brown**, usually with some darker radial lines or streaks. **Interior** of shell **glossy white** with outer shell colour toward the margins and often **iridescent patches** of olive yellow.

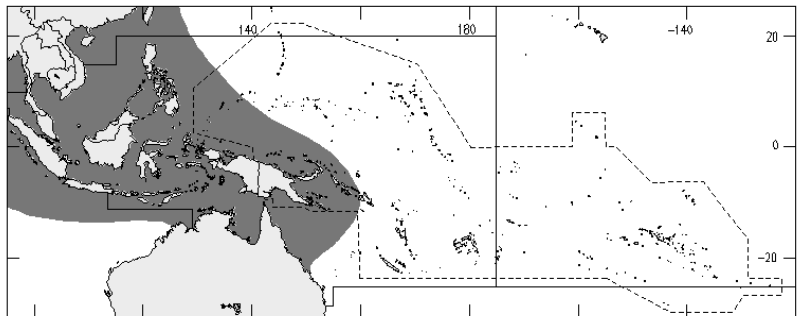
Size: Maximum shell height 10 cm, commonly to 6 cm.

Habitat, biology, and fisheries: On rocks or seawhip stems, in marine and estuarine waters. Common in mangrove areas. Lower intertidal zone and sublittoral to a depth of 5 m. Locally collected for food by coastal people, this species is cultured in Malaysia.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Melanesia; north to Japan and south to Queensland.



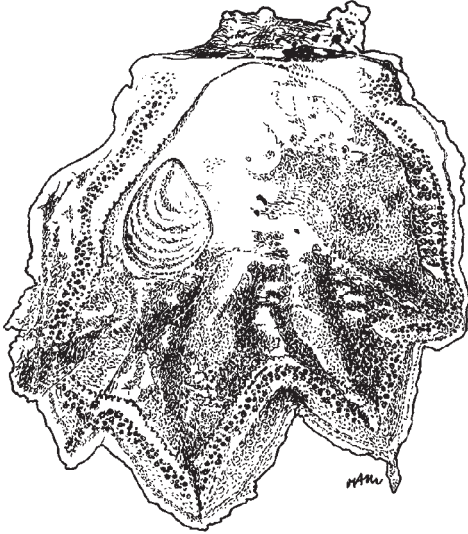
exterior of left valve



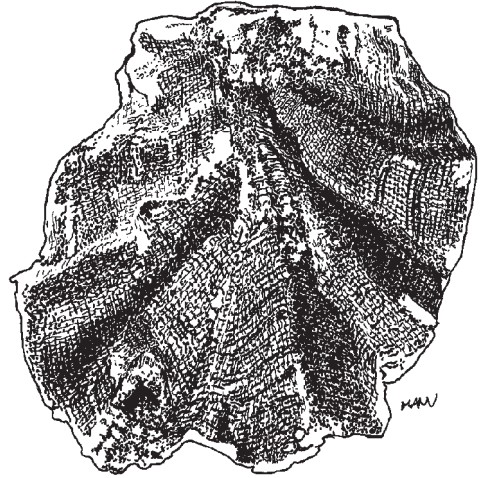
Lopha cristagalli (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Lopha folium* var. *cristagalli* (Linnaeus, 1758); *Ostrea cristagalli* (Linnaeus, 1758) / *Dendostrea folium* (Linnaeus, 1758).

FAO names: En - Cock's comb oyster; Fr - Huître crête-de-coq.



interior of left valve



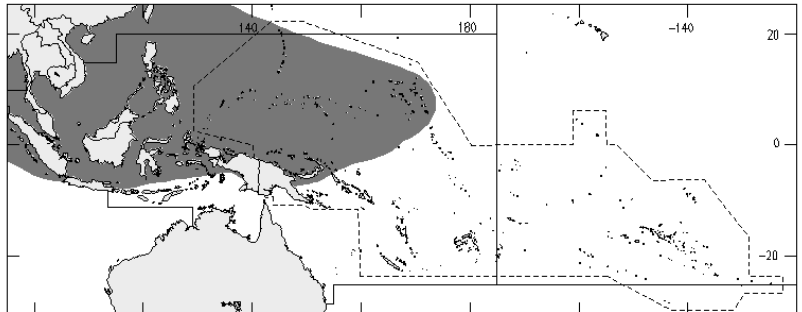
exterior of right valve

Diagnostic characters: Shell thin but solid, medium sized to large, subcircular to oval-reniform in outline; slightly inequivalve, the left (lower) valve deeper and somewhat overlapping the right (upper) valve umbonally. Outer surface of both valves devoid of imbricating growth scales, roughened by numerous small, low and rounded protuberances, arranged in obscure concentric and radial rows. About 4 to 8 very large, sharp radial folds on both valves, strongly affecting the ventral side of commissure. Ridges and troughs of radial folds acutely angled, and sides flattened. Left valve with hollow, recurved spines commonly rising from tops of folds, some forming long, clasping shelly extensions to attach the shell to substrate or extraneous objects. Exterior of right valve usually with distinct depressions corresponding with the spines of left valve. Interior of valves often with some shelly deposits smoothing the deep troughs of radial folds. Umbral cavity of left valve small to moderately deep. Adductor muscle scar semi-orbicular, straightish on its anterodorsal margin. Internal margins with numerous, small and rounded pustules, often present in both valves but more prominent in right valve. **Colour:** outside of shell with variable coloration, from dull light brown to deep purple. Interior porcelaneous, purplish brown or bronze to whitish.

Size: Maximum shell length 20.5 cm, commonly to 10 cm.

Habitat, biology, and fisheries: Attached on rocks and corals, mostly in shallow subtidal waters. Sublittoral, from depths of 5 to 30 m. Collected for food in many areas of the tropical western Pacific. However, the relatively small yield of its meat makes this oyster rather unattractive as an aquacultural species.

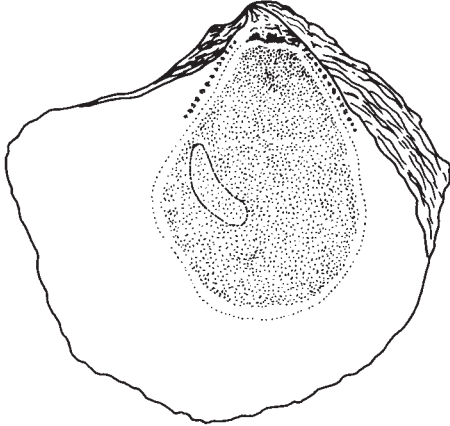
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to Micronesia; north to Japan and south to Indonesia.



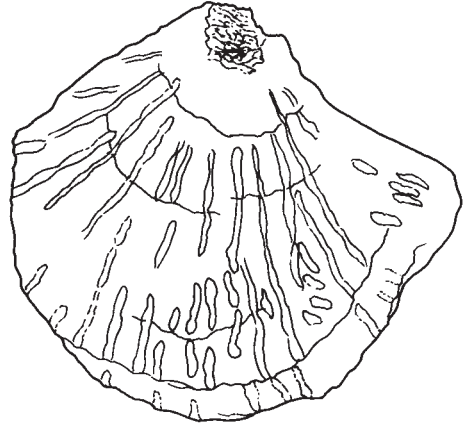
Planostrea pestigris (Hanley, 1846)

Frequent synonyms / misidentifications: *Crassostrea discoidea* (Awati and Rai, 1931); *C. rivularis* (Gould, 1861); *Ostrea palmipes* Sowerby, 1871; *O. paulucciae* Crosse, 1869; *O. pestigris* Hanley, 1846 / None.

FAO names: En - Palmate oyster; Fr - Huître palmée.



interior of left valve



exterior of left valve

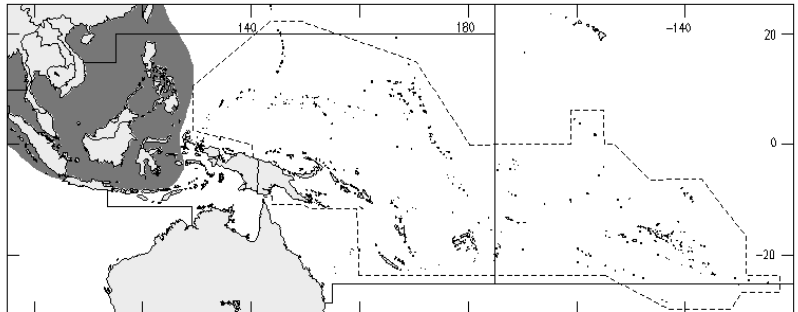
(after Harry, 1985)

Diagnostic characters: Shell rather thin but solid, of moderate size, **very compressed** laterally. **Commissure of valves smooth and flattish**, not plicate. Left (lower) valve shallowly convex, somewhat larger than right (upper) valve which is flattened or slightly convex. Attachment area of left valve often reduced. Surface of **left valve with narrow, rounded radial riblets**, variable in number and often **interrupted at irregular intervals**. Surface of **right valve relatively smooth**, with fine, irregular concentric growth marks and obscure radial lines. **Adductor muscle scar** crescent-shaped, **narrow and obliquely elongated**. Interior of valves with a wide peripheral shelf, flat, well defined along its inner edge and more developed in left valve than in right valve. Umbonal cavity very shallow. **Chomata** forming in each valve two straight lines of **small, densely spaced** ridgelets diverging from the umbo and **restricted to dorsal half of shell margins**. **Colour:** outside of shell variably coloured, from cream or greyish mauve to dark brownish purple. Interior white or cream with a vitreous or pearly lustre, sometimes irregularly tinged with olive-green.

Size: Maximum shell height 15 cm, commonly to 8 cm.

Habitat, biology, and fisheries: On various bottoms. Intertidal and shallow subtidal waters to a depth of 10 m. Exploited in the Philippines. This is a major cultivated species in southern China.

Distribution: Indo-West Pacific, from India and Mauritius Island to the Philippines; north to the Yellow Sea and south to Indonesia.

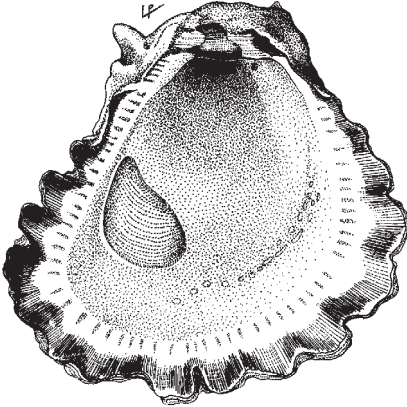


Saccostrea cucullata (Born, 1778)

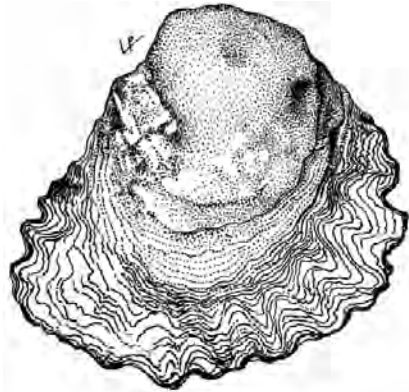
CSC

Frequent synonyms / misidentifications: *Crassostrea cucullata* (Born, 1778); *Ostrea cornucopiae* Chemnitz, 1785 (Invalid name); *O. cornucopiaeformis* Saville-Kent, 1893; *O. echinata* Quoy and Gaimard, 1835; *O. forskaelii* Chemnitz, 1785 (Invalid name); *O. forskalli* Gmelin, 1791; *O. glomerata* Gould, 1850; *O. malabonensis* Faustino, 1832; *O. mordax* Gould, 1850; *O. spinosa* Deshayes, 1836; *Saxostrea amasa* Iredale, 1939; *S. commercialis* Iredale and Roughley, 1933; *S. gravis* Iredale, 1939 / see **Remarks**.

FAO names: **En** - Hooded oyster; **Fr** - Huître-capuchon; **Sp** - Ostión capuchón.



interior of left valve



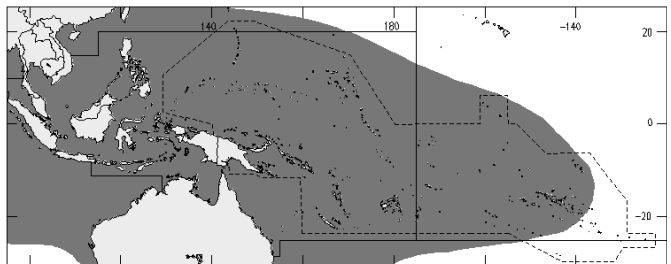
exterior of right valve

Diagnostic characters: Shell stout, very variable in shape and size, usually medium sized to small and very inequivalve. Left (lower) valve generally deep (occasionally very shallow), with large attachment area and strong radial ribs towards the periphery. Right (upper) valve flattish, fitting down into the plicate margins of the wider opposite valve. Outer surface of right valve smoothish, sometimes with distinct radial ribs and, when not too much eroded, with concentrically arranged, imbricating plates of horny material. Irregular tubular spines rising vertically from surface of right valve sometimes present on juveniles living in sheltered conditions (form *echinata* Quoy and Gaimard, 1835). In specimens not exposed to wave action and living crowded together, right valve may be small and operculiform, and left valve with a greatly elongated, partly coiled ligamental area, giving the shell a slender conical or cornucopia shape (form *cornucopiaeformis* Saville-Kent, 1893). Adductor muscle scar kidney-shaped, more or less posteroventral in position. Interior of valves with a crescent-shaped series of small disjunct pallial imprints between the posterior adductor scar and the anterodorsal margin. Umbonal cavity of left valve generally deep. Chomata present all around the internal shell margins, forming 1 row of distant ridgelets in right valve, and corresponding pits in left valve. **Colour:** exterior of shell dirty white to greyish brown, often with shades of purple. Interior creamy white, with deep purple margins and frequently a subnacreous iridescence. Adductor scar coloration may be darker than the surrounding shell area.

Size: Maximum shell height 20 cm, commonly to 10 cm.

Habitat, biology, and fisheries: Attached to various hard substrates, in marine, estuarine and mangrove areas, often in dense colonies. Intertidal and shallow subtidal levels to a depth of 5 m. Artisanal to industrial exploitation, from natural beds and by aquaculture. This is a major commercial species in many tropical western Pacific countries.

Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and south to New South Wales and New Zealand. Also occurring in the tropical eastern Atlantic, from Cameroun to Angola. Introduced recently in the Mediterranean Sea for aquaculture.



Remarks: The systematics of the genus *Saccostrea* has been very confused in the past and there is still no general agreement among authors about the number of species living in the Indo-West Pacific. However, as *Saccostrea cucullata* is often considered to be the only species occurring in that area, this conservative opinion is adopted here.

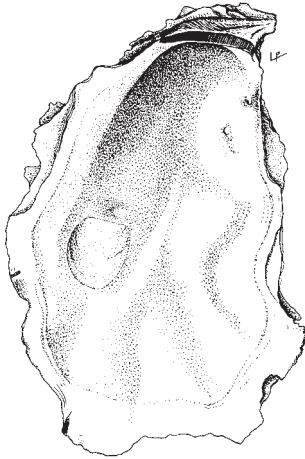
Crassostrea gigas (Thunberg, 1793)

OYG

Frequent synonyms / misidentifications: *Crassostrea angulata* (Lamarck, 1818); *C. laperosii* (Schrenck, 1862); *C. sikamea* (Amemiya, 1928); *C. talienwhenensis* Crosse, 1862 / None.

En - Giant cupped oyster; **Fr** - Huître creuse; **Sp** - Ostión japonés.

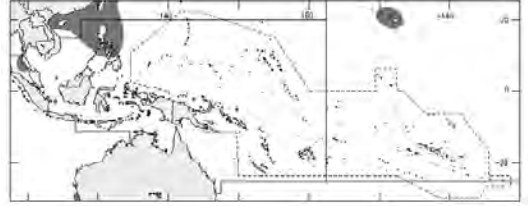
Maximum shell height 45 cm, commonly to 15 cm. On soft or hard bottoms. Intertidal and sublittoral to a depth of 15 m. Artisanal or industrial exploitation in some areas. A major commercial species, introduced for aquaculture in many countries. However, experimental plantings in tropical western Pacific islands often failed, apparently because of the sustained high temperature of the water. Primarily restricted to the temperate and subtropical western Pacific, in Kamchatka to Japan and the South China Sea. This species has been introduced for culture, often successfully, in many parts of the world, including the western Pacific (Hawaii, Philippines, western Thailand, Australia, Tasmania, and New Zealand), the Indian Ocean (Mauritius), the eastern Pacific (Chile, Costa Rica, and the coasts of North America from British Columbia to California), the eastern Atlantic (from the British Islands to the Iberian Peninsula), and the western Mediterranean Sea.



interior of left valve



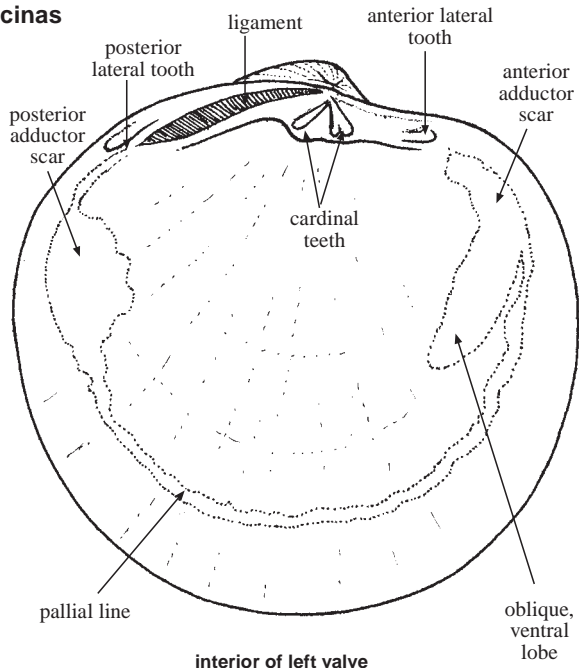
exterior of right valve



LUCINIDAE

Lucinas

Diagnostic characters: Shell generally **deiquivalve**, **lenticular** and rounded to subtrapezoidal, **slightly inequilateral**, not gaping. Umbones small and low, prosogyrate, about the midline of shell. Lunule small, often impressed and asymmetrical. Outer sculpture with concentric and/or radial components. Periostracum sometimes scaly and dehiscent. **Ligament** external, **more or less deeply sunken** in a groove of **posterodorsal margin**. Hinge typically with **2 cardinal teeth**, and anterior and posterior **lateral teeth** in either valve; some or all of the hinge teeth **sometimes reduced to absent**. **Two adductor muscle scars**, the **anterior narrowly elongate**, frequently with an **oblique ventral lobe detached from pallial line**. **No pallial sinus**. Internal margins smooth or finely crenulate. Gills of eulamellibranchiate type; inner demibranch large, smooth or weakly folded, outer demibranch reduced to absent. Foot long and worm-like, with a mucous gland at the more or less inflated extremity. Mantle with a broad anteroventral gape, a posterodorsal exhalant siphonal tube and a rounded posteroventral inhalant aperture. Pallial margin not papillate, often with an anteroventral accessory mantle gill.



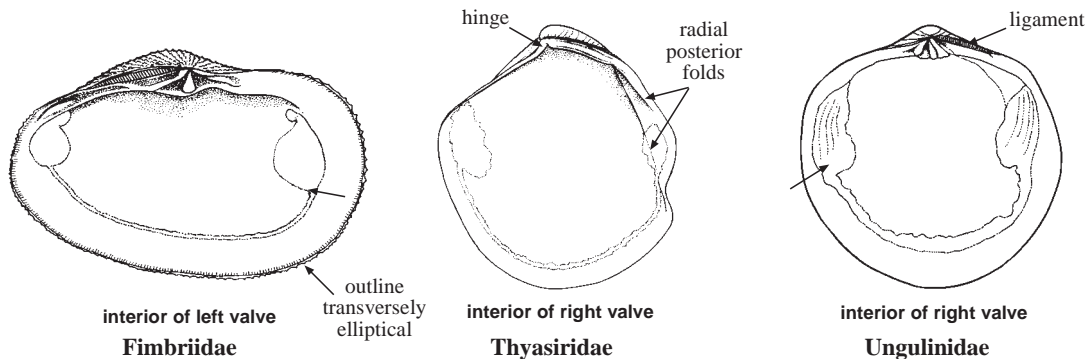
Habitat, biology, and fisheries: Burrowing, detritus-feeding animals, in which the inhalant siphon is usually replaced by an anterior tube lined with mucus and constructed within the substrate by the extensible, worm-like foot. The Lucinidae typically occur in sulphide-containing reduced sediments. The presence of the respiratory pigment haemoglobin enables them to live in these habitats of low oxygen concentration. Symbiotic, sulphur-oxidizing chemautotrophic bacterias are frequently housed in their thick gills and make a substantial contribution to their nutrition. Some of the larger and most common species are artisanally fished in some areas, and appear frequently in local markets, notably in the Philippines.

Similar families occurring in the area

Fimbriidae: shell markedly inflated, transversely elliptical in outline; anterior adductor muscle scar not projecting posteroventrally within the pallial line.

Thyasiridae: shell thin, trigonal, inequilateral, with 1 or more deep radial furrows or folds setting off the posterior part of shell; hinge without teeth.

Ungulinidae: shell shape very similar to Lucinidae; external ligament not sunken in a marginal groove; anterior adductor muscle scar elongate, but not posteroventrally detached from pallial line.



Key to species of interest to fisheries occurring in the area

- 1a. Outer sculpture radial and concentric; hinge with well-developed cardinal and lateral teeth (Fig. 1a) → 2
- 1b. Outer sculpture only concentric; hinge without teeth (at most with a faint cardinal tubercle in right valve) (Fig. 1b) → 5

- 2a. Radial ribs often distinctly dividing into 2, obliquely diverging on both anterior and posterior parts of valves (Fig. 2) *Epicodakia bella*
- 2b. Radial ribs not dividing into 2 nor obliquely diverging on anterior and posterior parts of valves → 3

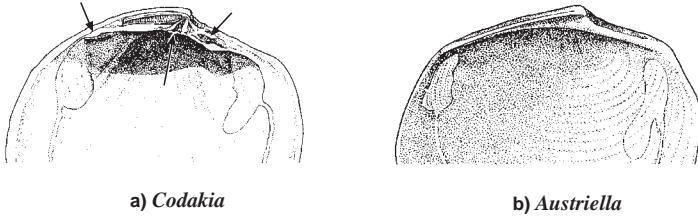


Fig. 1 hinge of left valve

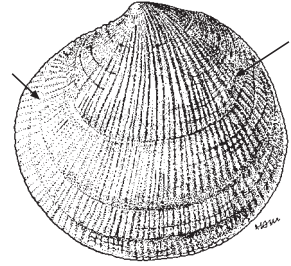


Fig. 2 *Epicodakia bella* (exterior)

- 3a. Outer sculpture of narrow, rounded radial ribs and concentric cords, forming distinct nodules at the points of intersection all over the surface of valves (Fig. 3) *Codakia tigerina*
- 3b. Outer sculpture not as above, not forming nodules at the points of intersection but sometimes on the anterior and posterior ends of valves → 4

- 4a. Main sculpture of broad, flattened radial ribs with deep, narrow interstices and fine concentric lines and grooves (Fig. 4) *Codakia punctata*
- 4b. Main sculpture of many, fine radial riblets with shallow interstices and concentric grooves (Fig. 5) *Codakia interrupta*

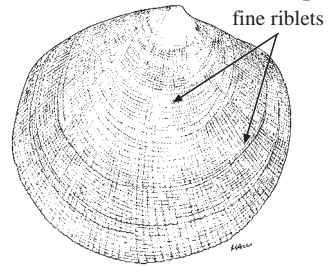
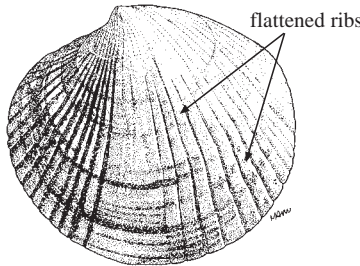
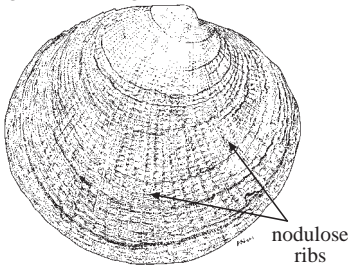


Fig. 3 *Codakia tigerina* (exterior) Fig. 4 *Codakia punctata* (exterior) Fig. 5 *Codakia interrupta* (exterior)

- 5a. Shell very inflated, globose; outer surface with irregular concentric growth lines (Fig. 6) *Anodontia edentula*
- 5b. Shell moderately inflated, not globose; outer surface with sharp concentric ridges and fine concentric grooves in the interspaces (Fig. 7) *Austriella corrugata*

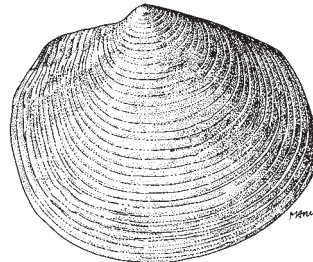
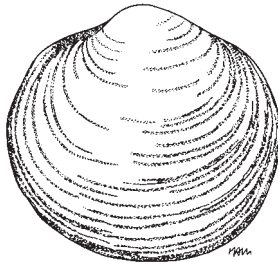


Fig. 6 *Anodontia edentula* (exterior) Fig. 7 *Austriella corrugata* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Anodontia edentula* (Linnaeus, 1758)
- 🐚 *Austriella corrugata* (Deshayes, 1843)
- 🐚 *Codakia interrupta* (Lamarck, 1816)
- 🐚 *Codakia punctata* (Linnaeus, 1758)
- 🐚 *Codakia tigerina* (Linnaeus, 1758)
- 🐚 *Epicodakia bella* (Conrad, 1837)

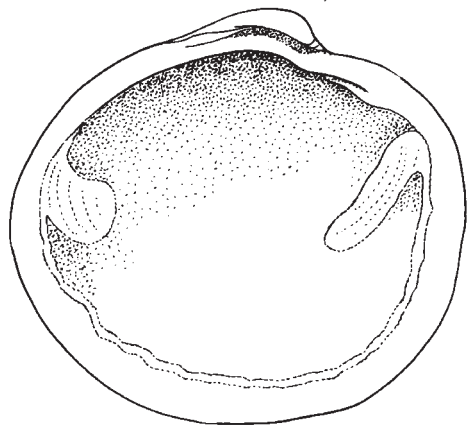
References

- Chavan, A. 1937a. Essai critique de classification des Lucines. *J. Conchyl.*, 81(2):133-153.
- Chavan, A. 1937b. Essai critique de classification des Lucines (Suite). *J. Conchyl.*, 81(3):198-216.
- Chavan, A. 1937c. Essai critique de classification des Lucines (Suite). *J. Conchyl.*, 81(4):237-282.
- Lamy, E. 1920a. Révision des Lucinacea vivants du Muséum d'Histoire naturelle de Paris (1° Partie). *J. Conchyl.*, 65(1):71-122.
- Lamy, E. 1920b. Révision des Lucinacea vivants du Muséum d'Histoire naturelle de Paris (2° Partie). *J. Conchyl.*, 65(2):169-222.
- Lamy, E. 1921. Révision des Lucinacea vivants du Muséum d'Histoire naturelle de Paris (3° Partie). *J. Conchyl.*, 65(3):233-318.

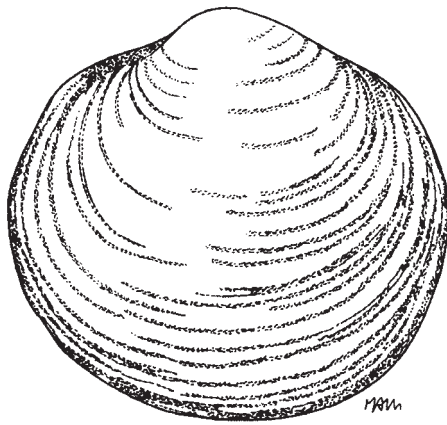
Anodontia edentula (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Anodontia hawaiiensis* (Dall, Bartsch, and Rehder, 1938); *Cryptodon eutornus* Tomlin, 1921; *C. globulosum* (Forsskål, 1775); *Lucina edentula* (Linnaeus, 1758); *L. ovum* Reeve, 1850 / *Anodontia pila* (Reeve, 1850).

FAO names: En - Toothless lucine; Fr - Lucine édentule.



interior of left valve



exterior of right valve

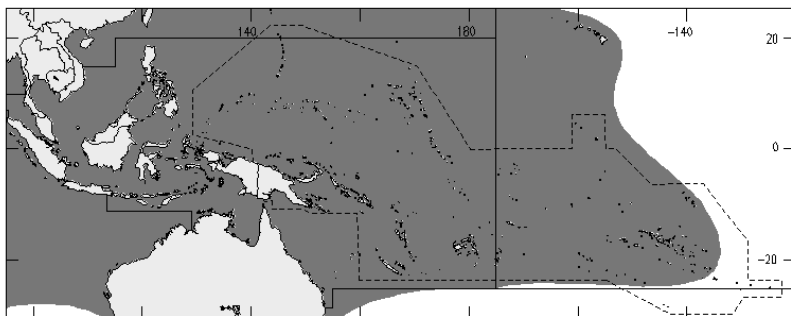
(after Habe, 1977)

Diagnostic characters: Shell moderately thin and rounded in outline, very inflated, globose. Anterodorsal margin subhorizontal, strongly rounded anteriorly. Posterodorsal margin slightly convex and sloping posteriorly. Umbones well in front of midline of valves. Lunule flattish, moderately large, slightly depressed near the umbones, nearly symmetrical. Outer surface of valves with dense, irregular concentric growth lines. Periostracum thin, appressed to shell surface. Ligament sunken, set in an oblique groove of posterodorsal margin. Hinge feeble, without teeth. Anterior adductor muscle scar long and arcuate. **Colour:** outside of shell dull white under the straw-coloured periostracum. Interior whitish.

Size: Maximum shell length 7.5 cm, commonly to 5 cm.

Habitat, biology, and fisheries: In muddy bottoms of estuarine and mangrove areas, often buried just under the surface of the substrate. Intertidal and sublittoral to a depth of 20 m. Abundant in local markets of the central Philippines, together with *Austriella corrugata*.

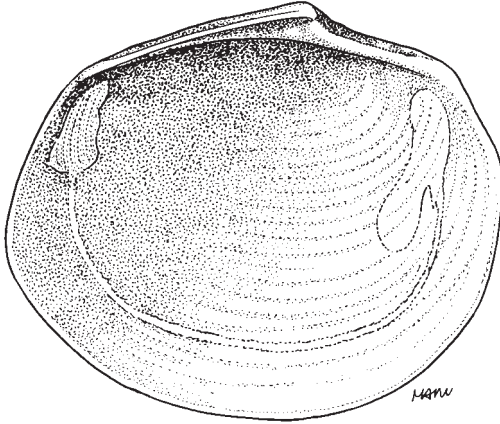
Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to southern Japan and Hawaii, and south to New South Wales.



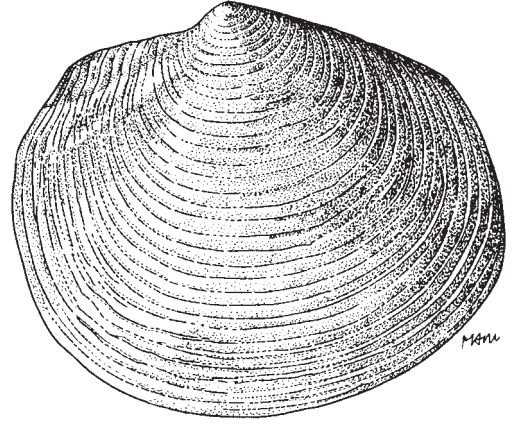
Austriella corrugata (Deshayes, 1843)

Frequent synonyms / misidentifications: *Austriella sordida* Tenison-Woods, 1881; *Cryptodon philippinarum* (Hanley, 1850); *Eamesiella corrugata* (Deshayes, 1843); *Lucina corrugata* Deshayes, 1843; *Pseudomithla corrugata* (Deshayes, 1843) / None.

FAO names: En - Corrugate lucine; Fr - Lucine ridée.



interior of left valve



exterior of left valve

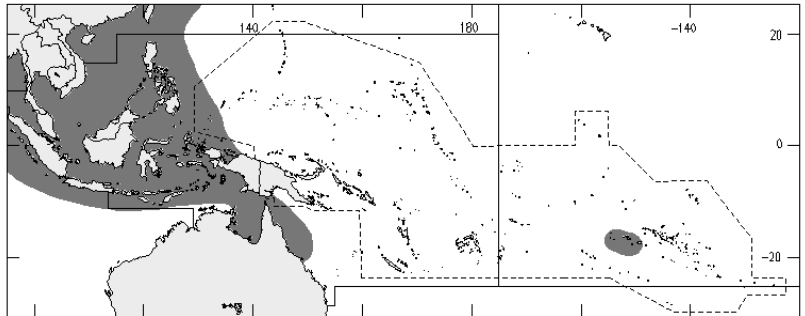
(after Alcock and Anderson, 1897)

Diagnostic characters: Shell rounded subquadrangular in outline, moderately inflated. Umbones well in front of midline of valves. Lunule shallow, rather long and narrow, nearly symmetrical. A faint radial furrow running from umbones to posteroventral margin. **Outer sculpture** of distantly spaced, sharp concentric ridges and fine concentric grooves in the interspaces. **Periostracum** strong, wrinkled, the umbones often corroded and showing the white shell. Ligament marginal, set in a long groove of posterodorsal margin. **Hinge** plate well developed but **without** distinct teeth. Anterior adductor muscle scar long and narrow, straightish. **Colour:** outside of shell chalky white under the brown periostracum. Interior whitish, sometimes with a light fawn hue under the umbones.

Size: Maximum shell length 7 cm, commonly to 5 cm.

Habitat, biology, and fisheries: In muddy bottoms of mangrove areas. Littoral to a depth of 10 m. Common in local markets of the central Philippines, mixed with *Anodontia edentula*.

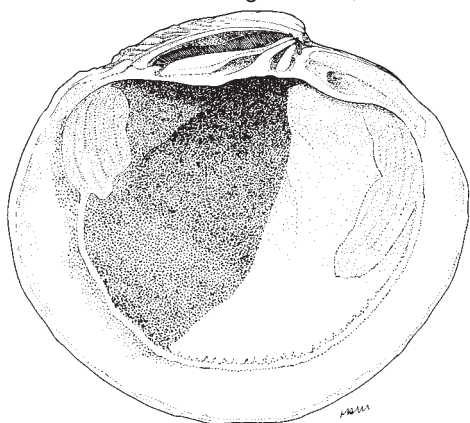
Distribution: Indo-Pacific, from the Bay of Bengal and Sri Lanka area to eastern Indonesia and Society Islands, eastern Polynesia; north to Japan and south to Queensland.



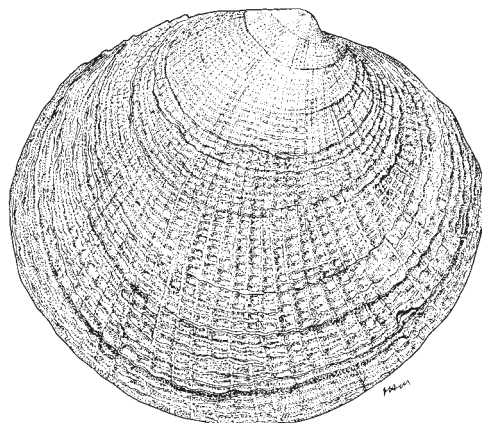
Codakia tigerina (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Codakia tigerina* (Linnaeus, 1758) (spelling error); *Lucina exasperata* Reeve, 1850 / None.

FAO names: En - Pacific tiger lucine; Fr - Lucine tigre.



interior of left valve



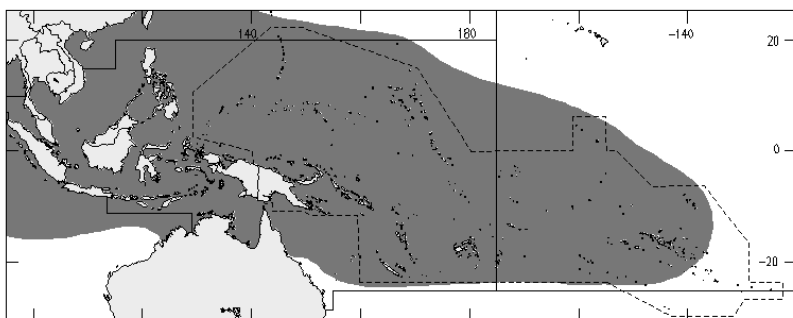
exterior of right valve

Diagnostic characters: Shell thick, subcircular in outline, laterally compressed. Umbones in front of midline of valves. Lunule small and short, depressed, asymmetrical, protruding beyond commissural plane in right valve and with a corresponding recess in left valve. Outer sculpture relatively strong, rough and latticed, composed of narrow, rounded radial ribs and concentric cords, forming nodules at the points of intersection all over the surface of valves. Periostracum inconspicuous. Ligament sunken, set in a large oblique groove of posterodorsal margin. Hinge with well-developed cardinal and lateral teeth; right valve with 1 nearby anterior lateral tooth and 1 remote posterior lateral tooth; left valve with 2 anterior and 2 posterior laterals, the latter reduced. Anterior adductor muscle scar long and arcuate. **Colour:** outside cream to white, sometimes yellowish on umbones or slightly tinged with pink on dorsal margin. Interior yellow, becoming paler to white on ventral margin and often more or less tinged with pink on dorsal margin.

Size: Maximum shell length 10 cm, commonly to 6 cm.

Habitat, biology, and fisheries: Buried in sandy bottoms, often in coral reef areas, from shallow sublittoral waters to a depth of 20 m. Locally exploited in the Philippines. The shell is used for shellcraft or to make lime, and the meat is eaten or chewed with betel nut to make the teeth strong.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf to eastern Polynesia; north to Japan and south to Queensland.

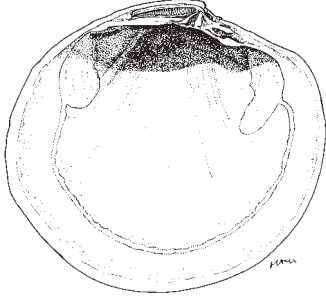


Codakia interrupta (Lamarck, 1816)

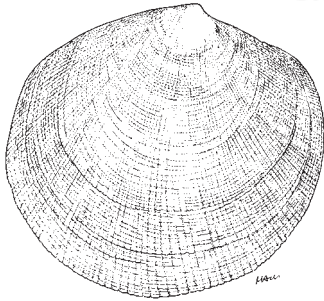
Frequent synonyms / misidentifications: *Lentillaria interrupta* (Lamarck, 1816); *Lucina interrupta* Lamarck, 1816; *L. simplex* Reeve, 1850 / None.

En - Interrupted lucine; **Fr** - Leucine interrompue.

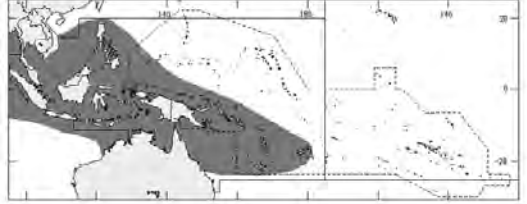
Maximum shell length 5.5 cm, commonly to 4 cm. Buried in sandy bottoms, often in coral reef areas. Littoral and shallow sublittoral zones to a depth of about 15 m. Occasionally found in local markets of the central Philippines. Distribution insufficiently known because of frequent confusion with other species. Probably widely distributed in the Indo-West Pacific, from Madagascar to Melanesia; north to the Philippines and south to Queensland and New Caledonia.



interior of left valve



exterior of right valve

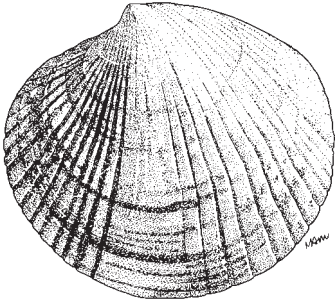


Codakia punctata (Linnaeus, 1758)

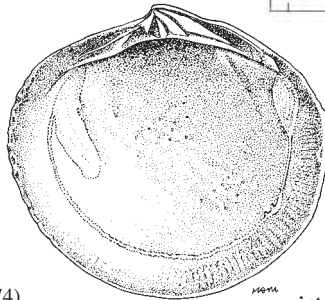
Frequent synonyms / misidentifications: *Codakia punctata* (Linnaeus, 1758) (spelling error) / None.

En - Punctate lucine; **Fr** - Leucine ponctuée.

Maximum shell length 10 cm, commonly to 6 cm. Buried in sand between shale blocks and in coral reef areas, in shallow sublittoral waters to a depth of 20 m. Locally collected as food; the shell is used for lime or shellcraft. Widespread in the Indo-West Pacific, from East Africa and Madagascar to eastern Polynesia; north to southern Japan and south to Queensland.

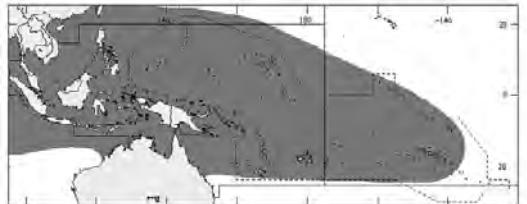


exterior of left valve



interior of right valve

(after Dance, 1974)

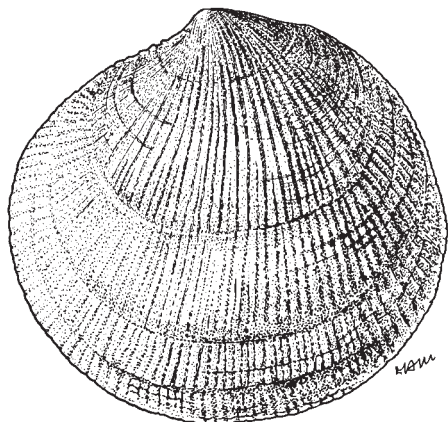


Epicodakia bella (Conrad, 1837)

Frequent synonyms / misidentifications: *Codakia divergens* (Philippi, 1850); *Ctena bella* (Conrad, 1837); *C. divergens* (Philippi, 1850); *Epicodakia divergens* (Philippi, 1850); *Lucina fibula* Reeve, 1850; *L. munda* A. Adams, 1856 / None.

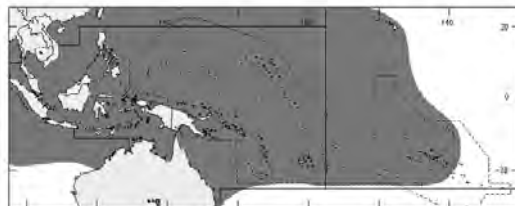
En - Divergent lucine; **Fr** - Lucine divergente.

Maximum shell length 3.5 cm, commonly to 2.5 cm. In coarse sand, often associated with coral reefs, in dense populations. Littoral and shallow waters to a depth of 15 m. Occasionally collected in the Philippines. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea to eastern Polynesia; north to Japan and Hawaii, and south to New South Wales.



exterior of left valve

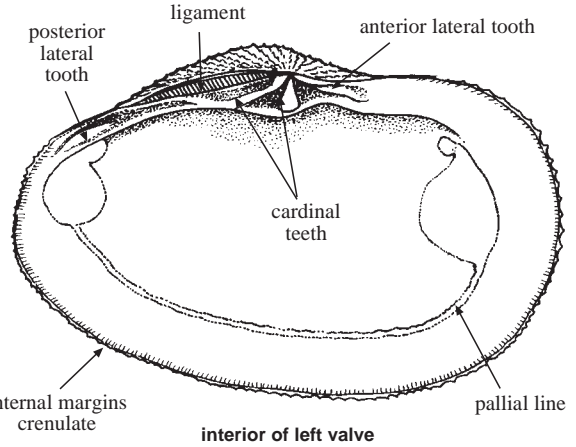
(after Salvat and Rives, 1975)



FIMBRIIDAE

Basket lucinas

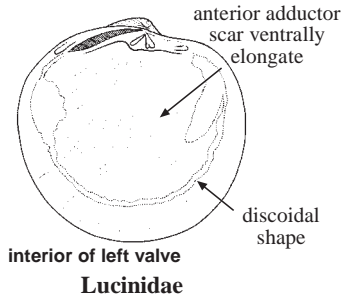
D **Diagnostic characters:** Shell equivalve and subequilateral, inflated, thick, transversely elliptical and not gaping. Umbones prosogyrate, small and rounded, about midlength of shell. Lunule lanceolate, small and impressed; escutcheon narrow and depressed, largely occupied by the ligament. **Outer surface with latticed sculpture, concentric ribs more prominent.** A shallow radial fold running from umbonal area to posteroventral angle of shell margin. Periostracum absent. **Ligament marginal,** a strong arched band set in a deep groove of posterodorsal margin. Hinge with **2 massive, tubercular cardinal teeth, 1 nearby anterior lateral tooth, and 1 long, remote posterior lateral tooth in each valve.** Interior of shell porcelaneous. **Two adductor muscle scars,** the anterior slightly larger but not projecting postero-ventrally inside the **pallial line** which is **devoid of sinus.** Internal margins crenulate. Gills of eulamellibranchiate type, with smooth branchial sheets; outer demibranches absent; inner demibranches united posteriorly to each other and to the mantle. Special mantle gills present beneath the anterior adductor muscle. Foot subtrigonal, heeled posteriorly, pointed anteriorly, laterally compressed and ventrally grooved. Mantle with a broad anteroventral gape, a posteroventral exhalant siphonal tube and a posteroventral rounded inhalant aperture. Pallial margin papillate.



Habitat, biology, and fisheries: Filter-feeding reef dwellers, probably burrowing only shallowly in coralline sand, in shallow water. Sexes separate. Free-swimming larval stage present. Locally used as food or raw material for shellcraft and to make lime.

Similar families occurring in the area

Lucinidae: shell discoidal in outline, laterally compressed; anterior adductor muscle scar with an oblique ventral lobe separate from pallial line.



Key to species of interest to fisheries occurring in the area

- 1a. Concentric ribs relatively coarse, some sinuous and appearing only on central part of shell (Fig. 1) *Fimbria fimbriata*
- 1b. Concentric ribs relatively thin, not sinuous and developed on whole length of shell (Fig. 2) *Fimbria soverbii*

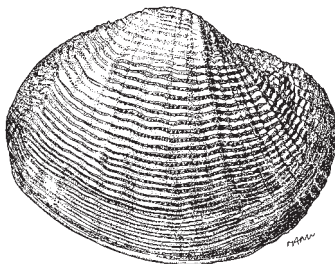


Fig. 1 *Fimbria fimbriata* (exterior)

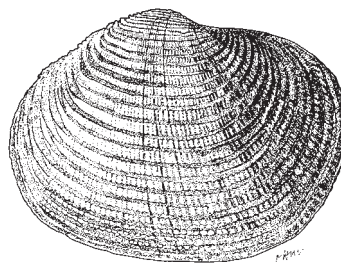


Fig. 2 *Fimbria soverbii* (exterior)

List of species of interest to fisheries occurring in the area

The symbol is given when species accounts are included.

- Fimbria fimbriata* (Linnaeus, 1758)
- Fimbria soverbii* (Reeve, 1842)

References

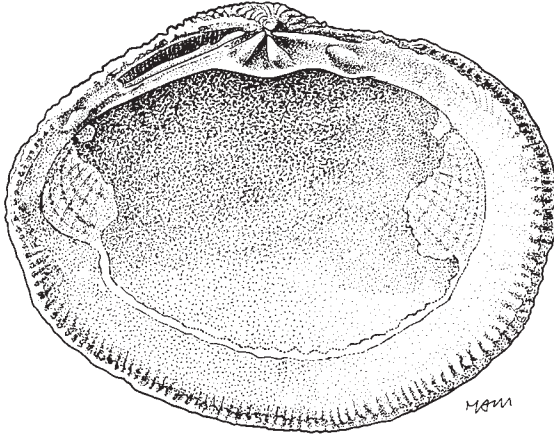
Morton, B.S. 1979. The biology and functional morphology of the sand coral bivalve *Fimbria fimbriata* (Linnaeus, 1758). *Rec. Aust. Mus.*, 32(11):389-420.

Nicol, D. 1950. Recent species of the lucinoid pelecypod *Fimbria*. *J. Wash. Acad. Sci.*, 40:82-87.

Fimbria fimbriata (Linnaeus, 1758)

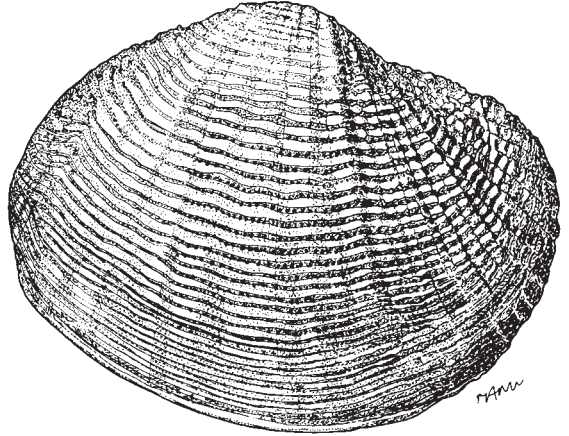
Frequent synonyms / misidentifications: *Corbis fimbriata* (Linnaeus, 1758) / None.

FAO names: En - Common basket lucina; Fr - Grand corbis.



interior of left valve

(after Lamprell and Whitehead, 1992)



exterior of right valve

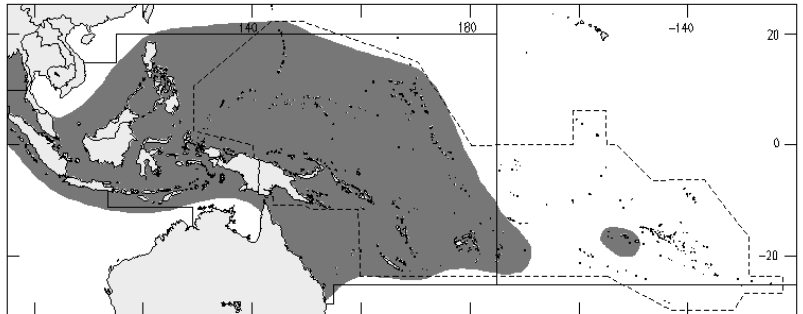
(after Nicol, 1950)

Diagnostic characters: Shell distinctly **inequilateral**, with the **anterior half** of valves **higher and more rounded** than the posterior half which is somewhat tapering posteriorly. Lunule inequivalve, somewhat protruding at right valve and covering the left valve margin. Each valve with a very shallow radial furrow extending obliquely from the umbo to the posterior end of ventral margin, where it produces a slight sinuation. **Outer sculpture latticed**, with the concentric and radial elements varying in strength and aspect over the different parts of the surface. **Concentric ridges relatively coarse, some sinuous and appearing only on central part of shell.** Radial ribs strongest and tuberculate on umbonal, anterior, and posterior areas. Radial ribs of central area rather distantly spaced and high, progressively turning into low, indistinct undulations ventrally, with numerous, fine radial riblets occurring between the heavy concentric ridges. **Colour:** **outside** of shell porcelaneous **white, often with a pinkish hue antero- and posterodorsally.** Interior off-white and matt inside the pallial line, bright pale pink on the margins. Hinge often tinged golden yellow anteriorly and posteriorly.

Size: Maximum shell length 9.5 cm, commonly to 7 cm.

Habitat, biology, and fisheries: In sandy-coral bottoms, fully buried to completely exposed, in shallow water to a depth of 20 m. Locally collected and marketed in southern Japan and the Philippines, where the shell is also used as raw material for shellcraft and to make lime.

Distribution: Western Pacific and eastern Indian Ocean, from Myanmar to Tonga; north to the Philippines and possibly also to Hawaii, and south to Queensland. Also recorded from Society Islands, eastern Polynesia.

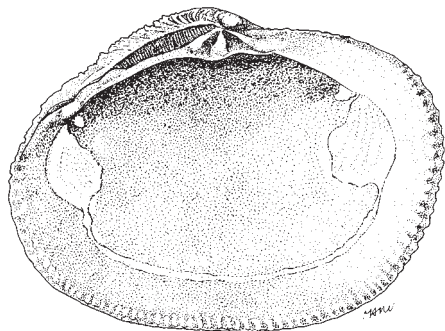


Fimbria soverbii (Reeve, 1842)

Frequent synonyms / misidentifications: *Corbis elegans* Deshayes, 1843; *C. soverbii* Reeve, 1842; *Fimbria sowerbii*, *F. sowerbyi* (spelling errors) / None.

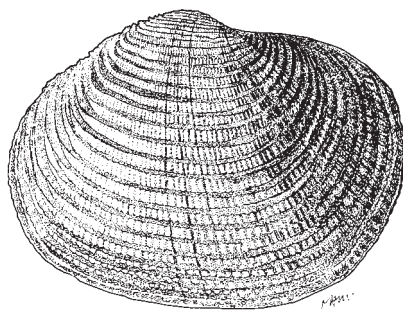
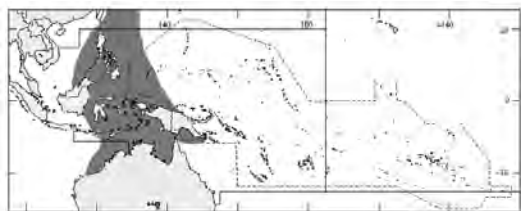
En - Elegant basket lucina; **Fr** - Corbis élégant.

Maximum shell length 10 cm, commonly to 7 cm. In sandy bottoms, from low tide levels to a depth of 20 m. Locally collected in the Philippines. Western Pacific, from Borneo to Papua New Guinea; north to Japan and south to Western Australia.



interior of left valve

(after Lamprell and Whitehead, 1992)

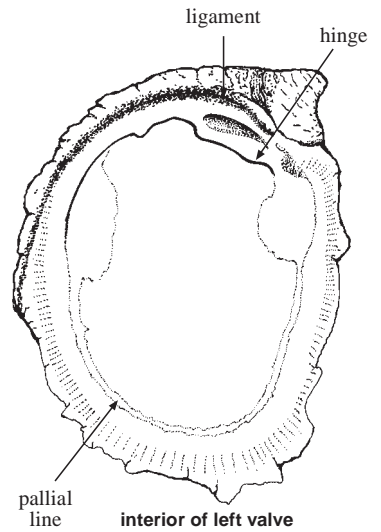


exterior of right valve

CHAMIDAE
Jewel box shells

Diagnostic characters: Shell usually thick and irregularly rounded in outline, strongly inequivalve and inequilateral; very variable in shape, often distorted, cemented to the substrate by either the left or the right valve; cemented, lower valve larger and deeper than the more or less flattened upper valve. Umbones prosogyrate, low, spirally wound. Sculpture usually well developed, concentric or radial or both, frequently leaf-like to spinose. Periostracum inconspicuous. Ligament external, in a groove of posterodorsal margin. Hinge thick and arched, with large curved teeth and corresponding sockets, more or less parallel to dorsal margin. Interior of shell porcelaneous. Two large, subequal, ovate and dorsoventrally elongate adductor muscles scars. Pallial line without a sinus. Internal margins often denticulate. Gills of eulamelibranchiate type, with folded branchial sheets; outer demibranch smaller than the inner and dorsally expanded. Mantle margins papillated, open anteroventrally, fused and forming 2 short siphons posteriorly.

Habitat, biology, and fisheries: Sedentary animals, common in coral reefs and rocky shores, living strongly cemented by one valve to the substrate. Suspension filter feeders. Sexes separate. Fertilization external, eggs hatching as free-swimming planktonic larvae. Chamidae are locally collected for subsistence. Their shell may be used as lime material, and in some areas (when not heavily eroded or encrusted by marine growths) to make decorative items or sold for shell collections.



Similar families occurring in the area

None. Hinge characters and subequal muscle scars easily distinguish the Chamidae from other bivalves living cemented to hard substrates.

Key to species of interest to fisheries occurring in the area

- 1a. Outer surface with very long, branched and radially striated concentric leaf-like expansions (Fig. 1). *Chama lazarus*
- 1b. Outer surface with moderately short and non-striated spines or lamellae → 2
- 2a. Posterodorsal area of upper valve with 2 radial rows of overlapping lamellae, separated by a furrow (Fig. 2); interior of lower valve with a denticulate furrow running parallel to posterodorsal margin *Chama savignyi*
- 2b. Posterodorsal area of upper valve with radial rows of numerous spines or scales (Fig. 3); interior of lower valve without a denticulate furrow *Chama pacifica*

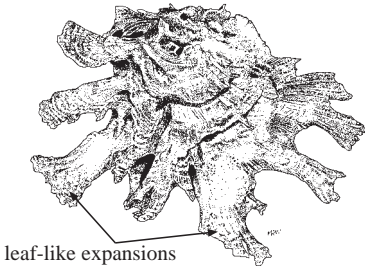


Fig. 1 *Chama lazarus* (exterior)

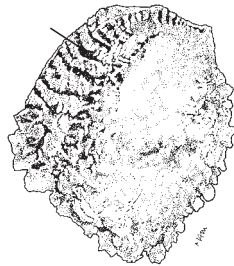


Fig. 2 *Chama savignyi* (exterior)

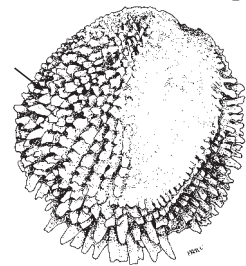


Fig. 3 *Chama pacifica* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Chama lazarus* Linnaeus, 1758
- 🐚 *Chama pacifica* Broderip, 1834
- 🐚 *Chama savignyi* Lamy, 1921

References

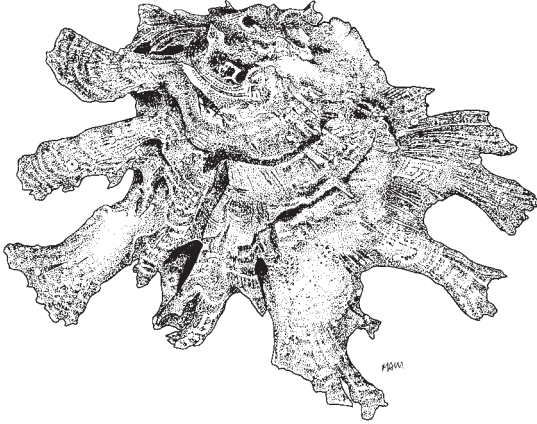
Lamy, E. 1928. Révision des *Chama* vivants du Muséum national d'Histoire naturelle de Paris. *J. Conchyl.*, 71(4):293-383.
 Nicol, D. 1952. Nomenclatural review of genera and subgenera of Chamidae. *J. Wash. Acad. Sci.*, 42(5):154-156.

Chama lazarus Linnaeus, 1758

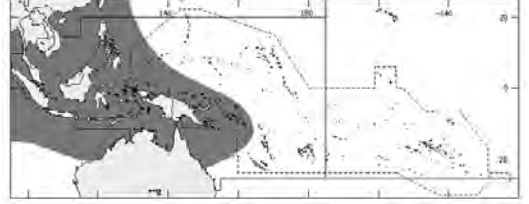
Frequent synonyms / misidentifications: *Chama damaecornis* Lamarck, 1819 / None.

En - Lazarus jewel box; **Fr** - Chame de Lazare.

Maximum shell length 14 cm, commonly to 9.5 cm. Attached to rocks or corals. Low intertidal zone and sublittoral to depths of about 30 m. Occasionally used for food by coastal populations, this species is nowadays mainly collected for its beautiful shell. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Melanesia; north to Japan and south to Queensland.



exterior of right valve
(after Sharabati, 1984)

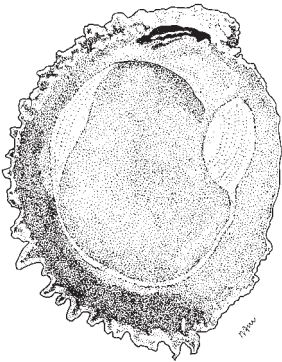


Chama pacifica Broderip, 1834

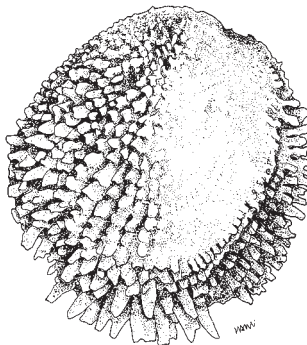
Frequent synonyms / misidentifications: *Chama divaricata* Reeve, 1846; *C. foliacea* Quoy and Gaimard, 1835; *C. reflexa* Reeve, 1846 / None.

En - Reflexed jewel box; **Fr** - Chame réfléchie.

Maximum shell length 8 cm, commonly to 6 cm. Attached to corals, rocks, and pebbles. Littoral and sublittoral to a depth of 30 m. Collected for food in some areas. The shell is used in local shellcraft. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and south to New South Wales.

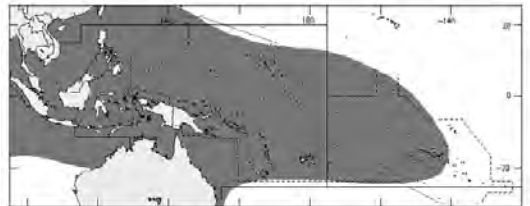


interior of left valve



exterior of right valve

(after Lamprell and Whitehead, 1992)

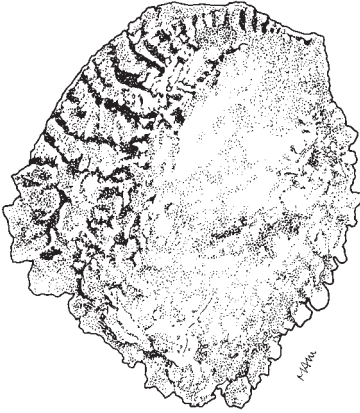


***Chama savignyi* Lamy, 1921**

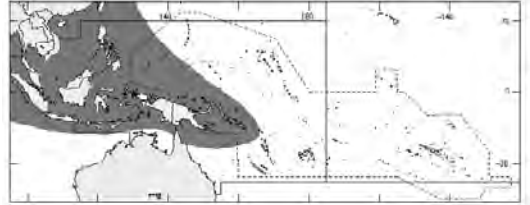
Frequent synonyms / misidentifications: *Chama imbricata* Broderip, 1834 (not of Lamarck, 1801); *C. plinthota* Cox, 1927 / *Chama imbricata* Lamarck, 1801.

En - Savigny's jewel box; **Fr** - Chame de Savigny.

Maximum shell length 10 cm, commonly to 7 cm. Strongly cemented to rock or coral platforms. At low tide levels and shallow subtidal depths. Collected for food in some areas. Shell used as raw material to make lime and for shellcraft. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to Melanesia; north to Japan and south to northern Queensland.



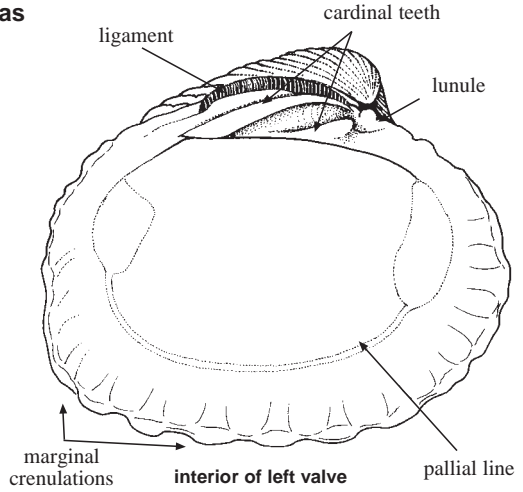
exterior of right valve
(after Lamprell and Whitehead, 1992)



CARDITIDAE

Carditas

Diagnostic characters: Shell **equivalve**, often **stout and inflated**, trigonal ovate to trapezoidal in outline, **inequilateral**. Umbones generally anterior, prosogyrate, and prominent. Lunule short and deep. **Exterior mostly with strong radial ribs**. **Ligament external**, attached behind umbones on well-marked nymphs. Hinge plate strong, usually with **2 cardinal teeth, unequal and often with fine transverse striations**; **lateral teeth frequently** more or less **reduced to absent**. **Two adductor muscle scars** slightly inequal. **Pallial line without a sinus**. Internal margins crenulate. Outer colour often with bright and variegated patterns. Gills of eulamelli-branchiate type, with smooth branchial sheets. Foot keeled, often byssiferous (at least in the young stages).

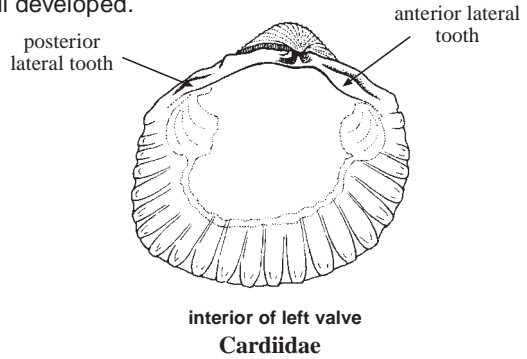
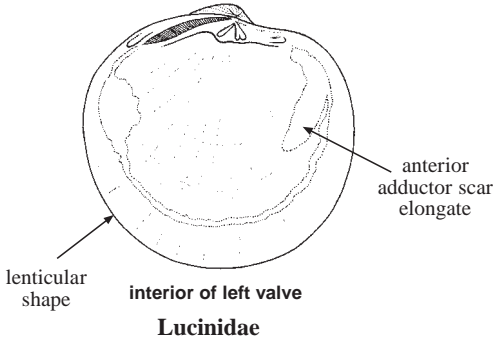


Habitat, biology, and fisheries: Suspension-feeding animals, often attached to substrate by their byssus and common in shallow waters. Sexes separate. Eggs generally brooded between inner and outer demibranch of the gills. Carditidae are collected for subsistence in the area, and sometimes marketed locally. Their shells, when colourful, are used in local shellcraft industries to make decorative items.

Similar families occurring in the area

Lucinidae: shell feebly inequilateral (a little more in young stages), lenticular; outer colour usually dull and pale; anterior adductor scar elongate, often with an oblique ventral lobe separate from pallial line.

Cardiidae: lunule shallow; hinge characteristic, with 2 conical cardinal teeth in each valve, cruciform in arrangement when valves interlock; lateral teeth well developed.





Key to species of interest to fisheries occurring in the area

- 1a. Shell roughly semicircular in outline, strongly expanded posteroventrally; sculpture of numerous, unequal radial riblets *Begonia semiorbiculata*
- 1b. Shell subtrapezoidal in outline, not strongly expanded posteroventrally; sculpture of about 20 broad radial ribs *Cardites bicolor*

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Begonia semiorbiculata* (Linnaeus, 1758)
-  *Cardites bicolor* (Lamarck, 1819)

References

Lamy, E. 1922a. Révision des Carditacea vivants du Muséum national d'Histoire naturelle de Paris. *J. Conchyl.*, 66(3) 218-276.

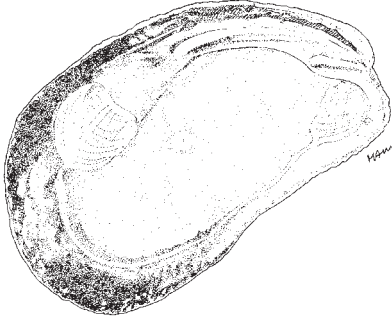
Lamy, E. 1922b. Révision des Carditacea vivants du Muséum national d'Histoire naturelle de Paris (Suite). *J. Conchyl.*, 66(4):289-368.

Begonia semiorbiculata (Linnaeus, 1758)

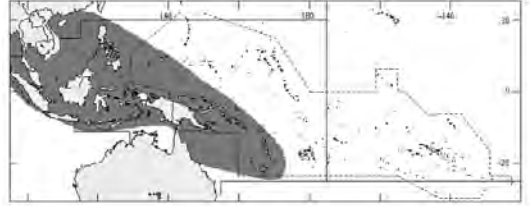
Frequent synonyms / misidentifications: None / None.

En - Halfround cardita; **Fr** - Cardite hémicirculaire.

Maximum shell length 10 cm, commonly to 7.5 cm. Attached by byssus to various hard substrates such as corals, rocks, or stones. Intertidal and sublittoral zones to depths of about 25 m. Occasionally sold in local markets of the central Philippines. Indo-West Pacific, from the Red Sea and northern Indian Ocean to Melanesia; north to China and south to Queensland and New Caledonia.



interior of left valve



exterior of right valve

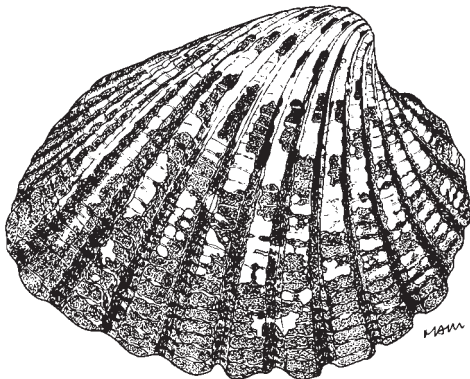
(after Lamprell and Whitehead, 1992)

Cardites bicolor (Lamarck, 1819)

Frequent synonyms / misidentifications: *Cardita bicolor* Lamarck, 1819; *Venericardia bicolor* (Lamarck, 1819) / *Cardita antiquata* (Linnaeus, 1758).

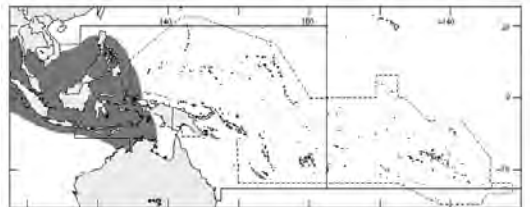
En - Twotoned cardita; **Fr** - Cardite bicolore.

Maximum shell length 5.5 cm, commonly to 4 cm. Attached by byssus, on various littoral and shallow sublittoral bottoms. Locally collected for subsistence by coastal populations. From northwestern Indian Ocean, including the Red Sea and the Persian Gulf, to the tropical West Pacific; north to the Philippines and south to northwestern Australia.



exterior of right valve

(after Lamy, 1922)



CARDIIDAE

Cockles

Diagnostic characters: Shell equivalve, inflated, **oval** to subtrigonal or **subquadrate**, often with a posterior ridge or angulation; **sometimes** very compressed anteroposteriorly, and **heart-shaped** when viewed from the anterior side. **Umbones** prosogyrate to orthogyrate, **prominent**, approximate. **External sculpture mostly radial**, often more or less differing on posterior slope. Periostracum usually weak to inconspicuous, rarely well developed. **Ligament external**, a short and prominent arched band behind the umbones. **Hinge characteristic, with teeth curving outwards** rather than being set on a flat hinge plate; **2 cardinal teeth**, and anterior and posterior **lateral teeth**, typically present in **each valve**; **cardinal teeth cruciform in arrangement**, when valves interlock. **Two** subequal **adductor muscle scars**. **Pallial line without a sinus**. Internal margins with crenulations, generally corresponding with the outer sculpture. Gills of eulamellibranchiate type, folded, with dorsoventrally slanting axis. Foot strong and long, sickle-shaped. Mantle widely open ventrally, smooth or papillate, sometimes with marginal eyes. Siphons naked, short and separate, papillate on top.

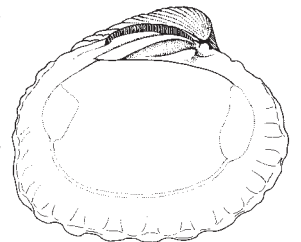
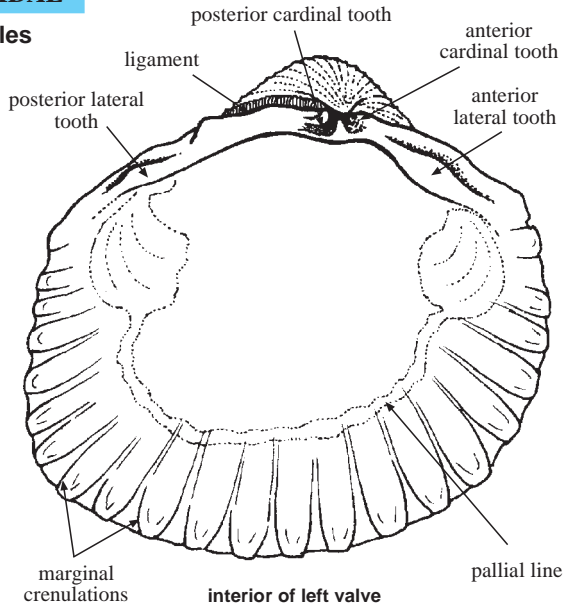
Habitat, biology, and fisheries: Shallow burrowers in sandy to muddy bottoms, most common in littoral and shallow subtidal waters. The geniculate foot can be used for jumping to escape predators. Sexes generally separate. Development with a free-swimming larval stage. In the tropical West Pacific, cockles are mainly collected for their shells, which are used as decorative items in local shellcraft. They are also eaten by coastal people and occasionally appear in local markets.

Similar families occurring in the area

The characteristic features of the hinge easily distinguish members of the Cardiidae from other radially ribbed eulamellibranchiate bivalves such as the Carditidae.

Key to species of interest to fisheries occurring in the area

- 1a. Shell strongly compressed anteroposteriorly; inflation about twice the length (Fig. 1) *Corculum cardissa*
- 1b. Shell not strongly compressed anteroposteriorly; inflation nearly equal to or smaller than length → 2
- 2a. Shell thin and fragile; outer sculpture feeble, of low radial ribblets with fine tufts of periostracum arising from radial grooves on top (Fig. 2) *Fulvia papyracea*
- 2b. Shell relatively thick and solid; outer sculpture of strong radial ribs with different characters → 3



interior of left valve

Carditidae

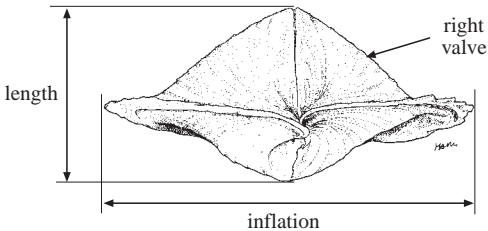


Fig. 1 *Corculum cardissa* (dorsal view)

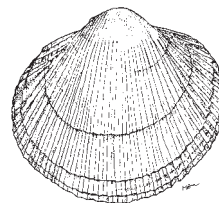


Fig. 2 *Fulvia papyracea* (exterior)

- 3a. Posterior slope markedly set off from the rest of the shell by a strong radial angulation; posterior margin meeting ventral margin at an angle of 90° or less → 4
- 3b. Posterior slope not markedly set off from the rest of the shell; posterior margin meeting ventral margin roundly or at an obtuse angle → 6

- 4a. Umboventral angulation forming a prominent keel; interstices of radial ribs transversely grooved (Fig. 3) *Fragum hemicardium*
- 4b. Umboventral angulation not forming a prominent keel; interstices of radial ribs smooth → 5
- 5a. Scales of radial ribs widely spaced and bright red (Fig. 4) *Fragum unedo*
- 5b. Scales of radial ribs close set and whitish (Fig. 5) *Fragum fragum*

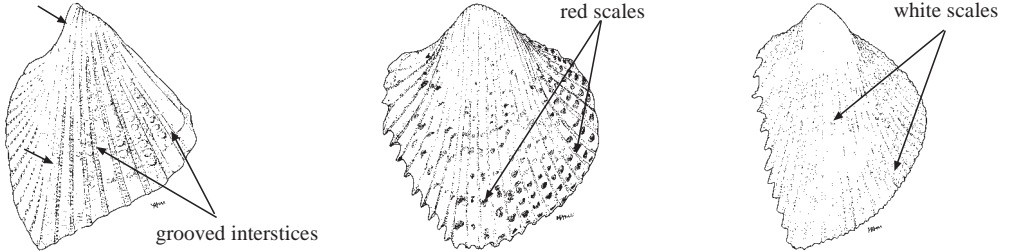


Fig. 3 *Fragum hemicardium* (exterior) Fig. 4 *Fragum unedo* (exterior) Fig. 5 *Fragum fragum* (exterior)

- 6a. Shell height about equal or smaller than length; cardinal teeth similar in size (Fig. 6a) → 7
- 6b. Shell height greater than length; cardinal teeth distinctly unequal in size (Fig. 6b) → 9
- 7a. Anterior and posterior sections of hinge almost the same size; outer surface with minute pustules, at least in the interstices of ribs → 8
- 7b. Anterior section of hinge shorter than posterior; outer surface devoid of minute pustules (Fig. 7) *Plagiocardium pseudolatum*

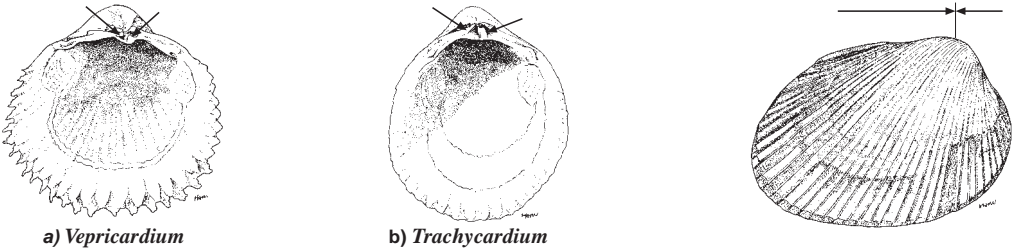


Fig. 6 interior of left valve

Fig. 7 *Plagiocardium pseudolatum* (exterior)

- 8a. Shell subequilateral, about as long as high; at least 26 radial ribs, with a series of erect lamellate spines forming a prominent, continuous palisade near shell margin (Fig. 8) *Vepricardium asiaticum*
- 8b. Shell inequilateral, longer than high; from 22 to 24 radial ribs, with small granules or a series of short spines, but not forming a prominent palisade near shell margin (Fig. 9) *Vepricardium sinense*
- 9a. Shell strongly inequilateral in outline, flared out posteroventrally; ribs of posteromedial area triangular and asymmetrical in cross-section (Fig. 10) *Trachycardium angulatum*
- 9b. Shell not much inequilateral in outline; ribs of posteromedial area rounded to quadrate in cross-section → 10

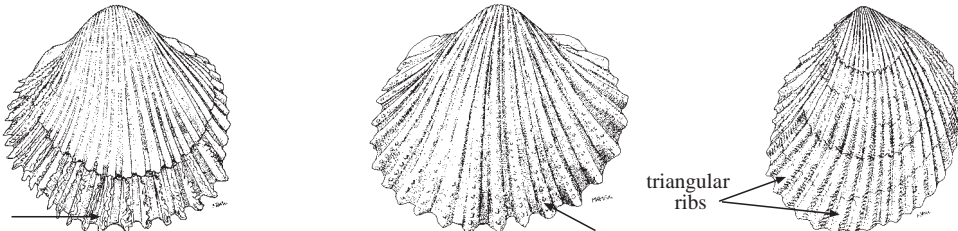


Fig. 8 *Vepricardium asiaticum* (exterior)

Fig. 9 *Vepricardium sinense* (exterior)

Fig. 10 *Trachycardium angulatum* (exterior)

- 10a.** At least 38 radial ribs; ribs of posteromedial area quadrate in cross-section; internal margins deep purple (Fig. 11) *Trachycardium orbita*
- 10b.** At most 32 radial ribs; ribs of posteromedial area not quadrate in cross-section; internal margins whitish → 11
- 11a.** Radial ribs relatively low, those of posterior slope feeble and smoothish (Fig. 12) *Trachycardium subrugosum*
- 11b.** Radial ribs relatively high, those of posterior slope well marked and spinose (Fig. 13) *Trachycardium rugosum*

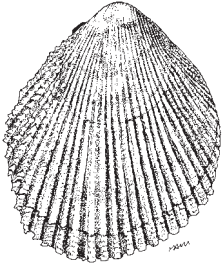


Fig. 11 *Trachycardium orbita*
(exterior)

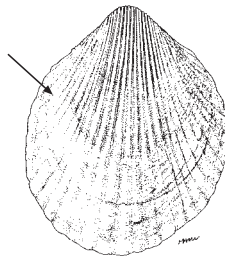


Fig. 12 *Trachycardium subrugosum*
(exterior)

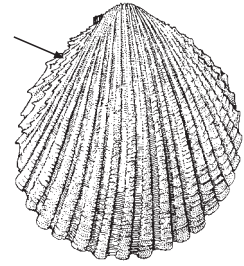


Fig. 13 *Trachycardium rugosum*
(exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Corculum cardissa* (Linnaeus, 1758)
- 🐚 *Fragum fragum* (Linnaeus, 1758)
- 🐚 *Fragum hemicardium* (Linnaeus, 1758)
- 🐚 *Fragum unedo* (Linnaeus, 1758)
- 🐚 *Fulvia papyracea* (Bruguière, 1789)
- 🐚 *Plagiocardium pseudolatatum* (Voskuil and Onverwagt, 1991)
- 🐚 *Trachycardium angulatum* (Lamarck, 1819)
- 🐚 *Trachycardium orbita* (Sowerby, 1833)
- 🐚 *Trachycardium rugosum* (Lamarck, 1819)
- 🐚 *Trachycardium subrugosum* (Sowerby, 1840)
- 🐚 *Vepricardium asiaticum* (Bruguière, 1789)
- 🐚 *Vepricardium sinense* (Sowerby, 1841)

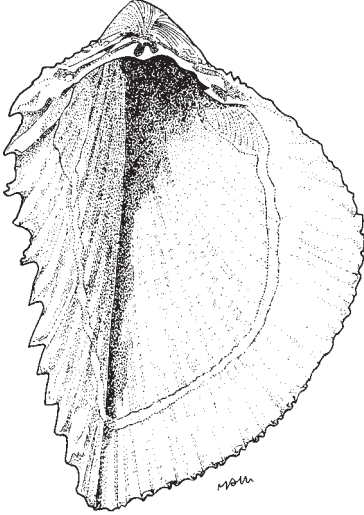
References

- Bartsch, P. 1947. The little hearts (*Corculum*) of the Pacific and Indian Oceans. *Pac. Sci.*, 1:221-226.
- Keen, A.M. 1980. The pelecypod family Cardiidae: a taxonomic summary. *Tulane Stud. Geol. Paleont.*, 16(1):1-40.
- Lambiotte, M. 1979. Note sur *Cardium burnupi* G.B. Sowerby, 1897. *Inf. Soc. belg. Malac.* 7(2):49-50.
- Voskuil, R.P.A. and W.J.H. Onverwagt. 1991a. Studies on Cardiidae. 3. The recent species of *Maoricardium* Marwick, 1944 (Mollusca, Bivalvia), with description of a new species. *Basteria*, 55:25-33.
- Voskuil, R.P.A. and W.J.H. Onverwagt. 1991b. Studies on Cardiidae. 4. The taxonomy of the genus *Trachycardium* (Part 1) with description of three new species. (Mollusca: Bivalvia). *Vita marina*, 41(2):56-72.
- Wilson, B.R. and S.E. Stevenson. 1977. Cardiidae (Mollusca, Bivalvia) of Western Australia. *West. Aust. Mus. spec. Publ.*, (9):1-114.

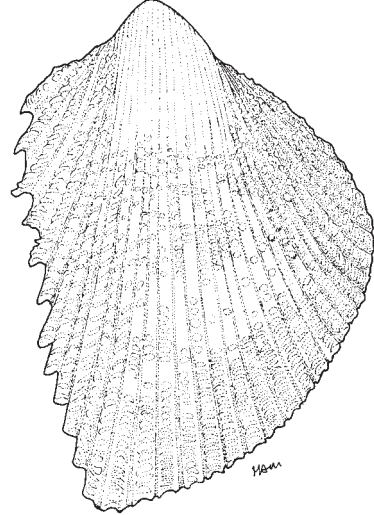
Fragum fragum (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Cardium imbricatum* Born, 1778; *Corculum fragum* (Linnaeus, 1758); *Fragum flavum* Röding, 1798 / None.

FAO names: En - White strawberry cockle; Fr - Bucarde à collier.



interior of left valve



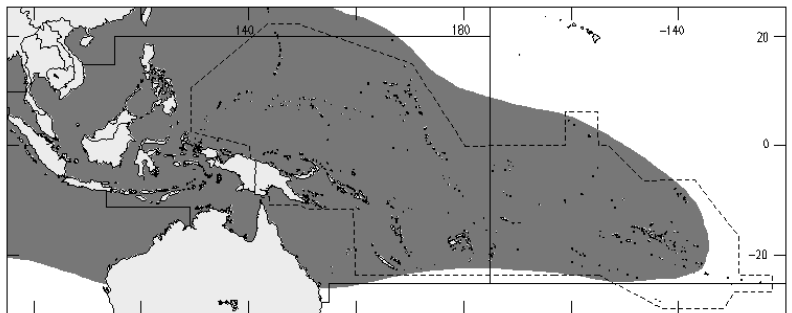
exterior of right valve

Diagnostic characters: Shell solid, **inequilateral, trapezoidal in outline**, with rounded anterior and almost straight, high posterior margins. **Posterior slope** markedly **set off** from the rest of the shell **by a sharp radial angulation**. **Anterodorsal margin longer than posterodorsal margin**. Posterior and ventral margins meeting at an angle distinctly less than 90°. **About 32** low and flat **radial ribs** (27 to 37) at each valve, **with close-set transverse scales** that become coarser on the anterior part of shell. **Interstices** of ribs **narrow and smooth**. Hinge stout, strongly bent under the umbones. Cardinal teeth of right valve connected dorsally. Posterior lateral teeth much closer to cardinals than anterior laterals. Internal margins crenulated, the posterior one with sharp points. **Colour: outside white**, often with pale pink to fawn blotches towards the umbones, **scales on ribs light yellow**. Interior white, usually with some pale orange to pink radial flares in the umbonal cavity.

Size: Maximum shell height 4 cm, commonly to 3 cm.

Habitat, biology, and fisheries: In littoral and sublittoral sand to a depth of 20 m. Frequently occurring in dense populations in shallow subtidal bottoms. Commonly collected in many areas, mainly for decorative purposes.

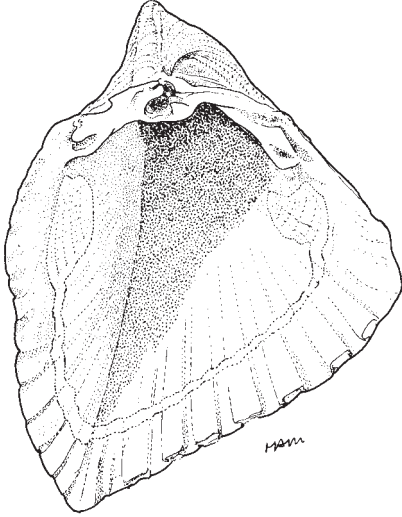
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea to eastern Polynesia; north to southern Japan and south to Queensland.



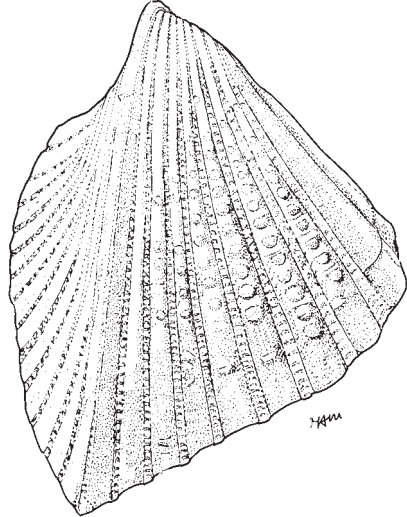
Fragum hemicardium (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Corculum hemicardium* (Linnaeus, 1758); *Lunulicardia hemicardia* (Linnaeus, 1758); *L. tumorifera* (Lamarck, 1819) / None.

FAO names: En - Pacific half cockle; Fr - Bucarde demi-coeur.



interior of left valve



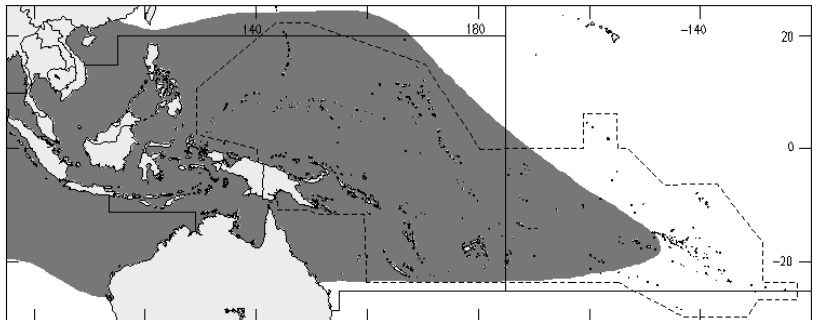
exterior of right valve

Diagnostic characters: Shell solid, **inequilateral, trapezoidal in outline**, with sharply rounded anterior and feebly convex, high posterior margins. **Posterior slope** markedly **set off** from the rest of the shell **by a sharp and prominent radial keel**. **Anterodorsal margin longer** and more sloping **than posterodorsal margin**. Posterior and ventral margins meeting at an acute angle. **About 23 flattened radial ribs** (18 to 27) at each valve, those on medial part of the shell usually bearing a row of rounded nodules. **Interstices of ribs narrow and pitted** or with transverse bars. Hinge stout, strongly bent and thickened under the umbones. Cardinal teeth of right valve connected dorsally. Posterior lateral teeth closer to cardinals than anterior laterals. Internal margins with wide crenulations. **Colour: outside white**, sometimes with a pale pink or fawn hue under the thin, straw-coloured periostracum. Interior white.

Size: Maximum shell height 5.5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: In littoral and shallow sublittoral sandy bottoms. Sometimes abundant in intertidal sand flats of sheltered bays. Of potential interest for a commercial exploitation in northwestern Australia.

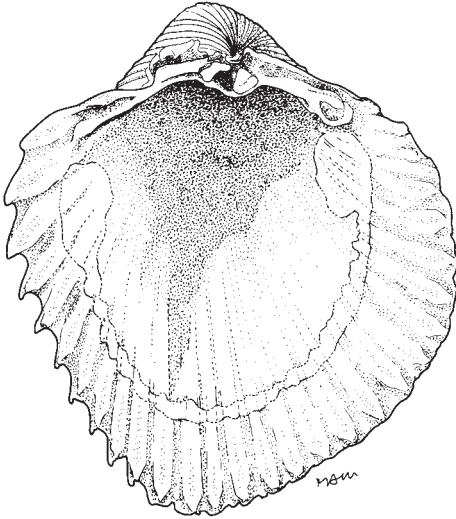
Distribution: Widespread in the Indo-West Pacific, from East Africa to Polynesia; north to the Philippines and southern China, and south to Queensland and New Caledonia.



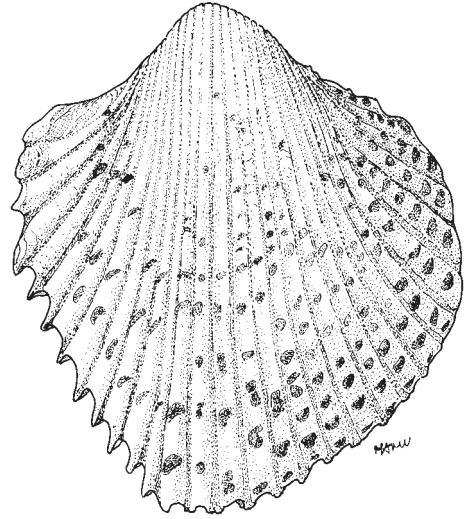
Fragum unedo (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Corculum unedo* (Linnaeus, 1758) / None.

FAO names: En - Pacific strawberry cockle; Fr - Bucarde fraise.



interior of left valve



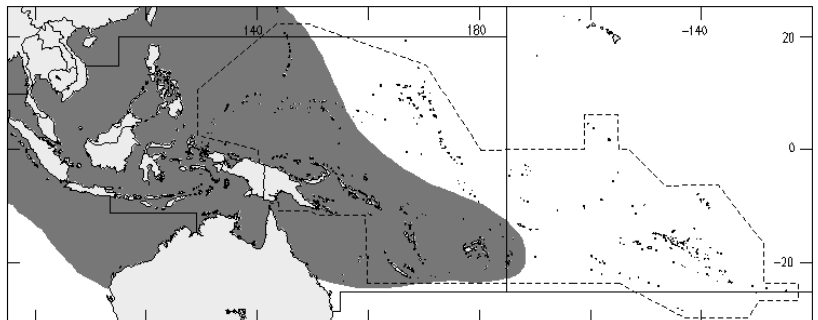
exterior of right valve

Diagnostic characters: Shell solid, inequilateral, subquadrate in outline, with rounded anterior and almost straight posterior margins. **Posterior slope set off from the rest of the shell by a rounded radial angulation. Anterodorsal and posterodorsal margins approximately equal** in length. Posterior and ventral margins meeting almost at right angle. **About 27** broad, low and flat radial ribs (23 to 31) at each valve, **with distantly spaced** transverse scales that become coarser and more numerous on the anterior part of shell. **Interstices** of ribs **narrow and smooth**. Hinge stout, strongly bent under the umbones. Cardinal teeth of right valve connected dorsally. Posterior lateral teeth slightly closer to cardinals than anterior laterals. Internal margins crenulated, the posterior one with sharp points. **Colour: outside** of shell **white** or cream, **with bright pink to dark red scales**. Interior white.

Size: Maximum shell height 6.5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: Shallow burrower of sandy bottoms, frequently occurring in dense populations. Most common in clean sand in shallow water. Littoral and sublittoral to a depth of 50 m. Exploitation at subsistence level in many areas. Appears in local markets in the central Philippines. The shell is commonly used in the shellcraft industry for decorative items. Of potential interest in Western Australia.

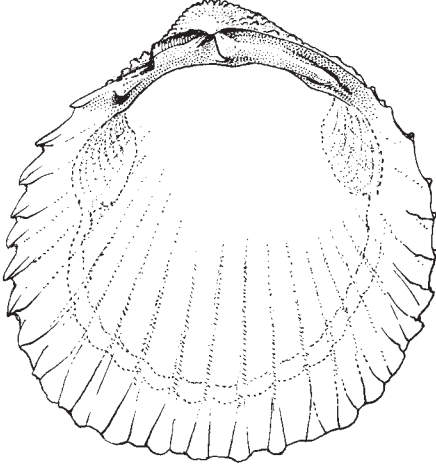
Distribution: Central and eastern Indian Ocean to western Pacific, from Mauritius Island and Sri Lanka to eastern Melanesia, north to southern Japan and south to Queensland.



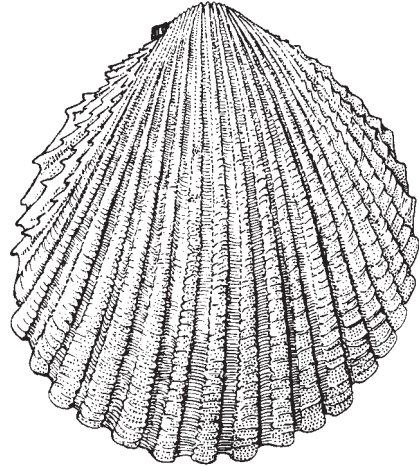
***Trachycardium rugosum* (Lamarck, 1819)**

Frequent synonyms / misidentifications: *Acrosterigma rugosa* (Lamarck, 1819); *Cardium flavum* "Linnaeus, 1758" (Dubious name); ? *C. pectiniforme* Born, 1780; *Vasticardium nigropunctatum* Habe and Kosuge, 1966 / *Trachycardium dupuchense* (Reeve, 1845); *T. marerubrum* Voskuil and Onverwagt, 1991.

FAO names: **En** - Pacific yellow cockle; **Fr** - Bucarde rugueuse.



interior of left valve



exterior of right valve

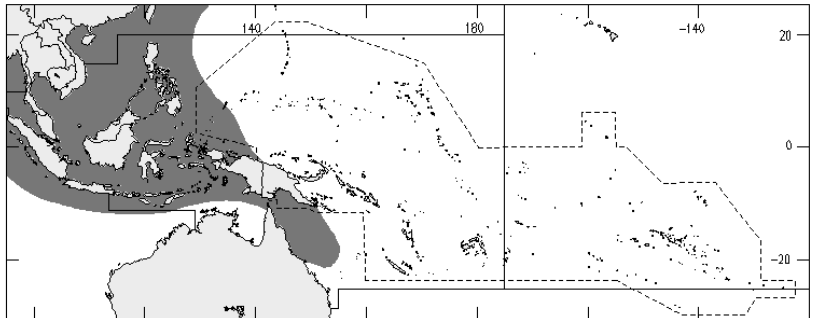
Diagnostic characters: Shell moderately thick, oblong-ovate and higher than long, slightly inequilateral with posterior part tending to be slightly expanded. About 30 prominent, rounded and rugose radial ribs (27 to 32) at each valve. Interstices of ribs relatively deep and flat, with fine concentric striations. Radial ribs bearing transverse scales on sides and top on the anterior half of shell, becoming smooth on top and finely crenate on sides behind the midline; ribs of posterior slope narrower and distinctly spinose. Periostracum thin and closely appressed to the shell, slightly fibrous, mostly persisting on periphery and in rib interstices. Hinge rather short and stout, arched. Cardinal teeth strongly unequal, anterior right and posterior left teeth reduced. Anterior and posterior lateral teeth approximately equidistant from cardinals. Internal margins strongly crenulated. **Colour:** outside of shell whitish, periostracum straw colour to olive-brown, sometimes with a scattering of black spots. Interior completely white, or more or less stained yellow.

Size: Maximum shell height 6.5 cm, commonly to 5 cm.

Habitat, biology, and fisheries: In coral sand and muddy-sand flats of sheltered areas, often forming large beds. Intertidal and shallow sublittoral waters to depths of about 20 m. Artisanally collected for food in Indo-China and the Philippines. The shell is used in local shellcraft.

Distribution: Widespread in the Indo-West Pacific, from East and Southeast Africa to eastern Indonesia; north to Japan and south to Queensland.

Remarks: There has been much confusion concerning this species, which is often misidentified with other members of the genus. Although recently and frequently used, the Linnaean name *Cardium flavum* is indeterminate and therefore considered invalid. Due to a pending revision of the group, *C. rugosum* Lamarck is used here as the first definite name correctly applied to this species.

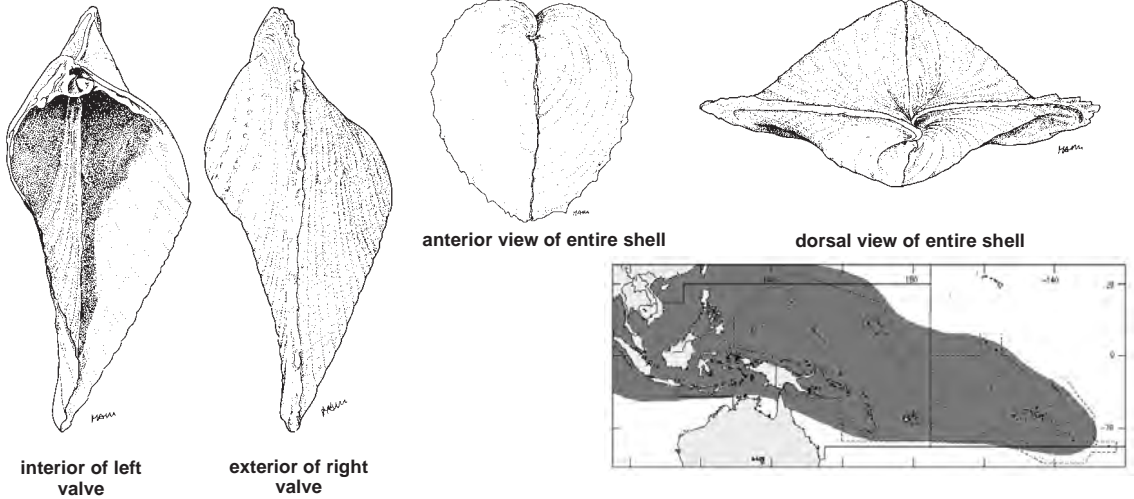


***Corculum cardissa* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Corculum aselae* Bartsch, 1947; *C. dionaeum* (Sowerby, 1829); *C. kirai* Shikama, 1964; *C. laevigatum* Bartsch, 1947; *C. obesum* Bartsch, 1947; *C. unimaculatum* (Broderip and Sowerby, 1833) / None.

En - True heart cockle; **Fr** - Bucarde coeur.

Maximum shell height 8 cm, commonly to 5 cm. In sandy bottoms, with the flattish posterior surface of shell lying horizontally just beneath the surface. Sometimes in dense colonies and often associated to coral reefs. Littoral and shallow sublittoral waters to a depth of 20 m. Artisanally collected in some areas, commonly in Thailand. Mainly used as an ornamental shell. Widespread in the Indo-West Pacific, from Mauritius Island, the Red Sea and the Persian Gulf, but probably not on the East African coast, to eastern Polynesia; north to Japan and south to northern Queensland and New Caledonia. The small form occurring in the tropical western Pacific islands is often considered a distinct species under the name *Corculum dionaeum* (Sowerby, 1829).

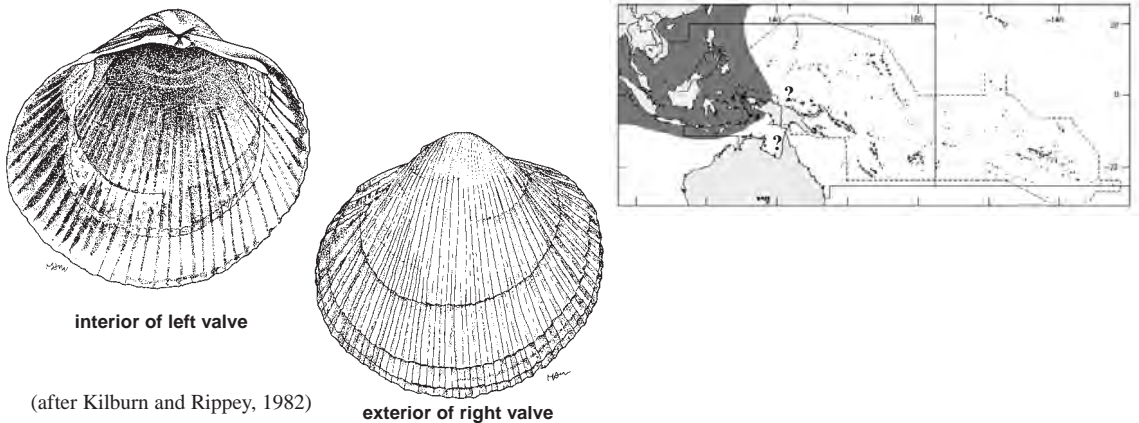


***Fulvia papyracea* (Bruguère, 1789)**

Frequent synonyms / misidentifications: *Cardium natalense* Krauss, 1848; *C. papyraceum* Chemnitz, 1782 (Invalid name); *Laevicardium papyraceum* (Bruguère, 1789) / *Fulvia aperta* (Bruguère, 1789).

En - Paper cockle; **Fr** - Bucarde papier.

Maximum shell length 6 cm, commonly to 5 cm. In muddy of sheltered bays and estuaries, from low tide level to shallow sublittoral waters. Collected for food and marketed in Thailand and Viet Nam. Apparently widely distributed in the Indo-West Pacific, the distribution of this species is imperfectly known because of frequent confusion with other species of the genus. Reported from East Africa, including South Africa and the Red Sea, to southern Japan, the Philippines, and eastern Indonesia.



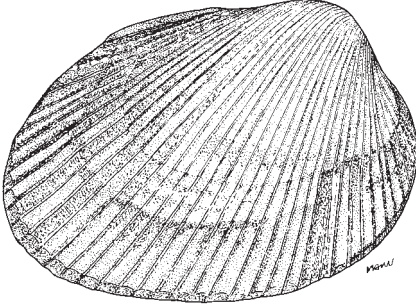
(after Kilburn and Rippey, 1982)

Plagiocardium pseudolatum (Voskuil and Onverwagt, 1991)

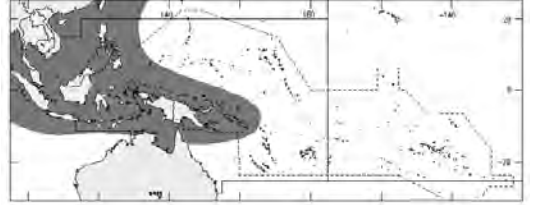
Frequent synonyms / misidentifications: *Cardium latum* of Authors (not of Born, 1780); *Maoricardium pseudolatum* Voskuil and Onverwagt, 1991 / *Plagiocardium setosum* (Redfield, 1846).

En - Broad cockle; **Fr** - Bucarde large.

Maximum shell length 7.5 cm, commonly to 4.5 cm. In littoral and shallow sublittoral sandy bottoms. Collected for food and used in the local shellcraft industry in the central Philippines. Central and eastern Indian Ocean to tropical western Pacific, from India and Sri Lanka, including Réunion and Mauritius islands and the Persian Gulf, to Solomon Islands; north to southern Japan and south to northern Queensland.



exterior of right valve
(after Voskuil and Onverwagt, 1991)

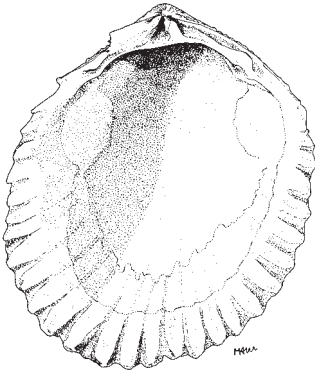


Trachycardium angulatum (Lamarck, 1819)

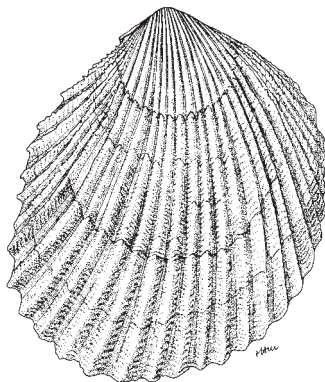
Frequent synonyms / misidentifications: *Acrosterigma angulata* (Lamarck, 1819); *Trachycardium alternatum* (Sowerby, 1840); *Vasticardium alternatum* (Sowerby, 1840) / None.

En - Angulate cockle; **Fr** - Bucarde anguleuse.

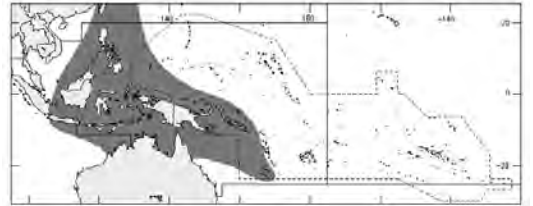
Maximum shell height 9.5 cm, commonly to 7 cm. In sandy bottoms. Littoral and shallow sublittoral waters to a depth of 20 m. Collected for food in the Philippines; the shell is used as raw material in local shellcraft. Western Indian Ocean, in East and Southeast Africa, Madagascar, the Seychelles and Mauritius Island, and western tropical Pacific, from Indonesia to Solomon Islands; north to southern Japan and south to Queensland and New Caledonia.



interior of left valve



exterior of right valve

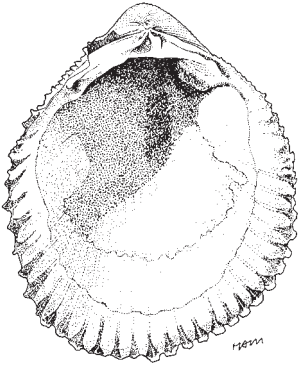


Trachycardium orbita (Sowerby, 1833)

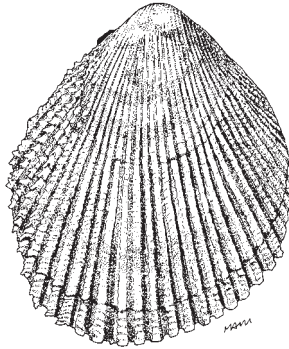
Frequent synonyms / misidentifications: *Cardium orbita* Sowerby, 1833; *C. philippinense* "Deshayes" Shirley, 1912; *Trachycardium hawaiiensis* Dall, Bartsch, and Rehder, 1938; *Vasticardium orbita* (Sowerby, 1833) / None.

En - Orbit cockle; **Fr** - Bucarde à ornères.

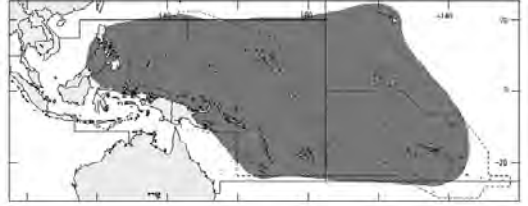
Maximum shell height 9.3 cm, commonly to 7 cm. In sandy bottoms, from low tide levels to shallow sublittoral depths. Collected for food in Polynesia. Widespread in tropical West Pacific islands, from the Philippines to Hawaii and eastern Polynesia.



interior of left valve



exterior of right valve

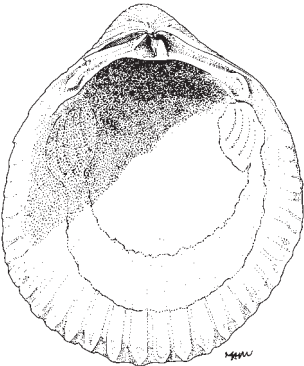


Trachycardium subrugosum (Sowerby, 1840)

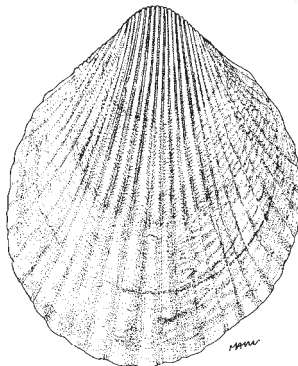
Frequent synonyms / misidentifications: *Acrosterigma subrugosa* (Sowerby, 1840) / *Trachycardium rugosum* (Lamarck, 1819).

En - Wrinkled cockle; **Fr** - Bucarde ridée.

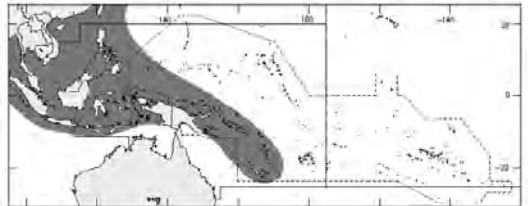
Maximum shell height 6 cm, commonly to 5 cm. In sandy bottoms. Intertidal and sublittoral waters to a depth of 20 m. Locally collected and marketed. Eastern Indian Ocean to the tropical western Pacific, from Nicobar Islands to Melanesia; north to southern Japan and south to New Caledonia.



interior of left valve



exterior of right valve

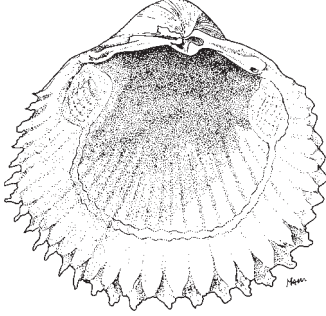


***Vepricardium asiaticum* (Bruguière, 1789)**

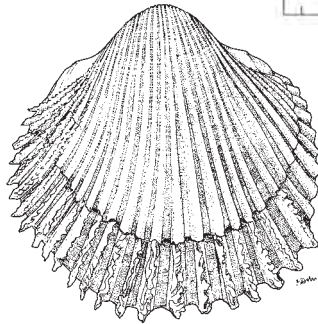
Frequent synonyms / misidentifications: *Cardium asiaticum* Bruguière, 1789; *Trachycardium asiaticum* (Bruguière, 1789); ? *Vepricardium coronatum* (Spengler, 1799); *Vepricardium fimbriatum* (Wood, 1815) / *Vepricardium burnupi* (Sowerby, 1897).

En - Asiatic cockle; **Fr** - Bucarde asiatique.

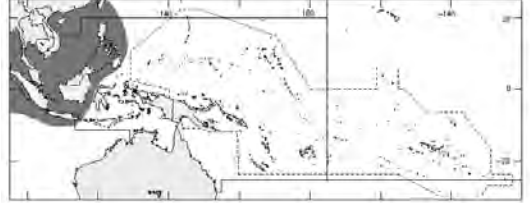
Maximum shell length 5 cm, commonly to 4 cm. In muddy-sand bottoms, from lower parts of the intertidal zone to depths of about 100 m. Locally abundant. Collected for food in the Gulf of Thailand. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Persian Gulf, to the Philippines; north to Taiwan Province of China and south to Indonesia.



interior of left valve



exterior of right valve

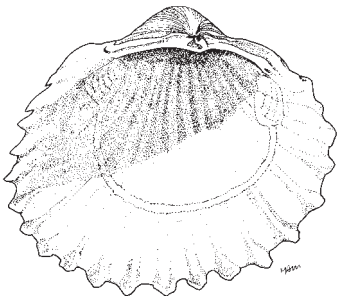


***Vepricardium sinense* (Sowerby, 1841)**

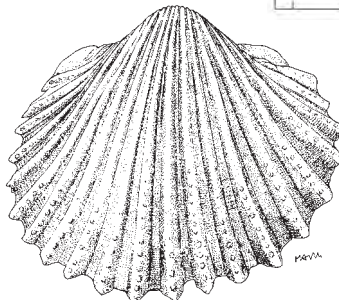
Frequent synonyms / misidentifications: *Cardium sinense* (Sowerby, 1841) / None.

En - Chinese cockle; **Fr** - Bucarde chinoise.

Maximum shell length 4.5 cm, commonly to 3.5 cm. In muddy-sand bottoms, from shallow subtidal water to a depth of about 45 m. Locally abundant. Collected for food in the Gulf of Thailand and southern Viet Nam. Restricted to the tropical western Pacific, from eastern Thailand to the Philippines; north to Taiwan Province of China and south to Indonesia. Perhaps also occurring in the eastern Indian Ocean.



interior of left valve



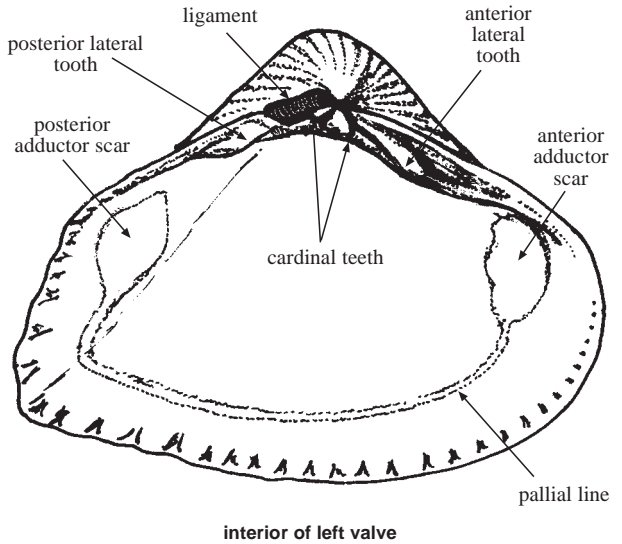
exterior of right valve



HEMIDONACIDAE

Hemidonax clams

D **Diagnostic characters:** Shell equivalve, subtrigonal to wedge-shaped and transversely elongate in outline, usually solid; more or less inequilateral, with the anterior side equal to, or longer than posterior side. Outer surface with weak to strong, smooth radial ribs, often reduced to absent on the anterior part of shell. Ligament external, lying behind the umbones, well within the dorsal part of the hinge plate. Hinge solid, with 2 unequal cardinal teeth and elongate lateral teeth in each valve; left valve with a single anterior and posterior lateral tooth; right valve with 2 anterior and 2 posterior lateral teeth, the upper lateral teeth often fused to dorsal shell margin. Interior of valves porcelaneous. Two subequal adductor muscle scars. Pallial line without a sinus. Internal margins crenulated. Gills of eulamellibranchiate type, with folded branchial sheets; outer demibranch smaller than inner demibranch and extended above the ctenidial axis. Foot wide, rather compressed, devoid of byssus and byssal groove. Siphons absent; posterodorsal exhalant aperture with short, simple tentacles, posteroventral inhalant aperture surrounded by complex, branched tentacles. Mantle widely open ventrally and fringed with small marginal tentacles, fused in its posterior third.

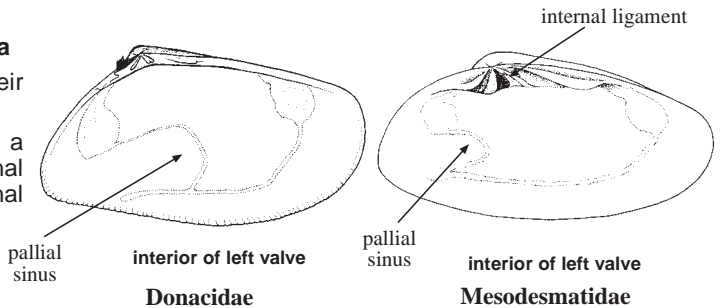


Habitat, biology, and fisheries: Suspension filter-feeding animals, occurring in clean sand bottoms of shallow subtidal areas. Probably moving just below the surface with the posterior apertures flush with the surface, and capable of quick burrowing. Locally collected in the Philippines.

Similar families occurring in the area

Donacidae: easily recognizable by their well-developed pallial sinus.

Mesodesmatidae: hinge plate with a large, socket-like pit bearing an internal ligament; pallial sinus present. Internal margins smooth.



References

Ponder, W.F., P.H. Colman, C.M. Yonge, and N.H. Colman. 1981. The taxonomic position of *Hemidonax* Mörch, 1871 with a review of the genus (Bivalvia: Cardiacea). *J. Malac. Soc. Aust.*, 5(1-2):41-64.

Wilson, B.R. and S.E. Stevenson. 1977. Cardiidae (Mollusca, Bivalvia) of Western Australia. *West. Aust. Mus. spec. Publ.*, (9):1-114.

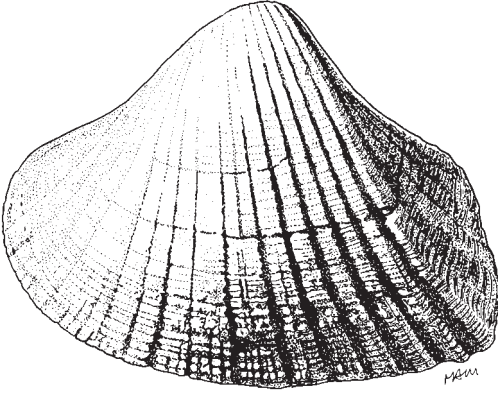
A single species of interest to fisheries occurring in the area

***Hemidonax donaciformis* (Bruguière, 1792)**

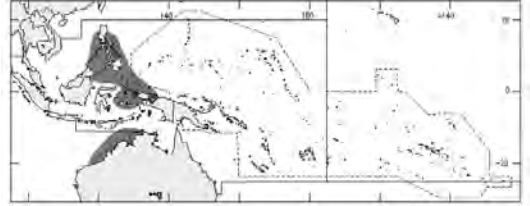
Frequent synonyms / misidentifications: *Cardium australiense* Reeve, 1844; *C. donaciforme* Chemnitz, 1782 or Schröter, 1786 (Invalid names) / *Hemidonax pictus* (Tryon, 1870).

En - Common hemidonax; **Fr** - Hémidonax commun.

Maximum shell length 3.5 cm, commonly to 2.5 cm. In clean coarse coral sand, from low tide marks to shallow sublittoral waters. Locally collected and marketed in the Philippines. The empty shells are used for lime. Restricted to the western tropical Pacific, including the Philippines, eastern Indonesia and northwestern Australia. Australian representatives of this species are generally considered a distinct subspecies under the name *Hemidonax donaciformis australiense* (Reeve, 1844).



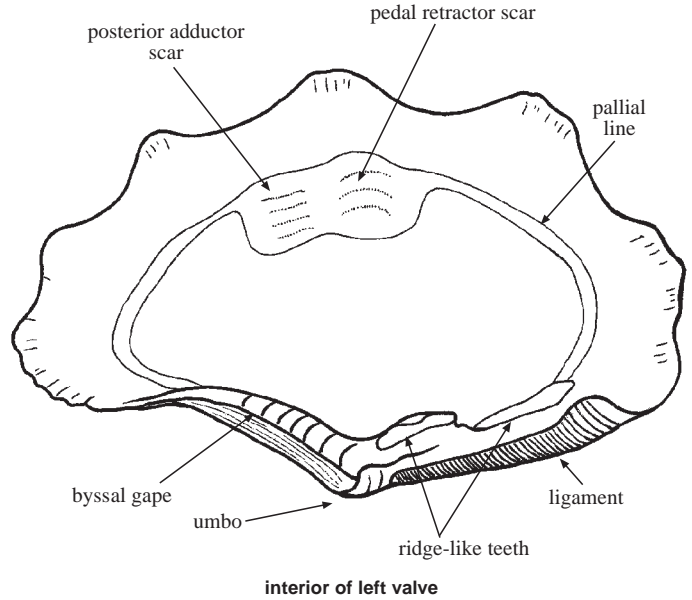
exterior of left valve
(after Ponder et al., 1981)



TRIDACNIDAE

Giant clams

Diagnostic characters: Shell **equivalve, thick, heavy and often very large, with strongly scalloped free margins**, inequilateral. **Umbones ventral** in position, pointing posteriorly. **Free margins of the valves dorsal most in position.** **Byssal gape** generally well developed (obsolete in genus *Hippopus*), **internally plicate**, near the umbones. **Outer surface of shell with strong radial folds** which may be fluted, ribbed or with transverse scales. **Ligament external**, set in a groove of anteroventral margin. **Hinge with a single, ridge-like cardinal tooth** in each valve, 1 lamellar lateral tooth in left valve, and 2 lateral teeth in right valve. Interior of shell porcelaneous. **A single, large and rounded (posterior) adductor muscle scar, associated with a generally large posterior pedal retractor scar**, both of them **submedian in position.** Anterior pedal retractor scar small, on superior surface of the cardinal tooth. **Pallial line without a sinus.**



Internal margins often more or less crenulated. Gills of eulamellibranchiate type, with moderately narrow, folded branchial sheets, the outer demibranch sometimes reduced. Foot either small and with a strong byssus (genus *Tridacna*), or relatively large and non-byssate (genus *Hippopus*). Exhalant siphon narrow, tubular, located mid-dorsally; inhalant siphon broad, situated high on posterior end of shell, and often provided with tentacles. Mantle margins papillate, extensively fused, provided with a ventral byssal-pedal opening and numerous, small hyaline organs with a lens.

Habitat, biology, and fisheries: The Tridacnidae are highly specialized sedentary bivalves, living in clear shallow waters of coral reefs, with the umbones and hinge situated at the underside of the body and the free edge of shell on the upper side. Depending on the species, they live either unattached in burrows within the corals, or fastened by a strong byssus. When covered during the tide, the valves are opened and the mantle lobes are protruded, exposing to the light 2 large, undulate, and often highly coloured bands. Nutrition partly occurs by filter-feeding, and by nutrient molecules gained from the photosynthesis of symbiotic algae (zooxanthellae) housed in the greatly developed mantle tissue. Hermaphroditic animals, breeding throughout the year or during the summer only (at higher latitudes). Fertilization external, giving free-swimming planktonic larvae. Symbiosis with zooxanthellae is established shortly after settlement of the young clam onto the substrate. Growth rapid in the larger species. Tridacnidae are traditionally harvested throughout the tropical western Pacific for their shell and highly prized meat. All the soft parts are edible except for the kidney which may accumulate arsenic and heavy metals. Widespread overfishing and deterioration of coral environments in some areas have frequently caused a decline of the clam populations in the recent past years. Since 1983, the Tridacnidae are listed on Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora in order to control their exploitation. Aquaculture trials are being attempted, for restocking of reefs and artisanal mariculture.

Remarks: Because of their highly specialized mode of life, the relationship between the body and shell in adult Tridacnidae appears to be reverse to other bivalves: the free margins of valves are dorsalmost in position, and the umbones, ligament, and hinge are situated ventrally. This unusual morphology is the result of growth mainly in the posterior direction, in contrast to typical growth of bivalves that occurs largely in a ventral direction. In consequence, the terminology used for shells of this family reflects the anatomical orientation of the adult giant clams, but bears no relation to the corresponding regions of typical bivalves.

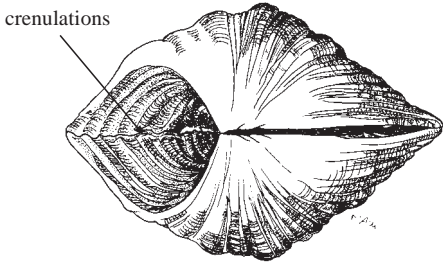
Similar families occurring in the area

None. The large, characteristic shell and special mode of life of the Tridacnidae easily distinguish them from other sedentary bivalves.

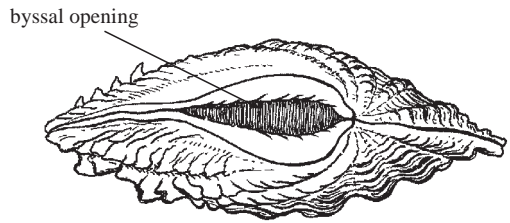
Key to species of interest to fisheries occurring in the area

Remarks on key characters: because of their sedentary mode of life, the Tridacnidae are somewhat variable in shell shape and ornamentation. Shell features may be more or less eroded or obscured by the development of encrusting and boring organisms, and then sometimes difficult to use in identification. Siphonal characters have been included in the following key for species of the genus *Hippopus*, as the shell differences tend to be less distinctive in larger specimens.

- 1a. Posteroventral margin of shell without a well-defined byssal orifice, bordered by interlocking crenulations (Fig. 1a) → 2
- 1b. Posteroventral margin of shell with a well-defined byssal orifice, bordered by small, not interlocking, crenulations (Fig. 1b) → 3



a) *Hippopus*



b) *Tridacna*

Fig. 1 ventral view of shell

- 2a. Shell of small specimens (less than 20 cm in length) relatively thin, with rather flat and smooth radial folds (Fig. 2); shape of the dorsal free margin rounded; inhalant siphon with tentacles *Hippopus porcellanus*
- 2b. Shell of small specimens relatively thick, with prominent, conspicuously ribbed radial folds; shape of the dorsal free margin triangulate (Fig. 3); inhalant siphon without tentacles *Hippopus hippopus*

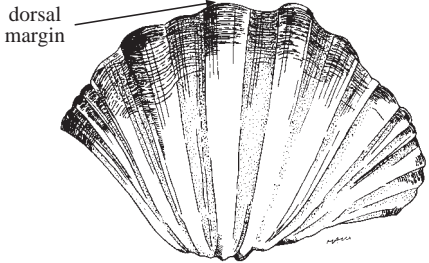


Fig. 2 *Hippopus porcellanus* (exterior)

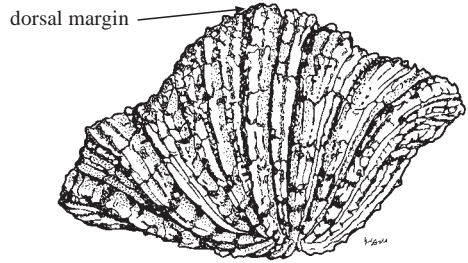
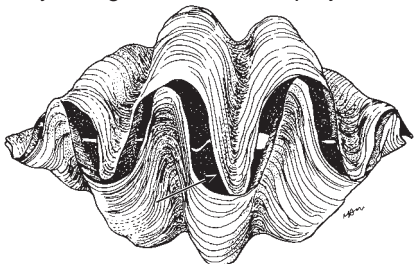
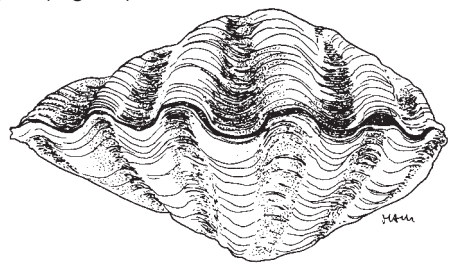


Fig. 3 *Hippopus hippopus* (exterior)

- 3a. Large specimens greater than 60 cm in length; radial folds deep, forming elongate-triangular projections on shell margins (Fig. 4a) *Tridacna gigas*
- 3b. Large specimens not exceeding 60 cm in length; radial folds broad and low, forming bluntly triangular or rounded projections on shell margins (Fig. 4b) → 4



a) *Tridacna gigas*



b) *Tridacna derasa*

Fig. 4 dorsal view of shell

- 4a. Maximum shell length largely exceeding 40 cm; umbones nearer to posterior end; concentric sculpture of growth marks without scales (Fig. 5) *Tridacna derasa*
- 4b. Maximum shell length of about 40 cm; umbones submedian, nearer to anterior end; concentric sculpture with scales, at least near margins →5

- 5a. Valves nearly equilateral; concentric sculpture of distant, blade-like projections (Fig. 6) *Tridacna squamosa*
- 5b. Valves inequilateral; concentric sculpture of closely-set, relatively low projections → 6

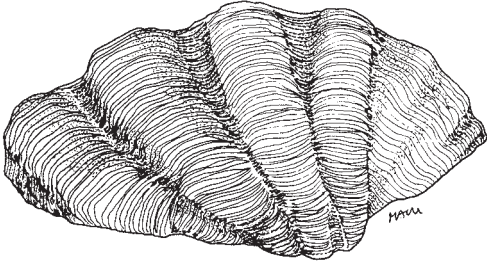


Fig. 5 *Tridacna derasa* (exterior)

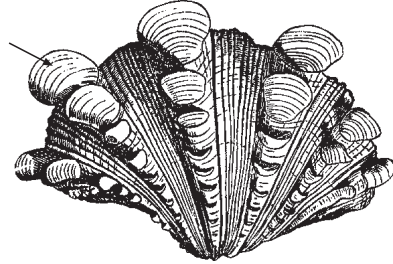


Fig. 6 *Tridacna squamosa* (exterior)

- 6a. Umbones moderately anterior in position; byssal aperture very large (Fig. 7); concentric scales only evident at shell margins; posterior adductor muscle scar more than twice the size of posterior pedal retractor scar. *Tridacna crocea*
- 6b. Umbones strongly anterior in position; byssal aperture large (Fig. 8); concentric scales developed over the whole shell (although sometimes more or less strongly eroded); posterior adductor muscle scar usually subequal in size to posterior pedal retractor scar *Tridacna maxima*

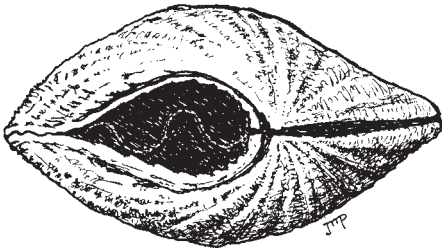


Fig. 7 *Tridacna crocea* (ventral view)

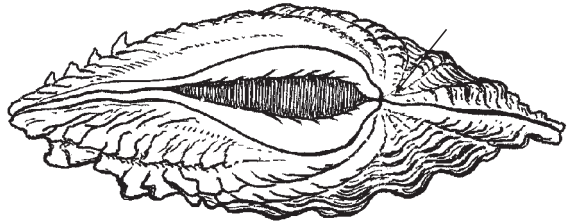


Fig. 8 *Tridacna maxima* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Hippopus hippopus* (Linnaeus, 1758)
- 🐚 *Hippopus porcellanus* Rosewater, 1982
- 🐚 *Tridacna crocea* Lamarck, 1819
- 🐚 *Tridacna derasa* (Röding, 1798)
- 🐚 *Tridacna gigas* (Linnaeus, 1758)
- 🐚 *Tridacna maxima* (Röding, 1798)
- 🐚 *Tridacna squamosa* Lamarck, 1819

References

Copland, J.W. and J.S. Lucas (eds). 1988. *Giant clams in Asia and the Pacific*. Canberra, Australian Center for International Agricultural Research, 274 p.

Knopp, D. 1995. *Riesenschnecken*. Ettlingen, Dähne, 255 p.

Rosewater, J. 1965. The family Tridacnidae in the Indo-Pacific. *Indo-Pac. Moll.*, 1(6):347-393.

Hippopus hippopus (Linnaeus, 1758)

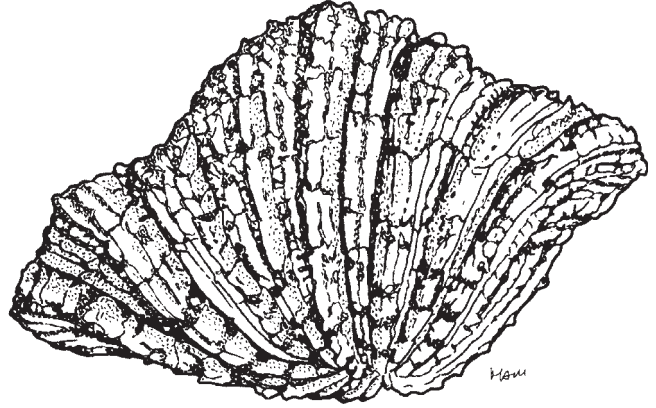
HIP

Frequent synonyms / misidentifications: *Hippopus maculatus* Lamarck, 1801 / *Hippopus porcellanus* Rosewater, 1982.

FAO names: En - Bear paw clam;

Fr - Bénitier tacheté.

Diagnostic characters: Shell very thick and heavy, medium to rather large sized, **globose** in shape and **triangularly ovate to subrhomboidal** in outline. Umbones strongly coiled, at about midlength or somewhat posterior. **Posteroventral margin** of valves **without a well-defined byssal orifice, bordered by interlocking crenulations** which become stronger posteriorly. **Dorsal free margin** of shell irregularly arched and **roughly triangular** in shape, more protruding at about midlength, sloping and slightly depressed anteriorly and posteriorly. Both ends narrowly rounded, the anterior one produced. Posteroventral slope more or less strongly concave, bordered by a marked radial angulation. **Surface of small specimens** (less than 20 cm in length) **moderately rough, with prominent, conspicuously ribbed radial folds.**



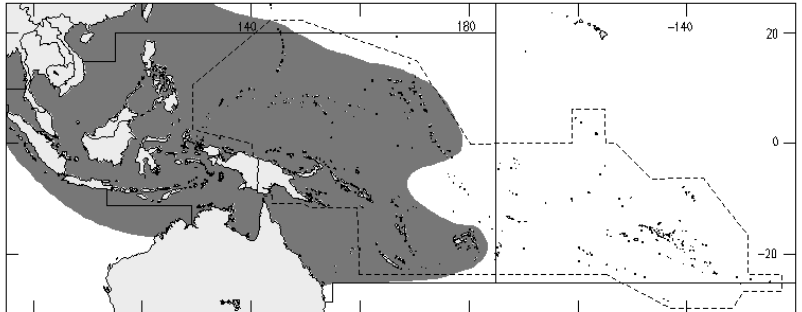
exterior of left valve
(after Habe, 1965)

Each valve with 9 to 13 or 14 large, rib-like folds and many low radial riblets throughout, crossed by fine, wavy concentric lines of growth. Radial riblets unequal in size and strength, often with short, prickly, semitubular spines. **Inhalent** (posterior) **siphonal opening without tentacles.** **Colour:** **outside** of shell **off-white**, with yellowish orange suffusion and **with reddish blotches arranged in irregular concentric bands.** **Interior porcelaneous white**, frequently **flushed with yellowish orange on ventral margin.** Dorsally exposed mantle area of living specimens yellowish brown, dull green or grey.

Size: Maximum shell length 40 cm, commonly to 20 cm.

Habitat, biology, and fisheries: On sandy bottoms of coral reefs, in shallow water to a depth of 6 m. Smaller specimens (up to about 15 cm in length) are often attached to coral rubble by byssal strands, while large and heavy specimens are unattached and lack a byssus. Collected for food and shell, the latter commonly used in the shellcraft industry.

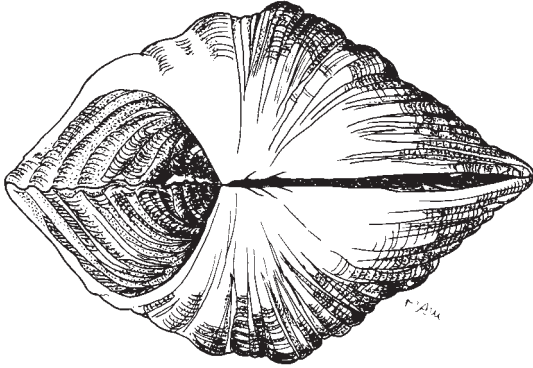
Distribution: Tropical eastern Indian Ocean to western Pacific, from Andaman Islands to eastern Melanesia; north to southern Japan and south to Queensland.



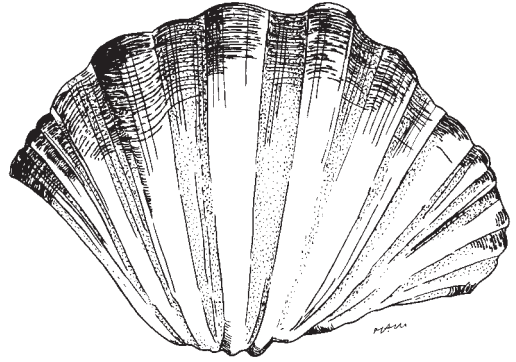
Hippopus porcellanus Rosewater, 1982

Frequent synonyms / misidentifications: None / *Hippopus hippopus* (Linnaeus, 1758).

FAO names: En - China clam; Fr - Bénitier porcelaine.



ventral view of entire shell



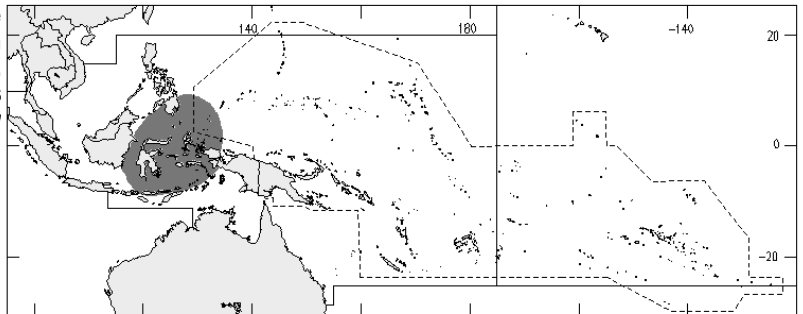
exterior of right valve

(after Copland and Lucas, 1988)

Diagnostic characters: Shell moderately thick and heavy, medium to rather large sized, **globose** in shape and **semicircular** in outline. Umbones strongly coiled, at about midlength or somewhat posterior. **Posteroventral margin** of valves **without a well-defined byssal orifice, bordered by interlocking crenulations** which become stronger posteriorly. **Dorsal free margin** of shell **regularly arched**, slightly produced anteriorly in mature specimens. Posteroventral slope flattish, becoming concave toward the umbones, bordered by a marked radial angulation. **Surface of small specimens** (less than 20 cm in length) **with moderately flat and smooth radial folds**. Each valve with 9 to 13 or 14 rib-like folds and many low radial riblets crossed by fine, wavy concentric lines of growth. Radial riblets mainly apparent in the interstices of ribs, usually without distinct semitubular spines (a few low spines sometimes present on ventral portion of the main folds). **Inhalant (posterior) siphonal opening with fringing tentacles.** **Colour:** **outside of shell off-white**, occasionally with scattered **weak reddish blotches**. **Interior porcelaneous white**, more or less **flushed with orange on ventral margin**. Dorsally exposed mantle area of living specimens yellowish brown, dull green or grey.

Size: Maximum shell length 40 cm, commonly to 20 cm. In shallow waters, on sandy bottoms of coral reefs. Young specimens often byssally attached to coral heads, mature specimens lack a byssus and lay unattached on the substrate. Collected for food and shell. A major target of the recent shell trade in the Philippines.

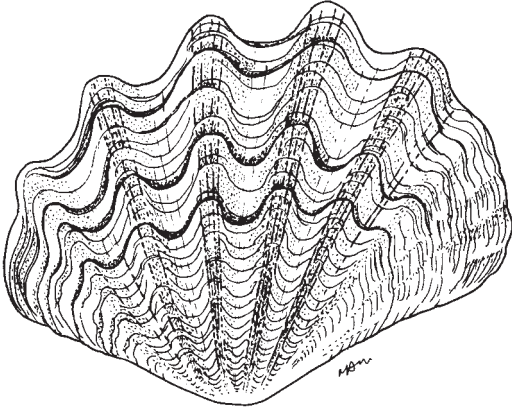
Distribution: Restricted in the tropical western Pacific; known from the southern Philippines, Sulawesi (Celebes), Moluccas and western Irian Jaya (New Guinea).



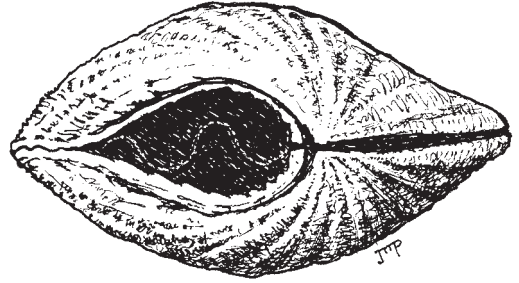
Tridacna crocea Lamarck, 1819

Frequent synonyms / misidentifications: None / None.

FAO names: En - Crocus giant clam; Fr - Bénéitier crocus.



exterior of left valve
(after Habe, 1977)



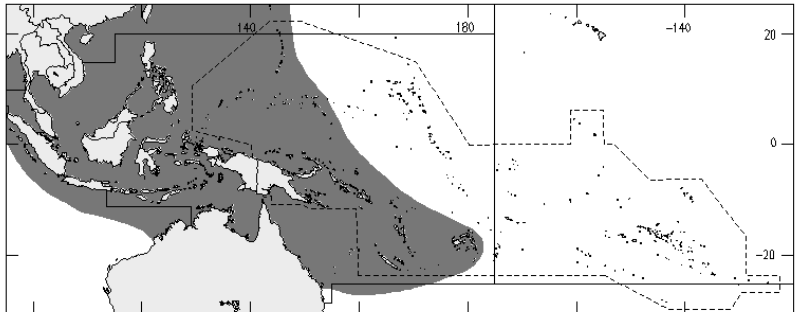
ventral view of entire shell

Diagnostic characters: Shell relatively small (not exceeding 15 cm in length), inequilateral and strongly inflated in shape, usually triangular-ovate in outline. Umbones moderately posterior in position, generally situated at about the anterior 2/5 of shell length. Posteroventral margin of valves with a very large byssal orifice, bordered by 4 to 9 small, non-interlocking crenulations, which become more distantly set posteriorly. Dorsal free margin widely arched and deeply undulated, with a series of 4 or 5, usually bluntly triangular, interdigitating projections which represent the extremities of radial furrows of the outer sculpture. Posteroventral area not set off by a distinct radial ridge or angulation, with crowded, low radial sculpture that results in crenulations on the internal margins at posterior end of shell. Outer surface quite smooth and obese, with 4 or 5 broad, moderately flattened, rib-like radial folds at each valve, bearing large and low concentric scales, only evident at dorsal free margin of shell. Secondary sculpture of closely spaced, undulate, concentric growth lines which are pronounced on main radial ribs, and weak radial riblets, 6 to 8 on main ribs and 3 or 4 on the interstices of ribs. Posterior pedal retractor scar relatively small, less than half the size of posterior adductor scar. Inhalant (posterior) siphonal opening with tentacles. **Colour:** exterior of shell greyish white, often suffused with yellow or pinkish orange and frequently encrusted with marine growths near dorsal margins of valves, but clean and nearly smooth ventrally. Interior porcelaneous white, sometimes with yellow to orange hues on margins. Dorsally exposed mantle area of living specimens often brightly coloured and variable in pattern and colour, including green, blue, purple, brown, and orange.

Size: Maximum shell length 15 cm, commonly to 11 cm.

Habitat, biology, and fisheries: Deeply burrowed in coral masses of reef flats and coral head, with the free valve margins nearly flush with the substrate's surface. In very shallow water to a depth of about 20 m (when the water is clear). Collected for food and shell trade. To remove the clam, the coral must be broken and the stout byssus undercut.

Distribution: Tropical eastern Indian Ocean to western Pacific, from Andaman Islands to Fiji Islands; north to Japan and south to New Caledonia and Queensland.

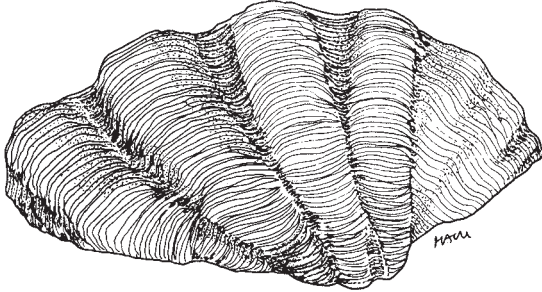


Tridacna derasa (Röding, 1798)

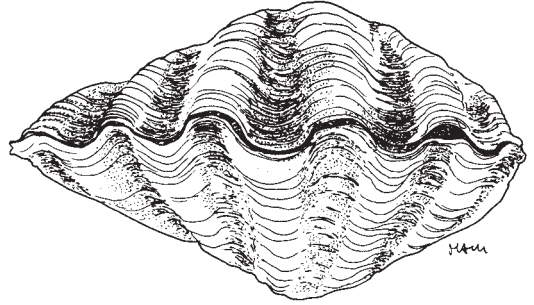
TDD

Frequent synonyms / misidentifications: *Tridacna serrifera* Lamarck, 1819; *Persikima whiteleyi* Iredale, 1937 / None.

FAO names: En - Smooth giant clam; Fr - Bénitier arasé.



exterior of left valve



dorsal view of entire shell

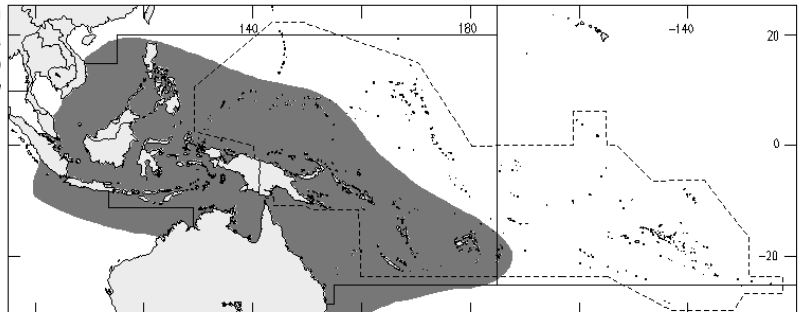
(after Copland and Lucas, 1988)

Diagnostic characters: Shell thick and heavy, reaching a very large size (up to 60 cm in length), inequilateral, weakly to rather strongly inflated and highly variable in shape, roughly semicircular in outline. Umbonal area massive, the umbones markedly posterior to midlength of shell in mature specimens. Posteroventral margin of valves with a moderately short and narrow byssal orifice, bordered by small, non-interlocking crenulations. Outer surface of each valve with 7 to 12 broad and low radial folds, forming rounded projections on dorsal free margin of shell which is regularly arched. Secondary sculpture of weak, evenly distributed radial riblets and closely spaced, wavy, concentric lines of growth. Inhalant (posterior) siphonal opening with tentacles. **Colour:** exterior of shell off-white, often partly encrusted with marine growths. Interior porcelaneous white, frequently tinged with orange on hinge area. Dorsally exposed mantle area of living specimens with elongate, often brilliant blue, patterns of colour.

Size: Maximum shell length 60 cm, commonly to 50 cm.

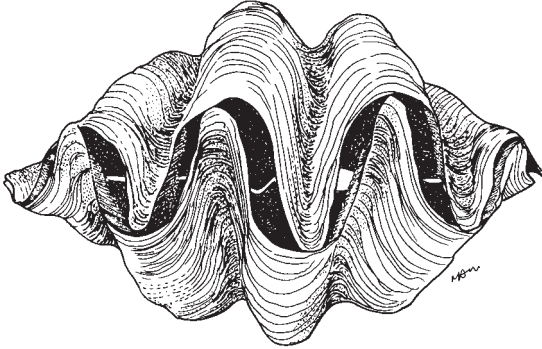
Habitat, biology, and fisheries: Outer edge of coral reefs, in shallow water to a depth of 20 m. Locally exploited for meat and shell. This species was previously quite abundant, but has been overcollected in many areas. Aquaculture attempts being made.

Distribution: Tropical western Pacific, from western Indonesia to eastern Melanesia; north to the Philippines and south to New South Wales.

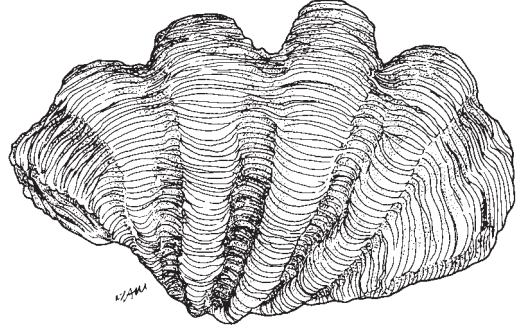


***Tridacna gigas* (Linnaeus, 1758)**

TDG

Frequent synonyms / misidentifications: None / None.**FAO names:** En - Giant clam; Fr - Bénitier géant.

dorsal view of entire shell



exterior of right valve

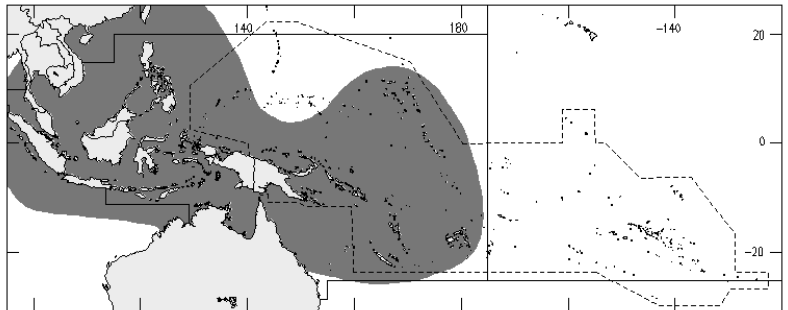
(after Copland and Lucas, 1988)

Diagnostic characters: Shell very thick and heavy, reaching an extremely large size (up to 137 cm in length), moderately to strongly inflated and rather equilateral in shape, subovate to fan-shaped in outline. Umbones usually near midlength of shell. **Posteroventral margin** of valves with a moderately small byssal orifice, bordered by obsolete, non-interlocking crenulations that become more distinct toward the umbones. Outer surface of each valve with 4 to 6 deep radial folds, 4 of which are generally very large, forming elongate-triangular projections on dorsal free margin. **Secondary sculpture** of weak radial riblets (both on and between the main radial folds) and overriding, fine concentric lines of growth, becoming obsolete on later stages of growth. Inhalant (posterior) siphonal opening without tentacles. **Colour:** exterior of shell off-white, often strongly encrusted with marine growths. Interior porcelainous white. Dorsally exposed mantle area of living specimens yellowish brown to olive green, with numerous, small, brilliant blue-green rings.

Size: Maximum shell length 137 cm, commonly to 80 cm.

Habitat, biology, and fisheries: On sand, in coral-reef areas, from depths of 2 to 20 m. Exploited for its meat and shell, this species has recently become nearly extinct within an important part of its range, due to overcollecting. Trials of aquaculture under progress for the restocking of reefs and local farming.

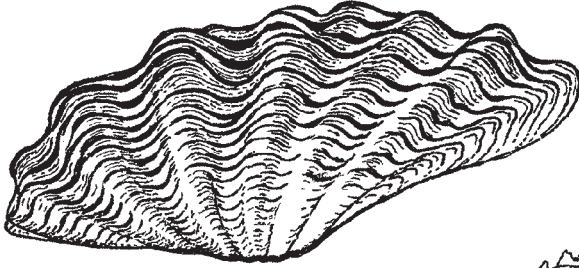
Distribution: Eastern Indian Ocean and tropical western Pacific, from southwestern Myanmar and western Indonesia to Micronesia and eastern Melanesia; north to southern Japan and south to Queensland and New Caledonia.



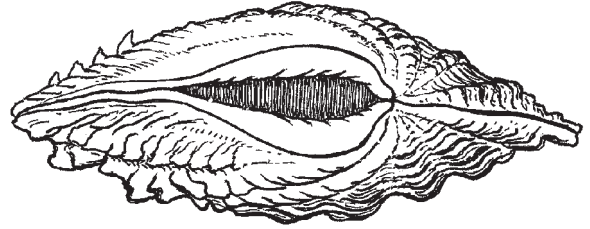
Tridacna maxima (Röding, 1798)

Frequent synonyms / misidentifications: *Tridacna elongata* Lamarck, 1819 / None.

FAO names: En - Elongate giant clam; Fr - Bénitier allongé.



exterior of left valve



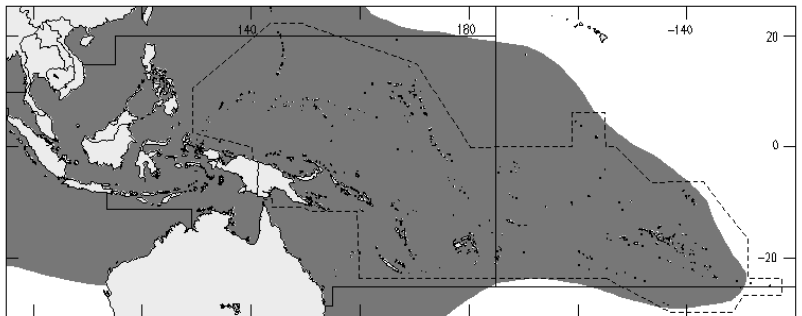
ventral view of entire shell

Diagnostic characters: Shell moderately large (reaching 35 cm in length) and inflated, strongly inequilateral and highly variable in shape, usually elongate-ovate to somewhat triangular in outline. Umbones markedly anterior in position, generally situated about the anterior 1/3 of shell length. Posteroventral margin of valves with a large byssal orifice, bordered by 4 to 9 small, distinct to obsolete and non-interlocking crenulations, which become more distantly set posteriorly. Dorsal free margin widely arched and deeply undulated, with a series of 5, usually sharply triangular, interdigitating projections which represent the extremities of radial furrows of the outer sculpture. Posteroventral area not set off by a distinct radial ridge or angulation, with crowded radial sculpture that results in crenulations on the internal margins at posterior end of shell. Outer surface of each valve with 6 or 7 very broad, moderately convex, rib-like radial folds, bearing closely set, erect but low, concentric scales. Scales developed on entire shell, although often more or less strongly eroded, especially near the umbones. Secondary sculpture of closely spaced, undulate concentric lines of growth, and weak radial riblets, 8 to 20 in number on the main ribs and 3 to 7 on the rather narrow interstices of ribs. Posterior pedal retractor scar relatively large, more than half the size to frequently subequal to posterior adductor scar. Inhalant (posterior) siphonal opening with tentacles. **Colour:** exterior of shell greyish white, often suffused with yellow or pinkish orange and strongly encrusted with marine growths. Interior porcelaneous white, sometimes with yellow to orange hues on margins. Dorsally exposed mantle area of living specimens often brightly coloured and variable in colour and pattern.

Size: Maximum shell length 35 cm, commonly to 25 cm.

Habitat, biology, and fisheries: On reefs, partially embedded in corals. Littoral and shallow water to a depth of 20 m. Collected for food and for the shell trade. Aquaculture trials currently underway.

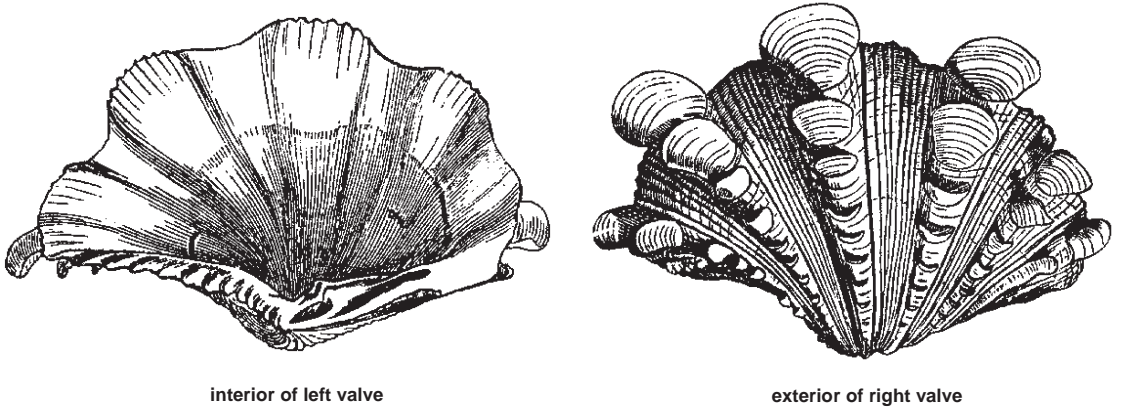
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf to eastern Polynesia; north to Japan and south to New South Wales and Lord Howe Island.



Tridacna squamosa Lamarck, 1819

TDS

Frequent synonyms / misidentifications: *Tridacna scapha* (Meuschen, 1787) (Invalid name) / None.
FAO names: En - Fluted giant clam; Fr - Bénitier écailléux.



interior of left valve

exterior of right valve

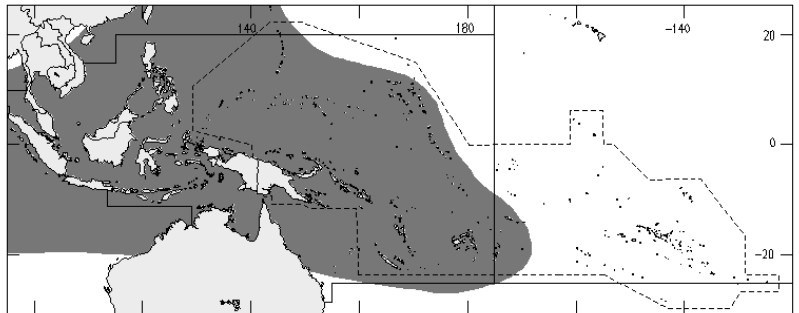
(after Chenu, 1862)

Diagnostic characters: **Shell moderately large** (attaining 40 cm in length), moderately compressed (in juveniles) to strongly inflated (in mature specimens) and **nearly equilateral** in shape, **semicircular in outline**. **Umbones about midlength of shell** or slightly anterior. **Posteroventral margin of valves with a medium-sized byssal orifice, bordered by 6 to 8 small, non-interlocking crenulations**. Dorsal free margin of shell regularly rounded, undulate. **Posteroventral slope relatively broad and flat**, with crowded radial sculpture that results in crenulations on the margin posterior to byssal opening. Outer surface of **each valve with 5 or 6 broad, rib-like radial folds bearing large and erect, distant, blade-like concentric scales** which are delicate and easily broken. **Secondary sculpture** of many **low radial riblets**, crossed by concentric growth lines, giving a finely latticed pattern, **mainly noticeable in the wide interstices of ribs**. Inhalant (posterior) siphonal opening with fringing tentacles. **Colour: exterior** of shell highly variable, **greyish white, often with different hues of orange, yellow, or pink to mauve**, and with the blade-like scales commonly of different shades or colour. **Interior porcelaneous white**, occasionally tinged with orange. Dorsally exposed mantle area of living specimens mottled in various mixes of green, blue, brown, orange, and yellow.

Size: Maximum shell length 40 cm, commonly to 30 cm.

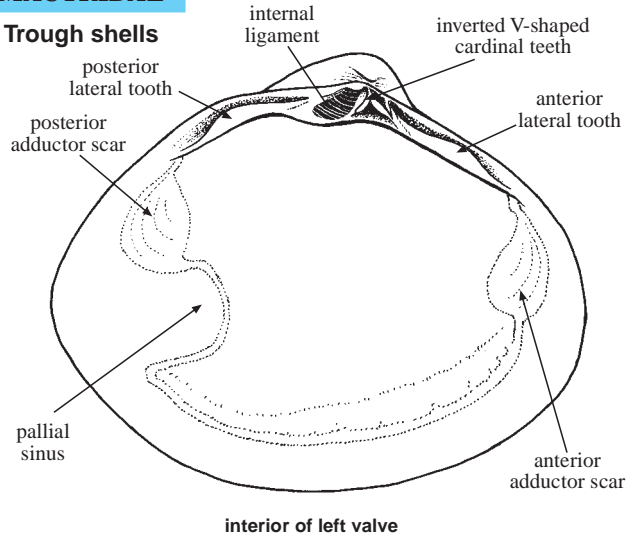
Habitat, biology, and fisheries: Attached by a byssus to the surface of coral reefs, usually in moderately protected localities such as reef moats. Littoral and shallow water to a depth of 20 m. Collected for food and the shell trade.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea, but not the Persian Gulf, to eastern Melanesia; north to southern Japan and south to Queensland and New Caledonia.



MACTRIDAE

Diagnostic characters: **Shell** equi-**valve**, ovate or trigonal to transversely elongated, closed to somewhat gaping posteriorly. **Umbones prosogyrate**, more or less prominent. Outer surface smooth or mostly concentrically sculptured, often with an obvious periostracum. External ligament short and not prominent, just behind the umbones; **internal ligament well developed**, set in each valve in a deep **trigonal pit of the hinge plate** and pointing towards the umbo. **Hinge characteristic**, each valve with **two cardinal teeth** and smooth or striated, more or less developed, **lateral teeth**; **cardinal teeth of the left valve forming an inverted V-shaped process**; delicate additional cardinal lamellae often present in either valve. Interior of shell porcelaneous. **Two**, often subequal, **adductor muscle scars**. **Pallial line with a well-developed sinus**. Internal margins usually smooth. Gills of eulamellibranchiate type, with generally smooth branchial sheets; outer demibranch expanded above the ctenidial axis. Foot large and compressed, heeled, without a byssus. Siphons united, generally rather short, naked or sheathed with an expansion of the periostracum, papillate on top. Mantle margins smooth, more or less cuticularly united or fused ventrally, with a large pedal opening anteriorly and an additional aperture beneath the inhalant siphon.

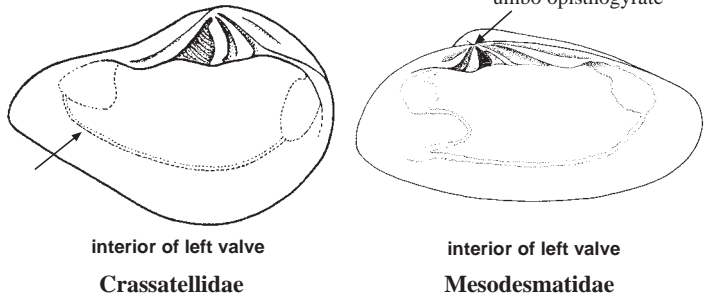


Habitat, biology, and fisheries: Active burrowers of sandy to muddy bottoms. Suspension filter-feeding animals. Sexes separate. Development with a free-swimming larval stage. Mastridae represent generally species of secondary importance in the harvest of edible bivalves in the area, although a few species are quite regularly fished locally.

Similar families occurring in the area

Crassatellidae: no inverted V-shaped process in the hinge of left valve; pallial line without a sinus.

Mesodesmatidae: umbones opisthogyrate; no inverted V-shaped process in the hinge of left valve; siphons separate; branchial sheets folded.



Key to species of interest to fisheries occurring in the area

- 1a. Shell transversely ovate in outline, widely gaping; pallial sinus deep, extending beyond midline of valves (Fig. 1a) → 2
- 1b. Shell subtrigonal in outline, nearly closed; pallial sinus shallow, not reaching midline of valves (Fig. 1b) → 3



Fig. 1 interior of a valve

- 2a. Radial sculpture of numerous, fine and irregular threads, developed on most parts of the surface of valves (Fig. 2) *Meropesta capillacea*
- 2b. Radial sculpture obsolete on most parts of the surface of valves (reduced to microscopic lines) (Fig. 3) *Meropesta pellucida*
- 3a. Anterior half of hinge plate deeply and broadly excavated, obliquely truncated by a transverse septum just in front of the anterior cardinal teeth (Fig. 4a); dorsalmost anterior lateral tooth of right valve reduced to a thin longitudinal ridge inside the hinge cavity . . *Mactra violacea*
- 3b. Anterior half of hinge plate not deeply or broadly excavated, without a transverse septum in front of the anterior cardinal teeth (Fig. 4b); dorsalmost anterior lateral tooth of right valve rather well developed and prominent → 4



Fig. 2 *Meropesta capillacea* (exterior)

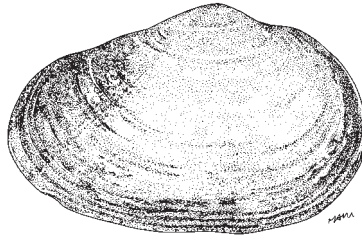


Fig. 3 *Meropesta pellucida* (exterior)

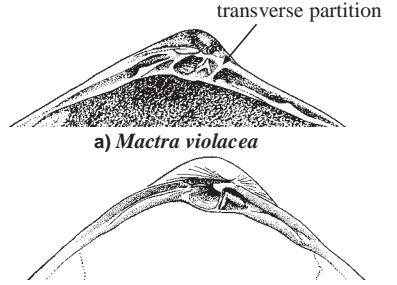


Fig. 4 hinge of left valve

- 4a. Outer colour of shell with spotted patterns; lunule and escutcheon areas without concentric grooves → 5
- 4b. Outer colour of shell without spotted patterns; lunule and escutcheon areas with concentric grooves → 6

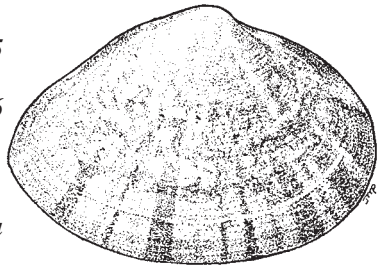


Fig. 5 *Mactra achatina* (exterior)

- 5a. Shell rather compressed, elliptical-ovate in outline; outer colour of brown to mauve or rose mottling and radial bands on a whitish background (Fig. 5) . . *Mactra achatina*
- 5b. Shell inflated, trigonal-ovate in outline; outer colour of irregular tan mottling and dots on a creamy background (Fig. 6) *Mactra maculata*

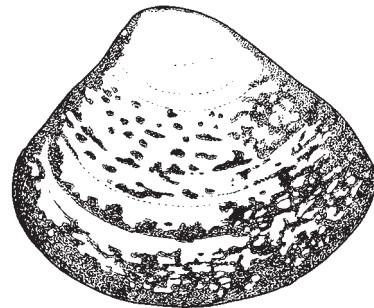


Fig. 6 *Mactra maculata* (exterior)

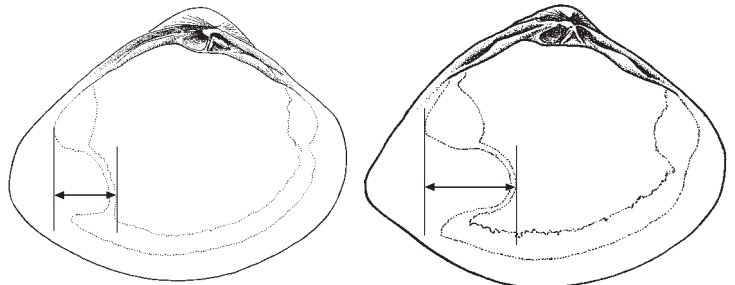


Fig. 7 interior of left valve

- 6a. Shell relatively small, up to 4 or 5 cm in length; pallial sinus shallow (Fig. 7a) → 7
- 6b. Shell relatively large, up to 9 cm in length; pallial sinus somewhat deeper (Fig. 7b) . . *Mactra mera*

- 7a. Shell subequilateral, symmetrically slanting anteriorly and posteriorly; a few concentric grooves near anteroventral margin (Fig. 8) *Mactra luzonica*
- 7b. Shell inequilateral, rounded anteriorly and rather angularly produced posteriorly; no concentric grooves near anteroventral margin (Fig. 9) *Mactra cuneata*

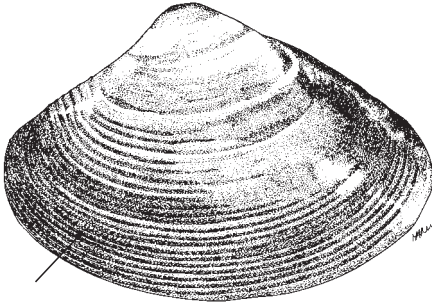


Fig. 8 *Mactra luzonica* (exterior)

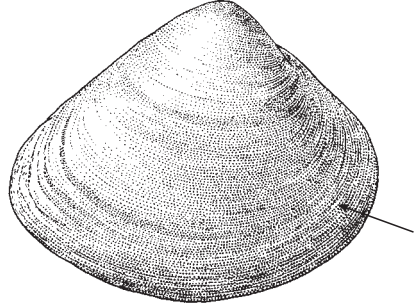


Fig. 9 *Mactra cuneata* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Mactra achatina* Holten, 1802
- 🐚 *Mactra cuneata* Gmelin, 1791
- 🐚 *Mactra luzonica* Reeve, 1854
- 🐚 *Mactra maculata* Gmelin, 1791
- 🐚 *Mactra mera* Reeve, 1854
- 🐚 *Mactra violacea* Gmelin, 1791
- 🐚 *Meropesta capillacea* (Reeve, 1854)
- 🐚 *Meropesta pellucida* (Gmelin, 1791)

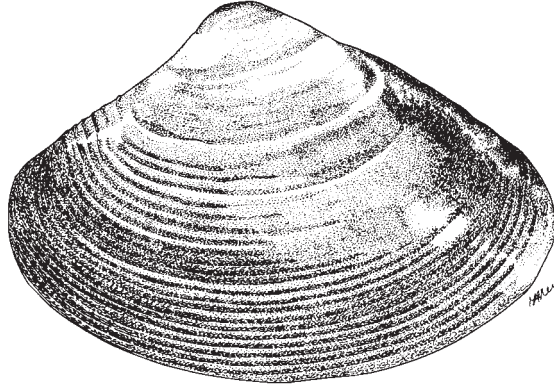
References

Lamy, E. 1917. Révision des Mactridae vivants du Muséum d'Histoire naturelle de Paris. *J. Conchyl.*, 63(3):173-275.
 Lamy, E. 1918. Révision des Mactridae vivants du Muséum d'Histoire naturelle de Paris (Suite). *J. Conchyl.*, 63(4):291-414.

Mactra luzonica Reeve, 1854

Frequent synonyms / misidentifications: *Mactra apicina* Reeve, 1854; *Telemactra luzonica* (Reeve, 1854) / None.

FAO names: En - Luzon troughshell; Fr - Mactre de Luçon.



exterior of left valve

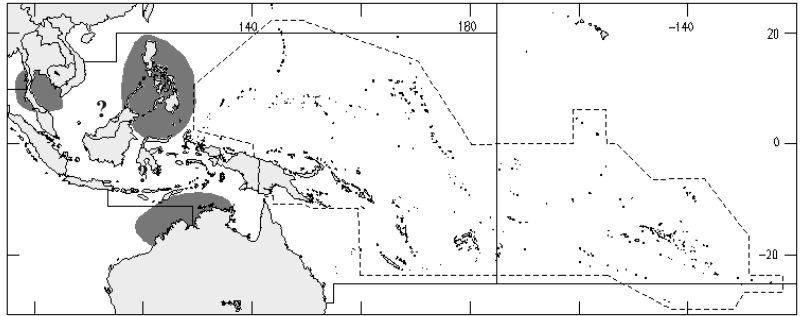
(after Habe and Kosuge, 1966)

Diagnostic characters: Shell moderately inflated, **trigonal-ovate** and relatively **elongate** in outline, **subequilateral**. Umbones a little in front of midline of valves. **Dorsal margin symmetrically slanting towards the rounded anterior and posterior margins**. Ventral margin widely and regularly arched. Outside of shell shiny, with **a few concentric grooves** that are mainly developed **near anteroventral margin**. **Lunule and escutcheon areas concentrically grooved**. Periostracum thin. **Lateral hinge teeth well developed**, 1 anterior and 1 posterior in left valve, 2 anterior and 2 posterior in right valve. **Pallial sinus shallow**, broadly rounded, higher than long. **Colour: outside of shell light brownish**, with paler and darker concentric bands, **often tinged purple dorsally**, on umbones, lunule and escutcheon areas. **Interior mauve**. Shell colour occasionally white externally and internally.

Size: Maximum shell length 5 cm, commonly to 3.5 cm.

Habitat, biology, and fisheries: In sand and mud bottoms. Littoral and sublittoral from low tide level to a depth of 20 m. Collected for food in the Philippines and regularly marketed. Shell used for local shellcraft.

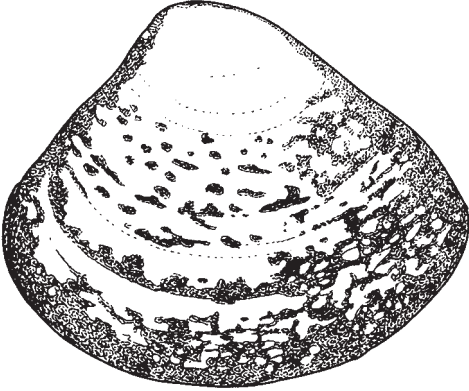
Distribution: Indo-West Pacific, from the Persian Gulf to the Philippines and Western Australia. Total distribution imperfectly known.



Mactra maculata Gmelin, 1791

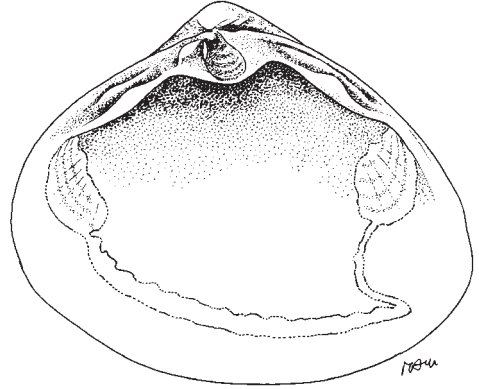
Frequent synonyms / misidentifications: *Mactra maculata* Chemnitz, 1785 (Invalid name); *M. reevei* Reeve, 1854; *M. squalida* Lamarck, 1818 / None.

FAO names: En - Maculated troughshell; Fr - Mactre tachetée.



exterior of left valve

(after Habe, 1965)



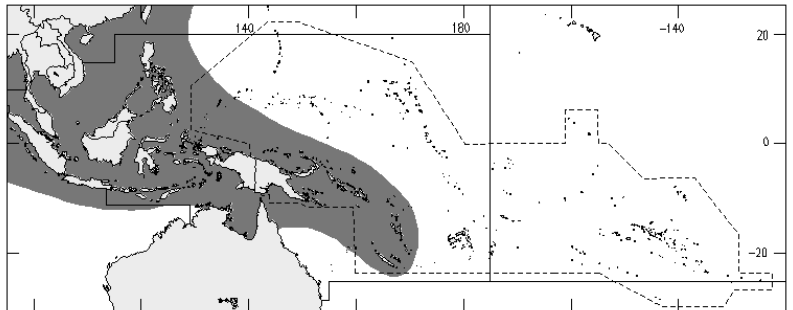
interior of right valve

Diagnostic characters: Shell inflated, trignon-ovate and relatively high in outline, nearly closed. Umbones a little in front of midline of valves. Dorsal margin strongly sloping on either side of umbo. Anterior margin rounded, posterior margin obtusely truncate. Outside of shell smoothish, with an obscure ridge radiating from umbones to posteroventral end. Periostracum thin and adherent, somewhat wrinkled marginally. Lateral hinge teeth well developed, 1 anterior and 1 posterior in left valve, 2 anterior and 2 posterior in right valve. Pallial sinus shallow and widely open, higher than long. **Colour:** outside of shell cream-coloured, with irregular tan mottling and dots; periostracum straw coloured, translucent. Interior porcelaneous white, with dark brown blotch on posterior end.

Size: Maximum shell length 7.5 cm, commonly to 6 cm.

Habitat, biology, and fisheries: In fine sandy bottoms. Littoral and sublittoral to a depth of 60 m. Actively exploited in the Philippines where it represents an important commercial species.

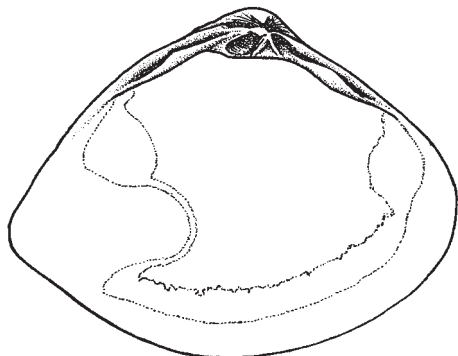
Distribution: Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to Japan and south to north Queensland and New Caledonia.



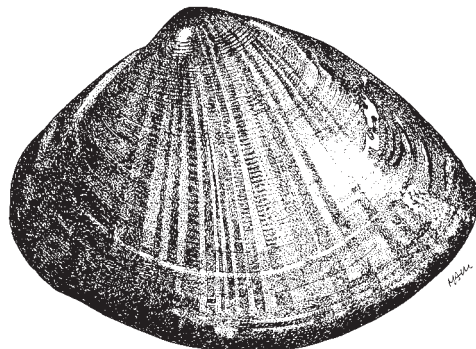
Mactra mera Reeve, 1854

Frequent synonyms / misidentifications: *Mactra antiquata* Reeve, 1854 (not of Spengler, 1802); *M. mera* Deshayes, 1855 / *Mactra grandis* Gmelin, 1791

FAO names: En - Plain troughshell; Fr - Mactre pure.



interior of left valve



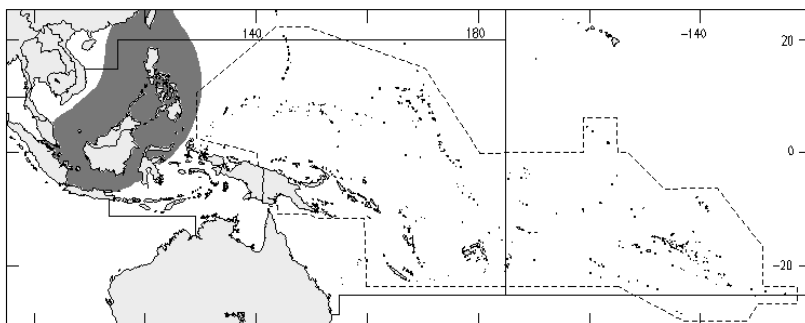
exterior of left valve
(after Habe and Kosuge, 1966)

Diagnostic characters: Shell moderately inflated, **subtrigonal** in outline, **nearly closed**. Umbones somewhat in front of midline of valves. **Dorsal margin markedly sloping** on either side of umbo. Anterior margin narrowly rounded, **posterior margin subangulate**. Posterodorsal slope of valves set off by a smooth angulation radiating from umbones to posteroventral end. Outside of shell smoothish, but for **concentric grooves on lunule and escutcheon areas**. Periostracum thin and adherent, mainly persisting on periphery of shell. **Lateral hinge teeth well developed**, 1 anterior and 1 posterior in left valve, 2 anterior and 2 posterior in right valve. **Pallial sinus broad and rounded, moderately shallow** nearly as high as long. **Colour:** **outside of shell purplish brown, with lighter and darker radial and concentric bands**, and tinged deep purple on umbones. Periostracum brownish. **Interior purple**, often with a lighter greyish hue on hinge and umbonal cavity.

Size: Maximum shell length 9 cm, commonly to 7 cm.

Habitat, biology, and fisheries: In sandy bottoms. Littoral and sublittoral to a depth of 30 m. Actively exploited in the Philippines where it represents a moderately important commercial species.

Distribution: Exact distribution not known because of confusion with *Mactra grandis*. Tropical western Pacific, from southern Japan to the Philippines and Indonesia; not in Australia.

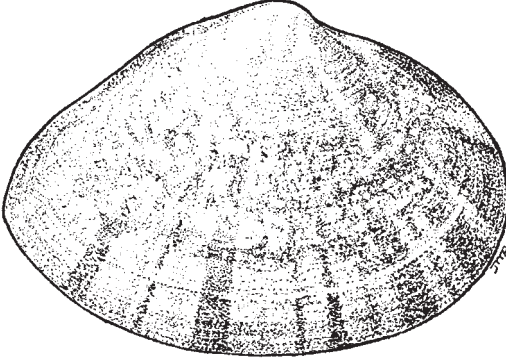


Mactra achatina Holten, 1802

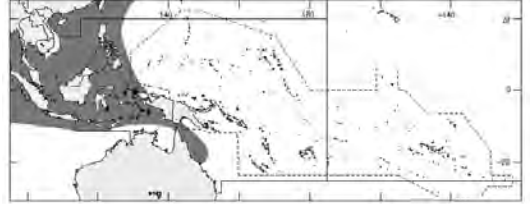
Frequent synonyms / misidentifications: *Mactra achatina* Chemintz, 1785 (Invalid name); *M. adpersa* Dunker, 1849; *M. maculosa* Lamarck, 1818; *M. ornata* Gray, 1836 / None.

En - Agate troughshell; **Fr** - Mactre achatine.

Maximum shell length 7.5 cm, commonly to 4.5 cm. In various sandy to muddy bottoms. From low tide level to a depth of about 60 m. Occasional bycatch in sublittoral trawling activities, in South East Asian countries. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to the Philippines and Indonesia; north to Japan and south to central Queensland.



exterior of right valve

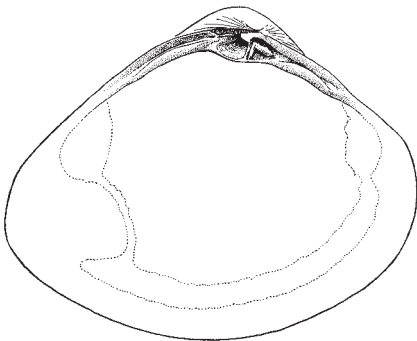


Mactra cuneata Gmelin, 1791

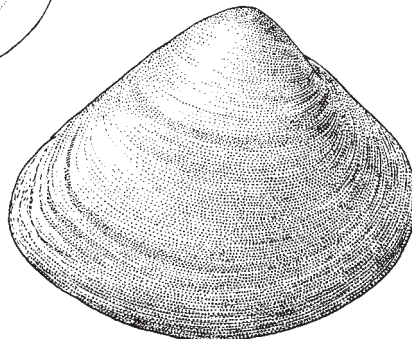
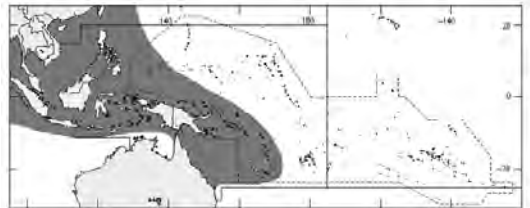
Frequent synonyms / misidentifications: *Colorimactra florens* Iredale, 1929 / None.

En - Wedge troughshell; **Fr** - Mactre cunéiforme.

Maximum shell length 4 cm, commonly to 3 cm. In muddy-sand bottoms. Littoral and sublittoral to a depth of 50 m. Locally collected for subsistence by coastal populations. Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to southern Japan and south to Queensland and New Caledonia.



interior of left valve



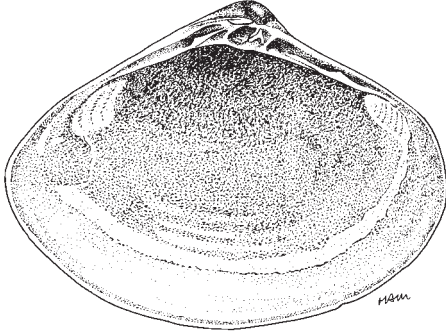
exterior of right valve

***Maetra violacea* Gmelin, 1791**

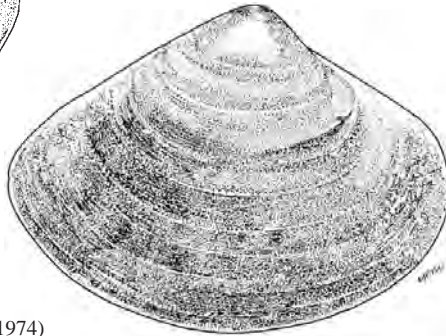
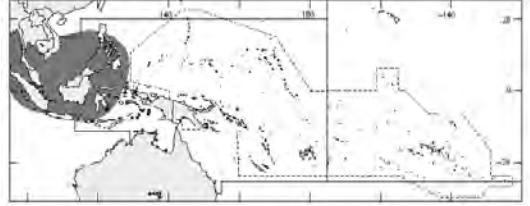
Frequent synonyms / misidentifications: *Coelomaetra violacea* (Gmelin, 1791) / None.

En - Violet troughshell; **Fr** - Mactre violette.

Maximum shell length 9.5 cm, commonly to 6 cm. In sandy bottoms, at shallow subtidal levels. Collected locally for subsistence. Indo-West Pacific, from eastern Indian Ocean to Indonesia and the Philippines.



interior of left valve



exterior of right valve

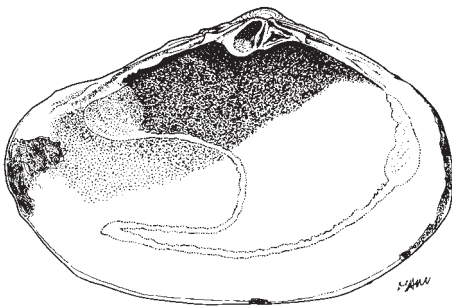
(after Dance, 1974)

***Meropesta capillacea* (Reeve, 1854)**

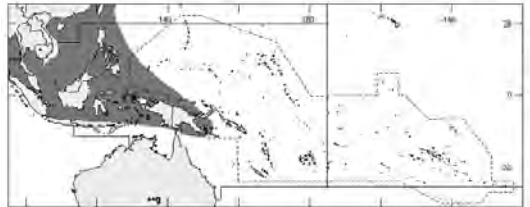
Frequent synonyms / misidentifications: *Spisula capillacea* (Deshayes, 1855); *Standella capillacea* (Reeve, 1854) / None.

En - Maidenhair maetra; **Fr** - Lutraire capillaire.

Maximum shell length 6.5 cm, commonly to 5 cm. In sandy-mud bottoms of the littoral zone. Frequent in local markets of the central Philippines, mixed with other bivalves. Indo-West Pacific, from India to the Philippines; north to Japan and China and south to Papua New Guinea.



interior of left valve



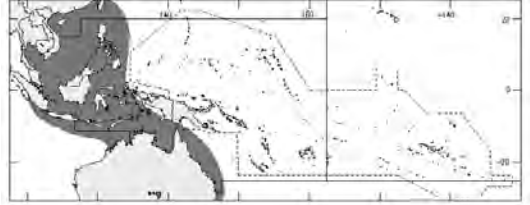
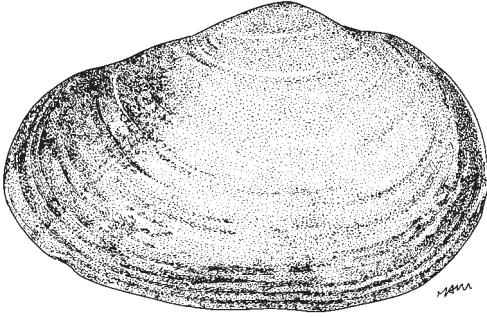
exterior of right valve

Meropesta pellucida (Gmelin, 1791)

Frequent synonyms / misidentifications: *Mactra depressa* Lamarck, 1819; *M. pellucida* Chemnitz, 1782 (Invalid name); *Spisula pellucida* (Gmelin, 1791); *Standella fragilis* Gray, 1853; *S. hubbardi* Iredale, 1929; *S. pellucida* (Gmelin, 1791) / None.

En - Pellucid mactra; **Fr** - Lutraire déprimée.

Maximum shell length 6 cm, commonly to 4.5 cm. In littoral sand and mud bottoms. Collected for subsistence in Indonesia, where it is locally common. Tropical western Pacific, from East and South China Seas to Indonesia and Australia; south to northern New South Wales.



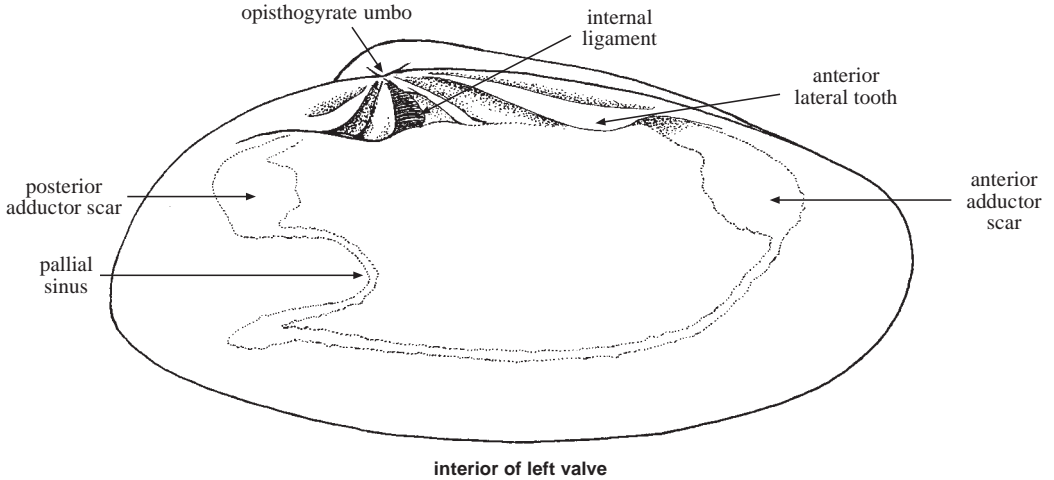
exterior of right valve

(after Lamprell and Whitehead, 1992)

MESODESMATIDAE

Wedge clams

Diagnostic characters: **Shell** equivalve, usually thick and heavy, more or less compressed laterally, **inequilateral**, elongate ovate or **subtrigonal to wedge-shaped** in outline. **Umbones** **opisthogyrate**. Outer surface smooth or mostly concentrically sculptured, with a well-developed and often glossy periostracum. External ligament short and not prominent, communicating with a strong **internal ligament** fitting in each valve in a **deep pit of the hinge plate**. Hinge with **1 or 2 cardinal teeth** and more or less developed **lateral teeth** in each valve. Interior of shell porcelaneous. **Two adductor muscle scars**, subequal in size. **Pallial line with a rather short sinus**. Internal margins smooth. Gills of eulamellibranchiate type, with folded branchial sheets. Foot strong and subtrigonal, without a byssus. Siphons separate, naked, papillate on top. Mantle margins smooth, with an anteroventral gape.

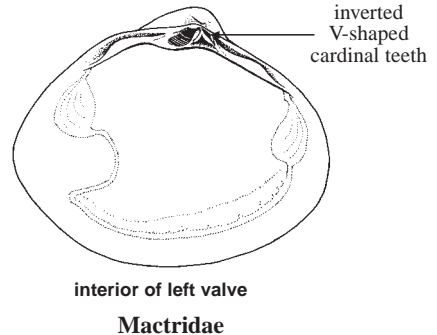
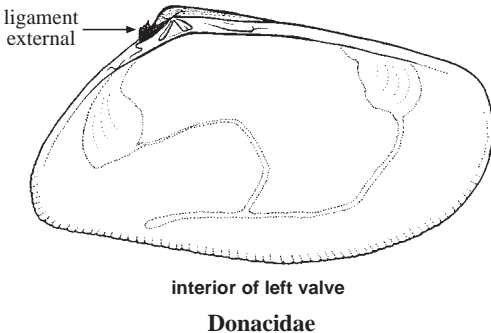


Habitat, biology, and fisheries: Suspension filter-feeding animals, actively burrowing in sandy bottoms; sexes separate; development with a free-swimming larval stage; locally collected as food by coastal people.

Similar families occurring in the area

Donacidae: hinge differently shaped, without an internal ligament; pallial sinus rather deep.

Mactridae: umbones prosogyrate; hinge of left valve with an inverted V-shaped process in front of the umbo; siphons fused; branchial sheets smooth.



References

- Beu, A.G. and L.A. De Rooij-Schuilng. 1982. Subgeneric classification of New Zealand and Australian species of *Paphies* Lesson (Bivalvia: Mesodesmatidae), and names for the two species of tuatua in New Zealand. *N.Z. J. Zool.*, 9:211-230.
- Sakurai, K. and T. Habe. 1973. Family Mesodesmatidae of Japan and adjacent areas with the description of a new species. *Venus*, 32(1):1-6.

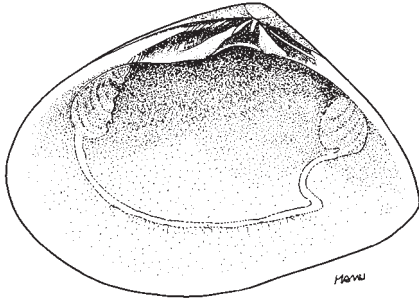
A single species of interest to fisheries occurring in the area

Atactodea striata (Gmelin, 1791)

Frequent synonyms / misidentifications: *Atactodea glabrata* (Gmelin, 1791); *Mesodesma trigonum* Deshayes, 1853; *Paphies striata* (Gmelin, 1791) / None.

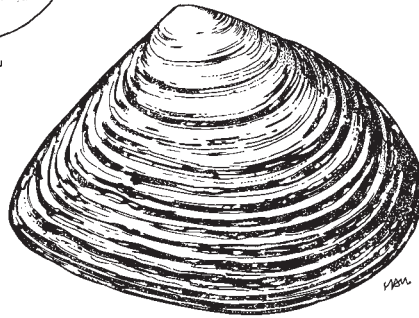
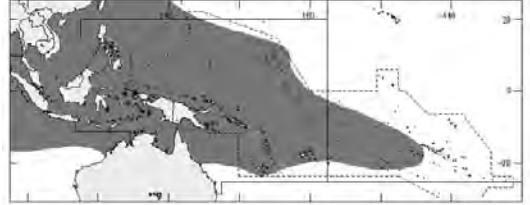
En - Striate beach clam; **Fr** - Mésodesme glabre.

Maximum shell length 4 cm, commonly to 2.5 cm. In sandy beaches, often abundant. Intertidal. Collected as food in some areas by coastal inhabitants. This abundant species is known to be exploited in Fiji Islands, India, and Japan. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan and south to central Queensland.



interior of right valve

(after Habe, 1977)

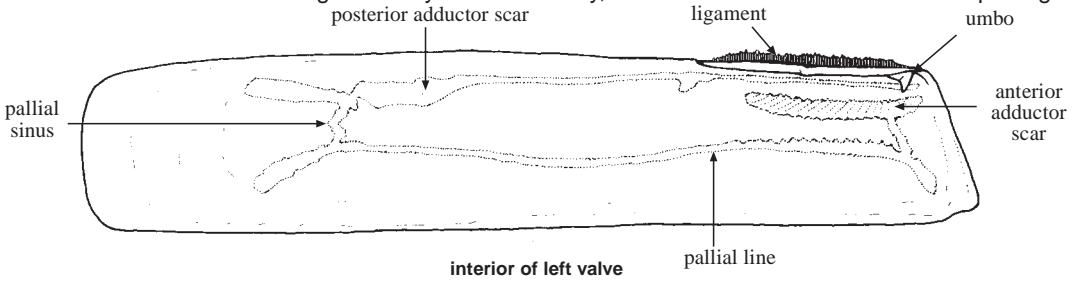


exterior of right valve

SOLENIDAE

Knife and razor clams

Diagnostic characters: **Shell equivalve**, laterally compressed to subcylindrical in cross-section, with **a narrowly elongate**, often sword-like or razor-like **shape**, very inequilateral and **gaping at both ends**. **Umbones** not prominent, **frequently near the anterior end** of dorsal margin. Outside of shell essentially with concentric growth marks, often changing abruptly in direction along a diagonal line running from the umbones to the posteroventral end of valves. Periostracum prominent, frequently glossy. **Ligament external**, set in an elongate linear groove of posterodorsal margin. **Hinge feeble**, with at least 1 peg-like cardinal tooth in each valve, and sometimes 1 or 2 lamellar posterior teeth. Interior of shell porcelaneous. **Two** dorsally placed, narrowly elongate to rounded, **adductor muscle scars**, the **anterior one** commonly **larger**. **Pallial sinus relatively shallow**, its ventral, and even sometimes dorsal limb largely confluent with pallial line. Internal margins smooth. Gills of eulamellibranchiate type, posteriorly placed, with smooth or folded branchial sheets. Foot long and narrow, often terminally swollen. Siphons naked, short to long, fused, at least at their base. Mantle margins widely fused ventrally, with an anterior to anteroventral opening.

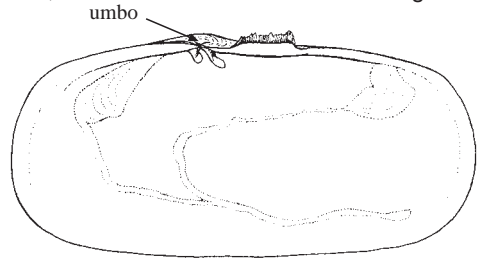


Habitat, biology, and fisheries: Filter-feeding animals, adapted to swift and deep-burrowing in soft bottoms with their powerful foot, capable of swelling at the end and protruding anteriorly through the narrowly elongate shell. Intertidal species of Solenidae are sometimes actively exploited, notably in the Philippines, Indonesia, and Malaysia.

Remarks: Some authors split razor clams into 2 families, considering that some species belong to a distinct family the Pharidae (or Cultellidae). However, they often disagree upon systematics and content of the latter family, a number of species of which have tellinoid affinities. One useful character to distinguish the razor clam families is the occurrence of at least 2 hinge teeth per valve in the Pharidae, instead of only 1 tooth in the Solenidae. A more conservative view is followed here, and both families are included together within the Solenidae.

Similar families occurring in the area

Solecurtidae: shell generally subequilateral, with subcentral umbones; pallial sinus deep; siphons long and separate; cruciform muscles generally present.

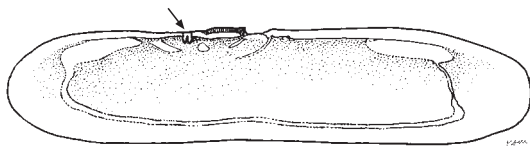


interior of right valve

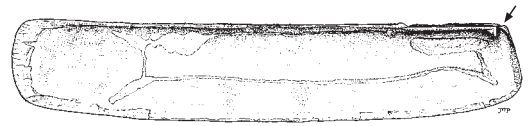
Solecurtidae

Key to species of interest to fisheries occurring in the area

- 1a. Umbones markedly behind the antero-dorsal end of shell; hinge with at least 2 cardinal teeth in each valve (Fig. 1a) → 2
- 1b. Umbones nearly at the anterodorsal end of shell; hinge with only 1 cardinal tooth in each valve (Fig. 1b) → 4



a) *Pharella* (right valve)



b) *Solen* (left valve)

Fig. 1 interior of a valve

- 2a. Umbones anterior to the first third of shell length; interior of valves with a narrow radial rib running diagonally from umbones to anteroventral margin; pallial sinus deep (Fig. 2) *Siliqua winteriana*
- 2b. Umbones posterior to the first third of shell length; interior without a narrow, diagonal radial rib; pallial sinus very shallow (Fig. 1a) → 3
- 3a. Shell very thin and elongated; periostracum light brown to greenish (Fig. 3) . . . *Pharella acutidens*
- 3b. Shell moderately thin and elongated; periostracum brownish, often dark in the middle of shell (Fig. 4) *Pharella javanica*

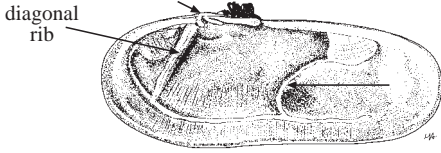


Fig. 2 *Siliqua winteriana* (interior)

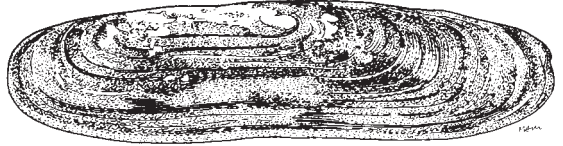


Fig. 3 *Pharella acutidens* (exterior)

- 4a. Shell relatively small, less than 5 cm in length; dorsal margin slightly concave; outside of shell with a rosy scattering (Fig. 5) *Solen roseomaculatus*
- 4b. Shell relatively large, exceeding 7 cm in length; dorsal margin not concave, nearly straight; outside of shell without a rosy scattering → 5



Fig. 4 *Pharella javanica* (exterior)



Fig. 5 *Solen roseomaculatus* (exterior)

- 5a. Shell medium sized, reaching 10 cm in length; outside of shell marked with purplish concentric bands, under a purplish brown periostracum (Fig. 6) *Solen lamarckii*
- 5b. Shell large sized, reaching 15 cm in length; outside of shell marked with pale rosy concentric bands, under a greenish yellow periostracum (Fig. 7) *Solen grandis*



Fig. 6 *Solen lamarckii* (exterior)

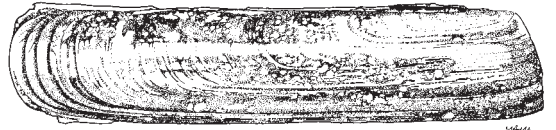


Fig. 7 *Solen grandis* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Pharella acutidens* (Broderip and Sowerby, 1828)
- 🐚 *Pharella javanica* (Lamarck, 1818)
- 🐚 *Siliqua winteriana* Dunker, 1852
- 🐚 *Solen grandis* Dunker, 1861
- 🐚 *Solen lamarckii* Deshayes, 1839
- 🐚 *Solen roseomaculatus* Pilsbry, 1901

References

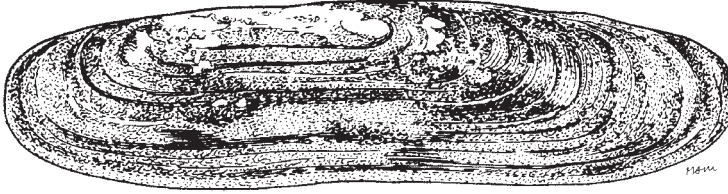
Cosel, R. von. 1990. An introduction to the razor shells (Bivalvia: Solenacea). In *The bivalvia. Proceedings of a memorial symposium in honour of Sir Charles Maurice Yonge, Edinburgh, 1986*, edited by B.S. Morton. Hong Kong, Hong Kong University, pp. 283-311.

Habe, T. 1964. Razor shells in Japan and its adjacent areas. *Bull. Nat. Sci. Mus.*, 7(1):7-15.

Pharella acutidens (Broderip and Sowerby, 1828)

Frequent synonyms / misidentifications: *Azorinus acutidens* (Broderip and Sowerby, 1828) / None.

FAO names: En - Sharp razor clam; Fr - Couteau tranchant



exterior of left valve

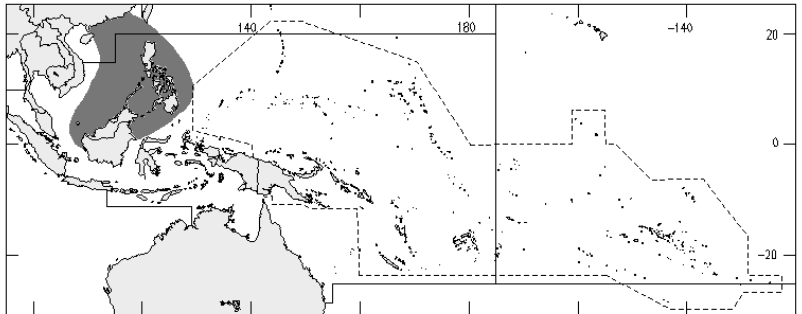
(after Abbott and Dance, 1983)

Diagnostic characters: Shell very thin and elongated, about 5 times longer than high. Anterior and posterior margins rounded. **Ventral margin** roughly parallel to dorsal margin, **slightly contracted in the middle**. **Umbones** low, situated **behind the anterior 1/3 of shell length**. Outer surface of valves with fine concentric growth lines. **Cardinal teeth** blade-like and **fragile, 2 in left valve and 3 in right valve**. Internal surface smooth, without a narrow, diagonal radial rib under the umbones. Adductor scars subequal, elongate ovate in shape, extending along the internal anterodorsal and posterodorsal margins. **Pallial sinus very shallow**, reduced to a slightly oblique line under the hind part of posterior adductor scar. **Colour:** outside of shell **off-white under the light brown to greenish periostracum**. Interior pale cream to bluish white.

Size: Maximum shell length 8 cm, commonly to 6 cm.

Habitat, biology, and fisheries: In mud and sand bottoms of mangrove areas. Often in mixed populations with *Pharella javanica*. Intertidal and shallow waters to a depth of 10 m. Active local exploitation in the Philippines. The shell is used for shellcraft.

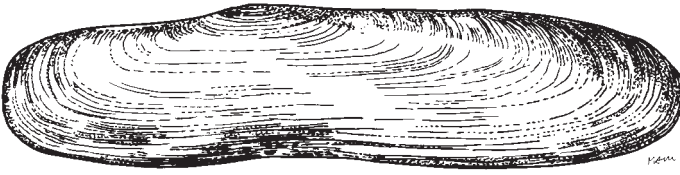
Distribution: Restricted to the tropical western Pacific, in South China Sea, Indonesia, and the Philippines.



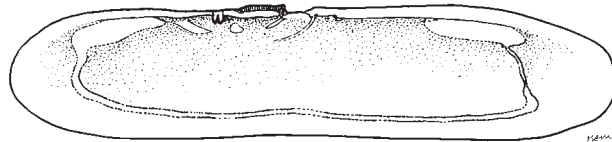
Pharella javanica (Lamarck, 1818)

Frequent synonyms / misidentifications: None / None.

FAO names: En - Javanese razor clam; Fr - Couteau javanais.



exterior of left valve
(after Chenu, 1862)



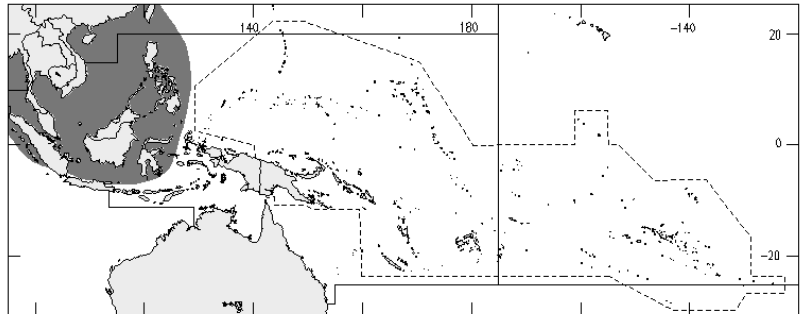
interior of right valve
(after von Cosel, 1990)

Diagnostic characters: Shell moderately thin and elongated, about 4 times longer than high. Anterior and posterior margins rounded. Ventral margin roughly parallel to dorsal margin, straightish, often faintly depressed in the middle. Umbones low, situated slightly behind the anterior 1/3 of shell length. Outer surface of valves with irregular concentric growth lines. Cardinal teeth blade-like and fragile, 2 in left valve and 3 in right valve. Internal surface smooth, without a narrow, diagonal radial rib under the umbones. Adductor scars subequal, elongate-ovate in shape, extending along the internal anterodorsal and posterodorsal margins. Pallial sinus very shallow, reduced to a slightly oblique line under the hind part of posterior adductor scar. **Colour:** outside of shell off-white under the brownish, often darker in the middle, periostracum. Interior pale cream to bluish white.

Size: Maximum shell length 8 cm, commonly to 6 cm.

Habitat, biology, and fisheries: In muddy or sandy bottoms, particularly in estuaries and mangrove areas. Sometimes in mixed populations with *Pharella acutidens*. Littoral and sublittoral to a depth of 25 m. Active local exploitation in the Philippines. The shell is used for shellcraft.

Distribution: Indo-West Pacific, from India to the Philippines; north to Taiwan Province of China and south to Indonesia.



Siliqua winteriana Dunker, 1852

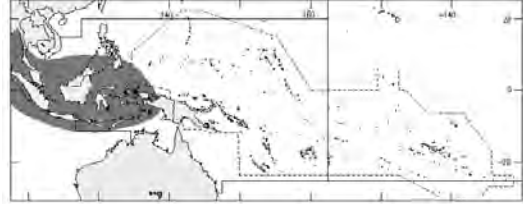
Frequent synonyms / misidentifications: *Neosiliqua winteriana* (Dunker, 1852) / None.

En - Winter's razor clam; **Fr** - Silique de Winter.

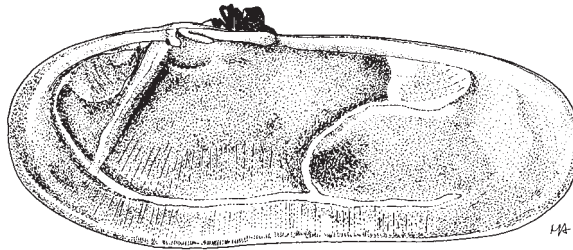
Maximum shell length 8 cm, commonly to 7 cm. In muddy bottoms. Intertidal and shallow waters. Common in Indonesia, where it is locally collected. Indo-West Pacific, from India to Indonesia.



exterior of left valve



(after Dunker, 1869)



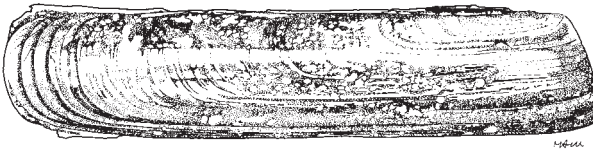
interior of right valve

Solen grandis Dunker, 1861

Frequent synonyms / misidentifications: *Solen beckii* Grabau and King, 1928 (not of Philippi, 1847) / *Solen aureomaculatus* Habe, 1964.

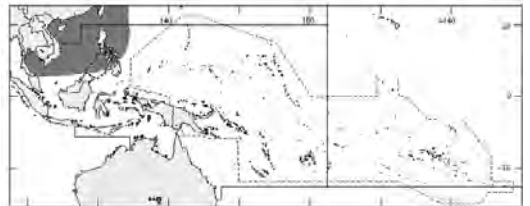
En - Grand razor shell; **Fr** - Grand couteau.

Maximum shell length 15 cm, commonly to 12 cm. In sandy bottoms. Littoral and sublittoral to a depth of 20 m. Occasionally marketed in Thailand and the Philippines. Tropical western Pacific, from Thailand to the Philippines; north to Korea and Japan.



exterior of right valve

(after Habe, 1964)

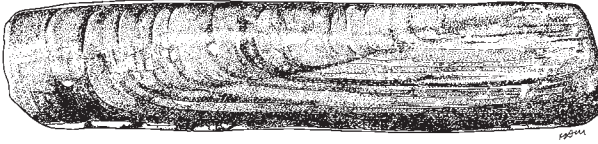


Solen lamarckii Deshayes, 1839

Frequent synonyms / misidentifications: *Solen lamarckii* Sowerby, 1874 / None.

En - Lamarck's razor shell; **Fr** - Couteau de Lamarck.

Maximum shell length 10 cm, commonly to 8 cm. In sandy bottoms. Littoral and sublittoral to a depth of 25 m. Collected for subsistence in some areas. Known to be artisanally exploited and marketed in India. Indo-West Pacific, from India and Sri Lanka to Borneo and the Philippines; north to South China Sea and Taiwan Province of China.



exterior of right valve

(after Habe, 1964)

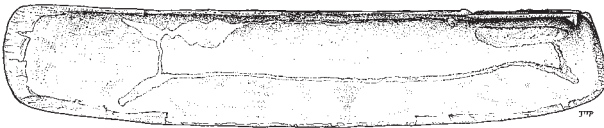


Solen roseomaculatus Pilsbry, 1901

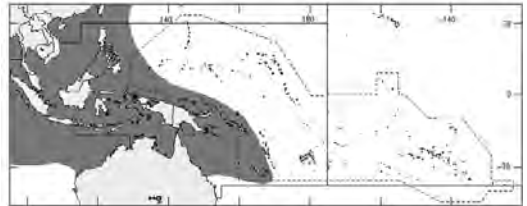
Frequent synonyms / misidentifications: None / None.

En - Pink-spotted razor shell; **Fr** - Couteau à points roses.

Maximum shell length 5 cm, commonly to 4 cm. In various sandy to muddy bottoms. Littoral, sublittoral and shelf zones to a depth of about 100 m. No data on the exploitation of this common small species in the area. It is commonly collected for food in eastern Africa. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf to Melanesia; north to East China Sea and Japan, and south to Queensland and New Caledonia.



interior of left valve

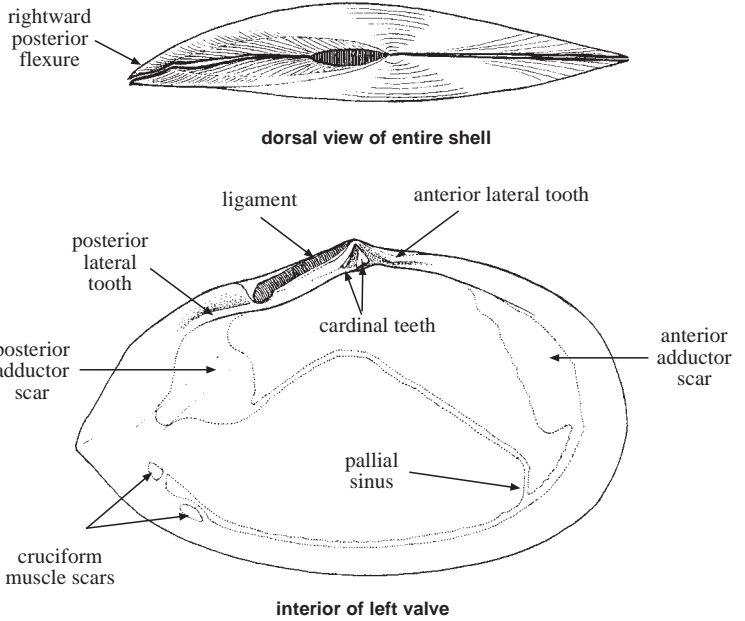


exterior of right valve

TELLINIDAE

Tellins

D **Diagnostic characters:** **Shell** variable in shape, usually elongate-ovate or suborbicular, **rather thin and somewhat laterally compressed, often slightly inequivalve (with a rightwards flexure on posterior end).** Umbones low. Outer surface often brightly coloured; sculpture not strong, chiefly concentric, sometimes feeble. **Ligament external, arched, behind umbones.** Hinge with **2 small cardinal teeth in either valve** (1 of which is generally bifid); **lateral teeth often present,** generally better developed in the right valve, with the anterior lateral tending to be proximal to the cardinal teeth. Interior of shell porcelaneous. **Two adductor muscle scars,** the anterior more or less elongated, the posterior somewhat rounded or quadrate. **Pallial sinus deep,** sometimes of a different shape in the 2 valves, often largely confluent ventrally with the pallial line. **Cruciform muscles leaving small paired round scars near the posteroventral end of pallial line.** Internal margins smooth. Gills of eulamellibranchiate type, with smooth branchial sheets, the outer one raised and sometimes reduced. Foot strong, laterally compressed. Long, narrow, separate and mobile naked siphons, with 6 lobes on top. Cruciform muscles present. Mantle margins widely open anteroventrally.



Habitat, biology, and fisheries: Active burrowers of soft substrates in which they may constitute dense communities, sucking up organic matter from the sea floor with their long siphons. Lay frequently in a horizontal position within the substrate, with the left valve uppermost. Sexes generally separate. Development with a free-swimming larval stage. Tellins are collected for food by coastal populations in many areas, and their delicate and often colourful shells are frequently used to make decorative items.

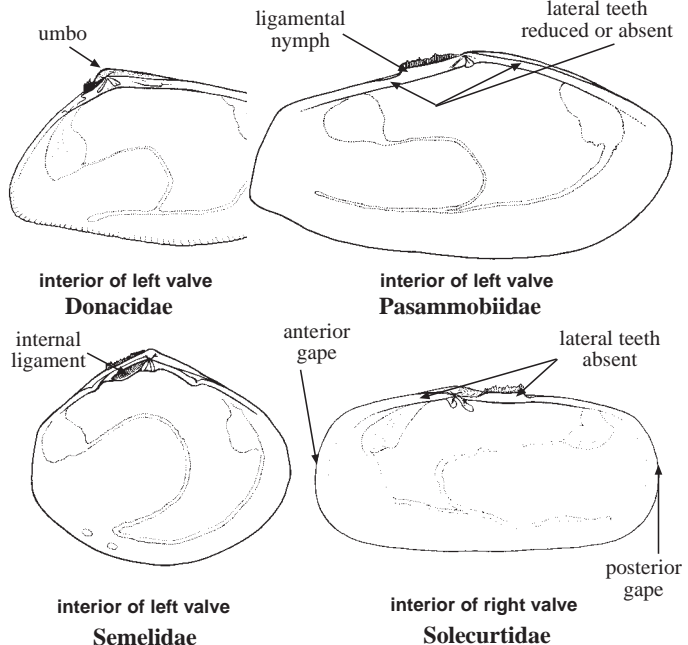
Similar families occurring in the area

Donacidae: trigonal to wedge-shaped shell with opisthogyrate umbones usually markedly posterior in position; hinge with cardinal and lateral teeth; cruciform muscle scars obscure; siphons quite short.

Psammobiidae: ovate to subelliptical or trapezoidal shell, weakly gaping at both ends; lateral teeth weak to absent; external ligament set on projecting nymphs.

Semelidae: a large, internal ligament, lodged in an oblique groove of the hinge plate in either valve.

Solecurtidae: shell elongate-subrectangular, widely gaping at both ends; no posterior flexure; lateral teeth absent.



Key to species of interest to fisheries occurring in the area

- 1a. Shell strongly folded posteriorly; hinge with cardinal teeth, but without lateral teeth (Fig. 1) . . . *Apolymetis ehippium*
- 1b. Shell not strongly folded posteriorly; hinge with cardinal and lateral teeth (Fig. 2) → 2

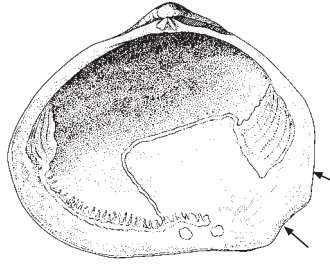


Fig. 1 *Apolymetis ehippium* (interior)



Fig. 2 *Tellina* (hinge of left valve)

- 2a. Outer surface with numerous, erect concentric scales → 3
- 2b. Outer surface without erect concentric scales → 4

- 3a. Shell nearly as high as long (Fig. 3) . . . *Tellina scobinata*
- 3b. Shell distinctly longer than high (Fig. 4) *Tellina linguafelis*

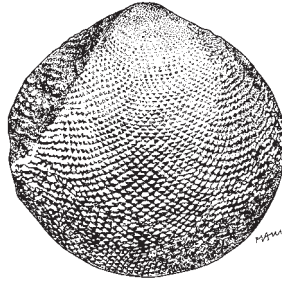


Fig. 3 *Tellina scobinata* (exterior)

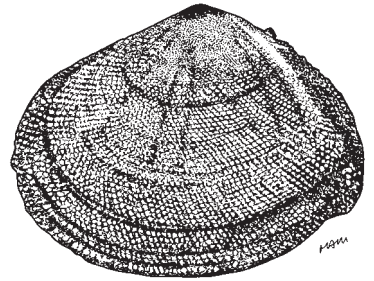


Fig. 4 *Tellina linguafelis* (exterior)

- 4a. Shell rounded-ovate to orbicular in outline → 5
- 4b. Shell elongate-ovate in outline → 6

- 5a. Sculpture of quite regular concentric ridges; anterior end of pallial sinus distant from anterior adductor muscle scar, but connected to it by a thin line (Fig. 5) *Tellina remies*
- 5b. Sculpture of irregular concentric wavy ridges; anterior end of pallial sinus close to anterior adductor muscle scar, but not connected to it by a thin line (Fig. 6) *Tellina palatam*

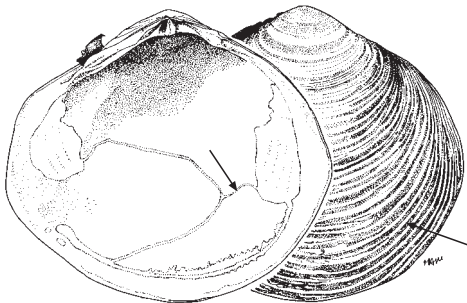


Fig. 5 *Tellina remies*

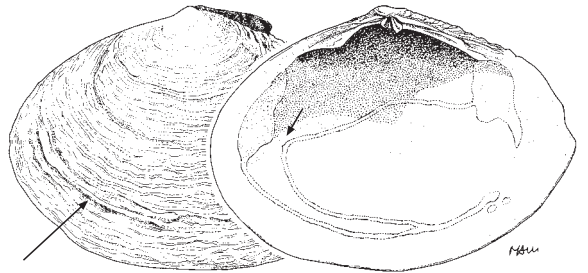


Fig. 6 *Tellina palatam*

6a. Hinge of right valve with 2 lateral teeth (1 anterior and 1 posterior) → 7

6b. Hinge of right valve with only 1 lateral tooth (the anterior one) (Fig. 7). *Tellina foliacea*

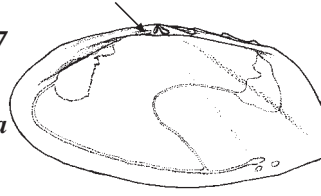


Fig. 7 *Tellina foliacea* (interior)

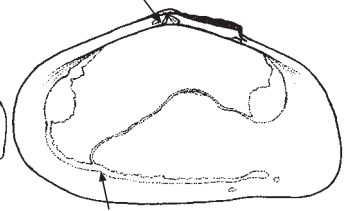


Fig. 8 *Tellina timorensis* (interior)

7a. Anterior lateral tooth of each valve close to cardinal teeth; ventral lobe of pallial sinus entirely confluent with the pallial line (Fig. 8). *Tellina timorensis*

7b. Anterior lateral tooth of each valve distant from cardinal teeth; ventral lobe of pallial sinus confluent with the pallial line in its posterior half → 8

8a. Shell height low in comparison to the length; umbones situated posterior to midlength; dorsal lobe of pallial sinus straightish (Fig. 9) *Tellina staurella*

8b. Shell height high in comparison to the length; umbones situated about mid-length; dorsal lobe of pallial sinus convex (Fig. 10) *Tellina virgata*

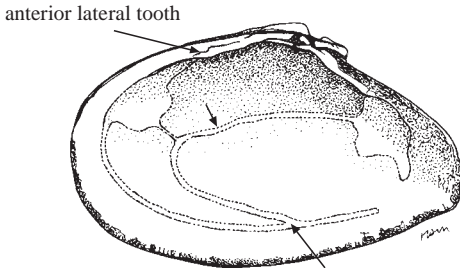


Fig. 9 *Tellina staurella* (interior)

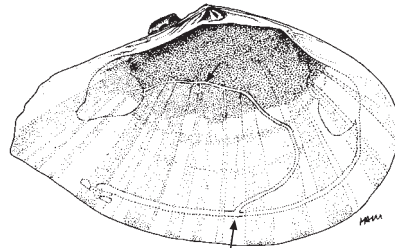


Fig. 10 *Tellina virgata* (interior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Apolymetis ephippium* (Spengler, 1798)
- 🐚 *Tellina foliacea* Linnaeus, 1758
- 🐚 *Tellina linguafelis* Linnaeus, 1758
- 🐚 *Tellina palatam* (Iredale, 1929)
- 🐚 *Tellina remies* Linnaeus, 1758
- 🐚 *Tellina scobinata* Linnaeus, 1758
- 🐚 *Tellina staurella* Lamarck, 1818
- 🐚 *Tellina timorensis* (Lamarck, 1818)
- 🐚 *Tellina virgata* Linnaeus, 1758

References

Afshar, F. 1969. Taxonomic revision of the superspecific groups of the cretaceous and cenozoic Tellinidae. *Geol. Soc. Am. Mem.*, 119:1-215.

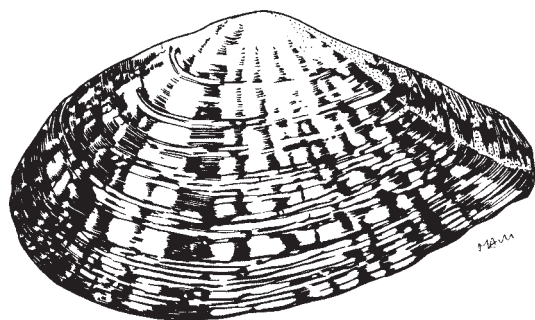
Boss, K.J. 1968. The subfamily Tellininae in South African waters. *Bull. Mus. Comp. Zool.*, 138(4):81-162.

Scarlato, O.A. 1965. Bivalve molluscs, superfamily Tellinacea of the China seas. *Stud. Mar. Sin.*, (8):27-114.

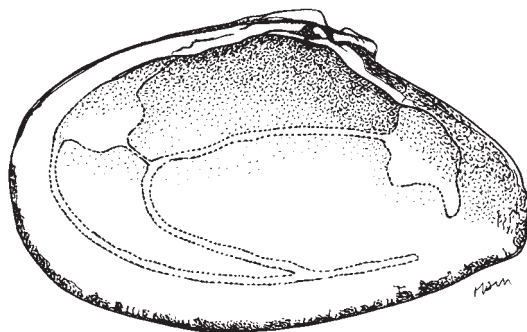
Tellina staurella Lamarck, 1818

Frequent synonyms / misidentifications: *Liotribella staurella* (Lamarck, 1818); *Tellinella staurella* (Lamarck, 1818) / *Tellina crucigera* Lamarck, 1818.

FAO names: En - Cross tellin; Fr - Telline croisette.



exterior of left valve



interior of right valve

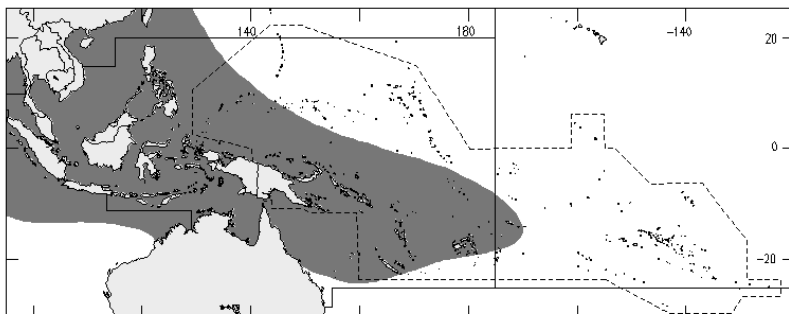
(after Habe, 1965)

Diagnostic characters: Shell elongate-ovate in outline, well rounded anteriorly and attenuated posteriorly. Height relatively low in comparison to the length. Rightwards flexure of valves relatively slight. Umbones distinctly posterior to midlength of shell. Outer surface with numerous, regularly spaced, fine concentric ridges. Anterior cardinal tooth of left valve and posterior cardinal of right valve bifid. One anterior and 1 posterior lateral tooth in each valve, strong in right valve, feeble in left valve. Posterior lateral teeth situated below distal end of the ligamental groove. Anterior lateral teeth moderately distant from cardinal teeth. Anterior adductor muscle scar elongate, posterior scar roughly quadrate and with a distinct ventral expansion. Pallial sinus very deep, extending forwards to a short distance of anterior adductor scar. Dorsal lobe of pallial sinus straightish, ventral lobe confluent with the pallial line in its posterior half. **Colour:** outside yellow to whitish, usually with broken red radial rays; umbones often marked with a reddish cross. Interior similarly coloured, frequently tinged with yellow.

Size: Maximum shell length 6.5 cm, commonly to 5 cm.

Habitat, biology, and fisheries: In coarse sandy bottoms. Littoral and sublittoral to a depth of 30 m. Locally collected and marketed in the Philippines, for food and shellcraft.

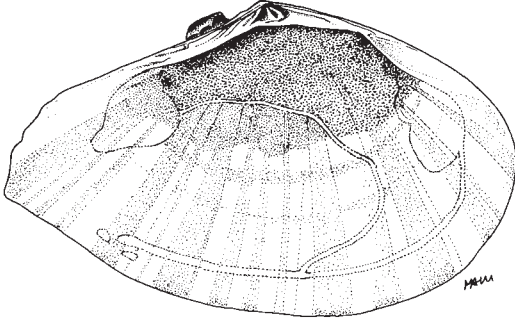
Distribution: Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Samoa Islands; north to Japan and south to central Queensland.



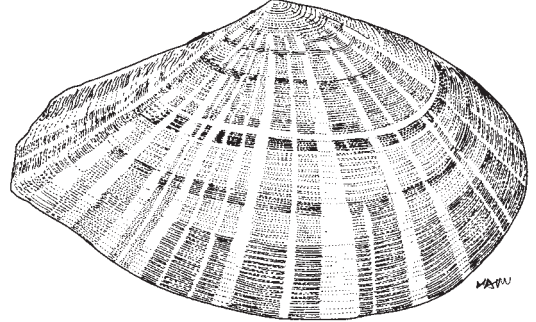
Tellina virgata Linnaeus, 1758

Frequent synonyms / misidentifications: *Tellinella virgata* (Linnaeus, 1758) / None.

FAO names: En - Virgate tellin; Fr - Telline vergée.



interior of left valve



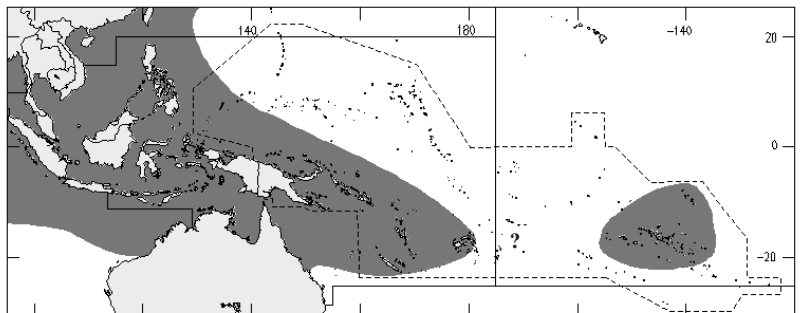
exterior of right valve

Diagnostic characters: Shell **elongate-ovate** in outline, well rounded anteriorly and attenuated posteriorly. **Height relatively high in comparison to the length.** Rightwards flexure of valves moderately strong, forming a depressed radial fold on posterodorsal slope of left valve. **Umbones situated about midlength of valves. Outer surface with numerous, regularly spaced, fine concentric ridges.** Anterior cardinal tooth of left valve and posterior cardinal of right valve bifid. **One anterior and 1 posterior lateral tooth in each valve**, strong in right valve, feeble in left valve. Posterior lateral teeth situated below distal end of the ligamental groove. **Anterior lateral teeth rather distant from cardinal teeth.** Anterior adductor muscle scar elongate, posterior scar roughly quadrate and with a distinct ventral expansion. **Pallial sinus very deep**, extending forwards to a short distance of anterior adductor scar. **Dorsal lobe of pallial sinus markedly convex, ventral lobe confluent with the pallial line in its posterior half.** **Colour:** outside white to yellow, usually with numerous, unequal, pink to red or purplish radial rays that are more or less interrupted concentrically; umbones sometimes with pink or yellowish hue. Interior paler, similarly coloured, often tinged yellow towards the umbones.

Size: Maximum shell length 8.5 cm, commonly to 5 cm.

Habitat, biology, and fisheries: In sand or muddy sand bottoms, in various environments (open marine coasts, sheltered bays, or estuaries). Littoral and sublittoral to a depth of 30 m. Collected for food and marketed in the Philippines. The shell is often used to make decorative items.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Persian Gulf, to eastern Polynesia; north to southern Japan and south to central Queensland.

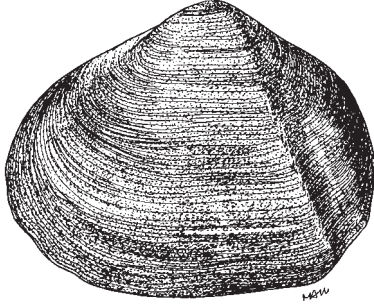


***Apolymetis ehippium* (Spengler, 1798)**

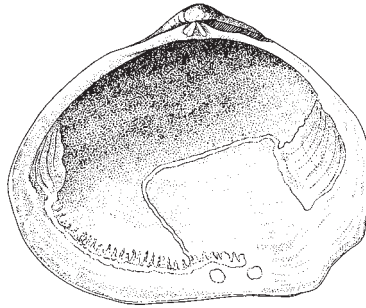
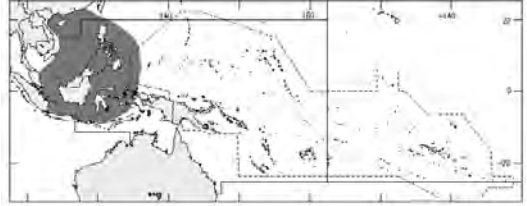
Frequent synonyms / misidentifications: *Leporimetis ehippium* (Spengler, 1798); *Psammotreta ehippium* (Spengler, 1798) / *Apolymetis papyracea* (Gmelin, 1791).

En - Saddle grooved macoma; **Fr** - Telline lacuneuse.

Maximum shell length 7.5 cm, commonly to 5 cm. In sand and mud bottoms, from the intertidal zone to a depth of about 25 m. Locally collected for food in Indonesia. Restricted to the tropical West Pacific, from South China Sea to Indonesia.



exterior of left valve
(after Abbott and Dance, 1983)



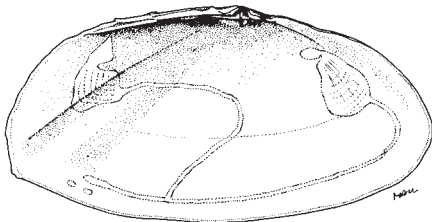
interior of right valve
(after Scarlato, 1965)

***Tellina foliacea* Linnaeus, 1758**

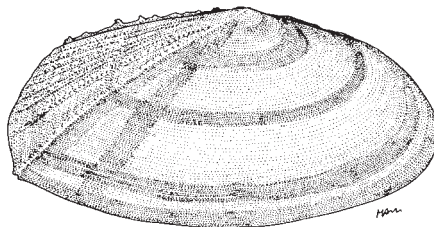
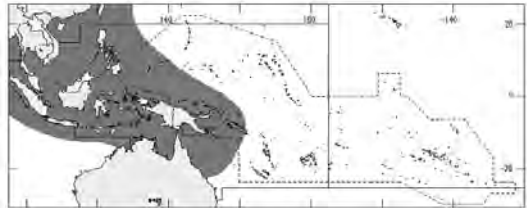
Frequent synonyms / misidentifications: *Phylloda foliacea* (Linnaeus, 1758) / None.

En - Foliated tellin; **Fr** - Telline foliacée.

Maximum shell length 9.5 cm, commonly to 7.5 cm. In fine clean sandy bottoms. Sublittoral, from a depth of 5 to about 50 m; most frequent between 8 and 20 m. Locally collected for human consumption; shell used in the shellcraft industry. Indo-West Pacific, from the Persian Gulf and India to Melanesia; north to southern Japan and south to Queensland.



interior of left valve



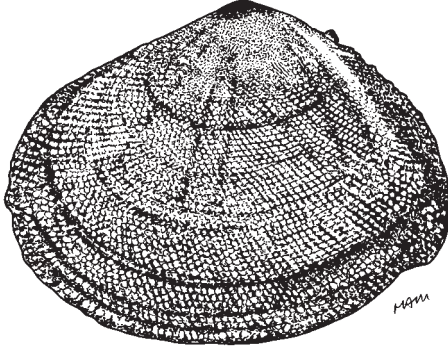
exterior of right valve

***Tellina linguafelis* Linnaeus, 1758**

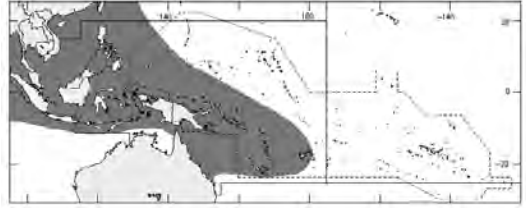
Frequent synonyms / misidentifications: *Scutarcopagia linguafelis* (Linnaeus, 1758) / None.

En - Cat's tongue tellin; **Fr** - Telline langue-de-chat.

Maximum shell length 6.5 cm, commonly to 5 cm. In coarse sandy bottoms. Littoral and sublittoral to a depth of 25 m. Locally marketed and eaten in the Philippines. Shell used for shellcraft. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, to Fiji Islands; north to southern Japan and south to Queensland.



exterior of left valve
(after Kira, 1962)

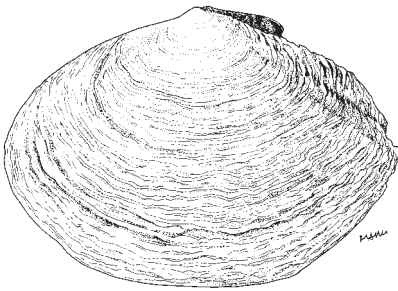


***Tellina palatam* (Iredale, 1929)**

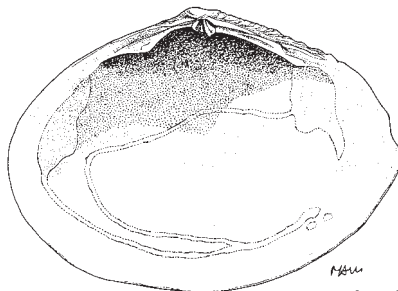
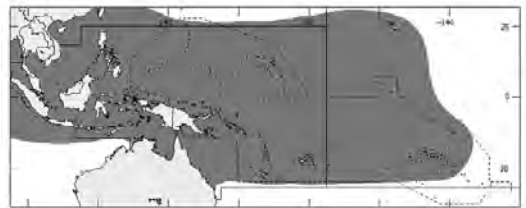
Frequent synonyms / misidentifications: *Quidnipagus palatam* Iredale, 1929; *Tellina rugosa* Born, 1778 (not Pennant, 1777) / None.

En - Palate tellin; **Fr** - Telline rugueuse.

Maximum shell length 6 cm, commonly to 5 cm. In coarse sandy bottoms. Common in lagoons of coral reefs. Littoral and sublittoral to a depth of 20 m. Collected for subsistence in many areas. Shell used for shellcraft in the Philippines. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan and Hawaii, and south to Queensland.



exterior of left valve



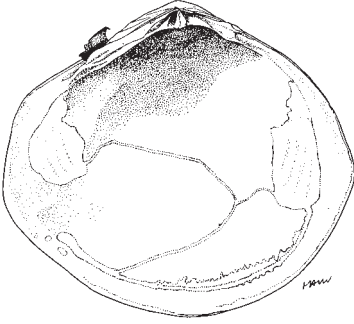
interior of right valve

***Tellina remies* Linnaeus, 1758**

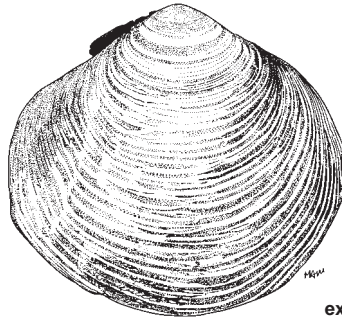
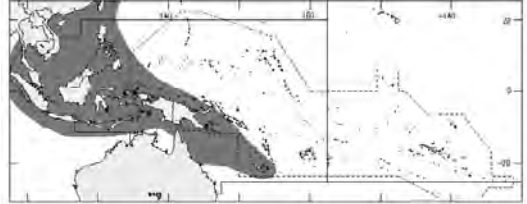
Frequent synonyms / misidentifications: *Cyclotellina remies* (Linnaeus, 1758); *Tellina sulcata* Lamarck, 1818 / None.

En - Remies tellin; **Fr** - Telline sillonnée.

Maximum shell length 10 cm, commonly to 7 cm. In sand and mud bottoms. Littoral and sublittoral to a depth of 30 m. Collected for food in the central and southern Philippines where it appears in local markets. Shell used for shellcraft. Eastern Indian Ocean to tropical western Pacific, from western Thailand to Papua New Guinea; north to southern Japan and south to central Queensland and New Caledonia.



interior of left valve



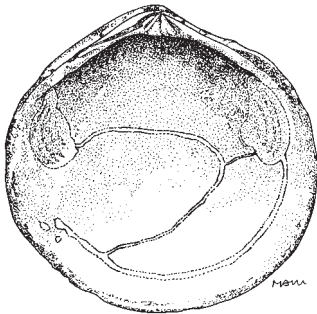
exterior of right valve

***Tellina scobinata* Linnaeus, 1758**

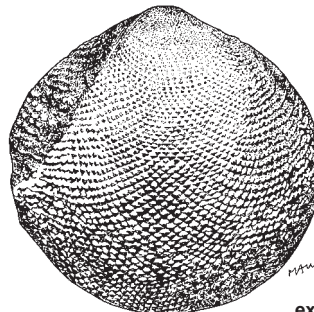
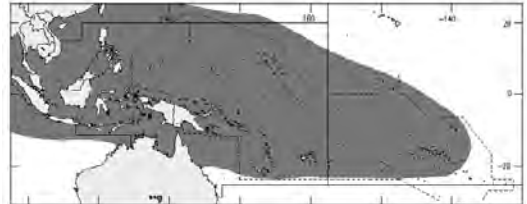
Frequent synonyms / misidentifications: *Scutarcopagia scobinata* (Linnaeus, 1758); *Tellina cratitia* Gould, 1861 / None.

En - Rasp tellin; **Fr** - Telline râpe.

Maximum shell length 7 cm, commonly to 6 cm. In coarse sand and gravel bottoms. Littoral and sublittoral to a depth of 20 m. Locally collected for food by coastal people in some areas, with other tellins. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to eastern Polynesia; north to Japan and south to central Queensland and New Caledonia.



interior of left valve



exterior of right valve

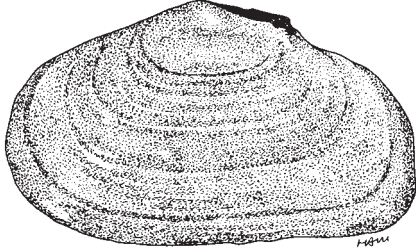
(after Afshar, 1969)

***Tellina timorensis* (Lamarck, 1818)**

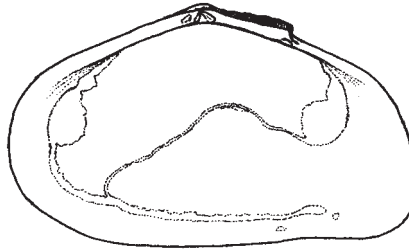
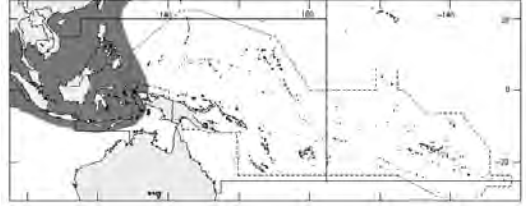
Frequent synonyms / misidentifications: *Tellina tridentata* Anton, 1838; *Tellinides timorensis* Lamarck, 1818 / None.

En - Timor tellin; **Fr** - Telline de Timor.

Maximum shell length 6 cm, commonly to 3.5 cm. In sandy bottoms. Littoral and sublittoral to a depth of 25 m. Locally collected for subsistence in Indonesia and Philippines. Marketed in the central Philippines. Central Indian Ocean to the tropical western Pacific, from Sri Lanka to the Philippines; north to southern Japan and south to southeastern Indonesia.



exterior of left valve
(after Kira, 1962)

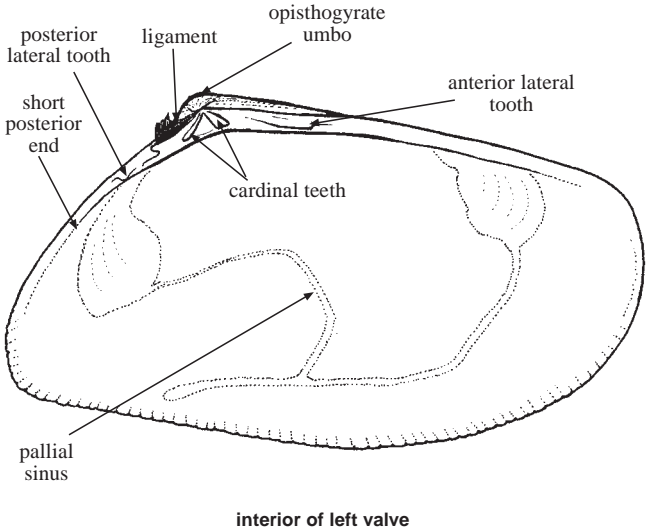


interior of right valve

DONACIDAE

Donax clams

D iagnostic characters: **Shell** equivalve or nearly so, usually solid, compressed, **trigonal to wedge-shaped**, not gaping; inequilateral, **with a shorter** and somewhat obliquely truncate **posterior end**. **Umbones** **opisthogyrate**. Posterodorsal slope often differently sculptured than the rest of the shell. **Ligament external**, in a groove behind umbones. Hinge with **2 small cardinal teeth** in each valve, the strongest commonly bifid, **and** more or less developed **lateral teeth**. Interior of shell porcelaneous. **Two adductor muscle scars**, about equal in size. **Pallial sinus deep**, largely confluent ventrally with the pallial line. **Cruciform muscle scars obscure**. Internal margins crenulated or smooth. Gills of eulamellibranchiate type, smooth or folded. Foot strong, laterally compressed. Siphons quite short, naked, separated to their base, with 6 lobes on top. Cruciform muscles present. Mantle margins widely open anteroventrally.



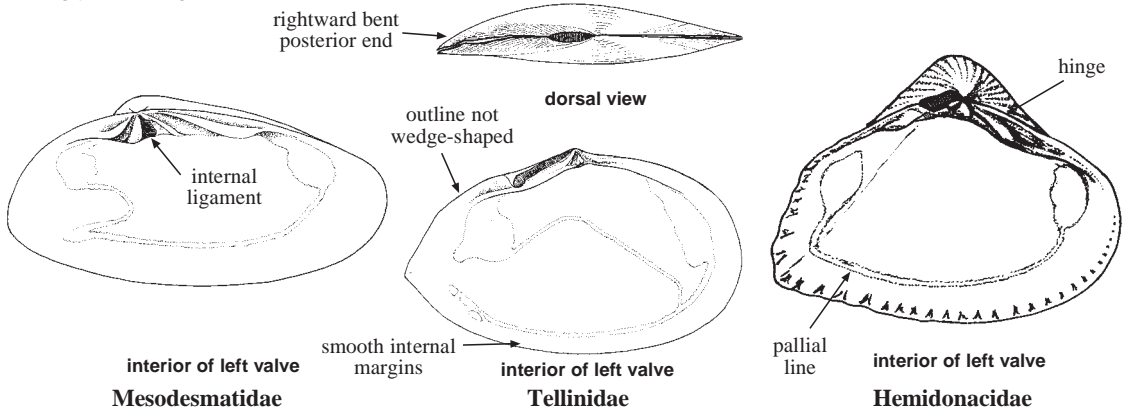
Habitat, biology, and fisheries: Quick shallow burrowers living in sandy bottoms, often under the influence of surf. Both suspension and deposit feeding animals. Sexes separate. Development with a free-swimming larval stage. Locally exploited by coastal people in the area. A single species is known to be collected in fairly large quantities in the Philippines.

Similar families occurring in the area

Mesodesmatidae: hinge with a large socket-like pit bearing an internal ligament.

Tellinidae: shell not wedge-shaped, often with a rightwards flexure on posterior end; internal margins never crenulated; cruciform muscle scars usually well marked; siphons elongated.

Hemidonacidae: shell shape similar to that of the Donacidae, but pallial line without a sinus and hinge strongly recalling that of the Cardiidae.



Key to species of interest to fisheries occurring in the area

- 1a. Shell rostrate posteriorly; posterior slope set off by a strong, spinose umbonoventral keel (Fig. 1) *Donax scortum*
- 1b. Shell not rostrate posteriorly; posterior slope set off by a blunt umbonoventral angle → 2
- 2a. Hinge without anterior lateral teeth (Fig. 2) *Donax deltoides*
- 2b. Hinge with anterior lateral teeth (Fig. 3) → 3

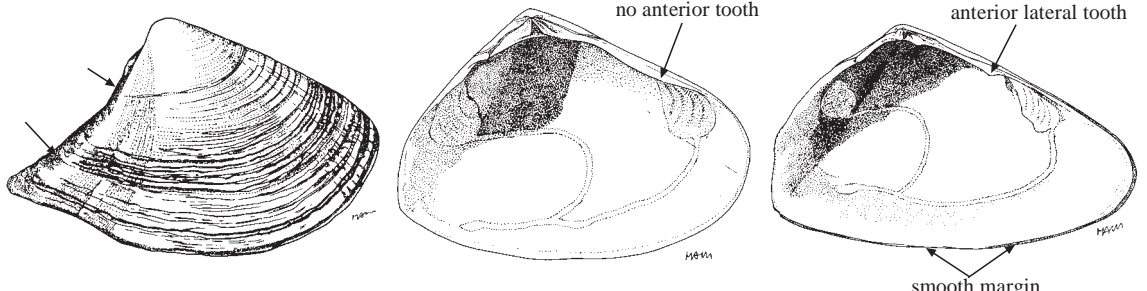


Fig. 1 *Donax scortum* (exterior) Fig. 2 *Donax deltoides* (interior) Fig. 3 *Donax cuneatus* (interior)

- 3a. Internal margins crenulated (Fig. 4) *Donax incarnatus*
- 3b. Internal margins smooth (Fig. 3) → 4
- 4a. Outer surface with fine concentric grooves, becoming strong and rugose on posterior slope (Fig. 5) *Donax cuneatus*
- 4b. Outer surface with strong concentric grooves on posterior third of shell, not becoming rugose on posterior slope (Fig. 6) *Donax faba*

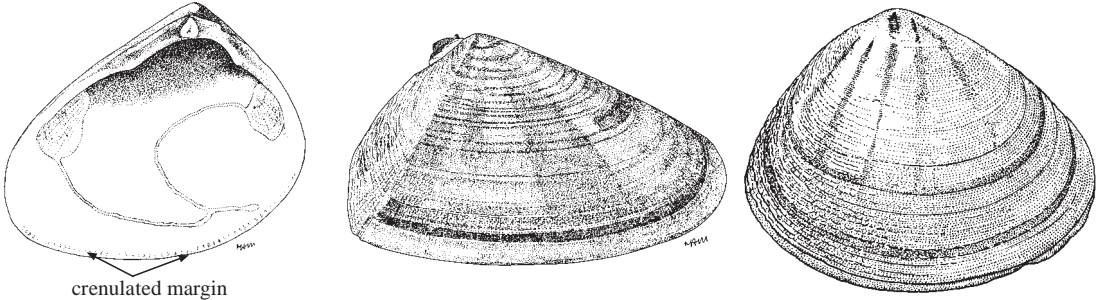


Fig. 4 *Donax incarnatus* (interior) Fig. 5 *Donax cuneatus* (exterior) Fig. 6 *Donax faba* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Donax cuneatus* Linnaeus, 1758
- 🐚 *Donax deltoides* Lamarck, 1818
- 🐚 *Donax faba* Gmelin, 1791
- 🐚 *Donax incarnatus* Gmelin, 1791
- 🐚 *Donax scortum* (Linnaeus, 1758)

References

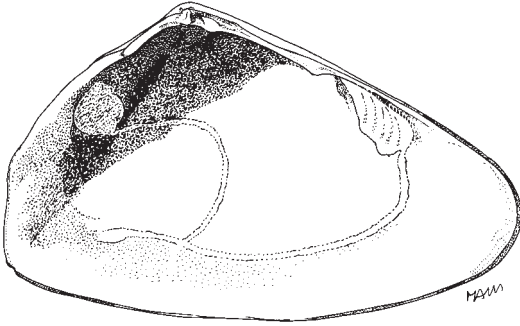
Ansell, A.D. 1985. Species of *Donax* from Hong Kong: morphology, distribution, behaviour, and metabolism. In *The malacofauna of Hong Kong and southern China. II (Volume 1). Proceedings of the second international workshop on the malacofauna of Hong Kong and southern China, Hong Kong, 1983*, edited by B.S. Morton and D. Dudgeon. Hong Kong, Hong Kong University, pp. 19-47.

Scarlato, O.A. 1965. Bivalve molluscs, superfamily Tellinacea of the China seas. *Stud. Mar. Sin.*, (8):27-114.

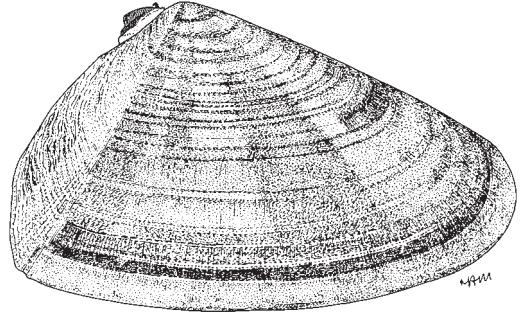
Donax cuneatus Linnaeus, 1758

Frequent synonyms / misidentifications: *Donax bicolor* Lamarck, 1818; *D. granosus* Lamarck, 1818; *D. obscurus* Deshayes, 1831; *D. radiatus* Humphrey, 1797; *Latona cuneata* (Linnaeus, 1758); *L. variabilis* (Schumacher, 1817) / None.

FAO names: **En** - Cuneate donax; **Fr** - Flion bicolore.



interior of left valve



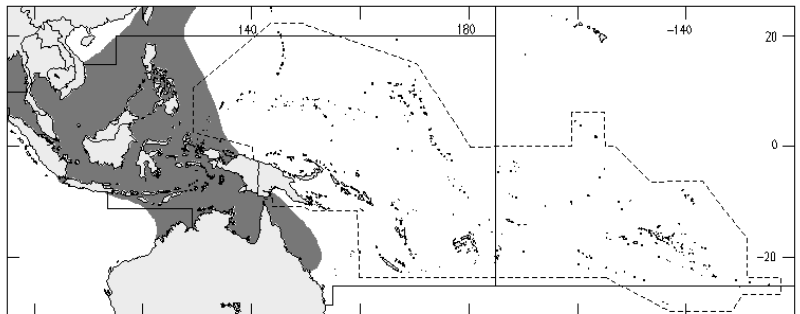
exterior of right valve

Diagnostic characters: Shell thick, laterally compressed and variable in shape, wedge-shaped to trigonal-ovate in outline, very inequilateral. Umbones small, situated well behind the midline. Posterodorsal margin markedly shorter and more slanting than anterodorsal margin, meeting the somewhat truncate posterior margin at an obtuse angle. Posterior slope set off from lateral face of valve by a blunt umbonoventral angle. **Outer surface** of lateral face rather smooth in appearance, with only fine concentric grooves and very closely-spaced, tenuous radial lines. Sculpture of **posterior slope with quite strong, rugose concentric grooves** crossed by finer radiating threads and often, at the anterior limit with lateral face, 1 or more radiating threads that are not affected by the sinuous concentric sculpturing. Periostracum thin, and glossy. **Hinge with 1 anterior and 2 posterior lateral teeth** in right valve, against 1 anterior and 1 posterior laterals in left valve. Pallial sinus deep and broad, extending nearly half way into the shell. **Internal margins smooth.** **Colour:** outside of shell variable, white, cream, brown, grey, or purple, often with darker radiating bands. Interior whitish, with variable orange or purple bands or blotches, sometimes dark purple overall.

Size: Maximum shell length 4 cm, commonly to 2.5 cm.

Habitat, biology, and fisheries: Intertidal. In sand of beach slopes in surf zones, migrating between the high and low tide marks with ebb and flow tides. Sometimes abundant. Local artisanal exploitation. Appears in local markets of the central and southern Philippines.

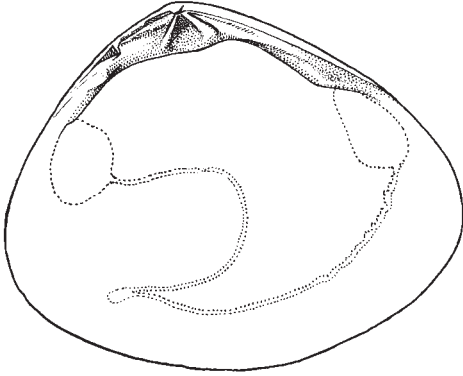
Distribution: Indo-West Pacific, from Madagascar, India and Sri Lanka to Indonesia; north to Japan and south to northern Australia.



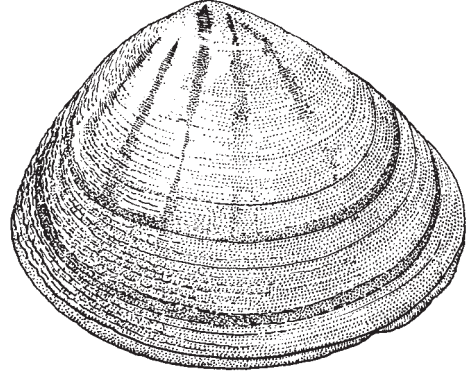
Donax faba Gmelin, 1791

Frequent synonyms / misidentifications: *Donax radians* Lamarck, 1818; *Latona faba* (Gmelin, 1791) / None.

FAO names: En - Pacific bean donax; Fr - Flion radieux.



interior of left valve



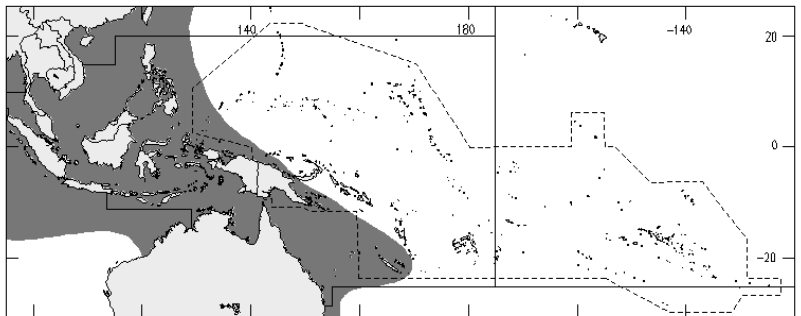
exterior of right valve

Diagnostic characters: Shell thick, **laterally compressed, trigonal-ovate** in outline but **not very inequilateral**. Dorsal margin strongly slanting in front of and behind the umbones which are situated only a little behind the midline. Ventral margin largely rounded. **Outer surface with concentric lines**, that become **coarser**, slightly lamellate **posteriorly** and crossed by very fine closely-spaced radial threads. Periostracum thin, rather smooth. **Hinge with 1 anterior and 2 posterior lateral teeth** in right valve, against 1 anterior and 1 posterior laterals in left valve. Pallial sinus deep and rounded, extending about half way into the shell. **Internal margins smooth**. **Colour:** outside of shell variable, white, cream, brown or purple, often with darker radiating rays. Interior glossy white, often with orange or purple irregular radiating bands.

Size: Maximum shell length 2.5 cm, commonly to 2 cm.

Habitat, biology, and fisheries: On sandy beaches, in all but the most sheltered areas, often in dense populations. Most common in wave-beaten areas, migrating up and down the beach with the tide. Frequently preyed upon by crabs and birds during migration. Often collected as food, and sporadically appearing in markets in many areas (Thailand, Malaysia, Indonesia, Indo-China, and the Philippines).

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, Mauritius and Réunion islands, to New Caledonia; north to southern Japan and south to New South Wales.

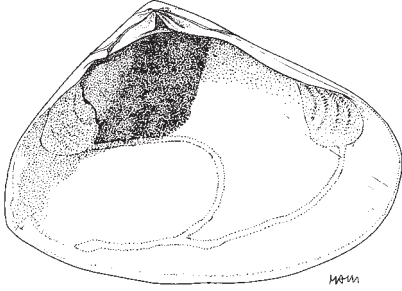


***Donax deltoides* Lamarck, 1818**

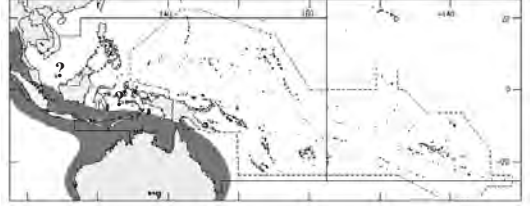
Frequent synonyms / misidentifications: *Donax compressa* Lamarck, 1818; *D. epidermia* Lamarck, 1818; *Plebidonax deltoides* (Lamarck, 1818) / None.

En - Goolwa donax; **Fr** - Flion deltoïde

Maximum shell length 7 cm, commonly to 4.5 cm. Sandy shores. Intertidal and shallow waters. Locally collected with other *Donax* species. In eastern Indian Ocean and western Pacific, from Andaman and Nicobar Islands to Indonesia and throughout Australia.



interior of left valve



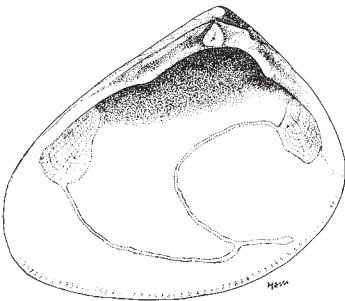
exterior of right valve

***Donax incarnatus* Gmelin, 1791**

Frequent synonyms / misidentifications: *Donax incarnatus* Chemnitz, 1782 (Invalid name); *D. trigonalis* Preston, 1908; *Latona incarnata* (Gmelin, 1791) / None.

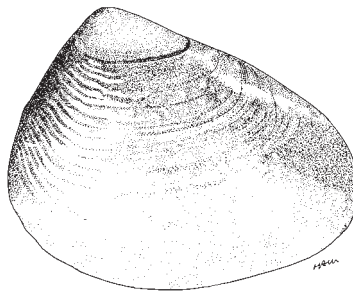
En - Fleshy donax; **Fr** - Flion incarnat.

Maximum shell length 4 cm, commonly to 2 cm. Intertidal sandy bottoms. Migrates up and down with the tide. Locally exploited in the Gulf of Thailand. Indo-West Pacific, from East Africa, including Madagascar, to the Malay Peninsula, Gulf of Thailand and western Indonesia.



interior of right valve

(after Ansell, 1985)



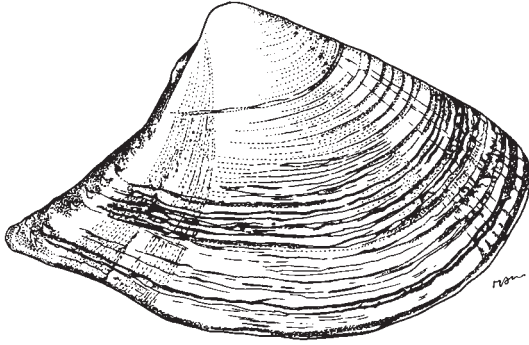
exterior of right valve

Donax scortum (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Donax pubescens* Linnaeus, 1758; *Hecuba scortum* (Linnaeus, 1758) / None.

En - Leather donax; **Fr** - Flion tanné.

Maximum shell length 9 cm, commonly to 6 cm. In muddy bottoms. Intertidal and shallow subtidal waters. No data available on exploitation of this common species in the area. It is known to be fished and marketed in India. Widespread in the Indo-West Pacific, from East Africa to the Philippines; north to China and south to Indonesia.



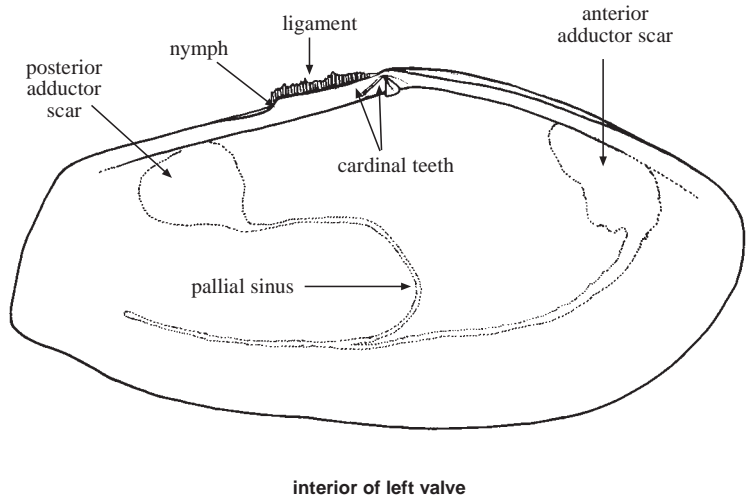
exterior of right valve
(after Tirmizi and Zehra, 1982)



PSAMMOBIIDAE
(= GARIIDAE)

Sunset clams, sanguins

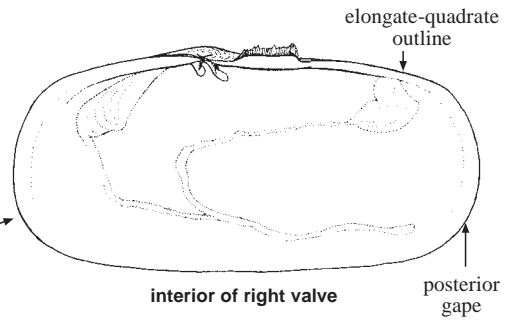
D **Diagnostic characters:** Shell inequilateral, **ovate to subelliptical or trapezoidal** in outline, laterally compressed, **somewhat gaping**, equivalve to feebly inequivalve because of a slight posterior flexure. Umbones not very prominent, generally near the midline of valves. Outer surface of shell smoothish or with a mainly concentric sculpture, sometimes also with developed radial elements on whole shell or on posterior slope only. Periostracum generally conspicuous, horny, and dehiscent. **Ligament external** and prominent, attached behind umbones **on projecting nymphs**. Hinge with **2 small cardinal teeth in either valve; lateral teeth absent**. Interior of shell porcelaneous. **Two adductor muscle scars**, unequal in shape. **Pallial sinus deep**. **Cruciform muscle scars** present, though **often** quite **obscure**. Internal margins smooth. Gills of eulamellibranchiate type, with folded branchial sheets; outer demibranch expanded above the ctenidial axis, but smaller than inner demibranch. Foot strong, laterally compressed, and pointed. Siphons naked, long, and separate to their base, with 6 lobes or tentacles at the end. Mantle margins papillate, fused ventrally, with a broad anteroventral opening.



Habitat, biology, and fisheries: Deposit or suspension feeding animals, generally lying buried at an oblique angle to the surface, with tips of siphons reaching the sea bottom. Can actively burrow in soft substrates with their strong foot. Sexes separate. Development with a free-swimming larval stage. The most common species of Psammobiidae are often collected for food in southeastern Asian countries of the tropical West Pacific, and some are considered a delicacy.

Similar families occurring in the area

Solecurtidae: shell equivalve, elongate-quadrate in shape, widely gaping at both ends; a strongly oblique sculpture sometimes present.



Key to species of interest to fisheries occurring in the area

- 1a. Radial sculpture well developed throughout the outer surface (Fig. 1) . . . *Asaphis violascens*
- 1b. Radial sculpture absent or confined to posterior slope of the outer surface → 2
- 2a. Outer surface with more or less oblique grooves on its anterior and median parts → 3
- 2b. Outer surface without oblique grooves → 4

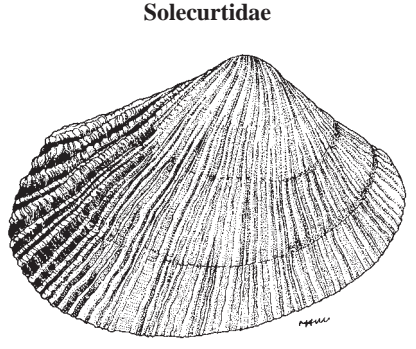


Fig. 1 *Asaphis violascens* (exterior)

- 3a. Posterior slope with strong radial ribs (Fig. 2) *Gari squamosa*
- 3b. Posterior slope with fine concentric grooves (Fig. 3) *Gari truncata*

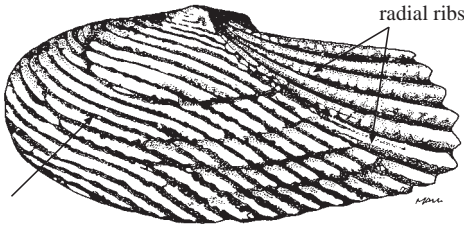


Fig. 2 *Gari squamosa* (exterior)

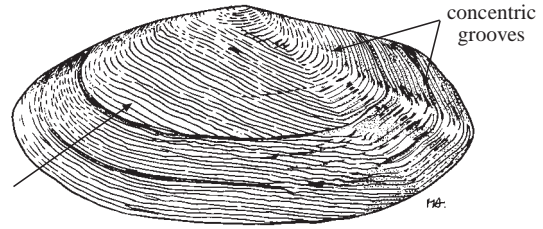
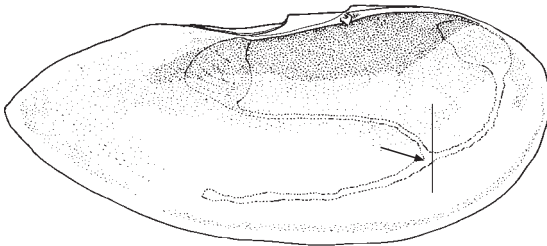
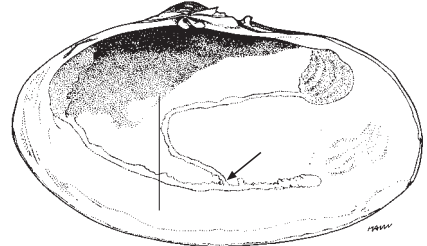


Fig. 3 *Gari truncata* (exterior)

- 4a. Pallial sinus sloping forwards, its ventral limb wholly confluent with the pallial line (Fig. 4a) *Soletellina diphos*
- 4b. Pallial sinus not sloping forwards, its ventral limb only partly confluent with the pallial line, or meeting it towards posteroventral end (Fig. 4b) → 5



a) *Soletellina diphos* (left valve)



b) *Gari* (right valve)

Fig. 4 interior of valve

- 5a. Shell purple in colour; ventral margin of valves straightish to slightly convex (Fig. 5) *Gari elongata*
- 5b. Shell whitish in colour; ventral margin of valves broadly rounded (Fig. 6) *Gari togata*

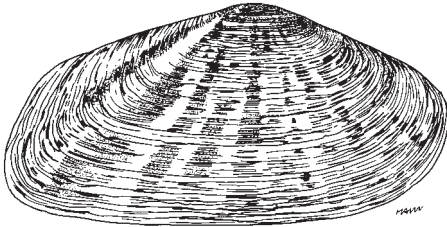


Fig. 5 *Gari elongate* (exterior)

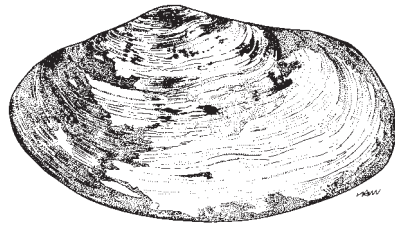


Fig. 6 *Gari togata* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Asaphis violascens* (Forsskål, 1775)
- 🐚 *Gari elongata* (Lamarck, 1818)
- 🐚 *Gari squamosa* (Lamarck, 1818)
- 🐚 *Gari togata* (Deshayes, 1855)
- 🐚 *Gari truncata* (Linnaeus, 1767)
- 🐚 *Soletellina diphos* (Linnaeus, 1771)

References

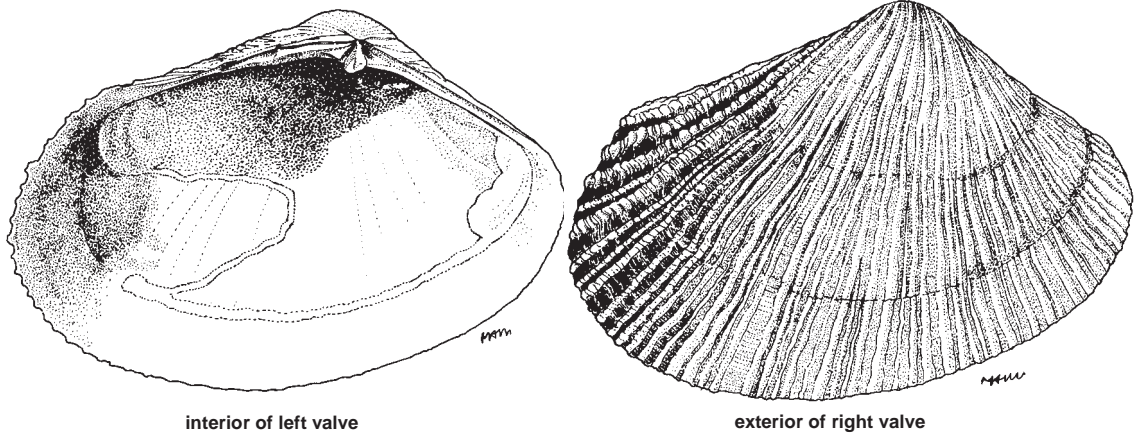
Scarlato, O.A. 1965. Bivalve molluscs, superfamily Tellinoidea of the China seas. *Stud. Mar. Sin.*, (8):27-114.

Willan, R.C. 1993. Taxonomic revision of the family Psammobiidae (Bivalvia: Tellinoidea) in the Australian and New Zealand region. *Rec. Aust. Mus. Suppl.*, 18:1-132.

Asaphis violascens (Forsskål, 1775)

Frequent synonyms / misidentifications: *Asaphis dichotoma* (Anton, 1838) / *Asaphis deflorata* (Linnaeus, 1758).

FAO names: En - Pacific asaphis; Fr - Sanguinolaire rugueuse.



interior of left valve

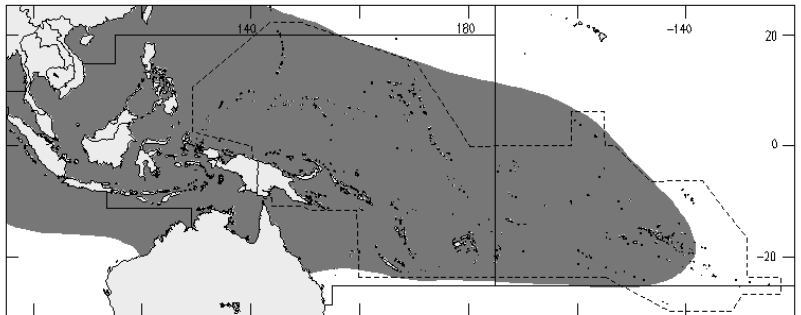
exterior of right valve

Diagnostic characters: Shell solid, rather large, inflated, slightly gaping posteriorly, elongate-ovate in outline but quite variable in shape and sculpture. Umbones a little forward of midlength of shell. Posterior margin convex, somewhat obliquely truncate, meeting the straight posterodorsal margin at an obtuse angle. Anterodorsal margin sloping toward the rounded anterior margin. Ventral margin broadly arched, often less strongly so posteriorly. **Outer sculpture** of numerous, strong, rounded and often forked radial ribs, developed throughout the valves and crossed by concentric lines that do not interrupt the ribs but make them slightly scaly or nodulose, at least on posterior slope. Periostracum thin, easily worn off. Hinge with **2 cardinal teeth in each valve**, the anterior tooth of left valve and posterior tooth of right valve larger, bifid and strongly protruding. **Pallial sinus relatively shallow**, not reaching level with umbones anteriorly. Ventral limb of pallial sinus sloping obliquely, meeting pallial line a short distance before its posteroventral end. **Colour:** outside of shell dull coloured, usually creamy white with a pale greyish brown periostracum, not uncommonly suffused with purple, pink, or orange, at least on the umbones, sometimes with poorly distinct radial bands of purplish brown. Interior slightly glossy, whitish, often with yellow or orange hue centrally and a dark purplish blotch posteriorly; purplish coloration mostly developed on ligamental nymphs and posterior margin, sometimes extending to the whole inner surface of valves.

Size: Maximum shell length 11 cm, commonly to 6.5 cm.

Habitat, biology, and fisheries: Deeply buried in sandy, often coarse to gravelly bottoms. Littoral and sublittoral to a depth of about 20 m. Collected for food and locally marketed in many areas. The shell is used to make decorative items and toys in the Philippines.

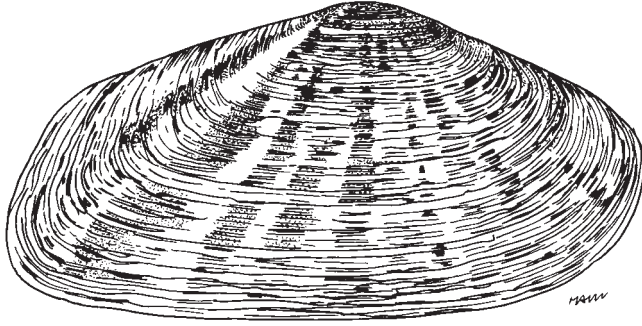
Distribution: Widespread in the Indo-West Pacific, from east Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and south to central Queensland and New Caledonia.



Gari elongata (Lamarck, 1818)

Frequent synonyms / misidentifications: *Hiatula elongata* (Lamarck, 1818); *Psammotaea elongata* (Lamarck, 1818); *P. minor* (Deshayes, 1855); *P. violacea* Lamarck, 1818; *Sanguinolaria elongata* (Lamarck, 1818); *Soletellina elongata* (Lamarck, 1818) / None.

FAO names: En - Elongate sunset clam; Fr - Psammobie allongée.



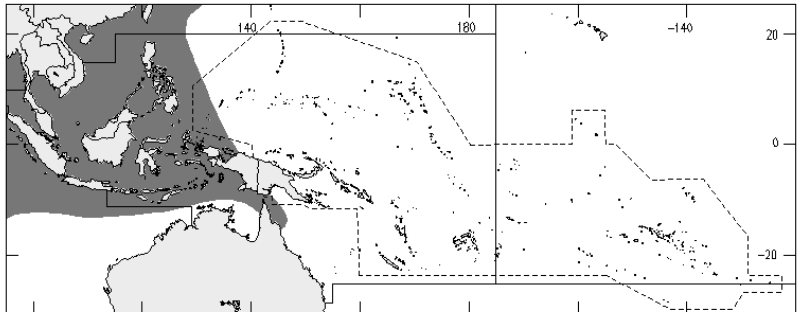
exterior of right valve
(after Habe, 1977)

Diagnostic characters: Shell elongate, moderately inflated, rather variable in shape, **subtrapezoidal-ovate** in outline. Anterior margin narrowly rounded. **Posterior margin** somewhat **obliquely truncate**, pointing towards posteroventral end, meeting straight posterodorsal margin at an obtuse angle. **Ventral margin nearly straight, occasionally smoothly convex.** Umbones slightly in front of midline of valves. A low, rounded ridge radiating from umbones to posteroventral end. **Outer surface** often smooth and polished in juveniles, dull and only **with concentric growth marks** in larger shells. Periostracum fibrous and adherent, usually worn off from umbones. **Pallial sinus not sloping forwards**, extending just in front of level with umbones. **Ventral limb of pallial sinus only partly confluent with pallial line**, generally meeting it a short distance to posteroventral end. **Colour: outside of shell purple**, uniform or with radiating and concentric bands, often with 2 pale rays passing from umbones to posterior ventral margin. **Periostracum** greenish to rusty **brown. Interior purple**, with teeth and nymphs whitish.

Size: Maximum shell length 7 cm, commonly to 5.5 cm.

Habitat, biology, and fisheries: In muddy-sand bottoms. Littoral and sublittoral to a depth of 30 m. Occurs in extensive beds at intertidal and shallow subtidal levels, often in bays and near mangroves. Actively collected in the Philippines for its prized meat. Shell form varies considerably with growth. The young shell, much shorter and ornamented with marked radial bands of colour, has been long considered a different species under the name *Gari minor* (Deshayes, 1855).

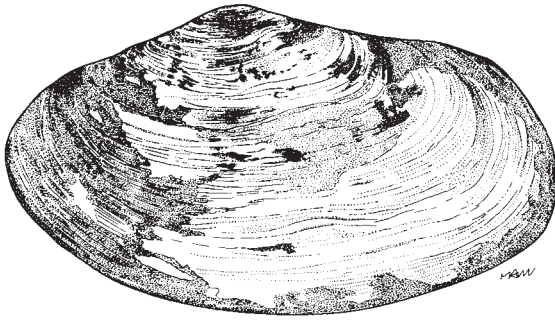
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to the Philippines; north to Japan and south to northern Queensland.



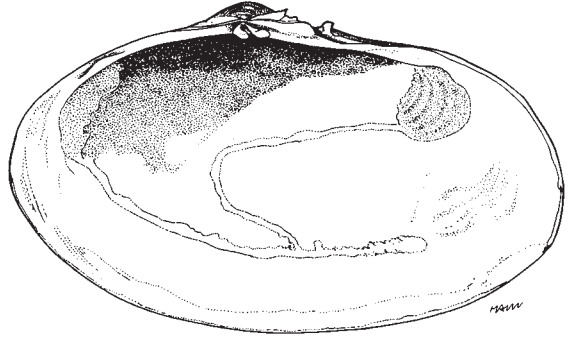
Gari togata (Deshayes, 1855)

Frequent synonyms / misidentifications: *Hiatula togata* (Deshayes, 1855); *Milligaretta togata* (Deshayes, 1855); *Psammotaea togata* (Deshayes, 1855); *Sanguinolaria togata* (Deshayes, 1855); *Soletellina montrouzieri* (A. Adams and Angas, 1863); *S. togata* (Deshayes, 1855) / None.

FAO names: En - Courtesan sunset clam; Fr - Psammobie courtesane.



exterior of left valve



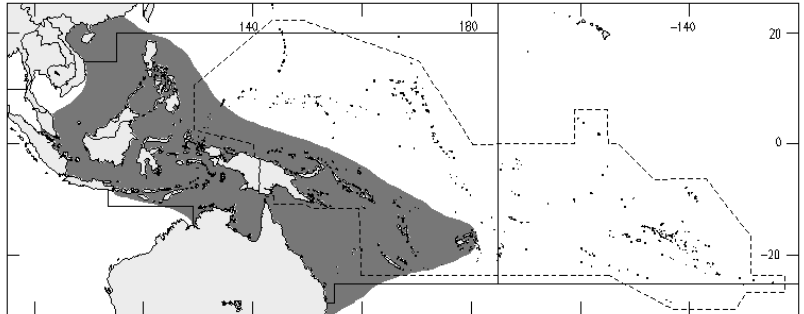
interior of right valve

Diagnostic characters: Shell elongate, moderately inflated, variable in shape, **subelliptical-ovate** in outline. Posterior margin rounded to slightly truncate. **Ventral margin broadly rounded.** Umbones decidedly anterior to midline of valves. **Outer surface dull, with numerous, irregular, fine to coarse, concentric growth marks.** Periostracum fibrous, often peeling off from umbonal area. **Pallial sinus not sloping forwards,** extending just in front to level with umbones. **Ventral limb of pallial sinus only partly confluent with pallial line,** generally meeting it a rather short distance to posteroventral end. **Colour: outside of shell whitish, under the olive-brown periostracum. Interior whitish.**

Size: Maximum shell length 10.5 cm, commonly to 7 cm.

Habitat, biology, and fisheries: Deep burrowing in thick muddy substrates of sheltered mangrove swamps, seagrass meadows or mud flats, from the intertidal zone to a depth of about 10 m. Commonly forming mixed populations with the greenish glaucomomya (*Glauconome virens* (Linnaeus)), a species with considerable external similarity, but absent from reduced salinity areas of estuaries. Locally exploited in the Philippines and very commonly marketed in Cebu together with *Glauconome virens* and solenid species of the genus *Pharella*.

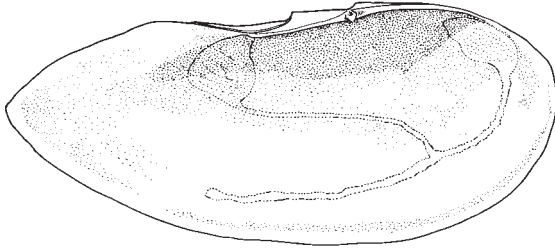
Distribution: The tropical Western Pacific Ocean, from Indonesia to Western Polynesia; north to China and south to northern New South Wales and New Caledonia.



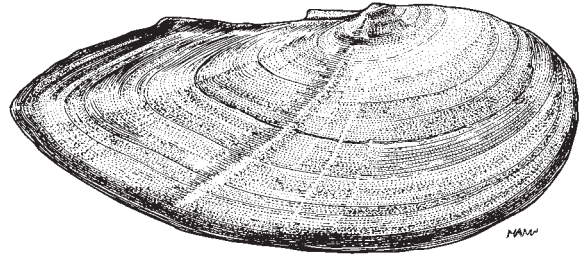
***Soletellina diphos* (Linnaeus, 1771)**

Frequent synonyms / misidentifications: *Hiatula diphos* (Linnaeus, 1771); *Sanguinolaria cumingiana* (Deshayes, 1857); *S. diphos* (Linnaeus, 1771); *Solen violaceus* Lamarck, 1818 (not *Psammotaea violacea* (Lamarck, 1818)); *Soletellina cumingiana* (Deshayes, 1857) / *Soletellina elongata* (Lamarck, 1818).

FAO names: En - Diphos sanguin; Fr - Sanguinolaire diphos.



interior of left valve



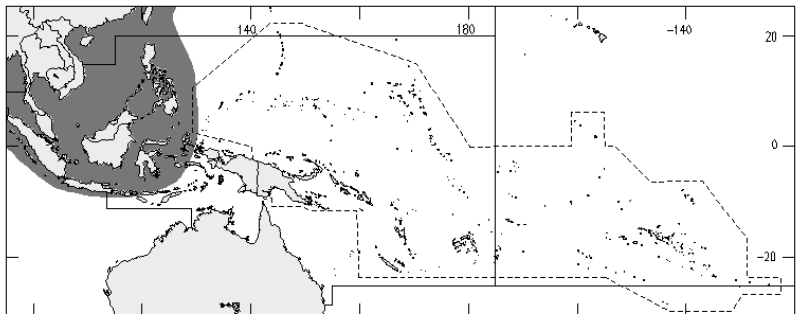
exterior of right valve

Diagnostic characters: Shell large, thin, rather compressed, moderately gaping anteriorly and posteriorly, elongate and elliptical-ovate in outline. Anterior side evenly rounded. Posterior margin somewhat obliquely truncate and pointing posteriorly, meeting the slightly concave posterodorsal margin at an obtuse angle. Ventral margin broadly convex. Umbones decidedly anterior to midlength of valves, with a low radial fold running very obliquely to posterior end of shell. Outer surface smoothish except for fine concentric growth marks. Periostracum tough and glossy. Ligament a thick and prominent arched band, set on very strong nymphs. Cardinal teeth blade-like and fragile. Pallial sinus very deep, reaching the anterior 1/4 of shell length, widely open behind and sloping forward, its ventral limb wholly confluent with the pallial line. Colour: outside of shell purplish blue, often with 2 paler rays extending obliquely from the umbones to posterior ventral margin. Periostracum highly polished, olive-brown. Interior deep purple.

Size: Maximum shell length 12 cm, commonly to 8 cm.

Habitat, biology, and fisheries: In muddy bottoms. Littoral and sublittoral, from low tide levels to a depth of about 30 m. Actively collected in the Philippines for its prized meat. This is an important commercial species in Taiwan Province of China. Other species of genus *Soletellina* are probably collected for food in the area.

Distribution: Northwestern Indian Ocean to the tropical western Pacific, from the Persian Gulf to Philippine Islands; north to Korea and Japan, and south to Indonesia.

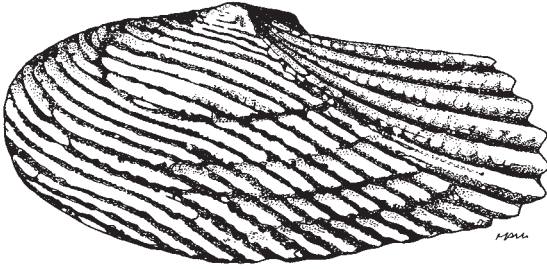


Gari squamosa (Lamarck, 1818)

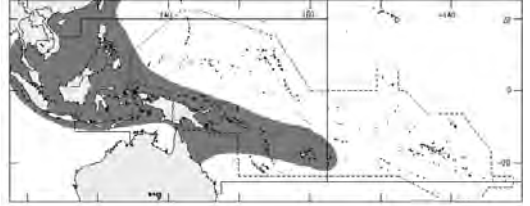
Frequent synonyms / misidentifications: *Grammatomya squamosa* (Lamarck, 1818) / None.

En - Squamose sunset clam; **Fr** - Psammobie écailléeuse.

Maximum shell length 3.5 cm, commonly to 2.5 cm. In fine sandy or muddy bottoms. Common in sea grass beds. Sublittoral, from shallow water to depths of about 40 m. Locally collected for food and marketed in the Philippines. Shell used to make decorative items. Eastern Indian Ocean and the tropical western Pacific, from Thailand and Indonesia to western Polynesia; north to southern Japan and south to Queensland and Tonga Islands.



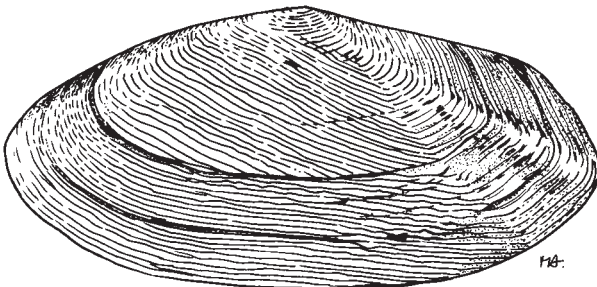
exterior of left valve
(after Woodward, 1854)

***Gari truncata*** (Linnaeus, 1767)

Frequent synonyms / misidentifications: *Psammobia caerulescens* Lamarck, 1818; *P. bipartita* Philippi, 1849; *Tellina gari* Linnaeus, 1758 (Rejected name) / None.

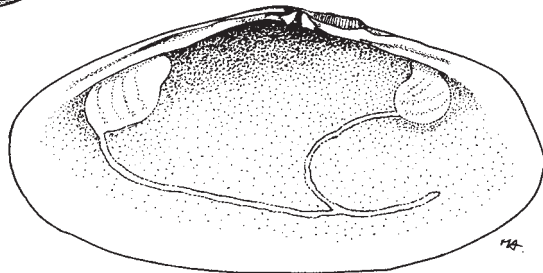
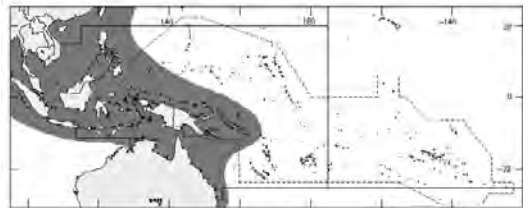
En - Truncate sunset clam; **Fr** - Psammobie tronquée.

Maximum shell length 5 cm, commonly to 4 cm. More or less deeply buried in fine sandy to muddy bottoms. Sublittoral, from depths of 5 to 40 m. Locally collected and marketed in the Philippines. Northwestern Indian Ocean to the tropical western Pacific, from the Red Sea and Sri Lanka to Melanesia; north to Japan and south to central New South Wales.



exterior of left valve

(after Habe, 1977)

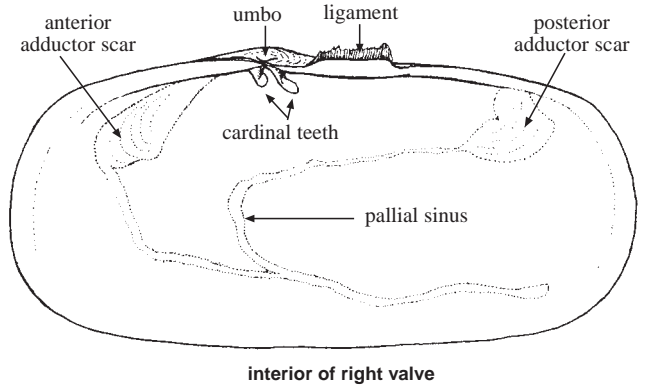


interior of right valve

SOLECURTIDAE

Short razor clams

Diagnostic characters: Shell equivalve, **elongate-quadrate** in outline, **widely gaping at both ends**, slightly inequilateral. **Umbones** not prominent, **subcentral** to more or less anterior. Outside of shell smoothish or with a low sculpture, mainly concentric or oblique. Periostracum well developed. **Ligament external** and prominent, attached behind umbones **on projecting nymphs**. Hinge plate rather weak, usually with **2**, more or less pedunculated, **cardinal teeth** in either valve. Interior of shell porcelaneous. **Two adductor muscle scars**, unequal in shape. **Pallial sinus deep**. Cruciform muscle scars obscure. Internal margins smooth. Gills of eulamellibranchiate type, with folded branchial sheets; outer demibranch somewhat shortened and expanded over the ctenidial axis. Foot tongue-shaped. Siphons naked, long, and separate to their base, with 6 lobes or tentacles at the end. Cruciform muscles, when present, somewhat anteriorly displaced. Mantle margins fused ventrally, with a rather reduced anteroventral opening.

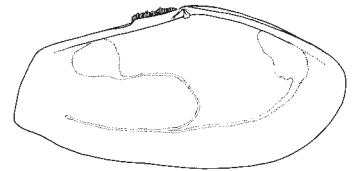


Habitat, biology, and fisheries: Suspension or deposit feeding animals, actively burrowing in soft bottoms with their powerful foot. Sexes separate. Free-swimming larval stage present. Generally collected for subsistence by coastal populations in the area. However, a single species is of economic importance in Thailand.

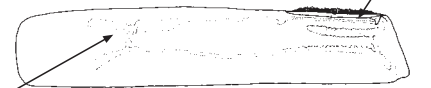
Similar families occurring in the area

Psammobiidae: shell inequilateral, ovate to subelliptical or trapezoidal in outline, less widely gaping and sometimes slightly flexed posteriorly.

Solenidae: shell narrowly elongate, very inequilateral; umbones near the anterodorsal end of valves; pallial sinus relatively shallow; siphons generally quite short, fused at their base.



interior of left valve
Psammobiidae



pallial sinus
interior of left valve
Solenidae

Key to species of interest to fisheries occurring in the area

- 1a. Outer surface with incised oblique grooves on its median and posterior parts; no shallow, radial depression running obliquely from umbones to ventral margin which is straight (Fig. 1) *Solecurtus divaricatus*
- 1b. Outer surface without incised oblique grooves on its median and posterior parts; a shallow depression running obliquely from umbones to ventral margin which is depressed in the middle (Fig. 2) *Azorinus abbreviatus*

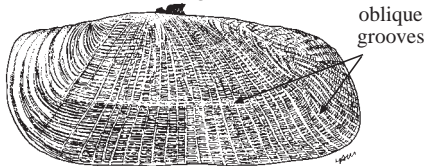


Fig. 1 *Solecurtus divaricatus* (exterior)

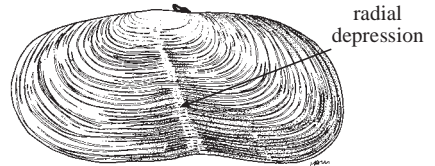


Fig. 2 *Azorinus abbreviatus* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Azorinus abbreviatus* (Gould, 1861)
- 🐚 *Solecurtus divaricatus* (Lischke, 1869)

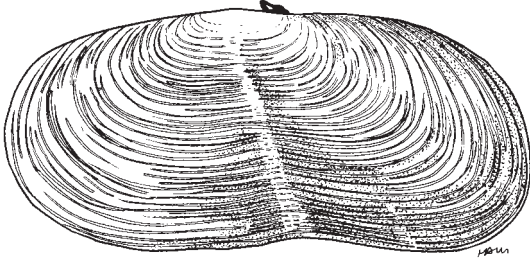
Reference

Scarlato, O.A. 1965. Bivalve molluscs, superfamily Tellinacea of the China seas. *Stud. Mar. Sin.*, (8):27-114.

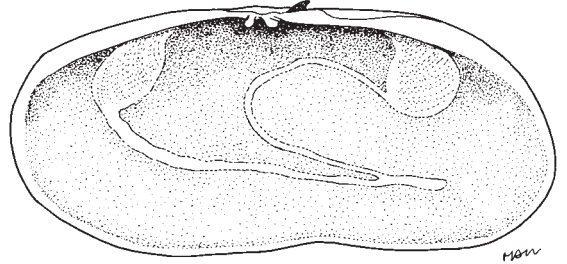
Azorinus abbreviatus (Gould, 1861)

Frequent synonyms / misidentifications: *Azorinus minutus* (Dunker, 1861); *Solen abbreviatus* (Gould, 1861) / *Azorinus coarctatus* (Gmelin, 1791) = *Azorinus chamasolen* (da Costa, 1778).

FAO names: En - Small short razor; Fr - Petit solécourte



exterior of left valve



interior of right valve

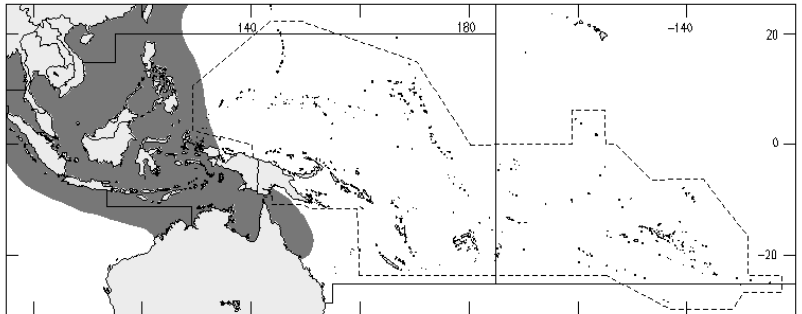
(after Habe, 1965)

Diagnostic characters: Shell moderately thin but solid, a little more than twice as long as high. Ventral margin rather straight, slightly depressed in the middle. Umbones small, orthogyrate, approximately situated at the anterior 2/5 of shell length. Outer surface of valves convex somewhat compressed medially, with a shallow radial depression running obliquely from the umbones to median part of ventral margin. Concentric lines of growth numerous and irregular. Pallial sinus broad and deep, rounded, and slightly ascending anteriorly, extending a little beyond midline of valves, nearly to level with umbones. Ventral limb of pallial sinus somewhat confluent with pallial line in its posterior part. **Colour:** outside of shell whitish, under a greyish brown, fibrous periostracum. Interior whitish.

Size: Maximum shell length 5 cm, commonly to 3.5 cm.

Habitat, biology, and fisheries: In sand and mud bottoms. Littoral and sublittoral to a depth of 50 m. Common in shallow water. Actively exploited from natural stocks in Thailand.

Distribution: Eastern Indian Ocean to the tropical western Pacific, from Andaman Islands to the Philippines; north to Japan and south to Queensland.

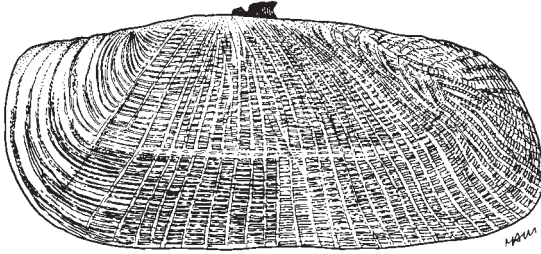


***Solecurtus divaricatus* (Lischke, 1869)**

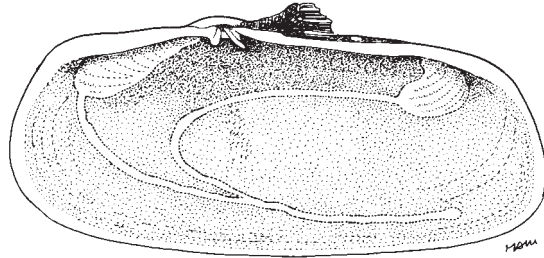
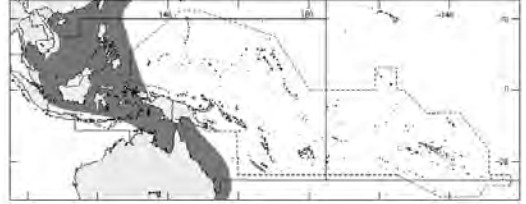
Frequent synonyms / misidentifications: *Solecurtus dunkeri* Kira, 1959; *S. leone* Woolacott, 1954 / None.

En - Divaricate short razor; **Fr** - Solécourte divergent.

Maximum shell length 7.5 cm, commonly to 6 cm. Active burrower of littoral and sublittoral sandy bottoms, from low in the intertidal zone to a depth of about 20 m. Collected locally for food in southeast Asian countries where the species is common. Restricted to the tropical western Pacific, from the Malay Peninsula to the Philippines; north to Japan and south to northern New South Wales.



exterior of left valve



(after Habe, 1965)

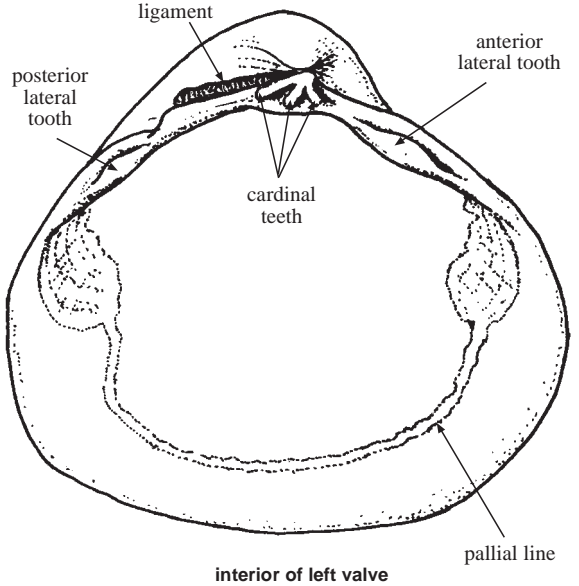
interior of right valve

CORBICULIDAE

Marsh clams

Diagnostic characters: Shell equivalve, solid to very thick, rounded to subtrigonal in outline, generally not gaping. **Umbones prosogyrate**, nearly at or in front of the midline of valves. **No lunule or escutcheon.** Sculpture, when developed, mainly concentric. **Periostracum conspicuous**, often fibrous. **Ligament external**, a thick arched band behind the umbones. Hinge with **3 diverging cardinal teeth in each valve, and strong anterior and posterior lateral teeth** which may be transversally striate. Interior of shell porcelaneous. **Two** subequal, rounded **adductor muscle scars.** **Pallial sinus reduced or absent.** Internal margins smooth. Gills of eulamellibranchiate type, fused to each other behind the foot; outer demibranch with or without an expansion above the axis. Foot generally grooved and hatchet-shaped. Mante broadly open ventrally. Siphons short.

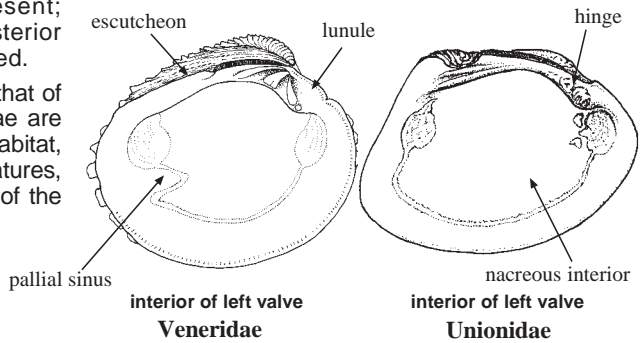
Habitat, biology, and fisheries: Suspension filter feeders, burrowing in soft bottoms of shallow fresh or brackish water areas. Sexes separate. Used locally for subsistence.



Similar families occurring in the area

Veneridae: lunule and/or escutcheon present; periostracum generally inconspicuous; posterior lateral teeth absent; pallial sinus well developed.

Unionidae: shell shape may be very similar to that of the corbiculid genus *Batissa*, but the Unionidae are characterized by their exclusively fresh-water habitat, strongly nacreous interior of shell and hinge features, typically with foliaceous cardinal teeth in front of the umbones and lamellar, posterior lateral teeth.



Key to species of interest to fisheries occurring in the area

- 1a. Umbones not prominent; lateral hinge teeth transversally striated (Fig. 1) *Batissa violacea*
- 1b. Umbones prominent; lateral teeth not striated → 2
- 2a. Shell distinctly expanded posteriorly, almost rostrate (Fig. 2) *Polymesoda expansa*
- 2b. Shell not expanded posteriorly, not rostrate → 3

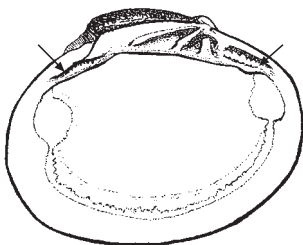


Fig. 1 *Batissa violacea* (interior)

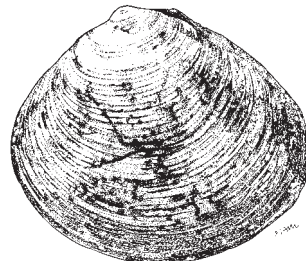


Fig. 2 *Polymesoda expansa* (exterior)

- 3a. Shell subrhomboidal-ovate in outline (Fig. 3) *Polymesoda erosa*
- 3b. Shell subtrigonal in outline (Fig. 4) *Polymesoda bengalensis*

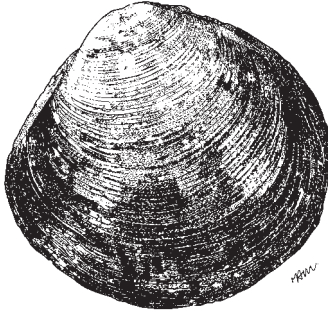


Fig. 3 *Polymesoda erosa* (exterior)

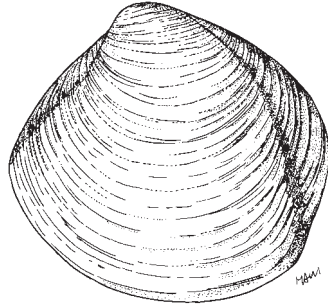


Fig. 4 *Polymesoda bengalensis* (exterior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Batissa violacea* (Lamarck, 1806)
- 🐚 *Polymesoda bengalensis* (Lamarck, 1818)
- 🐚 *Polymesoda erosa* (Lightfoot, 1786)
- 🐚 *Polymesoda expansa* (Mousson, 1849)

References

Brandt, R. 1974. The non-marine aquatic mollusca of Thailand. *Arch. Moll.*, 105:1-423.

Morton, B.S. 1984. A review of *Polymesoda* (*Geloina*) Gray 1842 (Bivalvia: Corbiculacea) from Indo-Pacific mangroves. *Asian Mar. Biol.*, 1:77-86.

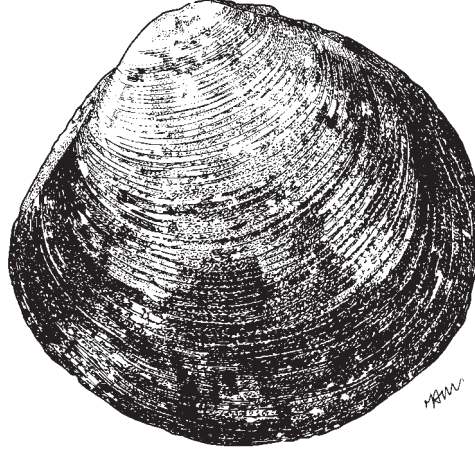
Morton, B.S. 1989. The functional morphology of the organs of the mouth cavity of *Batissa violacea* (Lamarck, 1797) (Bivalvia: Corbiculacea). *Am. Malac. Bull.*, 7(1):73-79.

Van Benthem Jutting, W.S.S. 1953. Systematic studies on the non-marine mollusca of the Indo-Australian Archipelago. IV. Critical revision of the freshwater bivalves of Java. *Treubia*, 22(1):19-73.

***Polymesoda erosa* (Lightfoot, 1786)**

Frequent synonyms / misidentifications: *Cyrena moussoni* Martens, 1897; *C. zeylanica* Lamarck, 1818; *Geloina coaxans* (Gmelin, 1791); *G. erosa* (Lightfoot, 1786); *Polymesoda coaxans* (Gmelin, 1791); *P. eximia* "(Solander)", Van Benthem Jutting, 1953 (not of Dunker, 1852); *P. proxima* (Prime, 1867) / *Polymesoda expansa* (Mousson, 1849).

FAO names: En - Common geloina; Fr - Cyrène érodée.



exterior of left valve

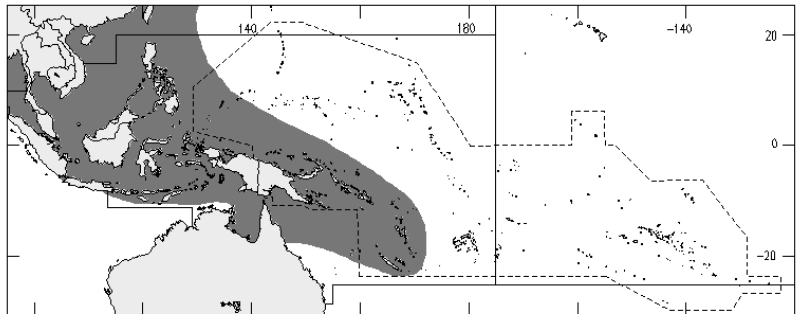
(after Morton, 1984)

Diagnostic characters: Shell equivalve, **subrhomboidal-ovate** in outline, **slightly inequilateral**. **Umbones** moderately inflated, **near the midline** of shell. Outer surface of valves concentrically striated. Periostracum thick and strongly wrinkled, the umbones often corroded and showing the shell material. Hinge teeth strong. Anterior and central right cardinal teeth bifid, as well as central and posterior left cardinals. **Lateral teeth smooth:** 1 anterior and 1 posterior laterals in left valve, against 2 in right valve. **Pallial sinus inconspicuous.** **Colour:** outside of shell **chalky white under the yellowish green periostracum**. Interior chalky or porcelaneous white.

Size: Maximum shell length 10.5 cm, commonly to 7 cm.

Habitat, biology, and fisheries: In muddy bottoms, in fresh and brackish waters of mangrove swamps, estuaries, and larger rivers. Highly tolerant to surface desiccation of its habitat; can survive by aerial respiration at the posterior mantle margin for a period of a few days, and feed from subterranean water by means of water exchange through a narrow anterior gape of valves. Widely collected as food in Asia.

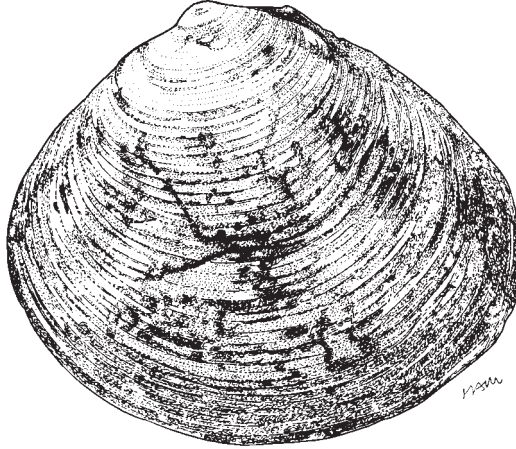
Distribution: Indo-West Pacific, from India to Vanuatu; north to southern islands of Japan, and south to Queensland and New Caledonia.



Polymesoda expansa (Mousson, 1849)

Frequent synonyms / misidentifications: *Cyrena ceylonica* (Chemnitz, 1782) (Invalid name); *Geloina expansa* (Mousson, 1849) / *Polymesoda proxima* (Prime, 1864).

FAO names: En - Broad geloina; Fr - Cyrène large.



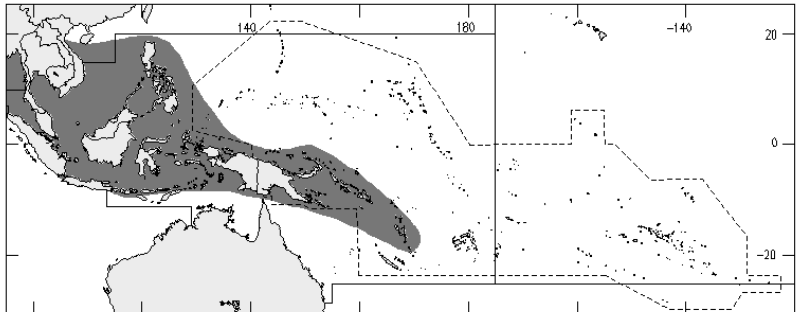
exterior of left valve
(after Morton, 1984)

Diagnostic characters: Shell equivalve, trigonal-ovate in outline, inequilateral, distinctly expanded posteriorly. Umbones inflated, in front of the midline of shell. Outer surface of valves concentrically striated, with a faint radial fold running from umbones to posteroventral margin. Periostracum thick and fibrous, the umbones often corroded and showing the shell material. Hinge teeth moderately strong. Anterior and central right cardinal teeth bifid, as well as central and posterior left cardinals. **Lateral teeth smooth:** 1 anterior and 1 posterior laterals in left valve, against 2 in right valve. **Pallial sinus inconspicuous.** **Colour:** outside of shell chalky white under the greenish to yellowish brown periostracum. Interior chalky or porcelainous white.

Size: Maximum shell length 10 cm, commonly to 7 cm.

Habitat, biology, and fisheries: In muddy, brackish to almost fresh-water areas of mangrove swamps. Diurnal rhythm of activity and inactivity strongly depending on the tides and rainfall. Can survive during drought periods by aerial respiration at the posterior mantle margins. Widely collected as food in Asia.

Distribution: Indo-West Pacific, from India to Vanuatu; north to Viet Nam and south to eastern Java.

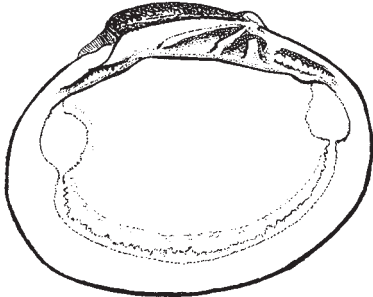


Batissa violacea (Lamarck, 1806)

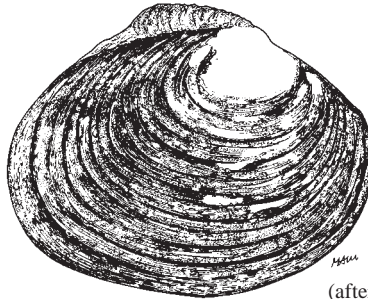
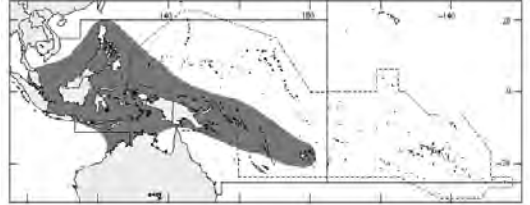
Frequent synonyms / misidentifications: None / None.

En - Violet batissa; **Fr** - Cyrène violette.

Maximum shell length 15 cm, commonly to 10 cm. Burrowing in mud and sand, in the banks and river beds or estuaries, in fresh and brackish, often running water. Often lays buried with the hind tip of the shell emerging at surface of the sediment with siphons slightly projecting between the valve margins. Capable of living deep within the sediment, with no siphonal access to the surface, to endure drought periods, then feeding from subterranean water through a narrow anterior gape of shell. Locally collected for food. Marketed in Fiji Islands. Shell used in the Philippines to make decorative items. Tropical western Pacific, from Malaysia to Fiji Islands; north to the Philippines and south to northwestern Australia.



interior of left valve



(after Morton, 1989)

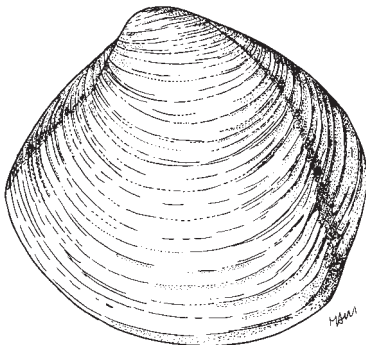
exterior of right valve

Polymesoda bengalensis (Lamarck, 1818)

Frequent synonyms / misidentifications: *Cyrena eximia* Dunker, 1852; *C. impressa* Deshayes, 1854; *C. sumatrensis* Lea, 1832; *C. turgida* Lea, 1832; *Geloina bengalensis* (Lamarck, 1818) / *Cyrena zeylanica* Lamarck, 1806.

En - Bengali geloina; **Fr** - Cyrène bengali.

Maximum shell length 9.5 cm, commonly to 7.5 cm. In mud flats and estuaries of mangrove areas. Locally exploited in Thailand. Reported as widely occurring in the Indo-West Pacific, but the exact distribution is imperfectly known because of frequent confusion with other species of the genus. From India to Thailand and Celebes, and possibly also from the Philippines to northern Australia.



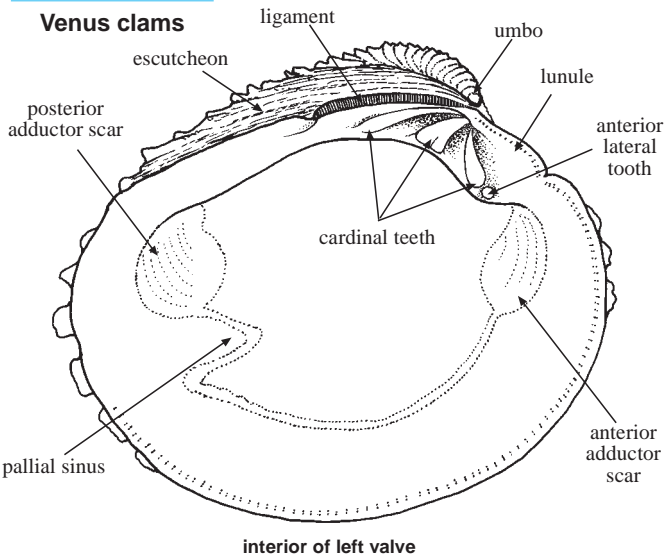
exterior of left valve



(after Van Benthem Jutting, 1953)

VENERIDAE

Venus clams



Diagnostic characters: Shell mostly **solid, equivalve** or subequivalve, obliquely rounded, or ovate to subtrigonal in outline and usually not gaping; **inequilateral**, with generally prominent, **prosogyrate umbones**, at or in front of the midline of shell. **Lunule and/or escutcheon usually present.** Sculpture only concentric, or with a radial component. Periostracum most of the time inconspicuous. **Ligament external**, behind the umbones, often inserted in a deep groove. Hinge with **3 usually radially disposed cardinal teeth in each valve** (1 or more of which may be grooved or bifid), **anterior lateral teeth sometimes present.** Interior of shell porcelaneous. **Two** more or less equal **adductor scars**, the posterior sometimes slightly larger. **Pallial sinus usually present.** Internal margins smooth to denticulate.

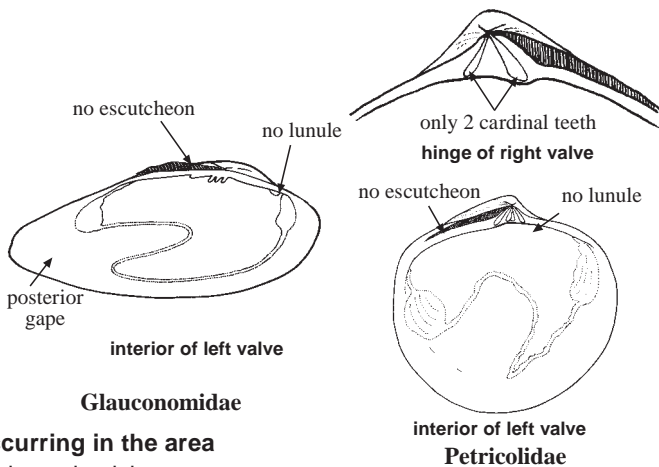
Gills of eulamellibranchiate type, with folded branchial sheets; outer demibranch smaller than the inner, expanded and almost flat above the axis. Foot large and rather short, hatchet-shaped, rarely byssate in the adult. Mantle broadly open ventrally. Siphons short to long, naked, fused or separate, with simple tentacles on tips and inside the inhalent opening to strain out large particles.

Habitat, biology, and fisheries: Active burrowers in various soft bottoms, sometimes nestling in rock crevices or among marine growths. Most common in low intertidal to shallow subtidal depths, especially in areas where organic debris is present in high concentration. Suspension feeders, filtering planktonic algae and organic matter from the water. Sexes generally separate. Eggs numerous, giving free-swimming pelagic larvae. In the area, many species of Veneridae are collected for food or commercially fished, sometimes in large quantities. Some represent major commercial species and are extensively cultivated to keep up with high demand and to compensate for effects of overexploitation and increasing pollution of coastal environments.

Similar families occurring in the area

Glauconomidae: no lunule nor escutcheon; valves gaping posteriorly; outside with a heavy, greenish periostracum which is united dorsally between the valves; lateral teeth always absent; pallial sinus deep and narrow.

Petricolidae: no lunule nor escutcheon; hinge with cardinal teeth only (sometimes reduced): 3 in the left valve, 2 in the right; lateral teeth always absent; pallial sinus deep.



Glauconomidae

interior of left valve

Petricolidae

Key to species of interest to fisheries occurring in the area

- 1a. Left valve with an anterior lateral tooth or denticle (Fig. 1) → 2
- 1b. Left valve without an anterior lateral tooth or denticle . . . → 17

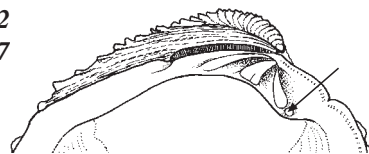


Fig. 1 hinge of left valve

2a. Pallial sinus very shallow, hardly extending forwards beyond the posterior adductor scar (Fig. 2a) → 3

2b. Pallial sinus well developed, pointing forwards well beyond the posterior adductor scar (Fig. 2b) → 9

3a. Outer surface glossy and very smooth → 4

3b. Outer surface with concentric and radial to diverging sculpture, the latter at least umbonally and laterally → 5

4a. Shell rounded-ovate in outline, with slightly anterior umbones and rounded posterodorsal margin; outside with some large dark, V-shaped markings or zig-zag lines (Fig. 3) *Lioconcha castrensis*

4b. Shell trigonal-ovate in outline, with markedly anterior umbones and nearly straight posterodorsal margin; outside with dense and fine darker, reticulate patterns and fine dots (Fig. 4) *Lioconcha ornata*

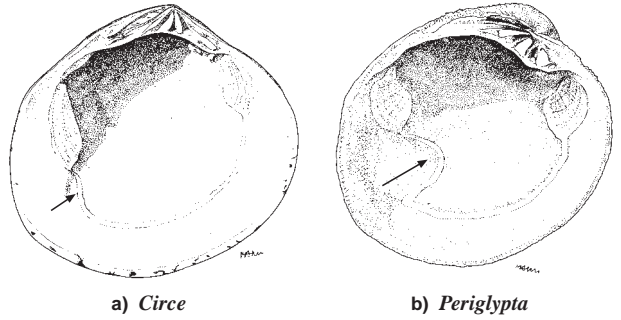


Fig. 2 interior of left valve

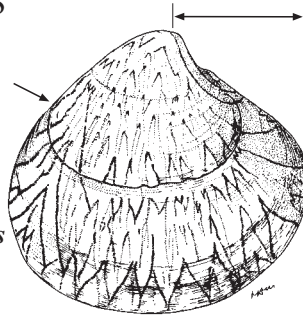


Fig. 3 *Lioconcha castrensis* (exterior)

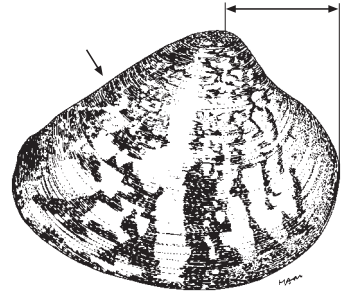


Fig. 4 *Lioconcha ornata* (exterior)

5a. Shell very compressed laterally, about as long as high; umbones submedian, flattened (Fig. 5) *Circe scripta*

5b. Shell moderately compressed to tumid, longer than high; umbones anterior to midline, somewhat inflated → 6

6a. Outer sculpture relatively fine → 7

6b. Outer sculpture relatively coarse → 8

7a. Main sculpture of median area of valves concentric (Fig. 6) *Gafrarium dispar*

7b. Main sculpture of median area of valves of slightly diverging radial riblets (Fig. 7) *Gafrarium divaricatum*

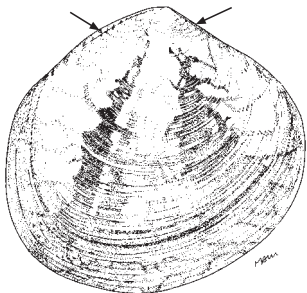


Fig. 5 *Circe scripta* (exterior)

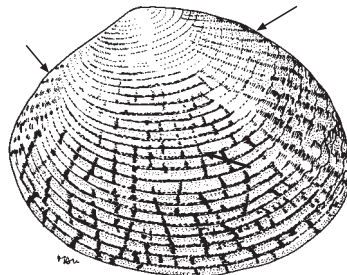


Fig. 6 *Gafrarium dispar* (exterior)

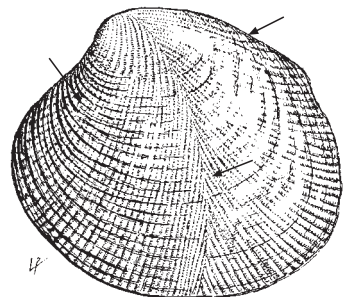


Fig. 7 *Gafrarium divaricatum* (exterior)

- 8a. Shell shape relatively inflated, short and high; outside of valves generally with indistinct dark brown blotches around umbonal area and posterodorsal margin (Fig. 8) *Gafrarium tumidum*
- 8b. Shell shape relatively compressed and elongated; outside of valves generally with brown blotches or spots throughout (Fig. 9) *Gafrarium pectinatum*
- 9a. Outside of shell with both concentric and radial sculpture →10
- 9b. Outside of shell smoothish or with concentric sculpture only →12
- 10a. Outer sculpture relatively coarse, strongly nodulose; hinge orange (Fig. 10) . . . *Periglypta reticulata*
- 10b. Outer sculpture relatively fine, not strongly nodulose; hinge white →11

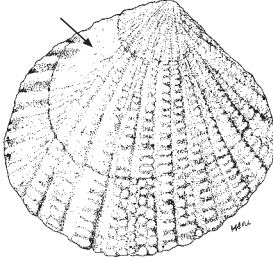


Fig. 8 *Gafrarium tumidum* (exterior)

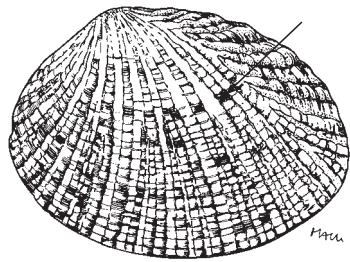


Fig. 9 *Gafrarium pectinatum* (exterior)

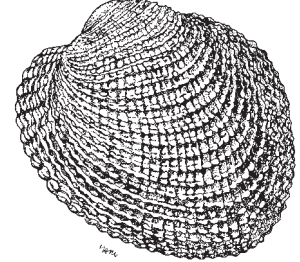


Fig. 10 *Periglypta reticulata* (exterior)

- 11a. Shell strongly inflated, nearly as high as long (Fig. 11) . . . *Periglypta puerpera*
- 11b. Shell moderately inflated, markedly longer than high (Fig. 12) *Periglypta clathrata*

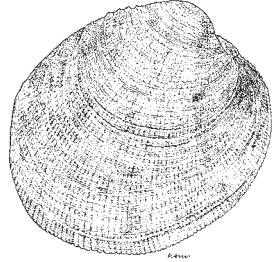


Fig. 11 *Periglypta puerpera* (exterior)

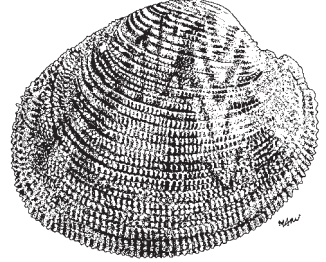
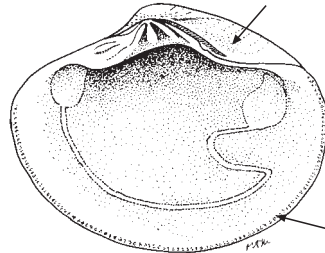
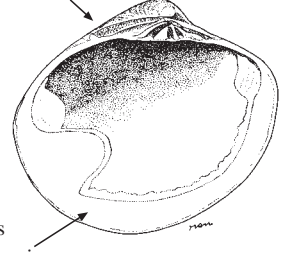


Fig. 12 *Periglypta clathrata* (exterior)

- 12a. Escutcheon large and deeply sunken; interior margins finely crenulate (Fig. 13a) → 13
- 12b. Escutcheon, if developed, not deeply sunken; interior margins smooth (Fig. 13b) . . . → 14



a) *Sunetta* (right valve)



b) *Pitar* (left valve)

Fig. 13 interior of a valve

- 13a. Shell rounded-ovate in outline (Fig. 14) *Sunetta menstrualis*
- 13b. Shell elongate-ovate in outline (Fig. 15) *Sunetta truncata*

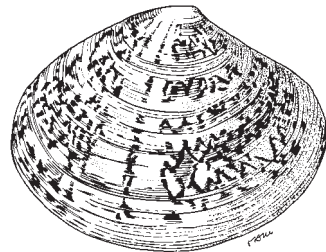


Fig. 14 *Sunetta menstrualis* (exterior)



Fig. 15 *Sunetta truncata* (exterior)

14a. Umbones poorly inflated, pointing on top of dorsal margin; pallial sinus relatively shallow, rounded anteriorly (Fig. 16a) → 15

14b. Umbones inflated, rounded on top of dorsal margin; pallial sinus relatively deep, narrowing anteriorly (Fig. 16b) → 16

15a. Outer surface smooth (Fig. 17) *Meretrix meretrix*

15b. Outer surface with incised concentric grooves (Fig. 18) *Meretrix lyrata*

16a. Lunule with a shallow peripheral groove; posterior third of shell with a brownish tinge externally and a corresponding dark purple blotch internally; lunule entirely whitish (Fig. 19) *Pitar citrinus*

16b. Lunule without a peripheral groove; posterior third of shell without a brownish tinge externally, nor a dark purple blotch internally; lunule with a purple spot under the umbones (Fig. 20) *Pitar pellucidus*

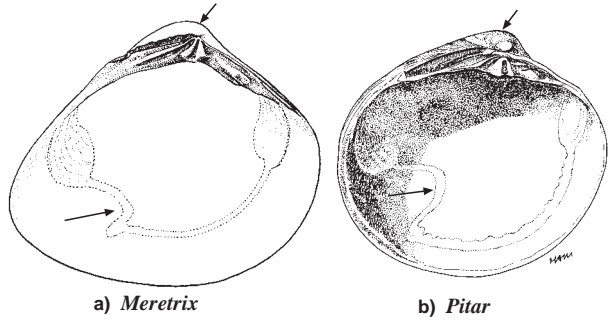


Fig. 16 interior of left valve

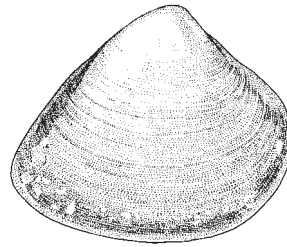


Fig. 17 *Meretrix meretrix* (exterior)

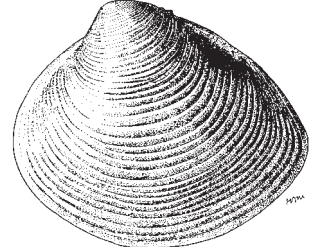


Fig. 18 *Meretrix lyrata* (exterior)

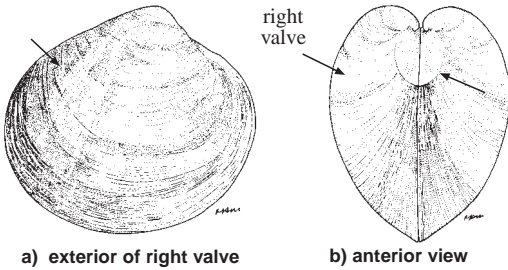


Fig. 19 *Pitar citrinus*

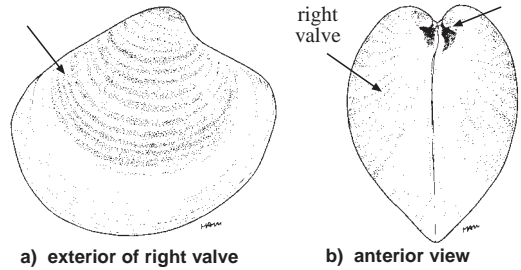


Fig. 20 *Pitar pellucidus*

17a. Inner margins crenulated (Fig. 21a) → 18
 17b. Inner margins smooth (Fig. 21b) → 20

18a. Shell relatively large, lenticular in outline; lunule absent (Fig. 22) *Cyclina sinensis*
 18b. Shell relatively small, oval-subquadrate or subtrigonal in outline; lunule present → 19

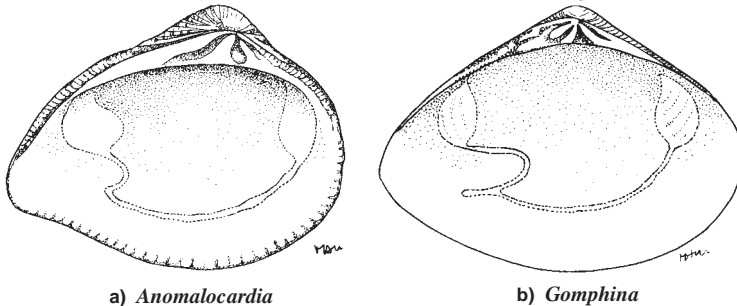


Fig. 21 interior of left valve

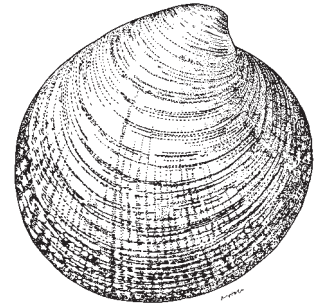


Fig. 22 *Cyclina sinensis* (exterior)

19a. Shell oval-subquadrate in outline; outer sculpture only concentric, of prominent, regularly spaced and recurved lamellae (Fig. 23) *Placamen tiara*

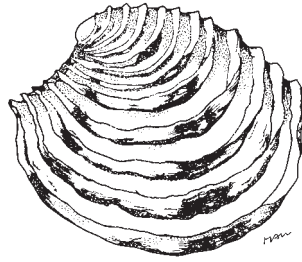


Fig. 23 *Placamen tiara* (exterior)

19b. Shell subtrigonal in outline; outer sculpture of dense radial riblets and low concentric cords (Fig. 24) *Anomalocardia squamosa*

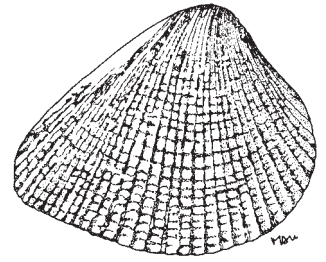


Fig. 24 *Anomalocardia squamosa* (exterior)

20a. Outside of valves smooth and glossy, sometimes with slightly oblique fine grooves crossing the concentric growth marks → 21

20b. Outside of valves with well-developed concentric sculpture → 24

21a. Shell elongate-ovate in outline → 22

21b. Shell trigonal-ovate in outline → 23

22a. Outside of valves with fine, slightly oblique, undulating grooves crossing the concentric growth marks (Fig. 25) *Paphia undulata*

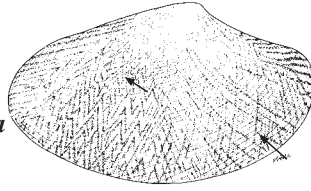


Fig. 25 *Paphia undulata* (exterior)

22b. Outside of valves devoid of undulating grooves (Fig. 26) *Paphia textile*

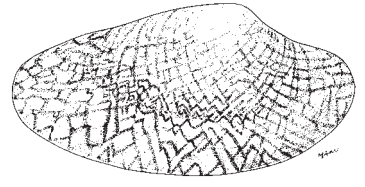


Fig. 26 *Paphia textile* (exterior)

23a. Shell subequilateral, with umbones slightly anterior to midline of valves (Fig. 27) *Gomphina aequilatera*

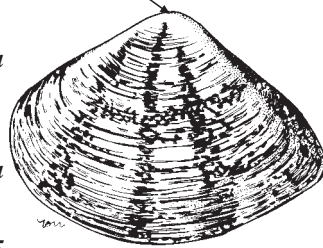


Fig. 27 *Gomphina aequilatera* (exterior)

23b. Shell inequilateral, with umbones strongly anterior to midline of valves (Fig. 28) *Marcia opima*

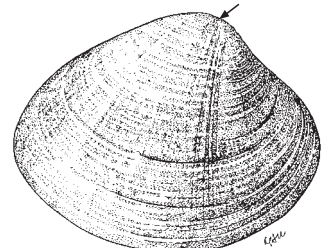


Fig. 28 *Marcia opima* (exterior)

24a. Outer sculpture both concentric and radial → 25

24b. Outer sculpture only concentric → 26

25a. Shell relatively short for its height, with a moderately strong sculpture; pallial sinus deep, nearly attaining midlength of valves (Fig. 29) *Ruditapes philippinarum*

25b. Shell relatively long for its height, with a moderately fine sculpture; pallial sinus shallow, far from attaining midlength of valves (Fig. 30) *Ruditapes variegatus*

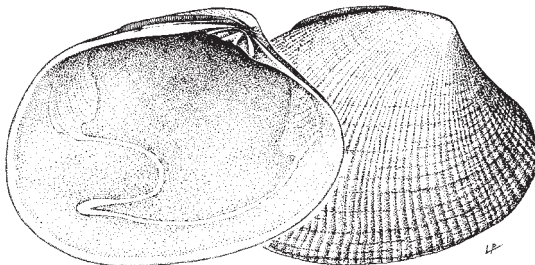


Fig. 29 *Ruditapes philippinarum*

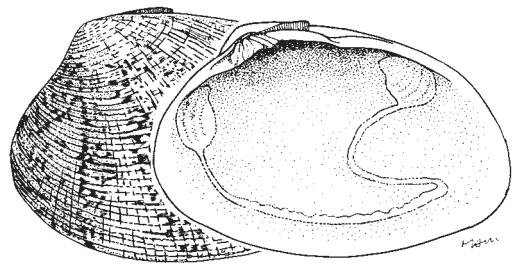


Fig. 30 *Ruditapes variegatus*

26a. Shell slightly twisted to the left posteroventrally by a radiating fold (Fig. 31) *Paphia gallus*

26b. Shell not twisted to the left posteroventrally → 27

27a. Median cardinal tooth of left valve strongest and widely bifid, appearing like 2 teeth; posterior cardinal tooth of right valve separated by a gap from median cardinal tooth → 28

27b. Median cardinal tooth of left valve rather narrow and slightly bifid, not appearing like 2 teeth; posterior cardinal tooth of right valve not separated by a gap from median cardinal tooth → 30

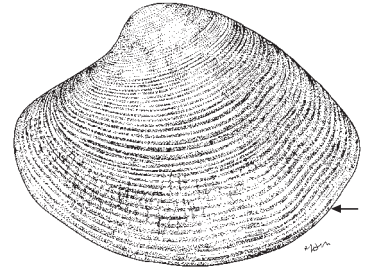
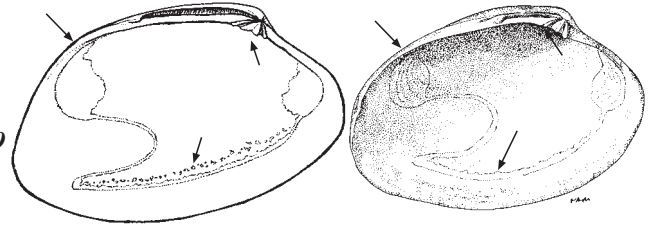


Fig. 31 *Paphia gallus* (exterior)

28a. Posterodorsal margin somewhat angulated posteriorly; dorsal side of pallial line bordered by a series of small scars (Fig. 32a) → 29

28b. Posterodorsal margin regularly rounded posteriorly; dorsal side of pallial line without a series of small scars (Fig. 32b) *Tapes belcheri*



a) *Tapes literatus* b) *Tapes belcheri*

Fig. 32 interior of left valve

29a. Posterodorsal margin shortly arcuate; sculpture of raised concentric ridges, becoming slightly lamellate posteriorly (Fig. 33) *Tapes dorsatus*

29b. Posterodorsal margin widely arcuate; sculpture of flat concentric ridges, not becoming lamellate posteriorly (Fig. 34) *Tapes literatus*

30a. Concentric grooves of the outer surface not developed on umbonal anterodorsal and posterodorsal areas of shell (Fig. 35) *Paphia semirugata*

30b. Concentric grooves, when present, developed throughout the outer surface of valves (sometimes fading out only near posterior half of ventral margin) → 31

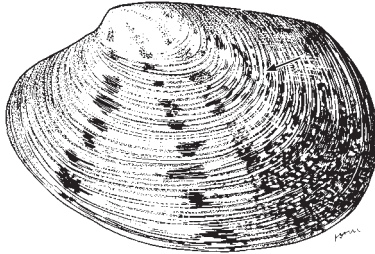


Fig. 33 *Tapes dorsatus* (exterior)

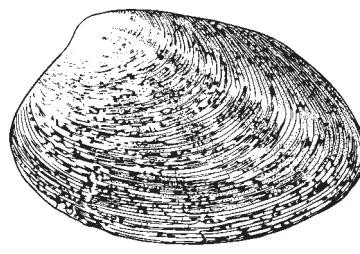


Fig. 34 *Tapes literatus* (exterior)

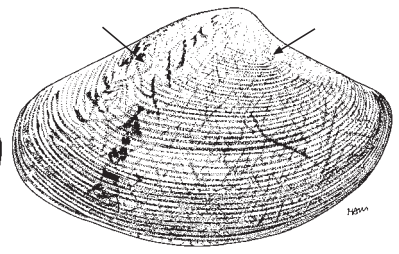


Fig. 35 *Paphia semirugata* (exterior)

31a. Shell elongate-ovate in outline (Fig. 36) *Katelsysia marmorata*

31b. Shell rounded-ovate to trigonal ovate in outline → 32

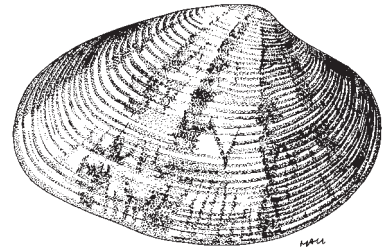


Fig. 36 *Katelsysia marmorata* (exterior)

32a. Shell trigonal-ovate in outline, with strongly sloping posterodorsal margin and somewhat pointing posterior end (Fig. 37) *Katelysia japonica*

32b. Shell rounded-ovate in outline, with widely arched posterodorsal margin and rounded posterior end (Fig. 38) *Katelysia hiantina*

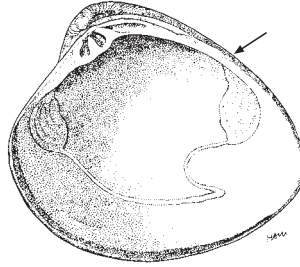


Fig. 37 *Katelysia japonica* (interior)

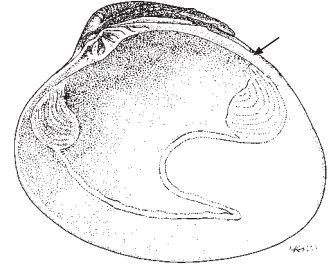


Fig. 38 *Katelysia hiantina* (interior)

List of species of interest to fisheries occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Anomalocardia squamosa* (Linnaeus, 1758)
- 🐚 *Circe scripta* (Linnaeus, 1758)
- 🐚 *Cyclina sinensis* (Gmelin, 1791)
- 🐚 *Gafrarium dispar* (Holten, 1802)
- 🐚 *Gafrarium divaricatum* (Gmelin, 1791)
- 🐚 *Gafrarium pectinatum* (Linnaeus, 1758)
- 🐚 *Gafrarium tumidum* Röding, 1798
- 🐚 *Gomphina aequilatera* (Sowerby, 1826)
- 🐚 *Katelysia hiantina* (Lamarck, 1818)
- 🐚 *Katelysia japonica* (Gmelin, 1791)
- 🐚 *Katelysia marmorata* (Lamarck, 1818)
- 🐚 *Lioconcha castrensis* (Linnaeus, 1758)
- 🐚 *Lioconcha ornata* (Dillwyn, 1817)
- 🐚 *Marcia opima* (Gmelin, 1791)
- 🐚 *Meretrix lyrata* (Sowerby, 1851)
- 🐚 *Meretrix meretrix* (Linnaeus, 1758)
- 🐚 *Paphia gallus* (Gmelin, 1791)
- 🐚 *Paphia semirugata* (Philippi, 1847)
- 🐚 *Paphia textile* (Gmelin, 1791)
- 🐚 *Paphia undulata* (Born, 1778)
- 🐚 *Periglypta clathrata* (Deshayes, 1854)
- 🐚 *Periglypta puerpera* (Linnaeus, 1771)
- 🐚 *Periglypta reticulata* (Linnaeus, 1758)
- 🐚 *Pitar citrinus* (Lamarck, 1818)
- 🐚 *Pitar pellucidus* (Lamarck, 1818)
- 🐚 *Placamen tiara* (Dillwyn, 1817)
- 🐚 *Ruditapes philippinarum* (Adams and Reeve, 1850)
- 🐚 *Ruditapes variegatus* (Sowerby, 1852)
- 🐚 *Sunetta menstrualis* (Menke, 1843)
- 🐚 *Sunetta truncata* (Deshayes, 1853)
- 🐚 *Tapes belcheri* Sowerby, 1852
- 🐚 *Tapes dorsatus* (Lamarck, 1818)
- 🐚 *Tapes literatus* (Linnaeus, 1758)

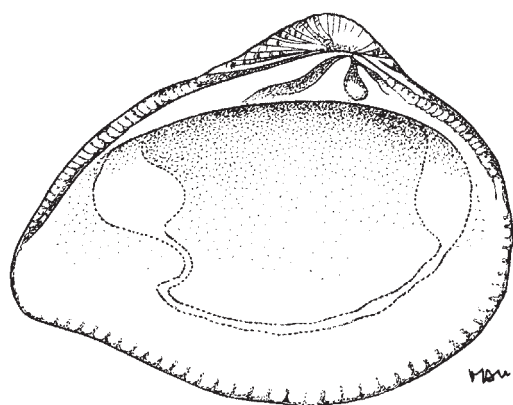
References

- Fischer-Piette, E. and B. Métivier. 1971. Révision des Tapetinae (Mollusques Bivalves). *Mém. Mus. Natn. Hist. Nat.*, (n. Sér.) A 71:1-106.
- Fischer-Piette, E. and P.H. Fischer. 1939. Révision des espèces vivantes de *Sunetta* du Muséum national d'Histoire naturelle. *J. Conchyl.*, 83(2-3):181-213.
- Fischer-Piette, E. and P.H. Fischer. 1941. Révision des espèces vivantes de *Meretrix* s.s. du Muséum national d'Histoire naturelle. *J. Conchyl.*, 85(4):313-344.
- Fischer-Piette, E. and D. Vucadinovic. 1977. Suite des révisions des Veneridae (Moll. Lamellibr.): Chioninae, Samaranginae et complément aux Vénus. *Mém. Mus. Natn. Hist. Nat.*, (n. Sér.) A(106):186 p.
- Lam, V.W.W. 1980. Shell form and diagnostic differences in the structure of the siphons and ciliary currents of the ctenidia in coastal species of the Tapetinae (Bivalvia:Veneracea) in Hong Kong. In *Proceedings of the first international workshop on the malacofauna of Hong Kong and southern China, 23 March-8 April 1977, Hong Kong*, edited by B.S. Morton. Hong Kong, Hong Kong University Press, pp. 11-31.
- Lamprell, K. and J. Stanisic. 1996. *Callista*, *Lioconcha* and *Pitar* in New Caledonia and adjacent waters (Mollusca, Veneridae). *Moll. Res.*, 17:27-48.
- Matsukuma, A. 1986. Studies on the Kawamura collection (Mollusca) in the National Science Museum, Tokyo. III. Genus *Tapes* Megerle, 1811 (Bivalvia), with description of a new species. *Venus*, 45(1):11-30.
- Matsukuma, A., T. Ozawa, and W. Yoosukh. 1988. *Paphia* (*Protapes*) *irrediviva* Makiyama, an extinct tropical embayment element of Japanese cenozoic mollusks, and allied species from the Indo-West Pacific. *Saito Ho-on Kai Spec. Publ.*, pp. 405-415.
- Matsukuma, A. and W. Yoosukh. 1988. Living *Bassina* and *Placamen* (Bivalvia:Veneridae) from the Australasia and the Indo-West Pacific (Studies on the Kawamura collection (Mollusca) stored in the National Science Museum, Tokyo. V.) *Saito Ho-on Kai spec. Publ.*, pp. 567-582.
- Oliver, P.G. 1992. *Bivalved seashells of the Red Sea*. Cardiff, Hemmen, Wiesbaden and National Museum of Wales, 330 p.
- Oliver, P.G. and E. Glover. 1996. *Paphia* (*Protapes*) (Bivalvia:Veneroidea) in the Arabian Sea, with the description of a new species. *J. Conch.*, 35(5):389-405.
- Zhuang, Q.Q. 1964. Studies on Chinese species of Veneridae (Class Lamellibranchia). *Stud. Mar. Sin.*, (5):43-106.

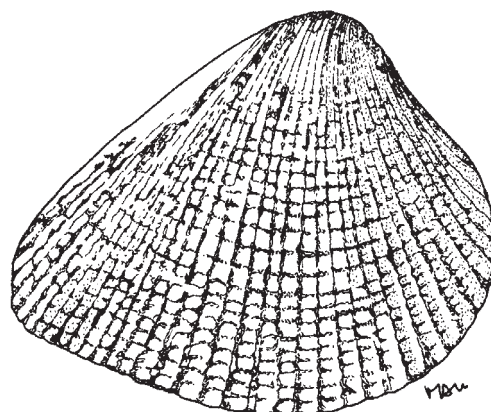
***Anomalocardia squamosa* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Anomalodiscus squamosus* (Linnaeus, 1758) / None.

FAO names: En - Squamose venus; Fr - Vénus écailleuse.



interior of left valve



exterior of right valve

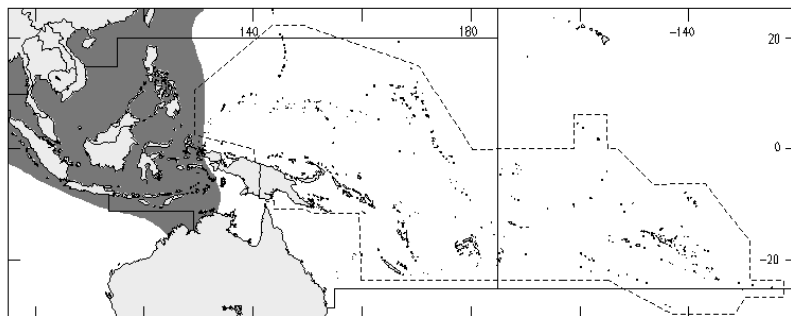
(after Habe, 1977)

Diagnostic characters: Shell small, solid, inflated and strongly inequilateral in shape, subtrigonal in outline. Umbones thick and prominent, well anterior to midlength of valves, on top of the strongly sloping anterodorsal and posterodorsal margins. Anterior side of shell rounded, posterior side produced and tapering to posterior end. Posteroventral margin slightly flexuous. **Lunule broad** and rounded, **well defined** by an incised peripheral groove, more shallowly sculptured than the main surface of shell. Posterodorsal slope depressed, set off by an obtuse ridge radiating from umbones to posterior end of shell and forming a shallow groove in front of it. Outer **sculpture of valves strong, of dense radial riblets and low concentric cords**, giving the surface a finely granulated and latticed aspect. **Sculpture of posterodorsal slope obsolete**, reduced to fine radial and concentric lines. **Hinge** plate trigonal, with 3 cardinal teeth at each valve, but **without lateral teeth**. **Pallial sinus small** and short, trigonal. **Internal margins crenulated**. Crenulations much smaller on dorsal margins, fading out at posterior end. **Colour: outside of shell dull yellowish white, often** flushed with slightly **darker** greyish to purplish brown **on lunule and escutcheon areas**. Interior whitish.

Size: Maximum shell length 4.5 cm, commonly to 3 cm.

Habitat, biology, and fisheries: In fine sandy to muddy bottoms, often near mangroves. Intertidal zone and shallow subtidal waters. Collected mainly for subsistence and sold in local Philippine markets.

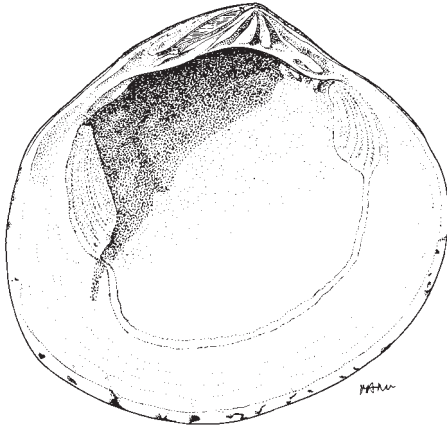
Distribution: Indo-West Pacific, from the Persian Gulf and India to eastern Indonesia; north to Korea and Japan, and south to north Western Australia.



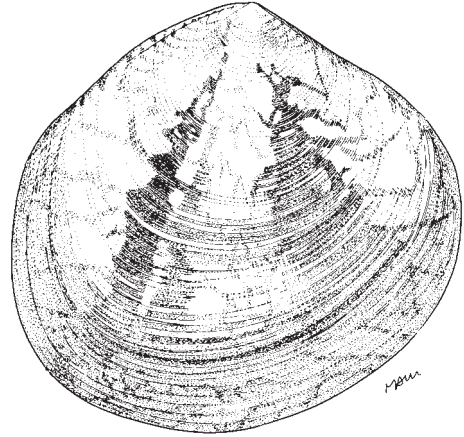
Circe scripta (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / None.

FAO names: En - Script venus; Fr - Circé violette.



interior of left valve



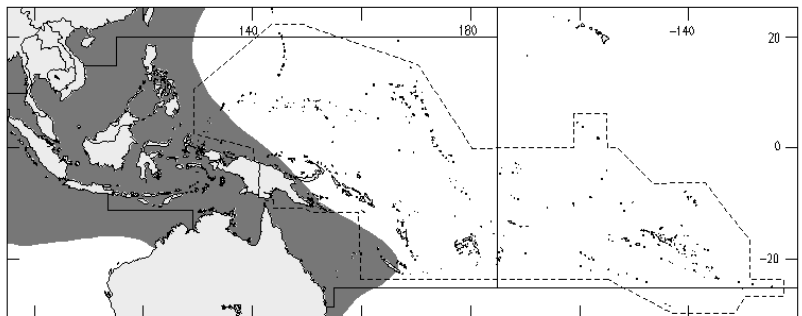
exterior of right valve

Diagnostic characters: Shell solid, **very compressed laterally**, trigonal-ovate in outline, **about as long as high**. Umbones **small, submedian, flattened**, on top of the strongly sloping anterodorsal and posterodorsal margins. Ventral half of shell rounded, often somewhat truncate at posterior margin. Lunule flattened, lanceolate, set off by a thin groove. Scutcheon narrow and elongate, poorly distinct. Outer **sculpture mainly concentric**, with numerous, low and rounded ridges, vanishing towards the umbones and **crossed by diverging radial riblets on anterodorsal and posterodorsal areas**. **Ligament sunken** in posterodorsal margin. **Hinge** plate rather high and short, **with 3 cardinal teeth** in each valve, and a **well-developed anterior lateral tooth in left valve**, fitting in a deep socket with beveled margins in right valve. Interior of shell smooth, with a low radial undulation running from umbonal area to posteroventral margin. **Pallial sinus very shallow**, reduced to a slight depression under the posterior adductor scar. **Internal margins** flattened, **smooth** and thin. **Colour:** **outer coloration** of shell **very variable**, whitish or **pale grey to cream**, with **various patterns of darker markings** which vary from being weak and interrupted, to broad and dense. Lunule and scutcheon often flecked with brown. Interior whitish with brown or purplish blotching.

Size: Maximum shell length 5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: Shallow burrower of sandy bottoms. Intertidal and shallow sublittoral levels to a depth of about 20 m. Collected for food at subsistence level in the Philippines and sold in local markets.

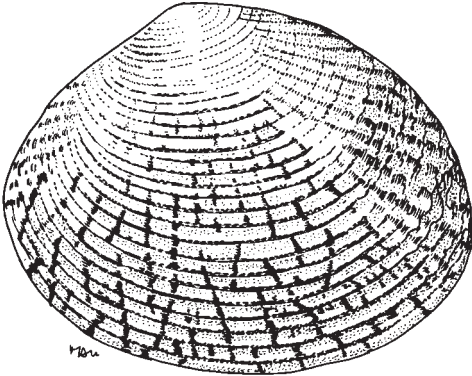
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to Papua New Guinea; north to Japan and south to New South Wales and New Caledonia.



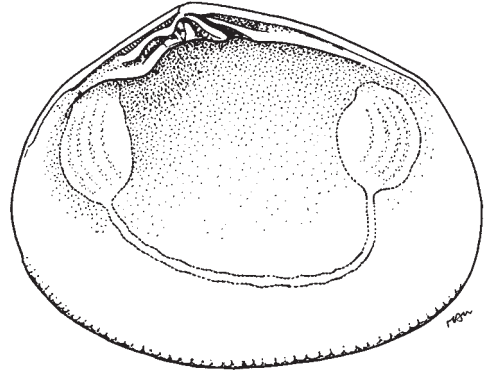
Gafrarium dispar (Holten, 1802)

Frequent synonyms / misidentifications: *Gafrarium dispar* (Chemnitz, 1795) (Invalid name) / *Gafrarium pectinatum* (Linnaeus, 1758).

FAO names: En - Discrepant venus; Fr - Circé mouchetée.



exterior of left valve



interior of right valve

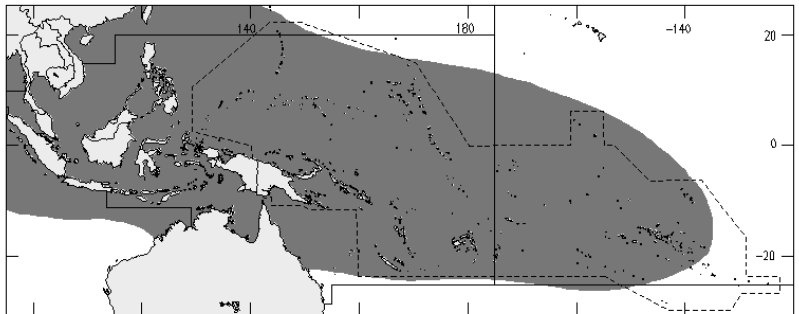
(after Habe, 1977)

Diagnostic characters: Shell rather small, thick and solid, somewhat inflated, ovate-subquadrate in outline. Umbones low and rounded, anterior to midline of valves. Lunule lanceolate, flattened, with concentric growth lines and peripheral groove. Escutcheon smoothish, indistinct. **Outer sculpture rather fine but well marked**, with many small concentric ridges and slightly nodulous, diverging radial riblets rapidly weakening medially and anteriorly. **Main sculpture of median area of valves of concentric ridges.** **Hinge with 3 cardinal teeth at each valve and well-developed anterior lateral teeth:** 1 in left valve and 2 in right valve, separated by a deep socket. **Pallial sinus very shallow**, reduced to a faint undulation under the posterior adductor scar. **Inner margins faintly crenulate.** **Colour: outside of shell cream to buff-coloured, with irregular reddish brown patches or lines, sometimes forming zigzag patterns.** Interior whitish, sometimes with yellowish hue.

Size: Maximum shell length 3 cm, commonly to 2 cm.

Habitat, biology, and fisheries: In sandy to muddy bottoms. Common in mangrove areas. Intertidal and shallow sublittoral levels to a depth of 20 m. Collected for food and commonly marketed in the Philippines.

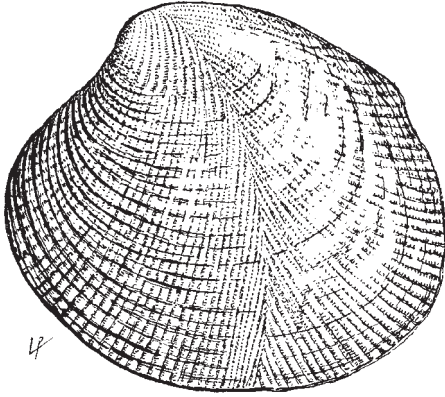
Distribution: Widespread in the Indo-West Pacific, from East Africa, including the Red Sea to eastern Polynesia; north to Japan and south to Queensland.



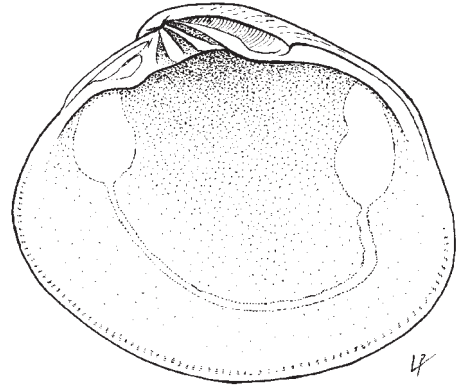
Gafrarium divaricatum (Gmelin, 1791)

Frequent synonyms / misidentifications: *Gafrarium divaricatum* (Chemnitz, 1782) (Invalid name) / *Gafrarium pectinatum* (Linnaeus, 1758).

FAO names: En - Forked venus; Fr - Circé divariquée.



exterior of left valve



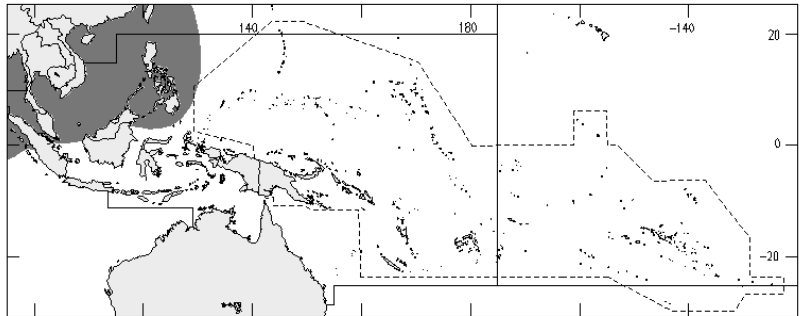
interior of right valve

Diagnostic characters: Shell rather thick and solid, **moderately inflated, rounded-ovate** in outline. **Umbones very low and rounded**, somewhat **anterior** to midline of valves. Lunule lanceolate, flattish, with concentric growth marks and fine peripheral groove. Escutcheon long and narrow, poorly distinct. **Outer sculpture rather fine and low**, with many small concentric ridges crossed by slightly diverging, weakly nodulous radial riblets weakening anteriorly and medially. **Main sculpture of median area of valves of diverging radial riblets**, that do not interrupt the concentric sculpturing. **Hinge with 3 cardinal teeth** at each valve and **well-developed anterior lateral teeth**: 1 in left valve and 2 in right valve, separated by a deep socket. **Pallial sinus very shallow**, reduced to a faint undulation under the posterior adductor scar. **Inner margins finely crenulate**. **Colour: outside of shell cream to brown, often with various patterns of darker or lighter lines and patches**. Interior whitish, sometimes tinged golden yellow and with brown blotching on hinge area.

Size: Maximum shell length 4.5 cm, commonly to 3.5 cm.

Habitat, biology, and fisheries: In clean or muddy sand, or in sandy gravel. Intertidal and sublittoral zones, to a depth of about 20 m. Artisanal exploitation in Thailand and the Philippines, where it appears commonly in local markets.

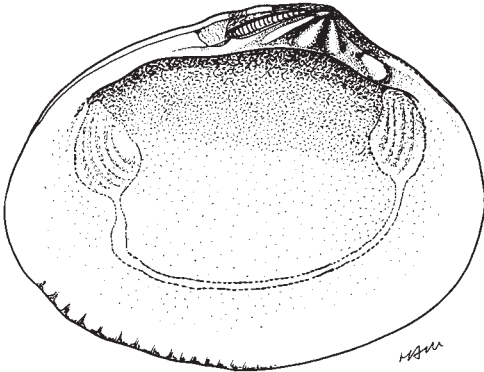
Distribution: Widespread in the Indo-West Pacific, from East and South Africa to the Philippines; north to Japan and south to Malaysia.



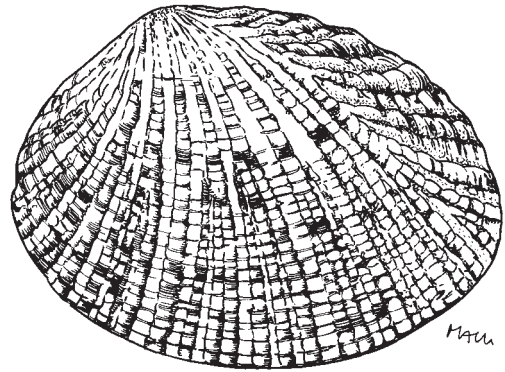
Gafrarium pectinatum (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Circe pectinata* (Linnaeus, 1758) / None.

FAO names: En - Comb venus; Fr - Circé pectinée.



interior of left valve



exterior of left valve

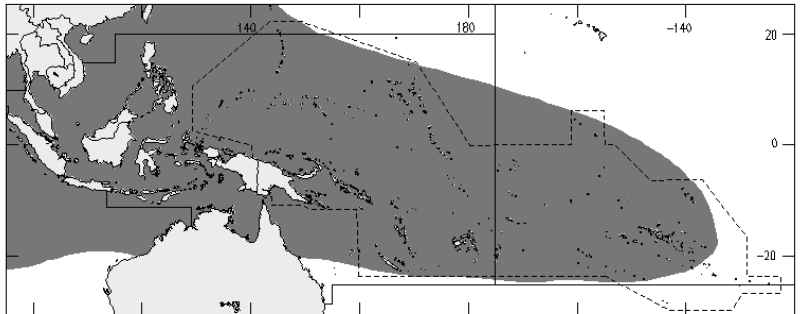
(after Habe, 1977)

Diagnostic characters: Shell thick and solid, with a variable, relatively compressed, elongated shape, elliptical-ovate in outline. Umbones thick, low and rounded, decidedly anterior to midline of valves. Lunule lanceolate, often slightly depressed, set off from valve by an incised peripheral groove, only sculptured with concentric growth marks. Escutcheon a very long and narrow, depressed area along posterodorsal margin of both valves. **Outer sculpture rather coarse, with strong, nodulous radial riblets, often dividing in 2 with growth and diverging obliquely towards anterior and posterior parts of valves.** Radial ribs of posterior slope strongly diverging and somewhat recurved in dorsal direction, with moderately wide interstices. **Anterior limit of posterior slope poorly distinct**, marked by a series of radial riblets, often appearing and/or branching at various levels between umbonal region and posteroventral margin. **Hinge plate strong, with 3 cardinal teeth at each valve and well-developed anterior lateral teeth:** 1 in left valve, and 2 in right valve, separated by a deep socket. **Pallial sinus very shallow**, reduced to a faint undulation under the posterior adductor scar. **Inner ventral margin crenulated.** **Colour:** outer coloration of shell variable, off-white to buff-coloured and generally with fawn or brown blotches or spots throughout. Lunule frequently darker towards the umbones. **Interior porcelainous white**, often with yellowish hue inside the pallial line, and with purple-brown blotching on lunular margin, posteroventral part of hinge and posterior margin of valves.

Size: Maximum shell length 4.8 cm, commonly to 3.5 cm.

Habitat, biology, and fisheries: In sandy bottoms. Intertidal and shallow sublittoral waters to a depth of about 20 m. Artisanal exploitation in the Philippines, where it appears commonly in local markets.

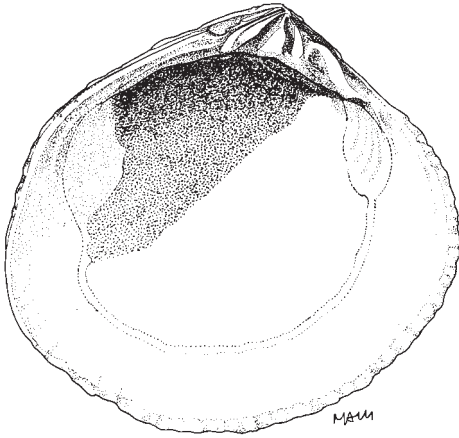
Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, the Red Sea and the Persian Gulf to eastern Polynesia; north to Japan and south to Queensland.



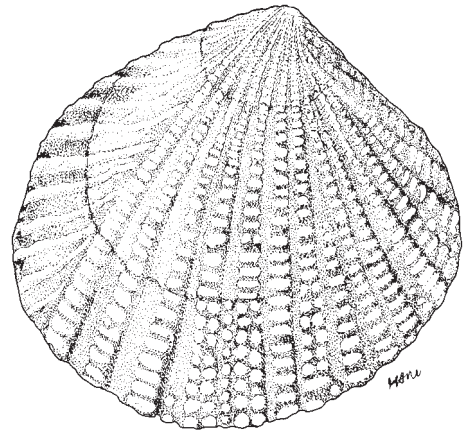
Gafrarium tumidum Röding, 1798

Frequent synonyms / misidentifications: *Circe gibbia* (Lamarck, 1818); *Gafrarium undulatum* Röding, 1798 / *Gafrarium pectinatum* (Linnaeus, 1758).

FAO names: En - Tumid venus; Fr - Circé gibbeuse.



interior of left valve



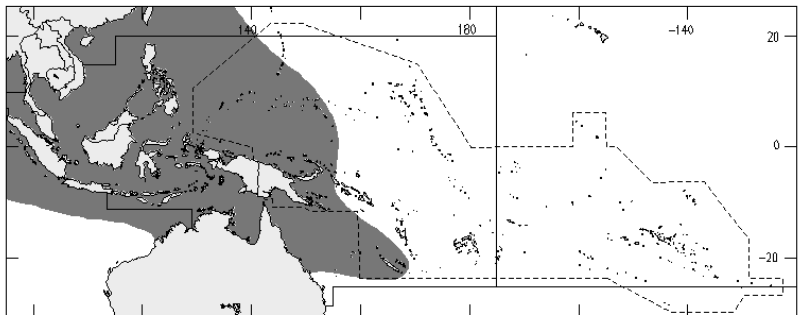
exterior of right valve

Diagnostic characters: Shell thick and solid, with a very variable, relatively inflated, short and high shape, **ovate-subquadrate to subtrigonal** in outline. Posterior margin convex, high and truncate to somewhat obliquely expanded posteroventrally. **Umbones** thick, **low and rounded**, markedly **anterior** to midline of valves. Lunule ovate, moderately flattish or somewhat depressed, set off from valve by an incised peripheral groove and only sculptured with concentric growth marks. Escutcheon long and narrow, depressed, smoothish. **Outer sculpture rather coarse, with strong, nodulous radial riblets, diverging obliquely towards anterior and posterior parts of valves**, some dividing into 2 with growth. Ribs of posterior slope weaker, strongly oblique and somewhat recurved dorsalwards, with rather wide interstices. **Anterior limit of posterior slope distinct**, generally marked by a single, uninterrupted radial rib, running from the umbonal region to posteroventral margin. **Hinge** plate strong, **with 3 cardinal teeth** at each valve and **well-developed anterior lateral teeth**: 1 in left valve, and 2 in right valve, separated by a deep socket. **Pallial sinus very shallow**, reduced to a faint depression under posterior adductor scar. **Inner ventral margin crenulated**. **Colour:** outer coloration of shell **variable**, usually **off-white** to fawn and **with indistinct dark brown blotches** around umbonal area and posterodorsal margin, but sometimes extending throughout the shell surface. Lunule commonly tinged dark brown, at least towards the umbones. **Interior of shell porcelaneous white, with variable dark purplish brown blotches** on hinge area and posterior half of shell.

Size: Maximum shell length 4 cm, commonly to 3 cm.

Habitat, biology, and fisheries: In sandy bottoms. Intertidal and sublittoral, to a depth of about 30 m. This species is artisanally exploited and marketed in Indonesia, Fiji Islands, and the Philippines.

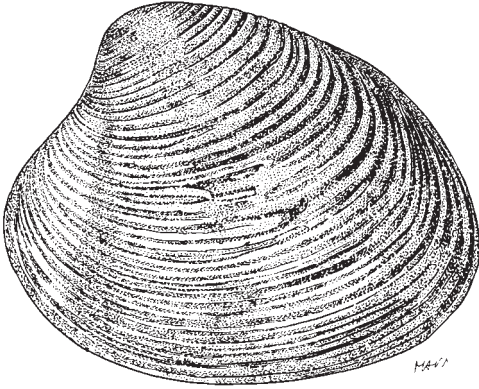
Distribution: Indo-West Pacific, from India, Sri Lanka, Mauritius and the Seychelles to Melanesia; north to southern Japan and south to Queensland and New Caledonia.



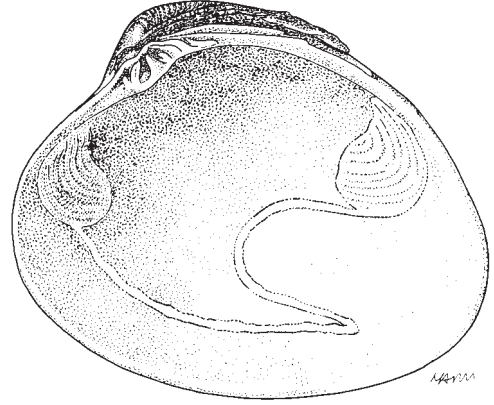
Katelysia hiantina (Lamarck, 1818)

Frequent synonyms / misidentifications: *Marcia hiantina* (Lamarck, 1818); *M. rimularis* (Lamarck, 1818); *Paphia hiantina* (Lamarck, 1818) / None.

FAO names: En - Hiant venus; Fr - Vénus sillonnée.



exterior of left valve



interior of right valve

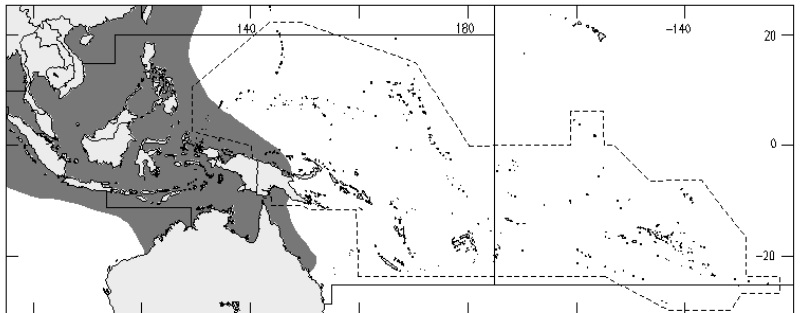
(after Römer, 1872)

Diagnostic characters: Shell solid, with a **variable**, moderately inflated, **inequilateral** shape, **roughly rounded-ovate in outline**. Umbones **markedly anterior** to midline, anterior side of shell rounded. **Posterodorsal margin widely arched and gently sloping, meeting the convex posterior margin at an obtuse, poorly marked angle**, giving a slightly truncate shape to posterior end of shell. Lunule lanceolate, not depressed, covered with concentric growth marks, bordered by a fine line. Escutcheon rather distinct, forming on both valves a narrow, smoothish band, somewhat depressed anteriorly. **Outer surface** of valves covered with **numerous, somewhat irregular concentric grooves and cords**, the latter sometimes flatter and less apparent, but always present, near posterior half of ventral margin. **Hinge** with 3 diverging cardinal teeth at each valve, but **without lateral teeth**. **Pallial sinus moderately deep** and broad, rounded anteriorly. **Internal margins smooth**. **Colour:** outside of shell **variable in colour and pattern**, whitish to grey, fawn-coloured or brown, frequently with various patterns of white, fawn or purplish radial bands, zigzags or trigonal spots or irregular blotches. **Interior dirty white**, often dark coloured on hinge area.

Size: Maximum shell length 6 cm, commonly to 5 cm.

Habitat, biology, and fisheries: In various sandy to muddy bottoms, especially in sheltered areas. Intertidal and sublittoral, to a depth of about 20 m. This species has relatively long siphons for the genus, and can therefore burrow to a depth of approximately 8 cm. Artisanal exploitation in Thailand and in the Philippines where it is commonly sold in local markets.

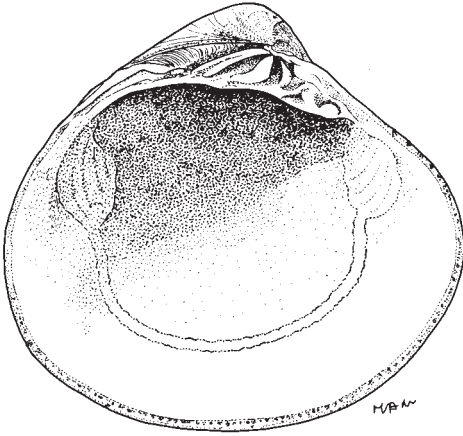
Distribution: Indo-West Pacific, from the Gulf of Aden to Papua New Guinea; north to southern Japan and south to Queensland.



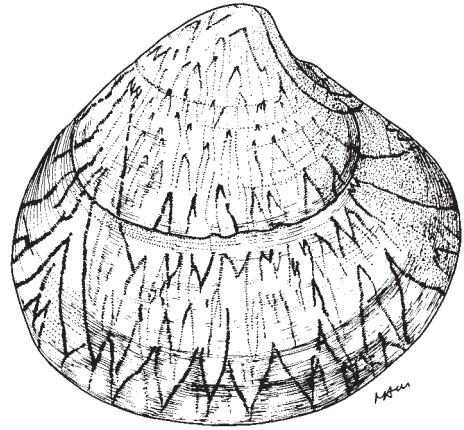
Lioconcha castrensis (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Cytherea ornata* Lamarck, 1818 / None.

FAO names: En - Camp pitar venus; Fr - Pitar aide-de-camp.



interior of left valve



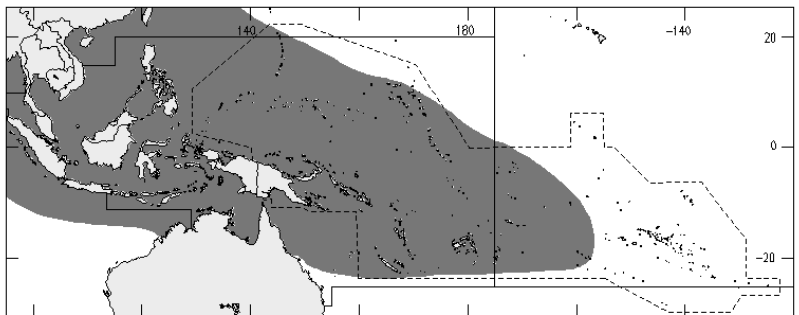
exterior of right valve

Diagnostic characters: Shell heavy and solid, **inflated, subequilateral** in shape, only a little longer than high and **rounded-ovate** in outline. **Umbones** inflated and rounded, **slightly anterior** to midline of valves. **Posterodorsal margin rounded** and steeply curving into the moderately high, faintly truncate posterior margin. **Lunule broad**, somewhat elevated above shell surface **and well demarcated**, with a deeply incised peripheral groove. Escutcheon indistinct. **Outer surface of shell smooth and shining**, only sculptured with fine concentric growth lines. External ligament deeply sunken into posterodorsal margin. **Hinge plate strong, with 3 cardinal teeth in each valve and well-developed anterior lateral teeth:** 1 in left valve, and 2 in right valve, separated by a deep socket. **Anterior and median cardinal teeth not radiating**, more or less vertical in direction. **Pallial sinus very shallow**, reduced to a faint undulation, **not extending forwards beyond the posterior adductor scar. Internal margins smooth. Colour: outside of shell creamy white, with some large, dark chestnut brown to almost black, V-shaped markings or zigzag lines.** Interior porcelaneous white.

Size: Maximum shell length 5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: Shallow burrower of sandy bottoms, common in coral reef areas. Intertidal and sublittoral to a depth of 25 m. Artisanal exploitation in the Philippines; commonly sold for food in the markets of the central Philippines; the shell is used in local shellcraft.

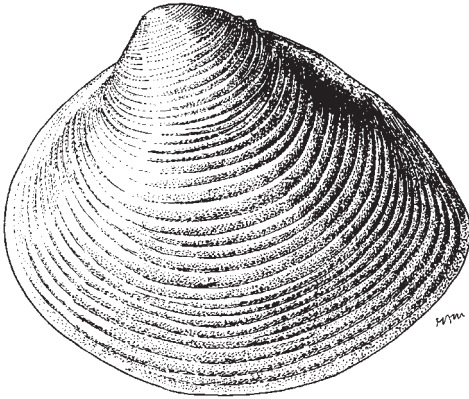
Distribution: Widespread in the Indo-West Pacific, from northwestern Indian Ocean, including the Red Sea, to Polynesia; north to Japan and south to Queensland.



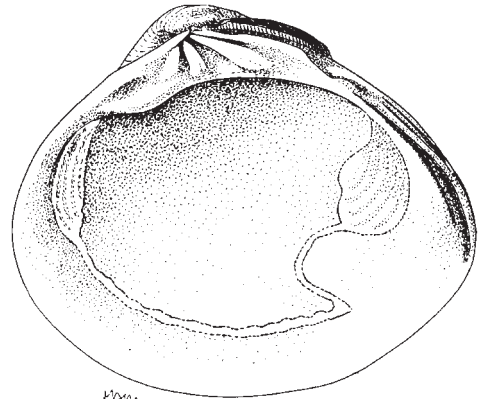
***Meretrix lyrata* (Sowerby, 1851)**

Frequent synonyms / misidentifications: None / None.

FAO names: En - Lyrate hard clam; Fr - Cythérée lyre.

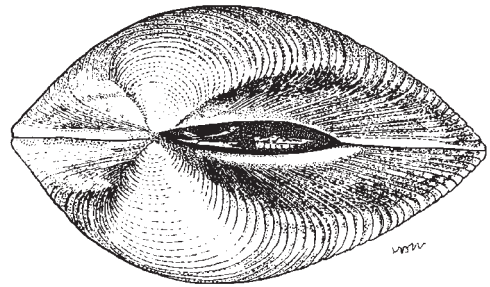


exterior of left valve



interior of right valve

Diagnostic characters: Shell thick, moderately inflated with a variable, inequilateral shape, subtrigonal in outline. Umbones anterior, poorly inflated, pointing on top of dorsal margin which is strongly sloping on both sides and longest posteriorly. Anterior and ventral margins rounded, posterior end of shell bluntly angled. Lunule and escutcheon areas smoothish and poorly distinct. Posterodorsal slope shallowly convex, bordered by a low fold radiating toward posteroventral end of valves. Outer surface of shell with incised concentric grooves fading out toward anterodorsal and posterodorsal margins, and sometimes also at ventral margin of larger specimens. Periostracum fine and glossy. Hinge plate strong, with an undulating, mostly concave ventral outline, bearing in each valve 3 diverging cardinal teeth and well-developed anterior lateral teeth: 1 in left valve, roughly parallel to dorsal margin, and 2 in right valve, with a deep median socket. Ligamental nymphs finely striate. Pallial sinus broadly open, rather shallow. Internal margins smooth. Colour: outside of shell light fawn to brown under the translucent, glossy, yellowish periostracum. Interior porcelaneous white.



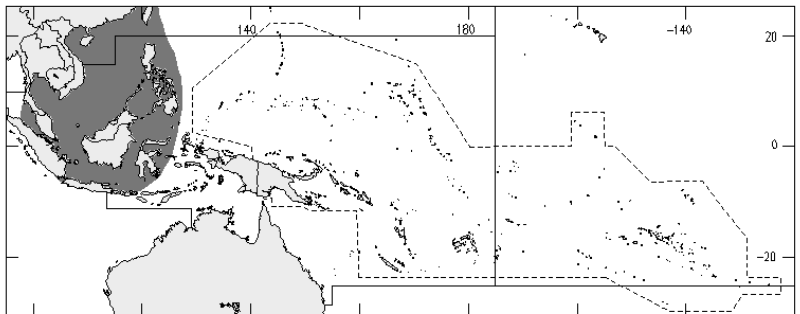
dorsal view of entire shell
(after Römer, 1859)

Posterodorsal slope shallowly convex, bordered by a low fold radiating toward posteroventral end of valves. Outer surface of shell with incised concentric grooves fading out toward anterodorsal and posterodorsal margins, and sometimes also at ventral margin of larger specimens. Periostracum fine and glossy. Hinge plate strong, with an undulating, mostly concave ventral outline, bearing in each valve 3 diverging cardinal teeth and well-developed anterior lateral teeth: 1 in left valve, roughly parallel to dorsal margin, and 2 in right valve, with a deep median socket. Ligamental nymphs finely striate. Pallial sinus broadly open, rather shallow. Internal margins smooth. Colour: outside of shell light fawn to brown under the translucent, glossy, yellowish periostracum. Interior porcelaneous white.

Size: Maximum shell length 6 cm, commonly to 5 cm.

Habitat, biology, and fisheries: In sand and mud bottoms. Intertidal and shallow sublittoral waters to a depth of about 20 m. Locally collected for food in Viet Nam and the Gulf of Thailand. Commercially fished in the Mallaca Strait area (Indonesia) and appearing in local markets of the southern Philippines.

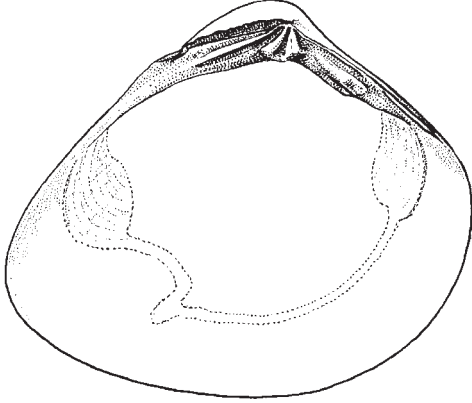
Distribution: Tropical West Pacific, from western Indonesia to the Philippines; north to the East China Sea and Taiwan Province of China, and south to southern Indonesia.



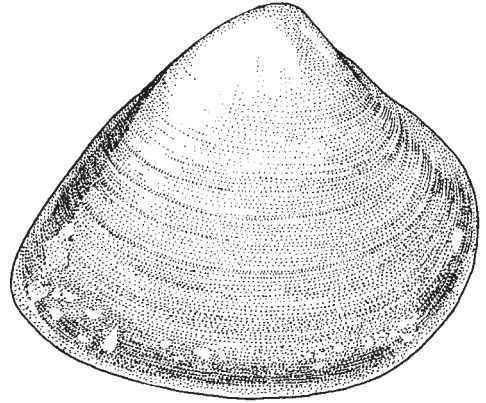
Meretrix meretrix (Linnaeus, 1758)

Frequent synonyms / misidentifications: Due to a pending taxonomic revision, *Meretrix meretrix* is considered here in a wide sense. However, some of its numerous varieties may represent distinct species, namely: *M. lamarckii* Deshayes, 1853; *M. lusoria* (Röding, 1798); *M. petechialis* (Lamarck, 1818).

FAO names: **En** - Asiatic hard clam; **Fr** - Cythérée commune.



interior of left valve



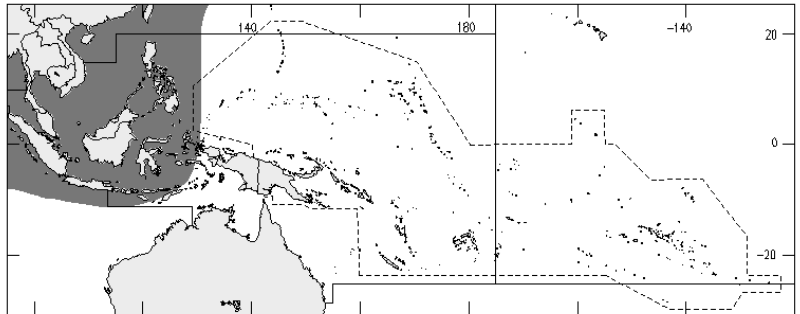
exterior of right valve

Diagnostic characters: Shell thick, moderately inflated with a variable, nearly equilateral to rather strongly inequilateral shape, **trigonal-ovate** in outline. Umbones anterior, **poorly inflated, pointing on top of dorsal margin which is strongly sloping** on both sides and **longest posteriorly**. Anterior and ventral margins broadly rounded, posterior end of shell bluntly angled. Lunule smooth and **poorly defined, escutcheon indistinct**. Posterodorsal slope shallowly convex, bordered by a faint radial fold that disappears toward posteroventral end of valves. **Outer surface** of shell **smooth**, except from low concentric growth marks. **Periostracum smooth and glossy**, closely applied to shell. **Hinge plate thick, with an irregularly shaped, concave ventral outline, bearing in each valve 3 cardinal teeth and well developed anterior lateral teeth:** a strong one in left valve, nearly parallel to dorsal margin, and 2 smaller ones in right valve, with a deep median socket. **Ligamental nymphs with fine transverse grooves. Pallial sinus broad and rather shallow, rounded anteriorly. Internal margins smooth. Colour: outside of shell very variable in colour and pattern**, under the transparent and glossy, pale straw-coloured periostracum; basically white and often flushed with deep purple brown on posterodorsal slope, or fawn to chestnut brown, plain or variously spotted, blotched or streaked with darker grey or brown. Interior porcelaneous white, sometimes stained with dark brown along posterodorsal margin.

Size: Maximum shell length 7 cm, commonly to 6 cm.

Habitat, biology, and fisheries: In sand and muddy-sand bottoms. Intertidal and sublittoral waters to a depth of about 20 m. An economically important species outside the area (India, Korea, China, Taiwan Province of China, and Japan). Artisanal exploitation in Thailand, the Philippines, and Indonesia, with a potential interest for export.

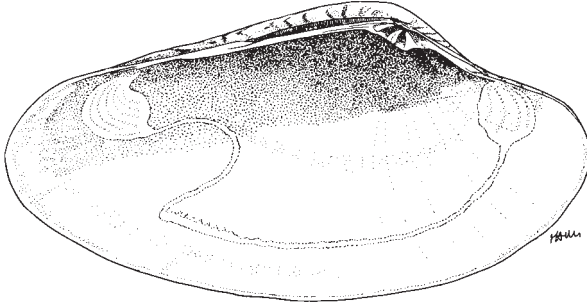
Distribution: Widespread in the Indo-West Pacific, from East Africa to the Philippines; north to Japan and south to Indonesia.



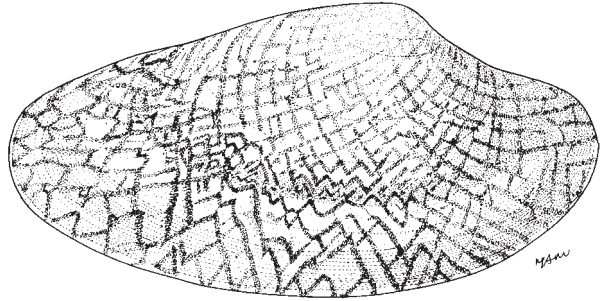
Paphia textile (Gmelin, 1791)

Frequent synonyms / misidentifications: *Tapes textrix* (Chemnitz, 1784) (Invalid name) / *Paphia undulata* (Born, 1778).

FAO names: En - Textile venus; Fr - Palourde textile.



interior of left valve



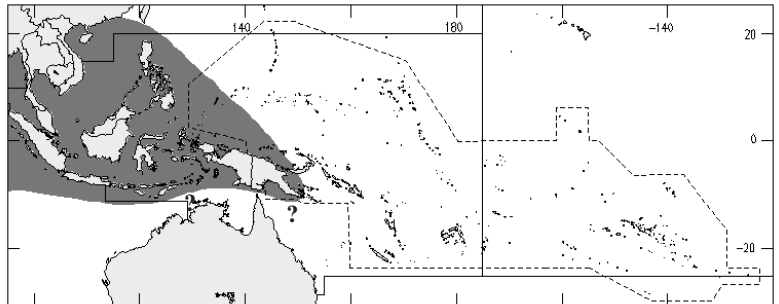
exterior of right valve

Diagnostic characters: Shell moderately inflated, strongly **elongate** transversely, **elliptical-ovate** in outline. Umbones markedly anterior, approximately situated at the anterior 1/3 of shell length. **Anterodorsal and posterodorsal margins** straightish and **gently sloping**. Ventral margin broadly rounded. Lunule lanceolate, delicately outlined by a finely impressed line. **Outer surface smooth and glossy**, only with shallow concentric growth marks, but **devoid of undulating oblique grooves** on medial part of the shell. **Hinge** narrow, **concentrated** under the umbo of each valve, with 3 radiating cardinal teeth but **without lateral teeth**. **Pallial sinus deep, markedly ascending**, rounded in front and approximately extending over the posterior 2/5 of shell length. **Internal margins smooth**. **Colour: outside of shell highly glossy**, cream to pinkish brown, **with a netted pattern of darker tan to greyish brown zigzag lines**. Dorsal margins with distant, dark purplish brown, short and transverse lines anterior and posterior to the umbones. Interior whitish.

Size: Maximum shell length 8 cm, commonly to 6 cm.

Habitat, biology, and fisheries: In fine sand and mud bottoms. Intertidal and sublittoral to a depth of about 20 m. Commonly collected for food with other *Tapes* and *Paphia* species.

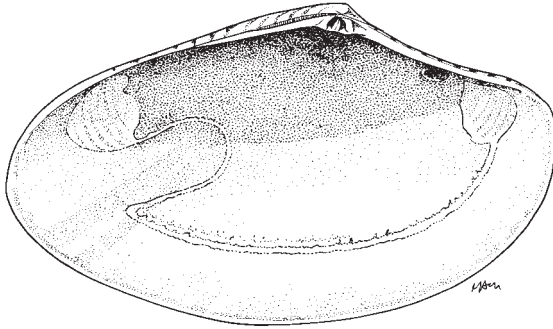
Distribution: Imperfectly known, because of frequent confusion with *Paphia undulata* (Born, 1778). Indo-West Pacific, from eastern Africa to Papua New Guinea; north to the South China Sea and south to Indonesia.



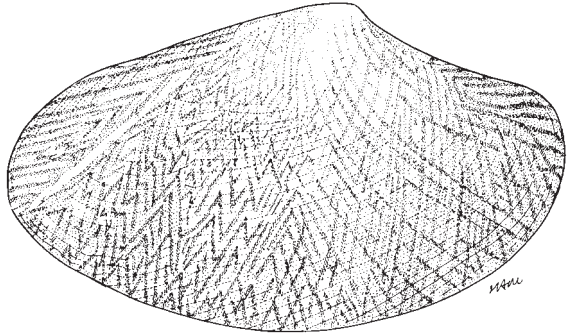
Paphia undulata (Born, 1778)

Frequent synonyms / misidentifications: *Paratapes scordalus* Iredale, 1936 / *Paphia textile* (Gmelin, 1791).

FAO names: En - Undulate venus; Fr - Palourde ondulée.



interior of left valve



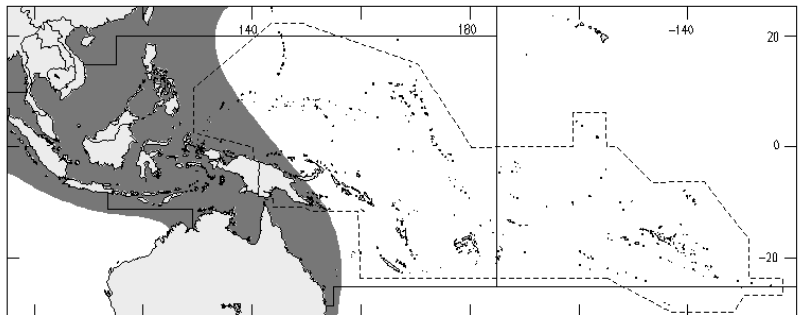
exterior of right valve

Diagnostic characters: Shell moderately inflated, transversely **elongate, elliptical-ovate** in outline. Umbones anterior to midline of shell. **Anterodorsal and posterodorsal margins** straightish and **gently sloping**. Ventral margin broadly rounded. Lunule lanceolate, delicately outlined by a finely impressed line. **Outer surface smooth and glossy, with fine, slightly oblique, undulating grooves crossing the shallow concentric growth marks** and disappearing towards anterior and posterior ends of shell. **Hinge** narrow, with 3 cardinal teeth concentrated under the umbo of each valve, but **without lateral teeth**. **Pallial sinus deep, markedly ascending**, rounded in front. **Internal margins smooth**. **Colour:** outside of shell cream to light mauve, **with a net-like pattern of tan zigzag lines**. Umbones often more or less tinged light purple. Lunule and escutcheon whitish, with transverse streaks of purplish brown. Interior white, generally with a mauve hue in the umbonal cavity.

Size: Maximum shell length 6.5 cm, commonly to 5 cm.

Habitat, biology, and fisheries: In fine sand and mud bottoms. Intertidal and sublittoral to a depth of about 30 m. Heavily exploited in Thailand, for both domestic demand and export (916 t of canned meat exported to Italy in 1987).

Distribution: Indo-West Pacific, from the north-western Indian Ocean, including the Red Sea, to Papua New Guinea; north to Japan and south to New South Wales.



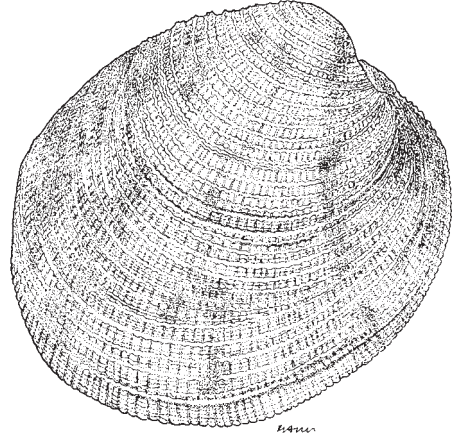
Periglypta puerpera (Linnaeus, 1771)

Frequent synonyms / misidentifications: *Antigona puerpera* (Linnaeus, 1771); *Venus aegrota* Reeve, 1863; *V. lacerata* Hanley, 1844; *V. puerpera* Linnaeus, 1771; *V. reticulata* Born, 1780 (not of Linnaeus, 1758) / None.

FAO names: En - Youthful venus; Fr - Praire chagrinée.



interior of left valve



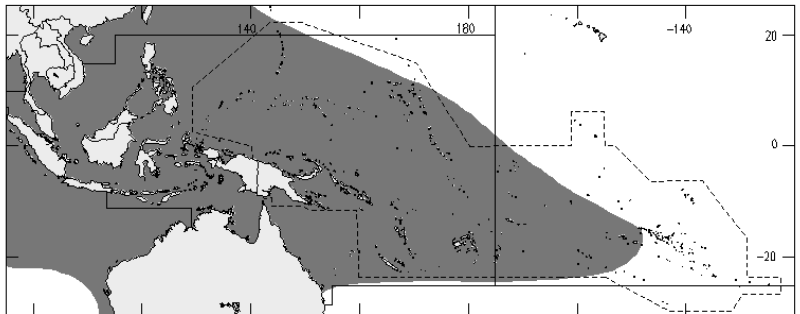
exterior of right valve

Diagnostic characters: Shell thick and strongly inflated, nearly as high as long, rounded-quadrate in outline, reaching a very large size. Umbones in the anterior 1/4. Lunule and escutcheon well marked, the latter smoothish, medially grooved in left valve and posteriorly overlain by the right valve margin. **Outer sculpture both concentric and radial, relatively fine, with many lamellous concentric ridges, radially undulated or crenulated** by numerous low, rounded riblets. Ligament deeply inset, partly overlapped by the edge of the escutcheon in right valve. **Hinge** plate strong, excavated at ventral margin, with 3 strong cardinal teeth in each valve and **with a small, tubercle-shaped anterior lateral tooth in left valve. Pallial sinus well developed**, extending on about 2/5 of the shell length. **Internal margins finely crenulated.** **Colour:** outside of shell whitish to light fawn, largely tinged with dark brown posteriorly, and with 3 or 4 interrupted radial bands of brown (reduced to small blotches towards the umbones). Interior whitish, often flushed pale yellow to orange and dark purple posteriorly.

Size: Maximum shell length 12.5 cm, commonly to 9 cm.

Habitat, biology, and fisheries: In sand and mud bottoms. Intertidal and sublittoral to a depth of about 20 m. Collected for food in Southeast Asia and Fiji Islands. Common in the markets of the central Philippines. Shell used in local shellcraft.

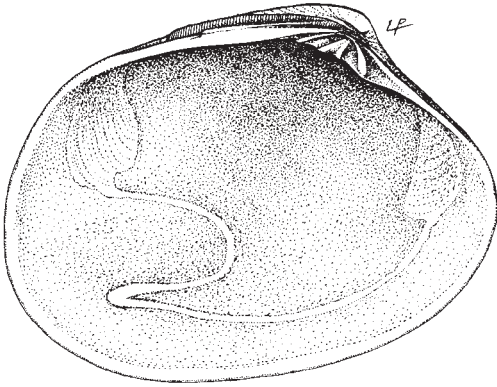
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to Polynesia; north to Japan and south to Queensland and South Australia.



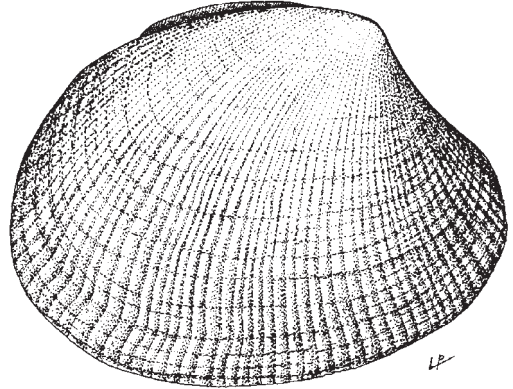
Ruditapes philippinarum (Adams and Reeve, 1850)

Frequent synonyms / misidentifications: *Tapes bifurcata* Quayle, 1938; *T. japonica* Deshayes, 1853; *T. philippinarum* (Adams and Reeve, 1850); *T. semidecussatus* Reeve, 1864; *Venerupis japonica* (Deshayes, 1853); *V. philippinarum* (Adams and Reeve, 1850); *V. semidecussatus* (Reeve, 1864) / None.

FAO names: En - Japanese carpet shell; Fr - Palourde japonaise.



interior of left valve



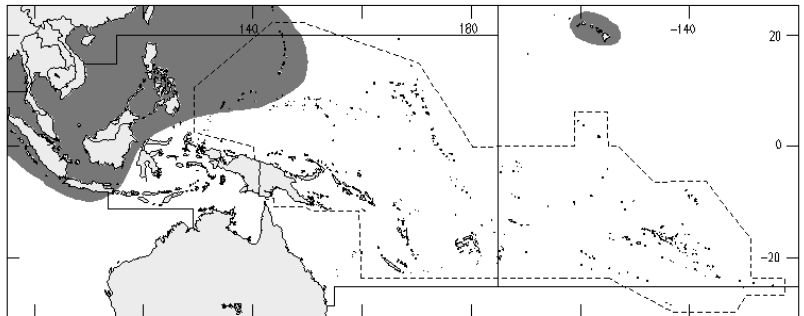
exterior of right valve

Diagnostic characters: Shell moderately strong and inflated, with a variable shape, generally relatively short for its height, elongate-subquadrate in outline. Umbones low, markedly anterior to midline of shell. Posterodorsal margin feebly arched and gently sloping, meeting the rounded and high posterior margin at an obtuse angle. Anterodorsal margin shorter, straightish to slightly concave, slanting obliquely towards the acutely rounded anterior margin. Ventral margin regularly and broadly rounded. Lunule smoothish, about twice as long as wide, with fine peripheral groove. Escutcheon asymmetrical, more distinct in left valve. Outer sculpture both concentric and radial, more pronounced anteriorly and posteriorly, giving a distinctly latticed and granulated characteristic pattern. Hinge with 3 cardinal teeth at each valve, but without lateral teeth. Pallial sinus deep and rounded, longer than high, nearly attaining midlength of valves. Internal margins smooth. Colour: outside variable, cream to light buff or fawn, uniform or variegated with various patterns of deeper brown. Interior whitish, often more or less stained with purple or brown, mainly posteriorly.

Size: Maximum shell length 8 cm, commonly to 5 cm.

Habitat, biology, and fisheries: In sandy and muddy bottoms. Common in protected marine areas; also in coastal lagoons. A major commercial species in the northern, subtropical western Pacific; intensively cultivated in Japan, Korea, and China. Introduced incidentally with Japanese oysters (*Crassostrea gigas*), or for aquaculture trials, in many areas.

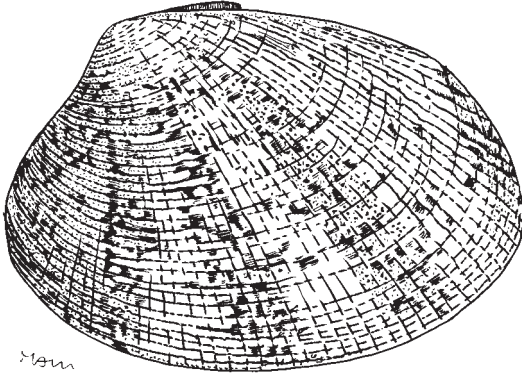
Distribution: Indo-West Pacific, from India and Sri Lanka to Micronesia; north to Sakhaline, the Japan Sea and Hawaii (introduced), and south to Indonesia.



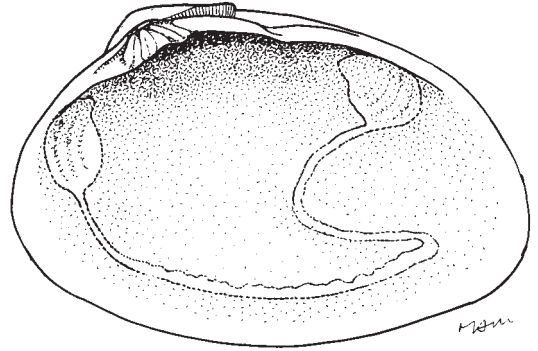
***Ruditapes variegatus* (Sowerby, 1852)**

Frequent synonyms / misidentifications: *Tapes cinerea* Deshayes, 1853; *T. punicea* Deshayes, 1853; *T. variegata* Sowerby, 1852; *Venerupis variegata* (Sowerby, 1852) / *Tapes bruguieri* (Hanley, 1845); *T. japonica* Deshayes, 1853.

FAO names: **En** - Variegated carpet shell; **Fr** - Palourde bigarrée.



exterior of left valve



interior of right valve

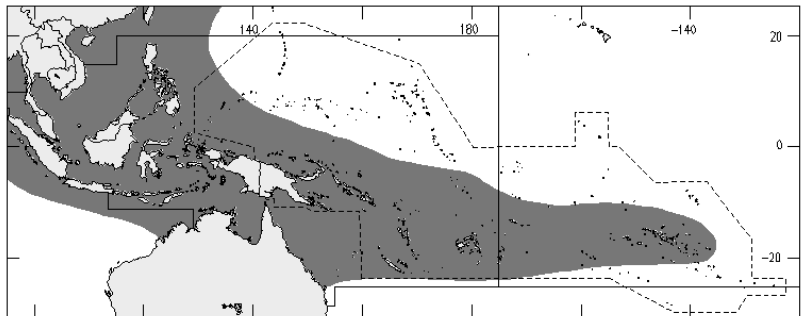
(after Habe, 1965)

Diagnostic characters: Shell rather strong, with a **variable, moderately inflated** shape, generally **relatively long for its height**, elongate-ovate to subquadrate in outline. **Umbones** low, **markedly anterior** to midline of shell. Posterodorsal margin moderately long, becoming more strongly sloping towards the rounded posterior end of shell. Anterior and ventral margins rounded, the latter more broadly so. **Lunule** smoothish, **long and narrow** (about 3 to 4 times longer than wide), with fine peripheral groove. **Escutcheon** narrow and often moderately deep, **well marked on both valves**. **Outer sculpture both concentric and radial**, more pronounced anteriorly and posteriorly, giving a **finely latticed** and granulated characteristic pattern. **Hinge** with 3 cardinal teeth at each valve, but **without lateral teeth**. **Pallial sinus well developed** and rounded, about as high as long, but **far from attaining midlength of valves**. **Internal margins smooth**. **Colour: outside variable**, cream to fawn, brown or grey, **uniform or variegated** with various patterns of lighter or darker colours. Umbones frequently hued in pink, yellow, orange, or deep purplish blue. **Interior often brightly tinged** in yellow, pink, orange, purple, or light bluish grey, paler towards the margins and with deep purple blotches on hinge area.

Size: Maximum shell length 6 cm, commonly to 4.5 cm.

Habitat, biology, and fisheries: In sandy bottoms, often with pebble. Intertidal and sublittoral to a depth of about 20 m. Locally collected for food with other venerid species. Intensive exploitation in Korea, aquaculture in China.

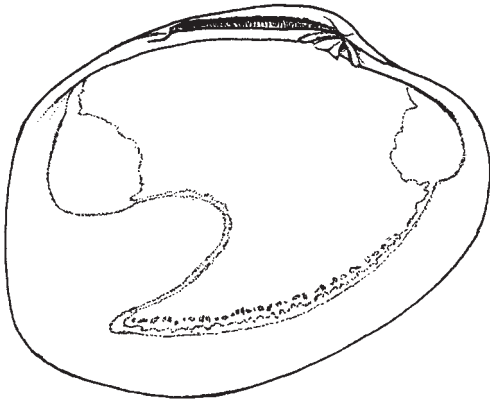
Distribution: Indo-West Pacific, from Pakistan and India to eastern Polynesia; north to Korea and Japan, and south to Queensland.



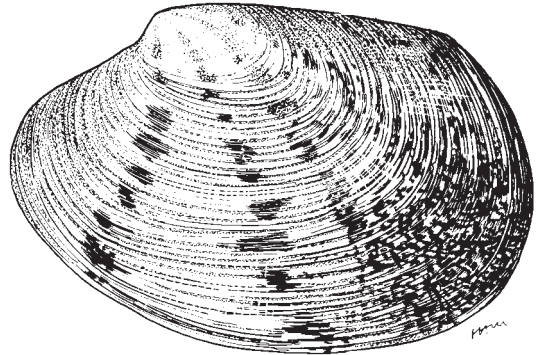
***Tapes dorsatus* (Lamarck, 1818)**

Frequent synonyms / misidentifications: *Paphia turgida* (Lamarck, 1818); *Tapes ovulaea* (Lamarck, 1818); *T. turgida* (Lamarck, 1818); *T. watlingi* Iredale, 1958 / None.

FAO names: En - Turgid venus; Fr - Palourde enflée.



interior of left valve



exterior of left valve

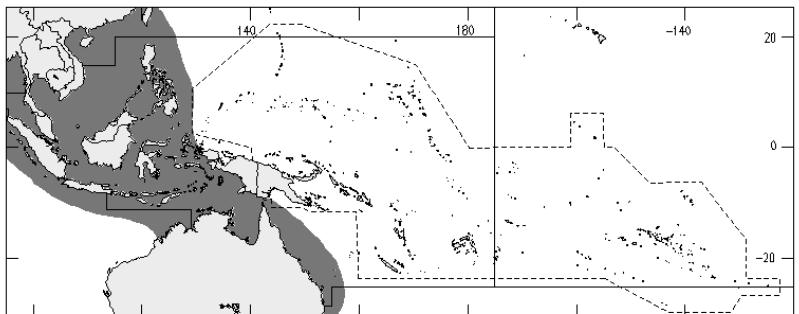
(after Talavera and Faustino, 1933)

Diagnostic characters: Shell elongate, slightly inflated, squarely oval in outline, with a narrowly rounded anterior margin and a wide, roughly truncate posterior margin. Umbones moderately low, markedly anterior to midline of shell. Posterodorsal margin moderately long, obtusely angulated posteriorly. Lunule lanceolate, bordered by a fine groove. Escutcheon well marked, long and narrow, depressed. Posterodorsal area sloping, set off by an obscure, broad angulation radiating from umbones to posteroventral end of shell. Outer surface ornamented with numerous, small and raised concentric ridges, separated by narrow grooves, becoming slightly lamellate posteriorly. Hinge narrow, with 3 cardinal teeth in each valve, but without lateral teeth. Median cardinal tooth of left valve strongest and widely bifid, appearing like 2 teeth. Posterior cardinal tooth of right valve separated by a gap from median cardinal tooth. Pallial sinus well developed, widely open behind. Dorsal side of pallial line bordered by a row of small scars. Internal margins smooth. **Colour:** outside variable, cream to light buff, with various pattern of brown lines and blotches, often forming a few radial rays. Lunule usually tinged with purple. Interior white, with an orange hue in the umbral area.

Size: Maximum shell length 9 cm, commonly to 7.5 cm.

Habitat, biology, and fisheries: In sandy bottoms. Intertidal and shallow sublittoral waters to a depth of 30 m. Local exploitation in the Philippines.

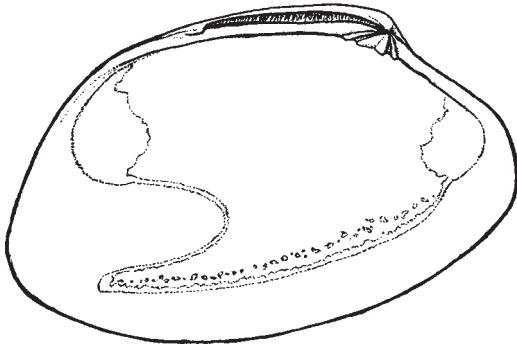
Distribution: Indo-West Pacific, from India to the Philippines; north to South China Sea and south to New South Wales.



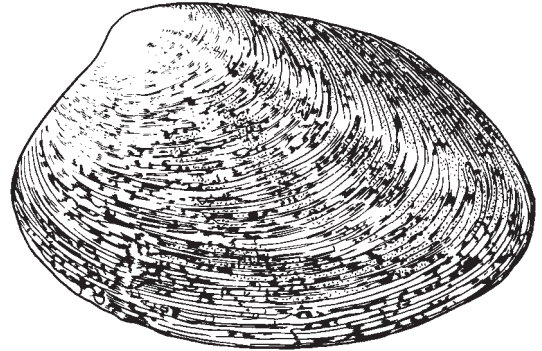
Tapes literatus (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Paphia guttulata* Röding, 1798; *P. literata* (Linnaeus, 1758); *Tapes laterata* Iredale, 1958; *Venus nocturna*, *punctata*, *radiata* (all of Chemnitz, 1784) (Invalid names) / None.

FAO names: **En** - Lettered venus; **Fr** - Palourde écriteure.



interior of left valve



exterior of right valve

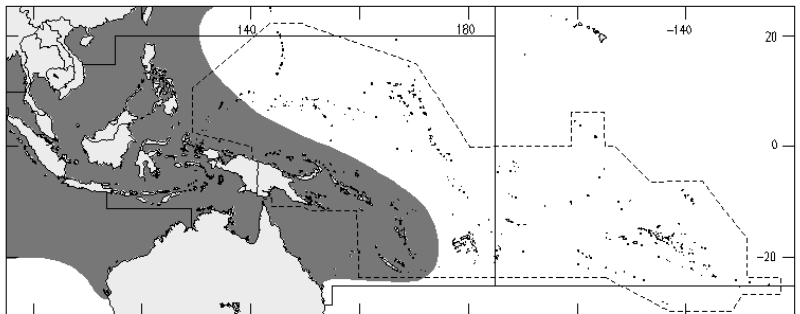
(after Habe, 1965)

Diagnostic characters: Shell elongate, laterally **compressed**, **ovate-subtrapezoidal** in outline, with a narrowly rounded anterior margin and a **wide, obliquely truncate posterior margin**. Umbones low, markedly anterior to midline of shell. **Posterodorsal margin** long and feebly convex, **somewhat angulated posteriorly**. Lunule lanceolate, bordered by a fine groove. Escutcheon well marked, long and narrow, depressed. Posterodorsal area sloping and flattish, set off by an obtuse angulation radiating from the umbones to posteroventral end of shell. **Outer surface** ornamented with **numerous, small and low concentric ridges**, separated by narrow grooves, **not becoming lamellate posteriorly**. **Hinge** narrow, with 3 cardinal teeth in each valve, but **without lateral teeth**. **Median cardinal tooth of left valve strongest and widely bifid, appearing like 2 teeth**. **Posterior cardinal tooth of right valve separated by a gap from median cardinal tooth**. **Pallial sinus well developed**, widely open behind. **Dorsal side of pallial line bordered by a row of small scars**. **Internal margins smooth**. **Colour:** outside variable, cream to light buff, more or less variegated with brown patterns of angular lines, dots or blotches. Interior white, often with yellow or light orange in the umbral area.

Size: Maximum shell length 10.8 cm, commonly to 8.5 cm.

Habitat, biology, and fisheries: In sandy bottoms. Most common in fine sand and muddy sand near mangroves on tidal and shallow subtidal flats. Littoral and sublittoral to a depth of 20 m. Exploited in the Philippines and Fiji Islands.

Distribution: Widespread in the Indo-West Pacific, from East and Southeast Africa, including Madagascar and the Red Sea to Melanesia; north to southern Japan and south to Queensland and New Caledonia.

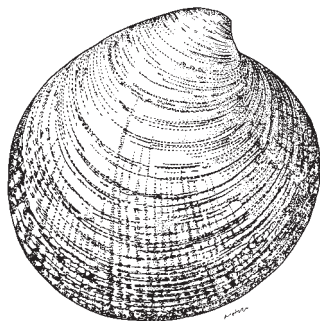


Cyclina sinensis (Gmelin, 1791)

Frequent synonyms / misidentifications: *Artemis orientalis* Sowerby, 1855; *Cyclina chinensis* (Chemnitz, 1788) (Invalid name) / None.

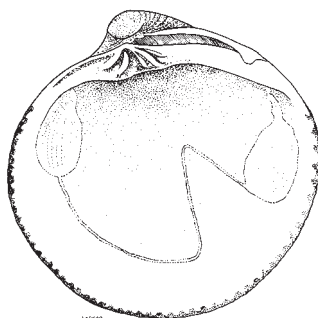
En - Oriental cyclina; **Fr** - Cycline orientale.

Maximum shell length 5 cm, commonly to 4 cm. In sand and mud bottoms of sheltered bays. Intertidal and shallow sublittoral levels to a depth of about 20 m. Locally collected for food. Outside the area, it is an important commercial species in Taiwan Province of China and China where it is extensively cultivated. Indo-West Pacific, from northwestern Indian Ocean to the Philippines; north to Japan and south to Malaysia.



exterior of right valve

(after Habe, 1965)



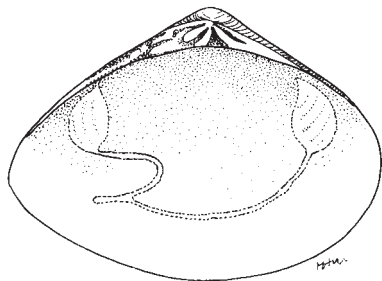
interior of right valve

Gomphina aequilatera (Sowerby, 1826)

Frequent synonyms / misidentifications: *Gomphina melanaegis* (Römer, 1861); *G. veneriformis* of authors (not of Lamarck, 1818) / None.

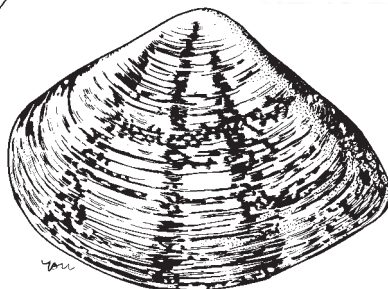
En - Equilateral venus; **Fr** - Vénus équilatérale.

Maximum shell length 9 cm, commonly to 7.5 cm. In sandy bottoms. Intertidal and sublittoral, mainly from depths of 10 to 50 m. Locally exploited for subsistence, where the species is abundant. Western Pacific, from Cambodia to eastern Indonesia; north to Japan and south to Java, Indonesia.



interior of left valve

(after Habe, 1977)



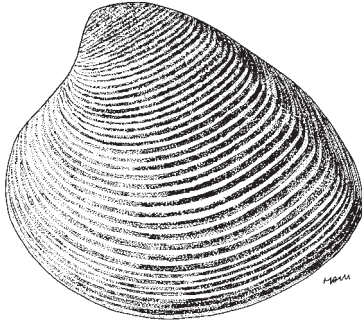
exterior of left valve

Katelysia japonica (Gmelin, 1791)

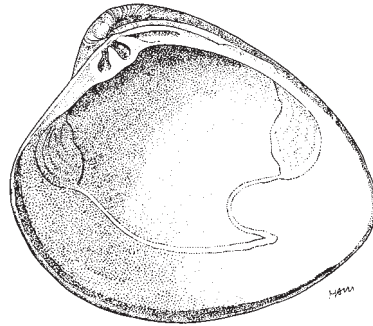
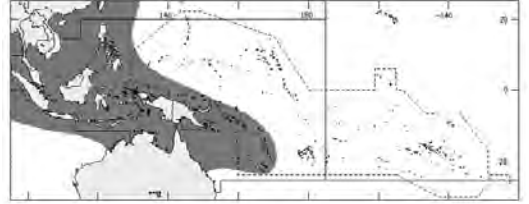
Frequent synonyms / misidentifications: *Marcia japonica* (Gmelin, 1791); *Paphia striata* (Gmelin, 1791); *Tapes caledonica* Bernardi, 1856 / None.

En - Japan venus; **Fr** - Vénus japonaise.

Maximum shell length 6 cm, commonly to 5 cm. Shallow burrower of fine sandy to muddy bottoms. Intertidal and sublittoral to a depth of 20 m. Locally exploited in the Philippines. Indo-West Pacific, from the eastern coast of India to Melanesia; north to Japan and south to central Queensland and New Caledonia.



exterior of left valve
(after Römer, 1872)



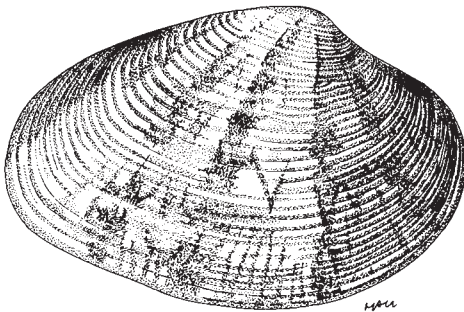
interior of right valve

Katelysia marmorata (Lamarck, 1818)

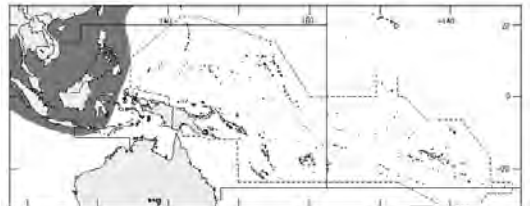
Frequent synonyms / misidentifications: *Marcia recens* (Chemnitz, 1791) (Invalid name); *Paphia ferruginea* (Reeve, 1864); *P. marmorata* (Lamarck, 1818) / None.

En - Marbled venus; **Fr** - Vénus marbrée.

Maximum shell length 5 cm, commonly to 4 cm. Shallow burrower of sand and muddy-sand bottoms. Intertidal and sublittoral to a depth of 50 m. Locally exploited in the Philippines. Indo-West Pacific, from the Persian Gulf and India to the Philippines; north to southern Japan and Taiwan Province of China, and south to Indonesia; occurrence in northern Australia doubtful.



exterior of right valve
(after Römer, 1872)

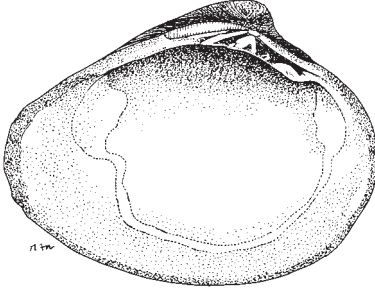


Lioconcha ornata (Dillwyn, 1817)

Frequent synonyms / misidentifications: *Lioconcha picta* (Lamarck, 1818) / None.

En - Ornate pitar venus; **Fr** - Pitar orné.

Maximum shell length 5 cm, commonly to 4 cm. Shallow burrower of sandy bottoms in coral reef areas. Shallow subtidal waters to a depth of about 20 m. Collected for food in the central Philippines; shell used to make decorative items. Widespread in the Indo-West Pacific, from western Indian Ocean, including Mauritius and Réunion islands and the Red Sea, to Polynesia; north to Japan and south to Queensland.



interior of left valve

(after Sotto and Cosel, 1983)



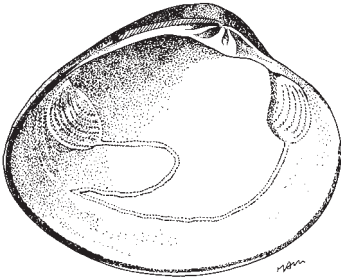
exterior of right valve

Marcia opima (Gmelin, 1791)

Frequent synonyms / misidentifications: *Katylisia opima* (Gmelin, 1791); *Marcia pinguis* (Chemnitz, 1782) (Invalid name) / None.

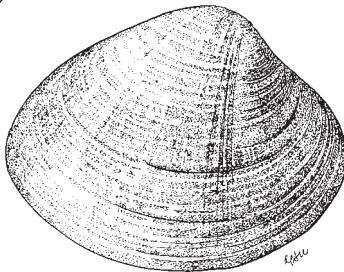
En - Fertile venus; **Fr** - Vénus fertile.

Maximum shell length 6.5 cm, commonly to 5 cm. In various soft bottoms, especially in protected coastal areas and near estuaries. Intertidal and shallow subtidal waters. Collected for food by coastal populations in Indonesia. Outside the area, this species is of commercial importance in India. Indo-West Pacific, from northwestern Indian Ocean and the Aden Gulf to Indonesia.

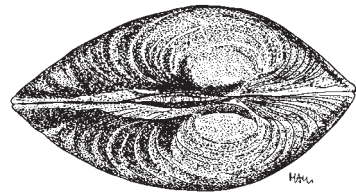


interior of left valve

(after Romer, 1872)



exterior of right valve



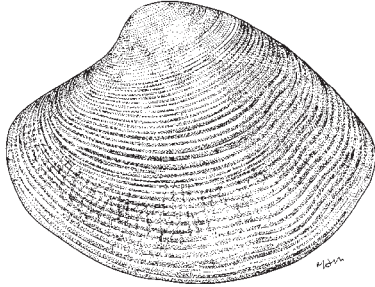
dorsal view of entire shell

Paphia gallus (Gmelin, 1791)

Frequent synonyms / misidentifications: *Paphia malabarica* (Chemnitz, 1782) (Invalid name); *Protapes gallus* (Gmelin, 1791) / None.

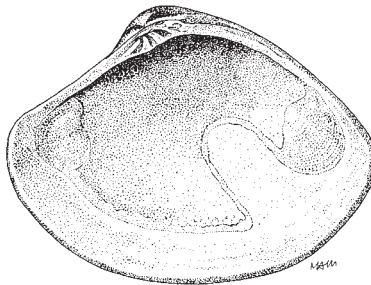
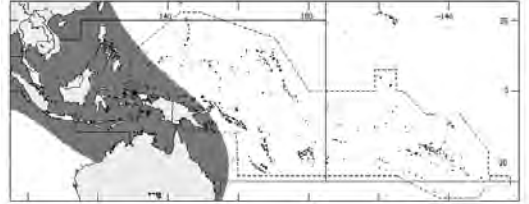
En - Rooster venus; **Fr** - Palourde coq.

Maximum shell length 7.5 cm, commonly to 6 cm. Common in sandy beaches, but also sublittorally in sand and mud to a depth of about 50 m. Collected for subsistence in the northern part of the area. Indo-West Pacific, from western India to Papua New Guinea; north to Taiwan Province of China and the South China Sea, and south to New South Wales. *Paphia gallus* has been frequently confused with *Paphia sinuata* (Lamarck, 1819), a very similar species distinguished by the coarser concentric sculpture and shallower pallial sinus. Both species co-occur in most parts of their range, but only *P. sinuosa* is present in the western part of the Indian Ocean. It is presently not known whether the latter species is exploited in the area.



exterior of left valve

(after Römer, 1870)



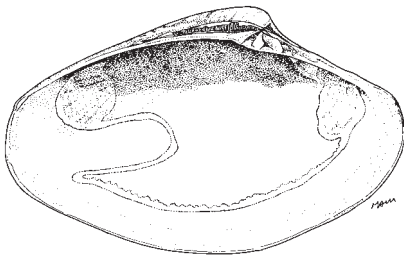
interior of right valve

Paphia semirugata (Philippi, 1847)

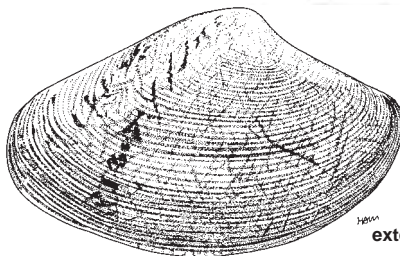
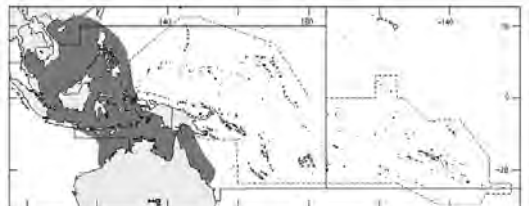
Frequent synonyms / misidentifications: *Paratapes wellsi* Iredale, 1958; *Tapes declivis* Sowerby, 1852; *T. polita* Sowerby, 1852 / *Paphia schnelliana* (Dunker, 1866); *P. vernicosa* (Gould, 1862).

En - Semigrooved venus; **Fr** - Palourde semirugueuse.

Maximum shell length 7.5 cm, commonly to 6 cm. In sand and mud bottoms. Intertidal, sublittoral, and shelf zones to a depth of about 110 m. Collected for food in shallow waters, and sporadically marketed in the central Philippines. Tropical West Pacific, from Thailand to the Philippines; north to southern China and south to Queensland.



interior of left valve



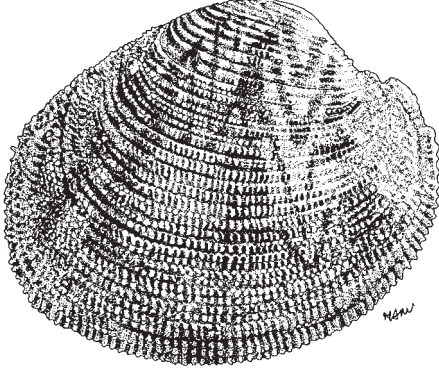
exterior of right valve

Periglypta clathrata (Deshayes, 1854)

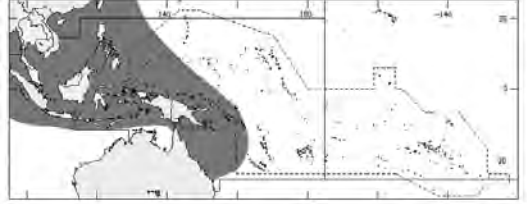
Frequent synonyms / misidentifications: *Antigona clathrata* (Deshayes, 1854); *Venus clathrata* Deshayes, 1854 / *Periglypta puerpera* (Linnaeus, 1758).

En - Clathrate venus; **Fr** - Praire grillagée.

Maximum shell length 10 cm, commonly to 7.5 cm. In coarse sand bottoms. Intertidal and sublittoral to a depth of 25 m. Occasionally collected for food in the Philippines. Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to Japan and south to Queensland.



exterior of right valve
(after Cernohorsky, 1972)

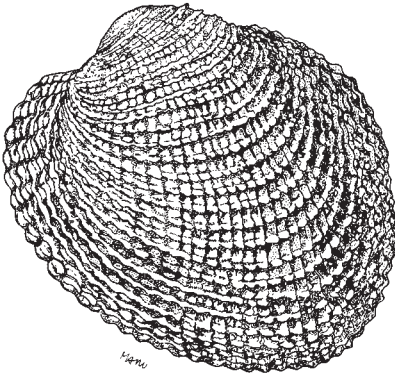


Periglypta reticulata (Linnaeus, 1758)

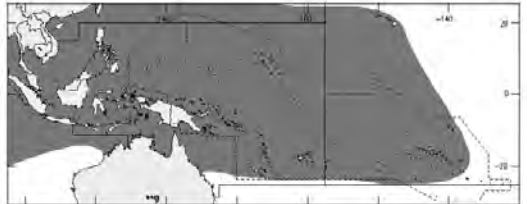
Frequent synonyms / misidentifications: *Antigona reticulata* (Linnaeus, 1758); *Periglypta edmondsoni* Dall, Bartsch and Rehder, 1938; *Venus reticulata* Linnaeus, 1758 / None.

En - Reticulated venus; **Fr** - Praire corbeille.

Maximum shell length 9 cm, commonly to 7.5 cm. In sand and mud bottoms. Intertidal and sublittoral to a depth of 25 m. Locally collected for food in the area. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and Hawaii, and south to Queensland.



exterior of left valve
(after Habe, 1965)

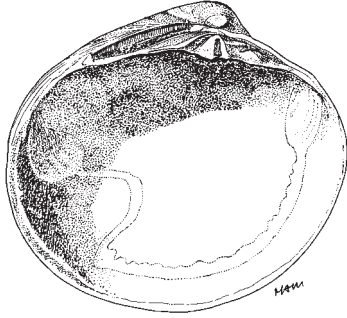


***Pitar citrinus* (Lamarck, 1818)**

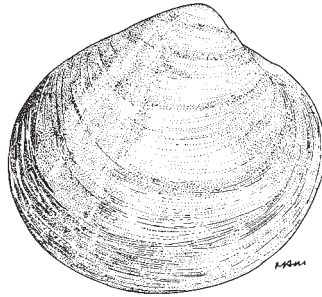
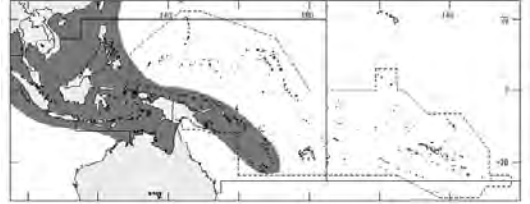
Frequent synonyms / misidentifications: *Pitar striatus* (Gray, 1838); *Pitaria citrina* (Lamarck, 1818); *P. ustulata* (Reeve, 1863) / None.

En - Yellow pitar venus; **Fr** - Pitar citron.

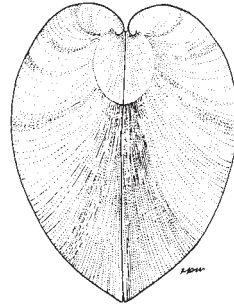
Maximum shell length 5 cm, commonly to 4 cm. In sandy bottoms. Intertidal and sublittoral to a depth of 20 m. Collected for subsistence in the Philippines and frequently found in local markets, mixed with other species of Veneridae. Central Indian Ocean and tropical West Pacific, from Sri Lanka to Melanesia; north to southern Japan and south to northern Australia and New Caledonia.



interior of left valve



exterior of right valve



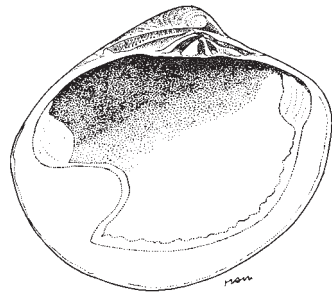
anterior view of entire shell

***Pitar pellucidus* (Lamarck, 1818)**

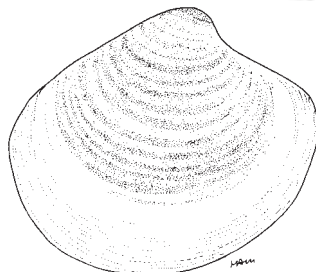
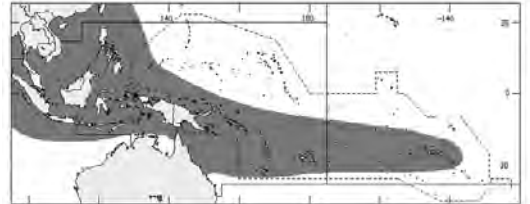
Frequent synonyms / misidentifications: *Pitaria australica* (Reeve, 1863); *P. pellucida* (Lamarck, 1818) / None.

En - Pellucid pitar venus; **Fr** - Pitar pellucide.

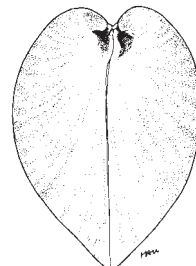
Maximum shell length 4.5 cm, commonly to 3.5 cm. In fine sandy bottoms. Intertidal and shallow sublittoral zones, to a depth of 20 m. Sporadically found in local markets of the central and northern Philippines, mixed with other species of Veneridae. Widely distributed in the Indo-West Pacific, from East Africa to eastern Polynesia; north to southern Japan and China, and south to central Queensland and New Caledonia.



interior of left valve



exterior of right valve



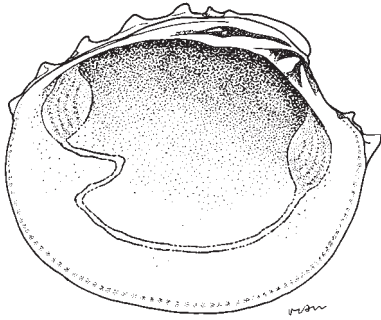
anterior view of entire shell

Placamen tiara (Dillwyn, 1817)

Frequent synonyms / misidentifications: *Anaitis foliacea* (Philippi, 1846); *Clausinella foliacea* (Philippi, 1846); *Venus alta* Sowerby, 1853; *V. foliacea* Philippi, 1846 / None.

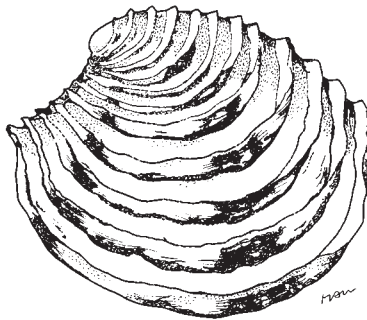
En - Tiar venus; **Fr** - Vénus tiare.

Maximum shell length 3.5 cm, commonly to 3 cm. In various soft bottoms. Sublittoral, from depths of 10 to 50 m. Local exploitation in the Philippines. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, to Melanesia; north to Japan and south to South Australia.

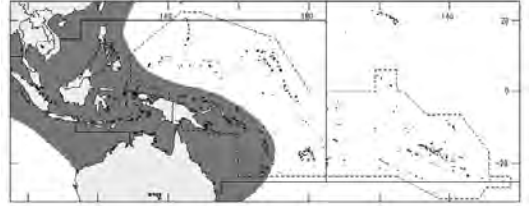


interior of left valve

(after Habe, 1977)



exterior of left valve

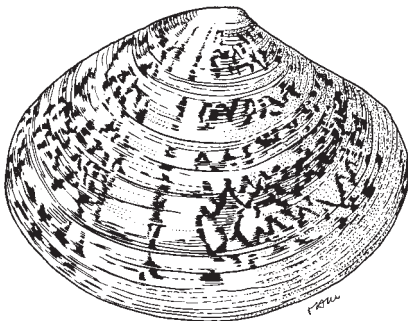


Sunetta menstrualis (Menke, 1843)

Frequent synonyms / misidentifications: *Cyclosunetta menstrualis* (Menke, 1843) / *Sunetta excavata* (Hanley, 1843).

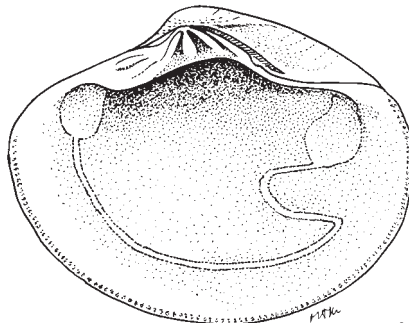
En - Mauve sunetta; **Fr** - Méroë mauve.

Maximum shell length 7.5 cm, commonly to 5 cm. In sand and mud bottoms. Mainly sublittoral, from depths of 5 to 50 m. Locally collected by coastal inhabitants for subsistence. Tropical and subtropical western Pacific, from Korea and Japan to Malaysia and northern Indonesia.

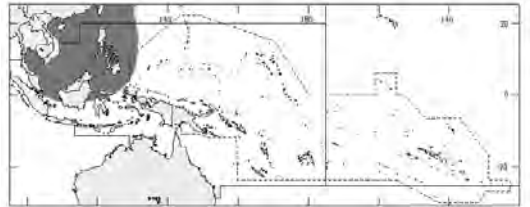


exterior of right valve

(after Habe, 1977)



interior of right valve

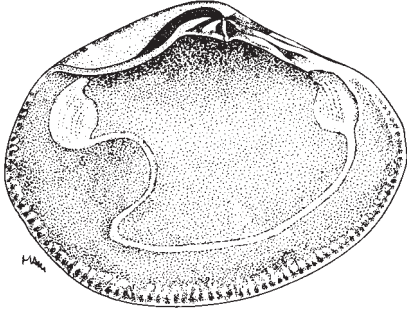


Sunetta truncata (Deshayes, 1853)

Frequent synonyms / misidentifications: *Cyclosunetta truncata* (Deshayes, 1853); *Sunetta concinna* Dunker, 1865 / None.

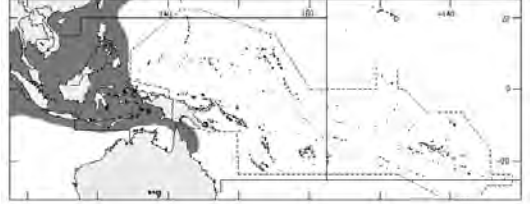
En - Truncate sunetta; **Fr** - Méroë tronquée.

Maximum shell length 4 cm, commonly to 3 cm. In sandy bottoms. Intertidal and sublittoral to a depth of 50 m. Locally collected by coastal people for subsistence in Indonesia. Indo-West Pacific, from Madagascar and India to the Philippines; north to Japan and south to northern Queensland.



interior of left valve

(after Lamprell and Whitehead, 1992)



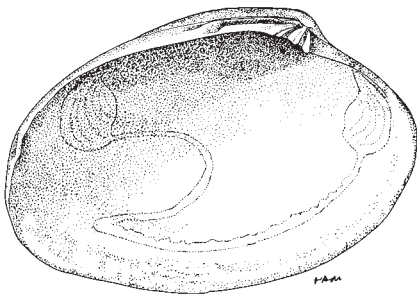
exterior of right valve

Tapes belcheri Sowerby, 1852

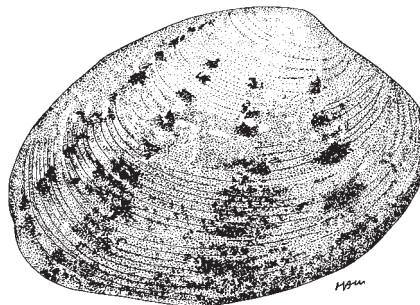
Frequent synonyms / misidentifications: *Tapes grata* Deshayes, 1853; *T. obscurata* Deshayes, 1853; *T. phenax* Pilsbry, 1901; *T. quadriradiata* Deshayes, 1853 / *Tapes dura* (Gmelin, 1791).

En - Belcher's venus; **Fr** - Palourde de Belcher.

Maximum shell length 5 cm, commonly to 4 cm. In sandy bottoms. Littoral and shallow subtidal zones. Collected for food in the central Philippines where it appears sometimes in local markets. Indo-West Pacific, from Mauritius Island and the Gulf of Aden to the Philippines; north to China and southern Japan, and south to central Queensland.



interior of left valve



exterior of right valve

GLAUCONOMIDAE

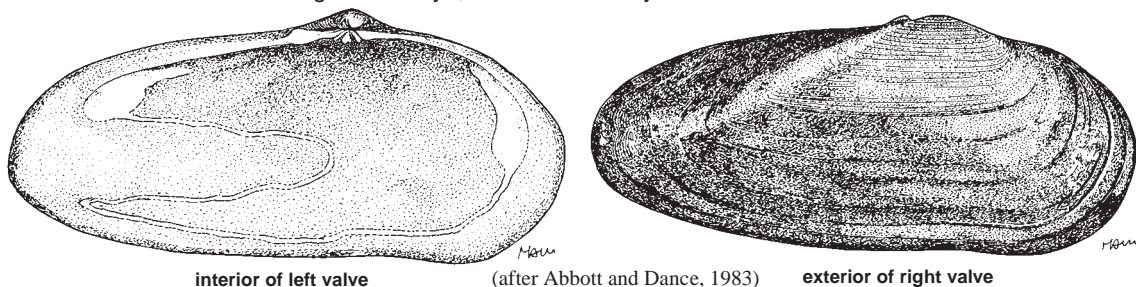
Glaucomyas

A single species of interest to fisheries occurring in the area.

Glaucome virens (Linnaeus, 1767)

Frequent synonyms / misidentifications: *Glaucomya virens* (Linnaeus, 1767); *Sinovacula virens* (Linnaeus, 1767); *Tanyisiphon virens* (Linnaeus, 1767) / *Glaucome rugosa* (Reeve, 1844).

FAO names: En - Greenish glaucomya; Fr - Glaucomye verte.



interior of left valve

(after Abbott and Dance, 1983)

exterior of right valve

Diagnostic characters: Shell moderately thin, **equivalve, elongate-ovate** in outline and narrowly **gaping posteriorly**; **strongly inequilateral**, anterior part relatively short and widely rounded, posterior part elongate and narrowly pointed. Umbones low, prosogyrate, situated well in front of midline of shell. Outer surface with irregular concentric lines and grooves, finely wrinkled. **No lunule nor escutcheon. Periostracum conspicuous**, often corroded on umbones, largely united dorsally between the 2 valves. **Ligament external**, set on nymphs behind umbones. **Hinge with 3 cardinal teeth in each valve; lateral teeth wanting**. Posterior right and median left cardinals strongly bifid. **Two adductor muscle scars**, the anterior somewhat narrow and the posterior rounded. **Pallial line with a deep and narrow sinus**, extending forwards almost to the level of umbones. Pallial sinus meeting ventrally the pallial line at its posterior extremity. Internal margins smooth. **Colour:** outside of shell white or cream, under a **greenish periostracum**. Inner side porcelaneous white.

Similar species occurring in the area

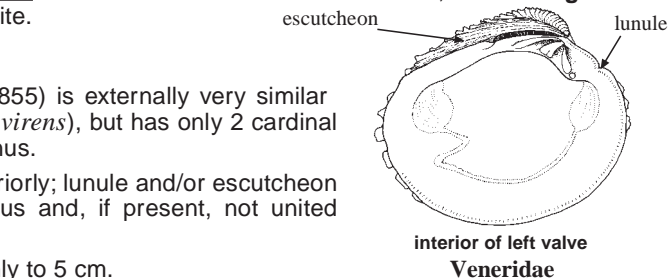
Psammobiidae: *Gari togata* (Deshayes, 1855) is externally very similar (living in the same habitat as *Glaucome virens*), but has only 2 cardinal teeth in each valve and a broader pallial sinus.

Veneridae: valves usually not gaping posteriorly; lunule and/or escutcheon present; periostracum mostly inconspicuous and, if present, not united dorsally between the valves.

Size: Maximum shell length 7 cm, commonly to 5 cm.

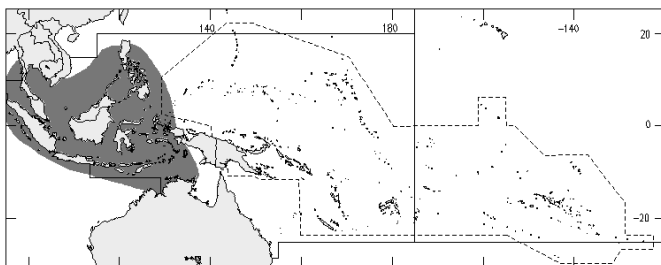
Habitat, biology, and fisheries: Embedded in muddy bottoms of brackish water areas, in estuaries and in mangrove forests and nipa palm swamps. Stays in an upright position, with the siphons pointing slightly above the surface of the bottom, forming in it a wedge-shaped hole by their whirling movements. Locally exploited in the Philippines, this species is very commonly marketed together with solenids of the genus *Pharella* in Cebu. It is not known whether the forms appearing in the markets of southern Thailand represent only this species or also the very similar *Glaucome rugosa* (Reeve, 1844).

Distribution: Western tropical Pacific, from Thailand and the Philippines to northern Australia.



interior of left valve

Veneridae



References

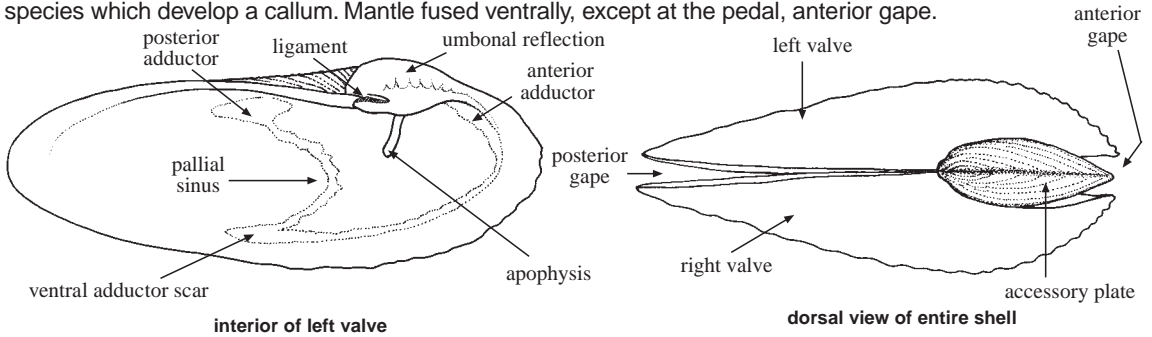
Brandt, R. 1974. The non-marine aquatic Mollusca of Thailand. *Arch Moll.*, 105:1-423.

Owen, G. 1959. Observations on the Solenacea with reasons for excluding the family Glaucomyidae. *Phil. Trans. R. Soc. Lond. (B)*, 242(687):59-97.

PHOLADIDAE

Angel wings, piddocks

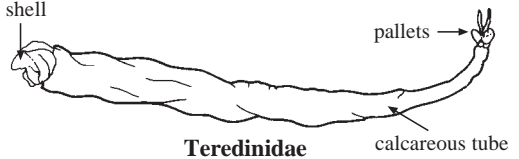
Diagnostic characters: Shell subequivalve, globular to elongated, generally **gaping** anteriorly and posteriorly, although anterior gape is sometimes closed by a calcareous "callum" in the adult shell. **Dorsal margin** unrolled over the umbones, **forming an umbonal reflection**. Anterior part of the valves with concentric and radial ribs, more or less spinose where they cross. **A number of accessory calcareous plates about the main shell**, along the dorsal margin and sometimes over the anteroventral gape and along the posteroventral margin. Periostracum thin, often more or less developed beyond shell margins. **Ligament reduced**, always internal. **Hinge without teeth**. Umbonal cavity often with a **finger-like apophysis** to which the foot muscles are attached. **Three adductor muscle scars**. Anterior adductor scar extending over the umbonal reflection. **Pallial line deeply sinuated**, with the scar of the third adductor muscle ventrally. Gills elongate of eulamelli-branchiate type, with 1 or 2 branchial sheets. Siphons long and united, smooth or papillate, often enclosed within a chitinous sheath. Foot more or less circular, truncated and forming a sort of sucker, atrophying in adult of species which develop a callum. Mantle fused ventrally, except at the pedal, anterior gape.



Habitat, biology, and fisheries: The Pholadidae are highly specialized bivalves adapted for boring into relatively hard substrates such as limestone, sandstone, stiff clay or wood. Filter-feeding animals. Sexes separate, or alternating hermaphrodites (*Martesia*). Some Pholadidae are known for causing severe damage to rocky or wooden structures in harbours and other coastal areas. A number of species are collected for food (one is of commercial importance in the Philippines), and are often considered a delicacy.

Similar families occurring in the area

Teredinidae: shell of the young *Martesia* similar to that of a Teredinidae but, in the latter, burrow is lined by a calcareous deposit and can be closed by a pair of partly calcified "pallets".



Key to species of interest to fisheries occurring in the area

- 1a. Accessory plates present along dorsal and ventral margins; anteroventral gape closed by a calcareous callum in the adult (Fig. 1) *Martesia striata*
- 1b. Accessory plates present only along dorsal margin; anteroventral gape not closed by a calcareous callum in the adult → 2
- 2a. Shell rounded anteriorly; umbonal reflection with transverse partitions; 3 accessory plates: anterior one roughly trigonal and elongated, median one small and transverse, posterior one long and narrow (Fig. 2) *Pholas orientalis*
- 2b. Shell somewhat rostrate anteriorly; umbonal reflection without transverse partitions; a single accessory plate (the anterior one) → 3

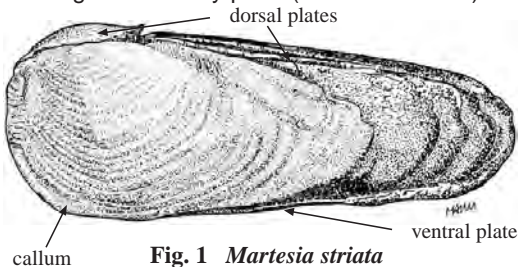


Fig. 1 *Martesia striata*
(exterior of entire shell)

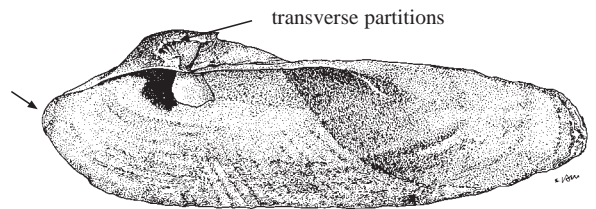


Fig. 2 *Pholas orientalis* (interior)

- 3a.** Shell rounded posteriorly; shape relatively long (about 2.5 times longer than high) (Fig. 3) *Barnea manilensis*
- 3b.** Shell broadly truncated posteriorly; shape relatively short (about 1.5 times longer than high) (Fig 4) *Barnea dilatata*

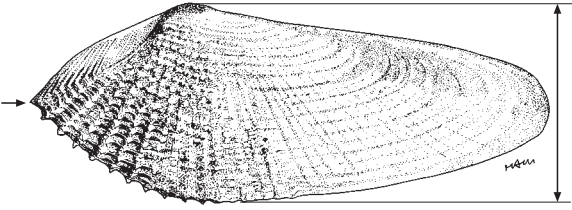


Fig. 3 *Barnea manilensis* (exterior)

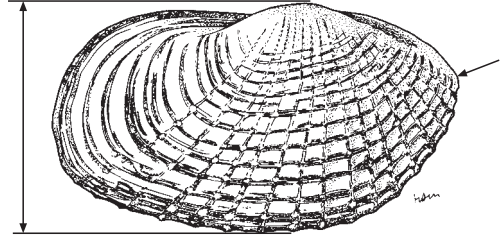







Fig. 4 *Barnea dilatata* (exterior)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Barnea dilatata* (Souleyet, 1843)
-  *Barnea manilensis* (Philippi, 1847)
-  *Martesia striata* (Linnaeus, 1758)
-  *Pholas orientalis* Gmelin, 1791

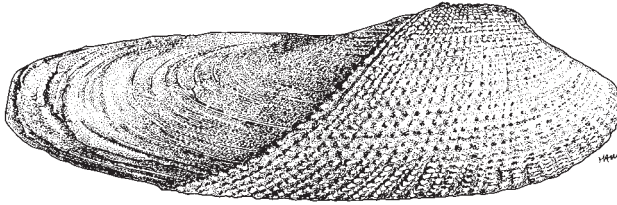
References

- Lamy, E. 1925a. Révision des Pholadidae vivants du Muséum national d'Histoire naturelle de Paris. *J. Conchyl.*, 69(1):19-51.
- Lamy, E. 1925b. Révision des Pholadidae vivants du Muséum national d'Histoire naturelle de Paris (Suite). *J. Conchyl.*, 69(2):79-103.
- Lamy, E. 1926a. Révision des Pholadidae vivants du Muséum national d'Histoire naturelle de Paris (Suite). *J. Conchyl.*, 69(3):136-168.
- Lamy, E. 1926b. Révision des Pholadidae vivants du Muséum national d'Histoire naturelle de Paris (Fin). *J. Conchyl.*, 69(4):193-222.

Pholas orientalis Gmelin, 1791

Frequent synonyms / misidentifications: *Monothyra orientalis* (Gmelin, 1791) / *Cyrtopleura costata* (Linnaeus, 1758).

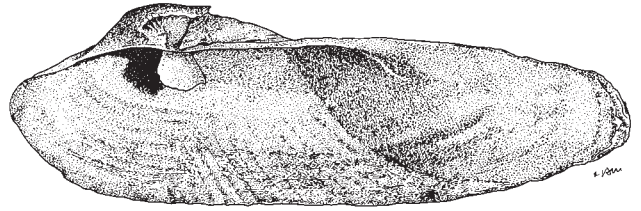
FAO names: En - Oriental angel wing; Fr - Aile d'ange orientale.



exterior of right valve



dorsal view of anterior accessory plate



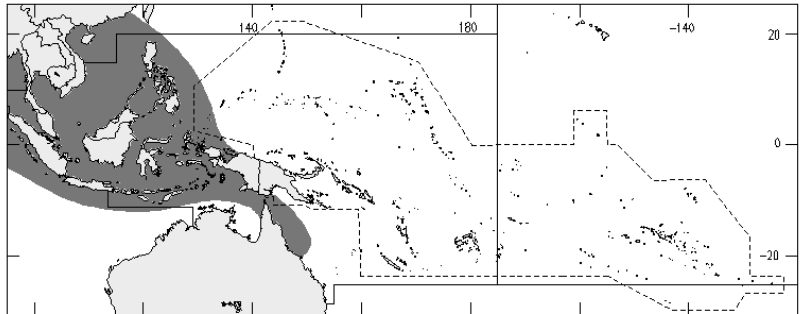
interior of right valve

Diagnostic characters: Shell elongate-ovate in outline, **more than 3 times longer than high, rounded at both anterior and posterior ends. Umbonal reflection** separated from dorsal margin of shell by a narrow space that is provided **with small, transverse calcareous partitions**. Anterior and ventral half of valves densely ridged and strongly spinose externally, sharply separated from the remainder part of shell by a radial line joining umbones to the posterior third of ventral margin. Posterior and dorsal half of valves smoothish, densely covered with tiny granulations. **Three accessory calcareous plates along dorsal margins of the valves; anterior plate roughly trigonal and elongated, median plate small and transverse, posterior plate long and narrow.** Internal apophysis of the umbonal cavity large and spatulate, depressed medially and recurved along its anterior and posterior margins. Interior of valves with the outer sculpture of riblets and spines showing through anteriorly, smooth and shiny posteriorly. **Colour:** outside of shell dirty white. Interior milky white and porcelaneous.

Size: Maximum shell length 12 cm, commonly to 9 cm.

Habitat, biology, and fisheries: Burrow up to 50 cm deep in peat, clay or sticky, soft sandy-mud bottoms rich in silt and detritus, often near river mouths. Intertidal and sublittoral areas. Tend to be gregarious, natural beds mostly found at depths from 5 to 10 m. Important commercial species in the Philippines. Collected by divers using an iron or wooden paddle-shaped implement or bare hands to dig the animals from their burrows. Local exploitation in Malaysia and Thailand.

Distribution: Northern Indian Ocean to tropical western Pacific, from Pakistan to the Philippines and Indonesia; north to South China Sea and south to Queensland.

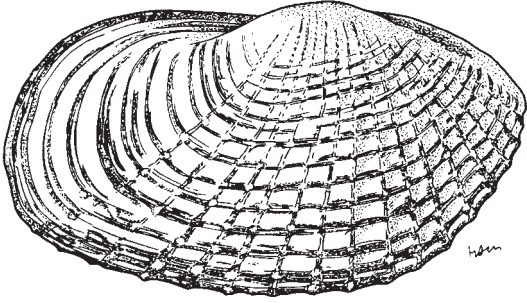


Barnea dilatata (Souleyet, 1843)

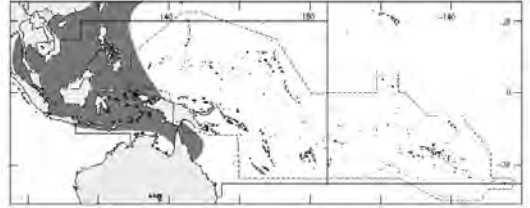
Frequent synonyms / misidentifications: *Barnea japonica* (Yokoyama, 1920); *Pholas latissima* Sowerby, 1849 / None.

En - Dilate piddock; **Fr** - Pholade dilatée.

Maximum shell length 10 cm, commonly to 7.5 cm. Boring in muddy bottoms at low tide and shallow subtidal levels. Used for human consumption in Japan, but no data on its exploitation are available for the Western Central Pacific. Western Pacific, from western Thailand to the Philippines; north to Japan and south to Queensland.



exterior of right valve
(after Habe, 1977)



dorsal view of accessory plate



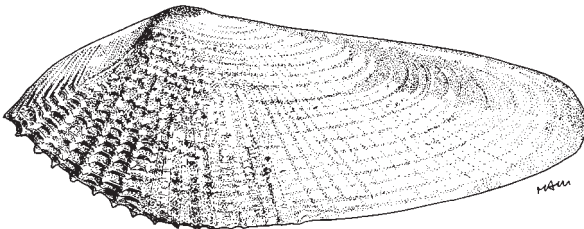
lateral view of accessory plate

Barnea manilensis (Philippi, 1847)

Frequent synonyms / misidentifications: *Anchomasa manilensis* (Philippi, 1847); ? *Barnea elongata* Tchang, Tsi, and Li, 1960; *B. inornata* (Pilsbry, 1895); *Pholas fragilis* Sowerby, 1849; *P. manilensis* Philippi, 1847 / None.

En - Manila piddock; **Fr** - Pholade de Manille.

Maximum shell length 7 cm, commonly to 5 cm. Boring in clay and soft rocks, from the intertidal zone to depths of about 20 m. Collected for subsistence by coastal people, this common species sometimes appears in local markets of the central Philippines. Western Pacific, from China to western Polynesia; north to northern Japan and south to Indonesia (southern limit of distribution still uncertain).



exterior of left valve
(after Philippi, 1849)

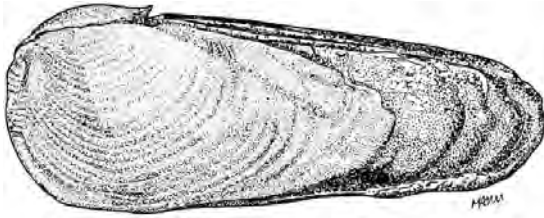


Martesia striata (Linnaeus, 1758)

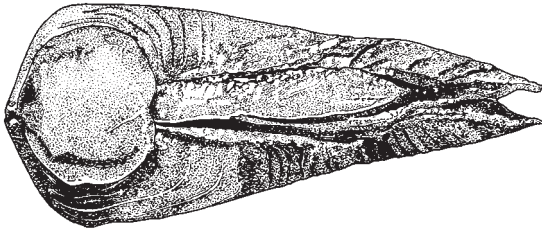
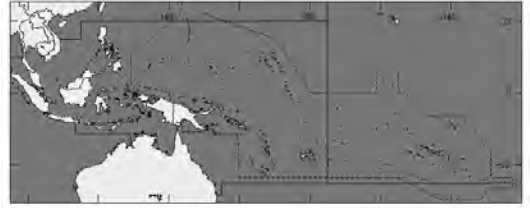
Frequent synonyms / misidentifications: *Hiata infelix* Zetek and McLean, 1936; *Martesia americana* Bartsch and Rehder, 1945; *M. hawaiiensis* Dall, Bartsch, and Rehder, 1938; *M. pulchella* Yokoyama, 1932; *M. tokyoensis* Yokoyama, 1927; *Mesopholas intusgranosa* Taki and Habe, 1945; *M. nucicola* Taki and Habe, 1945 / None.

En - Striate martesia; **Fr** - Martésie striée.

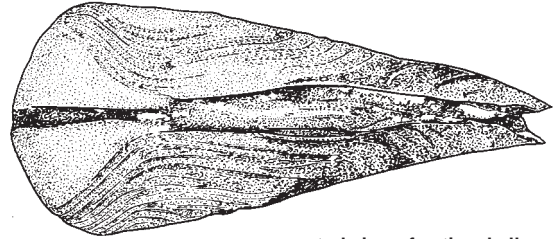
Maximum shell length 5 cm, commonly to 3.5 cm. Boring into timber, drifting logs or mangrove trees. Burrow shallow, a little deeper than the length of the shell which is frequently deformed when wood is hard. Feeds only on plankton. Alternating hermaphrodite changing sex with temperature, most individuals becoming female in summer and male in winter. Fertilization external. Free-swimming larval stage of about a month. Boring process occurs only during juvenile stages, the shell resembling that of a Teredinidae, widely gaping anteriorly and lacking a callum. Foot atrophying and callus developing at maturity. Locally exploited in Thailand. Worldwide distribution, in temperate and tropical marine waters.



left side view of entire shell



dorsal view of entire shell



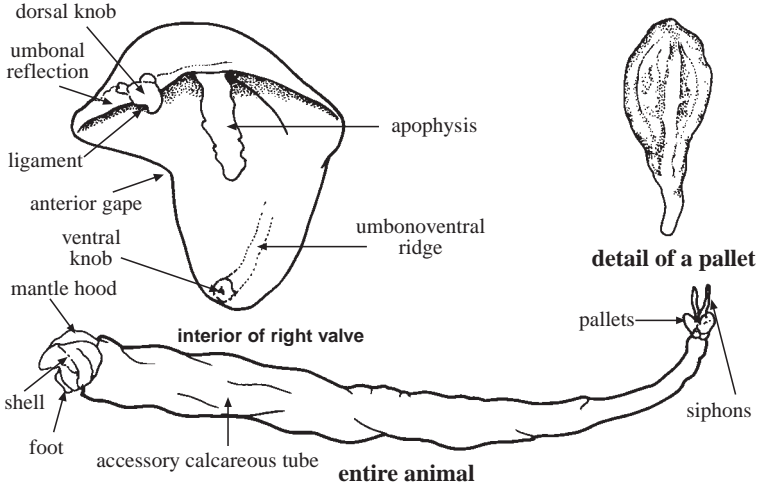
ventral view of entire shell

(after Turner *in* Moore, 1969)

TEREDINIDAE

Shipworms

Diagnostic characters: **Shell reduced**, covering only the anterior end of a long, worm-like animal which secretes a tubular, calcareous lining inside its burrow. Shell **equivalve**, hemispherical to auriculate, **widely gaping** anteriorly and posteriorly, divided into 3 parts (an anterior slope, a median disc and a posterior slope). **Anteroventral margin with a deep, right-angled notch**, posterior margin often lobed. **Dorsal margin** more or less unrolled over the umbones, **forming an umbonal reflection**. Outside of valves with an umbonoventral groove. Sculpture mainly concentric, forming denticulate ridges on anterior slope. **Ligament internal, reduced**. **Hinge without teeth**. Interior of shell porcelaneous. Umbonal cavity with a **finger-like apophysis** to which the foot muscles are attached. **An internal umbonoventral ridge** corresponding with the outer groove, **with a knob at both ends**, on which valves rock during boring process. **Three adductor muscles**, scars of which are generally obscure. Anterior adductor small, on umbonal reflection; posterior large, on lobed posterior slope; ventral small. Pallial line coincident with valve margin. **Accessory calcareous tube lining burrow long** and vermiform, greatly varying in extension and thickness, sometimes with septa near its aperture which can be **closed by a pair of paddle- or feather-like pallets**. Gills elongate, of eulamellibranch type, with only 1 branchial sheet. Siphons relatively short, fused or partly separate. Foot discoidal, truncated, forming a sort of sucker protruding through anterior gape of shell. Mantle fused ventrally, except at the pedal gape, with a thickened fleshy fold (the mantle hood) covering the umbonal region of valves.



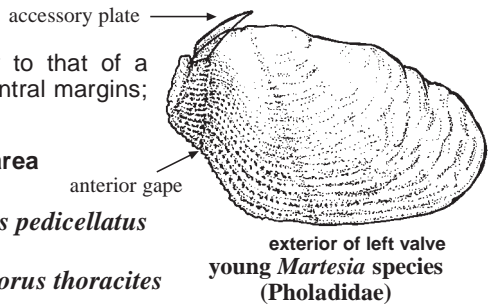
Habitat, biology, and fisheries: The Teredinidae are highly specialized bivalves adapted for boring into submerged wood and other plant materials. Filter-feeding animals, alternating spells of feeding on plankton with periods of utilization of rasped wood particles, initially digested by symbiotic bacteria. Internal calcareous lining of burrows probably preventing shipworms from intersecting one another. Mainly consecutive hermaphrodites, changing sex several times with age. Either external fertilization of numerous, small eggs hatching as free-swimming larvae with long pelagic stage, or internal fertilization of relatively few, large eggs yielding larvae with a short swimming life. Shipworms are generally well known for causing damage to shipping and harbour wooden structures. However, they are also locally used for human consumption in the area.

Similar families occurring in the area

Pholadidae (*Martesia*): shell of juvenile *Martesia* similar to that of a Teredinidae, but with accessory plates along dorsal and ventral margins; calcareous tube and pallets absent.

Key to species of interest to fisheries occurring in the area

- 1a. Distal end of pallets with a conspicuous periostracal sheet; siphons separated *Lyrodus pedicellatus*
- 1b. Distal end of pallets with a warty, bladder-like calcareous extension, siphons widely fused . . . *Bactronophorus thoracites*



List of species of interest occurring in the area

The symbol 🐚 is given when species accounts are included.

- 🐚 *Bactronophorus thoracites* (Gould, 1856)
- 🐚 *Lyrodus pedicellatus* (Quatrefages, 1849)

Reference

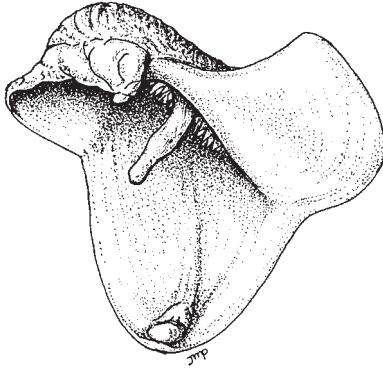
Turner, R.D. 1966. *A survey and illustrated catalogue of the Teredinidae (Mollusca: Bivalvia)*. Harvard, Museum of Comparative Zoology, 265 p.

***Bactronophorus thoracites* (Gould, 1856)**

Frequent synonyms / misidentifications: *Bactronophorus edulis* Sivickis, 1928; *B. filoteoi* Sivickis, 1928; *B. subaustralis* Iredale, 1936; *Calobates australis* Wright, 1866 / None.

En - Edible shipworm; **Fr** - Taret comestible.

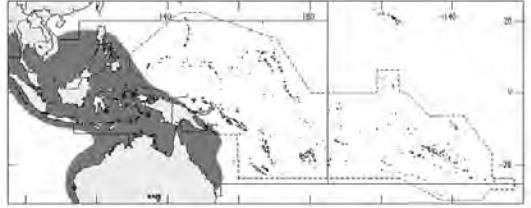
Maximum shell length 1.5 cm; total length of the animal 40 cm. Wood borer of mangrove and brackish-water areas. Collected for food and marketed in Thailand and central Philippines. Indo-West Pacific, from India to Papua New Guinea; north to the Philippines and south to Queensland.



interior of right valve



pallet

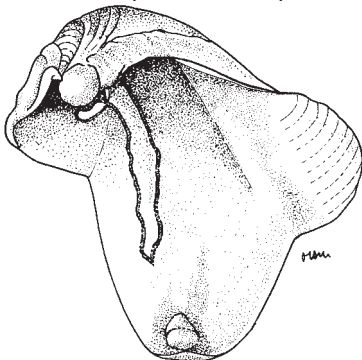


***Lyrodus pedicellatus* (Quatrefages, 1849)**

Frequent synonyms / misidentifications: *Lyrodus siamensis* (Bartsch, 1928); *L. chloroticus* (Gould, 1870); *L. taiwanensis* (Taki and Habe, 1945); *L. yatsui* (Moll, 1929); *Teredops diegensis* (Bartsch, 1916); *Teredo milleri* Dall, Bartsch and Rehder, 1938; *T. siamensis* Bartsch, 1928 / None.

En - Siamese shipworm; **Fr** - Taret siamois.

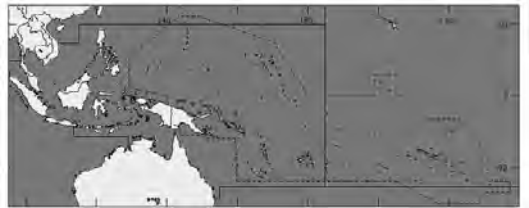
Maximum shell length 1 cm, total length of the whole animal 30 cm. Boring into submerged or floating wood. Brooding species. Collected for food in Thailand and Malaysia, but not often marketed. In Thailand, coastal people have for long cultivated this species in logs anchored in the sea. Worldwide in tropical and temperate seas.



interior of right valve



pallet

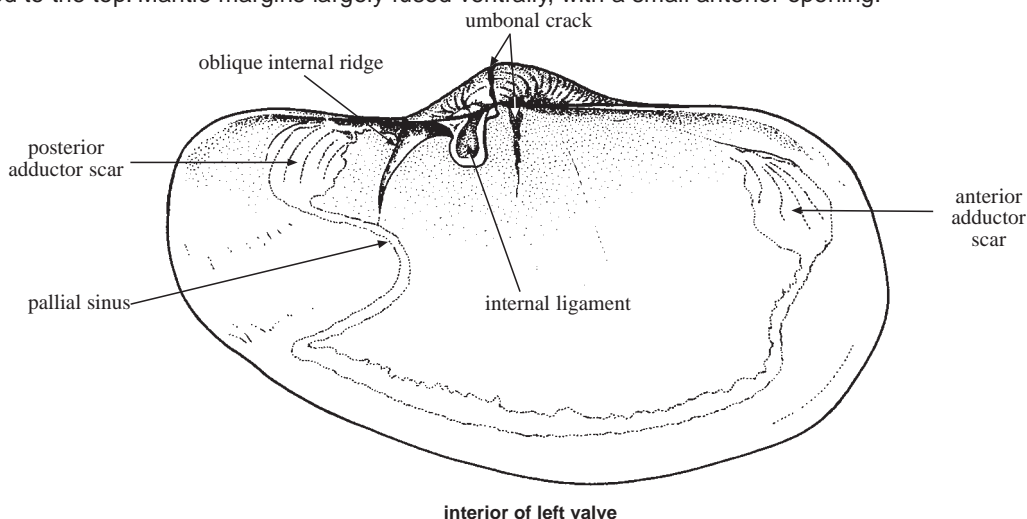


(after Turner in Moore, 1969)

LATERNULIDAE

Lantern clams

Diagnostic characters: Shell thin and brittle, inflated, transversely **elongate-ovate** in outline and **variably truncate to rostrate posteriorly, gaping** at both ends; **subequivalve**, with left valve a little larger and more convex than opposite valve. **Umboes** low, submedian or somewhat behind midlength of valves, **with an obvious median slit**. **Outer surface** of shell smoothish or concentrically wrinkled, pearly white and **finely granulated**. Periostracum thin, somewhat thickened marginally. **Internal ligament, attached on 2 protruding, spoon-like pits, each supported by an oblique radial ridge**. A small, boomerang-shaped, calcareous ossicle sometimes present on anterior side of the ligament. **Hinge without teeth**. **Interior of shell subnacreous**. **Two subequal adductor muscle scars**. **Pallial line** somewhat flattened or feebly concave anteriorly and **with a broad sinus** posteriorly. Internal margins smooth and thin. Gills of eulamellibranchiate type, with folded branchial sheets; outer demibranch smaller, upturned and without the ascending lamella. Foot small and nonbyssate in the adult. Siphons on long and papillate, fused to the top. Mantle margins largely fused ventrally, with a small anterior opening.

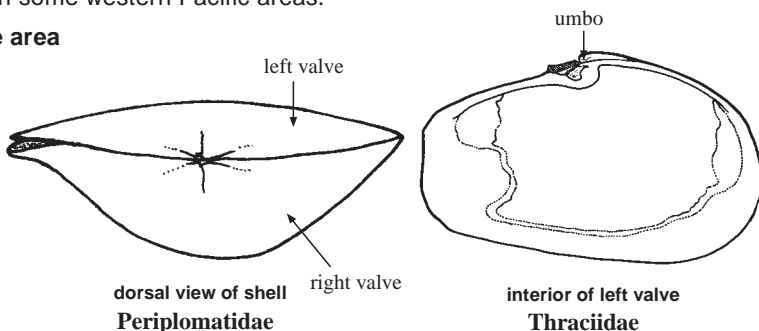


Habitat, biology, and fisheries: Sedentary detritus or suspension filter-feeders, living vertically buried in littoral and shallow sublittoral soft bottoms. Hermaphroditic animals, often brooding their eggs in the gills. More or less frequently collected in some western Pacific areas.

Similar families occurring in the area

Periplomatidae: shell more rounded in outline, markedly inequivalve; left valve flatter and smaller than right valve; siphons separate.

Thraciidae: shell usually closed, without an obvious umbonal slit; ligamental pit not projecting ventrally; no oblique radial buttress inside the umbonal cavity; siphons separate.



References

- Morton, B.S. 1973. The biology and functional morphology of *Laternula truncata* (Lamarck 1818) (Bivalvia: Anomalodesmata: Pandoracea). *Biol. Bull.*, 145(3):509-531.
- Morton, B.S. 1976. The structure, mode of operation and variation in form of the shell of the Laternulidae (Bivalvia: Anomalodesmata: Pandoracea). *J. moll. Stud.*, 42(2):261-278.

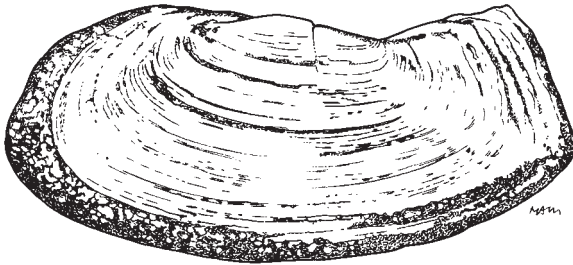
A single species of interest to fisheries occurring in the area

Laternula truncata (Lamarck, 1818)

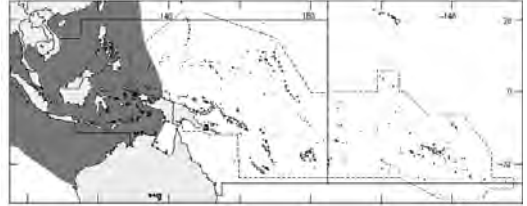
Frequent synonyms / misidentifications: *Anatina truncata* Lamarck, 1818; *Laternula rostrata* (Lamarck, 1818) / None.

En - Truncate lantern clam; **Fr** - Anatine tronquée.

Maximum shell length 9 cm, commonly to 6 cm. Permanently imbedded in muddy bottoms of mangrove areas, in littoral and shallow sublittoral waters, with the siphons flush with the surface and camouflaged by adhering sand grains. Once disturbed, the animal is incapable to reburrow as the reduced foot is only used as a cleansing organ. Extensively utilized as food and sometimes marketed in the Philippines, *Laternula truncata* is an important commercial species in Taiwan Province of China. Eastern Indian Ocean to tropical western Pacific, from India to eastern Indonesia; north to southern Japan and south to northwestern Australia.



exterior of left valve
(after Habe, 1977)

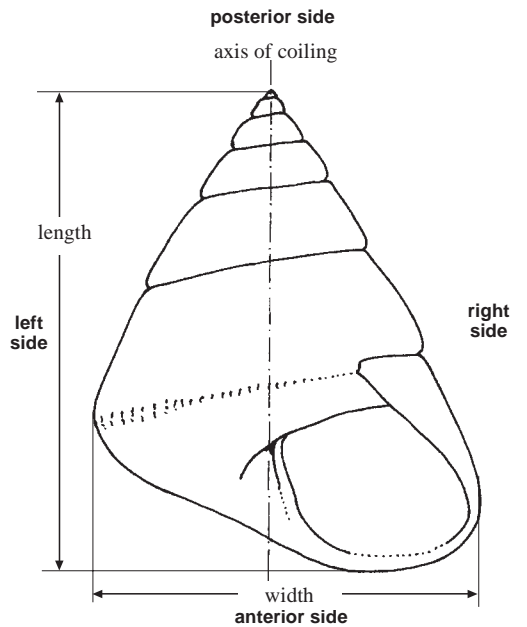
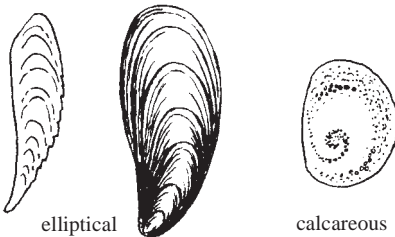
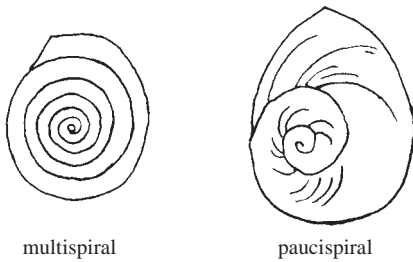
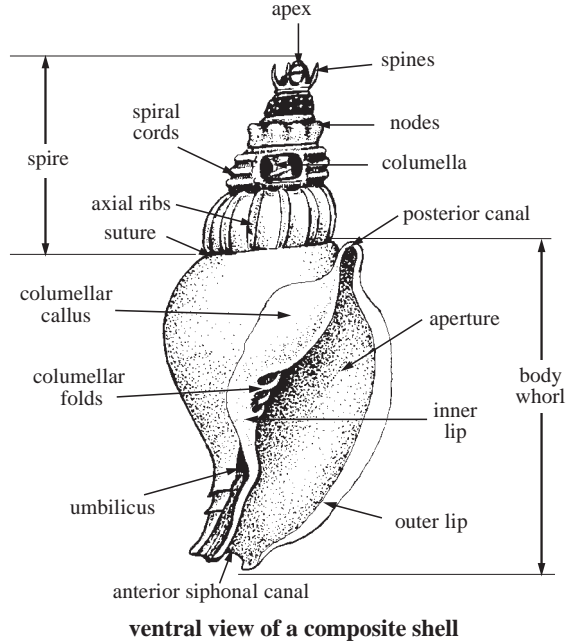
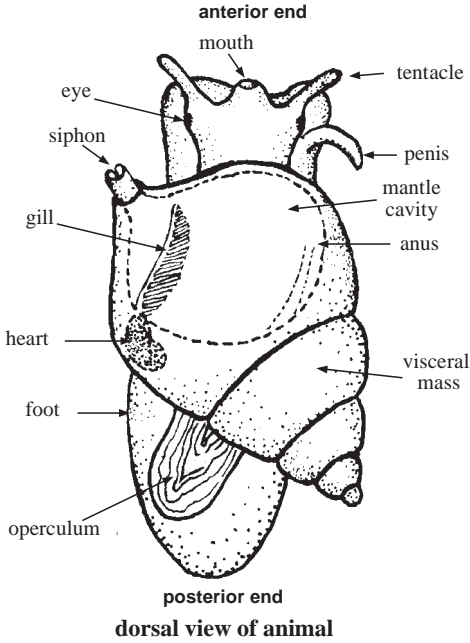


GASTROPODS

by J.M. Poutiers

GENERAL REMARKS

Gastropods are torted, asymmetrical molluscs, usually with a spirally coiled shell. Their soft body is divided into 4 main regions: the **head**, which normally protrudes anteriorly from the shell; the **foot**, a muscular ventral organ with a flattened base used for locomotion (creeping or burrowing); the **visceral mass**, which fills dorsally the spire of the shell, and contains most organ systems; the **mantle**, a collar-like tegument which lines and secretes the shell, and forms a mantle cavity normally provided with respiratory **gills** in aquatic species. The noteworthy asymmetry of the internal anatomy of gastropods results from a twisting through 180° called the "torsion", which occurs in the first few hours of larval development. Part of the paired organs of the visceral mass cease developing, and the animal begins to be asymmetrical. This internal asymmetry persists in the adult, even when a subsequent detorsion occurs.



operculum types

orientation and measurements of a shell

general characteristics of gastropods

The majority of the gastropods produce a **single coiled shell**, and many have a corneous or calcareous "trapdoor", the **operculum**, that seals the opening of the shell. In some species, the shell may appear as a simple conical or cap-shaped plate, or even may be absent.

Gastropods are usually divided into 4 main subclasses: **Prosobranchia**, with an anterior mantle cavity and 1 or 2 gills in front of the heart; **Opisthobranchia**, with a right-sided or posterior mantle cavity and a single gill behind the heart, or without gills; **Pulmonata**, the mantle cavity of which is modified into a primitive lung; **Gymnomorpha**, always devoid of shell and mantle cavity. As the majority of marine shelled gastropods belong to the Prosobranchia, this group also contains most of the species of interest to fisheries in the Western Central Pacific.

The shell of prosobranch gastropods typically consists of a spirally coiled tube increasing in diameter with growth, and an opening only at the ventral growing end, called the **aperture**. The axis of the shell whorls or **columella** may be hollow, forming at the base of the shell an opening, the **umbilicus**. The **base** of shell is formed by the largest spiral turn or **body whorl**, while the other whorls, which are closer to the summit or **apex**, constitute the **spire**. The continuous line where 2 adjacent whorls join is known as the **suture**. The aperture may have a simple, ovate outline, or can be deformed anteriorly by a **siphonal canal**. Its margin close to the columella forms the **inner lip**, while the opposite margin constitutes the **outer lip**; the latter sometimes shows a notch or **posterior canal**. Apart from **growth marks** left by the growing lip, the surface of the shell may be smooth, but usually it is **sculptured**. Sculptural elements are either **spiral** (following the curve of the whorls), or **axial** (transverse to the whorls and roughly parallel to the coiling axis).

The majority of prosobranchs are carnivores, herbivores or scavengers, using the **radula**, a cuticular ribbon carrying rows of teeth, to take in food. Sexes are generally separate, although a few species may be hermaphrodites. In primitive prosobranchs fertilization is external; in species with internal fertilization eggs may be enclosed in protective layers of gelatinous mucus or corneous capsules before they are deposited. According to the species, embryos may hatch as free-swimming planktonic larvae (accounting for dispersion over large areas by marine currents), or as crawling young (after metamorphosis).

The malacological fauna of the Western Central Pacific is doubtless the largest in the world, but no reliable estimate of the gastropod diversity is presently available. However, a recent evaluation of the nearby Japanese fauna may give an idea of the rich biodiversity in the area. Japanese gastropods comprise more than 6 600 marine and brackish-water species allocated to 238 families, compared to a total of 23 000 species in the world. For the present contribution, 249 species belonging to 42 families have been selected, mainly on the basis of size, abundance, distribution, and commercial interest. Only those species that are known to be used as food are included in this guide, but in view of the paucity of detailed information on fisheries in many places, other species may be added in the future, as new information will become available. The author had the opportunity to gather a considerable amount of information on gastropod species exploited in the central and northern Philippines during a workshop in support of the present field guide which was held in October 1995 in the Philippines, organized by FAO, MSI (Marine Science Institute, University of the Philippines), and ICLARM (International Centre for Living Aquatic Resources Management).

In the Western Central Pacific, a large diversity of species is traditionally collected by coastal populations for human consumption. Nowadays, although the shell trade is getting more and more important, many shellfish are collected by fishermen for personal consumption or sold as food on local markets before the empty shell is resold to collectors or to the shellcraft industry. Fishing effort in the past has concentrated on a limited number of gastropod species, which constitute only a small fraction of the total harvest when bivalve shellfish are included. However, some larger gastropods, such as predators, are consequently rather scarce and cannot tolerate an intensive fishery. An increasing number of species tends now to be exploited and aquaculture of some species has been successfully attempted in order to counteract the effects of overexploitation or pollution, or to diversify fishery activities, especially in the oceanic islands of the tropical Pacific.

GLOSSARY OF TECHNICAL TERMS

Anterior - direction into which the head points when the animal is active; in a spiral shell, the part of the aperture which is farthest from the apex.

Aperture - opening of shell, situated at the last formed margin and providing an outlet for the head-foot mass.

Apex - the first-formed end of the shell, generally pointed.

Apical - pertaining to the apex.

Axial - parallel to the coiling axis of the shell.

Base - lower part of shell, anterior to the level of periphery of body whorl.

Biconical - resembling 2 cones placed base to base.

Body whorl - the largest, last whorl of the spiral in a coiled shell.

Callus - thick secondary deposit of lime, generally shiny and porcellaneous.

Cancellate - with axial (or concentric) and spiral (or radial) components that intersect to form a latticed pattern.

Columella - coiling axis of shell, forming the anterior part of inner lip.

Concentric - parallel to lines of growth (in a cone-shaped shell).

Corneous - horny.

Coronate - with tubercles or nodules at the shoulder of whorls.

Crenulate - with the edge regularly notched or scalloped.

Denticulate - finely toothed.

Foot - mobile and extensible muscular organ, ventrally situated, with a flattened base used for locomotion.

Fusiform - Spindle-shaped, tapering at both ends.

Gill - respiratory organ of aquatic gastropods, housed in the mantle cavity. In most prosobranchs, the gill is composed of 1 row of numerous, flexible leaflets disposed along a main axis; gills of the most primitive prosobranchs have 2 rows of leaflets, and may be 1 (Lottiidae, Neritidae, Phenacolinpadidae, Trochidae, Turbinidae) or 2 in number (Fissurellidae, Haliotidae).

Growth marks - approximately axial (or concentric) lines left by the growing margin of aperture, superimposed on the outer sculpture of shell.

Hermaphrodite - with both male and female sex organs.

Inner lip - margin of the aperture closer to the coiling axis (in a spiral shell).

Keel - prominent angular ridge.

Lenticular - shaped like a biconvex lens.

Lira (pl. **lirae**) - fine linear elevations on the shell surface or within the outer lip.

Lirate - with lirae.

Mantle - fleshy tegument which lines and secretes the shell.

Mantle cavity - cavity enclosed by the mantle, housing the gills.

Multispiral - with numerous coils.

Nacreous - pearly, often with multi-coloured hues, as in mother-of-pearl.

Nucleus - the first-formed part of the operculum.

Operculum - horny or calcareous part attached to the foot; it seals the aperture when the animal withdraws into the shell.

Outer lip - margin of the aperture opposite to the inner lip (in a spiral shell).

Paucispiral - with relatively few coils.

Periostracum - layer of horny material, covering outside of shell.

Periphery - part of a whorl farthest from the coiling axis of the shell.

Porcelaneous - with translucent, porcelain-like appearance.

Posterior - direction opposite to that into which the head points in the active animal.

Posterior canal (or **sinus**) - notch or tube at or close to the posterior end of aperture.

Pustulose - with small tubercles.

Radial - diverging from the apex like the spokes of a wheel (in a cone-shaped shell).

Radula - the main feeding organ, consisting of a cuticular ribbon with transverse rows of horny teeth.

Sculpture - relief pattern developed on the outer surface of the shell.

Shoulder - distinct spiral angulation of a whorl.

Siphonal canal - trough-like or tubular extension of aperture anteriorly, for enclosure of a fleshy siphon.

Spiral - parallel to the curve of whorls, in a coiled shell.

Spire - all the whorls of a shell (excluding the last, or body whorl).

Suture - spiral line or groove of shell surface where adjacent whorls meet.

Turbinate - with a broad conical spire and a convex base.

Umbilicus - opening at base of shell made around the coiling axis when columella is hollow.

Varix (pl. **varices**) - axial rib-like thickening of the outer surface of shell, representing a previous growth halt during which the outer lip of aperture thickened.

IDENTIFICATION NOTE

An illustrated key to families comprising the species treated in this guide can be found on the following pages. After a family is determined by using this key, the user should turn to the descriptive accounts of families and species. Each section on a family includes, beside a diagnosis of the family, a key to the species treated here. Furthermore, there are detailed accounts for the most important species given, and abbreviated accounts for species of secondary interest.

KEY TO FAMILIES

Remarks on key characters: features used in this key only apply for species included in the present contribution; they do not consider a few exceptions within the families, the inclusion of which would make the key too complex for general use.

- 1a.** Shell reduced, internal or nearly so, permanently covered by the mantle **Figure A**
1b. Shell well developed, exposed, although it may be temporarily covered by mantle lobes which are withdrawn when touched → **2**
- 2a.** Shell permanently cemented to a substrate, loosely or irregularly coiled and generally twisted, resembling the calcareous tube of a polychaete worm **Figure B**
2b. Shell not permanently cemented to a substrate, tightly coiled or not coiled and conical, cap-shaped or slipper-shaped, but never resembling a worm tube → **3**
- 3a.** Shell ear-shaped or conical and not coiled, with a marginal indentation or slit anteriorly, or with one to several holes in addition to the aperture **Figure C**
3b. Shell not of these shapes, or without holes, anterior indentation or slit, apart from the aperture → **4**
- 4a.** Shell cap-shaped, slipper-shaped or conical, without obvious coiling; spire, if visible, not prominent **Figure D**
4b. Shell not of these shapes, conspicuously coiled → **5**
- 5a.** Outer lip of the aperture with a distinct notch anteriorly. **Figure E**
5b. Outer lip of the aperture without an anterior notch → **6**
- 6a.** Aperture stretching along the whole shell length; spire concealed under body whorl, or reduced and not protruding **Figure F**
6b. Aperture not stretching along the whole shell length, or spire not concealed under body whorl, more or less developed and protruding → **7**
- 7a.** Shell without an anterior siphonal canal → **8**
7b. Shell with an anterior siphonal canal → **10**
- 8a.** Interior of shell pearly **Figure G**
8b. Interior of shell not pearly → **9**
- 9a.** Length of the shell much smaller than the width **Figure H**
9b. Length of the shell about equal to the width, or decidedly larger **Figure I**

- 10a. Outer sculpture with axial varices **Figure J**
- 10b. Outer sculpture without axial varices → 11

- 11a. Columella with strong spiral folds **Figure K**
- 11b. Columella without strong spiral folds (low threads or grooves may be present) → 12

- 12a. Siphonal canal relatively long **Figure L**
- 12b. Siphonal canal relatively short → 13

- 13a. Spire short → 14
- 13b. Spire well developed → 15

- 14a. Shell shape globular. **Figure M**
- 14b. Shell shape elongate-ovate to conical **Figure N**

- 15a. Spire much longer than the aperture **Figure O**
- 15b. Spire not much longer than the aperture **Figure P**

Note: the following figures contain all the families included in this contribution, plus those quoted as similar to the treated families. These similar families are marked with an asterisk (*).

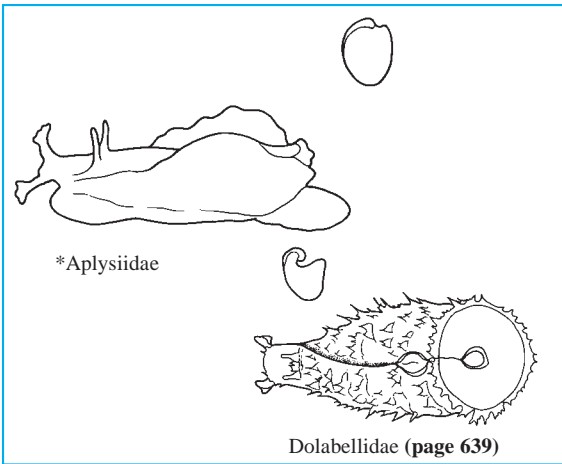


Figure A

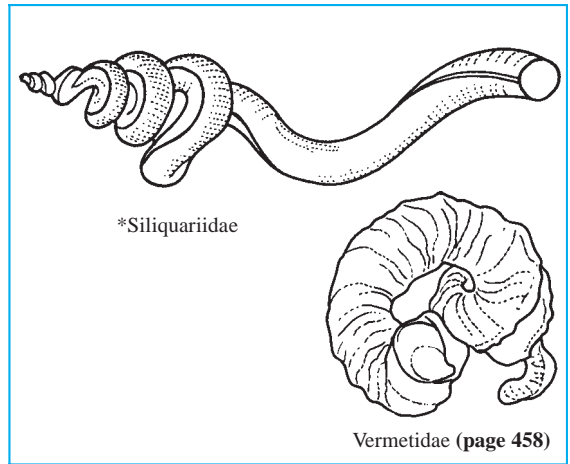


Figure B

Figure A:

*Aplysiidae: shell nearly internal, reduced, thin and membranous, not conspicuously coiled nor strongly concave on the right side. Animal somewhat resembling a crouching hare in shape, with 2 ear-like processes on the head. Body with a smooth skin. Foot strong, with 2 very broad lateral expansions, often forming swimming lobes.

Dolabellidae: shell nearly internal, reduced, well calcified, spirally coiled, conspicuously concave on the right side. Animal resembling a crouching cat in shape, with 2 ear-like processes on the head. Body with a rough skin. Foot long, with 2 outgrowths embracing the body laterally.

Figure B:

*Siliquariidae: shell tubular, loosely to irregularly coiled in the later stages, with a row of tiny holes or a slit along one side. Aperture without siphonal canal. Operculum horny, conical, multispiral, with bristles around the edges of the coils.

Vermetidae: shell irregularly coiled or even disjunct, resembling a worm tube but composed of 3 layers. Aperture without siphonal canal. Operculum horny, spiral, sometimes absent.

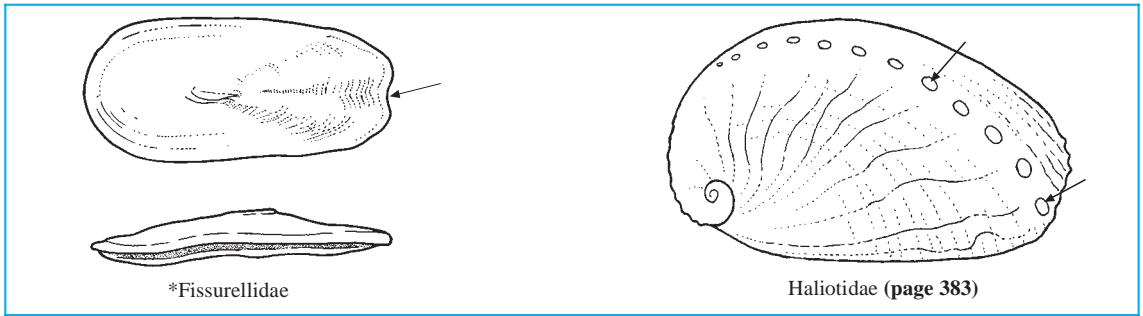


Figure C

Figure C:

*Fissurellidae: shell conical, with a hole at the apex, or a marginal notch or groove. Interior with a horseshoe-shaped muscle scar. No operculum.

Haliotidae: shell ear-shaped, depressed and loosely coiled. Spire eccentric. A spiral row of holes on body whorl. Aperture occupying most of the underside. Interior nacreous. No operculum.

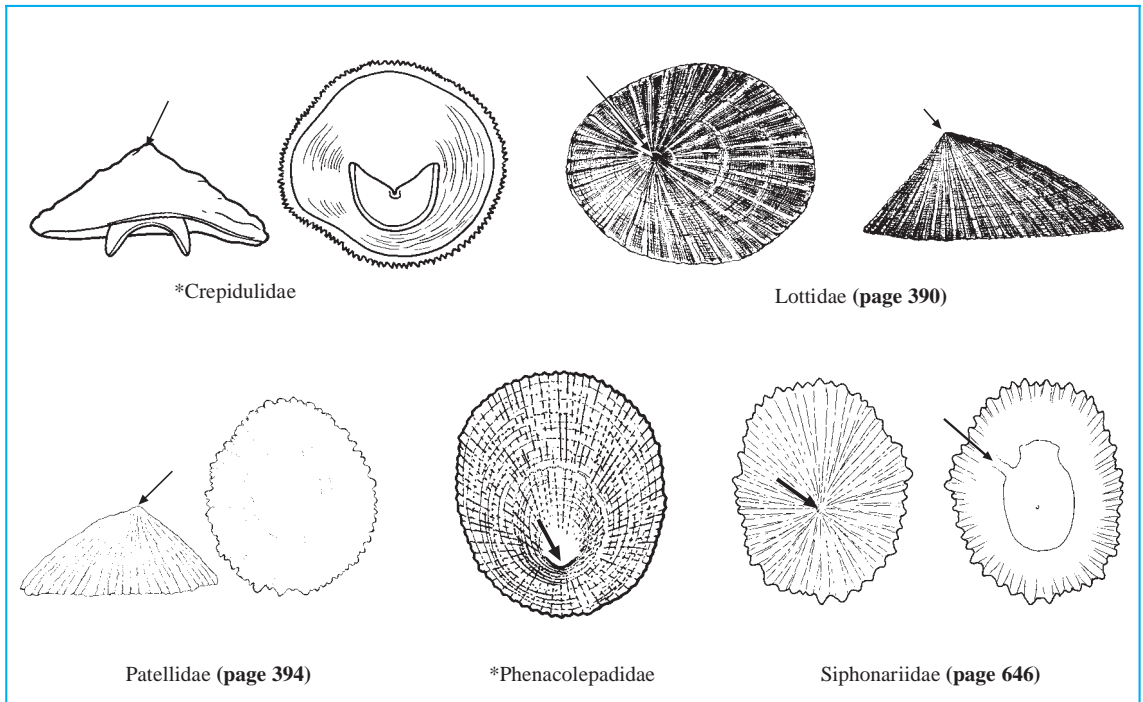


Figure D

Figure D:

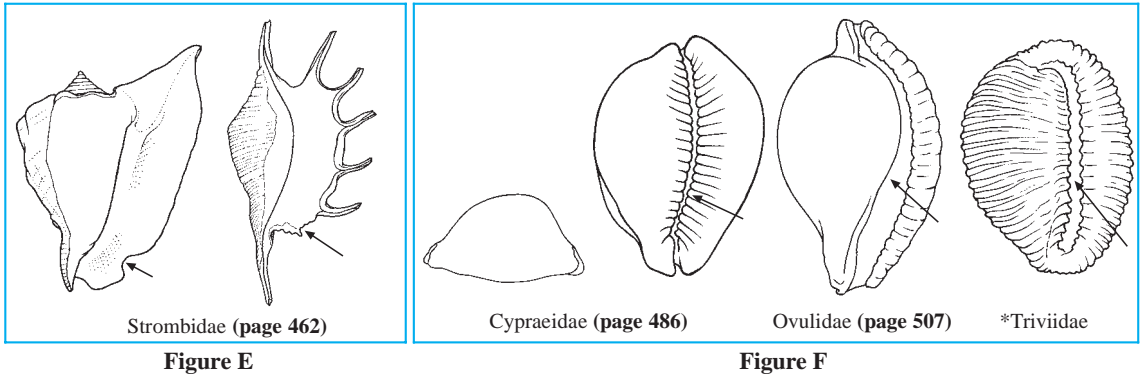
*Crepidulidae: shell cap-shaped to conical, with a central to posterior apex. Interior with a calcareous septum projecting from the apical region. No operculum.

Lottidae: shell conical. Sculpture essentially radial. Interior with a horseshoe-shaped muscle scar. No operculum. A single true gill in the mantle cavity.

Patellidae: shell conical. Sculpture essentially radial. Interior with a horseshoe-shaped muscle scar. No operculum. True gills replaced by a fringe of respiratory tentacles.

*Phenacolepadidae: shell conical, thin and whitish, with a posteriorly recurved apex. Interior with a horseshoe-shaped muscle scar. No operculum.

Siphonariidae: shell conical, with a weak marginal lobe on the right side. Interior with a ring-like muscle scar, interrupted on the right side where there is a shallow radial groove. No operculum.

**Figure E:**

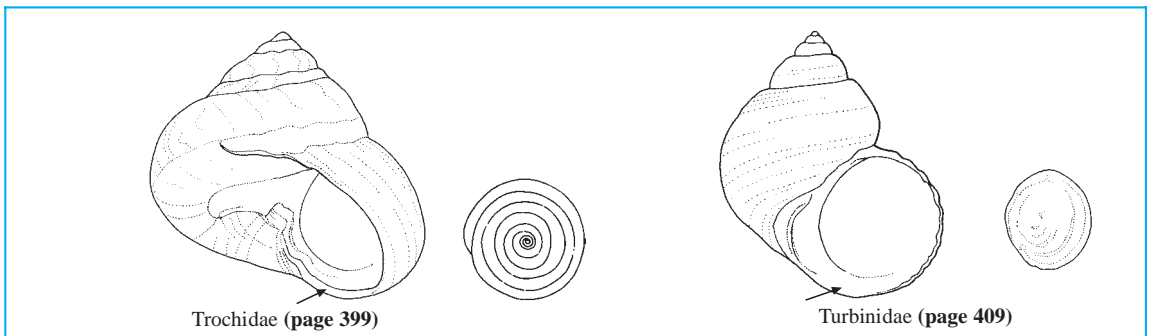
Strombidae: shell thick and solid, with a relatively large body whorl. Aperture with a well-marked siphonal canal. A distinct notch along the anterior margin of the outer lip. Operculum corneous, claw-like.

Figure F:

Cypraeidae: shell ovate or oblong, spire concealed under body whorl. Surface highly polished, smooth. Aperture long and narrow, channeled at both ends. Both lips with teeth. No operculum.

Ovulidae: shell globular to spindle-shaped, with more or less expanded extremities. Spire concealed under body whorl. Surface often smooth, porcellaneous. Aperture very long, channeled at both ends. Inner lip smooth. No operculum.

*Triviidae: shell ovate or oblong, usually small sized. Spire concealed under body whorl. Surface strongly sculptured. Aperture long and narrow, channeled at both ends. Apertural teeth on both lips, continued over the lateral and dorsal sides of shell. No operculum.

**Figure G:**

Trochidae: shell conical to globose, often with a flattened base. Aperture without a siphonal canal, nacreous within. Operculum corneous, nearly circular.

Turbinidae: shell thick, turbanate to conical. Outer sculpture often spiral to nodular. Aperture rounded, without a siphonal canal, nacreous within. Operculum strongly calcified.

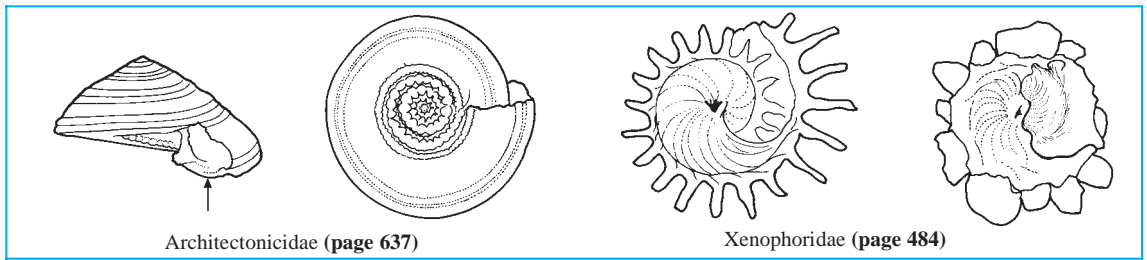


Figure H

Figure H:

Architectonicidae: shell wider than long, with a large, rather flat base. Umbilicus broadly open, within which can be seen the inverted larval shell. A nodular spiral rib bordering the umbilicus. Aperture without a siphonal canal. Operculum corneous, with a tubercle internally.

Xenophoridae: shell low-conical, with a broad, flattened concave base. Periphery with a lobed flange, hollow radial spines, or cemented foreign bodies. Aperture without a siphonal canal. Operculum corneous.

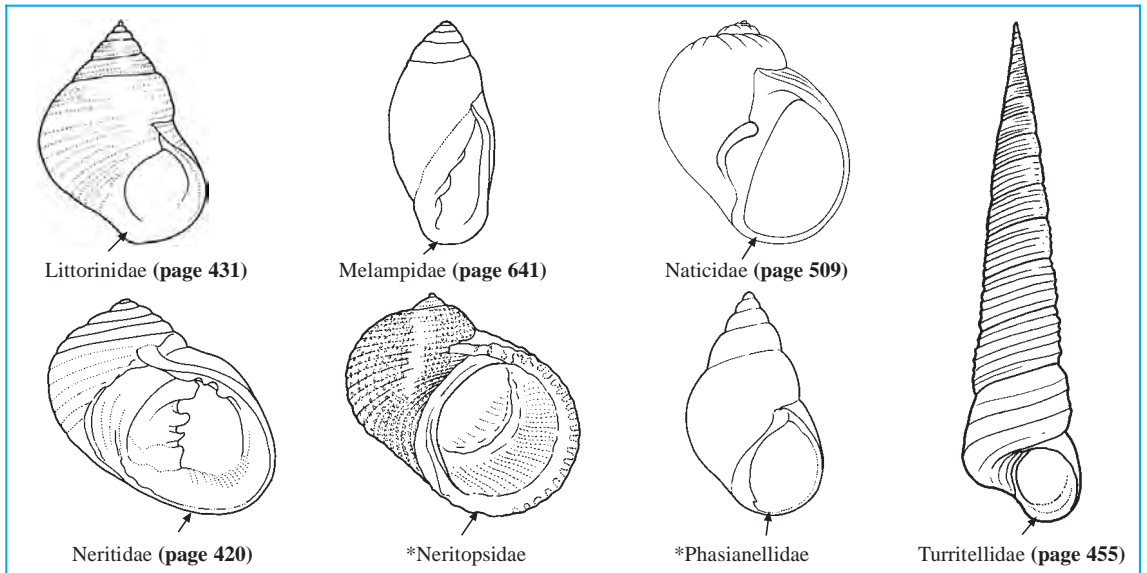


Figure I

Figure I:

Littorinidae: shell ovate-conical, without an umbilicus. Aperture rounded, without a siphonal canal. Operculum corneous, with relatively few spiral coils.

Melampidae: shell with a rather short, conical spire and large body whorl. Aperture often narrowed by folds and other constrictions. No siphonal canal. Operculum absent.

Naticidae: shell globular to ovate-conical. Outer surface smooth or with reduced sculpture. Aperture large, semicircular. Siphonal canal absent. Umbilicus open or closed, sometimes with an internal rib. Operculum corneous or calcified.

Neritidae: shell globose, with a relatively low spire and a very large, rounded body whorl. Aperture semicircular, without a siphonal canal. Inner lip protruding as a septum that narrows the aperture. Inner walls of the spire resorbed. Operculum calcified, with a projecting peg.

***Neritopsidae:** shell globose, with a rather low spire and a large, rounded body whorl. Aperture subcircular, without a siphonal canal. Inner lip moderately thickened, strongly concave. Inner walls of the spire not resorbed. Operculum calcified, with a subquadrate process.

***Phasianellidae:** shell ovate-conical, smooth. Aperture pear-shaped, without a siphonal canal. Operculum calcified, rounded.

Turritellidae: shell elongate, sharply conical, with numerous whorls and a small aperture. Whorls sculptured with spiral ribs or keels. Siphonal canal absent. Operculum corneous, rounded.

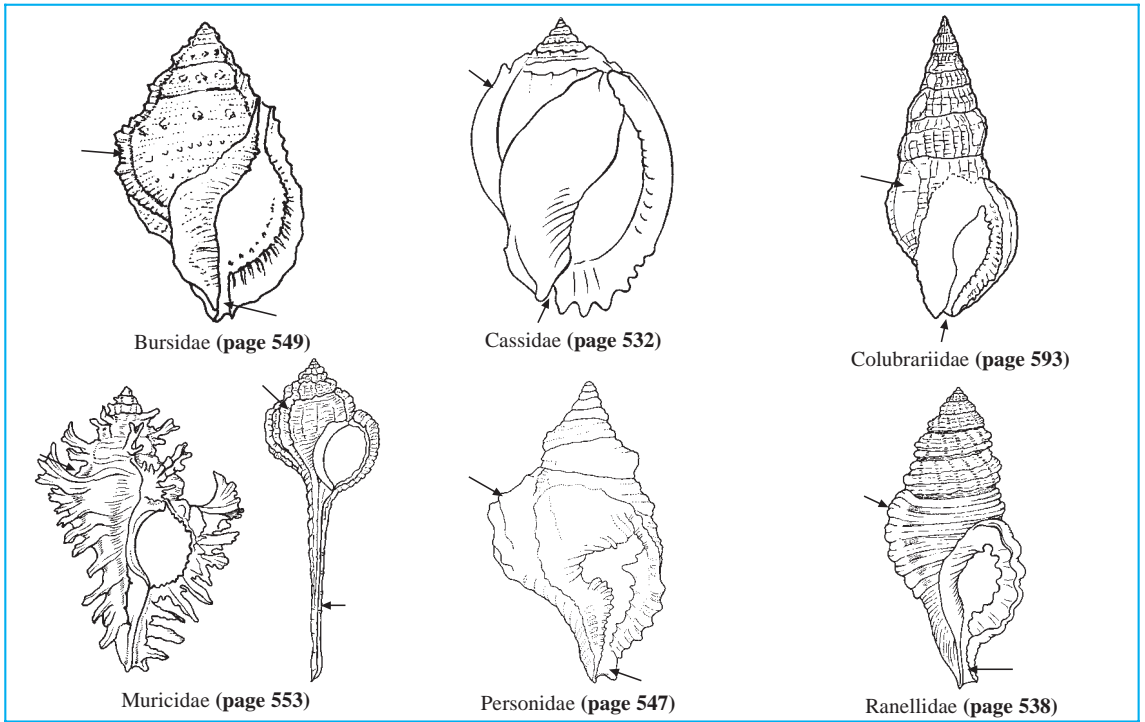


Figure J

Figure J:

Bursidae: shell ovate, often slightly dorsoventrally compressed, with 2 strong axial varices per whorl. Periostracum obsolete. Aperture with a short siphonal canal and a distinct posterior canal. Operculum corneous.

Cassidae: shell thick and solid, with a large body whorl and rather small, conical spire. Sculpture variable, axial varices sometimes present. Aperture elongate, with a short siphonal canal, recurved dorsally. Outer lip thickened. Inner lip with a shield-like callus. Operculum quite small, corneous.

Colubrariidae: shell thick, elongate-fusiform, with many convex whorls. Discontinuous axial varices and a finely granulose or reticulated surface. Aperture with a short siphonal canal. Outer lip thickened. Operculum corneous.

Muricidae: shell variably shaped, generally with a raised spire and strong sculpture with axial varices, spines, tubercles or blade-like processes. Periostracum absent. Aperture with a well-marked siphonal canal. Operculum corneous.

Personidae: shell fusiform, inflated, roughly sculptured, bumped, with a wavering suture and with axial varices. Periostracum fibrous to hairy. Aperture distorted, narrowed by strong teeth. Inner lip with an extensive callus. Siphonal canal recurved. Operculum corneous.

Ranellidae: shell ovate-fusiform, with a strong sculpture and axial varices. Periostracum frequently well developed and hairy. Aperture with a siphonal canal. Operculum corneous.

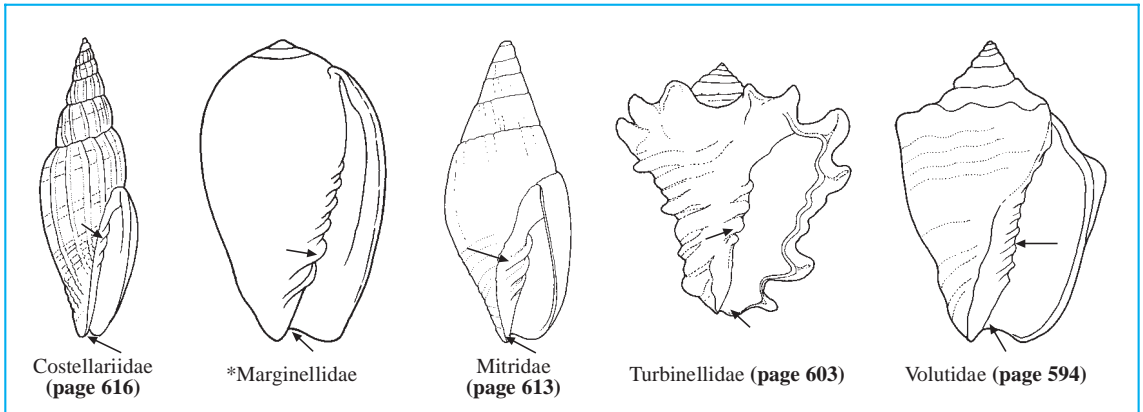


Figure K

Figure K:

Costellariidae: shell fusiform-ovate, with a predominantly axial sculpture. Aperture notched by a short siphonal canal. Outer lip finely lirate inside. Columella with strong folds, larger posteriorly. No operculum.

***Marginellidae:** shell ovate, usually smooth and polished, often small. Aperture elongate, with a short siphonal canal. Columella strongly folded. No operculum.

Mitridae: shell fusiform-ovate, with a predominantly spiral sculpture. Aperture notched by a short siphonal canal. Outer lip not lirate inside. Columella with strong folds, larger posteriorly. No operculum.

Turbinellidae: shell thick and heavy, biconical to fusiform, often nodulose to spinose on shoulder. Periostracum conspicuous. Siphonal canal present. Inner lip with strong folds. Operculum corneous.

Volutidae: shell variable in shape, often glossy and brightly coloured. Aperture long, with a short siphonal canal. Inner lip with strong folds, weaker posteriorly. Operculum horny, often absent.

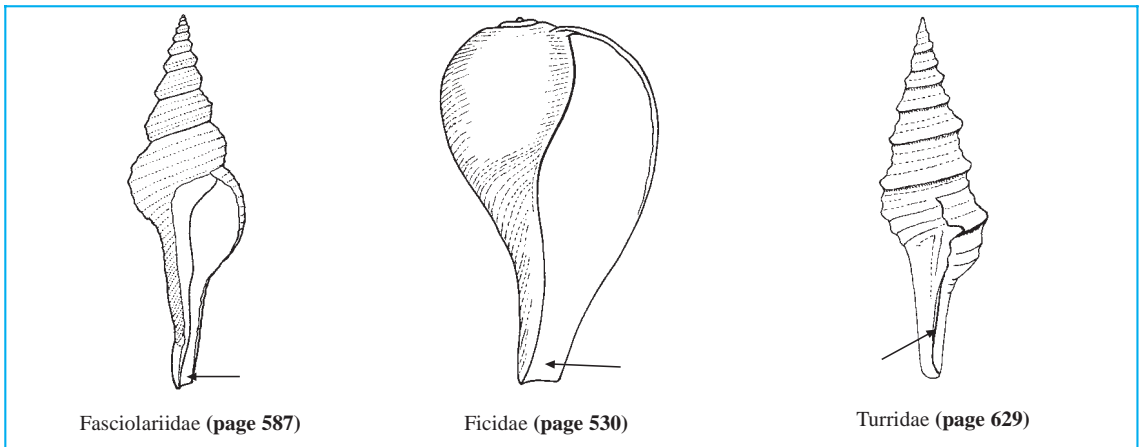


Figure L

Figure L:

Fascioliariidae: shell fusiform, with a well-developed siphonal canal. Columella often with a few low basal threads. Operculum corneous. Soft parts brilliant scarlet.

Ficidae: shell thin, pear-shaped, drawn out anteriorly into a long, tapered and gracefully curved siphonal canal. Operculum absent.

Turridae: shell generally fusiform, with a high spire. Siphonal canal well marked. A characteristic notch along the posterior part of the outer lip, reflected in the growth lines. Operculum corneous.

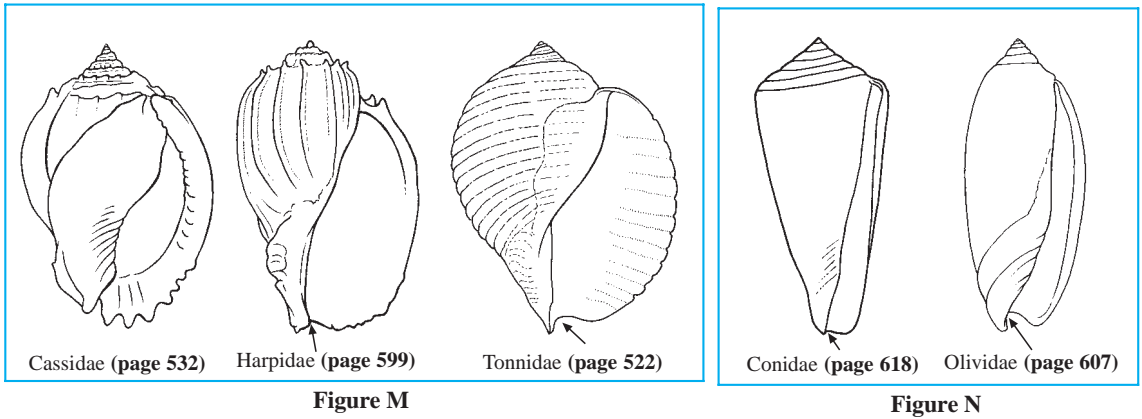


Figure M

Figure N

Figure M:

Cassidae: shell thick and solid, with a large body whorl and rather small, conical spire. Sculpture variable, axial varices sometimes present. Aperture elongate, with a short siphonal canal, recurved dorsally. Outer lip thickened. Inner lip with a shield-like callus. Operculum quite small, corneous.

Harpidae: shell ovate, with an inflated body whorl and a small conical spire. Surface glossy, with strong axial ribs. Inner lip covered by a smooth, large callus. Columella without folds. Siphonal canal short and wide. Operculum absent.

Tonnidae: shell thin, globose, with a short spire and very inflated body whorl. Sculpture only spiral. Siphonal canal short. Operculum absent.

Figure N:

Conidae: shell cone-shaped, with a low spire and a well-developed body whorl tapering towards the narrow anterior end. Aperture very long, with a short siphonal canal. Operculum corneous, quite small.

Olividae: shell elongate-ovate, with a short spire, a large body whorl and channeled sutures. Surface smooth, highly polished. Aperture elongate, with a short siphonal canal. Inner lip calloused, with oblique grooves anteriorly. Operculum absent.

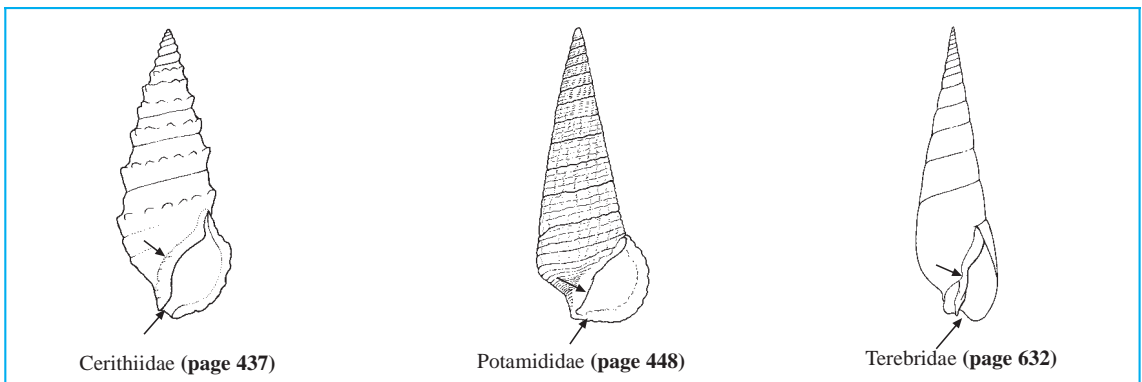


Figure O

Figure O:

Cerithiidae: shell sharply conical, with a high, many-whorled spire and rather small aperture. Sculpture variable. Aperture with a siphonal canal. Outer lip somewhat expanded. Operculum ovate, corneous, with a few spiral coils.

Potamididae: shell high-conical, with many spire whorls. Sculpture generally coarse. Aperture relatively small, with a short siphonal canal. Outer lip often flaring. Operculum rounded, corneous, with many spiral coils.

Terebridae: shell elongate, with a high, many-whorled spire and relatively small aperture. Surface smooth or with a low sculpture. Siphonal canal short and wide. Inner lip with a twisted columella. Operculum corneous.

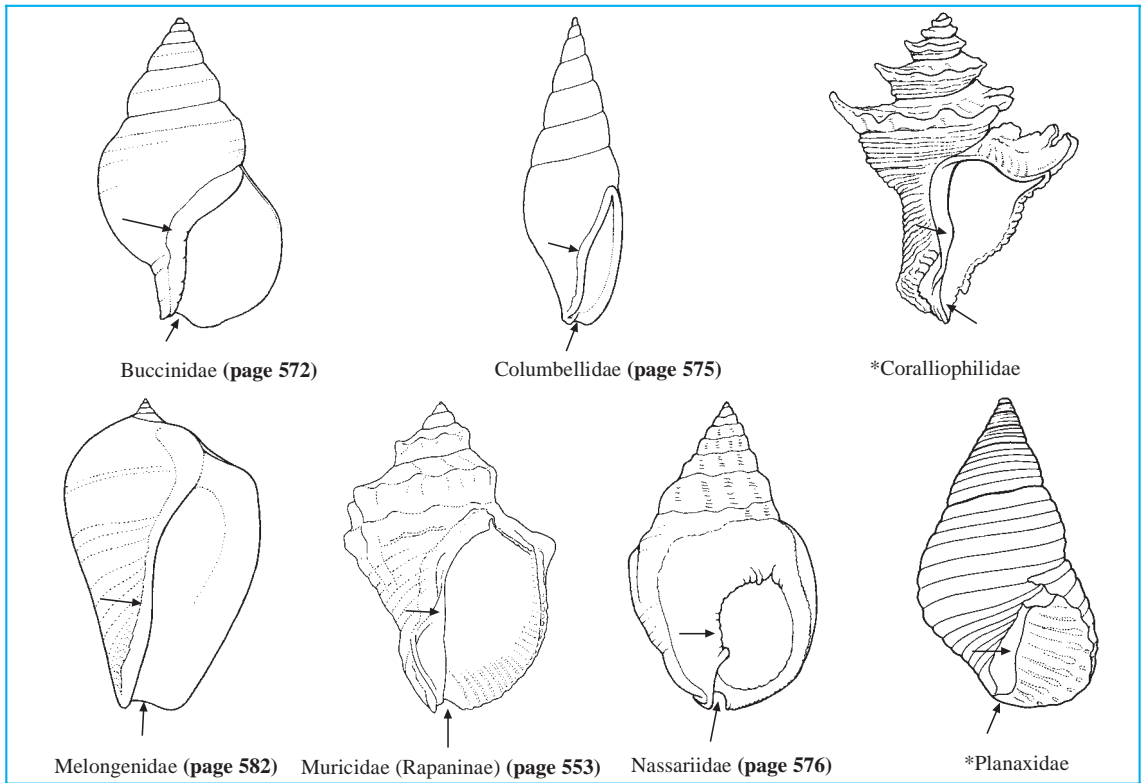


Figure P

Figure P:

Buccinidae: shell with a fairly high spire and large body whorl. Outer surface smooth or with sculpture, without axial varices. Siphonal canal rather short. Operculum corneous.

Columbellidae: shell small, fusiform, often boldly coloured. Aperture rather long and narrow, with a short siphonal canal. Inner lip not folded. Operculum corneous and small.

***Coralliophilidae:** shell variably shaped, ovate with a conical spire to globose. Outer surface white, smoothish to strongly sculptured, but without axial varices. Siphonal canal well marked. Operculum, when present, corneous.


Melongenidae: shell pear-shaped to fusiform, nodular to spiny on the shoulder. Aperture anteriorly narrowing into an open siphonal canal. Columella smooth. Operculum corneous.

Muricidae (Rapaninae): shell with a raised spire and often strong sculpture, with spines, tubercles or spiral ribs, but without axial varices. Siphonal canal rather short. Operculum corneous, with a lateral nucleus.






Nassariidae: shell ovately rounded with a conical spire. Body whorl anteriorly bordered by a strong spiral groove. Aperture rather small and rounded, with a short, recurved siphonal canal. Inner lip not folded, calloused. Operculum corneous, smaller than the aperture.

***Planaxidae:** shell ovate-conical, smooth or spirally grooved. Aperture with a very short, distinct siphonal canal. Outer lip grooved within. Operculum corneous.



LIST OF FAMILIES AND SPECIES OF INTEREST TO FISHERIES OCCURRING IN THE AREA

The symbol  is given when species accounts are included.




HALIOTIDAE

-  *Haliotis asinina* Linnaeus, 1758
-  *Haliotis glabra* Gmelin, 1791
-  *Haliotis ovina* Gmelin, 1791
-  *Haliotis planata* Sowerby, 1833
-  *Haliotis varia* Linnaeus, 1758










LOTTIIDAE

-  *Patelloida saccharina* (Linnaeus, 1758)
-  *Patelloida striata* (Quoy and Gaimard, 1834)











PATELLIDAE

-  *Cellana rota* (Gmelin, 1791)
-  *Cellana testudinaria* (Linnaeus, 1758)
-  *Patella flexuosa* Quoy and Gaimard, 1834








TROCHIDAE

-  *Monodonta labio* (Linnaeus, 1758)
-  *Tectus fenestratus* (Gmelin, 1791)
-  *Tectus pyramis* (Born, 1778)
-  *Trochus conus* Gmelin, 1791
-  *Trochus hanleyanus* Reeve, 1842
-  *Trochus maculatus* Linnaeus, 1758
-  *Trochus niloticus* Linnaeus, 1758
-  *Umbonium costatum* (Kiener, 1838)
-  *Umbonium vestiarium* (Linnaeus, 1758)

TURBINIDAE

-  *Astraliium calcar* (Linnaeus, 1758)
-  *Turbo argyrostomus* Linnaeus, 1758
-  *Turbo bruneus* (Röding, 1798)
-  *Turbo chryostomus* Linnaeus, 1758
-  *Turbo cinereus* Born, 1778
-  *Turbo coronatus* Gmelin, 1791
-  *Turbo crassus* Wood, 1828
-  *Turbo marmoratus* Linnaeus, 1758
-  *Turbo petholatus* Linnaeus, 1758
-  *Turbo setosus* Gmelin, 1791

NERITIDAE

-  *Nerita albicilla* Linnaeus, 1758
-  *Nerita chameleon* Linnaeus, 1758
-  *Nerita costata* Gmelin, 1791
-  *Nerita picea* Récluz, 1841
-  *Nerita planospira* Anton, 1839
-  *Nerita plicata* Linnaeus, 1758
-  *Nerita polita* Linnaeus, 1758
-  *Nerita squamulata* Le Guillou, 1841
-  *Nerita undata* Linnaeus, 1758
-  *Neritina turrita* (Gmelin, 1791)
-  *Neritodryas subsulcata* (Sowerby, 1836)

LITTORINIDAE

- ☞ *Littoraria scabra* (Linnaeus, 1758)
- ☞ *Nodilittorina pyramidalis* (Quoy and Gaimard, 1833)
- ☞ *Tectarius coronatus* Valenciennes, 1832
- ☞ *Tectarius grandinatus* (Gmelin, 1791)
- ☞ *Tectarius pagodus* (Linnaeus, 1758)

CERITHIIDAE

- ☞ *Cerithium coralium* Kiener, 1841
- ☞ *Cerithium echinatum* Lamarck, 1822
- ☞ *Cerithium nodulosum* Bruguière, 1792
- ☞ *Clypeomorus batillariaeformis* Habe and Kosuge, 1966
- ☞ *Pseudovertagus aluco* (Linnaeus, 1758)
- ☞ *Rhinoclavis aspera* (Linnaeus, 1758)
- ☞ *Rhinoclavis fasciata* (Bruguière, 1792)
- ☞ *Rhinoclavis sinensis* (Gmelin, 1791)
- ☞ *Rhinoclavis vertagus* (Linnaeus, 1758)

POTAMIDIDAE

- ☞ *Cerithidea cingulata* (Gmelin, 1791)
- ☞ *Cerithidea obtusa* (Lamarck, 1822)
- ☞ *Cerithidea quadrata* Sowerby, 1866
- ☞ *Telescopium telescopium* (Linnaeus, 1758)
- ☞ *Terebralia palustris* (Linnaeus, 1767)
- ☞ *Terebralia sulcata* (Born, 1778)

TURRITELLIDAE

- ☞ *Turritella duplicata* (Linnaeus, 1758)
- ☞ *Turritella terebra* (Linnaeus, 1758)

VERMETIDAE

- ☞ *Dendropoma maximum* (Sowerby, 1825)
- ☞ *Serpulorbis colubrinus* (Röding, 1798)
- ☞ *Serpulorbis medusae* (Pilsbry, 1891)

STROMBIDAE

- ☞ *Lambis chiragra chiragra* (Linnaeus, 1758)
- ☞ *Lambis crocata* (Link, 1807)
- ☞ *Lambis lambis* (Linnaeus, 1758)
- ☞ *Lambis millepeda* (Linnaeus, 1758)
- ☞ *Lambis scorpius* (Linnaeus, 1758)
- ☞ *Lambis truncata* (Humphrey, 1786)
- ☞ *Strombus aurisdianae* Linnaeus, 1767
- ☞ *Strombus bulla* (Röding, 1798)
- ☞ *Strombus canarium* Linnaeus, 1758
- ☞ *Strombus dentatus* Linnaeus, 1758
- ☞ *Strombus epidromis* Linnaeus, 1758
- ☞ *Strombus gibberulus* Linnaeus, 1758
- ☞ *Strombus labiatus* (Röding, 1798)
- ☞ *Strombus latissimus* Linnaeus, 1758
- ☞ *Strombus lentiginosus* Linnaeus, 1758
- ☞ *Strombus luhuanus* Linnaeus, 1758
- ☞ *Strombus marginatus* Linnaeus, 1758
- ☞ *Strombus mutabilis* Swainson, 1821
- ☞ *Strombus sinuatus* Humphrey, 1786
- ☞ *Strombus urceus* Linnaeus, 1758
- ☞ *Strombus variabilis* Swainson, 1820

☞ *Tibia fusus* (Linnaeus, 1758)

☞ *Terebellum terebellum* (Linnaeus, 1758)

XENOPHORIDAE

☞ *Xenophora solaris* (Linnaeus, 1764)

CYPRAEIDAE

☞ *Cypraea annulus* Linnaeus, 1758

☞ *Cypraea arabica* Linnaeus, 1758

☞ *Cypraea argus* Linnaeus, 1758

☞ *Cypraea bouteti* Burgess and Arnette, 1981

☞ *Cypraea caputserpentis* Linnaeus, 1758

☞ *Cypraea carneola* Linnaeus, 1758

☞ *Cypraea caurica* Linnaeus, 1758

☞ *Cypraea depressa* Gray, 1824

☞ *Cypraea eglantina* Duclos, 1833

☞ *Cypraea erosa* Linnaeus, 1758

☞ *Cypraea isabella* Linnaeus, 1758

☞ *Cypraea leviathan* (Schilder and Schilder, 1937)

☞ *Cypraea lynx* Linnaeus, 1758

☞ *Cypraea maculifera* Schilder, 1932

☞ *Cypraea mappa* Linnaeus, 1758

☞ *Cypraea mauritiana* Linnaeus, 1758

☞ *Cypraea moneta* Linnaeus, 1758

☞ *Cypraea obvelata* Lamarck, 1810

☞ *Cypraea onyx* Linnaeus, 1758

☞ *Cypraea schildererum* Iredale, 1939

☞ *Cypraea scurra* Gmelin, 1791

☞ *Cypraea talpa* Linnaeus, 1758

☞ *Cypraea tigris* Linnaeus, 1758

☞ *Cypraea ventriculus* Lamarck, 1810

☞ *Cypraea vitellus* Linnaeus, 1758

OVULIDAE

☞ *Ovula ovum* (Linnaeus, 1758)

☞ *Volva volva* (Linnaeus, 1758)

NATICIDAE

☞ *Natica euzona* Récluz, 1844

☞ *Natica gualteriana* Récluz, 1844

☞ *Natica lineata* (Röding, 1798)

☞ *Natica stellata* Hedley, 1913

☞ *Natica tigrina* (Röding, 1798)

☞ *Natica vitellus* (Linnaeus, 1758)

☞ *Neverita albumen* (Linnaeus, 1758)

☞ *Neverita peselephanti* (Link, 1807)

☞ *Polinices didyma* (Röding, 1798)

☞ *Polinices mammilla* (Linnaeus, 1758)

☞ *Polinices melanostomus* (Gmelin, 1791)

☞ *Polinices sebae* (Récluz, 1844)

TONNIDAE

☞ *Malea pomum* (Linnaeus, 1758)

☞ *Tonna allium* (Dillwyn, 1817)

☞ *Tonna canaliculata* (Linnaeus, 1758)

☞ *Tonna dolium* (Linnaeus, 1758)

☞ *Tonna olearium* (Linnaeus, 1758)

☞ *Tonna perdix* (Linnaeus, 1758)

☞ *Tonna sulcosa* (Born, 1778)

☞ *Tonna tessellata* (Lamarck, 1816)

FICIDAE

- ☞ *Ficus gracilis* (Sowerby, 1825)
- ☞ *Ficus subintermedia* (Orbigny, 1852)

CASSIDAE

- ☞ *Cassis cornuta* (Linnaeus, 1758)
- ☞ *Cypraecassis rufa* (Linnaeus, 1758)
- ☞ *Phalium areola* (Linnaeus, 1758)
- ☞ *Phalium bandatum* (Perry, 1811)
- ☞ *Phalium glaucum* (Linnaeus, 1758)

RANELLIDAE

- ☞ *Charonia tritonis tritonis* (Linnaeus, 1758)
- ☞ *Cymatium aquatile* (Reeve, 1844)
- ☞ *Cymatium intermedium* (Pease, 1869)
- ☞ *Cymatium lotorium* (Linnaeus, 1758)
- ☞ *Cymatium muricinum* (Röding, 1798)
- ☞ *Cymatium nicobaricum* (Röding, 1798)
- ☞ *Cymatium pileare* (Linnaeus, 1758)
- ☞ *Cymatium pyrum* (Linnaeus, 1758)

PERSONIDAE

- ☞ *Distorsio anus* (Linnaeus, 1758)
- ☞ *Distorsio reticularis* (Linnaeus, 1758)

BURSIDAE

- ☞ *Bufo naria crumena* (Lamarck, 1816)
- ☞ *Bufo naria rana* (Linnaeus, 1758)
- ☞ *Bursa bufonia* (Gmelin, 1791)
- ☞ *Tutufa bubo* (Linnaeus, 1758)
- ☞ *Tutufa rubeta* (Linnaeus, 1758)

MURICIDAE

- ☞ *Chicoreus brunneus* (Link, 1807)
- ☞ *Chicoreus ramosus* (Linnaeus, 1758)
- ☞ *Chicoreus torrefactus* (Sowerby, 1841)
- ☞ *Haustellum haustellum* (Linnaeus, 1758)
- ☞ *Hexaplex cichoreum* (Gmelin, 1791)
- ☞ *Murex pecten* Lightfoot, 1786
- ☞ *Murex ternispina* Lamarck, 1822
- ☞ *Murex trapa* Röding, 1798
- ☞ *Murex tribulus* Linnaeus, 1758

Subfamily Rapaninae

- ☞ *Cymia lacera* (Born, 1778)
- ☞ *Nassa francolina* (Bruguière, 1789)
- ☞ *Nassa sarta* (Bruguière, 1789)
- ☞ *Purpura panama* (Röding, 1798)
- ☞ *Purpura persica* (Linnaeus, 1758)
- ☞ *Rapana rapiformis* (Born, 1778)
- ☞ *Thais aculeata* (Deshayes and Milne Edwards, 1844)
- ☞ *Thais alouina* (Röding, 1798)
- ☞ *Thais armigera* (Link, 1807)
- ☞ *Thais bufo* (Lamarck, 1822)
- ☞ *Thais tuberosa* Röding, 1798
- ☞ *Vexilla vexillum* (Gmelin, 1791)

BUCCINIDAE

- ☞ *Babylonia areolata* (Link, 1807)
- ☞ *Babylonia lutosa* (Lamarck, 1822)
- ☞ *Cantharus undosus* (Linnaeus, 1758)

COLUMBELLIDAE

- ☞ *Pyrene scripta* (Lamarck, 1822)

NASSARIIDAE

- ☞ *Nassarius arcularius* (Linnaeus, 1758)
- ☞ *Nassarius coronatus* (Bruguière, 1789)
- ☞ *Nassarius crematus* (Hinds, 1844)
- ☞ *Nassarius dorsatus* (Röding, 1798)
- ☞ *Nassarius glans* (Linnaeus, 1758)

MELONGENIDAE

- ☞ *Pugilina cochlidium* (Linnaeus, 1758)
- ☞ *Pugilina colosseus* (Lamarck, 1816)
- ☞ *Pugilina ternatana* (Gmelin, 1791)
- ☞ *Volema myristica* (Röding, 1798)

FASCIOLARIIDAE

- ☞ *Fusinus colus* (Linnaeus, 1758)
- ☞ *Fusinus nicobaricus* (Röding, 1798)
- ☞ *Latirolagena smaragdula* (Linnaeus, 1758)
- ☞ *Latirus polygonus* (Gmelin, 1791)
- ☞ *Pleuroploca filamentosa* (Röding, 1798)
- ☞ *Pleuroploca trapezium* (Linnaeus, 1758)

COLUBRARIIDAE

- ☞ *Colubraria muricata* (Lightfoot, 1786)

VOLUTIDAE

- ☞ *Cymbiola vesperilio* (Linnaeus, 1758)
- ☞ *Melo amphora* (Lightfoot, 1786)
- ☞ *Melo melo* (Lightfoot, 1786)

HARPIDAE

- ☞ *Harpa articularis* Lamarck, 1822
- ☞ *Harpa harpa* (Linnaeus, 1758)
- ☞ *Harpa major* Röding, 1798

TURBINELLIIDAE

- ☞ *Syrinx aruanus* (Linnaeus, 1758)
- ☞ *Vasum ceramicum* (Linnaeus, 1758)
- ☞ *Vasum turbinellus* (Linnaeus, 1758)

OLIVIDAE

- ☞ *Oliva annulata* (Gmelin, 1791)
- ☞ *Oliva caerulea* (Röding, 1798)
- ☞ *Oliva miniacea* (Röding, 1798)
- ☞ *Oliva oliva* (Linnaeus, 1758)
- ☞ *Oliva reticulata* (Röding, 1798)
- ☞ *Oliva tricolor* Lamarck, 1811
- ☞ *Oliva vidua* (Röding, 1798)

MITRIDAE

- ☞ *Mitra eremitarum* Röding, 1798
- ☞ *Mitra mitra* (Linnaeus, 1758)
- ☞ *Mitra stictica* (Link, 1807)

COSTELLARIIDAE

- ☞ *Vexillum rugosum* (Gmelin, 1791)
- ☞ *Vexillum vulpeculum* (Linnaeus, 1758)

CONIDAE

- ☞ *Conus betulinus* Linnaeus, 1758
- ☞ *Conus coronatus* Gmelin, 1791
- ☞ *Conus flavidus* Lamarck, 1810
- ☞ *Conus generalis* Linnaeus, 1767
- ☞ *Conus leopardus* (Röding, 1798)
- ☞ *Conus litteratus* Linnaeus, 1758
- ☞ *Conus lividus* Hwass, 1792
- ☞ *Conus marmoreus* Linnaeus, 1758
- ☞ *Conus quercinus* Lightfoot, 1786
- ☞ *Conus radiatus* Gmelin, 1791
- ☞ *Conus suratensis* Hwass, 1792
- ☞ *Conus tessulatus* Born, 1778
- ☞ *Conus textile* Linnaeus, 1758

TURRIDAE

- ☞ *Lophiotoma indica* (Röding, 1798)
- ☞ *Turricula javana* (Linnaeus, 1758)
- ☞ *Turris babylonia* (Linnaeus, 1758)

TEREBRIDAE

- ☞ *Hastula hectica* (Linnaeus, 1758)
- ☞ *Terebra areolata* (Link, 1807)
- ☞ *Terebra maculata* (Linnaeus, 1758)
- ☞ *Terebra subulata* (Linnaeus, 1767)

ARCHITECTONICIDAE

- ☞ *Architectonica maxima* (Philippi, 1849)
- ☞ *Architectonica perspectiva* (Linnaeus, 1758)

DOLABELLIDAE

- ☞ *Dolabella auricularia* (Lightfoot, 1786)

MELAMPIDAE

- ☞ *Ellobium aurisjudae* (Linnaeus, 1758)
- ☞ *Ellobium aurismidae* (Linnaeus, 1758)
- ☞ *Pythia scarabaeus* (Linnaeus, 1758)

SIPHONARIIDAE

- ☞ *Siphonaria javanica* (Lamarck, 1819)
- ☞ *Siphonaria laciniosa* (Linnaeus, 1758)
- ☞ *Siphonaria sirius* Pilsbry, 1894

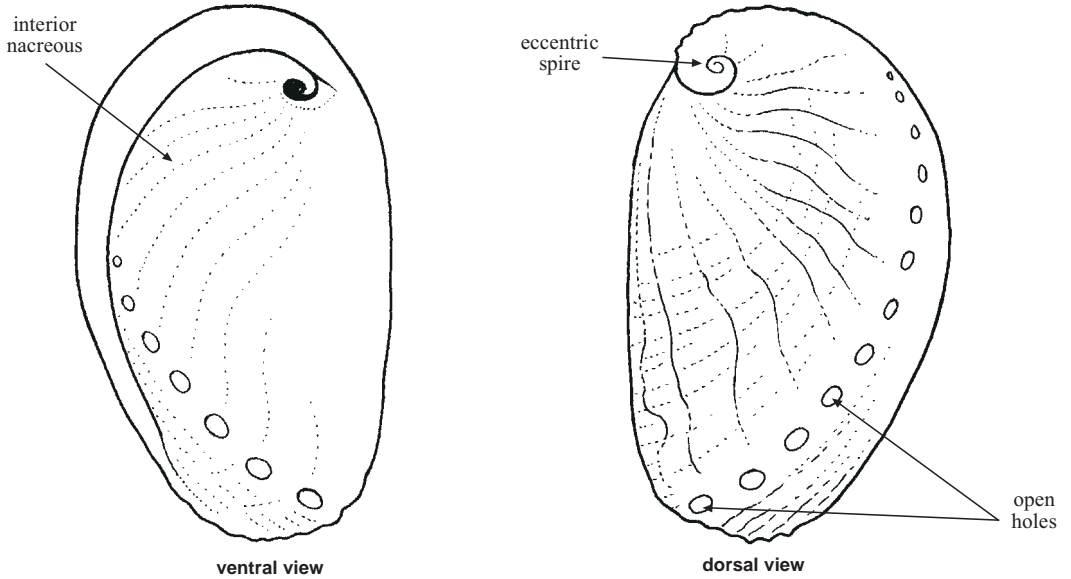
References

- Abbott, R.T. 1991. *Seashells of Southeast Asia*. Thornhill, Tynron, 145 p.
- Boss, K.J. 1982. Mollusca, p. 945-1166. In *Synopsis and classification of living organisms. Vol. I*, edited by S.P. Parker. New York, Mc Graw Hill.
- Cernohorsky, W.O. 1967. *Marine shells of the Pacific*. Sydney, Pacific Publications, 248 p.
- Cernohorsky, W.O. 1972. *Marine shells of the Pacific. Volume II*. Sydney, Pacific Publications, 411 p.
- Cernohorsky, W.O. 1978. *Tropical Pacific marine shells*. Sydney, Pacific Publications, 352 p.
- Dharma, B. 1988. *Siput dan Keran Indonesia I (Indonesian Shells)*. Jakarta, Pt, 111 p.
- Dharma, B. 1992. *Siput dan Keran Indonesia. Indonesian Shells II*. Wiesbaden, Hemmen, 135 p.
- Franc, A. 1968. Classe des Gastéropodes (Gastropoda Cuvier 1798). In *Traité de Zoologie. Anatomie, systématique, biologie. Tome V (Fascicule III)*, edited by P.P. Grassé. Paris, Masson, 893 p.
- Habe, T. 1964. *Shells of the Western Pacific in color. Vol. II*. Osaka, Hoikusha, 233 p.
- Habe, T. 1965. *New Illustrated Encyclopedia of the Fauna of Japan. [III]. Mollusca*. Tokyo, Hokuryukan, 332 p.
- Habe, T. and S. Kosuge. 1966. *Shells of the world in colour. Vol. II. The tropical Pacific*. Osaka, Hoikusha, 193 p.
- Hinton, A.G. 1972. *Shells of New Guinea and the Central Indo-Pacific*. Port Moresby, Brown and Jacaranda, Milton, 94 p.
- Hinton, A.G. 1978. *Guide to shells of Papua New Guinea*. Port Moresby, Brown, 74 p.
- Kay, E.A. 1979. Hawaiian marine shells. *Bernice P. Bishop Mus. Spec. Publ.*, 64(4):1-652.
- Kira, T. 1962. *Shells of the Western Pacific in color. Vol. I*. Osaka, Hoikusha, 224 p.
- Moore, R.C. (ed.). 1960. *Treatise on Invertebrate Paleontology. Part I. Mollusca I*. Boulder, Geological Society of America and Lawrence, University of Kansas, 351 p.
- Ponder, W.F. (ed.). 1988. Prosobranch Phylogeny. *Malac. Rev. Suppl.*, 4:1-346.
- Salvat, B. and C. Rives. 1975. *Coquillages de Polynésie*. Papeete, Editions du Pacifique, 392 p.
- Springsteen, F.J. and F.M. Leobrera. 1986. *Shells of the Philippines*. Manila, Carfel Seashell Museum, 377 p.
- Thiele, J. 1992. *Handbook of Systematic Malacology. Part 1 (Loricata; Gastropoda: Prosobranchia)*. [English translation of: *Handbuch der systematischen Weichtierkunde. Erster Teil (1929)*. Translated by J.S. Bhatti.] Washington, D.C., Smithsonian Institution and National Science Foundation, 625 p.
- Vaught, K.C. 1989. *A classification of the living Mollusca*. Melbourne, American Malacologists, 195 p.
- Wilson, B.R. 1993. *Australian marine shells. Prosobranch Gastropods. Part one*. Kallaroo, Odyssey, 407 p.
- Wilson, B.R. 1994. *Australian marine shells. Prosobranch Gastropods. Part two*. Kallaroo, Odyssey, 370 p.

HALIOTIDAE

Abalones

Diagnostic characters: Shell ear-shaped, depressed and loosely coiled. Spire eccentric and protruding only a little or not at all. A spiral row of holes on the left side of body whorl, sometimes on tubular projections, the last few remaining open. Aperture broad, occupying most of the underside, with a remarkably thickened inner lip. Interior nacreous, with a big subcentral muscle scar. No operculum. Head with a short snout and long, rounded tentacles bearing eyes on short lateral stalks of their outer bases. Foot broad and ovate, very strong. A sensory ridge around the edge of the foot, bearing a series of tentacles. Two gills, the right one slightly reduced in size.



Habitat, biology, and fisheries: Firmly attached to hard substrates by their powerful muscular foot, from intertidal to depths of about 50 m. Active during the night, crawling rapidly about and rasping algae. Sexes separate, fertilization external. Eggs released singly, each one enclosed in a gelatinous sheath and hatching as a planktonic larva. Abalones are commercially important species as food and for shell ornaments. Though tropical species are relatively small, compared to the temperate ones, they are actively collected in the area, due to the high demand of the Japanese market.

Similar families occurring in the area

None. Shell characters of the Haliotidae are very distinctive.

Key to species of interest to fisheries occurring in the area

- 1a. Outer surface of shell nearly smooth, except for low spiral cords on early whorls and on the left side of body whorl → 2
- 1b. Outer surface of shell conspicuously sculptured. → 3

- 2a. Shell elongate-ovate, with a somewhat protruding spire; outer lip slightly sinuous in the middle (Fig. 1) *Haliotis asinina*
- 2b. Shell ovate, with a low, non-protruding spire; outer lip regularly convex (Fig. 2) . . . *Haliotis glabra*

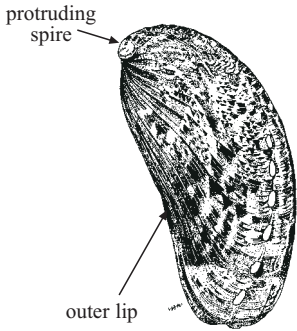


Fig. 1 *Haliotis glabra* (exterior)

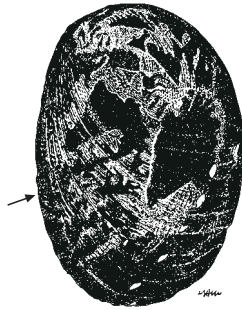


Fig. 2 *Haliotis glabra* (exterior)



Fig. 3 *Haliotis varia* (exterior)

- 3a. Shell ovate, rather flattened; periphery of left side keeled → 4
- 3b. Shell elongate-ovate, rather inflated; periphery of left side not keeled (Fig. 3) *Haliotis varia*

- 4a. Shell relatively large (up to 7 cm in length); upper part of left side depressed; holes on tubular projections, giving the spire a coronate appearance (Fig. 4) *Haliotis ovina*

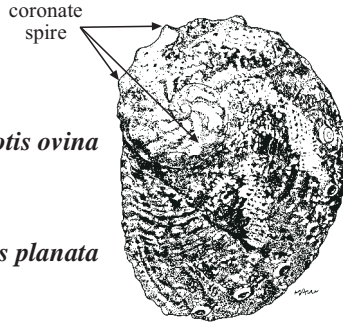


Fig. 4 *Haliotis ovina* (exterior)






- 4b. Shell relatively small (up to 4.5 cm in length); upper part of left side not depressed; holes not prominent (Fig. 5) *Haliotis planata*



Fig. 5 *Haliotis planata* (exterior)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Haliotis asinina* Linnaeus, 1758
-  *Haliotis glabra* Gmelin, 1791
-  *Haliotis ovina* Gmelin, 1791
-  *Haliotis planata* Sowerby, 1833
-  *Haliotis varia* Linnaeus, 1758

References

Habe, T. and S. Kosuge. 1964. *A list of the Indo-Pacific molluscs, concerning to the Japanese molluscan fauna. Superfamily Pleurotomarioidea.* Tokyo, National Science Museum, 8 p.

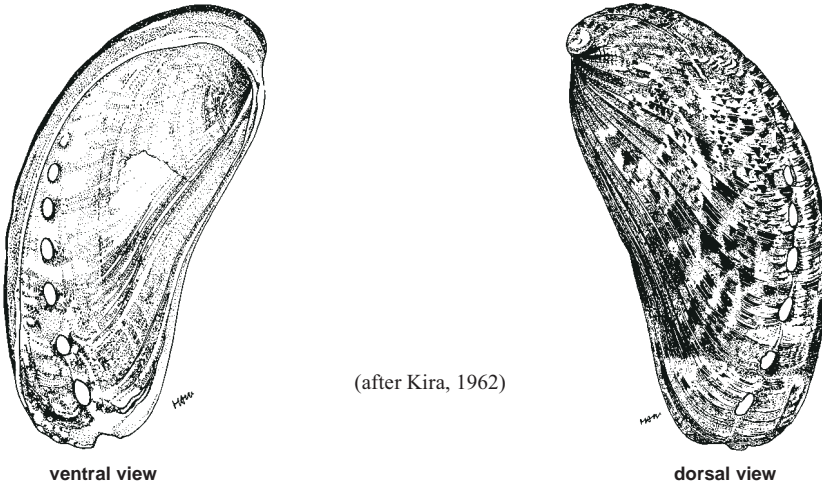
Pickery, R. 1980. Haliotidae. *Gloria Maris.*, 19(2):23-32.

Shepherd, S.A., M.J. Tegner, and S.A. Guzman Del Proo. (eds). 1992. *Abalone of the world. Biology, fisheries and culture. Proceedings of the 1st international symposium on abalone.* Oxford, Fishing New Books, 608 p.

Haliotis asinina Linnaeus, 1758

Frequent synonyms / misidentifications: None / None.

FAO names: En - Donkey's ear abalone; Fr - Ormeau oreille-d'âne.

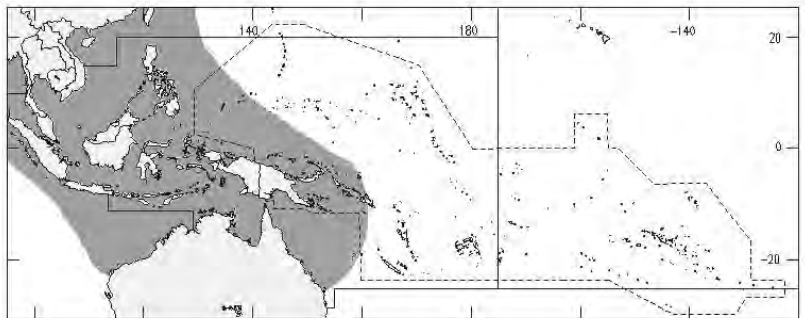


Diagnostic characters: Shell thin, **elongate, elliptical-ovate** in outline, rather inflated and arched dorsoventrally. **Spire somewhat protruding, apex close to posterior end** of shell. **Outer surface nearly smooth**, except for growth marks and low spiral cords on early whorls and on left side of body whorl. **Holes ovate, nearly flush with surface of shell**, the last 5 to 7 holes open. Ridge of inner lip not flattened, somewhat raised anteriorly and much thickened on posterior margin of the aperture. **Outer lip slightly sinuous in the middle**. Inner side of shell smoothish, muscle scar usually faint. **Colour: outside of shell lustrous**, olive green or brown, with various, often triangular patches of pale green or cream. **Interior highly iridescent**, with predominant pink and green shades.

Size: Maximum shell length 12 cm, commonly to 9 cm.

Habitat, biology, and fisheries: In coral reef areas. Intertidal and sublittoral to a depth of about 10 m. Common, but not aggregating in dense populations. In life, the exceptionally large green mantle almost covers the shell, which is then devoid of encrusting marine growths, unlike those of the other species. Actively collected in the Southeast Asian countries, for its shell and large fleshy animal. In the Philippines, the animal is commonly preserved and shipped abroad.

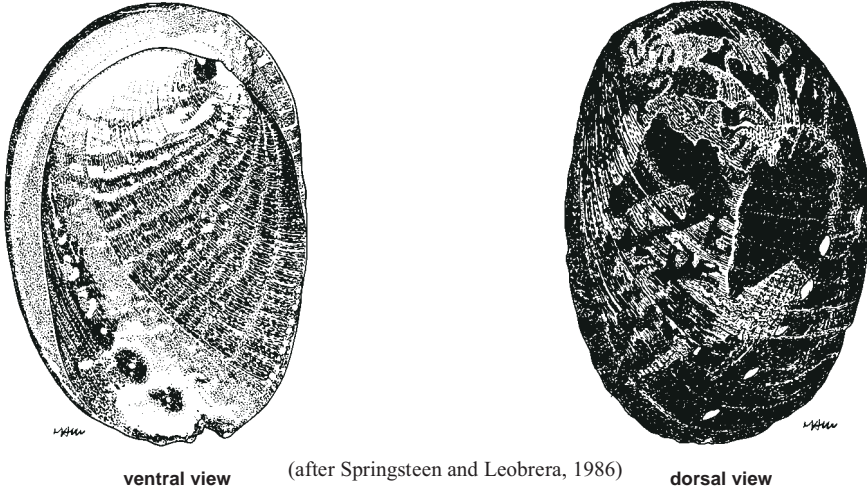
Distribution: Indo-West Pacific, from eastern part of Indian Ocean to Melanesia; north to southern Japan and south to southern Queensland.



Haliotis glabra Gmelin, 1791

Frequent synonyms / misidentifications: *Haliotis picta* Röding, 1798; *Schismotis glabra* (Gmelin, 1791) / None.

FAO names: En - Glistening abalone; Fr - Ormeau glabre.

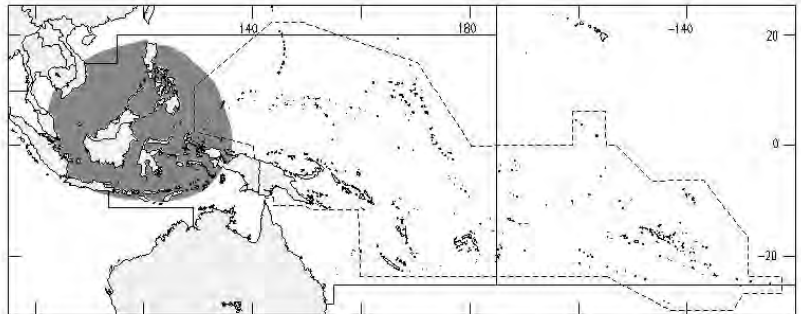


Diagnostic characters: Shell **ovate** in outline, with a low, **non-protruding spire**. **Outer surface smoothish**, only sculptured with low spiral grooves and overriding radial lines. **Holes slightly raised** above surface of shell, the last 5 or 6 holes open. Ridge of inner lip flattened, its posterior part somewhat hiding the internal coils of spire. **Outer lip regularly convex**. Inner side of shell smoothish, reflecting the outer sculpture, muscle scar faint. **Colour:** outside of shell **greenish brown, with cream or whitish streaks and blotches**. **Interior silvery**, iridescent.

Size: Maximum shell length 5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: On rocky bottoms, often in coral reef areas. Intertidal and shallow subtidal water. Collected for its nacreous shell and edible flesh. In the Philippines, the animal is frequently preserved and shipped abroad to Japan.

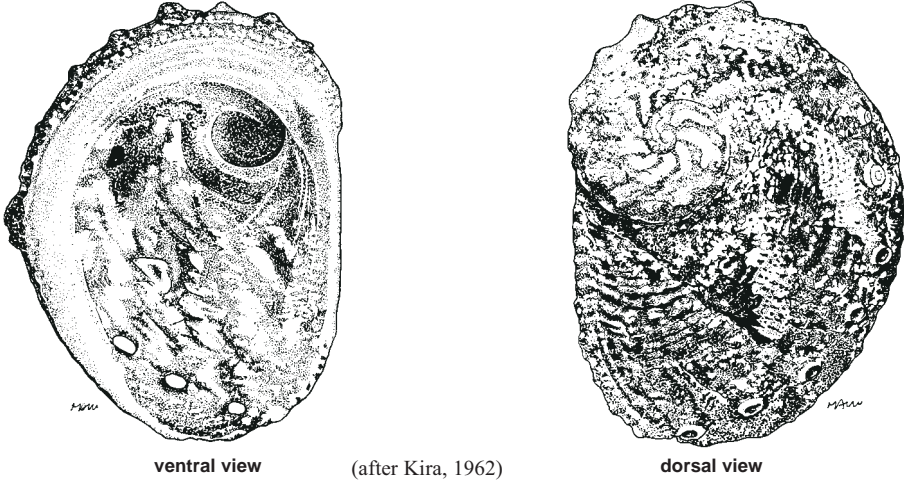
Distribution: Restricted to the tropical West Pacific, from the Philippine Archipelago to southern Indonesia.



Haliotis ovina Gmelin, 1791

Frequent synonyms / misidentifications: *Haliotis latilabris* Philippi, 1848; *H. ovina* Chemnitz, 1786 (Invalid name); *Ovinotis ovina* (Gmelin, 1791) / None.

FAO names: En - Oval abalone; Fr - Ormeau ovale.



ventral view

(after Kira, 1962)

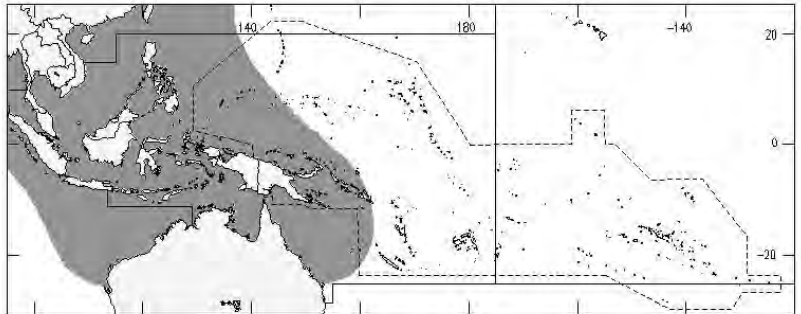
dorsal view

Diagnostic characters: Shell moderately thin, rounded-ovate in outline, keeled on periphery of left side. Holes on tubular projections, giving the low spire a coronate appearance; last 4 to 6 holes open. Outer sculpture of weak spiral grooves crossed by rather coarse, obliquely radiating undulations, sometimes forming spiral rows of nodules. Upper part of left side of body whorl depressed, lower part convex and weakly ribbed spirally. Ridge of inner lip wide and flat, its posterior part not hiding the well-marked internal coils of spire. Outer lip regularly convex, sometimes undulated on the margin by the outer sculpture. Inner side of shell irregularly undulated radially, muscle scar obscure. **Colour:** outside of shell greenish to reddish brown, generally with a few irregular radiating stripes of cream or yellow. Interior nacreous silver.

Size: Maximum shell length 7 cm, commonly to 6 cm.

Habitat, biology, and fisheries: Attached to corals or under rock ledges. Littoral and shallow subtidal zones. Actively collected for its edible flesh and nacreous shell. In the Philippines, its meat is preserved and shipped abroad or sold in local markets.

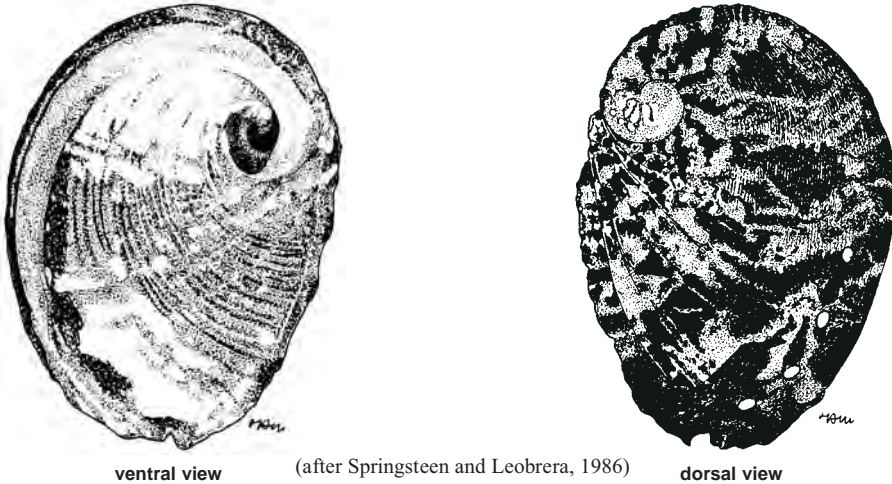
Distribution: Indo-West Pacific, from the eastern part of the Indian Ocean to Melanesia; north to southern Japan and south to southern Queensland.



Haliotis planata Sowerby, 1833

Frequent synonyms / misidentifications: *Sanhaliotis planata* (Sowerby, 1833) / None.

FAO names: En - Planate abalone; Fr - Ormeau aplati.

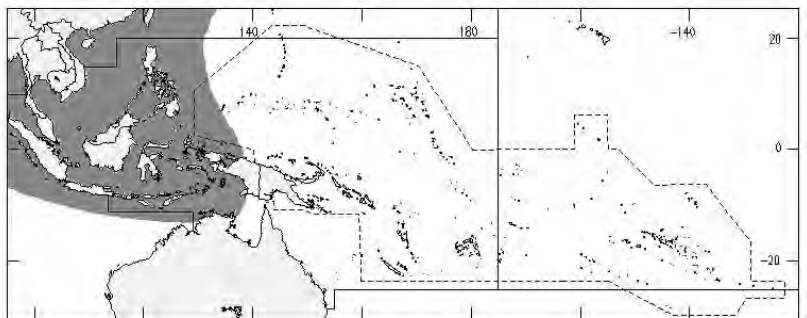


Diagnostic characters: Shell rather small, rounded-ovate in outline, keeled on periphery of left side, low spired. **Outer surface weakly tubercular**, with low radial folds near the spire and fine spiral cords. Left side of body whorl with a few spiral threads, not depressed along its upper part. **Holes not raised** above surface of shell, the last 4 or 5 holes open. Ridge of inner lip wide and flat, its posterior part not hiding the internal coils of spire. **Outer lip regularly convex**. Inner side of shell somewhat bumped and reflecting the outer spiral sculpture, muscle scar not prominent. **Colour: outside** of shell greenish or reddish brown, with irregular cream mottling, **often with alternating light and dark stripes at periphery** of inner lip. **Interior nacreous silver**.

Size: Maximum shell length 4.5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: Attached to rocks in coral reef areas. Intertidal and shallow subtidal waters. Collected for its nacreous shell and edible flesh. In the Philippines, the animal is preserved and shipped abroad or sold in local markets.

Distribution: Indo-West Pacific, from Sri Lanka to eastern Indonesia; north to southern Japan and south to Northern Territory (Australia).



Haliotis varia Linnaeus, 1758

Frequent synonyms / misidentifications: *Haliotis concinna* Reeve, 1846; *H. semistriata* Reeve, 1846; *H. viridis* Reeve, 1846; *Sanhaliotis varia* (Linnaeus, 1758) / None.

FAO names: En - Variable abalone; Fr - Ormeau bigarré.



ventral view

(after Kira, 1962)



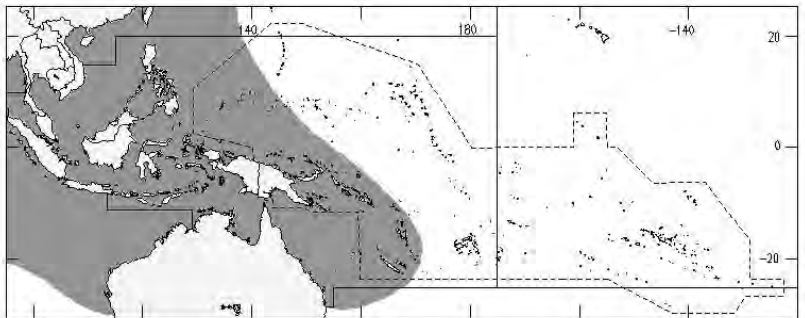
dorsal view

Diagnostic characters: Shell thick, elongate-ovate in outline, rather inflated, not keeled on periphery of left side. Outer sculpture extremely variable, comprising irregular radial folds crossed by low, rounded spiral ribs of different thickness, some of them warty to weakly knobbed. Periphery of left side with a few nodulose spiral cords. Holes rounded to oval, on slightly elevated tubercles, the last 4 or 5 holes open. Ridge of inner lip well developed, its posterior part hiding the internal coils of spire. Outer lip regularly convex. Inner side of shell somewhat reflecting the variable outer sculpture, muscle scar sometimes well marked. Colour: outside of shell with highly variable colour patterns of brown, reddish, greenish, or cream. Interior nacreous silver.

Size: Maximum shell length 8 cm, commonly to 6 cm.

Habitat, biology, and fisheries: Among rocks and under stones, in rocky shores and coral reef areas. Littoral to shallow subtidal depths. Sometimes very common. Regularly collected for food and shellcraft in many countries of the Indo-West Pacific area.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Melanesia; north to Japan and south to southern Queensland.

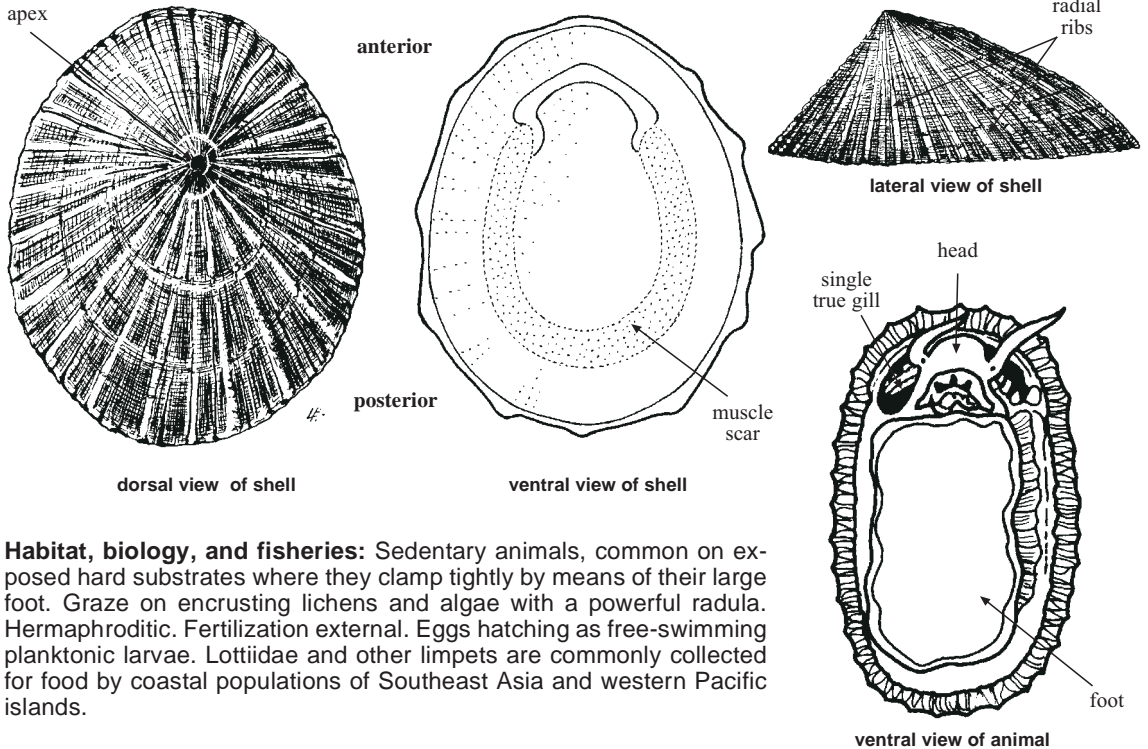


LOTTIIDAE

(= Acmaeidae)

Lottiid limpets

Diagnostic characters: Shell conical, not coiled, bilaterally symmetrical, without apical perforation or marginal slit. Apex central or somewhat anterior. **Sculpture** more or less developed, **essentially radial**. Internal border of aperture more or less distinctly defined. **Interior** of shell porcelaneous, never iridescent, without a calcareous septum, but **with** an anteriorly interrupted **horseshoe-shaped muscle scar**. **No operculum**. Head with a strong snout, and with or without eyes. Foot large, very strong. **A single true gill present in the mantle cavity**.



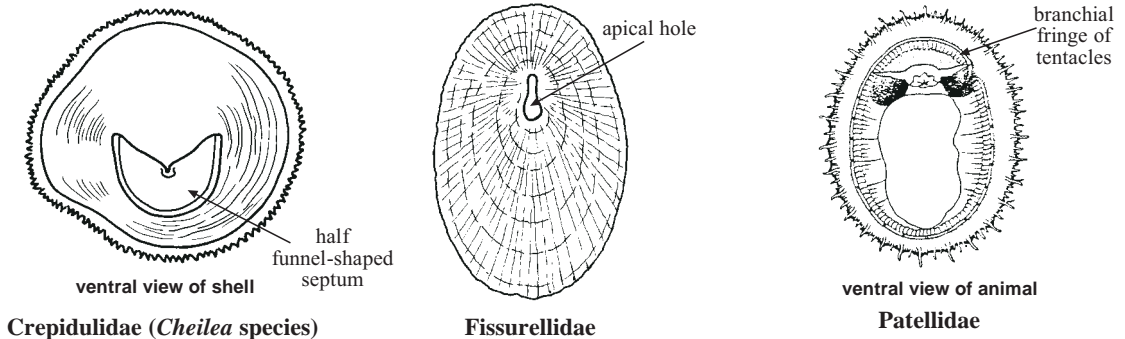
Habitat, biology, and fisheries: Sedentary animals, common on exposed hard substrates where they clamp tightly by means of their large foot. Graze on encrusting lichens and algae with a powerful radula. Hermaphroditic. Fertilization external. Eggs hatching as free-swimming planktonic larvae. Lottiidae and other limpets are commonly collected for food by coastal populations of Southeast Asia and western Pacific islands.

Similar families occurring in the area

Crepidulidae (*Cheilea* species): inner side of shell with a calcareous septum shaped like a half funnel projecting vertically from the apex.

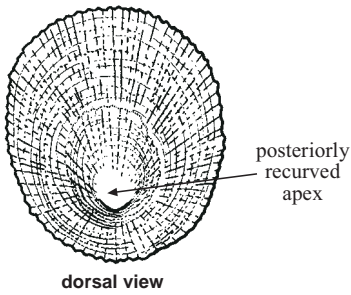
Fissurellidae: shell conical, with a hole at the apex or a notch on the anterior margin.

Patellidae: not distinguishable from Lottiidae by shell features; differ anatomically by the absence of true gills, which are replaced by fringes of tentacles on the mantle edge.



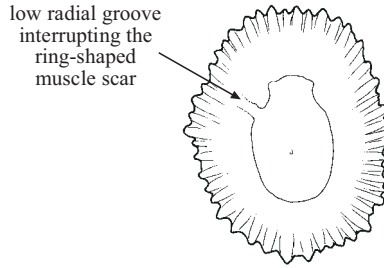
Phenacolepadidae: shell conical, thin and whitish, with a posteriorly recurved apex.

Siphonariidae: pulmonate snails with limpet-shaped shell, living on supratidal and intertidal rocks; interior of shell with a muscle scar forming an incomplete ring, opening on the right side where there is a shallow radial groove and often a weak lobe on the shell margin.



dorsal view

Phenacolepadidae



ventral view

Siphonariidae

Key to species of interest to fisheries occurring in the area

- 1a. Outside of shell with a few strong radial ribs, strongly produced at the margin (Fig. 1)
 *Patelloida saccharina*
- 1a. Outside of shell with numerous fine radial ribs, not produced at the margin (Fig. 2) . . . *Patelloida striata*

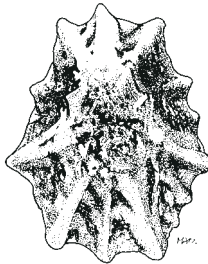


Fig. 1 *Patelloida saccharina* (exterior)

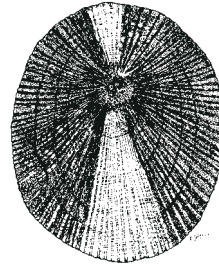





Fig. 2 *Patelloida striata* (exterior)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Patelloida saccharina* (Linnaeus, 1758)
-  *Patelloida striata* (Quoy and Gaimard, 1834)

References

Christiaens, J. 1980. The limpets of Hong Kong with descriptions of seven new species and subspecies. In *Proceedings of the first international workshop on the malacofauna of Hong Kong and southern China, 23 March-8 April 1977, Hong Kong*, edited by B.S. Morton. Hong Kong, Hong Kong University, pp. 61-83.

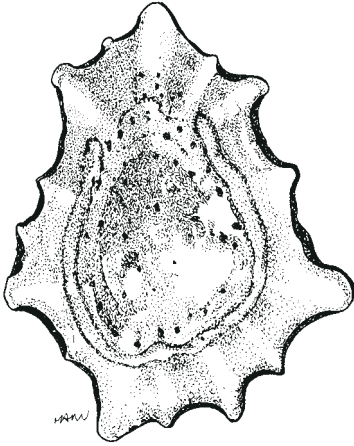
Lindberg, D.R. 1986. Names changes in the "Acmaeidae". *Veliger*, 29(2):142-148.

Ponder, W.F. and R.G. Creese. 1980. A revision of the Australian species of *Notoacmea*, *Collisella* and *Patelloida* (Mollusca: Gastropoda: Acmaeidae). *J. Malac. Soc. Aust.*, 4(4):167-208.

Patelloida saccharina (Linnaeus, 1758)

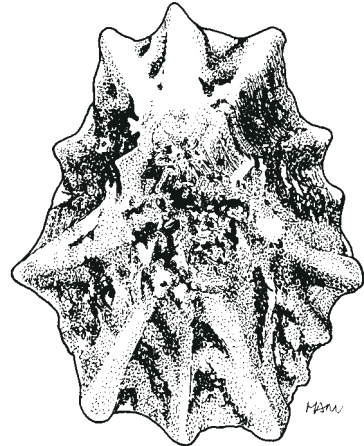
Frequent synonyms / misidentifications: *Collisellina saccharina* (Linnaeus, 1758); *Patelloida belatula* Iredale, 1929; *P. lanx* (Reeve, 1855); *P. paropsis* Iredale, 1929; *P. pentagona* (Blainville, 1825); *P. saccharinoides* Habe and Kosuge, 1966; *P. stella* (Lesson, 1830); *P. stellaris* Quoy and Gaimard, 1834 / None.

FAO names: En - Pacific sugar limpet; Fr - Patelle sucrée.



ventral view

(after Short and Potter, 1987)



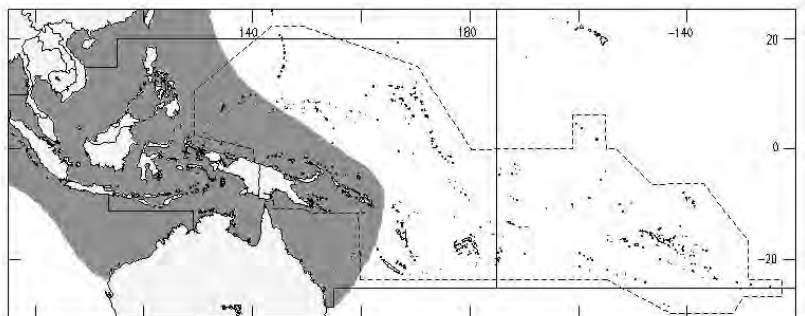
dorsal view

Diagnostic characters: Shell solid, opaque, with a variable and rather elevated shape. Outline roughly elongate-ovate, strongly scalloped, somewhat narrowing anteriorly. Apex subcentral, frequently eroded. External sculpture of 7 to 9 large, raised radial ribs that strongly project at the margin giving the shell the appearance of a web-foot, and weaker riblets in the interstices. Main radial ribs sometimes more numerous (up to 12 ribs in the form *saccharinoides*, and to 20 in the Australian subspecies *stella*). Interior smoothish, with low radial undulations corresponding to the main outer sculpture. **Colour:** outside of shell greyish white, with dark grey or brown banding in the interstices of ribs, sometimes forming V-shaped marks towards the margin. Interior porcelainous white, rimmed or spotted with black on the margin; apical region olive green, yellow or whitish and profusely speckled with brown spots or blotches.

Size: Maximum shell length 5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: Common on coastal rocks and other hard substrates in exposed areas. Also in rock pools. Intertidal. Collected for subsistence by coastal populations. In the Philippines, the shell is commonly used to make decorative items.

Distribution: Indian Ocean and the tropical West Pacific, from India and Sri Lanka to Melanesia; north to Japan and south to southern Queensland.



Patelloida striata (Quoy and Gaimard, 1834)

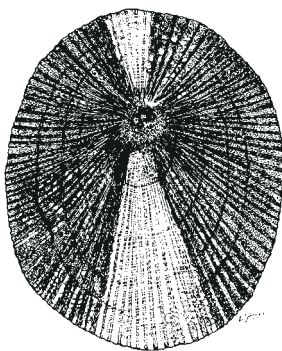
Frequent synonyms / misidentifications: *Chiazacmea striata* (Quoy and Gaimard, 1834); *Patelloida borneensis* (Reeve, 1854) / None.

En - Striate limpet; **Fr** - Patelle striée.

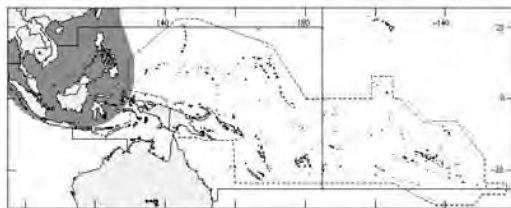
Maximum shell length 5 cm, commonly to 4 cm. Common on coastal rocks. Intertidal and sublittoral fringe. Collected for subsistence by coastal populations. Indian Ocean and tropical West Pacific, from India to the Philippines; north to Japan and south to Indonesia.



ventral view



dorsal view

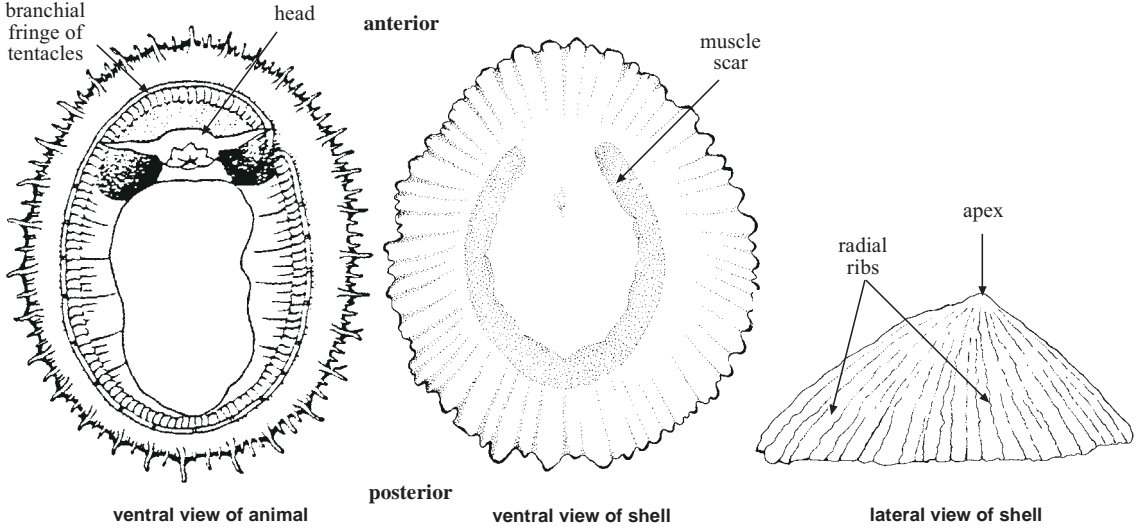


(after Springsteen and Leobrera, 1986)

PATELLIDAE

Patellid limpets

Diagnostic characters: Shell conical, not coiled, bilaterally symmetrical, without apical perforation or marginal slit or groove. Apex central to somewhat anterior. **Sculpture** more or less developed, **essentially radial**. Aperture ovate or irregularly polygonal, without a defined internal border. **Interior** of shell porcelaneous or iridescent, without a calcareous septum but **with a horseshoe-shaped muscle scar**, interrupted anteriorly. **No operculum**. Head with a strong snout and a pair of tentacles, generally provided with eyes. Foot large, very strong. True **gills** absent, **replaced by a fringe of respiratory tentacles** between the internal edge of mantle and the foot.



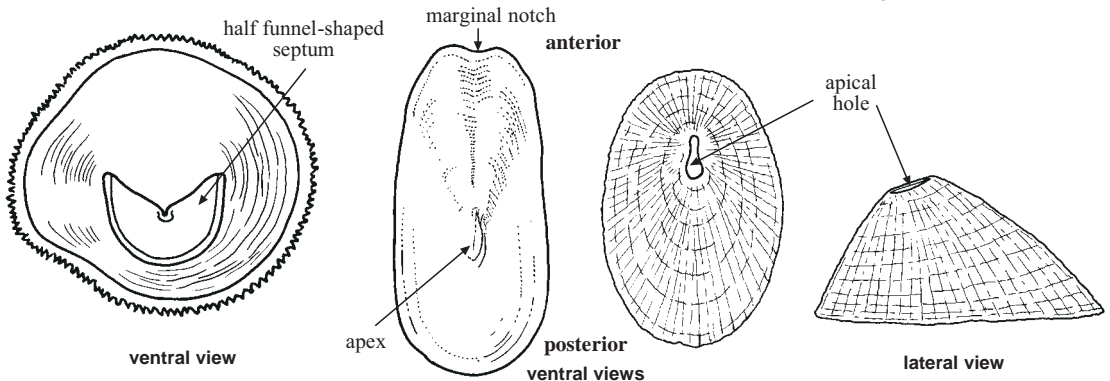
Habitat, biology, and fisheries: Sedentary animals, common on exposed hard substrates where they clamp tightly by means of their large foot. Mainly intertidal, often occurring in dense populations. Many species exhibit homing behaviour, excavating a shallow scar to which the shell margin conforms exactly, and returning to stick fast to the same spot after foraging for food. Graze on encrusting lichens and algae, or scrape tissue from kelp, with their powerful radula. Sexes separate or hermaphroditic, depending on the species. Fertilization external. Eggs hatching as free-swimming planktonic larvae.

Patellidae and other limpets are commonly collected for their edible foot by coastal populations in Southeast Asia and tropical West Pacific islands.

Similar families occurring in the area

Crepidulidae (*Cheilea* species): inner side of shell with a calcareous septum shaped like a half funnel projecting vertically from the apex.

Fissurellidae: shell conical, with a hole at the apex or a notch on the anterior margin.



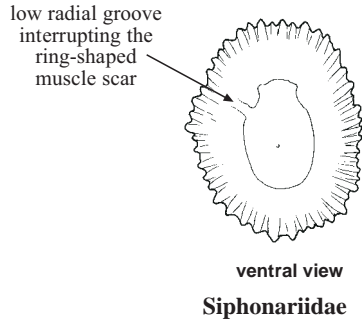
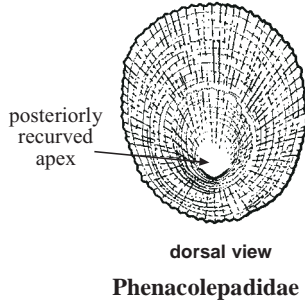
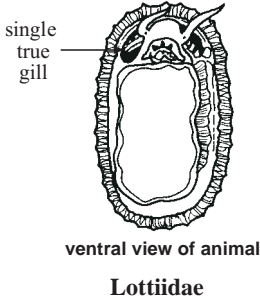
Crepidulidae (*Cheilea* species)

Fissurellidae

Lottiidae: not easily distinguishable from Patellidae by shell features; differ anatomically by the presence of a single true gill in the mantle cavity.

Phenacolepadidae: shell conical, thin and whitish, with a posteriorly recurved apex.

Siphonariidae: pulmonate snails with limpet-shaped shell, living on supratidal and intertidal rocks; interior of shell with a muscle scar forming an incomplete ring, opening on the right side which shows a shallow radial groove and often a weak lobe on the shell margin.



Key to species of interest to fisheries occurring in the area

Remarks on key characters: the taxonomy of Indo-Pacific Patellidae remains rather poorly understood, partly because some species are highly variable in shell characters and only few features are known to distinguish one from another. To secure identification of the selected species, the following key includes a number of shell characters as well as a few, simple, anatomical features.

- 1a. Shell semi-translucent, interior with metallic glaze; fringe of respiratory tentacles of the animal interrupted by the head → 2
- 1b. Shell opaque, interior porcelaneous; fringe of respiratory tentacles of the animal continuous in the head region (Fig. 1) *Patella flexuosa*
- 2a. Shell relatively large (up to 9 cm in length); sculpture of subequal, low radial riblets; outer colour greenish brown, with dark brown radial rays more or less joined concentrically by zigzag pattern or bold V-shaped marks; aperture with a continuous brown margin (Fig. 2) *Cellana testudinaria*
- 2b. Shell relatively small (up to 5 cm in length); sculpture of generally unequal radial riblets, often underlain by distinct radial folds; outer colour varying from cream with radial rays of brown spots to dark brown with whitish rays; aperture whitish with alternating white and brown blotches at the margin (Fig. 3) *Cellana rota*

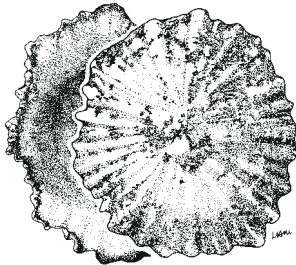


Fig. 1 *Patella flexuosa*

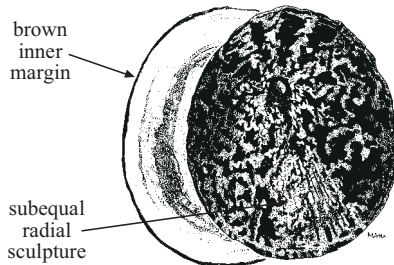


Fig. 2 *Cellana testudinaria*

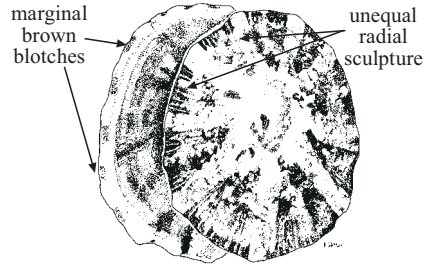


Fig. 3 *Cellana rota*

List of species of interest to fisheries occurring in the area

The symbol is given when species accounts are included.

- Cellana rota* (Gmelin, 1791)
- Cellana testudinaria* (Linnaeus, 1758)
- Patella flexuosa* Quoy and Gaimard, 1834

References

Christiaens, J. 1980. The limpets of Hong Kong with descriptions of seven new species and subspecies. In *Proceedings of the first international workshop on the malacofauna of Hong Kong and southern China, 23 March-8 April 1977, Hong Kong*, edited by B.S. Morton. Hong Kong, Hong Kong University, pp. 61-83.

Powell, A.W.B. 1973. The Patellid limpets of the world (Patellidae). *Indo-Pac. Moll.*, 3(15):75-206.

Cellana rota (Gmelin, 1791)

Frequent synonyms / misidentifications: *Acmaea bombayana* Smith, 1911; *A. travancorica* Preston, 1911; *Cellana enneagona* (Reeve, 1854); *C. eudora* Iredale, 1940; *Helcioniscus articulatus* (Reeve, 1855); *H. rota* (Gmelin, 1791); *Patella aster* Reeve, 1855; *P. luzonica* Reeve, 1855 / *Cellana radiata* (Born, 1778).

FAO names: En - Rayed limpet; Fr - Patelle à rayons.



ventral view

(after Powell, 1973)



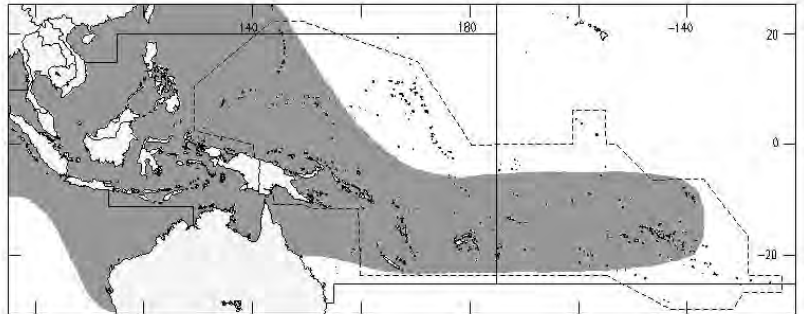
dorsal view

Diagnostic characters: Shell semi-translucent, rather thin, moderately elevated, with a variable shape. Outline rounded to elongate-ovate, sometimes broadly undulated. Apex subcentral or slightly anterior. External sculpture of numerous and generally unequal radial ribs, often underlain by distinct, broad radial folds. Interior smooth. **Colour:** shell coloration highly variable. Exterior basically cream or yellowish, with radial patterns of brown. Margin of the aperture often with alternating white and brown blotches. Interior with a silvery glaze, mainly whitish with a brown to orange apical region, sometimes centrally suffused with white.

Size: Maximum shell length 5 cm, commonly to 3.5 cm.

Habitat, biology, and fisheries: Common on rocky shores exposed to wave action, from mid-intertidal zone to shallow subtidal levels. Collected for food by villagers from the Southeast Asian area to eastern Polynesia.

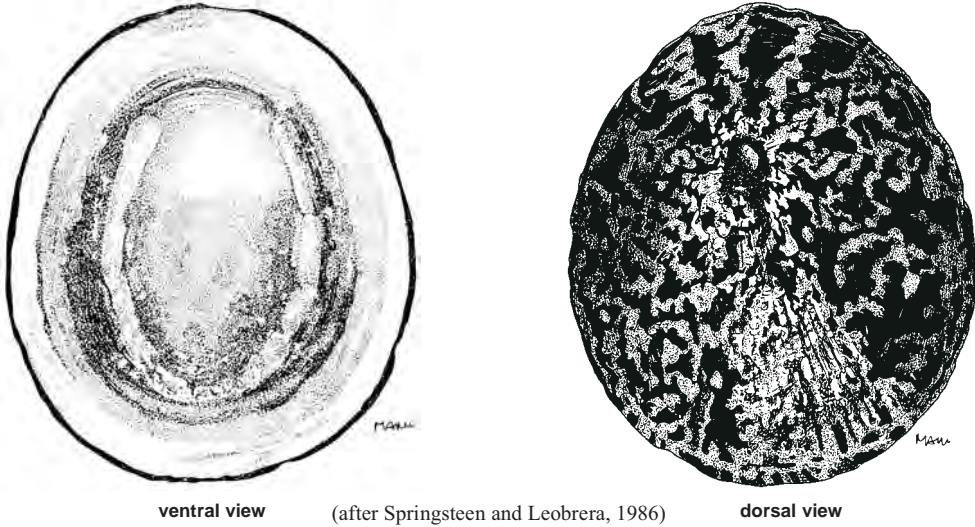
Distribution: Widespread in the Indo-West Pacific, from Madagascar to eastern Polynesia; north to southern Japan and south to Queensland and New Caledonia.



Cellana testudinaria (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Helcioniscus testudinaria* (Linnaeus, 1758); *H. rota* var. *discrepans* Pilsbry, 1891; *Patella insignis* Dunker, 1868 / *Cellana rota* (Gmelin, 1791).

FAO names: En - Turtle limpet; Fr - Patelle tortue.



ventral view

(after Springsteen and Leobrera, 1986)

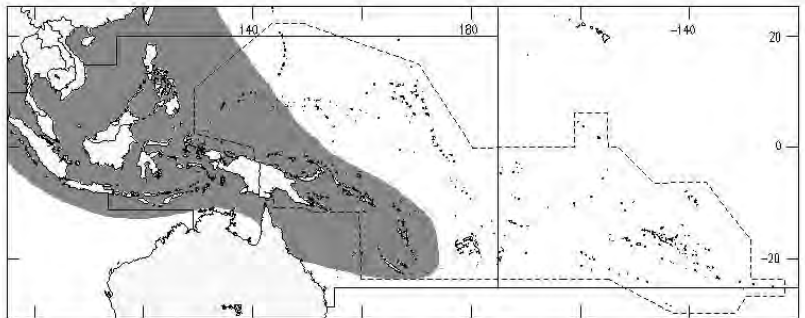
dorsal view

Diagnostic characters: Shell semi-translucent, solid, reaching a large size, moderately elevated, with a regular shape. Outline rounded-ovate. Apex somewhat anterior, at about the anterior 1/3 of shell length. External sculpture rather weak, of numerous and subequal low radial riblets. Interior smooth. **Colour:** exterior of shell greenish to yellowish brown, with dark brown radial rays more or less joined concentrically by zigzag patterns or bold V-shaped marks, within the shell substance. Aperture with a continuous brown margin. Interior bluish silver, apical region off-white to yellowish brown.

Size: Maximum shell length 9 cm, commonly to 7.5 cm.

Habitat, biology, and fisheries: On volcanic rocks in exposed situations, mainly near and below low tide marks. Used as food by coastal populations throughout its range.

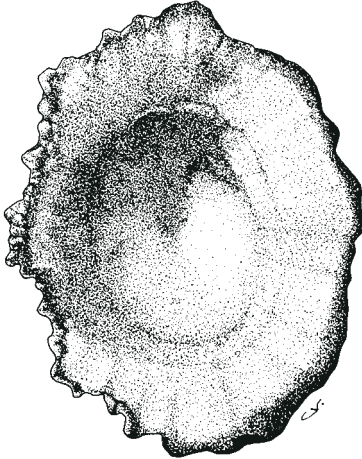
Distribution: Eastern part of the Indian Ocean and the tropical West Pacific, from the Andaman Islands to Melanesia; north to southern Japan and south to Queensland and New Caledonia.



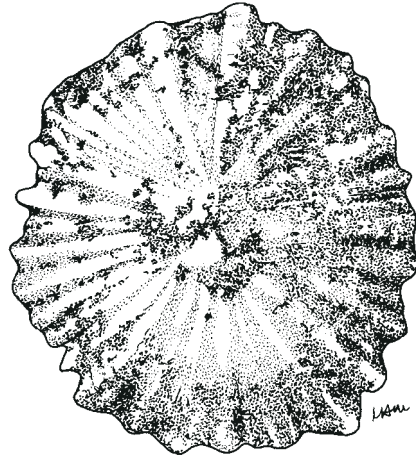
Patella flexuosa Quoy and Gaimard, 1834

Frequent synonyms / misidentifications: *Helcioniscus flexuosus* (Quoy and Gaimard, 1834); *Patella stellaeformis* Reeve, 1842; *Penepatella arrecta* Iredale, 1929; *P. inquisitor* Iredale, 1929; *P. intraurea* Iredale, 1929; *P. optima* (Pilsbry, 1927) / None.

FAO names: En - Star-shaped limpet; Fr - Patella flexueuse.



ventral view



dorsal view

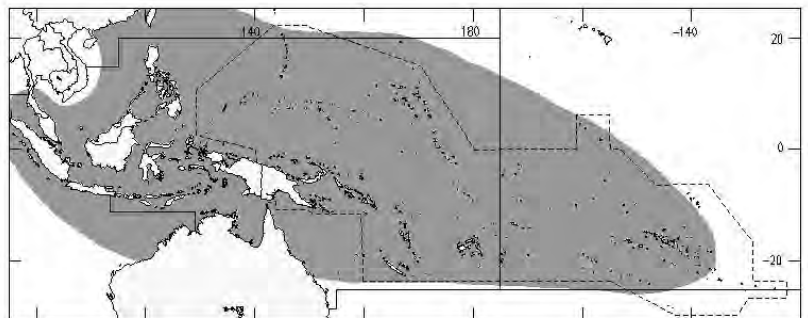
(after Powell, 1973)

Diagnostic characters: Shell opaque, highly variable in thickness and shape, moderately elevated to almost flat. Outline irregularly rounded to elongate ovate, and roughly crenulated to polygonal. Apex nearly central. External sculpture of 7 to 9 large radial ribs that strongly project at the margin and numerous, scaly to spinose radial cords throughout the surface. Interior smoothish. **Colour:** exterior of shell dull white, sometimes speckled with brown in the interstices of ribs. Interior porcelaneous white, apical region white, grey, yellow or orange-brown.

Size: Maximum shell length 9.5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: On rocky and coral-rock bottoms, or on stones and larger shells. Intertidal and shallow subtidal zones. This common species is collected for food by coastal people in many parts of the area.

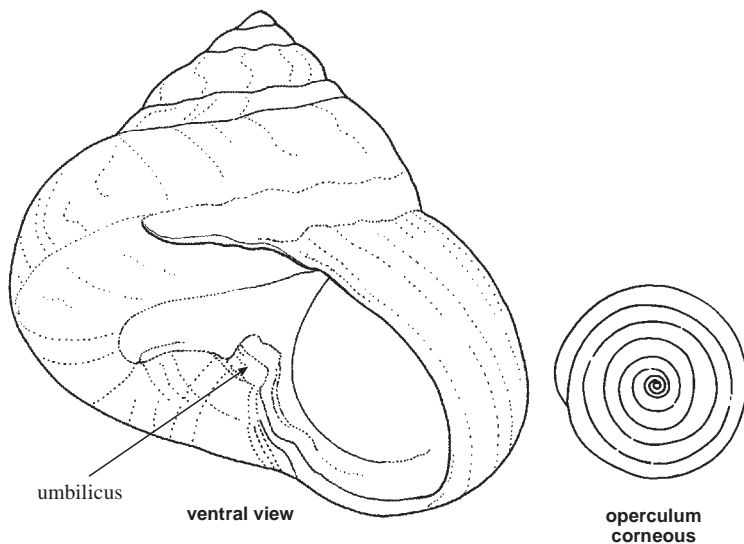
Distribution: Eastern part of the Indian Ocean and the tropical West Pacific, from the Andaman Islands to Micronesia and eastern Polynesia; north to southern Japan and south to southern Queensland and New Caledonia.



TROCHIDAE

Top shells

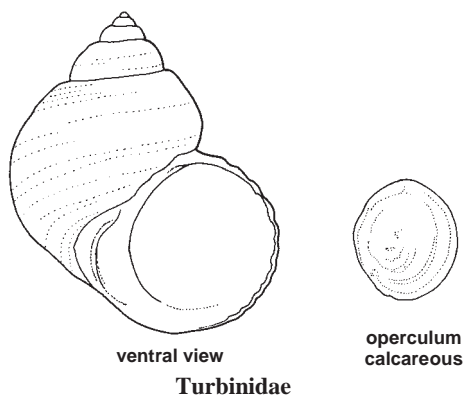
Dagnostic characters: Shell pyramidal, conical to globose in shape, with a moderately large, rounded to angular body whorl and often with a flattened base. Umbilicus more or less narrow to closed, sometimes with a calloused plug. Outer surface smooth or sculptured axially and spirally, with beads, nodules, or tubercles. Periostracum sometimes conspicuous. **Aperture** rounded to squarish, without a siphonal canal, nacreous inside. Columella and margin of the outer lip generally not in the same plane. **Operculum corneous, nearly circular**, with many coils and a central nucleus. Head with a short snout, a pair of conical, often papillate tentacles and cup-shaped, open eyes on distinct stalks. Foot moderately small, often medially grooved, with a large fleshy ridge on either side bearing sensitive tentaculate processes.



Habitat, biology, and fisheries: Mostly littoral and shallow sublittoral, occurring in large numbers on hard substrates like rocky shores or coral reefs. However, there are also species living among eelgrass or on deep-water bottoms of sand or mud. Slow moving animals, browsing on detritus and algae, sometimes filter-feeding (genus *Umbonium*). Sexes separate, fertilization external. Eggs laid singly in sea water and hatching as free-swimming planktonic larvae, or bound in gelatinous masses and then frequently hatching as crawling juveniles. Larger or most common species of Trochidae are traditionally used as food by coastal populations in Southeast Asia and oceanic islands of the Southwest Pacific. Shells are utilized by the shellcraft industries, sometimes serving as mother-of-pearl or as lime material.

Similar families occurring in the area

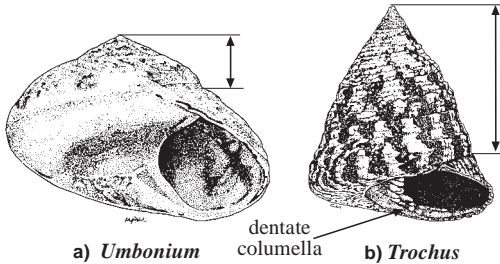
Turbinidae: appearance of shell sometimes strongly convergent with Trochidae; easily distinguished from the latter by their operculum strongly calcareous externally.



Turbinidae

Key to species of interest to fisheries occurring in the area

- 1a. Shell lenticular, much wider than long; spire low; outer surface polished (Fig. 1a) → 2
- 1b. Shell turbinate or conical, at least as long as wide; spire high; outer surface not polished (Fig. 1b) → 3
- 2a. Spire whorls with spiral grooves; umbilical callus moderately large (Fig. 2) . . . *Umbonium costatum*
- 2b. Spire whorls without concentric grooves; umbilical callus very large (Fig. 3) . *Umbonium vestiarium*



a) *Umbonium* dentate columella b) *Trochus*
Fig. 1 ventral view of shell

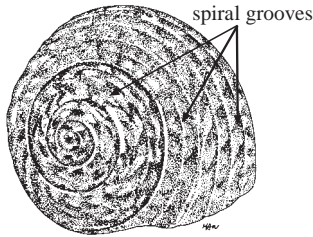


Fig. 2 *Umbonium costatum* (apical view)

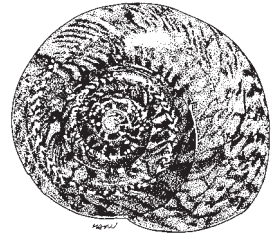
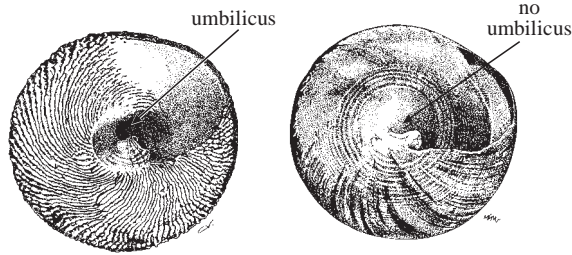


Fig. 3 *Umbonium vestiarium* (apical view)

- 3a. Umbilicus present (Fig. 4a) → 6
- 3b. Umbilicus absent (Fig. 4b) → 4
- 4a. Shell turbinate, with a convex base and rounded aperture; columella with a strong tooth (Fig. 5) *Monodonta labio*
- 4b. Shell conical, with a flat base and squarish aperture; columella with a concave spiral fold → 5



a) *Trochus* umbilicus b) *Tectus* no umbilicus
Fig. 4 basal view of shell

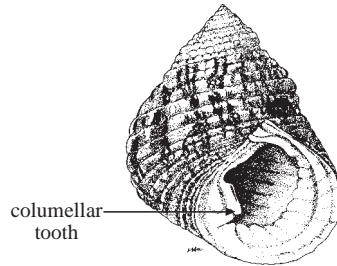


Fig. 5 *Monodonta labio* (ventral view)

- 5a. Outer surface strongly sculptured with thick, rounded oblique ribs, at least on the lower half of each whorl (Fig. 6) *Tectus fenestratus*
- 5b. Outer surface weakly sculptured, with only low tubercles at the suture and sometimes weak spiral threads (Fig. 7) *Tectus pyramis*
- 6a. Columella smoothish (Fig. 8) → 7
- 6b. Columella multidentate (Fig. 1b) → 8

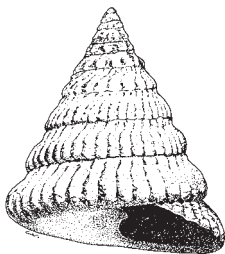


Fig. 6 *Tectus fenestratus* (ventral view)

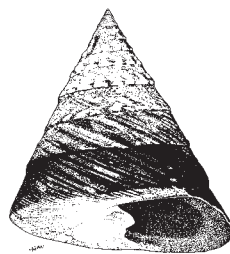


Fig. 7 *Tectus pyramis* (ventral view)

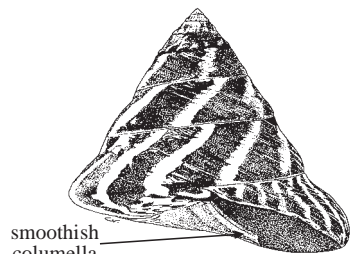


Fig. 8 *Trochus niloticus* (ventral view)

- 7a. Shell large sized (up to 15 cm in length); surface of body whorl smoothish (Fig. 8) *Trochus niloticus*
- 7b. Shell medium sized (up to 8 cm in length); surface of body whorl with beaded spiral threads (Fig. 9) *Trochus conus*
- 8a. Shell colour generally with fine axial lines; base with numerous, crowded and wavy radiating lines (Fig. 10) *Trochus hanleyanus*
- 8b. Shell colour generally with axial streaks; base with radiating streaks or spots (Fig. 11) *Trochus maculatus*

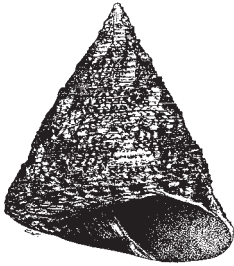


Fig. 9 *Trochus conus*
(ventral view)



Fig. 10 *Trochus hanleyanus*
(basal view)

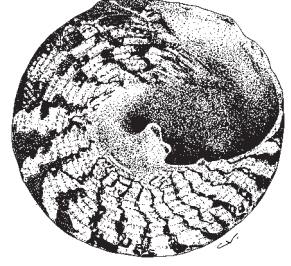











Fig. 11 *Trochus maculatus*
(basal view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Monodonta labio* (Linnaeus, 1758)
-  *Tectus fenestratus* (Gmelin, 1791)
-  *Tectus pyramis* (Born, 1778)
-  *Trochus conus* Gmelin, 1791
-  *Trochus hanleyanus* Reeve, 1842
-  *Trochus maculatus* Linnaeus, 1758
-  *Trochus niloticus* Linnaeus, 1758
-  *Umbonium costatum* (Kiener, 1838)
-  *Umbonium vestiarium* (Linnaeus, 1758)

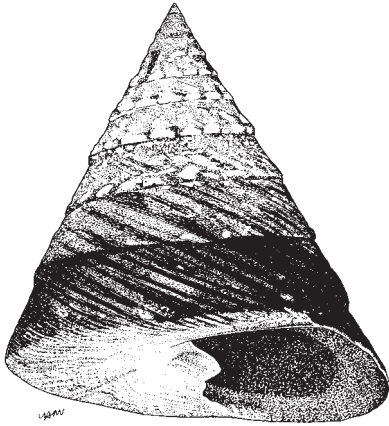
References

- Hickman, C.S. and Mclean, J.H. 1990. Systematic revision and suprageneric classification of trochacean gastropods. *Sci. Ser. nat. Hist. Mus. Los Angeles Cty*, 35:1-169.
- Pilsbry, H.A. 1889. Family Trochidae. In *Manual of conchology; structural and systematic. With illustrations of the species. Vol. XI*, edited by G.W. Tryon Jr. Philadelphia, Conchological Section Academy of Natural Sciences, pp. 5-519.

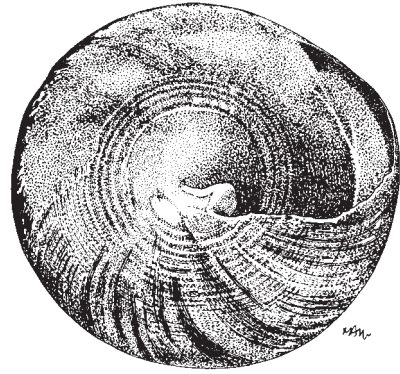
Tectus pyramis (Born, 1778)

Frequent synonyms / misidentifications: *Tectus noduliferus* (Lamarck, 1822); *T. obeliscus* (Gmelin, 1791); *Trochus obeliscus* Gmelin, 1791; *T. pyramis* Born, 1778 / None.

FAO names: En - Pyramid top; Fr - Troque obélisque.



ventral view



basal view

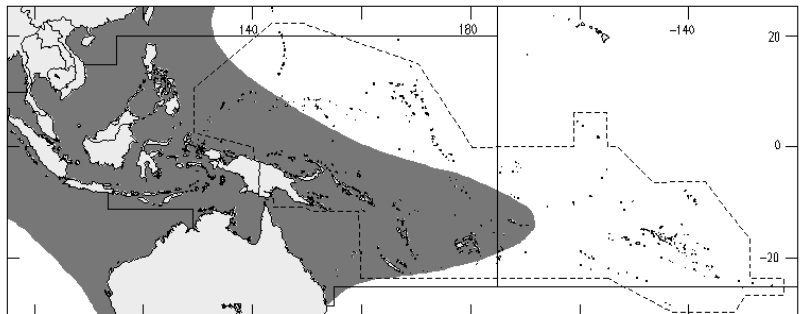
(after Wilson, 1993)

Diagnostic characters: **Shell large** (up to 15 cm long), **conical in shape**, about as wide as long or slightly longer. Spire tall, with pointed apex, **flat-sided whorls** and **reduced sculpture** usually weakening with growth and becoming obsolete on body whorl of large specimens. Sculpture of whorls **comprising** a row of **low tubercles just above the** deeply impressed **suture**, strongly oblique lines of growth and **sometimes** a few **finely beaded spiral threads**. Periphery of last whorl markedly angulate. **Base of shell flat**, with many fine, shallow spiral grooves becoming indistinct towards periphery and with a glazed central area coming from the aperture. **Umbilicus absent**. **Aperture squarish in outline**. Outer lip markedly angulated at periphery and strongly oblique above, nearly smooth inside apart from a few short spiral grooves near columella, corresponding with the outer sculpture of base. **Columella with a strong, concave spiral fold**. **Colour:** **outside** of shell **lightly mottled in shades of drab grey to brown or green**. **Base** creamy brown, green or blue-green towards periphery, **becoming white and glossy towards columella and aperture** which is nacreous inside.

Size: Maximum shell length 15 cm, commonly to 8 cm.

Habitat, biology, and fisheries: Abundant in coral reef and rocky shore habitats. Littoral and shallow subtidal zones to a depth of about 10 m. Collected for food in the Philippines, Fiji Islands, and southern Japan. Shell used to make decorative items.

Distribution: Indo-West Pacific, from Sri Lanka to western Polynesia; north to Japan and south to southern Queensland and New Caledonia.



Trochus conus Gmelin, 1791

Frequent synonyms / misidentifications: *Tectus conus* (Gmelin, 1791); *Trochus acutangulus* Chemnitz, 1781 (Invalid name) / None.

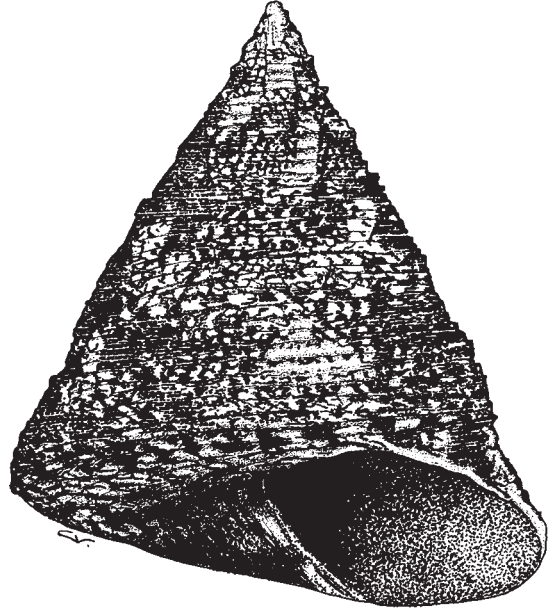
FAO names: En - Cone-shaped top; Fr - Troque conique.

Diagnostic characters: Shell medium sized (up to 8 cm long), heavy, **conical in shape** and longer than wide. Spire tall, with pointed apex, straight-sided whorls and weakly impressed sutures. Sculpture of **whorls with numerous beaded spiral threads** (about 10 per whorl) separated by superficial interstices **and, just above the sutures, a stronger row of tubercles** which usually become obsolete on later stages of growth. **Periphery of last whorl acutely rounded. Base of shell flat, with many low spiral grooves. Umbilicus present, with a deeply entering spiral fold. Aperture roughly quadrate.** Outer lip markedly rounded at periphery, strongly oblique above, nearly smooth inside. **Columella curved and smooth, with a slightly thickened margin ending abruptly in an obscure knob. Colour: outside of shell pinkish white with deep red axial flammules. Spiral cords of base red and white articulated, interstices white. Aperture and columellar ridge nacreous, with a glossy white spiral margin encircling the umbilicus.**

Size: Maximum shell length 8 cm, commonly to 6 cm.

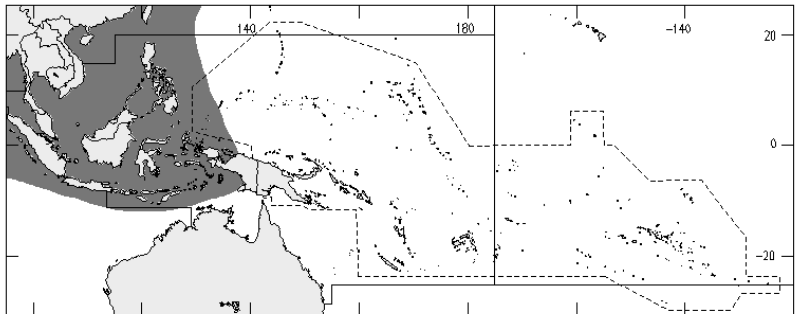
Habitat, biology, and fisheries: Near coral reefs, on subtidal bottoms to a depth of 5 m. Collected for its edible flesh and nacreous shell in Japan and the Philippines.

Distribution: Indo-West Pacific, from India to the Philippines; north to southern Japan, and south to Indonesia.



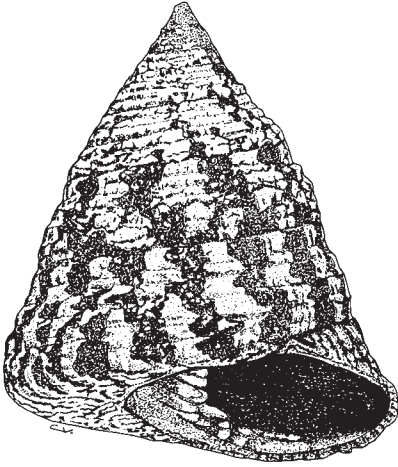
ventral view

(after Springsteen and Leobrera, 1986)



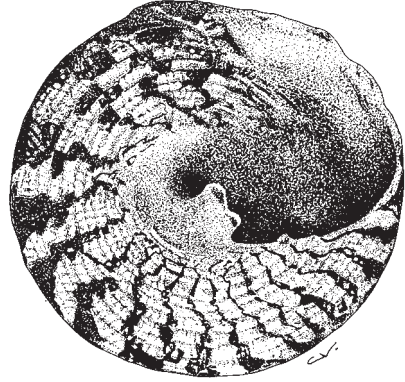
Trochus maculatus Linnaeus, 1758

Frequent synonyms / misidentifications: *Trochus verrucosus* Gmelin, 1791 / *Trochus stellatus* Gmelin, 1791.
FAO names: En - Maculated top; Fr - Troque tacheté.



ventral view

(after Wilson, 1993)



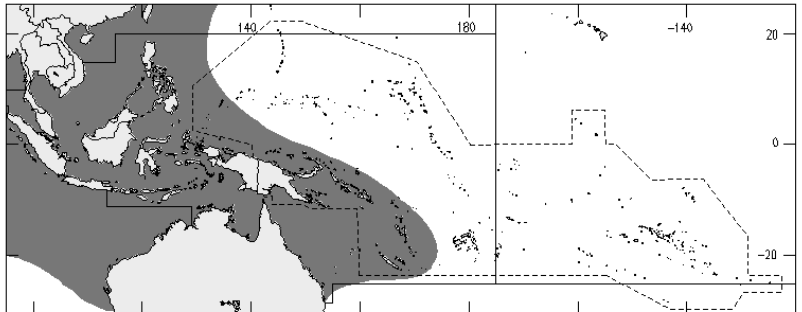
basal view

Diagnostic characters: Shell medium sized (up to 7 cm long), thick and solid, **highly variable, conical in shape**, about as wide as long to markedly longer. Spire tall, often strongly narrowed in its upper part and with pointed apex, **whorls** either concave, flat or convexly bulging, their sides **covered with numerous spiral rows of irregularly sized granules** (usually 6 to 8 per whorl). Granules either rounded and separated or laterally compressed, like axial folds, giving occasionally short axial ribs at the otherwise rather shallow sutures. **Periphery of body whorl acutely rounded. Base of shell flat**, with many low and finely beaded spiral threads. **Umbilicus present, spirally corded. Aperture roughly quadrate to sub-trigonal. Outer lip strongly oblique above periphery, delicately lirate inside. Columella with 4 to 5 low spiral cords, giving its margin a multi-dentate aspect. Colour: outside of shell extremely variable, usually whitish with roughly axial stripes or blotches of deep red, purple, or brown**, with the stripes occupying more space than the ground colour or vice-versa. Stripes radiating, often narrower, discontinuous and somewhat lighter coloured on the base. Umbilicus area and columella nacreous.

Size: Maximum shell length 6 cm, commonly to 5 cm.

Habitat, biology, and fisheries: Common in coral reefs and rocky shores, from low in the intertidal zone to a depth of about 10 m. Collected for food and shell trade in Viet Nam and the Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to Japan, and south to southern Queensland and New Caledonia.

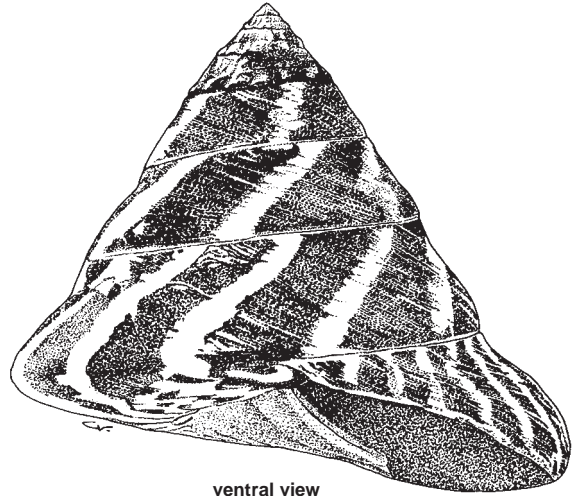


***Trochus niloticus* Linnaeus, 1767**

Frequent synonyms / misidentifications: *Tectus niloticus* (Linnaeus, 1767); *Trochus maximus* Philippi, 1844 / Juvenile stages often confused with other *Trochus* species.

FAO names: En - Commercial top; Fr - Trocha nacrier.

Diagnostic characters: **Shell large** (up to 15 cm long), thick and **very heavy, conical in shape**, about as long as wide. Spire tall, with pointed apex and shallow sculpture, weakening with growth and disappearing on later whorls. **Early spire whorls distinctly tuberculated just above the sutures**, with slightly oblique axial undulations and beaded spiral cords, **the following ones flat-sided and quite smooth**, separated by linear sutures. **Body whorl** of large specimens nearly **smooth, with** concave sides above a **protruding, acutely rounded** and thickened **periphery**. **Base of shell flattish**, with numerous, shallow spiral cords that are faintly visible on larger specimens. **Umbilicus present**, partly filled with a spiral ridge of columella. **Periostracum fibrous**, enhancing the strongly oblique incremental lines, usually rubbed off from upper part of the spire. **Aperture squarish**, broader than high. Outer lip strongly oblique above periphery, smooth inside. **Columella long, curved and smooth**, somewhat **thickened marginally**, ending abruptly in an obtuse anterior knob. **Colour:** under the yellowish brown periostracum, the outer **surface of shell is off-white, with large, irregularly axial reddish stripes**, which are usually narrower and lighter on the base. Columellar ridge nacreous, with a pure white, glossy spiral margin encircling the umbilicus.



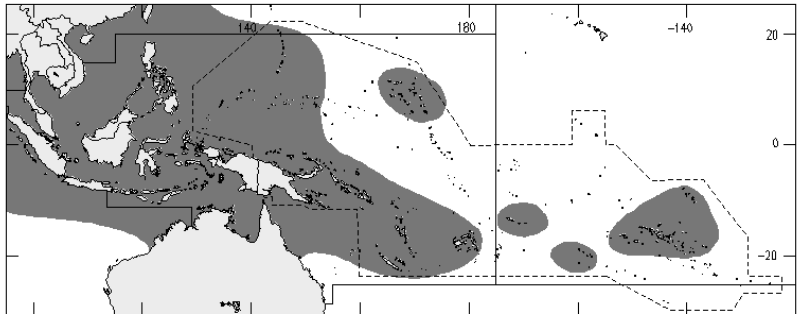
ventral view

(after Dance, 1993)

Size: Maximum shell length 15 cm, commonly to 11 cm.

Habitat, biology, and fisheries: In coral reef areas, typically in shallow, high-energy portions of barrier and fringing reefs. Feeds on filamentous algae and generally avoids bottoms of sand and living corals. Densities of populations generally decreasing in deeper areas, while the mean size of individuals increases. Rarely occurring beyond a depth of 10 m. *Trochus niloticus* is the most economically important gastropod species in the tropical West Pacific. It is both an important traditional food and a leading export item used as a source of mother-of-pearl material for buttons and jewellery. Commercial fisheries exist in the Philippines, Indonesia, Papua New Guinea, Australia, New Caledonia, Vanuatu, Fiji, French Polynesia, Marshall, Mariana, Caroline, Solomon, and Cook Islands. Many small-sized artisanal fisheries for meat and shell exist in other islands of the area, and the species is also commercially fished in the Indian Ocean. Total annual harvest between 5 to 6 million kg. Due to severe and frequent overfishing, management policies are often adopted and aquaculture trials are under way.

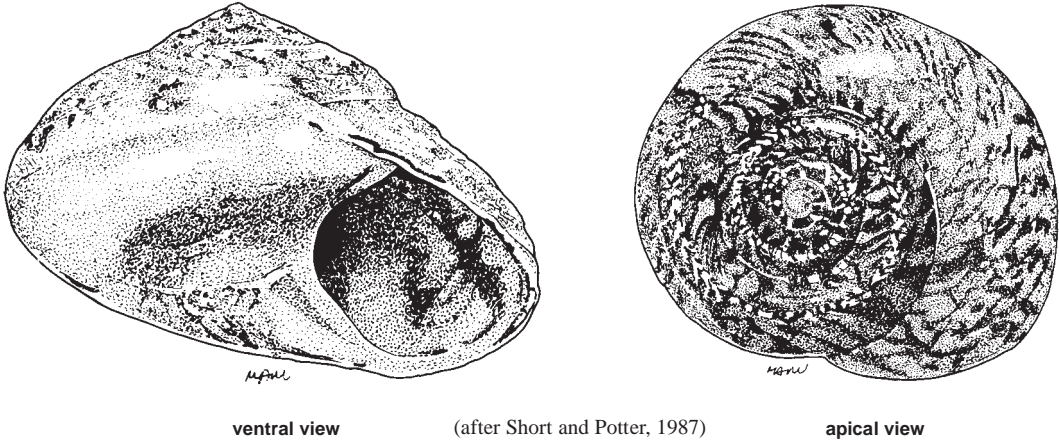
Distribution: Widespread in the Indo-West Pacific, from Madagascar to Micronesia; north to Japan, and south to Queensland; also successfully introduced in tropical oceanic islands as far east as French Polynesia.



Umbonium vestiarius (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / None.

FAO names: En - Common button top; Fr - Rotelle commune.



ventral view

(after Short and Potter, 1987)

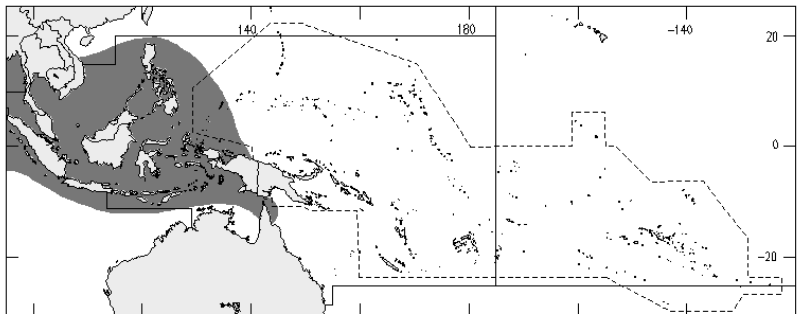
apical view

Diagnostic characters: **Shell small** (width not exceeding 1.5 cm), **lenticular in shape, much wider than long. Spire low**, with faintly convex, somewhat embracing whorls and shallowly incised suture. **Periphery** of body whorl **regularly rounded. Base of shell flattened, with a very large, smooth callus plug** filling completely the umbilicus. Entire **surface of shell smooth and polished, devoid of concentric grooves** on the spire whorls. Outer lip of the aperture sharp, smooth inside. Columella smooth, strongly curved anteriorly. **Colour: outside of shell highly glossy, extremely variable in pattern and coloration**, in shades of grey, brown, olive green, pink, red, yellow or even white, nearly uniform or with various axial and/or spiral patterns. Umbilical callus usually with a different colour.

Size: Maximum shell width 1.5 cm, commonly to 1 cm.

Habitat, biology, and fisheries: Abundant on fine sandy bottoms. Low tide and shallow subtidal water to a depth of about 5 m. Commonly used for food in the Philippines. In local markets, vendors traditionally give the buyer aromatic thorns (*Acacia pennata*) to pry the meat out of the small shell. Also used in the shellcraft industry, to make dolls and decorative items.

Distribution: Widespread in the Indo-West Pacific, from East Africa to eastern Indonesia; north to the Philippines and south to northern Queensland.

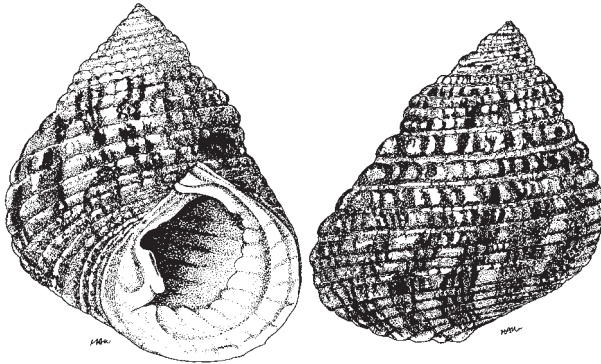


Monodonta labio (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / None.

En - Labio monodont; **Fr** - Monodonte lippue.

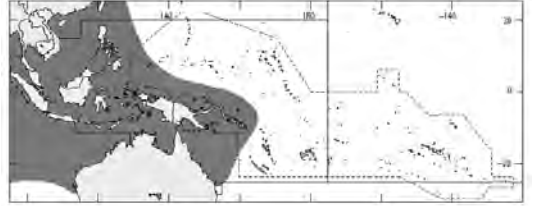
Maximum shell length 4 cm, commonly to 3 cm. On rocks and coral reefs. From high in the intertidal zone to shallow subtidal depths. Locally collected for subsistence by coastal people. Shell used in shellcraft. Widespread in the Indo-West Pacific, from East Africa, including Madagascar to Melanesia; north to Japan, and south to southern Queensland.



ventral view

dorsal view

(after Pilsbry, 1889)

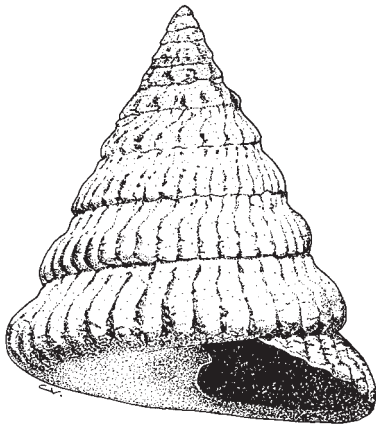


Tectus fenestratus (Gmelin, 1791)

Frequent synonyms / misidentifications: *Trochus fenestratus* Gmelin, 1791 / None.

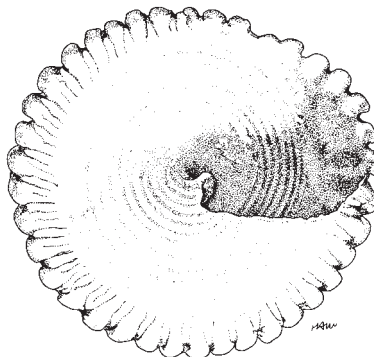
En - Fenestrate top; **Fr** - Troque fenestré.

Maximum shell length 7 cm, commonly to 5 cm. On rocky shores, usually in muddy areas. Locally collected for food. Frequently present in local markets of the northern and central Philippines, often mixed with other gastropod species. Indo-West Pacific, from the eastern part of Indian Ocean to Melanesia; north to the Philippines and south to central Queensland.

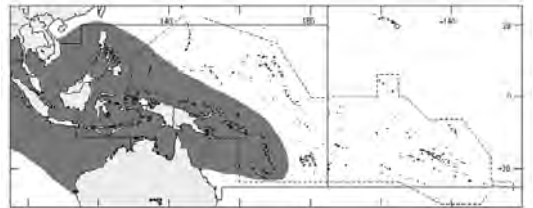


ventral view

(after Wilson, 1993)



basal view

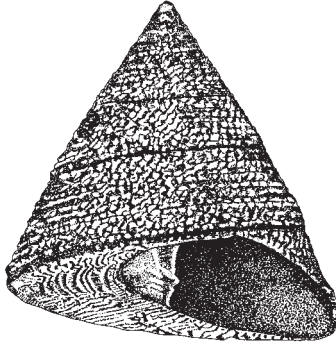


***Trochus hanleyanus* Reeve, 1842**

Frequent synonyms / misidentifications: *Trochus lineatus* Lamarck, 1822 (not of da Costa, 1778) / *Trochus maculatus* Linnaeus, 1758.

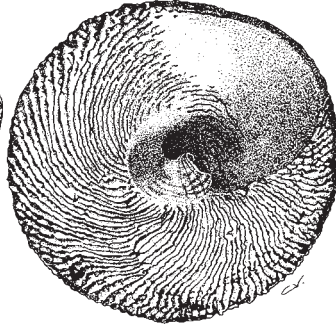
En - Lined top; **Fr** - Troque rayé.

Maximum shell length 7 cm, commonly to 5 cm. Common in rocky shore and coral-reef habitats. Locally collected for food at low tide. Easternmost part of the Indian Ocean and the tropical West Pacific, from western Indonesia to the Philippines and to southern Queensland.

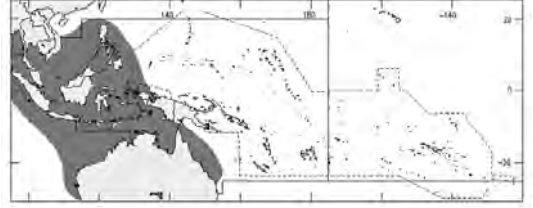


ventral view

(after Wilson, 1993)



basal view

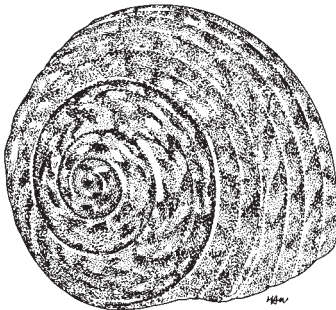


***Umbonium costatum* (Kiener, 1838)**

Frequent synonyms / misidentifications: None / *Umbonium moniliferum* (Lamarck, 1822).

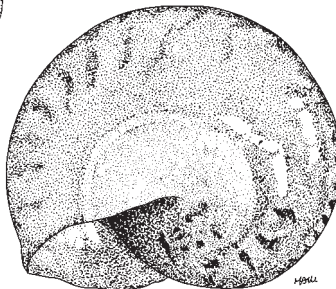
En - Costate button top; **Fr** - Rotelle costulée.

Maximum shell length 3.5 cm, commonly to 2.5 cm. On fine sandy bottoms of open coasts. Low tide and shallow sublittoral zone to a depth of about 20 m. Collected locally for food in Japan and the Philippines. Restricted to the tropical West Pacific, from Japan, Korea, and Taiwan Province of China to the Philippines.

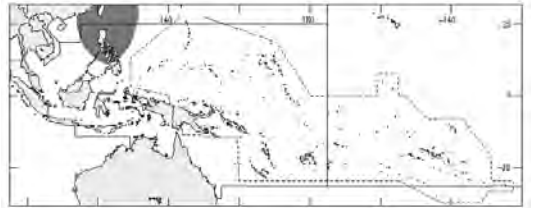


apical view

(after Kira, 1962)



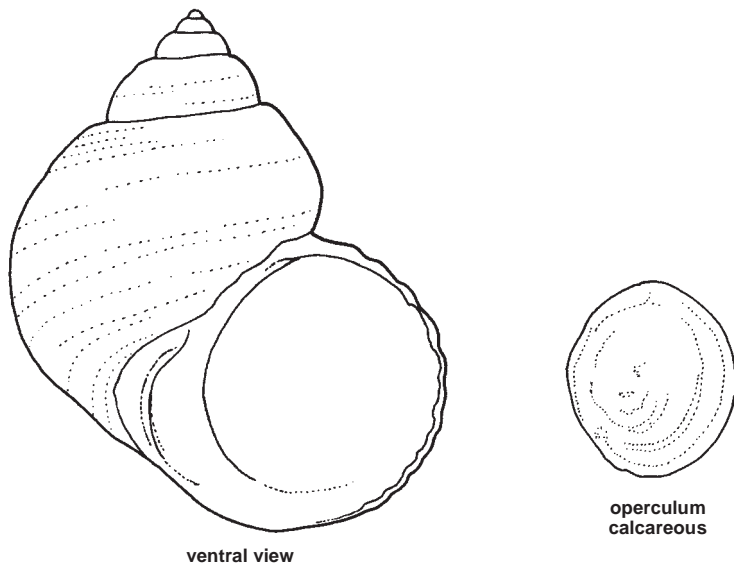
basal view



TURBINIDAE

Turban shells

Diagnostic characters: Shell thick, often heavy, turbanate to conical (occasionally flattened) in shape. **Outer sculpture** very variable, often spiral to nodular. Periostracum well developed to absent. **Aperture** variously rounded, without a siphonal canal, nacreous inside. Inner lip smooth. Umbilicus present, at least at juvenile stages. **Operculum strongly calcified** externally, its inner layer corneous, usually showing spiral coiling with a subterminal or central nucleus. Head with a short, mid-ventrally split snout, and a pair of long tentacles, the eyes on stalks at their outer bases. Foot large and ovate, sometimes anteriorly truncate, with a fleshy ridge on either side bearing tentaculate processes.

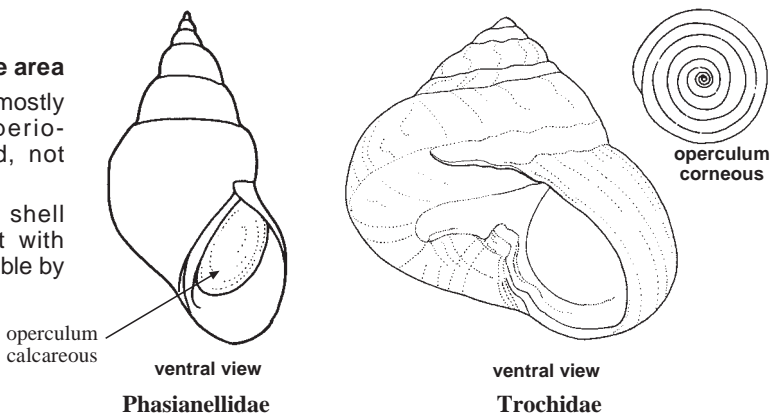


Habitat, biology, and fisheries: Mainly living in shallow waters of warm temperate and tropical seas, especially on rocky and coral reef habitats. Herbivorous animals, feeding on small epibenthic algae and vegetable detritus. Sexes separate, fertilization external. Eggs generally released in gelatinous masses, hatching as free-swimming planktonic larvae. Turbans (especially the larger species) are commonly collected in the Indo-West Pacific, both for their edible flesh and nacreous shell. They are locally valued for food and some are sought for mother-of-pearl or for carving ornaments. In recent years, heavy commercial exploitations have locally depleted populations. Efforts are expected in the future to produce juveniles in hatcheries and introduce turbans in areas in which they have become extinct or areas currently poor in fisheries resources.

Similar families occurring in the area

Phasianellidae: shell rather thin, mostly small and smooth, without periostracum; aperture pear-shaped, not nacreous inside.

Trochidae: appearance of the shell sometimes strongly convergent with Turbinidae, but easily distinguishable by the entirely corneous operculum.



Key to species of interest to fisheries occurring in the area

- 1a. Periphery of whorls sharply angulated, with a series of flattened spines (Fig. 1); operculum ovate, with a subterminal nucleus *Astralium calcar*
- 1b. Periphery of whorls not sharply angulated, without flattened spines; operculum nearly circular, with a subcentral nucleus → 2
- 2a. Surface of shell smooth and highly polished (Fig. 2) *Turbo petholatus*
- 2b. Surface of shell with a distinct sculpture, not polished → 3
- 3a. Spire low, dome-shaped → 4
- 3b. Spire well developed, pointed → 5
- 4a. Surface of shell covered with fine nodulose spiral threads (Fig. 3) *Turbo cinereus*
- 4b. Surface of shell covered with spiral rows of coarse nodules and granules (Fig. 4) . *Turbo coronatus*

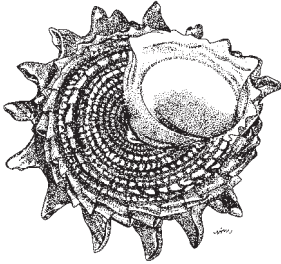


Fig. 1 *Astralium calcar* (basal view)

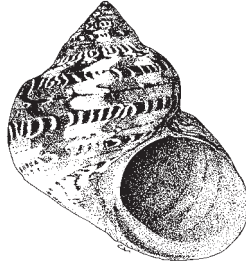


Fig. 2 *Turbo petholatus* (ventral view)

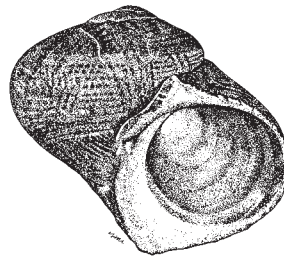


Fig. 3 *Turbo cinereus* (ventral view)

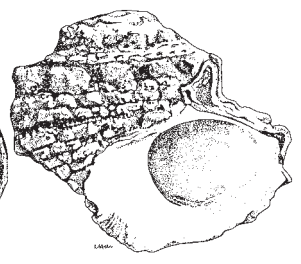


Fig. 4 *Turbo coronatus* (ventral view)

- 5a. Outside of operculum with a spiral ridge and central perforation (Fig. 5) *Turbo bruneus*
- 5b. Outside of operculum without a spiral ridge and central perforation → 6
- 6a. Shell very large (up to 22 cm in length); spiral sculpture poorly developed, apart from 3 ribs bearing blunt tubercules on body whorl (Fig. 6) *Turbo marmoratus*
- 6b. Shell moderately large (up to 10 cm in length); spiral sculpture well developed, with numerous ribs and grooves throughout → 7
- 7a. Axial sculpture of threads, spines or scales → 8
- 7b. Axial sculpture of fine striae only → 9

- 8a. Outside of operculum approximately smooth, with oblique marginal grooves; colour of the aperture mostly orange-yellow (Fig. 7) *Turbo chrysolostomus*
- 8b. Outside of operculum prominently pustulose, with oblique marginal grooves; colour of the aperture mostly silvery white (Fig. 8) *Turbo argyrostomus*

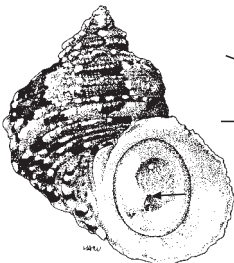


Fig. 5 *Turbo bruneus* (ventral view)

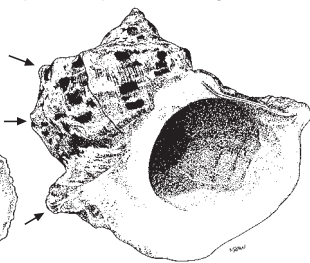


Fig. 6 *Turbo marmoratus* (ventral view)

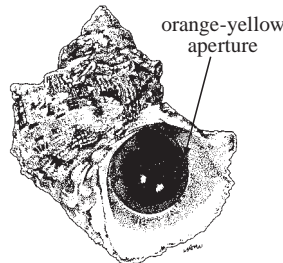


Fig. 7 *Turbo chrysolostomus* (ventral view)

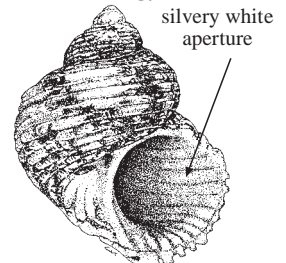


Fig. 8 *Turbo argyrostomus* (ventral view)

- 9a. Spire relatively long (Fig. 9); operculum deep brown at the centre *Turbo crassus*
 9b. Spire relatively short (Fig. 10); operculum whitish at the centre *Turbo setosus*

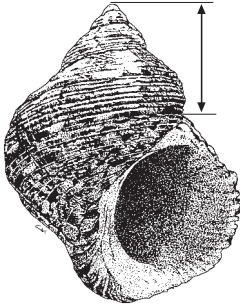


Fig. 9 *Turbo crassus* (ventral view)

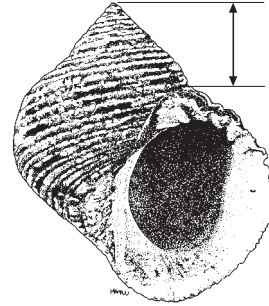












Fig. 10 *Turbo setosus* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Astralium calcar* (Linnaeus, 1758)
-  *Turbo argyrostomus* Linnaeus, 1758
-  *Turbo bruneus* (Röding, 1798)
-  *Turbo chryostomus* Linnaeus, 1758
-  *Turbo cinereus* Born, 1778
-  *Turbo coronatus* Gmelin, 1791
-  *Turbo crassus* Wood, 1828
-  *Turbo marmoratus* Linnaeus, 1758
-  *Turbo petholatus* Linnaeus, 1758
-  *Turbo setosus* Gmelin, 1791

References

- Hickman, C.S. and J.H. Mclean. 1990. Systematic revision and suprageneric classification of trochacean gastropods. *Sci. Ser. nat. Hist. Mus. Los Angeles City*, 35:1-169.
- Pilsbry, H.A. 1888. Monograph of the Turbinidae and Trochidae: family Turbinidae. In *Manual of conchology; structural and systematic. With illustrations of the species. Vol. X, Part Second*, edited by G.W. Tryon Jr. Philadelphia, Academy of Natural Sciences, pp. 161-323.

***Turbo argyrostomus* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Marmarostoma argyrostoma* (Linnaeus, 1758) / None.

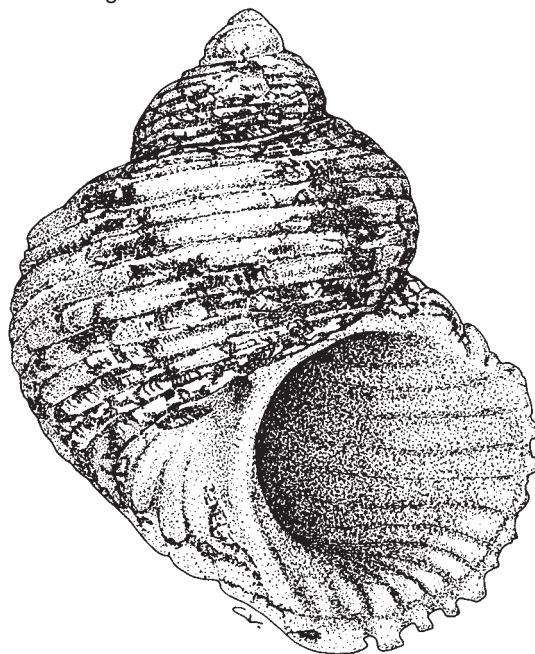
FAO names: En - Silvermouth turban; Fr - Turbo bouche-d'argent.

Diagnostic characters: Shell large (up to 10 cm long), solid and heavy, **turbinata** in shape with length about equal to or slightly greater than width. Spire well developed, pointed, **whorls strongly convex** with shoulder keel weak or lacking and **deeply impressed sutures**. Outer **sculpture variable**, with **rounded spiral cords** of unequal size which are wider than their interstices and **which may bear small prickles**, and with fine, overriding axial threads. Body whorl usually with a more prominent spiral cord near the suture and 1 or 2 other ones towards periphery. **Aperture rounded ovate**, extending on about half of the total length of shell, with a thick, serrate outer lip. Columella smooth, **not flaring anteriorly**, slightly grooved under the **umbilicus** which is **generally deeply open**. Operculum more or less circular in outline, with a subcentral nucleus. **Exterior of operculum convex**, **prominently pustulose**, with fine oblique marginal wrinkles. **Colour: outside** of shell either **whitish or irregularly marbled with green and brown**, or uniformly greenish. **Aperture glossy white**, becoming **silvery white inside**. Exterior of **operculum white**, often with a **greenish centre and brown to orange outer margin**.

Size: Maximum shell length 10 cm, commonly to 7.5 cm.

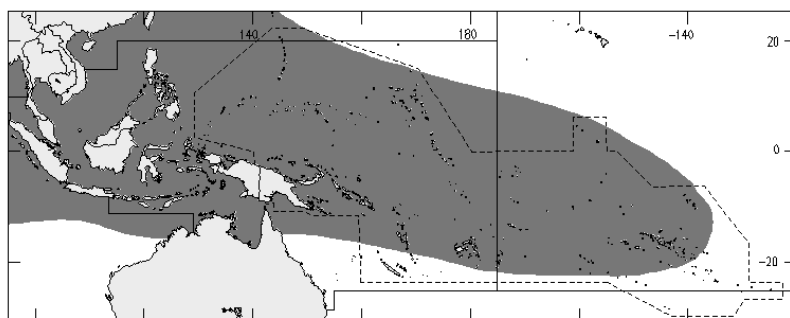
Habitat, biology, and fisheries: Coral reef areas, in moderately exposed habitats and in lagoons of atolls. One of the most frequently collected species of turban shells in the tropical Southwest Pacific. Mainly used as food, but the shell locally serves also for making buttons.

Distribution: Widespread in the Indo-West Pacific, from East and Southeast Africa to eastern Polynesia; north to southern Japan and south to northern Queensland.



ventral view

(after Short and Potter, 1987)



***Turbo chrysostomus* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Marmarostoma chrysostoma* (Linnaeus, 1758) / None.

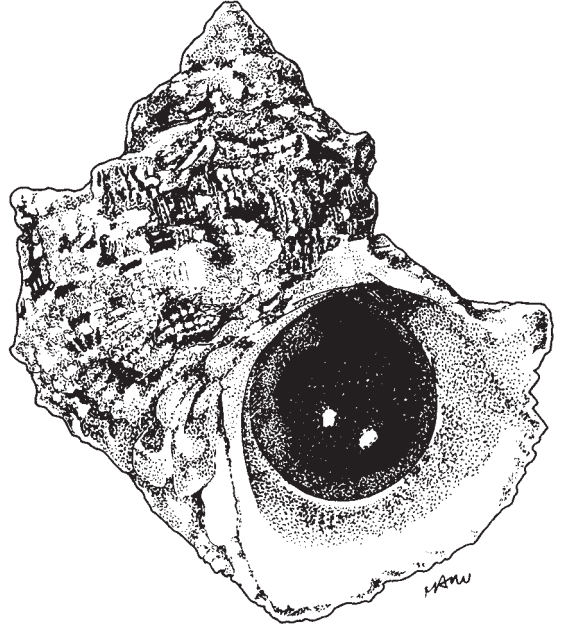
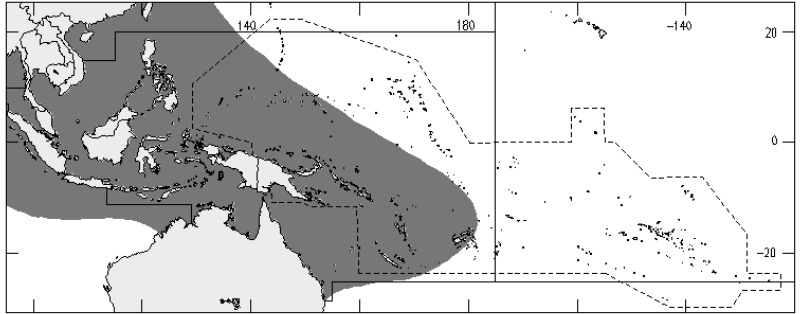
FAO names: En - Goldmouth turban; Fr - Turbo bouche-d'or.

Diagnostic characters: Shell moderately large, solid and heavy, **turbinate** in shape with length usually greater than width. Spire well developed, pointed, **whorls strongly convex** and **with angular shoulders**. Outer sculpture **variable, with rounded, unequal spiral cords** and many fine scaly **axial threads**, most developed on the interstices of cords. **Body whorl biangulate, with stronger spiral cords at shoulder and periphery**, each bearing a row of **short open spines or nodules**. **Aperture** roughly **rounded-ovate**, about half the total length of shell, forming a blunt angle at the slightly flaring anterior end of smooth columella. Outer lip marginally serrate, smoothish inside. **Umbilicus** closed or **reduced to a slight chink**. Operculum nearly circular in outline, with a subcentral nucleus. **Exterior of operculum** very convex, **approximately smooth**, with fine oblique grooves on its outer margin. **Colour: outside of shell brownish or cream-coloured, often marbled with irregular axial stripes** of darker brown and/or green. **Aperture** mostly **bright orange to golden yellow**, with white margins. **Exterior of operculum brown or dark green, becoming whitish at periphery**.

Size: Maximum shell length 8 cm, commonly to 6 cm.

Habitat, biology, and fisheries: In coral reef areas. Intertidal and shallow sublittoral zones, to a depth of about 20 m. Exploited in Fiji Islands, and frequently collected for food locally by coastal people, where abundant. Shell used in shellcraft.

Distribution: Widespread in the Indo-West Pacific, from southeastern Africa to Melanesia; north to southern Japan and south to southern Queensland and New Caledonia.



ventral view

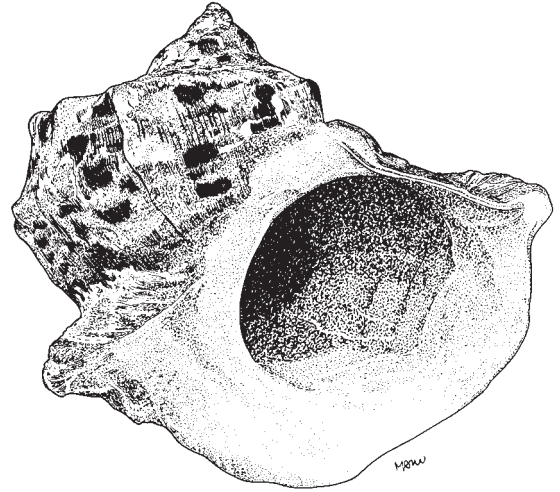
(after Wilson, 1993)

Turbo marmoratus Linnaeus, 1758

Frequent synonyms / misidentifications: *Lunatica marmorata* (Linnaeus, 1758); *Turbo regenfussi* Deshayes, 1843 / None.

FAO names: En - Green turban; Fr - Turbo vert.

Diagnostic characters: Shell reaching a **very large** size (up to 22 cm long), **sturdy, roughly turbanate** in shape with a rather small, pointed spire and a **strongly developed, massive body whorl**. Length of shell about equal to or slightly smaller than width. Spire whorls rounded, becoming angular on shoulder in later stages of growth. Outer surface of shell densely set with numerous fine axial marks of growth. **Spiral sculpture poorly developed, apart from 3 ribs** on shoulder, periphery, and base of **body whorl, bearing blunt tubercles**. Aperture rounded and very large, extending on about 2/3 of total length of shell. **Outer lip thick-walled, smooth inside**, somewhat angular at shoulder and **flaring outward at anterior end**, forming with the columella a broad, flattened projection. Inner lip strongly concave and extensively calloused. **Umbilicus narrow** in large adults (closed in small specimens), **encircled by a heavy oblique ridge**. Operculum massive, circular in outline, with a subcentral nucleus. **Exterior of operculum smooth** to finely granular. **Colour: outside of shell dull-coloured, uniformly greenish or with spiral bands of alternating chestnut brown and grey spots. Interior of aperture silvery white. Exterior of operculum whitish.**

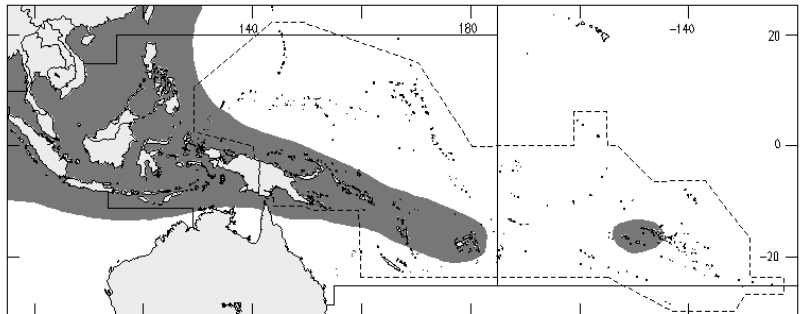


ventral view
(after Dance, 1993)

Size: Maximum shell length 22 cm, commonly to 18 cm.

Habitat, biology, and fisheries: In subtidal, coral reef areas open to a constant flow of clean oceanic water. Juveniles mainly living on reefs crests, at depths of 1 to 5 m; adults also occurring deeper on slopes, to about 20 m or more. Extensively used for food, shell jewellery, inlay, and button making. It is the most important commercial species of Turbinidae in the tropical Indo-West Pacific, with a total production of 1 000 t in 1988 (FAO, 1990). Intensive fishing for the mother-of-pearl trade has drastically reduced many turban populations in recent years. In order to protect existing resources and to increase the possibilities of long-term exploitations, attempts of juvenile production, reintroduction, translocation, and commercial legislation are under way in the area.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, to eastern Melanesia; north to southern Japan and south to northern Queensland and Fiji Islands. Successfully introduced in French Polynesia since the 1960s.



***Turbo petholatus* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Turbo elegans* Philippi, 1847; *T. reevei* Philippi, 1847 / None.

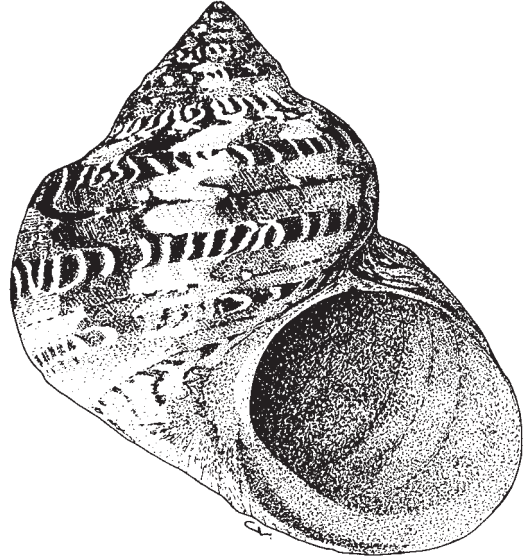
FAO names: En - Tapestry turban; Fr - Turbo tapisserie.

Diagnostic characters: Shell moderately large, thick and heavy, **turbinate** in shape with length equal to or slightly greater than width. Spire well developed, pointed, **whorls strongly convex** with a rounded outline becoming somewhat flattened beneath the **impressed sutures**. Outer **surface of shell smooth and highly polished**. Aperture rounded-ovate, extending on about half the total length of shell. Outer lip thin, smooth inside. **Columella smooth, without an umbilicus**. **Operculum** nearly circular in outline, with a subcentral nucleus and a **convex, smooth** external surface. **Colour: outside of shell variable in colour and pattern**, usually brown, red, orange, or greenish, **often ornamented with dark spiral bands and/or thin, chevron-shaped, pale-coloured axial stripes**. **Aperture silvery white inside, often suffused with yellow, orange or green on margins**, especially on inner-lip margin. Exterior of **operculum shiny, bluish green in the centre**, becoming brown towards the margins.

Size: Maximum shell length 8.5 cm, commonly to 6 cm.

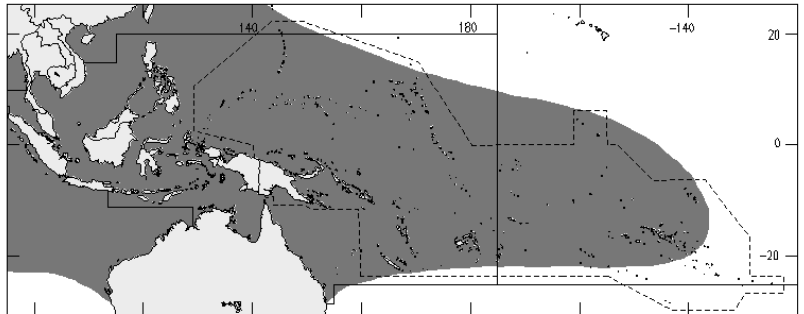
Habitat, biology, and fisheries: Shallow coral reefs and rocky shores, in relatively protected habitats. Sublittoral, to depths of about 40 m. Collected for food and for its highly polished, colourful shell. The operculum is well known in shell jewellery under the name "cat's eye".

Distribution: Widespread in the Indo-West Pacific, from East and Southeast Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan and south to southern Queensland and New Caledonia.



ventral view

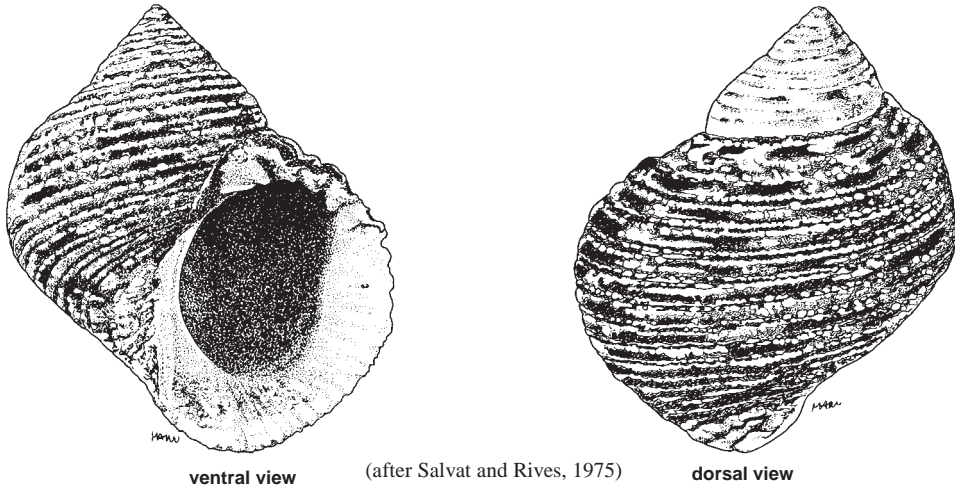
(after Short and Potter, 1987)



***Turbo setosus* Gmelin, 1791**

Frequent synonyms / misidentifications: *Marmarostoma setosa* (Gmelin, 1791) / *Turbo crassus* Wood, 1828.

FAO names: En - Rough turban; Fr - Turbo soyeux.



ventral view

(after Salvat and Rives, 1975)

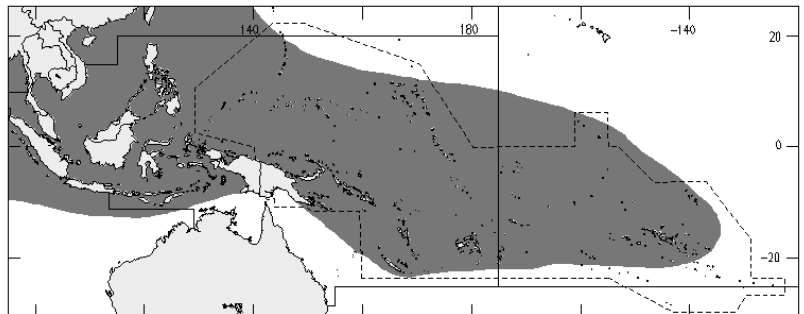
dorsal view

Diagnostic characters: Shell moderately large, thick and heavy, turbanate in shape with length usually greater than width. Spire pointed, well developed but relatively short, whorls strongly convex, regularly rounded, with moderately impressed sutures. Outer sculpture of strong, unequal spiral cords, with groove-like interstices and very fine axial striae. Aperture large and oval, exceeding half of the total length of shell, somewhat flaring at the anterior end of the smooth columella. Outer lip crenulated at margin and spirally fluted inside. Umbilicus closed or nearly so. Operculum almost circular in outline, with a subcentral nucleus. Exterior of operculum smoothly convex, finely granulated in the centre and striated at the outer margin. **Colour:** outside of shell whitish or light fawn, irregularly maculated with dark brown or greyish green along the spiral cords. Aperture silvery white inside, the outer lip sometimes with a green hue. Columella glossy white. Operculum whitish externally.

Size: Maximum shell length 8 cm, commonly to 5 cm.

Habitat, biology, and fisheries: In exposed areas of coral reefs. Sublittoral zone, in shallow water. Like *Turbo argyrostomus*, one of the most frequently collected Turbinidae in the area, mainly for food. Shell also used as material for making buttons.

Distribution: Widespread in the Indo-West Pacific, from Madagascar and the Mascareign Islands to eastern Polynesia; north to southern Japan and south to Papua New Guinea and New Caledonia.

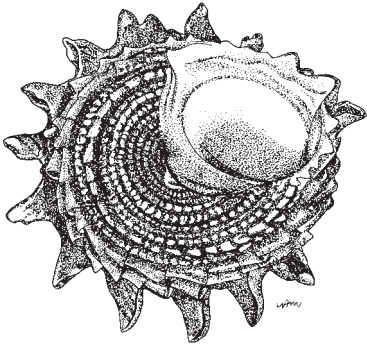


Astraliium calcar (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Astrea calcar* (Linnaeus, 1758) / None.

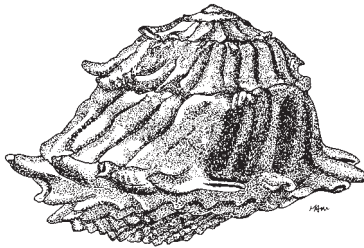
En - Spurred turban; **Fr** - Turbo éperonné.

Maximum shell length 6 cm, commonly to 4 cm. On rocky shores and coral reefs. Intertidal and shallow subtidal waters. Occasionally appearing on local markets of the northern Philippines. Eastern Indian Ocean and the tropical West Pacific, from the Andaman Sea to Melanesia; north to southern Japan and south to New Caledonia.

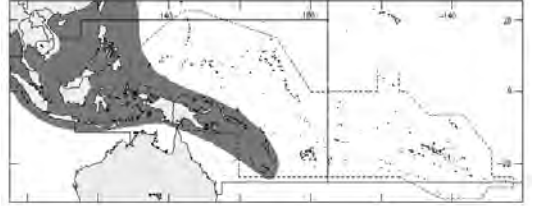


basal view

(after Pilsbry, 1988)



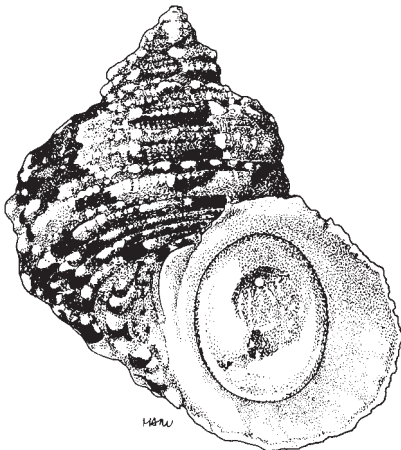
dorsal view

***Turbo bruneus*** (Röding, 1798)

Frequent synonyms / misidentifications: *Marmarostoma bruneus* (Röding, 1798); *Turbo ticaonicus* Reeve, 1848 / *Turbo intercostalis* Menke, 1843 (= *Turbo pulcher* Reeve, 1842).

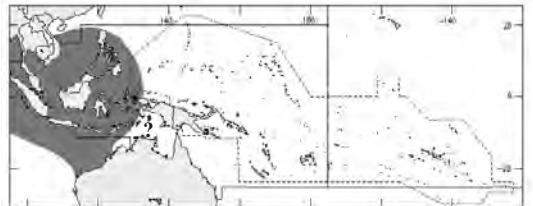
En - Brown Pacific turban; **Fr** - Turbo brun.

Maximum shell length 6 cm, commonly to 4 cm. Rocky shores and coral reefs, in shallow subtidal waters to a depth of about 20 m. Collected mainly for food by coastal populations. Widespread in the Indo-West Pacific, from Madagascar and India to eastern Indonesia; north to the Philippines and south to northern Australia.



ventral view

(after Wilson, 1993)

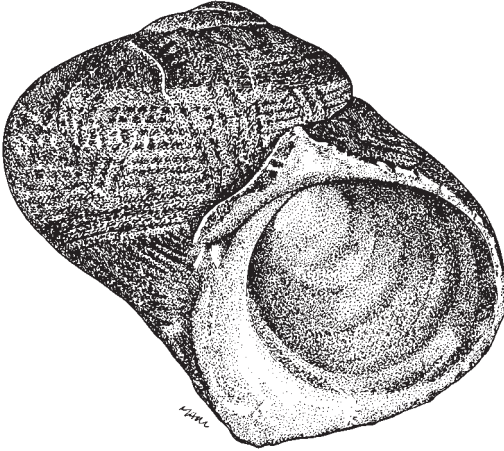


***Turbo cinereus* Born, 1778**

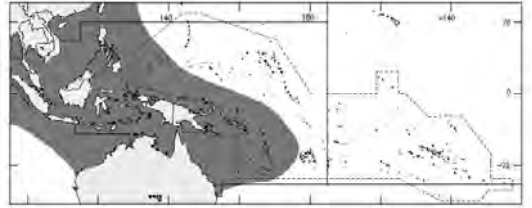
Frequent synonyms / misidentifications: *Lunella cirenea* (Born, 1778); *Turbo lugubris* Reeve, 1848; *T. picta* Röding, 1798; *T. porphyres* Gmelin, 1791; *T. versicolor* Gmelin, 1798 / None.

En - Smooth moon turban; **Fr** - Turbo cendré.

Maximum shell length 4 cm, commonly to 3 cm. Common among rocks or gravel. Intertidal. Collected locally for food and shellcraft. Eastern Indian Ocean and tropical West Pacific, from eastern India to Melanesia; north to southern Japan and south to southern Queensland and New Caledonia.



ventral view
(after Habe, 1964)

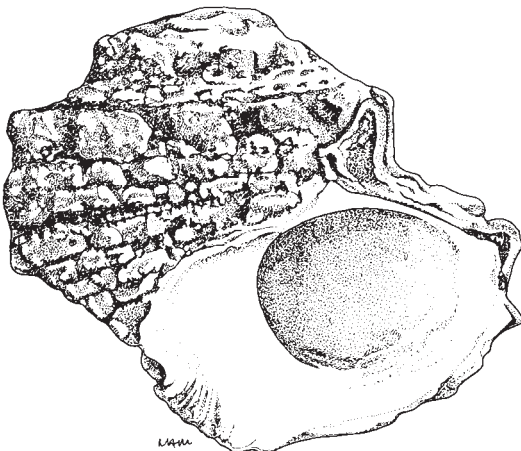


***Turbo coronatus* Gmelin, 1791**

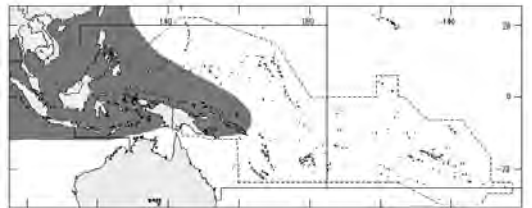
Frequent synonyms / misidentifications: *Lunella coronata* (Gmelin, 1791); *Turbo coreensis* Récluz, 1844 / None.

En - Coronate moon turban; **Fr** - Turbo couronné.

Maximum shell length 5.5 cm, commonly to 3.5 cm. Among rocks and gravel, or in crevices. Intertidal. Collected locally for food and shellcraft on the Indochinese peninsula. In seaside villages of Japan, children put the operculum in vinegar because it makes a circular movement as it gradually dissolves. Widespread in the Indo-West Pacific, from East and South Africa to Melanesia; north to southern Japan and south to Indonesia.



ventral view
(after Kilburn and Rippey, 1982)

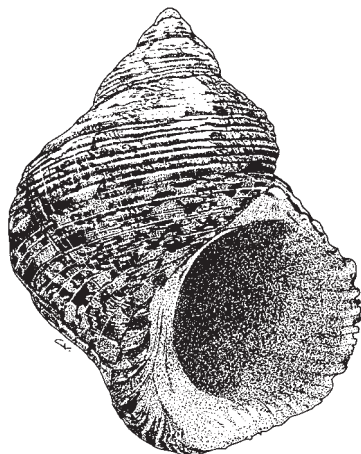


Turbo crassus Wood, 1828

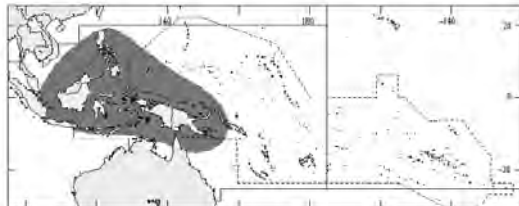
Frequent synonyms / misidentifications: *Marmarostoma crassa* (Wood, 1828) / *Turbo setosus* Gmelin, 1791.

En - Crass turban; **Fr** - Turbo épais.

Maximum shell length 8.5 cm, commonly to 6 cm. Near reefs, in shallow subtidal water, mainly at depths of 1 to 5 m. Collected where common with other *Turbo* species for subsistence or bait. Tropical West Pacific, from Indonesia to Papua New Guinea; north to the Philippines and south to northern Queensland.



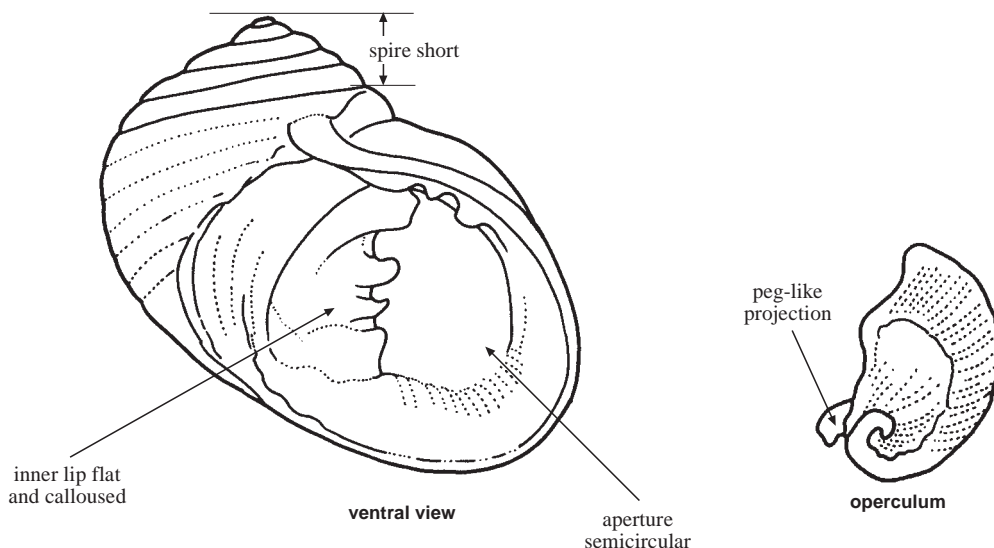
ventral view
(after Short and Potter, 1987)



NERITIDAE

Nerites

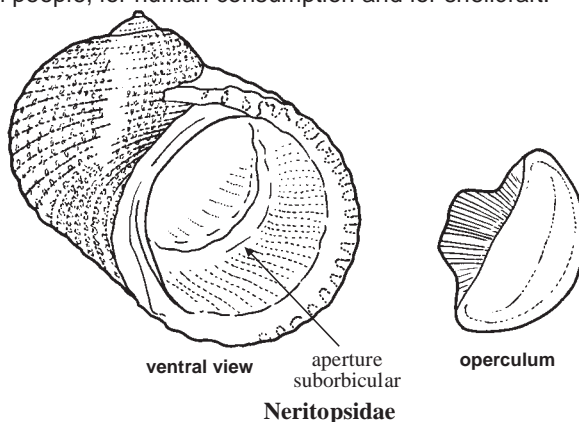
Diagnostic characters: Shell globose, often thick and solid, with a moderately low spire and a very large, rounded body whorl. No umbilicus. Outer surface smooth, or costulate to spinose. Aperture semicircular, without a siphonal canal. Inner and outer lip often toothed. Columella forming a flat, calloused inner lip, protruding as a septum that narrows the aperture. Columellar shield smooth, ridged or pustulose. Interior of shell porcelaneous, with the inner walls of the spire whorls resorbed in adult stages. Operculum semicircular, calcified, with a few spiral coils and a projecting peg on its inner edge. Head large, with a broad, short and commonly indented snout. Cephalic tentacles slender, with eyes on prominent stalks at their outer bases. Foot oblong, wide in front and attenuated behind. Mantle cavity deep, with a single long, triangular gill.



Habitat, biology, and fisheries: Along shorelines in warm temperate to tropical, marine, brackish, or even fresh-water habitats. Marine species often live quite high in the intertidal zone, and are exposed to the air and sun for long periods. The tightly fitting operculum prevents desiccation and, in some species, the surface of the mantle cavity acts as a primitive lung. Herbivorous animals, grazing by night at low tide on fine algae and detritus covering the bottoms where they live. Sometimes forming very large colonies. Sexes separate, fertilization internal. Eggs laid in capsules, attached to the rocks or to the shells of nerites. In the area, nerites are commonly collected by coastal people, for human consumption and for shellcraft.

Similar families occurring in the area

Neritopsidae: aperture of shell suborbicular, columellar edge concave, curving in a regular arc to meet the outer lip; inner walls of spire whorls not resorbed; operculum not spiral, trapezoidal.



Neritopsidae

Key to species of interest to fisheries occurring in the area

- 1a. Shell rather thick; outer lip of aperture thickened and often toothed inside → 3
- 1b. Shell rather thin; outer lip of aperture sharp, not thickened or toothed inside → 2
- 2a. Spire blunt; surface of shell with many conspicuous spiral grooves; peg of the operculum longitudinally grooved (Fig. 1) *Neritodryas subsulcata*
- 2b. Spire elevated; surface of shell without conspicuous spiral grooves (Fig. 2); peg of the operculum not grooved longitudinally *Neritina turrita*

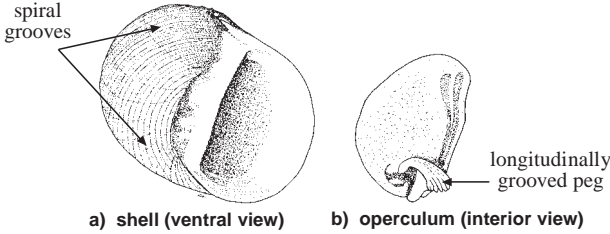


Fig. 1 *Neritodryas subsulcata*

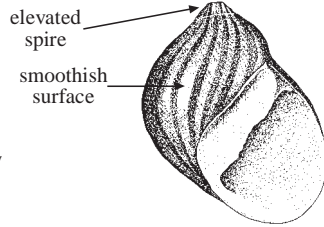


Fig. 2 *Neritina turrita* (ventral view)

- 3a. Sculpture of shell reduced to axial growth lines and grooves (Fig. 3) *Nerita polita*
- 3b. Sculpture of shell with more or less developed spiral elements, in addition to the axial growth marks (Fig. 4a) → 4
- 4a. Columellar shield smooth (Fig. 4b) *Nerita picea*
- 4b. Columellar shield ridged or granular → 5

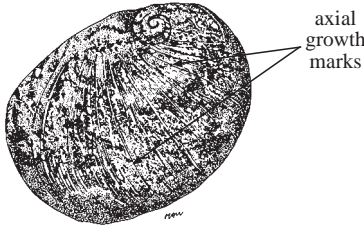
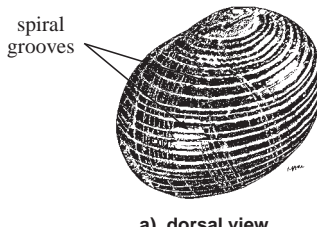
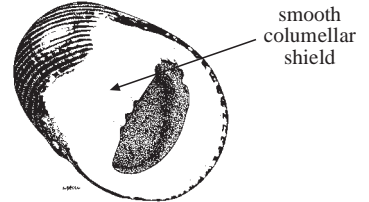


Fig. 3 *Nerita polita* (dorsal view)



a) dorsal view



b) ventral view

Fig. 4 *Nerita picea*

- 5a. Spire moderately high; columellar shield ridged → 6
- 5b. Spire very low to flat; columellar shield granular → 8
- 6a. Surface sculptured with numerous fine spiral cords (numbering 30 to 40 on body whorl); inner edge of outer lip finely toothed (apart from 1 or 2 stronger teeth posteriorly) (Fig. 5) *Nerita undata*
- 6b. Surface sculptured with rather few, coarse spiral ribs (numbering 20 or less on body whorl); inner edge of outer lip strongly toothed (including the stronger tooth posteriorly) → 7
- 7a. Spire relatively low; spiral ribs broader and less numerous, about 12 to 15 on body whorl; outer colour dull black, sometimes with yellowish lines between the ribs (Fig. 6) *Nerita costata*
- 7b. Spire relatively high; spiral ribs narrower and more numerous, about 15 to 20 on body whorl; outer colour dull white or creamy yellow, sometimes spotted with grey or purplish brown (Fig. 7) *Nerita plicata*

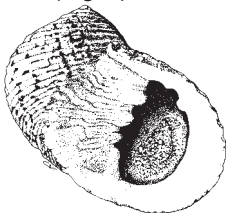


Fig. 5 *Nerita undata* (ventral view)

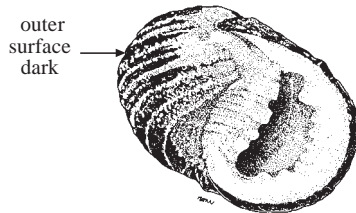


Fig. 6 *Nerita costata* (ventral view)

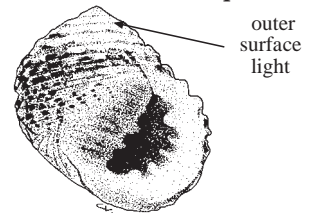


Fig. 7 *Nerita plicata* (ventral view)

- 8a. Outer surface with spiral cords and axial threads (Fig. 8) *Nerita squamulata*
- 8b. Outer surface with spiral cords only → 9
- 9a. Outer surface with a few, weak spiral cords; columellar shield wide, with distinct pustules (Fig. 9) *Nerita albicilla*
- 9b. Outer surface with numerous, moderately rough spiral cords; columellar shield relatively narrow, with weak pustules → 10

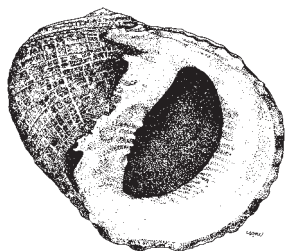


Fig. 8 *Nerita squamulata* (ventral view)

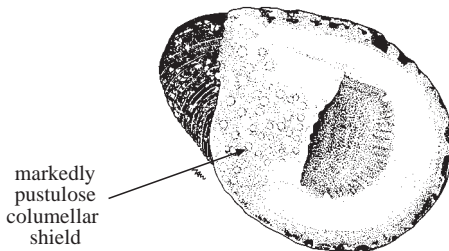


Fig. 9 *Nerita albicilla* (ventral view)

- 10a. Shoulder moderately angulate; operculum smooth (Fig.10) *Nerita planospira*
- 10b. Shoulder rounded; operculum finely granulose (Fig. 11) *Nerita chameleon*

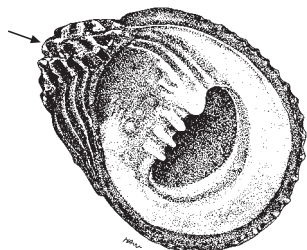


Fig. 10 *Nerita planospira* (ventral view)

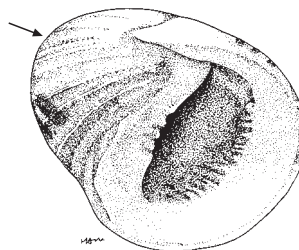









Fig. 11 *Nerita chameleon* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Nerita albicilla* Linnaeus, 1758
-  *Nerita chameleon* Linnaeus, 1758
-  *Nerita costata* Gmelin, 1791
-  *Nerita picea* Récluz, 1841
-  *Nerita planospira* Anton, 1839
-  *Nerita plicata* Linnaeus, 1758
-  *Nerita polita* Linnaeus, 1758
-  *Nerita squamulata* Le Guillou, 1841
-  *Nerita undata* Linnaeus, 1758
-  *Neritina turrita* (Gmelin, 1791)
-  *Neritodryas subsulcata* (Sowerby, 1836)

References

Delsaerdt, A. 1996. Neritoidea of the Solomon Islands. Alphabetical review. Part 1, marine species. *Gloria Maris*, 35(3):33-48.

Fretter, V. 1965. Functional studies of the anatomy of some neritid prosobranchs. *J. Zool. Lond.*, 147:46-74.

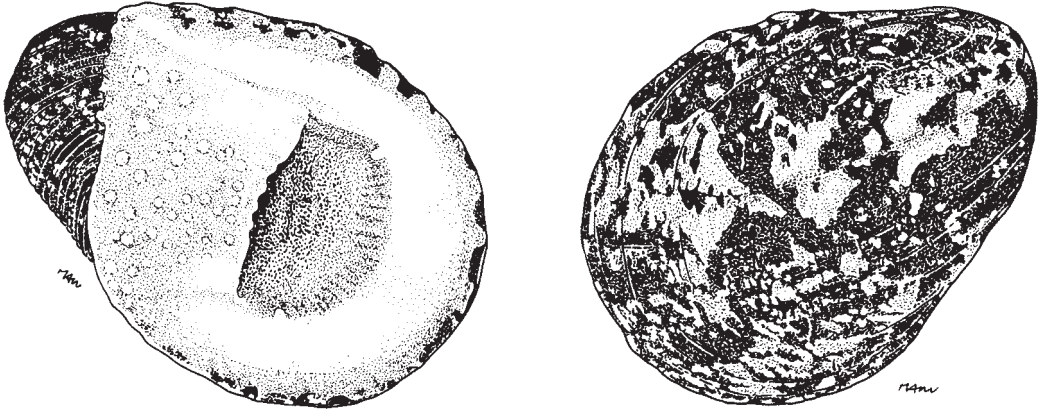
Tryon, G.W. Jr. 1888. *Manual of Conchology; structural and systematic. With illustrations of the species. Vol.X. Family Neritidae.* Philadelphia, Academy of Natural Sciences, pp. 3-82.

Van Benthem Jutting, W.S.S. 1956. Systematic studies on the non-marine mollusca of the Indo-Australian Archipelago. V. Critical revision of the Javanese freshwater gastropods. *Treubia*, 23(2):259-477.

Nerita albicilla Linnaeus, 1758

Frequent synonyms / misidentifications: *Nerita imperfecta* Röding, 1798; *N. ustulata* Sowerby, 1883; *N. venusta* Dunker, 1844; *Theliostyla albicilla* (Linnaeus, 1758) / None.

FAO names: En - Oxpalate nerite; Fr - Néríte brûlée.



ventral view

(after Short and Potter, 1987)

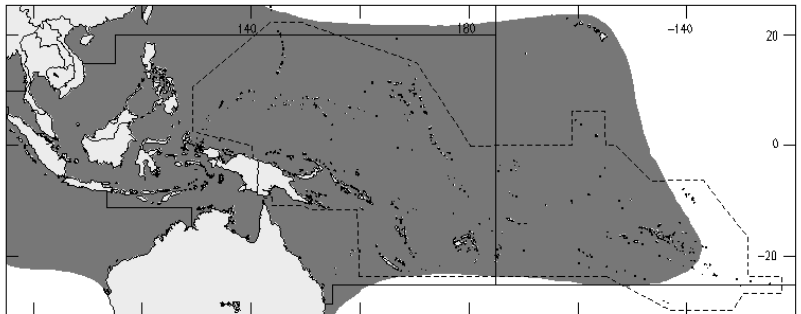
dorsal view

Diagnostic characters: Shell thick, globose, with a flat spire, width conspicuously greater than length. Outer surface dull, with broad and low, rounded spiral cords which often become obsolete towards the outer lip of aperture, in addition to fine, wavy growth lines. Outer lip somewhat flattened, with small denticles at inner margin. Anteriormost and posteriormost teeth somewhat larger than the other ones. Columellar shield wide and flat, with numerous, distinct pustules over most of its surface and with a few small teeth at centre of its inner margin. Operculum finely granulose. Colour: outer coloration very variable, mostly white or cream, marbled and often spirally banded with grey, brown, black, or orange. Aperture and columellar shield whitish, often tinged yellow interiorly. Operculum grey, greenish, or yellow.

Size: Maximum shell length 3.5 cm, commonly to 2.5 cm.

Habitat, biology, and fisheries: Abundant in rocky shores, forming dense colonies in upper mid-tidal pools, on damp and submerged rocks and in crevices. Collected for its edible flesh and for its shell in various localities of the area.

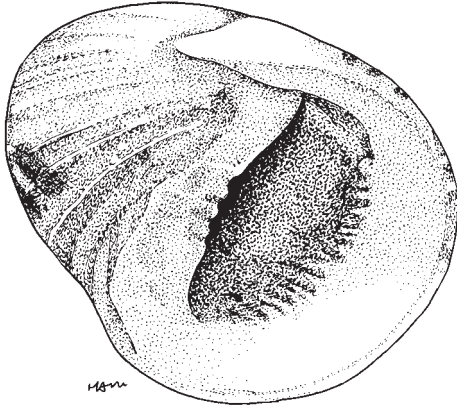
Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including the Red Sea and the Persian Gulf, to eastern Polynesia; north to South Japan and Hawaii, and south to northern New South Wales.



***Nerita chameleon* Linnaeus, 1758**

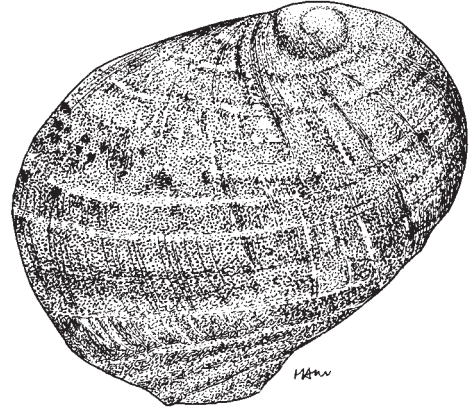
Frequent synonyms / misidentifications: *Nerita bizonalis* Lamarck, 1822; *Ritena chameleon* (Linnaeus, 1758) / None.

FAO names: En - Chameleon nerite; Fr - Néríte chaméléon.



ventral view

(after Wilson, 1993)



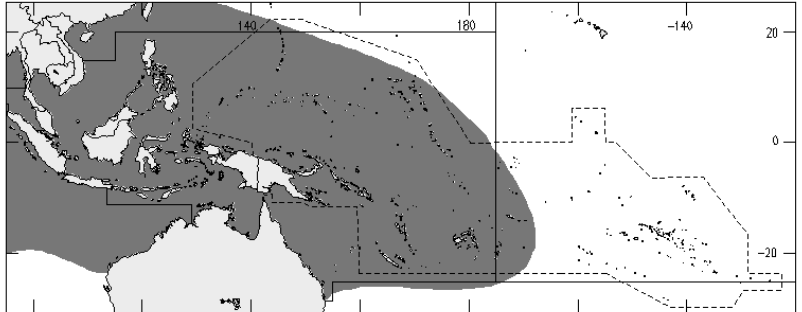
dorsal view

Diagnostic characters: Shell thick, globose, with a low spire, width and length about equal. Outer surface dull, with rough spiral ribs and sometimes fine cords between them. Outer lip of the aperture with sharp outer edge and with 10 to 12 small, equal-sized denticles at inner margin. Columellar shield flat to slightly depressed, relatively narrow, with a few wrinkles and pustules, and 2 to 4 centrally placed small teeth on its inner margin. Operculum finely granulose. **Colour:** outer coloration very variable, sometimes uniformly white, grey, black, yellow or orange brown, often banded, maculated or spotted with grey, black or purplish brown. Aperture and columellar shield white. Operculum grey or greenish in colour.

Size: Maximum shell width 3.5 cm, commonly to 2.5 cm.

Habitat, biology, and fisheries: Abundant on intertidal rocks. Regularly collected and marketed in the northern Philippines for its shell which is extremely variable in colour, and for its edible flesh.

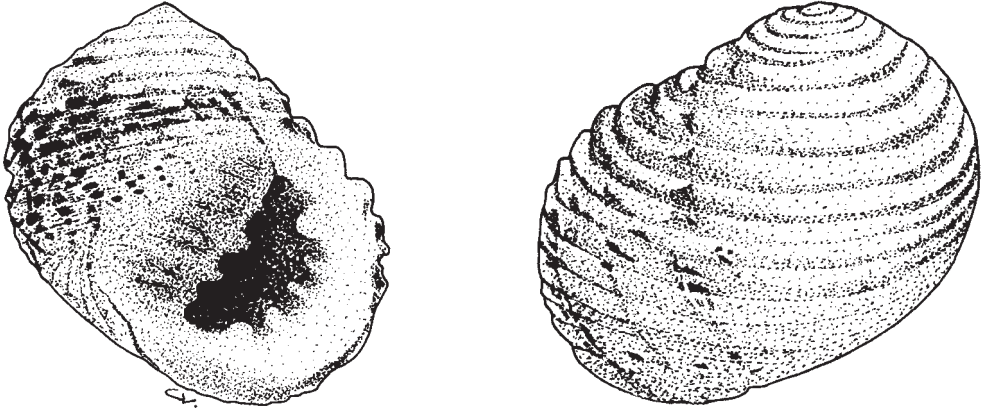
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and Reunion Island, to western Polynesia; north to southern Japan and south to southern Queensland.



***Nerita plicata* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Nerita versicolor* Quoy and Gaimard, 1834 (not of Gmelin, 1791); *Ritena plicata* (Linnaeus, 1758) / None.

FAO names: En - Plicate nerite; Fr - Néríte plissée.



ventral view

(after Short and Potter, 1987)

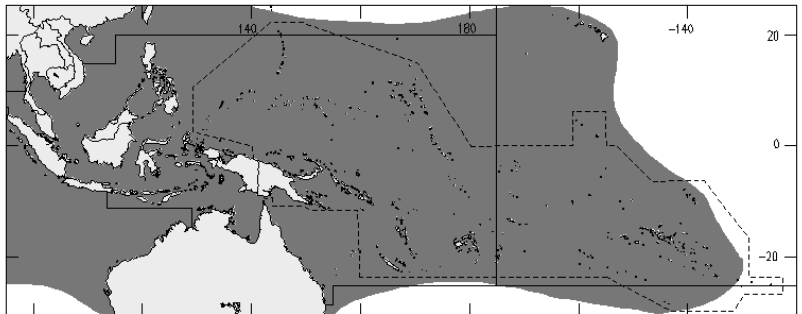
dorsal view

Diagnostic characters: Shell thick, turbinate, with a moderately high, conical spire and large globose body whorl. Outer surface dull, with about 15 to 20 coarse, rounded spiral ribs on body whorl, ribs wider spaced near the suture than toward the base. Outer lip of the aperture thick, crenulate by the external ribbing, with 5 to 7 strong, prominent teeth at its inner margin. Anteriormost and posteriormost teeth larger than the other ones. Columellar area calloused and convex, with transverse wrinkles and about 4 strong, elongate and squared teeth on its markedly rounded inner margin. Operculum smooth and shiny, with a narrow, dull thickening at anterior end. **Colour:** outside of shell uniformly white or creamy yellow, sometimes spotted with grey or purplish brown. Aperture and columellar area white, occasionally rimmed with yellow or orange internally. Operculum fawn.

Size: Maximum shell length 3.5 cm, commonly to 2.5 cm.

Habitat, biology, and fisheries: Very common in the upper part of shores, often in crevices and pits of rock benches, or on branches of littoral trees overhanging the water. Moves up and down the shore in correlation with the prevailing high water level of the tide and can withstand heat and desiccation for long periods. Used as food by coastal populations of oceanic islands in the West Pacific.

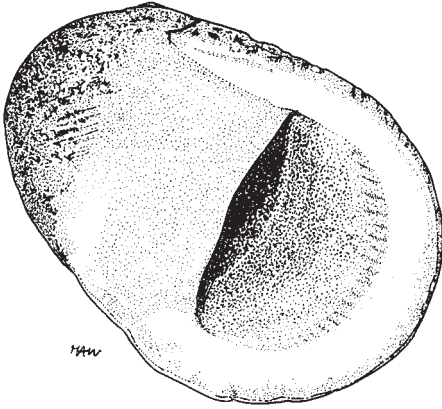
Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, to eastern Polynesia; north to southern Japan and Hawaii, and south to northern New South Wales and New Caledonia.



Nerita polita Linnaeus, 1758

Frequent synonyms / misidentifications: *Amphinerita polita* (Linnaeus, 1758) / None.

FAO names: En - Polished nerite; Fr - Nérîte lustrée.



ventral view



dorsal view

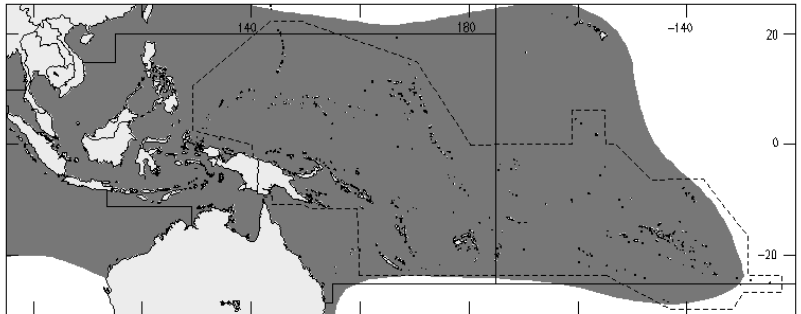
(after Short and Potter, 1987)

Diagnostic characters: Shell thick and heavy, subglobose, with a flat spire, width greater than length. Outer surface polished and smoothish, sculpture reduced to axial growth lines and grooves. Outer lip of the aperture with numerous, small and low denticles at inner margin. Columellar shield smooth except for several weak, rather rounded teeth at centre of its inner margin. Operculum smooth, except for a narrow, obliquely grooved area near the outer margin. **Colour:** outer coloration highly variable, white, cream, brown, dark grey, or green, variously marbled, streaked or spotted with brown, dark grey, or green, orange, or pink; 3 deep purplish pink spiral bands sometimes present. Aperture and columellar shield glossy white, sometimes rimmed with dark orange or red on inner margins. Operculum brownish or grey to nearly black.

Size: Maximum shell length 4 cm, commonly to 3 cm.

Habitat, biology, and fisheries: Common in the upper intertidal rocky and coral reef areas. Often buried in the sand during the day, and emerging at night to graze on nearby rocks. This very common species is prized for food and for its attractive shell. Frequently marketed in the Fiji Islands.

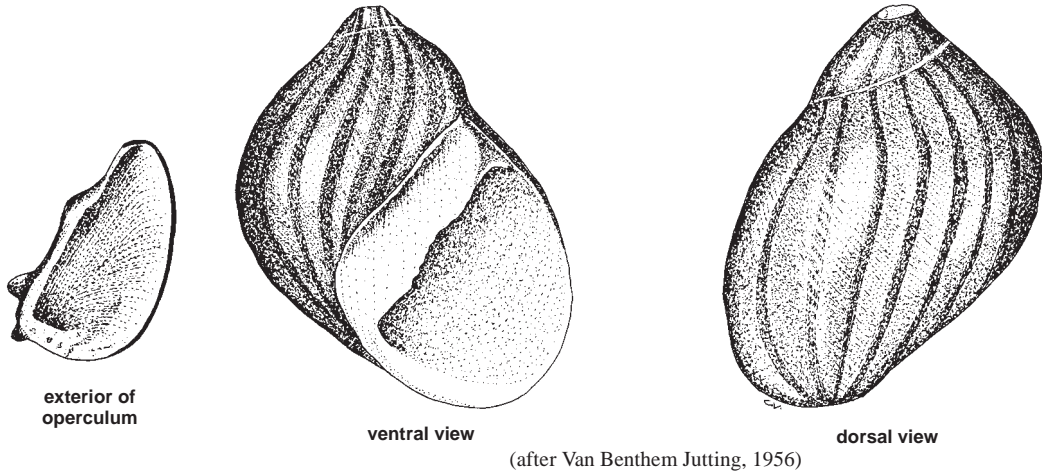
Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, Mascareign islands and the Red Sea, to eastern Polynesia; north to southern Japan and Hawaii, and south to northern New South Wales and New Caledonia.



Neritina turrita (Gmelin, 1791)

Frequent synonyms / misidentifications: *Nerita turrita* Gmelin, 1791; *Neritina semiconica* (Lamarck, 1822); *N. strigilata* (Lamarck, 1822); *Vittina turrita* (Gmelin, 1791) / None.

FAO names: En - Turreted nerite; Fr - Néríte tourelle.

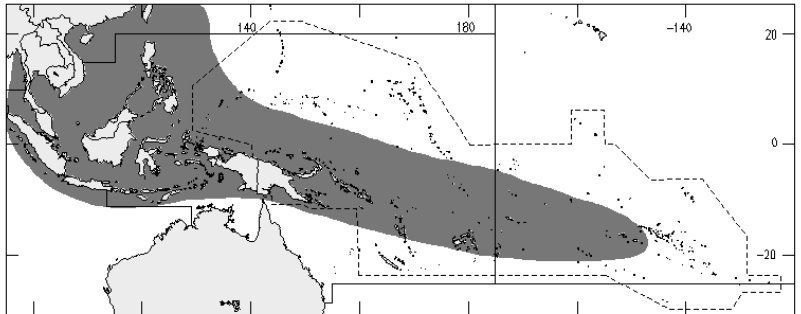


Diagnostic characters: Shell rather thin but solid, **elongate-ovate** in outline, **with an elevated, conical spire** and large, inflated body whorl. Spire often eroded at the apex, **whorls** rapidly increasing in size, convex but **slightly concave just below the** strongly embracing **suture**. Outer **surface smooth** except for fine axial growth marks, **with a shiny, thick and adherent periostracum** which is covered by a microscopical pattern of crowded, tiny, cancellate lines. **Outer lip** of the aperture **thin, sharp and smooth, not toothed inside**. **Columellar shield** thick and **smoothish, with numerous, small teeth along its inner edge**. **Operculum finely granulate, with a rounded, protruding knob near anterior end**, in addition to the projecting peg of the inner margin. **Colour: outer coloration variable, shiny, usually bluish grey, mahogany or yellowish brown with black, somewhat undulating and oblique, axial stripes, or with fine, light axial lines on a dark background, or sometimes with 3 or 4 spiral row of dark spots on a light brown background. Aperture whitish, columellar shield porcelaneous white or yellowish.** Operculum creamy or yellowish brown.

Size: Maximum shell length 3.5 cm, commonly to 2.5 cm.

Habitat, biology, and fisheries: On muddy bottoms, in brackish water of estuaries and in mangrove areas, but also in running fresh water. This species is used as food, and the shell is collected for its conspicuously striped colour. Sold in local markets of the northern Philippines.

Distribution: Eastern part of the Indian Ocean and the tropical West Pacific, from the Andaman Sea to eastern Polynesia; north to southern Japan, and south to southern Indonesia and Melanesia.

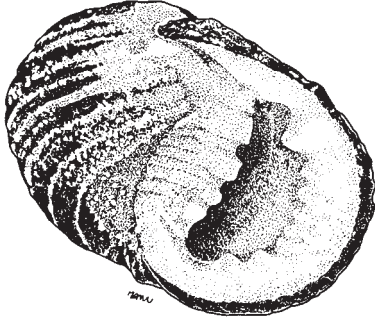


***Nerita costata* Gmelin, 1791**

Frequent synonyms / misidentifications: *Nerita grossa* Born, 1780 (not of Linnaeus, 1758); *N. scabricosta* Delessert, 1841; *Ritena costata* (Gmelin, 1791) / None.

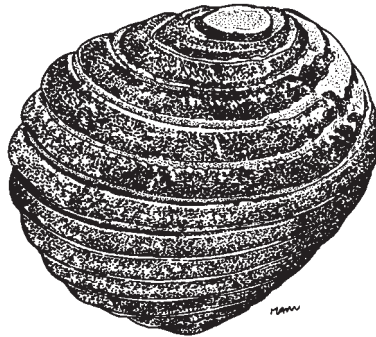
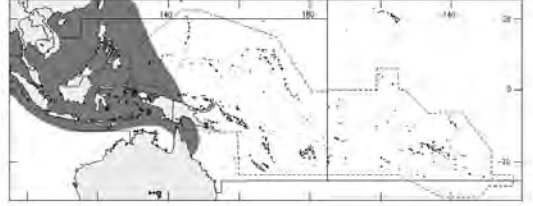
En - Costate nerite; **Fr** - Nérîte côtelée.

Maximum shell width 3.5 cm, commonly to 2.5 cm. Common on intertidal rocks. Collected for food and for the shell by coastal populations. Indo-West Pacific, from the Gulf of Bengal to Papua New Guinea; north to southern Japan and south to Queensland.



ventral view

(after Short and Potter, 1987)



dorsal view

***Nerita picea* Récluz, 1841**

Frequent synonyms / misidentifications: None / None.

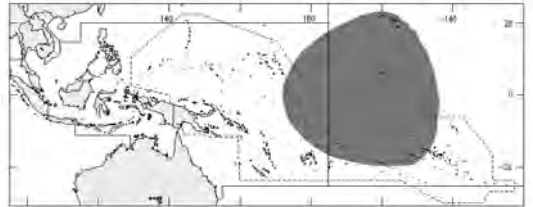
En - Pitchy nerite; **Fr** - Nérîte ébène.

Maximum shell length 3 cm, commonly to 2 cm. On rocks and corals. Intertidal. Used as food where common. Oceanic islands of Polynesia, from Hawaii to the Society Islands.



ventral view

(after Salvat and Rives, 1975)



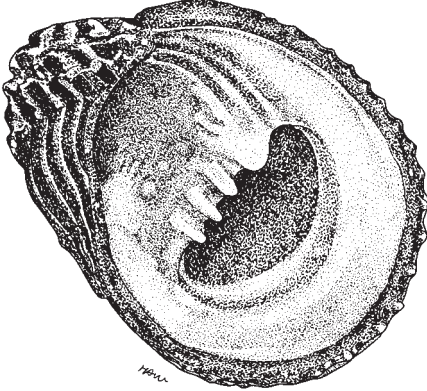
dorsal view

***Nerita planospira* Anton, 1839**

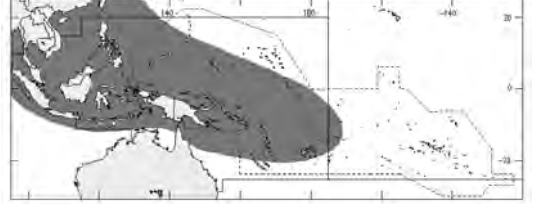
Frequent synonyms / misidentifications: *Theliostyla planospira* (Anton, 1839) / None.

En - Flatspired nerite; **Fr** - Nérîte à spire plate.

Maximum shell length 3.5 cm, commonly to 2 cm. On intertidal mud and rock bottoms and in mangrove areas. Locally common. Occasionally collected for food and shellcraft. Indo-West Pacific, from the Gulf of Bengal to western Polynesia; north to southern Japan and south to northern Queensland.



ventral view
(after Pilsbry, 1889)

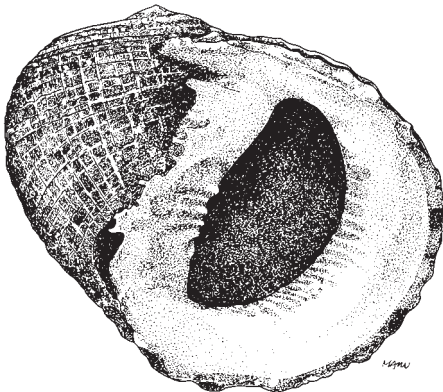


***Nerita squamulata* Le Guillou, 1841**

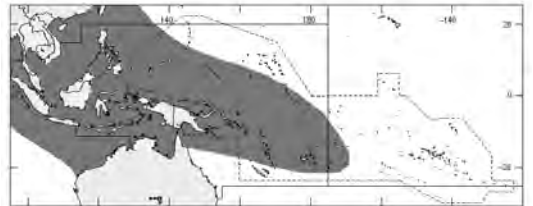
Frequent synonyms / misidentifications: *Ritena squamulata* (Le Guillou, 1841); *Theliostyla squamulata* (Le Guillou, 1841) / *Nerita chameleon* Linnaeus, 1758.

En - Scaly nerite; **Fr** - Nérîte écailleuse.

Maximum shell width 3.5 cm, commonly to 2.5 cm. Common on intertidal rocks. Collected with other nerites by coastal populations. Used as food and for shellcraft. Distribution imperfectly known because of frequent confusion with *Nerita chameleon*. Probably from India to western Polynesia; north to southern Japan and south to northern Queensland.



ventral view
(after Wilson, 1993)



***Nerita undata* Linnaeus, 1758**

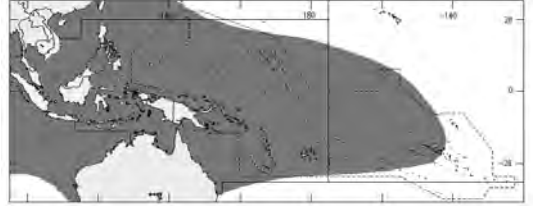
Frequent synonyms / misidentifications: *Nerita chrystoma* Récluz, 1841; *N. striata* Burrow, 1815; *Ritena undata* (Linnaeus, 1758) / None.

En - Waved nerite; **Fr** - Néríte ondée.

Maximum shell length 4 cm, commonly to 3 cm. On rocky shores, often in crevices and other protected areas. Collected where common, for food and shellcraft, in many localities of the whole Indo-West Pacific. Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to southern Japan, and south to southern Queensland and New Caledonia.



ventral view (after Dance, 1974)

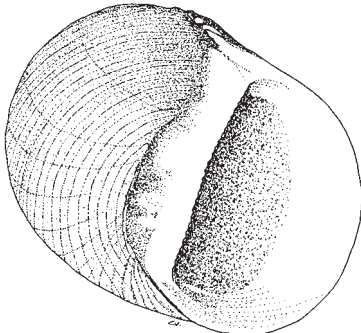


***Neritodryas subsulcata* (Sowerby, 1836)**

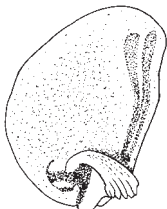
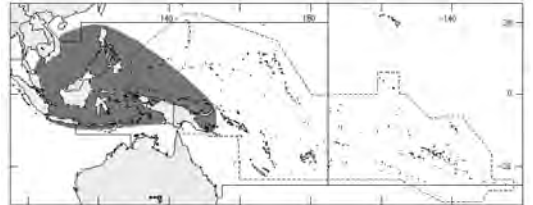
Frequent synonyms / misidentifications: *Neritina subsulcata* Sowerby, 1836 / *Neritodryas cornea* (Linnaeus, 1758).

En - Weakly cut nerite; **Fr** - Néríte sillonnée.

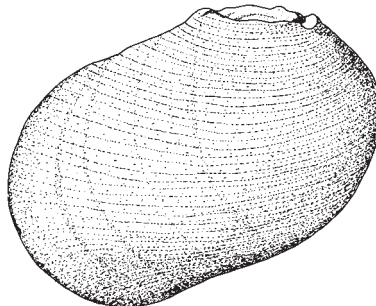
Maximum shell width 3 cm, commonly to 2.5 cm. Abundant in mangrove, brackish-water areas. Intertidal. Locally collected for food in Indonesia. Shell used to make ornaments. Tropical West Pacific, from Malaysia and Indonesia to Melanesia; north to the Philippines and south to southern Indonesia.



ventral view



interior of operculum



dorsal view

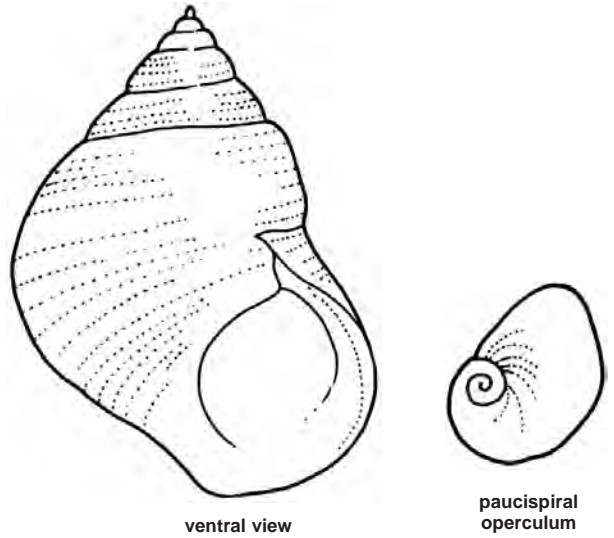
(after Van Benthem Jutting, 1956)

LITTORINIDAE

Periwinkles

Diagnostic characters: Shell ovate-conical, usually strong and without an umbilicus. Outer surface smoothish or with spiral or nodular sculpture. Periostracum absent. Aperture rounded, porcelaneous, without a siphonal canal. Columella smooth or with a tooth-like swelling. Operculum thin and corneous, with relatively few spiral coils and either ovate with a lateral nucleus or rounded with a subcentral nucleus. Head with a short snout and conical tentacles bearing eyes on small swellings at their outer bases. Foot rather strong, the 2 sides of which can move independently.

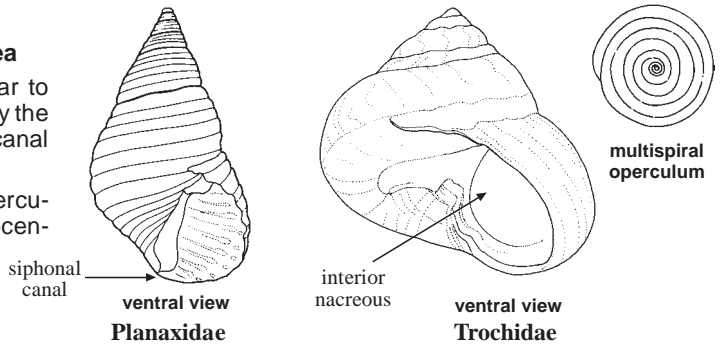
Habitat, biology, and fisheries: Widely distributed littoral animals, occurring in tropical, temperate to cold climates, in the intertidal zone and the splash area well above high tide levels. Species living high up the shore can survive desiccation, and have reduced gills and a vascularized mantle cavity acting as a primitive lung. Very common on rocky shores, or in tidal marshes and mangroves. Herbivores, feeding on algae which are grazed with a powerful radula. Sexes separate, fertilization internal. Eggs generally laid in small corneous capsules and hatching as free-swimming planktonic larvae, or brooded in the mantle cavity of the female. Littorinidae are easily collected on the shore by coastal inhabitants, for subsistence or for local shellcraft.



Similar families occurring in the area

Planaxidae: shape of shell very similar to Littorinidae, but readily distinguished by the short, but distinct, anterior siphonal canal of the aperture.

Trochidae: shell nacreous inside; operculum rounded, with many coils and a subcentral nucleus.



Key to species of interest to fisheries occurring in the area

- 1a. Operculum ovate, with a few spiral coils and a lateral nucleus (Fig. 1a); columella completely smooth -> 2
1b. Operculum rounded, with a moderate number of spiral coils and a central nucleus (Fig. 1b); columella with a more or less developed tooth-like swelling -> 3

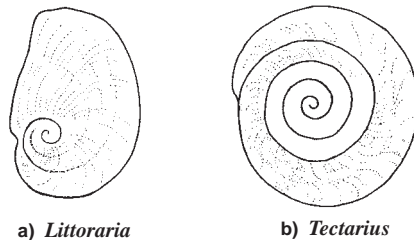


Fig. 1 operculum (exterior)

- 2a. Outer surface with 2 spiral rows of nodules; blue-grey in colour, with whitish nodules and brown columella (Fig. 2) *Nodilittorina pyramidalis*
- 2b. Outer surface without nodulose sculpture; pale brown in colour, with dense pattern of oblique, irregular dark stripes (Fig. 3) *Littoraria scabra*
- 3a. Shell relatively large (up to 6.5 cm in length); shoulder of whorls prominent, with a row of keeled spines (Fig. 4) *Tectarius pagodus*
- 3b. Shell relatively small (up to 4 cm in length); shoulder not prominent, without a row of carinate spines → 4

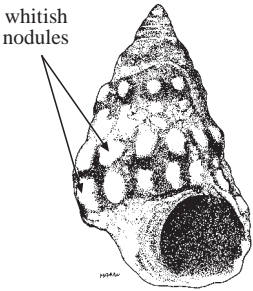


Fig. 2 *Nodilittorina pyramidalis* (ventral view)

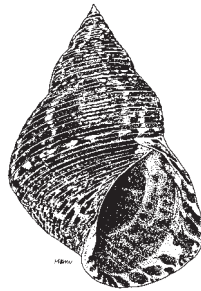


Fig. 3 *Littoraria scabra* (ventral view)

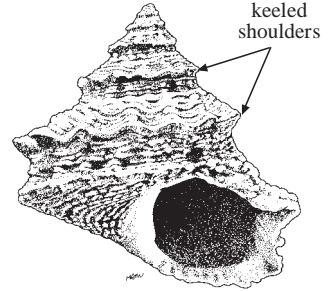


Fig. 4 *Tectarius pagodus* (ventral view)

- 4a. Suture deep; outer colour plain dull grey or greenish grey (Fig. 5). *Tectarius grandinatus*
- 4b. Suture shallow; outer colour cream to pinkish orange, with a dark spiral band under the suture (Fig. 6) *Tectarius coronatus*

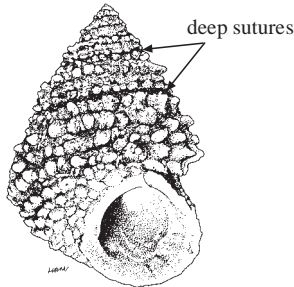


Fig. 5 *Tectarius grandinatus* (ventral view)

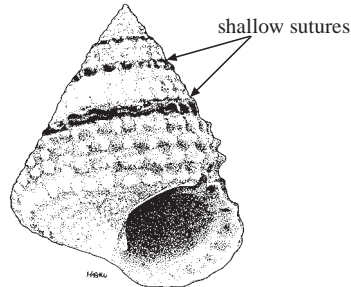







Fig. 6 *Tectarius coronatus* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Littoraria scabra* (Linnaeus, 1758)
-  *Nodilittorina pyramidalis* (Quoy and Gaimard, 1833)
-  *Tectarius coronatus* Valenciennes, 1832
-  *Tectarius grandinatus* (Gmelin, 1791)
-  *Tectarius pagodus* (Linnaeus, 1758)

References

Bandel, K. and D. Kadolsky. 1982. Western Atlantic species of *Nodilittorina* (Gastropoda: Prosobranchia): Comparative morphology and its functional, ecological, phylogenetic and taxonomic implications. *Veliger*, 25(1):1-42.

Reid, D.G. 1986. *The littorinid molluscs of mangrove forests in the Indo-Pacific region. The genus Littoraria*. London, British Museum (Natural History), 228 p.

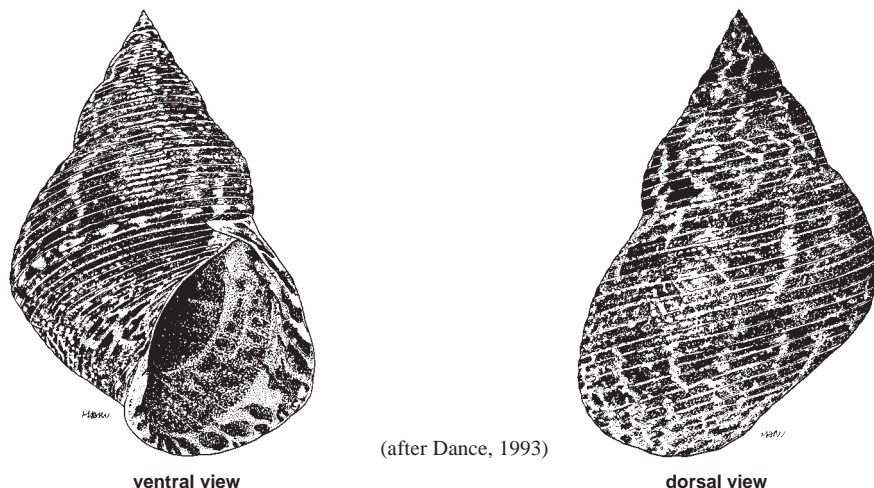
Rosewater, J. 1970. The family Littorinidae in the Indo-Pacific. Part I. The subfamily Littorininae. *Indo-Pac. Moll.*, 2(11):417-506.

Rosewater, J. 1972. The family Littorinidae in the Indo-Pacific. Part II. The subfamilies Tectariinae and Echininae. *Indo-Pac. Moll.*, 2(12):507-528.

Littoraria scabra (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Littorina scabra* (Linnaeus, 1758); *Littorinopsis scabra* (Linnaeus, 1758) / *Littorina angulifera* Lamarck, 1822.

FAO names: En - Rough periwinkle; Fr - Littorine rugueuse.



(after Dance, 1993)

ventral view

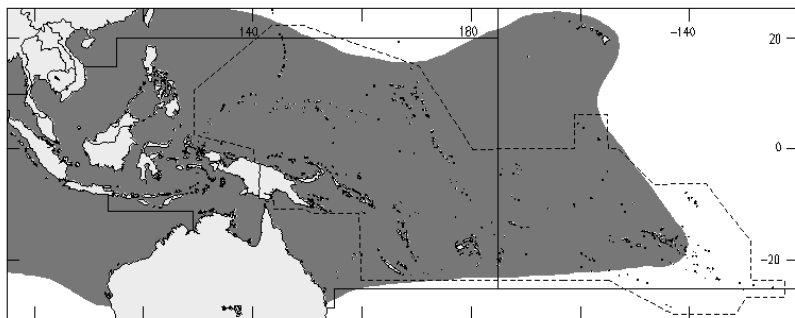
dorsal view

Diagnostic characters: Shell thin but solid, with a tall, conical spire and low sculpture. Spire whorls convex, with a narrowly channeled, incised suture, numerous, fine, low and flattened spiral cords and a raised, rounded cord determining a well-marked angle at periphery. Outer lip of aperture thin and smooth. Columella smooth, straightish anteriorly and meeting the basal end of shell at an acute angle. Operculum ovate, with a few spiral coils and lateral nucleus. **Colour:** outside of shell whitish to pale brown, with dense pattern of dark brown and black dashes mostly on spiral cords, generally more or less aligned into oblique axial stripes. Peripheral cord usually with conspicuous white gaps between the dashes. Aperture pale yellow to whitish, with the outer dark pattern showing through. Columella white, sometimes stained brown or purple.

Size: Maximum shell length 4.4 cm, commonly to 3 cm.

Habitat, biology, and fisheries: Abundant on trees and roots, at the seaward edge of mangrove areas, or sometimes on driftwood on sandy shores where mangroves are absent. Rare on sheltered rocks. Collected locally for food, notably in Viet Nam, the Gulf of Thailand and Indonesia.

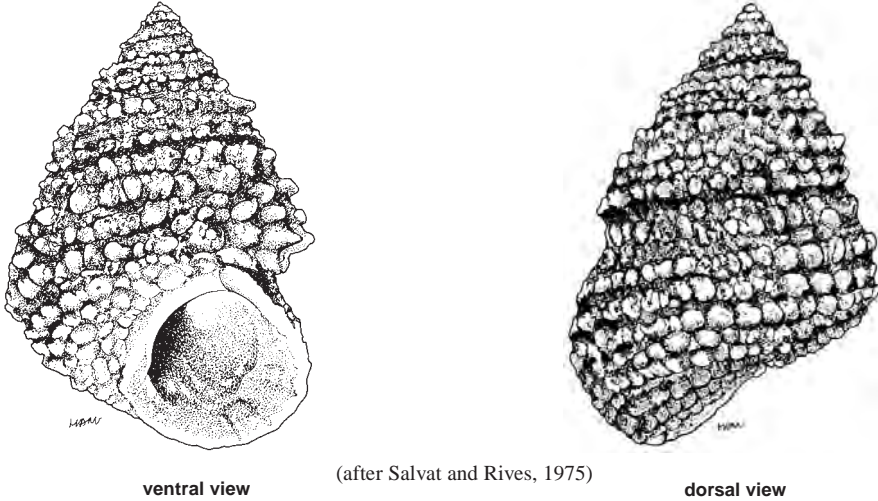
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to southern Japan and Hawaii, and south to southern Queensland and New Caledonia.



Tectarius grandinatus (Gmelin, 1791)

Frequent synonyms / misidentifications: *Tectarius bullatus* (Martyn, 1784) (Invalid name); *T. coronarius* (Lamarck, 1816) / None.

FAO names: En - Hailstorm prickly-winkle; Fr - Littorine grêlée.

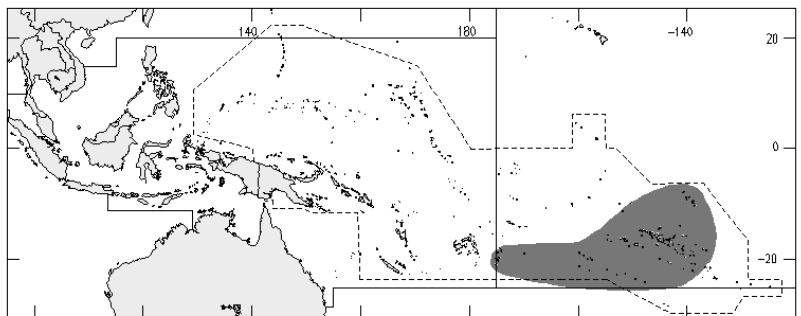


Diagnostic characters: Shell thick, with high conical shape and strong sculpture. Spire whorls convex, with deeply channeled suture, 4 spiral rows of rounded spines and a few, narrow spiral threads between them. Spines generally not regularly aligned axially. Base of body whorl somewhat flattened, with nodulose spiral cords. Outer lip of the rounded aperture strongly thickened and grooved inside, tapering to a thinner, crenulated outer edge. Inner lip with a thin glaze posteriorly and a tooth-like swelling anteriorly. Operculum rounded, with a moderate number of coils and a central, darker nucleus. Colour: outside of shell generally yellowish white, often more or less coated by a thin, easily peeled off, greyish brown periostracum. Aperture whitish, stained with brown on the posterior glaze of inner lip.

Size: Maximum shell length 4 cm, commonly to 3 cm.

Habitat, biology, and fisheries: On coral reef flats, near high tide levels, on jagged pieces of raised reef. Collected in Polynesia for food and to make decorative items.

Distribution: Restricted to the tropical Southwest Pacific, from Tonga and Cook islands to French Polynesia.

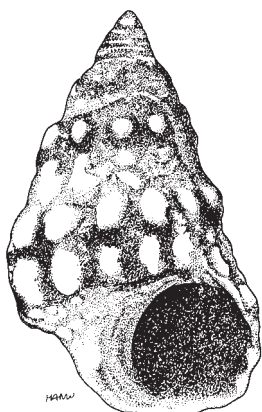


***Nodilittorina pyramidalis* (Quoy and Gaimard, 1833)**

Frequent synonyms / misidentifications: *Littorina monilifera* Eydoux and Souleyet, 1852; *L. pyramidalis* Quoy and Gaimard, 1833; *Trochus nodulosus* Gmelin, 1791 (not of Solander, 1766); *Turbo trochiformis* Dillwyn, 1817 (not of Brocchi, 1814) / None.

En - Pyramidal prickly-winkle; **Fr** - Littorine pyramidale.

Maximum shell length 2.5 cm, commonly to 2 cm. On shore rocks. Upper intertidal zone and splash area of the supralittoral zone. Locally collected for food and for shell trade, especially in Viet Nam and the Gulf of Thailand. Indo-West Pacific, from the west coast of India to eastern Polynesia; north to Japan and south to southern New South Wales and Norfolk Island; also occurring in Pitcairn and Easter islands (subspecies *pascua*).



ventral view

(after Kira, 1962)

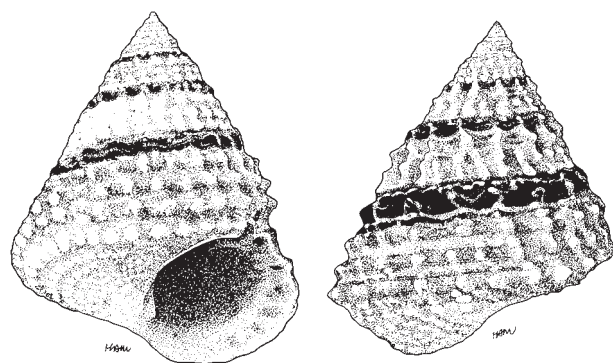


***Tectarius coronatus* Valenciennes, 1832**

Frequent synonyms / misidentifications: ? *Tectarius rugosus* (Wood, 1828) / *Tectarius papillosus* (Lamarck, 1822) (= *Tectarius tectumperspicum* (Linnaeus, 1758)).

En - Coronate prickly-winkle; **Fr** - Littorine couronnée.

Maximum shell length 4 cm, commonly to 3 cm. On shore rocks and limestone cliffs. High in the intertidal zone, well above high levels of neap tide. Sometimes used as food, but mainly collected for its decorative shell. Restricted to the tropical West Pacific, from the Philippines to central Indonesia.



ventral view

dorsal view

(after Dance, 1993)

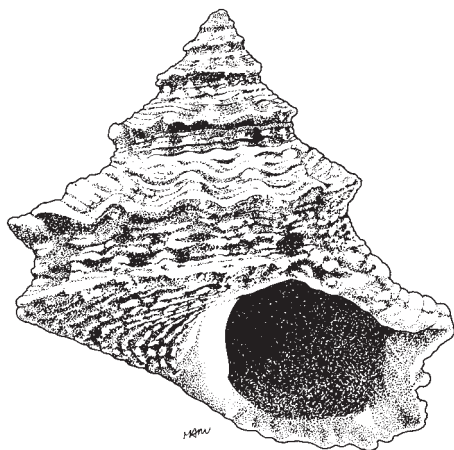


Tectarius pagodus (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Tectarius bicolor* (Lamarck, 1822) / None.

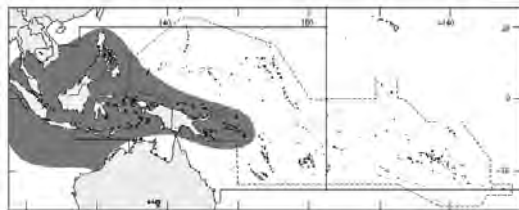
En - Pagoda prickly-winkle; **Fr** - Littorine pagode.

Maximum shell length 6.5 cm, commonly to 5 cm. Rocky shores and limestone cliffs. Upper intertidal and supralittoral zones. Locally collected for food and shell trade. Easternmost part of the Indian Ocean and the tropical West Pacific, from the Andaman Sea and Cocos (Keeling) Islands to Melanesia; north to the Philippines and south to southern Papua New Guinea.



ventral view

(after Dance, 1974)



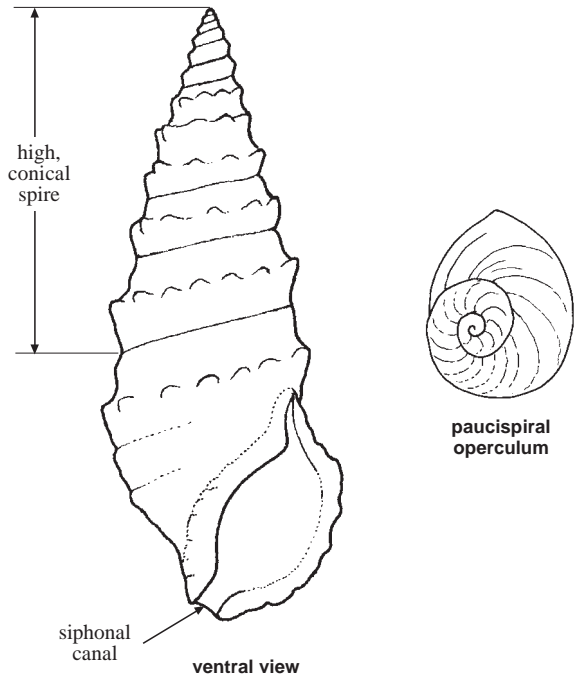
CERITHIIDAE

Ceriths

D **Diagnostic characters:** Shell elongate, thick and solid, sharply conical with a high, many-whorled spire and small aperture. Sculpture variable, usually spiral or nodulose, and with axial ribs or varices. Umbilicus generally absent. Periostracum obsolete. **Aperture with a distinct, anterior siphonal canal** which may be drawn out, up-turned and often laterally twisted. **Outer lip somewhat expanded**, usually notched posteriorly. Inner lip smooth or twisted. **Operculum ovate, corneous, with a few spiral coils** and an eccentric nucleus. Head with a large snout and long, cylindrical tentacles bearing eyes on swellings of their outer bases. Foot broad and short, angular anteriorly. Fleishy siphon weakly developed.

Habitat, biology, and fisheries: Mainly tropical to warm temperate, shallow water animals living on sandy to muddy bottoms of marine and estuarine environments, though small species may abound under rocks or on marine vegetation. Gregarious herbivores, grazing on small algae, bacteria and organic debris. Species are often specialized to different sizes of food particles, and may be locally extremely abundant, where the habitat is favourable.

Sexes separate, fertilization internal; sperm transferred during mating in spermatophores which disintegrate at the entrance to the mantle cavity of the female. Eggs released on substrate in gelatinous masses, hatching as planktonic larvae or directly as crawling juveniles, depending on the species. As ceriths are often abundant and easily accessible in coastal areas, they are commonly collected locally, both for food and for shellcraft. Species living in mangroves frequently appear in the local markets mixed with Potamididae.



Similar families occurring in the area

Potamididae: shell very similar to Cerithiidae, but recognizable by the rounded operculum with many spiral coils.



Key to species of interest to fisheries occurring in the area

- 1a. Inner lip with a median oblique fold extending internally along the entire axis of shell (Fig. 1) → 2
- 1b. Inner lip without a median oblique fold → 5
- 2a. Sculpture mainly spiral (Fig. 2) *Rhinoclavis sinensis*
- 2b. Sculpture mainly axial → 3

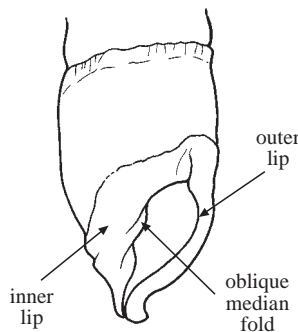


Fig. 1 detail of aperture

Fig. 2 *Rhinoclavis sinensis* (ventral view)

- 3a. Sculpture prominent, with 3 rows of rounded spines on each whorl (Fig. 3) . . . *Rhinoclavis aspera*
- 3b. Sculpture relatively low, without spines → 4
- 4a. Shell shape slender (length-width ratio about 4:1), with flat-sided whorls; outer colour often with spiral bands or blotches of tan to brown, more developed in the lower half of whorls (Fig. 4) *Rhinoclavis fasciata*
- 4b. Shell shape stocky (length-width ratio about 3:1), with inflated whorls; outer colour generally white to yellowish-brown, with pale banding under the suture (Fig. 5) *Rhinoclavis vertagus*
- 5a. Shell medium-sized to large (up to 8 cm in length, or more); anterior end of outer lip expanded over the siphonal canal in mature specimens → 6
- 5b. Shell small (not exceeding 5 cm in length); anterior end of outer lip not expanded over the siphonal canal in mature specimens → 8
- 6a. Whorls angulate in the middle, with a row of prominent nodules that do not disappear towards body whorl. → 7
- 6b. Whorls not angulate in the middle, with a row of spines under the suture that disappear towards body whorl (Fig. 6) *Pseudovertagus aluco*

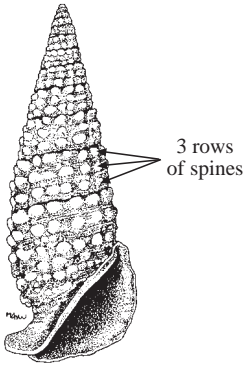


Fig. 3 *Rhinoclavis aspera* (ventral view)

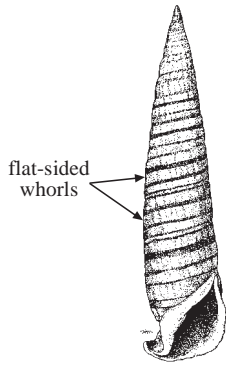


Fig. 4 *Rhinoclavis fasciata* (ventral view)

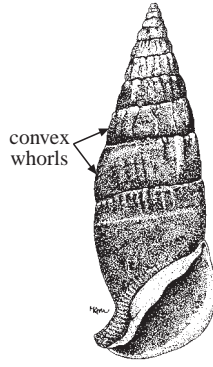


Fig. 5 *Rhinoclavis vertagus* (ventral view)

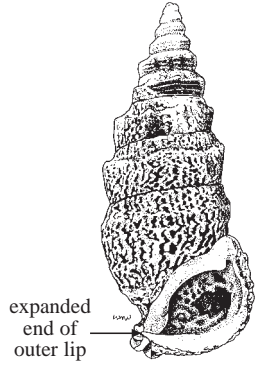


Fig. 6 *Pseudovertagus aluco* (ventral view)

- 7a. Shell large sized (up to 15 cm in length); median tubercles very strong; outer lip flaring (Fig. 7) *Cerithium nodulosum*
- 7b. Shell medium sized (up to 8 cm in length); median nodules moderately strong; outer lip not flaring (Fig. 8) *Cerithium echinatum*
- 8a. Shell relatively small (up to 3 cm in length); outer colour pale cream with black blotching on granules (Fig. 9) *Clypeomorus batillariaeformis*
- 8b. Shell relatively large (up to 5 cm in length); outer colour purple brown to black (Fig. 10) *Cerithium coralium*

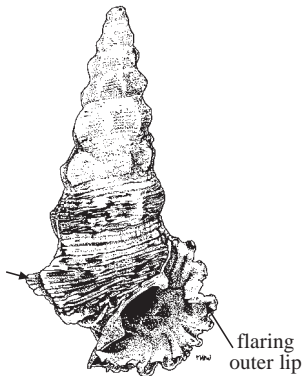


Fig. 7 *Cerithium nodulosum* (ventral view)



Fig. 8 *Cerithium echinatum* (ventral view)



Fig. 9 *Clypeomorus batillariaeformis* (ventral view)

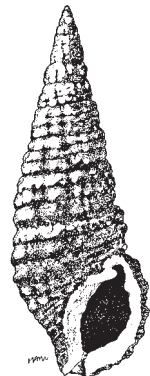











Fig. 10 *Cerithium coralium* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Cerithium coralium* Kiener, 1841
-  *Cerithium echinatum* Lamarck, 1822
-  *Cerithium nodulosum* Bruguière, 1792
-  *Clypeomorus batillariaeformis* Habe and Kosuge, 1966
-  *Pseudovertagus aluco* (Linnaeus, 1758)
-  *Rhinoclavis aspera* (Linnaeus, 1758)
-  *Rhinoclavis fasciata* (Bruguière, 1792)
-  *Rhinoclavis sinensis* (Gmelin, 1791)
-  *Rhinoclavis vertagus* (Linnaeus, 1758)

References

- Houbrick, R.S. 1978. The family Cerithiidae in the Indo-Pacific. Part 1: The genera *Rhinoclavis*, *Pseudovertagus* and *Clavocerithium*. *Monogr. mar. Moll.*, 1:1-130.
- Houbrick, R.S. 1985. Genus *Clypeomorus* Jousseaume (Cerithiidae: Prosobranchia). *Smithson. Contr. Zool.*, (403):131 p.
- Houbrick, R.S. 1992. Monograph of the genus *Cerithium* Bruguière in the Indo-Pacific (Cerithiidae: Prosobranchia). *Smithson. Contr. Zool.*, (510):210 p.

***Cerithium coralium* Kiener, 1841**

Frequent synonyms / misidentifications: *Cerithium granosum* Kiener, 1841; *Clypeomorus coralium* (Kiener, 1841) / *Cerithium ruppelli* Philippi, 1848.

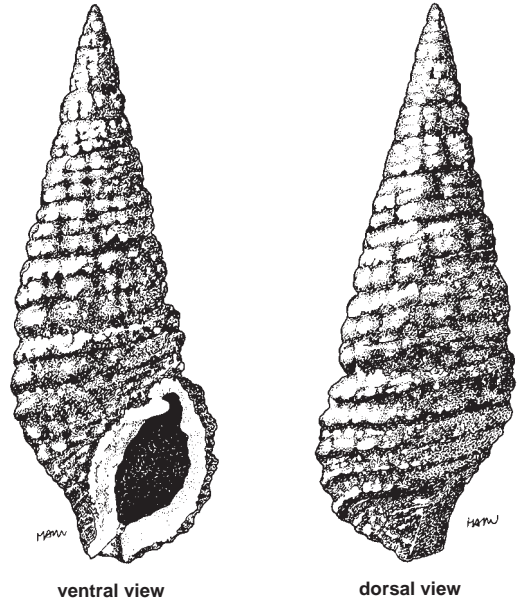
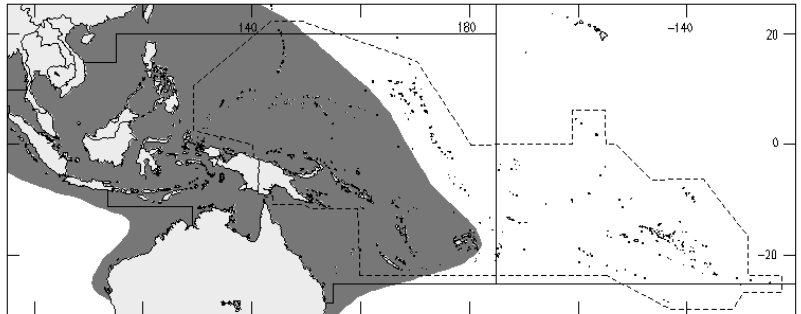
FAO names: En - Coral cerith; Fr - Cérithé corail.

Diagnostic characters: Shell moderately small and elongate, length almost 3 times as long as width. Spire whorls straight sided, with deeply incised sutures and randomly distributed, low axial varices. Sculpture of the spire composed of **granulose spiral cords** (3 in number on later whorls) and **many, fine spiral threads, crossed by axial ridges**. Body whorl wide, weakly constricted at the base, with 5 or 6 beaded spiral cords and numerous fine grooves, but **lacking axial ribs**. A rather strong axial varix present on dorsal side of body whorl. **Outer lip** of aperture **thickened** and somewhat protruding laterally, **weakly crenulate** on margin, with elongate denticles inside. **Columella** moderately concave, narrowly and thickly calloused, with a tooth-like ridge at posterior end but **without a median oblique fold**. Anterior **siphonal canal short, broad and only slightly recurved**. **Colour:** outer coloration of shell variable, **purple brown to black or dirty grey**, sometimes banded with brown or whitish, and **with dark granules**. **Aperture white**, sometimes brownish.

Size: Maximum shell length 5 cm, commonly to 3 cm.

Habitat, biology, and fisheries: On midtidal mud flats of estuarine and mangrove areas, commonly associated with various Potamididae such as *Cerithidea cingulata* (Gmelin). May occur in very dense populations. Often collected for food together with Potamididae, and sold with them in the local markets. An important species off the Coromandel coast of India.

Distribution: Indo-West Pacific, from the west coast of India and Sri Lanka to eastern Melanesia; north to Japan and south to New South Wales and New Caledonia.



(after Houbrick, 1992)

***Cerithium echinatum* Lamarck, 1822**

Frequent synonyms / misidentifications: *Cerithium mutatum* Sowerby, 1834; *C. rubus* Deshayes, 1843 / None.

FAO names: En - Spinose cerith; Fr - Cérithé épineux.

Diagnostic characters: Shell medium sized, stout and strongly sculptured, length only a little more than twice as long as the width. Spire whorls convex, with a median spiral cord bearing prominent, spinose nodules, 3 or 4 minor, sometimes spinose, nodulose spiral cords and incised spiral grooves between them. Nodes and spines often drawn out axially, forming low axial ridges. Aperture ovate, with a narrowly channeled posterior end. Outer lip thickened, somewhat protruding laterally, crenulate and spinose at margin, with its anterior end partly expanded over the siphonal canal. Columella slightly concave, with a thick callus, a well-marked lip and a strong ridge near posterior end, but without a median oblique fold. Anterior siphonal canal rather short, tubular and recurved dorsally and to the left. **Colour:** outside of shell cream, with variable purplish brown spots. Aperture porcelaneous white.

Size: Maximum shell length 8 cm, commonly to 6.5 cm.

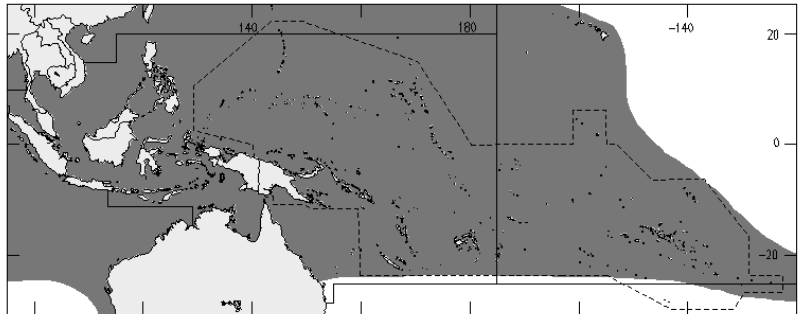
Habitat, biology, and fisheries: On rocky and coral reef areas. Intertidal and shallow sublittoral zones. Often very common. Collected by coastal populations in the tropical West Pacific for food and shell trade.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including the Red Sea and Madagascar, to eastern Polynesia and Easter Island; north to Japan, Midway and Hawaii, and south to southern Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)



***Cerithium nodulosum* Bruguière, 1792**

Frequent synonyms / misidentifications: *Cerithium erythraeonense* Lamarck, 1822 / None.

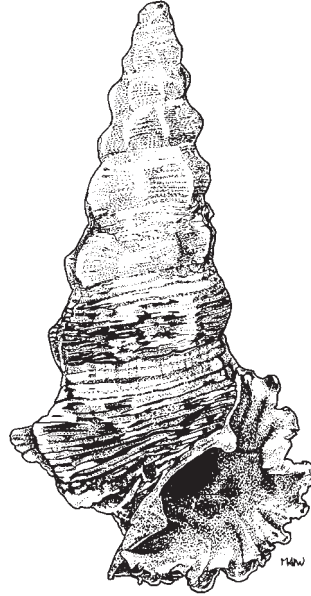
FAO names: En - Giant knobbed cerith; Fr - Cérithé noduleux.

Diagnostic characters: Shell large, solid, elongate and heavily sculptured. Spire whorls strongly angulate at periphery, each bearing a single row of conspicuous tubercles and a number of weakly nodulose spiral cords. Body whorl very large, with strongly prominent median tubercles on its dorsal side and a very large warty varix on left side, above the siphonal canal. Base strongly excavated, with about 5 coarse nodulose spiral ribs and deep grooves between. Aperture large, with a posterior canal determined by a strong spiral ridge near posterior end of inner lip. Outer lip thick, flaring, strongly crenulate and spirally channeled inside, with an anterior claw-like extension crossing over the siphonal canal. Columella concave, narrowly and thickly calloused, but without a median oblique spiral fold. Anterior siphonal canal rather short, constricted and recurved dorsally and laterally. **Colour:** outside of shell often encrusted with calcareous growths, dirty white or cream with irregular greyish brown axial spots, streaks and blotches. Aperture porcelaneous white, sometimes with a few dark blotches deeply inside.

Size: Maximum shell length 15 cm, commonly to 12 cm.

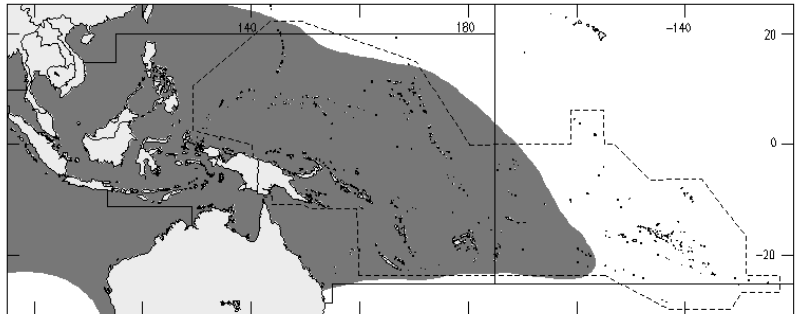
Habitat, biology, and fisheries: In sand and rubble, on intertidal reef flats, usually near the outer edge of reefs. Commonly collected in the Indo-West Pacific, for food and shell trade.

Distribution: Widespread in the Indo-West Pacific, from East Africa to western Polynesia; north to southern Japan and south to southern Queensland and New Caledonia; the form occurring from the Red Sea to the Gulf of Oman is usually distinguished under the name *Cerithium erythraeonense*.



ventral view

(after Short and Potter, 1987)



Clypeomorus batillariaeformis Habe and Kosuge, 1966

Frequent synonyms / misidentifications: *Cerithium moniliferum* Kiener, 1841 (not of Deshayes, 1833) / *Cerithium humilis* Dunker, 1861; *C. morus* Lamarck, 1822; *C. tuberculatum* (Linnaeus, 1758); *Clypeomorus bifasciata* (Sowerby, 1855).

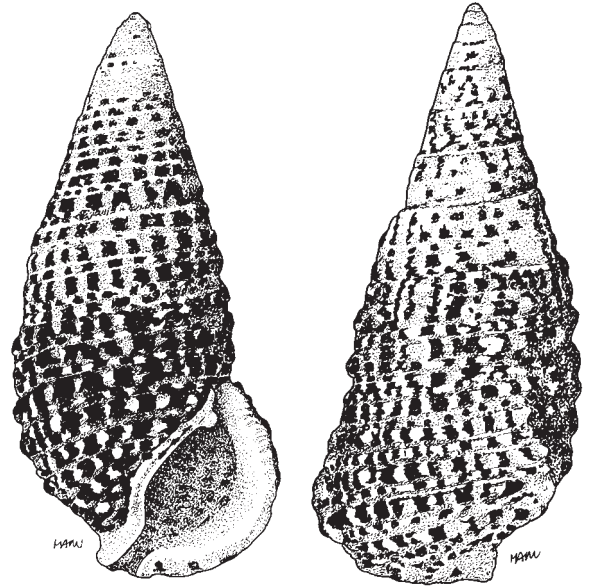
FAO names: En - Necklace cerith; Fr - Cérithé collier.

Diagnostic characters: Shell small, squat, length always less than 3 times as long as width. Surface of early whorls usually strongly eroded. Spire whorls slightly inflated, with moderately incised sutures, 3 equally spaced spiral cords that are beaded with smooth, rounded to somewhat elongate granules, and finer interstitial spiral threads. Anterior cord frequently smaller and with less distinct granules than the 2 other cords. Body whorl with 6 to 8 main spiral beaded cords, and a strong, slightly oblique, axial varix on left part of dorsal side. Beaded sculpture of shell usually not aligned axially. Outer lip of aperture rounded, moderately thickened, smooth to weakly crenulate on margin and finely lirate inside. Columella concave, poorly calloused, with a thick ridge at posterior end but without a median oblique fold. Anterior siphonal canal very short and narrow, deeply incised directed leftward at about 45° to shell axis. **Colour:** outside of shell with variable coloration, often pale grey or cream with dark brown or black granules which may be drawn out into transverse lines. **Aperture whitish** on margins of mature specimens, spirally banded with black inside.

Size: Maximum shell length 3 cm, commonly to 2.5 cm.

Habitat, biology, and fisheries: On sandy bottoms of reef flats and estuaries. Intertidal, often in extremely dense populations. Collected in fairly large quantities in the northern Philippines.

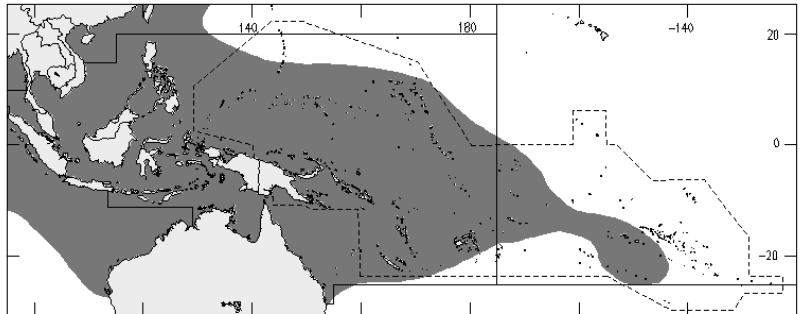
Distribution: Widespread in the Indo-West Pacific, from East Africa, including the Seychelles and Western India, to eastern Polynesia, but not in the northwestern part of the Indian Ocean, the Red Sea or the Persian Gulf; north to southern Japan and south to southern Queensland and New Caledonia.



ventral view

dorsal view

(after Wilson, 1993)



Rhinoclavis fasciata (Bruguière, 1792)

Frequent synonyms / misidentifications: *Cerithium bandatum* Perry, 1811; *C. fasciatum* Bruguière, 1792; *C. procerum* Kiener, 1841; *Clava fasciata* (Bruguière, 1792) / None.

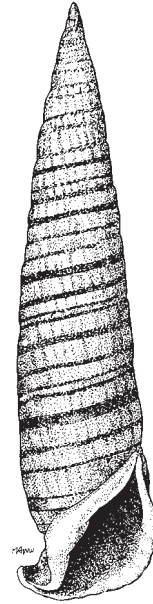
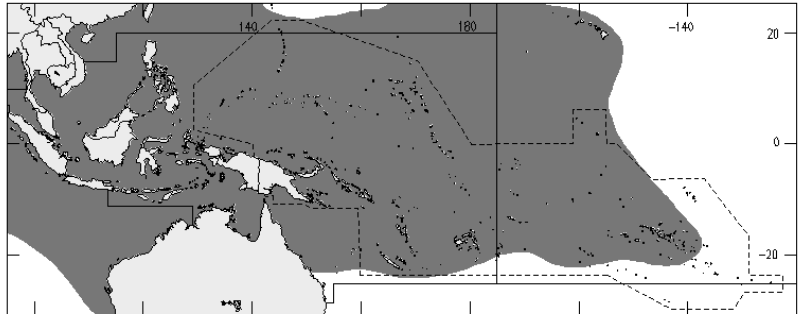
FAO names: En - Banded vertagus; Fr - Cérithé fascié.

Diagnostic characters: Shell medium sized, solid, **fusi-form and elongate**, with a slightly stepped spire and **slender shape**. Shell **length about 4 times as long as width**. Spire **whorls flat sided**, with incised sutures. **Sculpture relatively low**, variable, with 2 to 4 well-marked **spiral grooves** per whorl and **flattened**, short **axial ribs at suture**, that are prominent on earlier whorls and less distinct or lacking on later ones. Surface of early whorls often with a cancellate appearance. No axial varices. Aperture obliquely ovate, almost fusiform, with a narrow sharp posterior end. Outer lip smooth, slightly thickened and broadly curved, almost straight posteriorly. **Inner lip thickened, with a strong median oblique fold extending internally along the entire axis of shell**. Anterior **siphonal canal rather long and recurved** dorsally almost at a right angle to the coiling axis of shell. **Colour: outside of shell glossy**, very variable in coloration, **mostly white with spiral bands or blotches of tan to brown** that are **more developed in the lower (anterior) half of whorls**. **Aperture porcelaneous white**.

Size: Maximum shell length 9.5 cm, commonly to 8 cm.

Habitat, biology, and fisheries: Common in clean sandy bottoms of coral reef areas. Subtidal, to a depth of 18 m. Most common to a depth of 10 m, sometimes in very dense colonies. Collected locally for food in the Indo-Pacific, but mainly used for its shell.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan, Midway and Hawaii, and south to Queensland and New Caledonia.



ventral view

(after Habe, 1964)

Rhinoclavis vertagus (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Cerithium vertagus* (Linnaeus, 1758); *Clava vertagus* (Linnaeus, 1758); *Vertagus communis* Schumacher, 1817 / None.

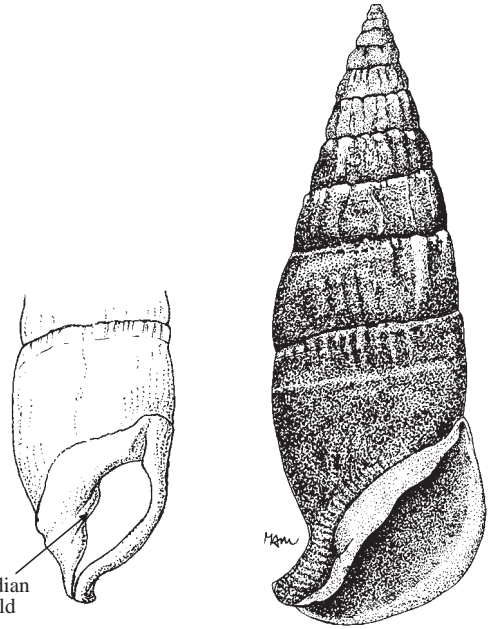
FAO names: En - Common vertagus; Fr - Cérithé vautre.

Diagnostic characters: Shell medium sized, solid, **fusiform**, with a slightly stepped spire and **stocky** shape. Shell **length about 3 times as long as width**. Spire **whorls somewhat inflated**, smooth anteriorly and more swollen near the moderately incised suture. **Sculpture relatively low, with fine spiral grooves and strong short axial folds under suture**, becoming obsolete anteriorly and on body whorl. Surface of early whorls rugose. Low axial varices present on all earlier whorls of spire, weaker on later whorls and frequently absent on body whorl. Aperture obliquely ovate, almost fusiform, with a narrow sharp posterior end. Outer lip smooth, rather thin and broadly curved, almost straight posteriorly. **Inner lip thickened, with a strong median oblique fold extending internally along the entire axis of shell**. Anterior **siphonal canal rather long and recurved dorsally** almost at a right angle to the coiling axis of shell. **Colour: outside of shell generally bright white to yellowish brown, with pale banding under the suture**. Aperture porcelaneous white.

Size: Maximum shell length 7 cm, commonly to 5 cm.

Habitat, biology, and fisheries: Abundant on sandy substrates. Intertidal and shallow sublittoral zones to a depth of 13 m. Collected mainly for its shell, though occasionally eaten, especially in the northern Philippines where it appears in the local markets.

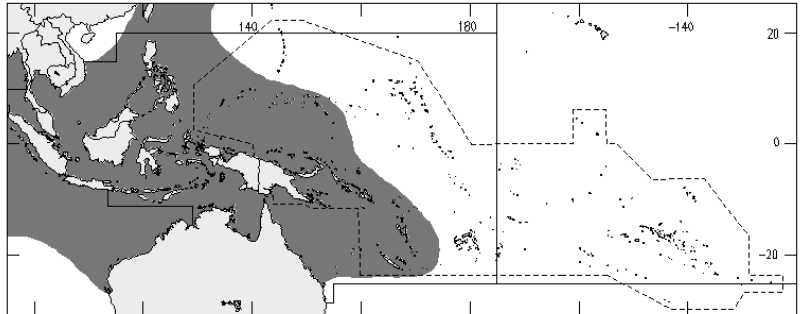
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and Sri Lanka to Melanesia, but apparently not in the northwestern Indian Ocean, the Red Sea nor the Persian Gulf, north to southern Japan and south to southern Queensland and New Caledonia.



oblique view
of aperture

ventral view

(after Habe, 1964)



***Pseudovertagus aluco* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Cerithium aluco* (Linnaeus, 1758); *Rhinoclavis aluco* (Linnaeus, 1758); *Vertagus aluco* (Linnaeus, 1758); *V. cumingii* "A. Adams" of authors / None.

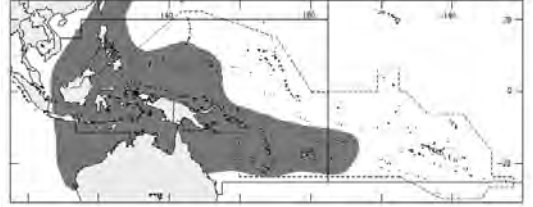
En - Aluco vertagus; **Fr** - Cérithé aluco.

Maximum shell length 10 cm, commonly to 7.5 cm. Seagrass beds and coral rubble. Intertidal and shallow sublittoral zones. Locally collected for food and shell trade. Tropical West Pacific, from Indonesia to western Polynesia; north to Japan and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

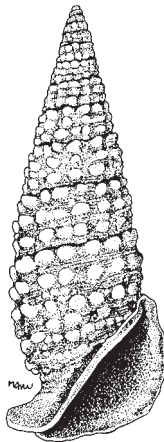


***Rhinoclavis aspera* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Cerithium asperum* (Linnaeus, 1758); *C. lineatum* Lamarck, 1822; *Clava aspera* (Linnaeus, 1758); *Vertagus granulatus* (Linnaeus, 1758) / None.

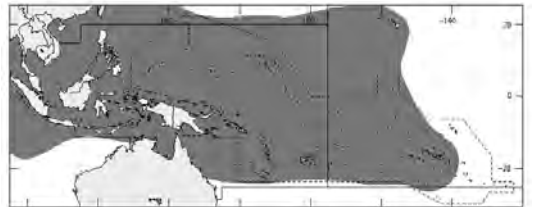
En - Rough vertagus; **Fr** - Cérithé rêche.

Maximum shell length 6 cm, commonly to 5 cm. In sandy areas associated with coral reefs, from shallow subtidal waters to a depth of about 30 m. One of the most common gastropods in some lagoons of the Indo-West Pacific. Like other ceriths, locally collected by coastal people, where abundant. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan, Wake and Hawaii, and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

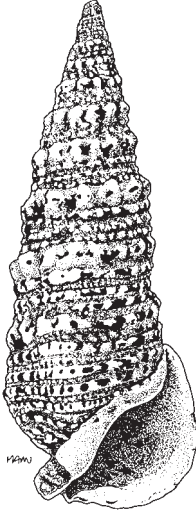


Rhinoclavis sinensis (Gmelin, 1791)

Frequent synonyms / misidentifications: *Cerithium chinensis* (Chemnitz, 1882) (Invalid name); *C. obeliscus* Bruguière, 1792; *Clypeomorus obeliscus* (Bruguière, 1792); *Ochetoclava sinensis* (Gmelin, 1791); *Pseudovertagus sinensis* (Gmelin, 1791) / None.

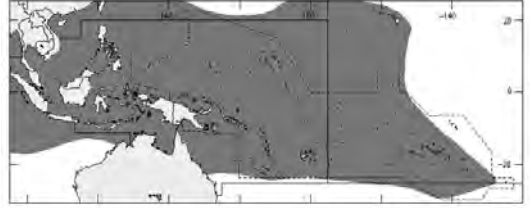
En - Obelisk vertagus; **Fr** - Cérithé obélisque.

Maximum shell length 7 cm, commonly to 5 cm. On reef flats and lagoons, in sandy, coral rubble bottoms. Intertidal and sublittoral, to a depth of 23 m. Common, and frequently heavily preyed upon by other gastropods such as ranellids, muricids and naticids, or by crabs. Collected for food and its shell where abundant. An important species off the Coromandel coast of India. Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan, Midway and Hawaii, and south to central Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

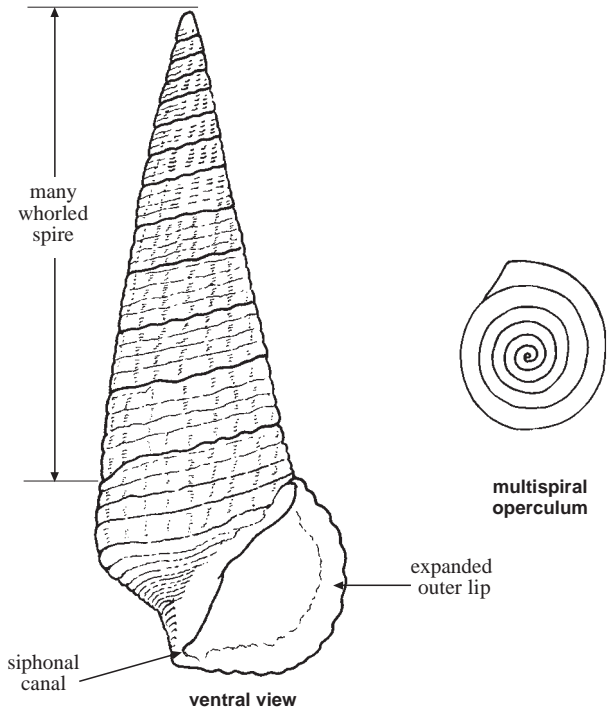


POTAMIDIDAE

Swamp-ceriths and horn shells

Diagnostic characters: Shell thick and solid, tapering, high-conical, with many flattened or slightly convex spire whorls. Sculpture generally coarse, with spiral grooves or cords and often axial ribs, giving a reticulated to nodular aspect. Axial varices sometimes present. Periostracum usually well developed, brownish to corneous. Aperture relatively small, with a short and deep anterior siphonal canal. Outer lip often thickened and more or less flaring. Operculum rounded, corneous, with many spiral coils and a sub-central nucleus. Head with a pair of tentacles, abruptly narrowing distally and bearing eyes at or above their thickened bases. Foot rounded in front and obtuse behind.

Habitat, biology, and fisheries: Abundant in brackish-water environments, on mud flats of estuaries and in mangrove swamps near high tide line. Feeds on algae or detritus, which are scraped with a powerful radula. Sexes separate. Males devoid of penis, sperm transferred during mating in spermatophores. Potamididae are extensively used as food in the area, and their shell is mainly utilized for making lime. In the Philippines, they appear quite often in local markets. They are consumed steamed or boiled, and a somewhat piquant taste increases the desire for drinking.



Similar families occurring in the area

Cerithiidae: shell very similar, but easily distinguished by the ovate operculum with only a few spiral coils.



Key to species of interest to fisheries occurring in the area

- 1a. Shell with both axial and spiral sculpture → 2
- 1b. Shell with spiral sculpture only (Fig. 1) *Telescopium telescopium*

- 2a. Columella with 2 spiral ridges internally (not always visible from the outside). → 3

- 2b. Columella without spiral ridges → 4

- 3a. Shell small (up to 6 cm in length); anterior end of outer lip expanded over the siphonal canal (Fig. 2) . . . *Terebralia sulcata*

- 3b. Shell large (up to 19 cm in length); anterior end of outer lip not expanded over the siphonal canal (Fig. 3) *Terebralia palustris*

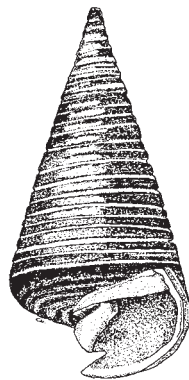


Fig. 1 *Telescopium telescopium* (ventral view)

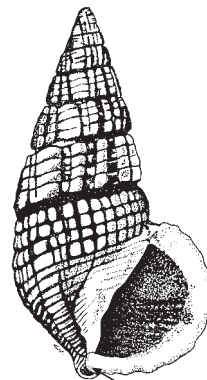


Fig. 2 *Terebralia sulcata* (ventral view)

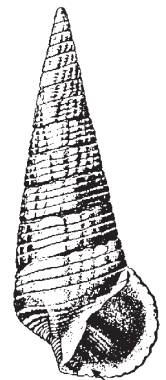


Fig. 3 *Terebralia palustris* (ventral view)

- 4a. Outer lip posteriorly expanded in a flaring, wing-like process (Fig. 4) *Cerithidea cingulata*
- 4b. Outer lip not expanded posteriorly in a flaring, wing-like process → 5

- 5a. Periphery of last whorl angular (Fig. 5) *Cerithidea quadrata*
- 5b. Periphery of last whorl rounded (Fig. 6). *Cerithidea obtusa*

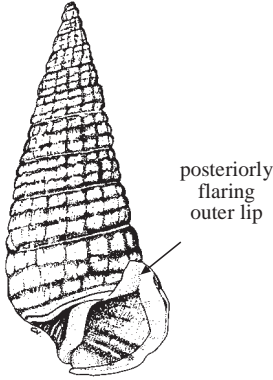


Fig. 4 *Cerithidea cingulata*
(ventral view)

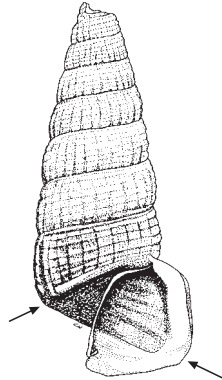


Fig. 5 *Cerithidea quadrata*
(ventral view)

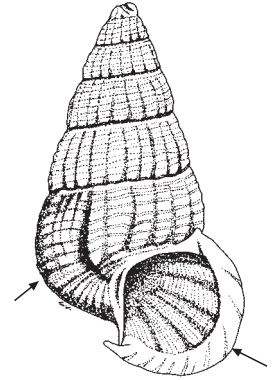


Fig. 6 *Cerithidea obtusa*
(ventral view)

List of species of interest to fisheries occurring in the area

The symbol is given when species accounts are included.

- Cerithidea cingulata* (Gmelin, 1791)
- Cerithidea obtusa* (Lamarck, 1822)
- Cerithidea quadrata* Sowerby, 1866
- Telescopium telescopium* (Linnaeus, 1758)
- Terebralia palustris* (Linnaeus, 1767)
- Terebralia sulcata* (Born, 1778)

References

Brandt, R. 1974. The non-marine aquatic mollusca of Thailand. *Arch. Moll.*, 105:1-423.

Houbrick, R.S. 1991. Systematic review and functional morphology of the mangrove snails *Terebralia* and *Telescopium* (Potamididae: Prosobranchia). *Malacologia*, 33(1-2):299-338.

Van Benthem Jutting, W.S.S. 1956. Systematic studies on the non-marine mollusca of the Indo-Australian Archipelago. V. Critical revision of the javanese freshwater gastropods. *Treubia*, 23(2):259-477.

***Cerithidea obtusa* (Lamarck, 1822)**

Frequent synonyms / misidentifications: *Potamides obtusus* (Lamarck, 1822) / None.

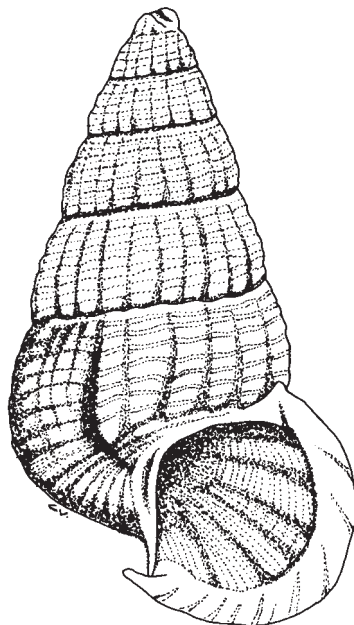
FAO names: En - Obtuse horn shell; Fr - Potamide obtus.

Diagnostic characters: Shell medium sized, with a moderately high conical spire and broad rounded base. Spire whorls convex, with moderately deep suture, 6 or 7 rounded spiral cords crossed by stronger, relatively broad axial ridges, and forming a pattern of more or less sharp nodules. Apical part of the spire always broken off. Body whorl wide, rounded at periphery, with the axial ridges fading away and with 12 to 15 fine spiral cords on the base. An indistinct axial varix sometimes present on left ventral side of body whorl. Aperture wide, subcircular in outline, without a wing-like expansion at posterior end. **Outer lip thickened and flaring**, with a tongue-shaped anterior end produced over the siphonal canal. **Columella** narrow, posteriorly interrupted, **without internal spiral ridges**. Anterior **siphonal canal short, open and oblique**. **Colour:** outside of shell brown or dull purplish brown, with a brighter zone just below the suture; base plain brown or yellowish with a darker brown zone. **Aperture brownish, outer lip of mature specimens cream.**

Size: Maximum shell length 6 cm, commonly to 5 cm.

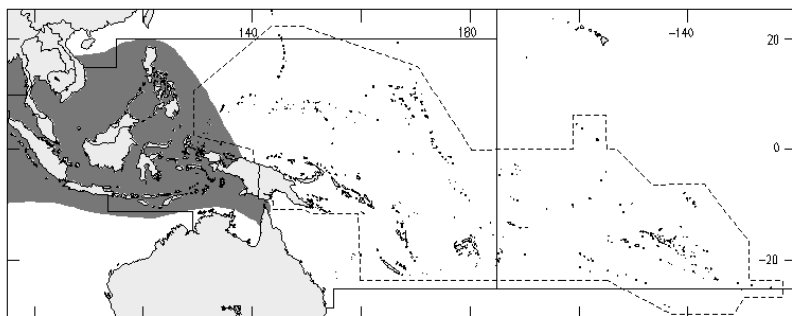
Habitat, biology, and fisheries: Common in mangrove swamps, on roots and branches above the substrate, or on mud tidal banks. Animals often concentrate in the wettest spots, when the mud bottom is partly dry at low tide. This species serves commonly as food in Southeast Asia and Indonesia.

Distribution: Indo-West Pacific, from Madagascar and India to eastern Indonesia; north to the Philippines and south to northern Queensland.



ventral view

(after Van Benthem Jutting, 1956)



Telescopium telescopium (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Potamides telescopium* (Linnaeus, 1758); ? *Telescopium mauritsi* Butot, 1954 / None.

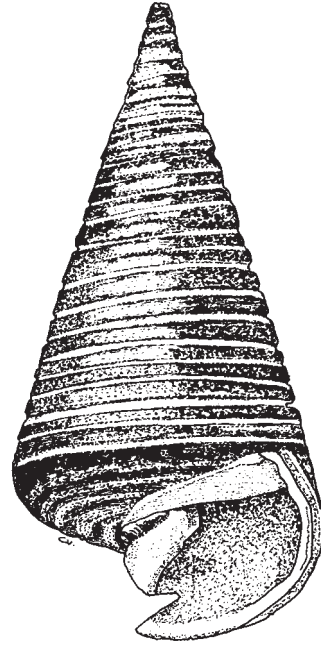
FAO names: En - Telescope snail; Fr - Potamide télescope.

Diagnostic characters: Shell large, with a high conical spire and a broad, rather flat base. Axial sculpture reduced to growth marks. Spire whorls flat sided, with weakly defined suture, 3 large, flat-topped spiral cords and a narrower one, alternate with deep spiral grooves. Spiral cords sometimes disappearing with age or erosion. Body whorl angulate to strongly rounded on periphery, with spiral cords on the base and a deep spiral groove around the columella. **Aperture** obliquely quadrangular, relatively small. Outer lip not flared, thin and nearly smooth, its lateral margin concave with respect to direction of growth. **Columella** twisted, with a strong, central spiral ridge. Anterior siphonal canal very short, open and strongly twisted. **Colour:** outside of shell dark reddish brown to almost black, often with a paler spiral band near the suture. Interior similarly coloured, with a light brown or whitish columella.

Size: Maximum shell length 13 cm, commonly to 11 cm.

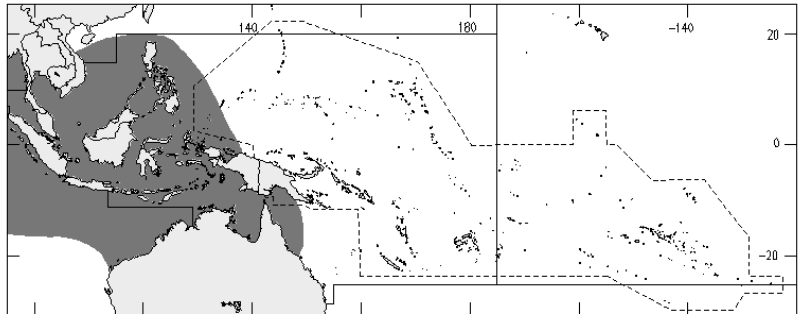
Habitat, biology, and fisheries: Abundant in mangrove areas and on intertidal mud flats, where the water is salt or highly brackish. Often partly buried in mud, with only top of spire projecting. Used as food in certain areas of Southeast Asia. Frequently appearing in local markets of Thailand, Indonesia and the Philippines.

Distribution: Indo-West Pacific, from Madagascar, Réunion Island, India and Sri Lanka, to Papua New Guinea; north to the Philippines and south to central Queensland.



ventral view

(after Van Benthem Jutting, 1956)



Terebralia palustris (Linnaeus, 1767)

Frequent synonyms / misidentifications: *Potamides palustris* (Linnaeus, 1767); *Pyrazus palustris* (Linnaeus, 1767) / None.

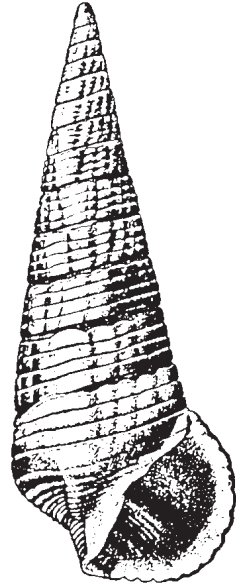
FAO names: En - Mud creeper; Fr - Potamide des marais.

Diagnostic characters: Shell large, elongate-fusiform with a rounded base. Spire whorls flat sided, with deep, narrow suture, 4 equal-sized, flattened spiral ribs alternate with deep, narrow spiral grooves and overlain by broad axial ridges, producing a pattern of weak, squared nodules. Body whorl wide, regularly rounded, with numerous, slightly beaded spiral cords on the base, and a thick axial varix on its left side. Earlier varices randomly distributed along the spire. Aperture ovate, grooved inside. **Outer lip somewhat thickened and flared**, not expanded over the anterior siphonal canal. **Columella calloused, with 2 spiral ridges internally** (not visible from the outside in full grown specimens with intact outer lip). Anterior **siphonal canal short, open**, inclined toward the left. **Colour: outside of shell dark brown to bluish black**, sometimes with lighter spiral bands or indistinct axial flames. **Aperture glossy**, blackish brown with **light tan columella**.

Size: Maximum shell length 19 cm, commonly to 12 cm.

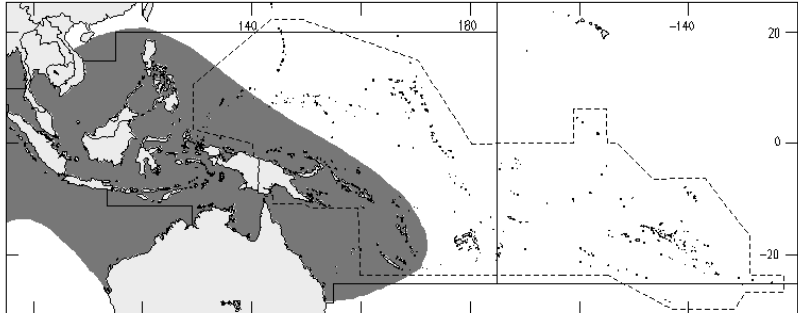
Habitat, biology, and fisheries: Abundant and conspicuous in the mud of mangroves, and more generally, in brackish-water coastal areas of the Indo-West Pacific. Extensively collected for food in many places of its distribution.

Distribution: Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to Melanesia; north to the Philippines and south to southern Queensland and New Caledonia.



ventral view

(after Van Benthem Jutting, 1956)



Terebralia sulcata (Born, 1778)

Frequent synonyms / misidentifications: *Pyrazus sulcatus* (Born, 1778) / None.

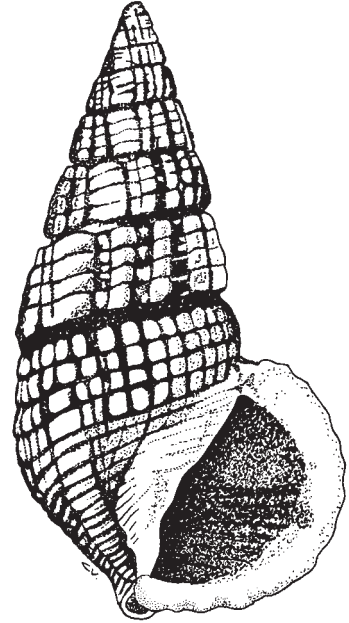
FAO names: En - Sulcate swamp cerith; Fr - Potamide sillonné.

Diagnostic characters: Shell medium sized, elongate-fusi-form with a rounded base. Spire whorls weakly inflated, with deeply incised suture, 4 or 5 spiral cords alternate with deep spiral grooves and overlain by numerous axial ridges, forming a pattern of squared nodules. Body whorl wide, regularly rounded, with numerous beaded spiral cords on the base, and a thick axial varix on its left side. Earlier varices randomly distributed. **Outer lip** of the aperture thickened and widely flared, smooth to slightly crenulated, expanded anteriorly to the base of columella over the short, tubular siphonal canal. **Columella** glazed, with 2 spiral ridges anteriorly (hardly visible from the outside in full grown specimens with intact outer lip). **Colour:** outside of shell light to dark brown, with paler axial varices and sometimes with spiral banding. **Aperture** shiny brown to cream.

Size: Maximum shell length 6.5 cm, commonly to 5 cm.

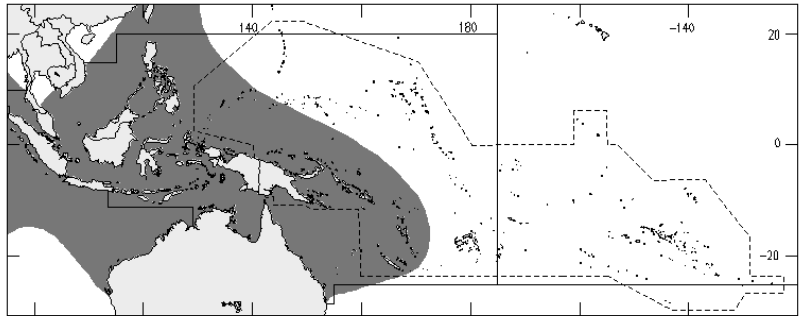
Habitat, biology, and fisheries: On mud flats in estuaries and mangrove areas, often on stems and roots of the trees. Extensively used as food and lime material in the Philippines.

Distribution: Indo-West Pacific, from Madagascar to Melanesia; north to Japan and south to southern Queensland and New Caledonia.



ventral view

(after Van Benthem Jutting, 1956)

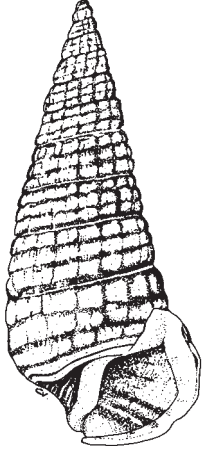


Cerithidea cingulata (Gmelin, 1791)

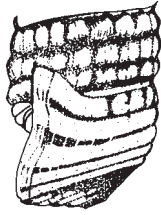
Frequent synonyms / misidentifications: *Potamides cingulatus* (Gmelin, 1791); *Tympanotonos fluviatilis* (Potiez and Michaud, 1838) / None.

En - Girdled horn shell; **Fr** - Potamide sanglé.

Maximum shell length 4.5 cm, commonly to 3.5 cm. Abundant on mud flats near mangroves and in brackish or supersalted fishponds. Locally, numbers of about 500 individuals per square meter can occur. Usually living in the upper bottom layer of mud which is almost liquid. Extensively collected for food and to make lime in the Philippines. Indo-West Pacific, from India and Sri Lanka to Papua New Guinea; north to Japan and south to central Queensland.

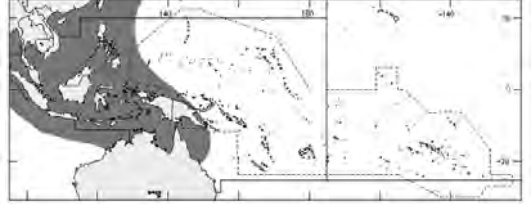


ventral view



anterior 1/3 of shell
(lateral view)

(after Van Benthem Jutting, 1956)

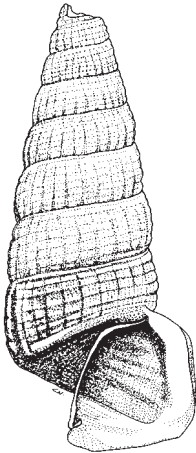


Cerithidea quadrata Sowerby, 1866

Frequent synonyms / misidentifications: *Potamides quadratus* (Sowerby, 1866) / *Cerithidea obtusa* (Lamarck, 1822); *C. rhizophorarum* A. Adams, 1855.

En - Quadrate horn shell; **Fr** - Potamide équarri.

Maximum shell length 5.5 cm, commonly to 4.5 cm. In mangrove areas and brackish fishponds. Often climbing up the trees to feed on algae growing at the roots and stems. Commonly found together with *Cerithidea obtusa*. Collected for food in many areas of Southeast Asia. Eastern part of the Indian Ocean and the tropical West Pacific, from the Andaman Sea to eastern Indonesia; north to Viet Nam and the Philippines, and south to southern Indonesia.



ventral view

(after Van Benthem Jutting, 1956)

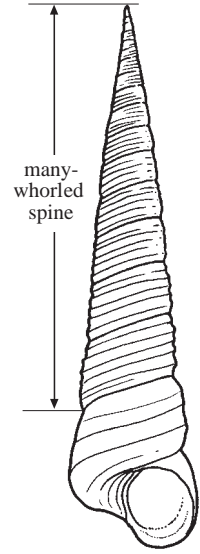


TURRITELLIDAE

Turret shells

Diagnostic characters: Shell elongate, sharply conical, with numerous whorls and a small, square to rounded aperture. Umbilicus usually absent. Whorls strongly sculptured with spiral ribs or keels. Growth lines arched to sinuous. Outer lip of the aperture thin, often concave. Inner lip smooth. Anterior siphonal canal absent. Operculum corneous, rounded, with many spiral coils and a central nucleus; border of the operculum very thin, often with flexible bristles. Head large and prominent, with a short snout and long, tapering tentacles bearing eyes on slight swellings at their outer bases. Foot rather short, truncate anteriorly, obtusely attenuated posteriorly and grooved beneath.

Habitat, biology, and fisheries: Filter-feeding, mostly living in soft, subtidal bottoms of sand or mud. Organic particles are drawn through the mantle cavity by means of ciliary water currents, sorted by small tentacles and the tiny bristles of the operculum, trapped in mucous sheets on the gills and transferred to the mouth. Sexes separate, fertilization internal. Eggs generally laid in a cluster of spherical, stalked capsules, attached to stones. A short, planktonic larval stage is usually present, but some species brood their eggs and embryos to the crawling stage. In the area, Turritellidae are collected occasionally for food, but mainly for their shells that are used in the shellcraft industries to make decorative items.



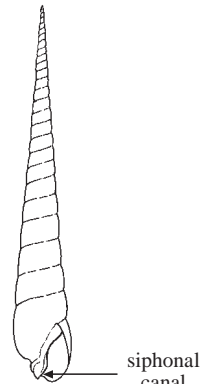
ventral view

Similar families occurring in the area

Terebridae: general shape of shell similar to Turritellidae, but with a well-marked, notched siphonal canal at the anterior end; operculum ovate, with a terminal nucleus.

Key to species of interest to fisheries occurring in the area

- 1a. Sides of the whorls sharply keeled *Turritella duplicata*
- 1b. Sides of the whorls rounded, not keeled . . . *Turritella terebra*





ventral view

Terebridae

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Turritella duplicata* (Linnaeus, 1758)
-  *Turritella terebra* (Linnaeus, 1758)

References

Garrard, T.A. 1972. A revision of Australian recent and tertiary Turritellidae. *J. Malac. Soc. Aust.*, 2:267-337.
 Marwick, J. 1957. Generic revision of the Turritellidae. *Proc. Malac. Soc. Lond.*, 32:144-166.

Turritella terebra (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / None.

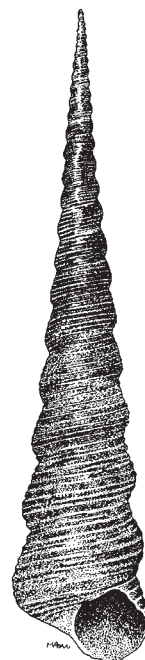
FAO names: En - Screw turret; Fr - Turritelle vis.

Diagnostic characters: Shell large and solid, with an extremely long and tapering spire, with 25 or more whorls in mature specimens. Whorls strongly convex in outline, with impressed suture and up to 6 prominent spiral cords and weaker interstitial spiral threads. Apical end of spire invariably missing in adult shells. Aperture almost circular in outline. Margin of outer lip rather thin, forming a broad, very shallow sinus leaning backward with respect to direction of growth, continued as a straight line across the base (on specimens with a broken aperture, shape of the outer lip retained in the axial growth marks of body whorl). **Colour:** shell light to dark brown externally and internally.

Size: Maximum shell length 17 cm, commonly to 15 cm.

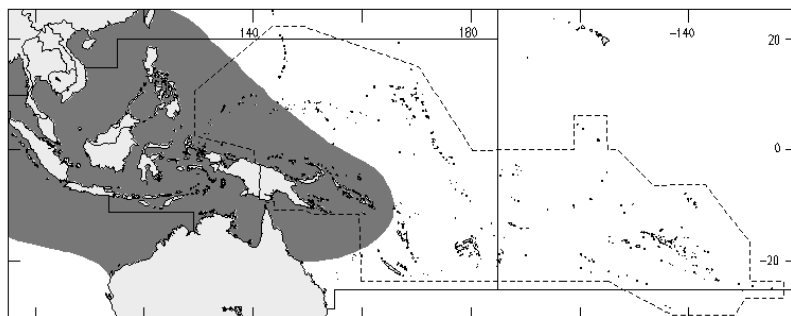
Habitat, biology, and fisheries: On soft bottoms, from shallow sublittoral zones to a depth of about 30 m. Regularly collected and marketed in the northern Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Melanesia; north to Taiwan Province of China and south to central Queensland.



ventral view

(after Dance, 1993)

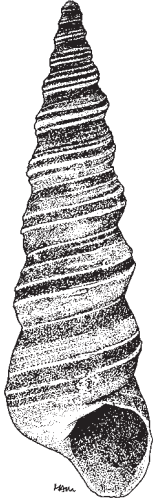


Turritella duplicata (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Turritella acutangula* (Linnaeus, 1758); *Zaria duplicata* (Linnaeus, 1758) / None.

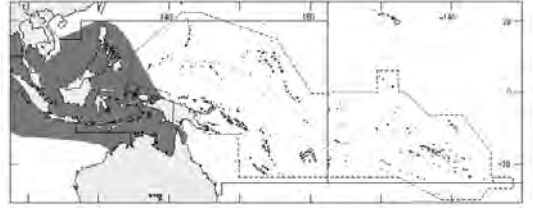
En - Duplicate turret; **Fr** - Turritelle anguleuse.

Maximum shell length 18 cm, commonly to 15 cm. On subtidal sand and mud bottoms. Collected where common, in the Southeast Asian region. Indo-West Pacific, from Madagascar to Indonesia; north to the Philippines and south to northern Queensland.



ventral view

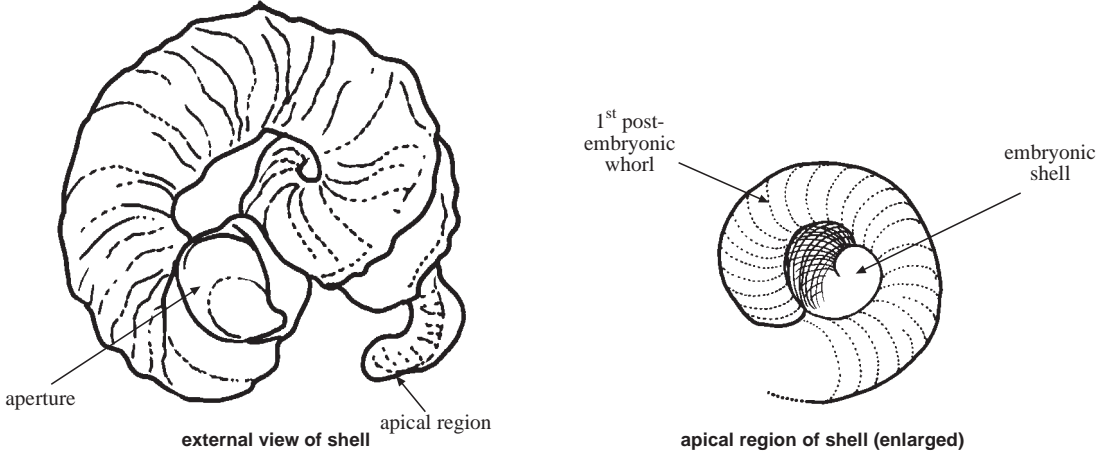
(after Short and Potter, 1987)



VERMETIDAE

Worm shells

Diagnostic characters: Shell long, usually **irregularly coiled** or **even disjunct** and **resembling a worm tube, but composed of 3 layers**, with the inner one porcelaneous. Shell permanently attached to a hard substrate. First whorls coiled around an axis at a 90° angle to that of the larval shell. Sculpture weak, longitudinal or transverse, and irregular. **Aperture** rounded, sharp-edged, **without a siphonal canal**. **Operculum** **horny, spiral, sometimes absent**. Head with short tentacles bearing eyes at their outer bases. Foot small.



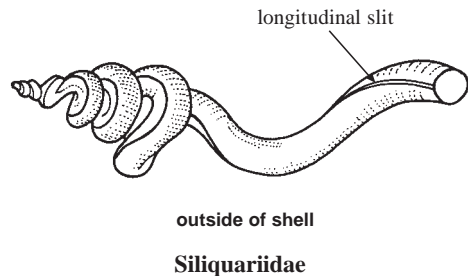
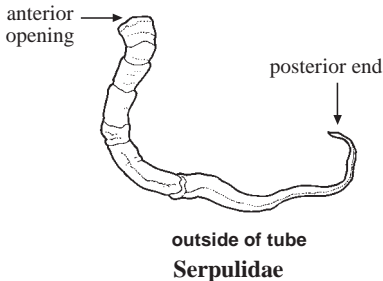
Habitat, biology, and fisheries: Mostly in warm-temperate or tropical, intertidal, and shallow water environments. Attached to rocks, corals and other shells, sometimes corroding the substrate and partly or even completely embedded in it. Some species occur in dense masses and may be important contributors to reef-building. Filter-feeding animals, extracting tiny planktonic organisms or detrital fragments from the water by means of 2 different ways of capture. In the ciliary feeding method, food is swept in the mantle cavity with the incurrent water, caught on the gill filaments, wrapped in mucous and carried along ciliary tracts to the mouth. In the mucous feeding method, a secretory gland of the foot produces sticky mucous strings or nets that are released in the water to entangle the food, then drawn back and swallowed. Sexes separate, fertilization internal, presumably by means of water-borne sperm. Eggs brooded by the female, hatching as crawling juveniles, or as free-swimming larvae for a short planktonic stage. Worm shells are traditionally used as food by some coastal populations of the area, notably in Polynesia. Though they may be regularly collected, they generally appear in markets only rarely.

Remarks: The taxonomy of the Vermetidae remains poorly known, at least at the species level. The larval and first stages of the juvenile shell can be essential in identification, but are usually lost in adult specimens. However, newly settled shells frequently occur among the latter.

Similar families occurring in the area

Serpulidae: sedentary Polychaetes building a tube open at both ends, or without an initial spiral coiling, and composed of only 2 layers (the inner one not porcelaneous).

Siliquariidae: shell tubular, loosely coiled in the later stages, with a row of tiny holes or a slit along one side; usually embedded in sponges.



Key to species of interest to fisheries occurring in the area

- 1a. Shell corroding a trench in the substrate; operculum present, filling the aperture of tube (Fig. 1a, b) *Dendropoma maximum*
- 1b. Shell not corroding the substrate; operculum absent → 2
- 2a. Shell rather short (reaching 5 cm in length), with the entire coil in contact with the substrate; outer colour blackish brown (Fig. 2). *Serpulorbis colubrinus*
- 2b. Shell rather long (reaching 11 cm in length), with only the initial stages of growth in contact with the substrate; outer colour yellowish white with reddish brown spiral lines (Fig. 3) *Serpulorbis medusae*

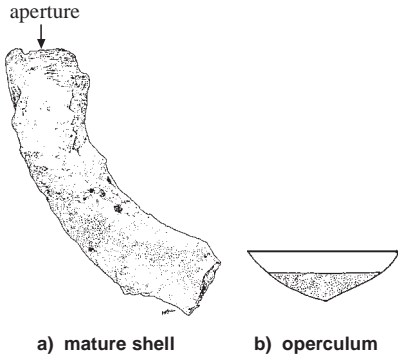


Fig. 1 *Dendropoma maximum* (lateral view)

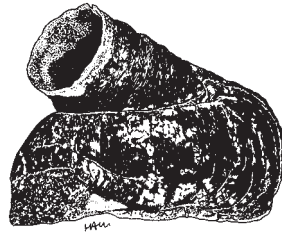


Fig. 2 *Serpulorbis colubrinus* (external view)

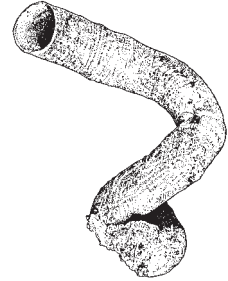





Fig. 3 *Serpulorbis medusae* (external view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Dendropoma maximum* (Sowerby, 1825)
-  *Serpulorbis colubrinus* (Röding, 1798)
-  *Serpulorbis medusae* (Pilsbry, 1891)

References

Keen, A.M. 1961. A proposed reclassification of the gastropod family Vermetidae. *Bull. Br. Mus. Nat. Hist. (Zool.)*, 7(3):183-213.

Morton, J.E. 1965. Form and function in the evolution of the Vermetidae. *Bull. Br. Mus. nat. Hist. (Zool.)*, 11(9):585-630.

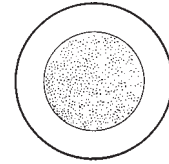
Dendropoma maximum (Sowerby, 1825)

Frequent synonyms / misidentifications: *Siphonium maximum* (Sowerby, 1825); *Vermetus maximus* Sowerby, 1825 / *Vermetus novaehollandiae* Chenu, 1843.

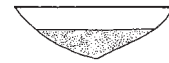
FAO names: En - Great worm shell; Fr - Grand vermet.



external view of mature shell



external view



lateral view
operculum

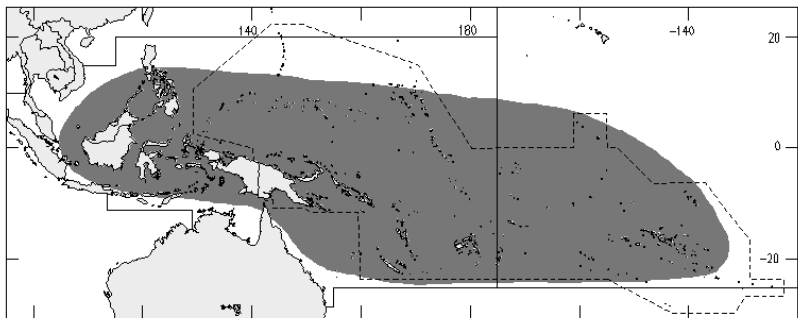
(after J.E. Morton, 1965)

Diagnostic characters: Shell large, solid, tubular, irregularly coiled, often straight or only slightly curved in the adult, partly embedded in the substrate. Sculpture variable, with weak lamellar transverse threads. Operculum well developed, as large as the aperture, smooth and concave externally, its inner surface with a distinct, slightly thickened central scar for attachment to the foot. Body of the animal thick and cylindrical, about the diameter of a man's small finger in the average adult specimens, with a short, blunt-tipped and only slightly arched visceral mass. **Colour:** outside of shell whitish to pale brown, sometimes stained brown; interior glossy white. Operculum translucent golden brown. Head and exposed parts of the foot elegantly pigmented in bluish black and light brown. Exposed margins of the mantle with a wide bluish black band.

Size: Maximum shell length 45 cm, commonly to 10 cm.

Habitat, biology, and fisheries: Abundant on the outer parts of coral reefs, partly imbedded among corals. Ciliary feeding species. Traditionally collected for food in eastern Polynesia.

Distribution: Islands of the tropical West Pacific, from Indonesia to eastern Polynesia; north to the Philippines and south to the Great Barrier Reef, eastern Queensland.

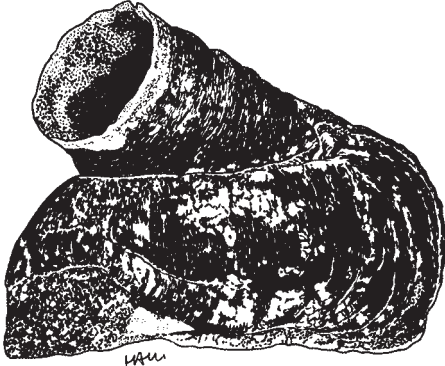


***Serpulorbis colubrinus* (Röding, 1798)**

Frequent synonyms / misidentifications: *Cladopoda colubrina* (Röding, 1798); *Vermetus ater* Chenu, 1843; *V. colubrinus* (Röding, 1798) / None.

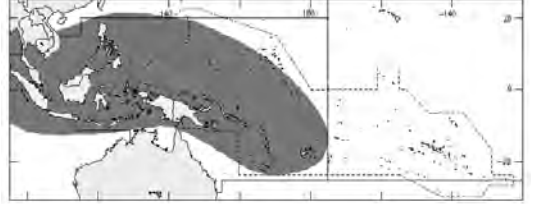
En - Snake-like worm shell; **Fr** - Vermet serpentin.

Maximum shell length 5 cm, commonly to 3.5 cm. Common on rocky substrates. Intertidal and shallow subtidal zones. Mucous-feeding species. Occasionally collected by native populations in the tropical Pacific. Distribution imperfectly known. Thought to be widespread in the Indo-West Pacific; most common in the central part of that area.



external view of shell

(after Sprinsteen and Leobrera, 1986)

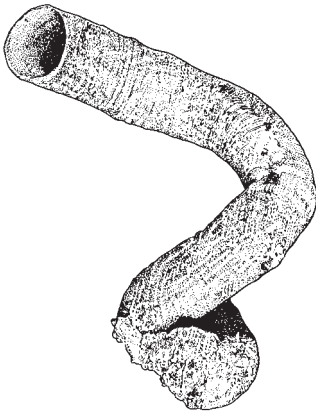


***Serpulorbis medusae* (Pilsbry, 1891)**

Frequent synonyms / misidentifications: *Thylacodes medusae* Pilsbry, 1891; *Vermetus medusae* (Pilsbry, 1891) / None.

En - Jellyfish worm shell; **Fr** - Vermet méduse.

Maximum shell length 11 cm, commonly to 8 cm. Common on hard substrates. Intertidal and shallow subtidal waters. Mucous-feeding species. Occasionally collected for subsistence. Limited to the western Pacific, from Indonesia to the Philippines and Japan.



external view of shell

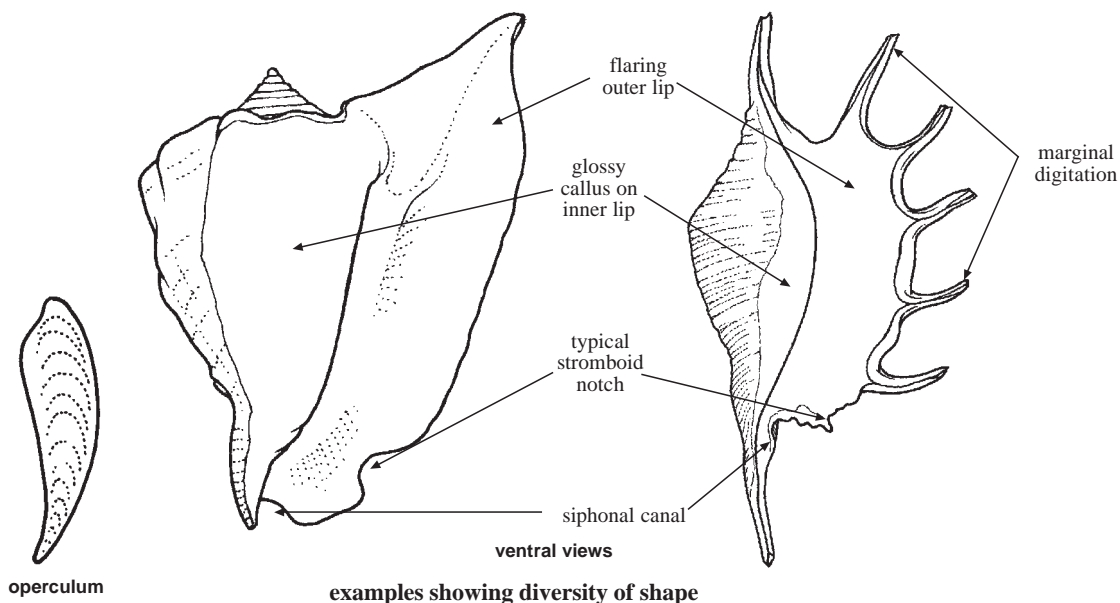
(after Springsteen and Leobrera, 1986)



STROMBIDAE

Conchs

Diagnostic characters: Shell thick and solid, with a relatively large body whorl and variable shape. Outer surface smooth to sculptured with axial and spiral threads, nodes or knobs. Periostracum mostly thin and velvety. **Aperture** elongated, with a well-marked siphonal canal. Inner lip covered by a glossy callus, with a nearly straight columella. Outer lip generally thickened and often flaring in adult specimens, sometimes winged or digitate. **A distinct notch** present along the anterior margin of the outer lip. No umbilicus. **Operculum** thick and **corneous, claw-like**, narrowly elliptical with a sharp, terminal nucleus, and often serrated along one edge. Head bearing complex eyes with highly coloured iris, on top of long stalks which protrude, the one along the anterior canal, the other under the notch of outer lip.



Habitat, biology, and fisheries: Tropical to subtropical and often gregarious animals, mainly living in shallow water, on sandy, muddy or rubble bottoms or on marine grassflats. Very active, using their narrow foot and strong operculum in a leaping locomotion and as a defensive weapon. Mostly herbivores, browsing on delicate algae, or swallowing sand and detritus to digest the decomposing plant matter. Sexes separate, the male frequently smaller than the female. Fertilization internal. Eggs numerous, laid in gelatinous, tubular, tangled masses, and hatching as planktonic larvae. Strombidae are commonly collected for food in the area, and may be of economic importance locally.

Similar families occurring in the area

None. Among the shell characters, the anterior notch on the outer flaring lip of aperture usually distinguishes this family from other ones.

Terebellum terebellum, the only species with atypical shell characters, can be recognized by its stromboid anatomical features (in particular, the stalked eyes with highly coloured iris).

Key to species of interest to fisheries occurring in the area

- 1a. Outer lip of the aperture thickened, with an anterior notch (Fig. 1) → 2
- 1b. Outer lip of the aperture thin, without an anterior notch (Fig. 2) *Terebellum terebellum*

- 2a. Shell spindle-shaped; aperture approximately as long as the spire (Fig. 3) *Tibia fusus*
- 2b. Shell differently shaped; aperture much longer than the spire → 3

- 3a. Outer lip and anterior canal expanded in large, hollow digitations (Fig. 1a) → 4
- 3b. Outer lip and anterior canal not expanded in hollow digitations (Fig. 1b) → 9

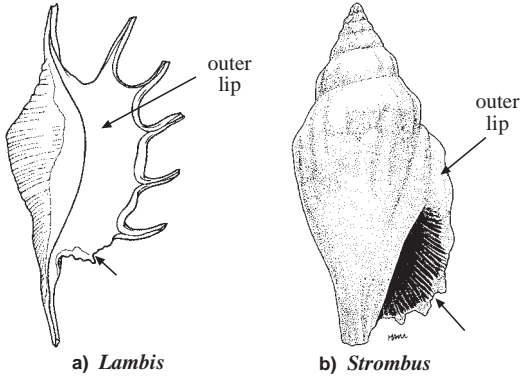


Fig. 1 ventral view

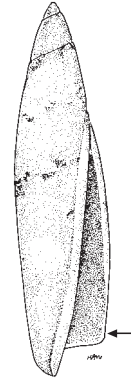


Fig. 2 *Terebellum terebellum* (ventral view)

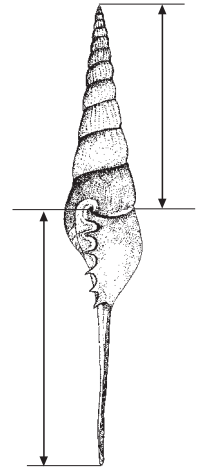


Fig. 3 *Tibia fusus* (lateral view)

- 4a. Columella and outer lip of the aperture smooth or nearly so → 5
- 4b. Columella and outer lip of the aperture distinctly lirate → 7

- 5a. Anterior canal expanded in a very long and slender digitation (Fig. 4) *Lambis crocata*
- 5b. Anterior canal expanded in a relatively short and wide digitation. → 6

- 6a. Shell very large (up to 43 cm in length), with strong knobs on the spire (Fig. 5) . . . *Lambis truncata*
- 6b. Shell large (up to 29 cm in length), with relatively small and inconspicuous knobs on the spire (Fig. 6) *Lambis lambis*

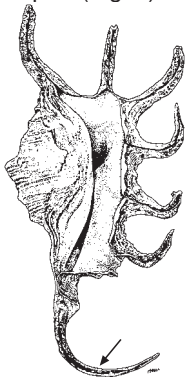


Fig. 4 *Lambis crocata* (ventral view)

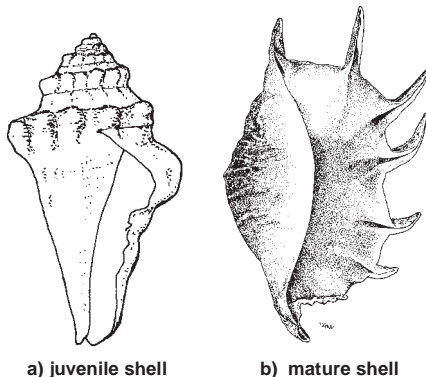


Fig. 5 *Lambis truncata* (ventral view)

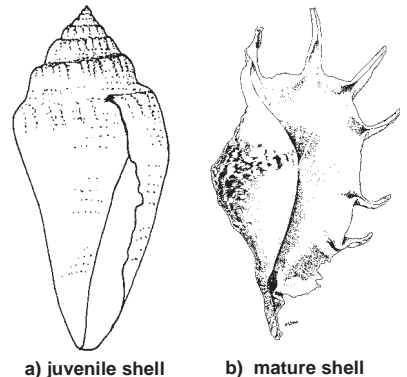


Fig. 6 *Lambis lambis* (ventral view)

- 7a. Anterior canal and posteriormost digitation of outer lip with their bases recurved at right angle to the left side (Fig. 7) *Lambis chiragra chiragra*
- 7b. Anterior canal and posteriormost digitation of outer lip approximately axial in direction, their bases not recurved at right angle to the left side → 8
- 8a. Aperture with 7 long, nodulose digitations (including the anterior canal) (Fig. 8) . . . *Lambis scorpius*
- 8b. Aperture with 10 short, not nodulose digitations (including the anterior canal) (Fig. 9) *Lambis millepeda*
- 9a. Shell conical, with a low spire (Fig. 10) *Strombus luhuanus*
- 9b. Shell not conical, with a moderately tall spire → 10

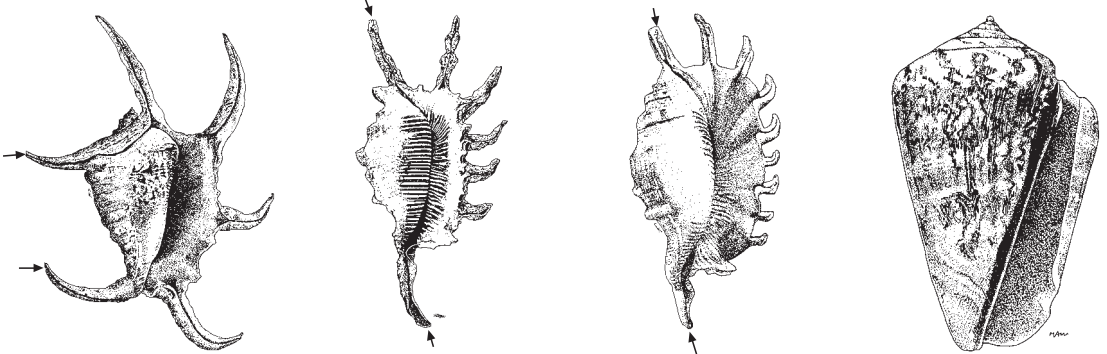


Fig. 7 *Lambis chiragra chiragra* (ventral view) Fig. 8 *Lambis scorpius* (ventral view) Fig. 9 *Lambis millepeda* (ventral view) Fig. 10 *Strombus luhuanus* (ventral view)

- 10a. Shell asymmetrically coiled, distortion most conspicuous on penultimate whorl (Fig. 11) *Strombus gibberulus*
- 10b. Shell symmetrically coiled → 11
- 11a. Outer lip with a prong-like posterior expansion → 12
- 11b. Outer lip without a prong-like posterior expansion → 13
- 12a. Body whorl dull and rough, with a row of large knobs on the shoulder and strong spiral ridges all over, 2 or 3 of them somewhat knobby (Fig. 12) *Strombus aurisdianae*
- 12b. Body whorl glossy and smoothish, with a row of large knobs on the shoulder and almost obsolete spiral ridges, none of them knobby (Fig. 13) *Strombus bulla*
- 13a. Outer lip expanded posteriorly → 14
- 13b. Outer lip not expanded posteriorly → 16
- 14a. Posterior expansion of outer lip evenly rounded, much higher than the spire (Fig. 14) *Strombus latissimus*
- 14b. Posterior expansion of outer lip distinctly undulate, not higher than the spire → 15

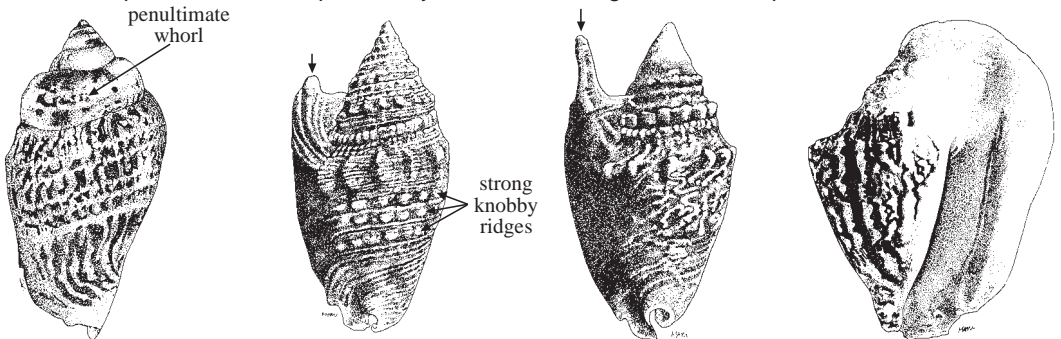


Fig. 11 *Strombus gibberulus* (dorsal view) Fig. 12 *Strombus aurisdianae* (dorsal view) Fig. 13 *Strombus bulla* (dorsal view) Fig. 14 *Strombus latissimus* (ventral view)

- 15a. Posterior expansion of outer lip nearly as high as the spire, with relatively deep undulations (Fig. 15) *Strombus sinuatus*
- 15b. Posterior expansion of outer lip decidedly lower than the spire, with relatively shallow undulations (Fig. 16) *Strombus lentiginosus*

- 16a. Outer lip distinctly lirate inside → 17
- 16b. Outer lip smooth inside → 21

- 17a. Outer lip with a long posterior process, extending onto the spire (Fig. 17). . . *Strombus marginatus*
- 17b. Outer lip without a long posterior process, reaching shoulder at the most → 18

- 18a. Outer lip with 3 or 4 distinct flat teeth on anterior margin (Fig. 18) *Strombus dentatus*
- 18b. Outer lip without teeth on anterior margin → 19

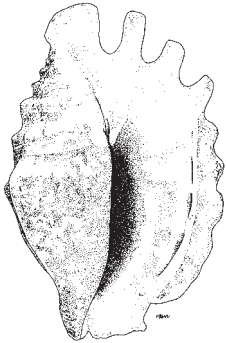


Fig. 15 *Strombus sinuatus* (ventral view)

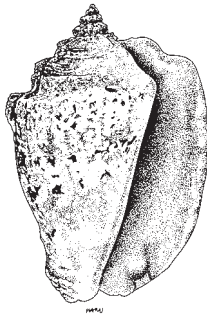


Fig. 16 *Strombus lentiginosus* (ventral view)

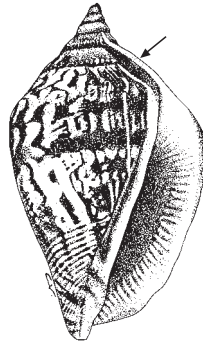


Fig. 17 *Strombus marginatus* (ventral view)

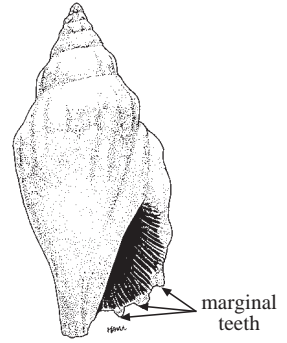


Fig. 18 *Strombus dentatus* (ventral view)

- 19a. Columellar callus entirely lirate → 20
- 19b. Columellar callus only lirate at both ends (Fig. 19) *Strombus urceus*

- 20a. Ventral side of body whorl with many distinct axial folds under the shoulder; spire relatively high (Fig. 20) *Strombus labiatus*
- 20b. Ventral side of body whorl without axial folds under the shoulder; spire relatively low (Fig. 21) *Strombus mutabilis*

- 21a. Anterior notch of outer lip deep; spire whorls distinctly shouldered and nodulose → 22
- 21b. Anterior notch of outer lip shallow; spire whorls weakly ribbed and variccate (Fig. 22) *Strombus canarium*

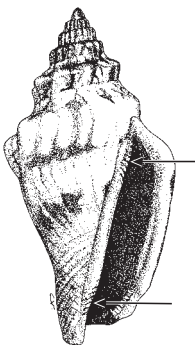


Fig. 19 *Strombus urceus* (ventral view)

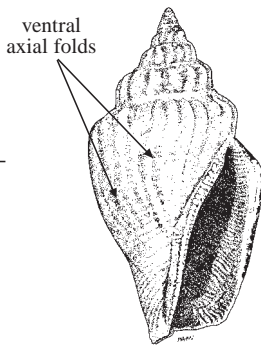


Fig. 20 *Strombus labiatus* (ventral view)

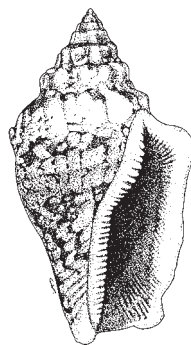


Fig. 21 *Strombus mutabilis* (ventral view)

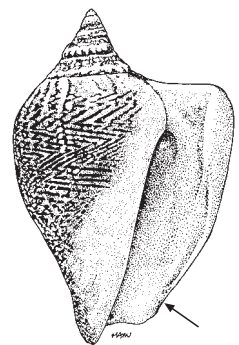


Fig. 22 *Strombus canarium* (ventral view)

- 22a. Outer lip sinuated posteriorly (Fig. 23) *Strombus variabilis*
 22b. Outer lip evenly rounded posteriorly (Fig. 24) *Strombus epidromis*

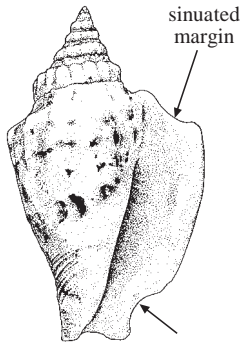


Fig. 23 *Strombus variabilis* (ventral view)

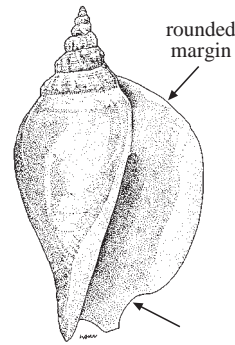

























Fig. 24 *Strombus epidromis* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Lambis chiragra chiragra* (Linnaeus, 1758)
-  *Lambis crocata* (Link, 1807)
-  *Lambis lambis* (Linnaeus, 1758)
-  *Lambis millepeda* (Linnaeus, 1758)
-  *Lambis scorpius* (Linnaeus, 1758)
-  *Lambis truncata* (Humphrey, 1786)
-  *Strombus aurisdianae* Linnaeus, 1767
-  *Strombus bulla* (Röding, 1798)
-  *Strombus canarium* Linnaeus, 1758
-  *Strombus dentatus* Linnaeus, 1758
-  *Strombus epidromis* Linnaeus, 1758
-  *Strombus gibberulus* Linnaeus, 1758
-  *Strombus labiatus* (Röding, 1798)
-  *Strombus latissimus* Linnaeus, 1758
-  *Strombus lentiginosus* Linnaeus, 1758
-  *Strombus luhuanus* Linnaeus, 1758
-  *Strombus marginatus* Linnaeus, 1758
-  *Strombus mutabilis* Swainson, 1821
-  *Strombus sinuatus* Humphrey, 1786
-  *Strombus urceus* Linnaeus, 1758
-  *Strombus variabilis* Swainson, 1820
-  *Tibia fusus* (Linnaeus, 1758)
-  *Terebellum terebellum* (Linnaeus, 1758)

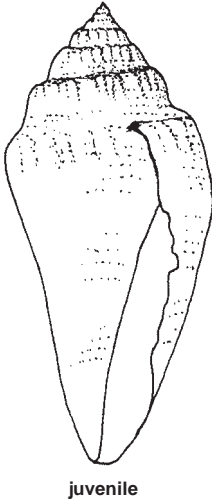
References

- Abbott, R.T. 1960. The genus *Strombus* in the Indo-Pacific. *Indo-Pac. Moll.*, 1(2):33-146.
 Abbott, R.T. 1961. The genus *Lambis* in the Indo-Pacific. *Indo-Pac. Moll.*, 1(3):147-174.
 Jung, P. and R.T. Abbott. 1961. The genus *Terebellum* in the Indo-Pacific. *Indo-Pac. Moll.*, 1(7):445-454.
 Walls, J.G. 1980. *Conchs, tibias, and harps*. T.F.H., Reigate, 191p.

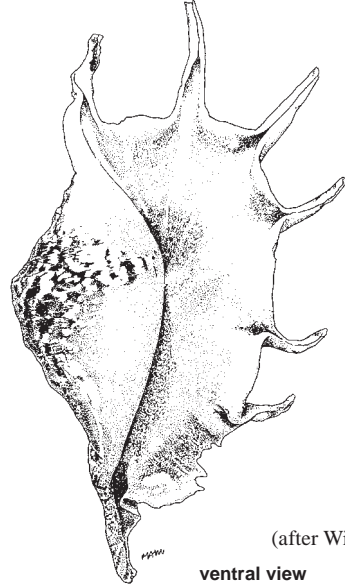
Lambis lambis (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / *Pterocera crocata* Link, 1807.

FAO names: En - Common spider conch; Fr - Ptérocère commun.



juvenile



(after Wilson, 1993)

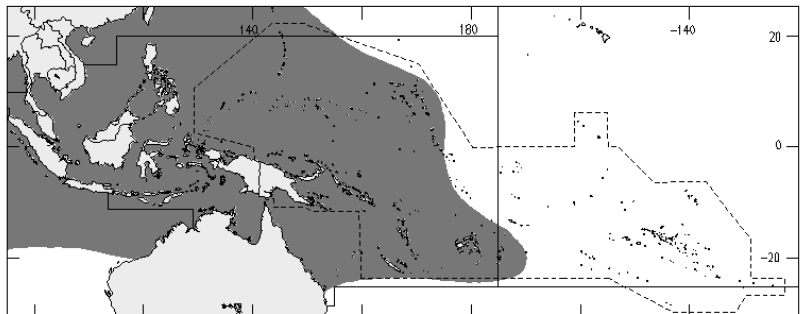
ventral view

Diagnostic characters: Shell large, thick and heavy, with a moderately high, pointed spire and large marginal spikes on the strongly flaring outer lip. Spire whorls slightly concave on their apical half, with fine spiral threads and a row of relatively small knobs on the sharply angulate shoulder. Dorsal side of body whorl rough, with low, irregular spiral cords and 2 or 3 spiral rows of blunt tubercles, forming large knobs on the shoulder. Middorsal tubercle of the shoulder generally much thicker and higher than the others in female specimens. Ventral side of shell extensively glazed. Columella and outer lip of the aperture nearly smooth. Outer lip with a deep stromboid notch and 6 slender, hollow digitations. Anteriormost 3 digitations of the outer lip rather short and bent posteriorly (in males), or long and recurved towards dorsal side of shell (in females). Inner lip with a heavy, extensive callus, becoming thinner on shoulder area and tending to cover most of the ventral side of body whorl and spire. Siphonal canal forming a rather wide and moderately developed digitation anteriorly, slightly bent towards the right. **Colour:** outer coloration of shell variable, cream to tan, often with various patterns of brown, purplish tan, or bluish black. Glazed ventral side rich pink, orange, or purple tan, sometimes whitish.

Size: Maximum shell length 29 cm, commonly to 18 cm.

Habitat, biology, and fisheries: Common on reef flats and on coral-rubble bottoms or in mangrove areas, usually associated with fine red algae on which it feeds. Often occurring in colonies. In shallow water, from low tide levels to a depth of about 5 m. Sexual dimorphism pronounced. Shell of the males usually smaller and with shorter digitations on the outer lip. This common species is often collected for food by coastal populations, and the shell used in shellcraft. Appears in markets in the northern Philippines and in Fiji Islands.

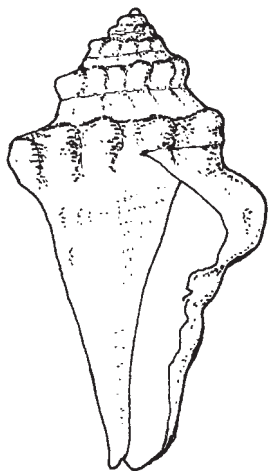
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Persian Gulf, but probably not in the Red Sea, to Micronesia and eastern Melanesia; north to Taiwan Province of China and southern Japan, and south to southern Queensland and New Caledonia.



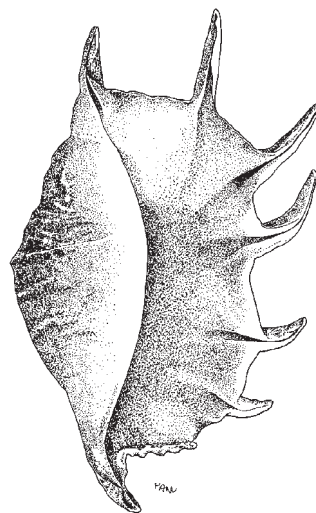
Lambis truncata (Humphrey, 1786)

Frequent synonyms / misidentifications: *Lambis bryonia* (Gmelin, 1791); *L. sebae* ("Valenciennes", 1786) / *Lambis lambis* (Linnaeus, 1758).

FAO names: En - Giant spider conch; Fr - Ptérocère géant.



shell of juvenile (ventral view)



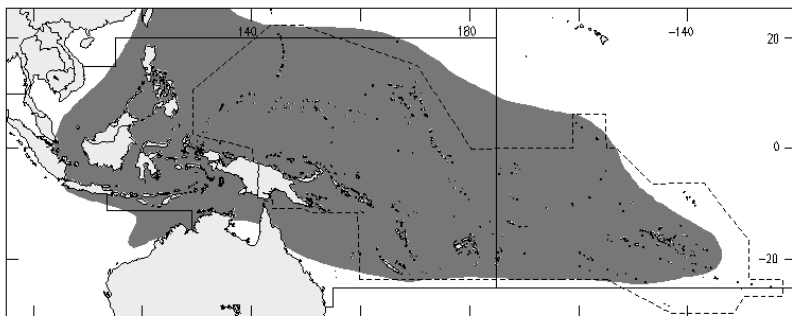
ventral view

Diagnostic characters: Shell very large, massive, with a moderately high, pointed spire and large marginal spikes on the strongly flaring outer lip. Spire whorls convex, with fine spiral threads and a row of large, conspicuous knobs on the shoulder. Dorsal side of body whorl with low spiral ribs and 2 or 3 spiral rows of blunt, rather weak knobs that are stronger on the shoulder. Middorsal tubercle of the shoulder not much developed in female specimens. Ventral side of shell extensively glazed. Columella and outer lip of the aperture nearly smooth. Outer lip with a well-marked stromboid notch and 6 slender, hollow digitations. Inner lip with a heavy, extensive callus covering most of the ventral side of body whorl and spire, including sometimes the apex in mature specimens. Siphonal canal forming a wide and moderately developed digitation anteriorly, slightly bent towards the right. **Colour:** outside of shell cream, sometimes with spare light brown to tan speckles. Aperture white deep inside, outer lip and ventral callus creamy pink, sometimes becoming purplish towards the edges of the glazed area.

Size: Maximum shell length 43 cm, commonly to 28 cm.

Habitat, biology, and fisheries: Lives in colonies on sandy, algal, and coral-rubble bottoms in coral reef areas, from shallow lagoons to the outer edge of reefs. Shell of old specimens often worn and encrusted with calcareous algae, vermetid snails, and tubes of polychaete worms. In shallow, generally sublittoral waters, to depths of about 30 m. Actively collected by native populations for food, by hand at low tide on the reefs, or by diving. In spite of its weight and considerable size, the shell is favoured, especially by tourists, due to the beauty of its heavily glazed aperture.

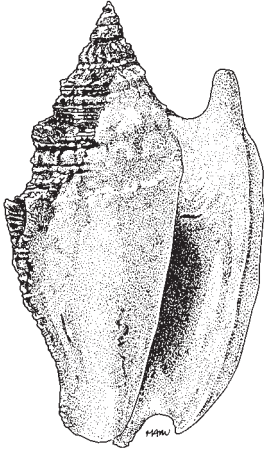
Distribution: Widespread in the Indo-West Pacific, this species occurs in 3, geographically disjunct areas. Indian Ocean, from central East Africa, including Madagascar and the Mascareign Islands, to the Bay of Bengal and Cocos (Keeling) Island. The Red Sea and Persian Gulf region. The tropical West Pacific, from Indonesia to eastern Polynesia; north to southern Japan and south to northern Queensland and New Caledonia. Specimens from the western Pacific, Red Sea and Persian Gulf are generally considered as the subspecies *Lambis truncata sebae* (Kiener, 1843).



Strombus aurisdianae Linnaeus, 1767

Frequent synonyms / misidentifications: *Euprotomus aurisdianae* (Linnaeus, 1767); ? *Strombus aratrum* (Röding, 1798); *S. chrysostomus* Kuroda, 1942 / None.

FAO names: En - Diana conch; Fr - Strombe de Diane.



ventral view

(after Short and Potter, 1987)



dorsal view

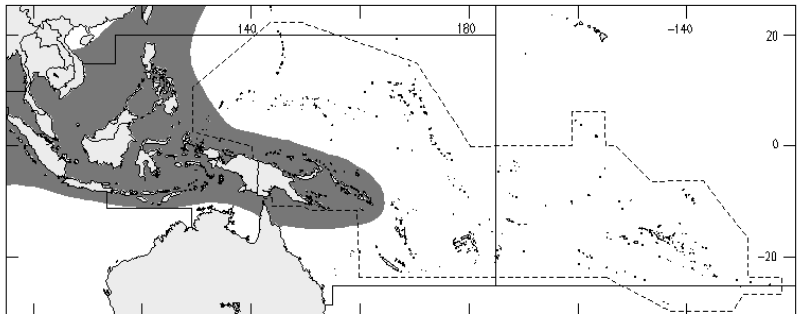
(after Walls, 1980)

Diagnostic characters: Shell thick, almost elliptical, with a high pointed spire, and with a prong-like posterior expansion on the flared outer lip. Spire whorls with fine spiral threads, a larger wavy cord just below the suture, and blunt spines at the shoulder. **Body whorl rough and dull, with a row of large knobs on the shoulder and many well-marked and unequal spiral ridges all over, 2 or 3 of them somewhat knobby.** Ventral side of shell extensively glazed. Aperture slightly lirate inside, at the anterior and posterior ends of the outer lip. Margin of the outer lip thickened, smoothish externally, with a deep anterior notch. Prong-like projection of the outer lip extending posteriorly about halfway as far as the apex of the spire. Inner lip smooth, with a moderately thin callus spreading ventrally over most of body whorl and part of the spire. Siphonal canal strongly recurved dorsally. **Colour:** outside of shell dull cream or light grey, scattered with irregular dark brown to greyish spots or lines. Exterior of the outer lip margin with spiral bands of greyish brown and cream. Ventral callus and inner lip generally glossy white. Aperture rich orange or pink inside, becoming paler to whitish towards the outer lip margins.

Size: Maximum shell length 9 cm, commonly to 7 cm.

Habitat, biology, and fisheries: Common on various shallow water bottoms of coral reef areas such as grassy sand flats, coral sand, or dead coral. Low in the intertidal zone and shallow subtidal levels to a depth of about 10 m. In some places, a distinct form, often considered as subspecies *Strombus aurisdianae aratrum* (Röding, 1798), occurs nearer to the mainland and in muddier environments. Collected for food where abundant. Shell used in shellcraft. Appears in local markets of the central and northern Philippines.

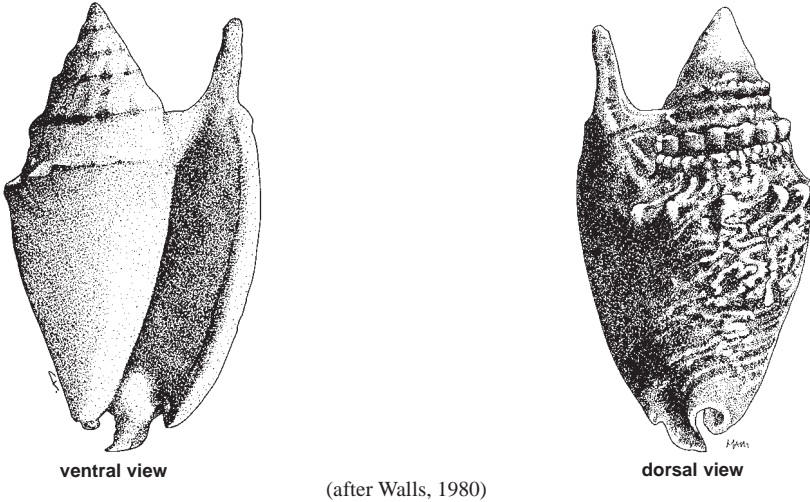
Distribution: Widespread in the Indo-West Pacific, from central East Africa, including Madagascar and the southern Red Sea, but not in the northwestern Indian Ocean, to Melanesia; north to southern Japan, and south to northern Queensland.



Strombus bulla (Röding, 1798)

Frequent synonyms / misidentifications: *Euprotomus bulla* (Röding, 1798); *Strombus guttatus* "Martini" Kiener, 1843 / *Strombus aurisdianae* Linnaeus, 1767.

FAO names: En - Bubble conch; Fr - Strombe tacheté.

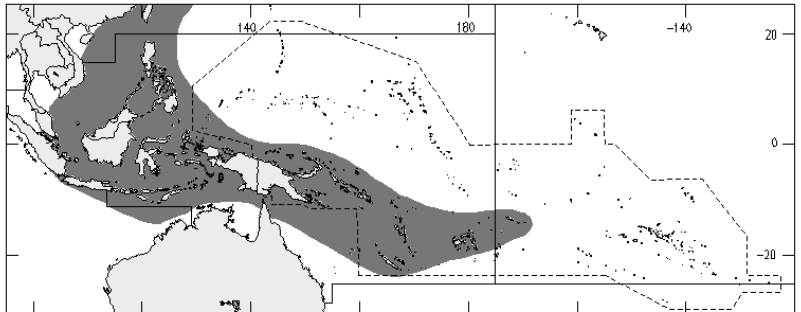


Diagnostic characters: Shell thick, almost elliptical, with a high pointed spire, and with a prong-like posterior expansion on the flared outer lip. Spire whorls finely cancellate and knobbed at the shoulder, but often largely obscured by a thick glaze spreading from ventral side of shell. **Body whorl smoothish and rather glossy, with a row of well-marked knobs on the shoulder and many, almost obsolete spiral ridges, none of them knobby.** Ventral side of shell heavily and extensively glazé. **Columella and outer lip of the aperture completely smooth.** Outer lip thickened on margin and smooth externally, with a deep anterior notch. Prong-like projection of the outer lip extending posteriorly about 3/4 way to the apex of spire. Inner lip **callus thick, spreading over most of the ventral side of shell, and often over dorsal side of spire** to the apex in mature specimens. **Siphonal canal strongly recurved dorsally.** **Colour:** outside of shell **glossy cream with fawn mottlings** and spiral bands of greyish appearing on the outer lip margin. **Ventral side of shell and glazé part of the spire glossy white,** sometimes with a mauve hue at both ends. **Aperture bright pink or orange inside,** white on margins.

Size: Maximum shell length 7.5 cm, commonly to 6 cm.

Habitat, biology, and fisheries: On clean sand bottoms, near coral reefs. Sublittoral, from the lowest tide levels to a depth of about 20 m. Mainly collected for its shell, occasionally eaten.

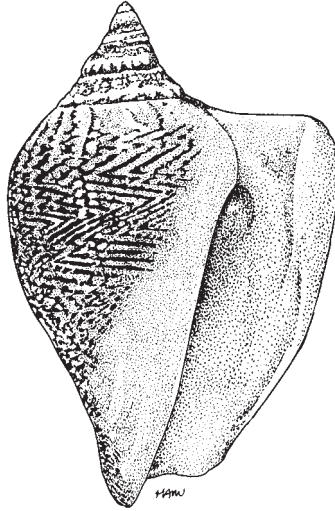
Distribution: Western Pacific, from Indonesia to Melanesia and western Polynesia; north to southern Japan and south to northern Queensland and New Caledonia.



Strombus canarium Linnaeus, 1758

Frequent synonyms / misidentifications: *Laevistrombus canarium* (Linnaeus, 1758); *L. turturella* (Röding, 1798); *Strombus isabella* Lamarck, 1822 / None.

FAO names: En - Dog conch; Fr - Strombe isabelle.



ventral view

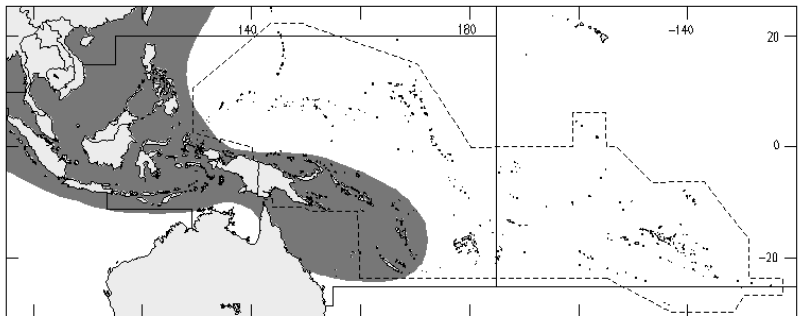
(after Short and Potter, 1987)

Diagnostic characters: Shell heavy, rotund and smoothish, with a moderately high conical spire, devoid of marginal spikes on the widely flaring outer lip. Spire whorls convex, only weakly ribbed and varicate. Body whorl roundly swollen at the shoulder, smooth except for a few spiral grooves anteriorly. Columella and outer lip of aperture smooth. Outer lip roughly wing-shaped, strongly thickened marginally, not expanding posteriorly beyond the last whorl. Anterior notch shallow. Columellar callus mainly restricted to the inner lip area, somewhat broader and thicker anteriorly. Siphonal canal short and broad, straightish. **Colour:** outer coloration of shell variable, light (rarely dark) yellowish brown or grey, uniform or with a network of closely spaced, fine wavy axial lines of darker brown; colour of body whorl often paler ventrally. Aperture white, sometimes with a golden brown or metallic grey glaze on thickened margin of the outer lip and on columellar callus of mature specimens.

Size: Maximum shell length 10 cm, commonly to 6.5 cm.

Habitat, biology, and fisheries: Abundant on muddy sand and algae bottoms of larger islands and continental shores. Littoral and sublittoral zones, from low tide levels to a depth of about 55 m. Commercially fished for food in many parts of South East Asia. In the Philippines, shells are traditionally used by fishermen as sinkers for nets.

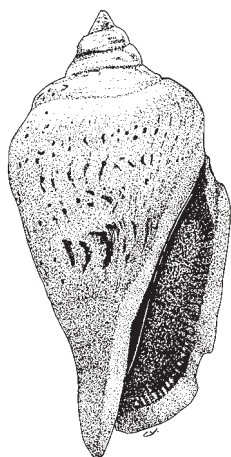
Distribution: Indo-West Pacific, from southern India and Sri Lanka to Melanesia; north to Japan and south to Queensland and New Caledonia.



Strombus gibberulus Linnaeus, 1758

Frequent synonyms / misidentifications: *Gibberulus gibberulus* (Linnaeus, 1758); *G. gibbosus* (Röding, 1798) / None.

FAO names: En - Gibbose conch; Fr - Strombe gibbeux.



ventral view

(after Short and Plotter, 1987)



dorsal view

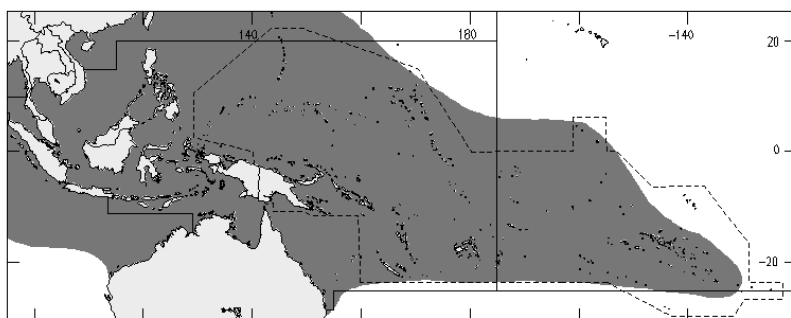
(after Walls, 1980)

Diagnostic characters: Shell moderately small, solid, roughly fusiform in shape, with a moderately high, somewhat asymmetrically coiled spire and only slightly thickened and flared outer lip. Body whorl pear-shaped, attenuate and twisted towards the anterior end. Spire whorls with fine spiral grooves, broad and rounded varices, and undulating sutures. Distorsion of the spire most conspicuous on penultimate whorl, which is strongly and roundly shouldered, so that the last third of body whorl descend rapidly, thus giving a distorted shape. Surface of body whorl smoothish, but for slightly raised spiral threads near the outer lip margin and the anterior end. Outer lip distinctly lirate inside, with a sharp margin posteriorly sinuated. Anterior notch deep. Inner lip smooth and narrowly calloused. Siphonal canal short, a little twisted and dorsally recurved. Colour: outer pattern of coloration variable, usually white with various bands and streaks of yellow to brown. Aperture all-white, or tinted internally with brown, purple, orange or yellow. A purple-brown, elongate blotch on columellar margin.

Size: Maximum shell length 7 cm, commonly to 5 cm.

Habitat, biology, and fisheries: Abundant in or near coral reef areas. Mostly in shallow waters, on clear sand and seagrass bottoms, but also occurring in sandy patches of reef flats, in sandy lagoons or in muddy sand bottoms. Shells of specimens living in deeper water tend to be smaller and more brightly coloured. Migrates often from deep to shallow water environments for breeding. Intertidal and sublittoral to a depth of about 20 m. Commonly collected for its shell, or for subsistence. Exploited in the Fiji Islands, and appearing also in local markets of the northern Philippines.

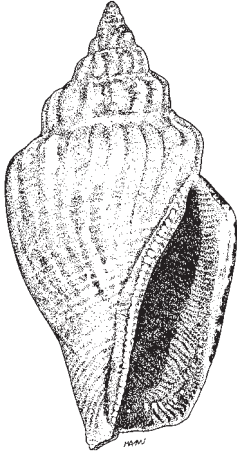
Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to southern Japan and Marcus Island, and south to southern Queensland and New Caledonia. Populations of the West Pacific and western Australian coasts belong to subspecies *Strombus gibberulus gibbosus* (Röding, 1798).



***Strombus labiatus* (Röding, 1798)**

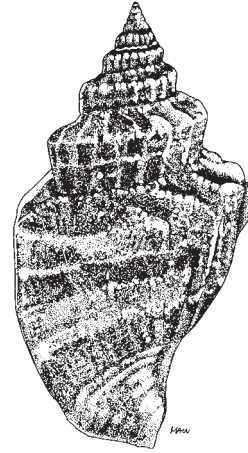
Frequent synonyms / misidentifications: *Canarium labiatum* (Röding, 1798) / *Strombus urceus* Linnaeus, 1758.

FAO names: En - Plicate conch; Fr - Strombe plissé.



ventral view

(after Walls, 1980)



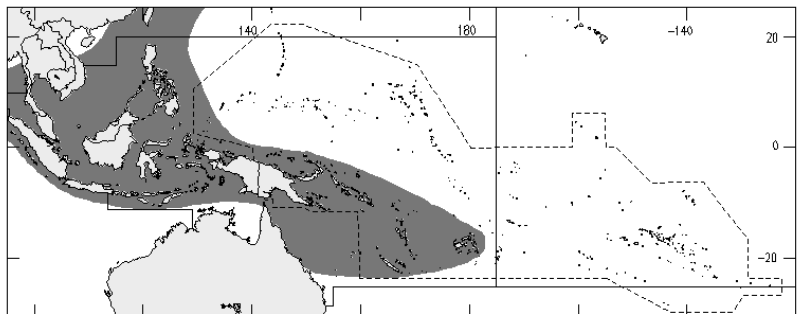
dorsal view

Diagnostic characters: Shell small, elongate-ovate, with a relatively high, conical spire and a **poorly developed outer lip, devoid of marginal spikes**. Spire whorls markedly shouldered and nodulose. Body whorl with prominent, elongate knobs on the shoulder (1 or 2 of them larger than the others on dorsal side), and numerous weak spiral cords anteriorly. Shoulder knobs giving rise to **many distinct axial folds on ventral side of body whorl**. Aperture moderately small and narrow, not reaching shoulder posteriorly. **Outer lip** slightly thickened at margin, **densely lirate inside**. **Anterior notch poorly to well developed**. **Inner lip** narrowly calloused, **finely lirate** along its entire length. **Siphonal canal short and straightish, truncate**. **Colour:** outer coloration of shell **very variable**, plain white, grey, tan or dark brown, or with various brown to orange dots, bands or patches on a paler background. Aperture deep brown to purple or orange inside, **inner lip orange or yellowish**.

Size: Maximum shell length 5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: Burrowing in seagrass beds and algal bottoms. Abundant in intertidal and shallow subtidal waters. Mainly collected for shellcraft, especially in the Philippines, where the species is locally very abundant.

Distribution: Discontinuous in the Indo-West Pacific: Western Indian Ocean, from central East Africa, including Madagascar and Mauritius Island, to Sri Lanka. Eastern Indian Ocean and the tropical West Pacific, from Andaman and Nicobar islands to eastern Melanesia; north to Japan and south to Queensland and New Caledonia.



Strombus lentiginosus Linnaeus, 1758

Frequent synonyms / misidentifications: *Lentigo lentiginosus* (Linnaeus, 1758) / None.

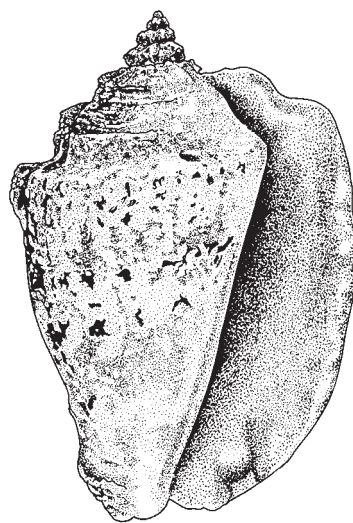
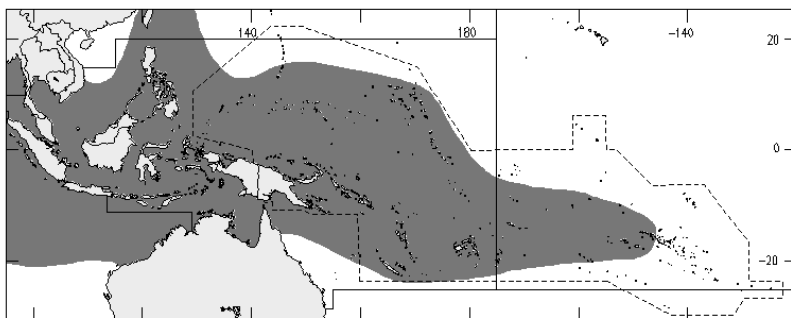
FAO names: En - Silver conch; Fr - Strombe lentigineux.

Diagnostic characters: Shell thick and heavy, with a moderately high, stepped spire and **marginal undulations on the moderately flaring and posteriorly expanded outer lip. Spire whorls partly overlapping each other, with a spiral row of heavy knobs and fine overriding spiral grooves.** Dorsal side of **body whorl rough, with low, irregular spiral cords and about 4 spiral rows of blunt tubercles, forming strongly protruding knobs on the shoulder.** **Ventral side of shell smoothish, extensively glazed. Aperture smooth inside.** Outer lip strongly thickened and shallowly undulate on margin, with 3 broad undulations at posterior end. Posterior expansion of outer lip decidedly lower than spire. Anterior notch deep. Inner lip smooth, with an extensive callus spreading ventrally over most of the body whorl and part of the spire. Columella projecting anteriorly. **Siphonal canal somewhat recurved dorsally.** **Colour: outside of shell creamy white, with irregular chestnut brown blotches and dots in vaguely spiral bands.** Columellar callus with a translucent silvery glaze. **Aperture pink to orange deep inside, becoming cream towards the margins.** A series of soft light tan blotches on lateral margin of outer lip.

Size: Maximum shell length 10 cm, commonly to 7.5 cm.

Habitat, biology, and fisheries: On coral-sand bottoms in clear water, sometimes with rocks and seaweeds. Common on barrier, fringing or lagoon reefs. Intertidal and shallow subtidal zones to a depth of about 4 m. Outer surface of shell sometimes with Vermetid and Hipponicid gastropods, or more or less covered with green algae, bryozoans, and other marine growths. Locally collected for food, this species is not rare in the local markets of the central Philippines. Shell used in shellcraft.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, but not the Red Sea and the Persian Gulf, to eastern Polynesia; north to southern Japan, and south to north Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

Strombus luhuanus Linnaeus, 1758

Frequent synonyms / misidentifications: *Conomurex luhuanus* (Linnaeus, 1758) / None.

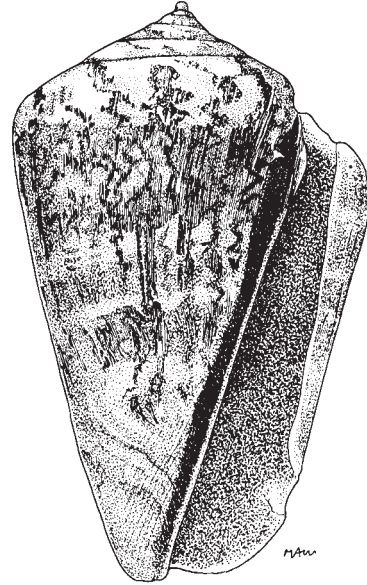
FAO names: En - Strawberry conch; Fr - Strombe fraise.

Diagnostic characters: Shell cone-shaped, with a relatively low, conical spire and a well-developed body whorl tapering towards the moderately narrow anterior end. Spire whorls convex, smooth or with rounded axial ribs and with a somewhat wavering suture. **Body whorl strongly shouldered, nearly smooth** but for a few shallow spiral grooves on anterior 1/3, and for fine axial growth lines. **Periostracum thick and rough**, easily eroded. **Outer lip** of the aperture **almost rectangular**, extending along most of the body whorl, **slightly in-turned instead of flaring**, smoothish inside (i.e. smooth to the naked eye, but appearing minutely lirate under a hand lens). **Anterior notch deep**; another, well-marked notch present at shoulder slope's level. Inner lip smooth, **columnellar callus reduced** to a narrow axial margin. **Siphonal canal short and truncate**. **Colour: outside of shell white, with variable light tan to brown blotches and zigzag lines arranged in narrow and broad spiral bands**, sometimes entirely brown or white. Periostracum yellowish to greenish brown. **Aperture rich orange, red or pink inside, inner lip rimmed with chocolate brown or black.**

Size: Maximum shell length 8 cm, commonly to 5 cm.

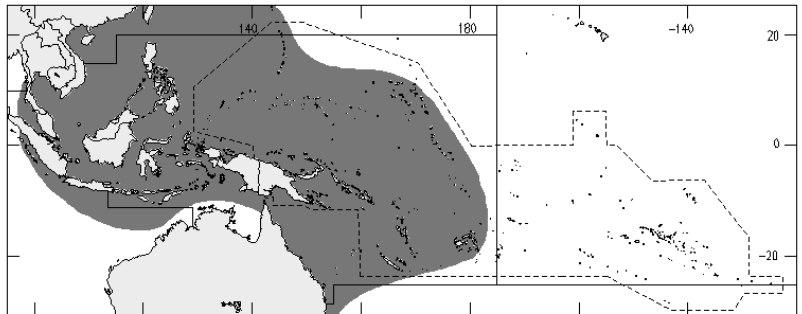
Habitat, biology, and fisheries: Abundant on sandy bottoms of coral reef areas, among seagrass and coral rubble. Also in coastal lagoons, bays and other protected areas, where the bottom is devoid of mud. Intertidal and shallow sublittoral zones to a depth of about 20 m. Commonly collected for food in many areas, especially in the Philippines and Papua New Guinea where it is a popular resource.

Distribution: Western Pacific, from the western coasts of Thailand to eastern Melanesia and Palmyre Island, Polynesia; north to Japan and south to northern New South Wales and New Caledonia.



ventral view

(after Short and Potter, 1987)



***Strombus urceus* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Canarium urceus* (Linnaeus, 1758) / *Strombus plicatus* Lamarck, 1822.

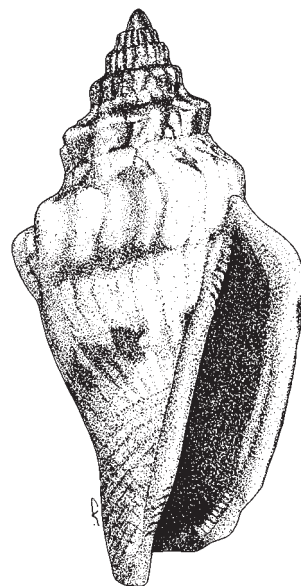
FAO names: En - Little pitcher conch; Fr - Strombe cruchon.

Diagnostic characters: Shell small, elongate-ovate with a tall spire, highly variable in shape and sculpture. Outer lip poorly developed, devoid of marginal spikes. Spire whorls with incised suture, rounded to angulate shoulder, and nodulose axial cords and varices. Sculpture of body whorl generally reduced, with fine spiral grooves near the anterior end and the outer lip margin, and with a row of low knobs at the shoulder, smaller ventrally and larger dorsally. (In the north Australian subspecies *Strombus urceus orrae* Abbott, 1960, shoulder knobs are more prominent and axial folds may be present on ventral side of body whorl). Aperture moderately small and narrow, reaching, or not reaching, the shoulder posteriorly. Outer lip thickened and slightly expanded at margin, widely arched to roughly squared in outline, densely lirate inside. Anterior notch not very deep but well marked. Inner lip narrowly thickened, finely lirate at both ends only. Siphonal canal short and widely arched. Colour: outer coloration of shell highly variable, plain white, greyish, orange or brown, or with various darker bands and spots on a pale background. Aperture white, purplish brown to almost black deep inside, often becoming yellow to orange towards the lips and stained with black on the anterior siphonal canal; margins of the aperture sometimes rimmed with black.

Size: Maximum shell length 6 cm, commonly to 5 cm.

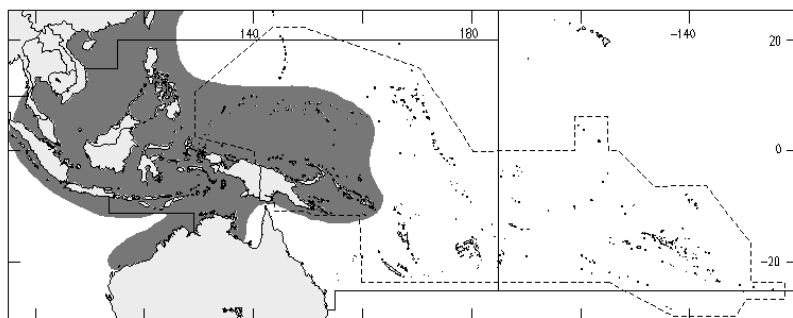
Habitat, biology, and fisheries: On sand or sandy mud bottoms, sometimes associated with sparse algae. Often occurring in colonies. Intertidal and sublittoral zones to a depth of about 40 m. Actively collected in the Philippines, this common species is often sold in the markets of northern Luzon. Shell frequently used to make decorative items.

Distribution: The most eastern part of the Indian Ocean and the tropical West Pacific, from the Andaman Sea to Micronesia and Melanesia; north to southern Japan and south to the northern coasts of Australia.



ventral view

(after Walls, 1980)

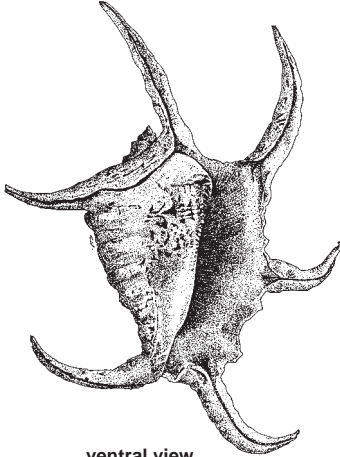


Lambis chiragra chiragra (Linnaeus, 1758)

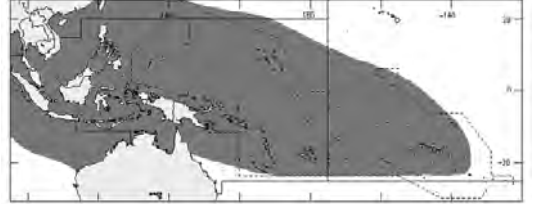
Frequent synonyms / misidentifications: *Harpago chiragra* (Linnaeus, 1758); ? *Lambis rugosa* (Sowerby, 1842) / None.

En - Chiragra spider conch; **Fr** - Ptérocère rugueux.

Maximum shell length 32 cm, commonly to 17 cm. In coral reef areas, often on coarse sand with coral rubble and algae. Littoral and sublittoral, in tidal pools and low tide levels to a depth of about 25 m. Sexual dimorphism strong, females usually much larger than the males. Collected for food by local populations. Shell used in shellcraft. Eastern Indian Ocean and the tropical West Pacific, from Sri Lanka and the Gulf of Bengal to eastern Polynesia; north to Taiwan Province of China and southern Japan, and south to northern Queensland and New Caledonia. The subspecies *Lambis chiragra arthritica* Röding, 1798, is restricted to the western Indian Ocean.



ventral view
(after Short and Potter, 1987)

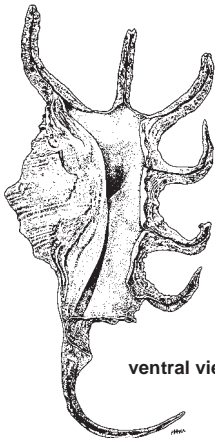


Lambis crocata (Link, 1807)

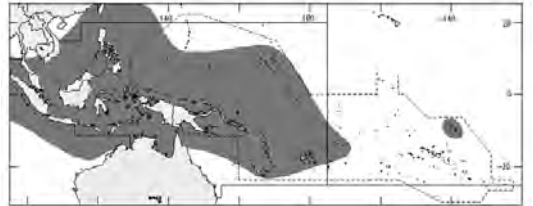
Frequent synonyms / misidentifications: *Pterocera aurantia* Lamarck, 1822 / *Lambis scorpius* (Linnaeus, 1758).

En - Orange spider conch; **Fr** - Ptérocère orange.

Maximum shell length 24 cm, commonly to 13 cm. On reef bottoms among living colonies and dead boulders of coral. Low intertidal levels and sublittoral zone to a depth of about 10 m. A large sized subspecies (*Lambis crocata pilsbryi* Abbott, 1961) occurs in eastern Polynesia. Collected for food and for shell trade where common. Indo-West Pacific, from East Africa, including Madagascar, but not in the northwestern Indian Ocean, Red Sea and Persian Gulf, to eastern Polynesia; north to southern Japan and south to north Queensland and New Caledonia. The subspecies *Lambis crocata pilsbryi* Abbott, 1961, is restricted to the Marquesas Islands, eastern Polynesia.



ventral view
(after Short and Potter, 1987)

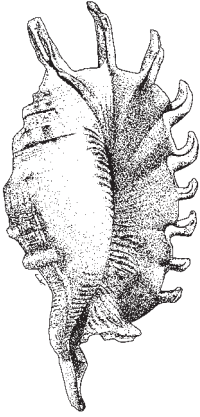


Lambis millepeda (Linnaeus, 1758)

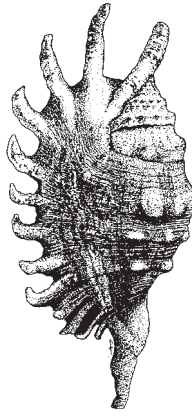
Frequent synonyms / misidentifications: *Millepes millepeda* (Linnaeus, 1758) / None.

En - Milleped spider conch; **Fr** - Ptérocère millepattes.

Maximum shell length 15 cm, commonly to 10 cm. Common on various shallow-water bottoms, from low in the intertidal zone to a depth of a few metres. Mainly collected for its shell. Appears frequently in the local markets of the central Philippines, though the flesh is said to have a somewhat bitter taste, and then to be less often eaten than the other *Lambis* species. Restricted to central portion of the western Pacific, from the Philippines to southern Indonesia and Papua New Guinea.



ventral view



dorsal view

(after Dance, 1974)

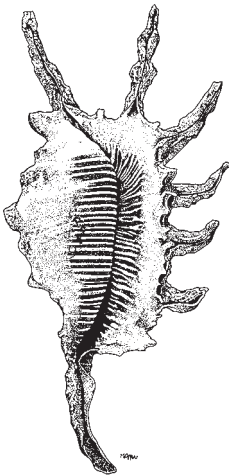


Lambis scorpius (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Pterocera nodosa* Lamarck, 1816; *P. scorpio* (Linnaeus, 1758) / None.

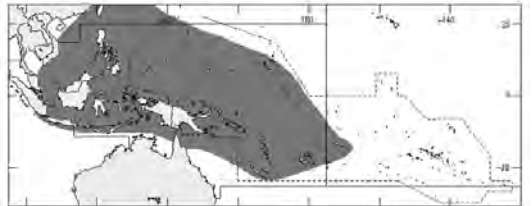
En - Scorpio spider conch; **Fr** - Ptérocère scorpio.

Maximum shell length 17 cm, commonly to 13 cm. In protected areas of coral reef flats, under or among dead coral slabs and boulders. In shallow waters, from low tide levels to shallow subtidal zone to a depth of about 5 m. Collected for shell trade and occasionally for subsistence. The tropical West Pacific, from western Indonesia to western Polynesia; north to southern Japan, and south to northern Queensland and New Caledonia. A distinct subspecies, *Lambis scorpius indomaris* Abbott, 1961, occurs uncommonly in the eastern and central Indian Ocean.



ventral view

(after Short and Potter, 1987)

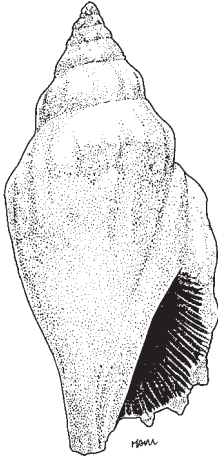


***Strombus dentatus* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Canarium dentatum* (Linnaeus, 1758) / None.

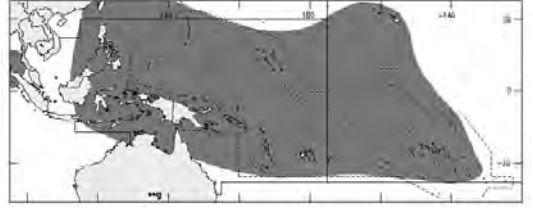
En - Samar conch; **Fr** - Strombe trident.

Maximum shell length 6 cm, commonly to 4 cm. On pure sand bottoms, usually on or near coral reefs. Littoral and sublittoral, from low tide marks to a depth of 80 m. Though occasionally eaten, this species is mainly collected for its attractive shell. It appears incidentally in local markets of the northern Philippines. Widespread in the Indo-West Pacific, this species has apparently a disjunct geographic distribution: the western Indian Ocean, from East Africa and the southern Red Sea to the Maldive Islands. Eastern Indian Ocean, in the Andaman Sea. Tropical West Pacific, from Borneo to eastern Polynesia; north to Japan and Hawaii, and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

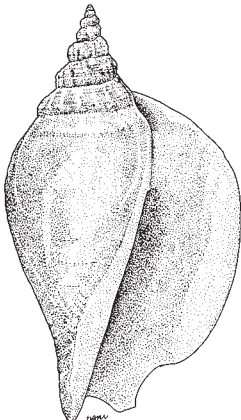


***Strombus epidromis* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Labiostrombus epidromis* (Linnaeus, 1758); *Strombus epidromus* (Spelling error) / None.

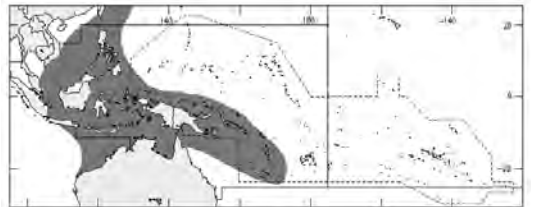
En - Swan conch; **Fr** - Strombe aile-de-cygne.

Maximum shell length 9 cm, commonly to 7.5 cm. On sandy to muddy bottoms, generally in larger islands only. May occur in large colonies at some localities. Mainly sublittoral, from low tide limit to a depth of about 30 m. Occasionally collected for food and for its shell where common. Tropical West Pacific, from western Indonesia to Melanesia; north to southern Japan and south to northern Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

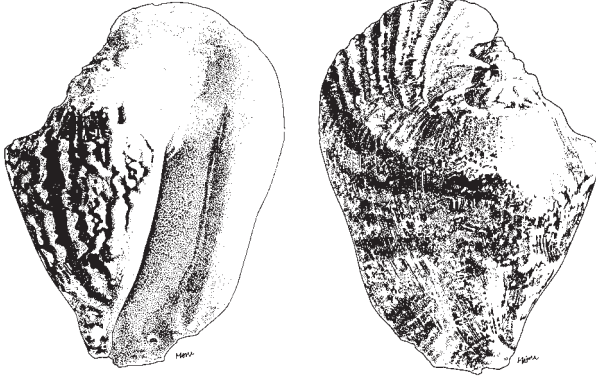


***Strombus latissimus* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Tricornis latissimus* (Linnaeus, 1758) / None.

En - Widest Pacific conch; **Fr** - Grand strombe du Pacifique.

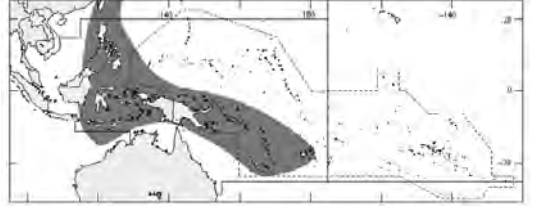
Maximum shell length 20 cm, commonly to 15 cm. On sand bottoms, around coral reefs. Sublittoral, at depths of 4 to 20 m. Generally not very abundant, this species is locally collected for food and for its large, decorative shell. Islands of the tropical West Pacific, from southern Japan to eastern Melanesia.



ventral view

dorsal view

(after Dance, 1974)

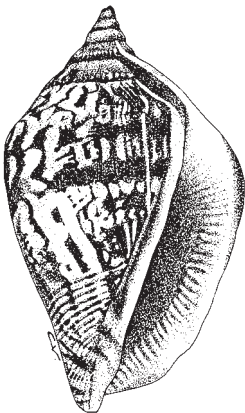


***Strombus marginatus* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Dolomena marginata* (Linnaeus, 1758); *Strombus robustus* Sowerby, 1874; *S. septimus* Duclos, 1844; *S. succintus* Linnaeus, 1767 / None.

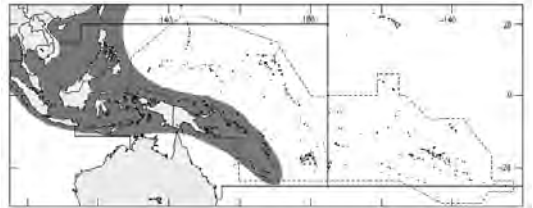
En - Marginate conch; **Fr** - Strombe marginé.

Maximum shell length 7 cm, commonly to 5 cm. In coral sand, or muddy-sand bottoms. Mainly sublittoral, from low tide limit to a depth of about 30 m. This variable species exhibits a number of geographical and ecological forms or subspecies throughout its range. As other *Strombus* species, it is locally collected for food and shell trade. No precise data available on this species in the area, but it is considered to be economically important in eastern India. Eastern Indian Ocean and the tropical West Pacific, from the east coast of India and Sri Lanka to eastern Melanesia; north to Japan and south to New Caledonia.



ventral view

(after Kira, 1962)

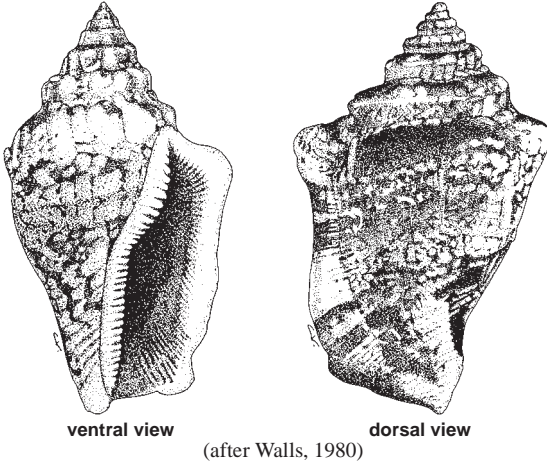


***Strombus mutabilis* Swainson, 1821**

Frequent synonyms / misidentifications: *Canarium mutabilis* (Swainson, 1821); *Strombus floridus* Lamarck, 1822 / None.

En - Mutable conch; **Fr** - Strombe fleuri.

Maximum shell length 4 cm, commonly to 3.5 cm. Abundant on sandy and rubble bottoms of coral and rocky reefs, either in exposed or in protected areas and in clear to turbid waters. Most common just below low tide marks. Intertidal and sublittoral to a depth of about 20 m. Shell used in shellcraft. Occasionally appearing in the markets of the northern Philippines. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan, and south to central New South Wales and Lord Howe Island.

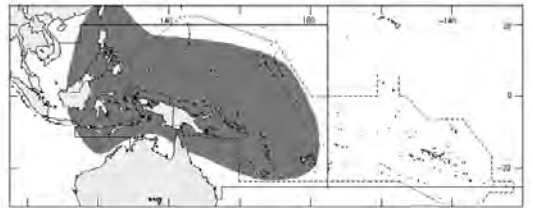
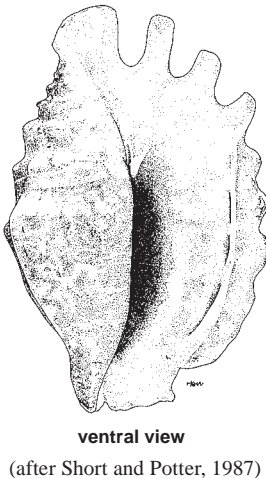


***Strombus sinuatus* Humphrey, 1786**

Frequent synonyms / misidentifications: *Strombus cristatus* Lamarck, 1822; *Tricornis sinuatus* (Humphrey, 1786) / None.

En - Lacinate conch; **Fr** - Strombe à crête.

Maximum shell length 13 cm, commonly to 10 cm. On sand bottoms with broken corals and algae, in relatively clear waters. From low in the intertidal zone to a depth of about 20 m. Occasionally collected in small colonies by native fishermen in eastern Papua New Guinea. Tropical western Pacific, from Borneo to Micronesia and eastern Melanesia; north to southern Japan and south to northern Queensland and New Caledonia.

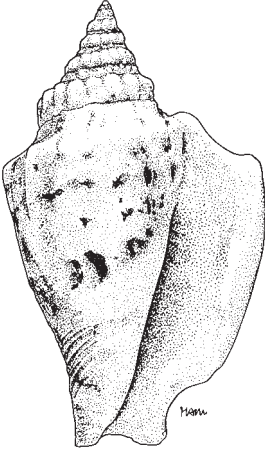


***Strombus variabilis* Swainson, 1820**

Frequent synonyms / misidentifications: *Dolomena variabilis* (Swainson, 1820); *Strombus athenius* Duclos, 1844 / None.

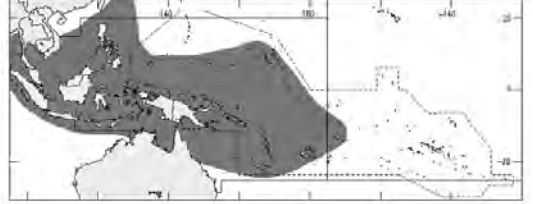
En - Variable conch; **Fr** - Strombe variable.

Maximum shell length 6 cm, commonly to 4.5 cm. On coral sand and sandy-mud bottoms. Mainly sublittoral, from low tide levels to a depth of about 50 m. Occasionally collected for food and shell trade. Eastern part of the Indian Ocean and the tropical West Pacific, from the Andaman Sea to western Polynesia; north to southern Japan and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

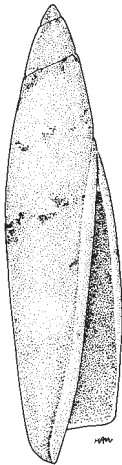


***Terebellum terebellum* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: None / None.

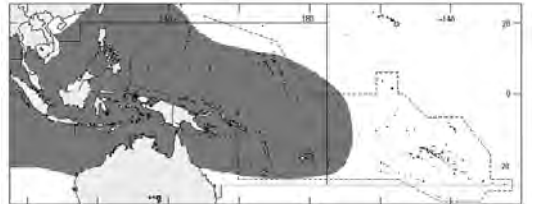
En - Terebellum conch; **Fr** - Térébelle.

Maximum shell length 7 cm, commonly to 5 cm. Burrower of coastal sand bottoms, most common subtidally. Mainly collected for shellcraft because of the highly variable colour patterns of its shell. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to Micronesia and western Polynesia; north to Japan, and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)



Tibia fusus (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Rostellaria serrata* Perry, 1811 / None.

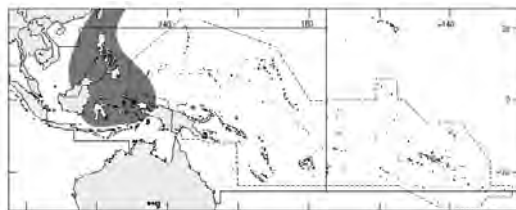
En - Shinbone tibia; **Fr** - Rostellaire fuselée.

Maximum shell length 30 cm, commonly to 23 cm. On sandy bottoms. Sublittoral, at depths of 5 to about 50 m. Occasional bycatch in the northern Philippines. Shell highly prized for its long siphonal canal. Limited to the tropical West Pacific, from southern Japan and the Philippines to the Banda Sea, Indonesia.



ventral view

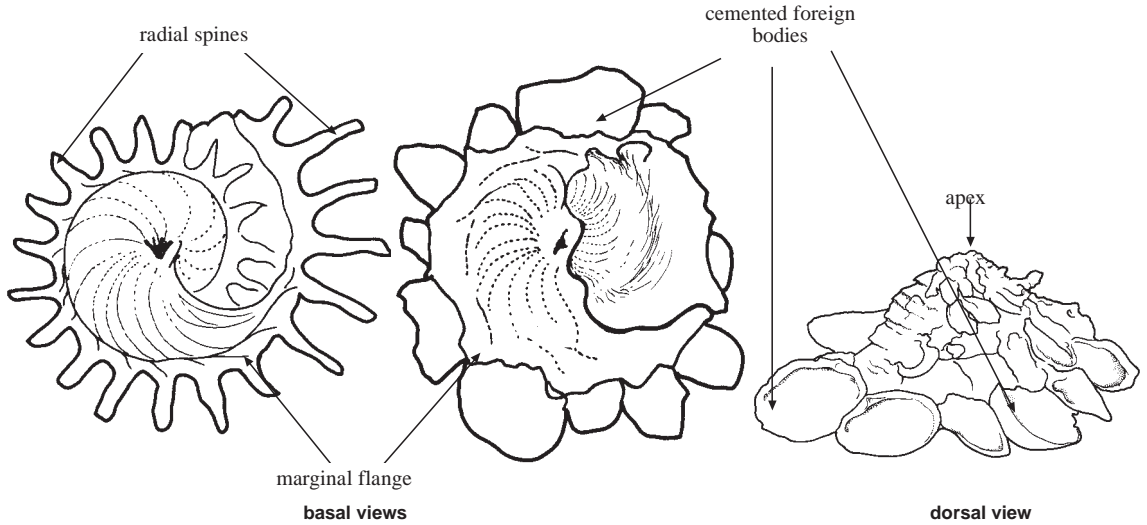
(after Kira, 1962)



XENOPHORIDAE

Carrier shells

Diagnostic characters: Shell lightweight, usually wider than long, **low-conical** in shape with a somewhat depressed spire and a **broad, flattened concave base**. Sculpture of dorsal surface often with irregular radial folds. **Periphery** carinated, **with a lobed marginal flange, hollow radial spines, or cemented foreign bodies** such as empty shells, coral debris, pebbles, or sand grains. Umbilicus large to reduced, sometimes closed. **Aperture** oblique, low and wide, **without a siphonal canal**, with a strongly arched basal margin and a columellar callosity tending to obscure the umbilicus. Interior of shell porcelaneous. **Operculum corneous**, stout and ovate, with a lateral nucleus.

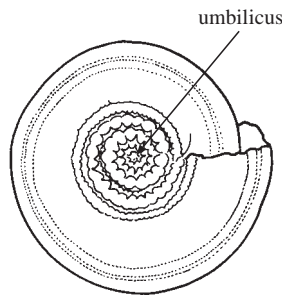


Habitat, biology, and fisheries: Found below the low tide level, mostly in comparatively shallow water but also deeper to 700 m, on calm bottoms of sand and mud. The projecting shell periphery and attached foreign objects help to stabilize the shell and raise it off the soft substrate, allowing the animal to collect tiny detritus underneath or to rasp. Foot and operculum used for a leaping locomotion. Sexes separate. Larvae probably planktonic. Carrier shells are occasionally collected with other gastropod species by shrimp trawlers, and their shells are used in shellcraft.

Similar families occurring in the area

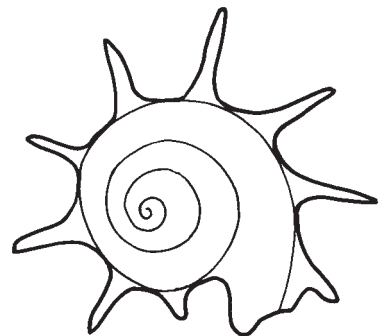
Architectonicidae: periphery keeled, but not projecting and always without attached foreign objects; base flattened but not concave; umbilicus widely open, with a granular spiral keel inside.

Turbinidae (genus *Guildfordia*): easily differentiated from Xenophoridae with peripheral spines by the calcareous operculum and nacreous interior.



basal view

Architectonicidae



apical view

Turbinidae (*Guildfordia* species)

References

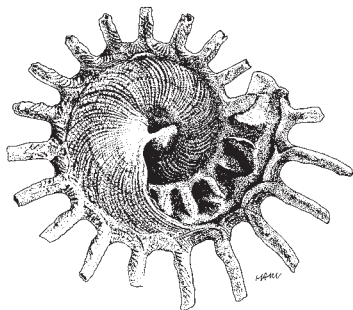
- Morton, J.E. 1958. The adaptations and relationships of the Xenophoridae (Mesogastropoda). *Proc. Malac. Soc. Lond.*, 33(3):89-101.
- Ponder, W.F. 1983. A revision of the recent Xenophoridae of the world and of the Australian fossil species (Mollusca: Gastropoda). *Aust. Mus. Mem.*, 17:1-126.

A single species of interest to fisheries occurring in the area***Xenophora solaris* (Linnaeus, 1764)**

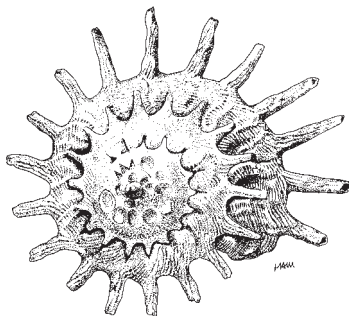
Frequent synonyms / misidentifications: *Stellaria solaris* (Linnaeus, 1764); *S. paucispinosa* Kosuge and Nomoto, 1972 / None.

En - Sunburst carrier shell; **Fr** - Xénophore solaire.

Maximum shell width 13 cm, commonly to 10 cm. On sand and mud bottoms of the continental shelf and upper slope. From shallow subtidal water to a depth of about 250 m. Occasionally collected in shrimp trawls. Shell used in shellcraft. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea and the Persian Gulf, to eastern Indonesia; north to the Philippines and south to southern Indonesia.



basal view
(after Lindner, 1976)

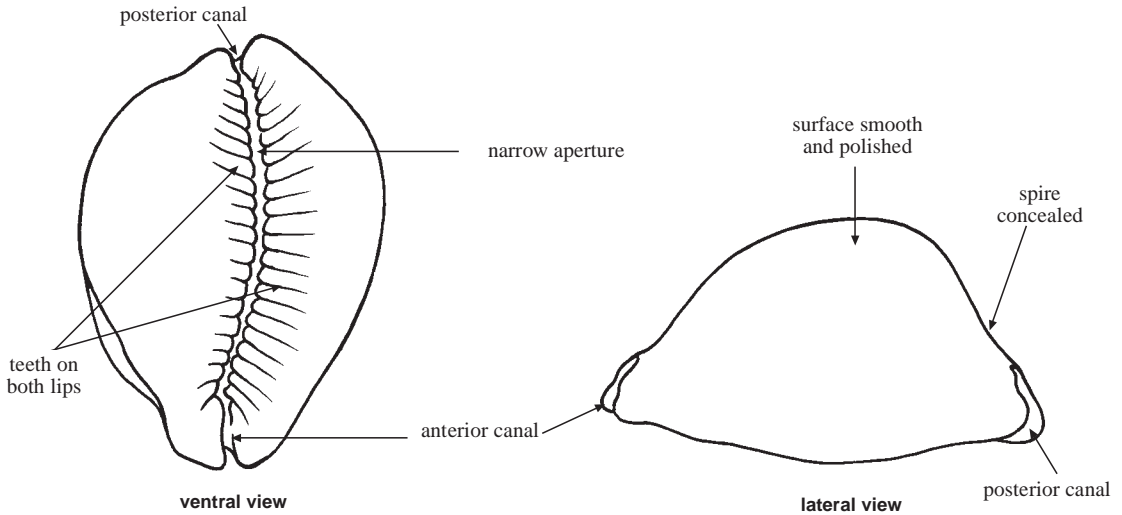


apical view
(after Grassé, 1969)

CYPRAEIDAE

Cowries

Diagnostic characters: Shell fairly sturdy, **ovate or oblong**, **spire** short and **concealed under body whorl** in the adult. **Surface highly polished, smooth** and usually vividly patterned, with a low groove on midline of the dorsal side. Periostracum absent. Ventral side more or less flattened to calloused. **Aperture long and narrow**, extending almost the full length of shell, shortly **channeled at both ends**. **Both lips with raised transverse ridges or teeth**, the outer one thickened and incurved; inner lip with a shallow longitudinal furrow situated towards front end. **No operculum**. Mantle very large, with 2 lobes expanding in life over the shell and meeting along the dorsal groove. Mantle lobes often brightly coloured and with numerous small, finger-like or branched sensory outgrowths.

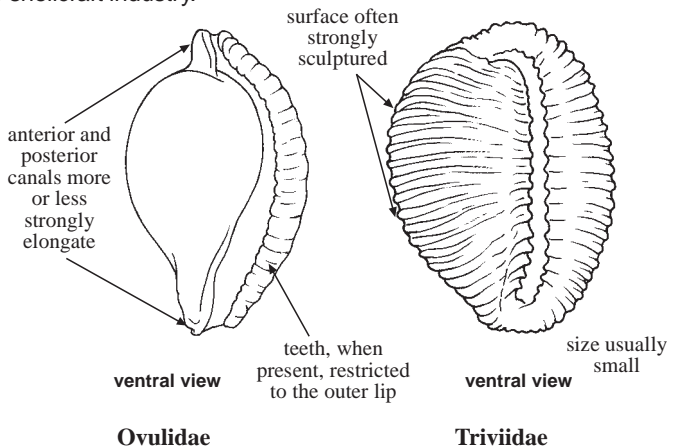


Habitat, biology, and fisheries: Generally associated with coral reefs. Feed most actively at night, browsing on encrusting algae and sponges or tiny animals that grow on rock and coral. Sexes separate, fertilization internal. Eggs laid in horny capsules attached to the substrate by a short stalk and grouped together in a cluster. After laying, the female covers the eggs with her foot until they hatch as free-swimming larvae or as crawling young. Juvenile shell strikingly different from the adults: thin and resembling an olive shell in shape, with a pointed spire, a wide aperture and a sharp, untoothed outerlip. When animal nears maturity, features of the adult appear. Then, the shell cannot increase in size but is thickened by deposition of material over the whole surface, producing the glossy aspect and the distinctive adult colour pattern. Though cowries have been traditionally used as food by native fishermen in many parts of the area, they are nowadays mainly collected for their highly prized shell, for collection purposes or for the shellcraft industry.

Similar families occurring in the area

Ovulidae: teeth, when present, restricted to the outer lip; anterior and posterior canals sometimes strongly elongate.

Triviidae: size usually small; surface often strongly sculptured, with the apertural teeth continued over the lateral and dorsal sides of shell.



Key to species of interest to fisheries occurring in the area

- 1a. Shell cylindrical in outline (Fig. 1a) → 2
- 1b. Shell ovate to pear-shaped in outline (Fig. 1b) → 7

- 2a. Outer surface spotted → 3
- 2b. Outer surface without spots → 5

- 3a. Dorsal side with numerous brown rings of varying size and colour (Fig. 2) *Cypraea argus*
- 3b. Dorsal side without brown rings → 4

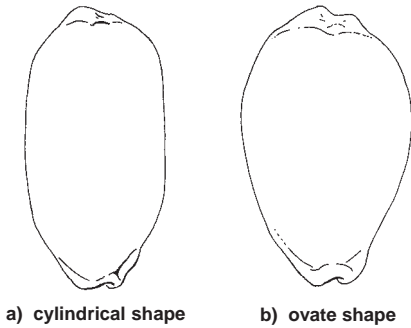


Fig. 1 dorsal view of shell



Fig. 2 *Cypraea argus* (ventral view)

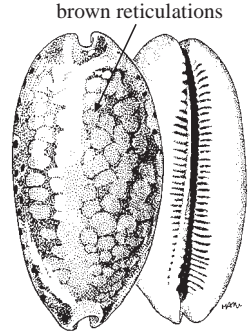


Fig. 3 *Cypraea scurra*

- 4a. Aperture with fine, orange-brown teeth; dorsal side with brown reticulations leaving circular patches (Fig. 3) *Cypraea scurra*
- 4b. Aperture with rather strong, white teeth; dorsal side heavily spotted with brown (Fig. 4) *Cypraea caurica*

- 5a. Ventral side deep chocolate brown (Fig. 5) *Cypraea talpa*
- 5b. Ventral side cream to white → 6

- 6a. Both ends of shell tinged with bright orange; dorsal side with axial dark streaks (Fig. 6) *Cypraea isabella*
- 6b. Ends of shell not tinged with bright orange; dorsal side with large transverse banding (Fig. 7) *Cypraea bouteti*

- 7a. Ventral side enlarged; lateral margins more or less strongly expanded or calloused → 8
- 7b. Ventral side not enlarged; lateral margins not expanded nor calloused → 17

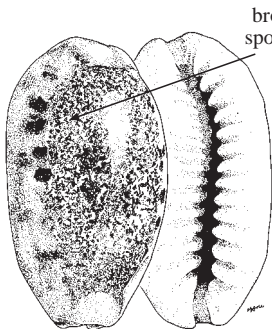


Fig. 4 *Cypraea caurica*



Fig. 5 *Cypraea talpa* (dorsal view)



Fig. 6 *Cypraea isabella* (dorsal view)

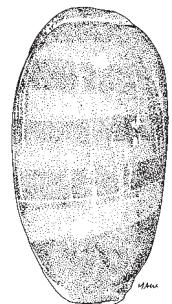


Fig. 7 *Cypraea bouteti* (dorsal view)

- 8a. Shell relatively small (not exceeding 6 cm long); dorsal side rounded but not humped, relatively depressed (Fig. 8a) → 9
- 8b. Shell relatively large (frequently exceeding 7 cm long); dorsal side rounded and more or less humped, never depressed (Fig. 8b) → 14

- 9a. Outer surface spotted → 10
- 9b. Outer surface without spots → 12

- 10a. Shell almost circular in outline; teeth of the aperture reddish brown (Fig. 9) *Cypraea depressa*
- 10b. Shell differently shaped; teeth of the aperture pale fawn to white → 11

- 11a. Shell elongate-ovate in outline; lateral margins produced and somewhat pitted, pale cream with a large, median brown blotch on each side (Fig. 10) *Cypraea erosa*
- 11b. Shell deltoidal-ovate in outline; lateral margins flattened and smooth, dark chocolate brown (Fig. 11) *Cypraea caputserpentis*

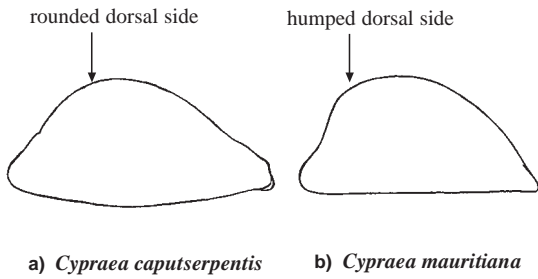


Fig. 8 lateral view of shell

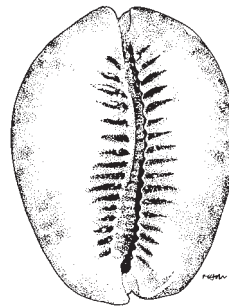


Fig. 9 *Cypraea depressa* (ventral view)

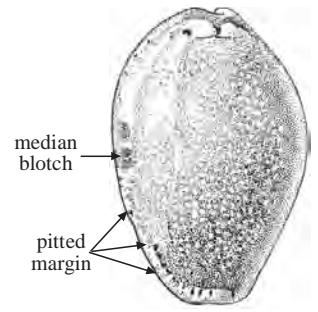


Fig. 10 *Cypraea erosa* (dorsal view)

- 12a. Lateral margins with extremely well-developed callus; a linear depression at junction of dorsal side with periphery of shell (Fig. 12) *Cypraea obvelata*
- 12b. Lateral margins at the most with poorly developed callus; no linear depression at junction of dorsal side with periphery of shell → 13

- 13a. Shell deltoidal in outline, with widened, angulate lateral margins (Fig. 13); ventral side flat to convex *Cypraea moneta*
- 13b. Shell ovate in outline, with rounded lateral margins (Fig. 14); ventral side concave *Cypraea annulus*

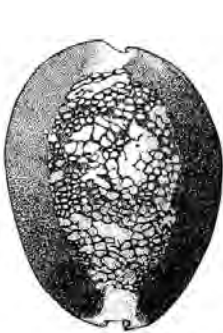


Fig. 11 *Cypraea caputserpentis* (dorsal view)

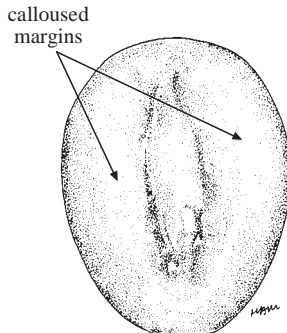


Fig. 12 *Cypraea obvelata* (dorsal view)

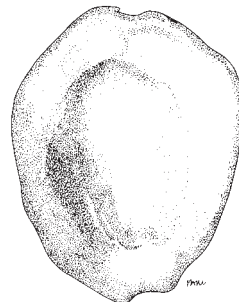


Fig. 13 *Cypraea moneta* (dorsal view)

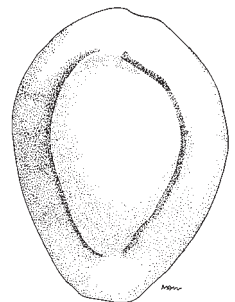


Fig. 14 *Cypraea annulus* (dorsal view)

- 14a. Ventral side and teeth of the aperture brown-black (Fig. 15) *Cypraea mauritiana*
- 14b. Ventral side whitish to creamy grey or pale fawn, teeth of the aperture reddish brown → 15

- 15a. Columellar surface with a well-marked brown blotch (Fig. 16) *Cypraea maculifera*
- 15b. Columellar surface without brown blotch → 16

- 16a. Ventral side convex; dorsal side with a small brown blotch beside the spire (Fig. 17)
 *Cypraea eglantina*
- 16b. Ventral side flat to concave; dorsal side without a spire blotch (Fig. 18) *Cypraea arabica*

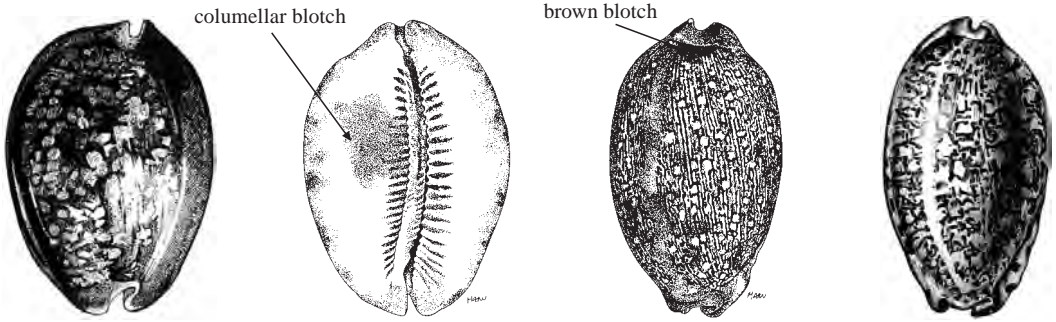


Fig. 15 *Cypraea mauritiana* (dorsal view) Fig. 16 *Cypraea maculifera* (ventral view) Fig. 17 *Cypraea eglantina* (dorsal view) Fig. 18 *Cypraea arabica* (dorsal view)

- 17a. Outer surface spotted → 18
- 17b. Outer surface without spots → 21

- 18a. Minute, transverse whitish stripes on lateral sides (Fig. 19) *Cypraea vitellus*
- 18b. No transverse stripes on lateral sides → 19

- 19a. Dorsal groove undulate and branched (Fig. 20) *Cypraea mappa*
- 19b. Dorsal groove linear and unbranched → 20

- 20a. Ventral side with 2 distinct axial ridges midway between aperture and lateral margins; aperture white, tinged bright orange between the teeth (Fig. 21) *Cypraea lynx*
- 20b. Ventral side without axial ridges; aperture entirely white (Fig. 22) *Cypraea tigris*

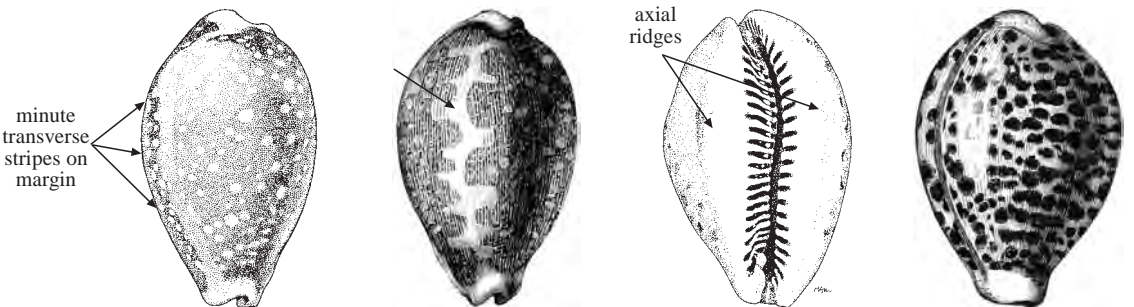


Fig. 19 *Cypraea vitellus* (dorsal view) Fig. 20 *Cypraea mappa* (dorsal view) Fig. 21 *Cypraea lynx* (ventral view) Fig. 22 *Cypraea tigris* (dorsal view)

- 21a. Ventral side entirely dark brown to jet black (Fig. 23) *Cypraea onyx*
- 21b. Ventral side differently coloured. → 22
- 22a. Teeth of the aperture purple. → 23
- 22b. Teeth of the aperture white → 24
- 23a. Shell relatively large (up to 9.5 cm long); lateral margins covered with small tubercles (Fig. 24) *Cypraea leviathan*
- 23b. Shell relatively small (up to 6 cm long); lateral margins devoid of tubercles (Fig. 25) *Cypraea carneola*
- 24a. Ventral side flat to concave, with relatively strong and developed apertural teeth (Fig. 26) *Cypraea ventriculus*
- 24b. Ventral side convex, with fine and short teeth, confined to the aperture (Fig. 27) *Cypraea schilderoorum*



Fig. 23 *Cypraea onyx* (dorsal view)

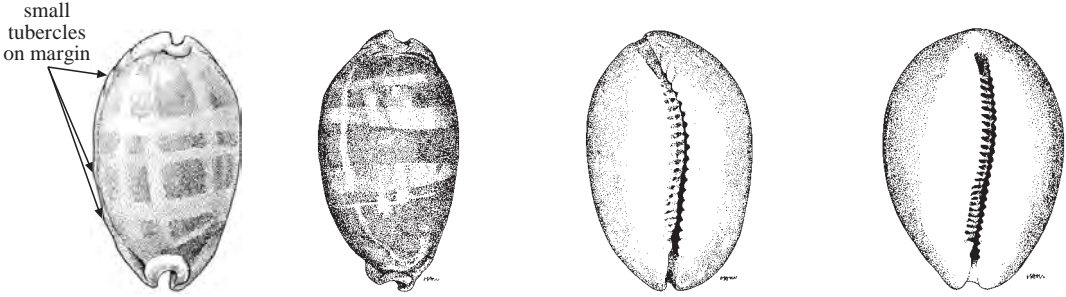


Fig. 24 *Cypraea leviathan* (dorsal view) Fig. 25 *Cypraea carneola* (dorsal view) Fig. 26 *Cypraea ventriculus* (ventral view) Fig. 27 *Cypraea schilderoorum* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol is given when species accounts are included.

- Cypraea annulus* Linnaeus, 1758
- Cypraea arabica* Linnaeus, 1758
- Cypraea argus* Linnaeus, 1758
- Cypraea bouteti* Burgess and Arnette, 1981
- Cypraea caputserpentis* Linnaeus, 1758
- Cypraea carneola* Linnaeus, 1758
- Cypraea caurica* Linnaeus, 1758
- Cypraea depressa* Gray, 1824
- Cypraea eglantina* Duclos, 1833
- Cypraea erosa* Linnaeus, 1758
- Cypraea isabella* Linnaeus, 1758
- Cypraea leviathan* (Schilder and Schilder, 1937)
- Cypraea lynx* Linnaeus, 1758
- Cypraea maculifera* Schilder, 1932
- Cypraea mappa* Linnaeus, 1758
- Cypraea mauritiana* Linnaeus, 1758
- Cypraea moneta* Linnaeus, 1758
- Cypraea obvelata* Lamarck, 1810
- Cypraea onyx* Linnaeus, 1758
- Cypraea schilderoorum* Iredale, 1939
- Cypraea scurra* Gmelin, 1791
- Cypraea talpa* Linnaeus, 1758
- Cypraea tigris* Linnaeus, 1758
- Cypraea ventriculus* Lamarck, 1810
- Cypraea vitellus* Linnaeus, 1758

References

Burgess, C.M. 1985. *Cowries of the world*. Capt Town, Verhoef, 289 p.

Lorenz, F. Jr. and A. Hubert. 1993. *A guide to worldwide cowries*. Wiesbaden, Hemmen, 571 p.

***Cypraea arabica* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Arabica arabica* (Linnaeus, 1758); *Mauritia arabica* (Linnaeus, 1758); *Peribolus arabicus* (Linnaeus, 1758) / *Cypraea grayana* (Schilder, 1930).

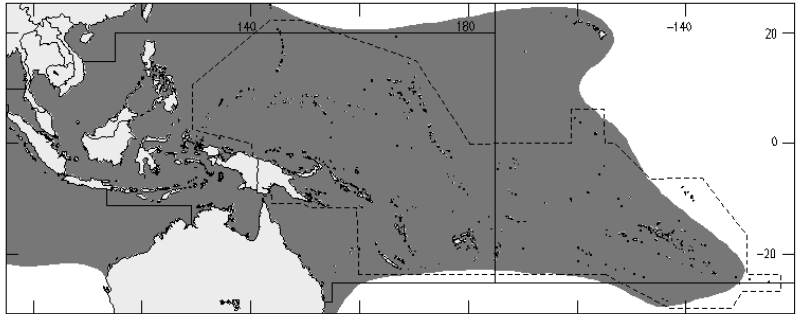
FAO names: En - Arabian cowrie; Fr - Porcelaine arabe.

Diagnostic characters: Shell moderately large, solid, elongate-ovate to elliptical in outline. Dorsal side rounded and more or less humped, never depressed. Spire slightly protruding although coated with enamel, distinguishable dorsally beside posterior end of shell. Dorsal mantle groove very shallow, mainly appearing in the colour pattern. Lateral margins distinctly calloused, especially toward anterior and posterior ends. Ventral side broad and flat to slightly concave, somewhat enlarged by lateral thickening. Aperture narrow, slightly larger anteriorly. Teeth of outer lip strong, often a little extended over the ventral surface. Teeth of inner lip finer, rather short on posterior half of shell, but extending interiorly across the deeply concave longitudinal groove of columella. **Colour:** dorsal side of shell cream to light fawn with shades of greyish brown, overlaid by a dense but irregular pattern of mainly axial, darker brown lines interrupted by clear rounded spaces and often merging, giving appearance of arabic script. A large axial line devoid of dark brown netting on dorsal mantle groove. No dark brown blotch beside the spire at posterior end. Lateral margins greyish, heavily spotted with black or dark brown. Ventral side creamy grey, sometimes with a purplish or pinkish fawn hue and brown marginal spots. Teeth reddish brown, white into the aperture of columellar side.

Size: Maximum shell length 10.5 cm, commonly to 8 cm.

Habitat, biology, and fisheries: Under slabs and stones and in caverns of the outer edge of coral reefs. In well-aerated waters, from low in the intertidal zone to shallow sublittoral depths. Mainly nocturnal. Collected for food by coastal populations in many areas. Shell used in shellcraft or sold for collections.

Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, but not in the Red Sea nor the Persian Gulf, to eastern Polynesia; north to southern Japan, and south to northern New South Wales.



dorsal view

Cypraea mappa Linnaeus, 1758

Frequent synonyms / misidentifications: *Leporicypraea mappa* (Linnaeus, 1758); *Mauritia mappa* (Linnaeus, 1758) / None.

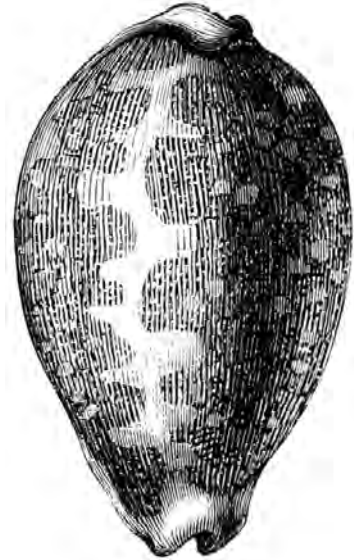
FAO names: En - Map cowrie; Fr - Porcelaine carte.

Diagnostic characters: Shell moderately large, solid, elongate-ovate to pear-shaped in outline. Lateral margins convex, pinched in at the anterior extremity. Dorsal side inflated, the mantle groove undulating and branched, with short alternate lateral extensions. Ventral side slightly convex, with a narrow aperture. Teeth of outer lip short and moderately strong. Teeth of inner lip finer and more numerous, extending deep into the aperture. **Colour:** dorsal side of shell creamy fawn or whitish, with crowded irregular brown axial lines interrupted by clear rounded patches and a very prominent, wavy and branched wide line on mantle groove, giving a pattern resembling an ancient map. Lateral margins spotted. Ventral side very variable in colour, white, cream, light purple, brown or orange, with pale yellow to cream teeth and sometimes a brownish hue on mid-columellar surface, or with pale orange to brown teeth and a distinct columellar blotch of dark purple to brown.

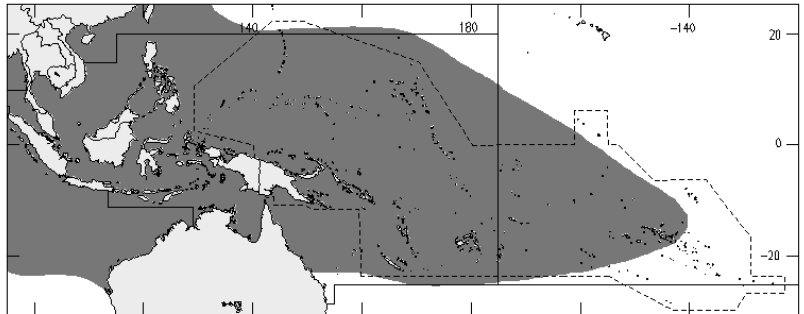
Size: Maximum shell length 10 cm, commonly to 8 cm.

Habitat, biology, and fisheries: Under coral slabs and stones, in coral reef and rocky habitats. Intertidal and sublittoral waters to a depth of about 45 m. Collected in various localities of its wide range, for food and shell trade. Frequently marketed in the northern Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and southeastern part of the Red Sea, to eastern Polynesia; north to southern Japan and south to Queensland and New Caledonia.



dorsal view



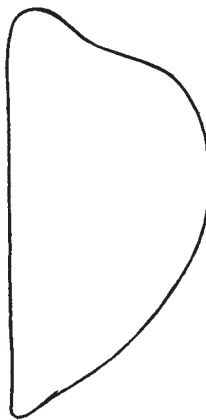
Cypraea mauritiana Linnaeus, 1758

Frequent synonyms / misidentifications: *Mauritia mauritiana* (Linnaeus, 1758); *Peribolus mauritianus* (Linnaeus, 1758) / None.

FAO names: En - Humpback cowrie; Fr - Porcelaine bossue.



dorsal view



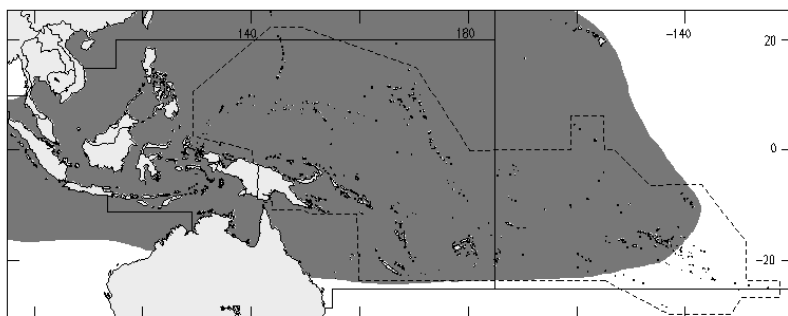
lateral view

Diagnostic characters: Shell large and heavy, very solid, elliptical-ovate in outline. Dorsal side rounded and strongly humped, mantle groove often indistinct. Lateral margins with an angular profile, markedly calloused. Ventral side broad and slightly concave, enlarged by peripheral thickening. Aperture narrow and widely arched, slightly broader anteriorly. Flat, spade-like projections obliquely pointing on both sides of the anterior siphonal aperture. Anterior longitudinal groove of columella moderately long and shallow. Teeth strong and prominent, not extending over the ventral surface, but somewhat showing through its outer enamel coat. Teeth of the inner lip extending deep into the aperture. **Colour:** dorsal side of shell pale tan, with brownish pattern leaving light rounded spots which often merge into one another. Dorsal mantle groove sometimes enhanced by a narrow, creamy axial line. Lateral sides and ventral surface of shell, including the teeth, uniformly deep chocolate brown to black, often with a translucent glossy hue of bluish grey. Interstices of teeth white or cream.

Size: Maximum shell length 13 cm, commonly to 10 cm.

Habitat, biology, and fisheries: Under stones and in crevices of coral reefs and rocky headlands exposed to strong wave action. Mostly active at night. Littoral and sublittoral zones, mainly in low tide and shallow subtidal levels. Frequently collected in the Indo-West Pacific for food and shellcraft.

Distribution: Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia, including northern Madagascar, but not in the Red Sea, the Persian Gulf, nor the Gulf of Bengal; north to Japan and Hawaii, and south to central Queensland and New Caledonia.



Cypraea talpa Linnaeus, 1758

Frequent synonyms / misidentifications: *Talparia talpa* (Linnaeus, 1758) / None.

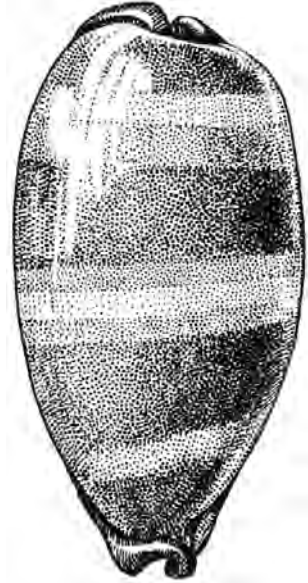
FAO names: En - Mole cowrie; Fr - Porcelaine taupe.

Diagnostic characters: Shell large, solid, almost cylindrical in outline, with widely convex to nearly straight lateral margins and slightly produced anterior and posterior extremities, especially at posterior margin of outer lip. Dorsal side moderately swollen, without a mantle groove. Ventral side flattish, rounded laterally, with a narrow, straightish aperture which is only a little curved posteriorly. Apertural teeth numerous, short and fine. Teeth of inner lip not extending far into the aperture. Anterior longitudinal furrow of inner lip short and rather deep. **Colour:** dorsal side of shell cream to coffee, with 4 wide, transverse bands of darker golden brown. Lateral margins, anterior and posterior extremities, ventral side and teeth deep chocolate brown to black. Interstices of teeth stained with cream or white.

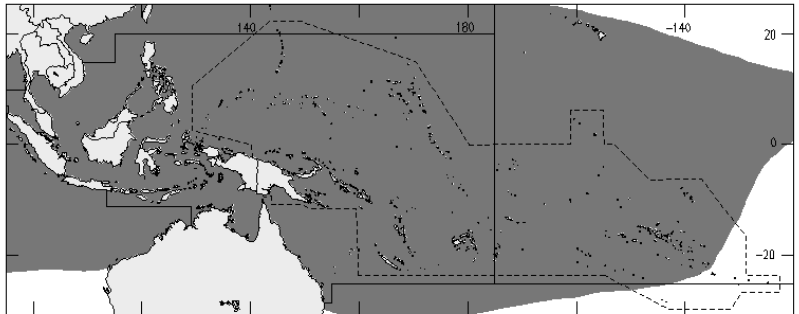
Size: Maximum shell length 10.5 cm, commonly to 8 cm.

Habitat, biology, and fisheries: In coral reefs, under slabs or in large coral heads, either on the external slope or in protected areas of the reef. Intertidal and sublittoral zones to a depth of about 10 m. Egg capsules densely laid in a big cluster about as wide as the length of the adult shell. Collected for food and the shell trade, this species appears in local markets of the northern Philippines. The unusual beauty of its contrasted colour pattern makes the shell a favourite of many collectors.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf to eastern Polynesia and Cocos Islands off Central America; north to Japan and Hawaii, and south to northern New South Wales and Lord Howe Island.



dorsal view



Cypraea tigris Linnaeus, 1758

Frequent synonyms / misidentifications: None / None.

FAO names: En - Tiger cowrie; Fr - Porcelaine tigre.

Diagnostic characters: Shell large and heavy, very solid, with variable, **ovate to pear-shaped** outline. **Dorsal side inflated, with an unbranched, linear mantle groove.** Lateral margins rounded, generally not produced. Aperture somewhat widening anteriorly and with a well-developed longitudinal furrow on inner lip. Teeth of the outer lip strong and short; teeth of the inner lip finer and longer but not much extending on ventral side of shell, the most 4 or 5 anterior ones usually distinctly coarser than the others. **Colour: shell coloration very variable**, ranging from almost white to nearly black, but **usually whitish to light bluish grey, with a dense overlay of closely packed and irregularly sized, rounded spots of dark brown to black on dorsal and lateral sides.** Dark spots frequently edged with bright yellowish fawn or orange tints. Dorsal mantle groove orange or light fawn. **Ventral side of shell white throughout**, including the teeth, often with a pale greyish brown hue on mid-columellar surface.

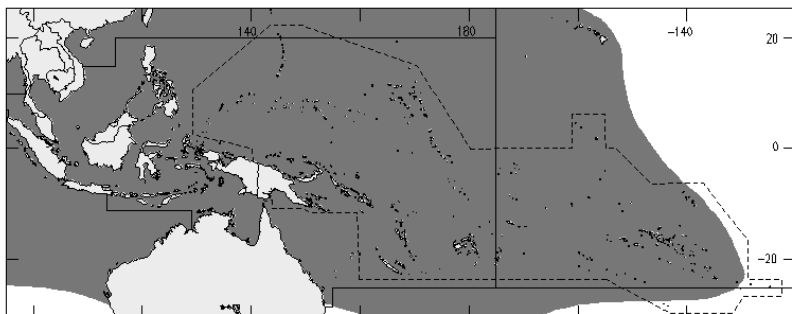
Size: Maximum shell length 15 cm, commonly to 9 cm.

Habitat, biology, and fisheries: Abundant on reef areas, on sand among rocks or corals, in tidal pools or on branched corals, often nearby seaweeds. Active during the day. Intertidal and sublittoral zones to a depth of about 30 m. Commonly collected for food in many parts of the area, mainly in the shallow water zone. Shell used for shellcraft. Due to frequent overcollecting and destruction of the coral reef environment by dynamite fishers, this common species may be nearly extinct locally or confined to the deeper part of its habitat (to depths over 10 m).

Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, to eastern Polynesia; north to Japan and Hawaii, and south to northern New South Wales and Lord Howe Island.



dorsal view



Cypraea vitellus Linnaeus, 1758

Frequent synonyms / misidentifications: *Lyncina vitellus* (Linnaeus, 1758); *Mystaponda vitellus* (Linnaeus, 1758) / None.

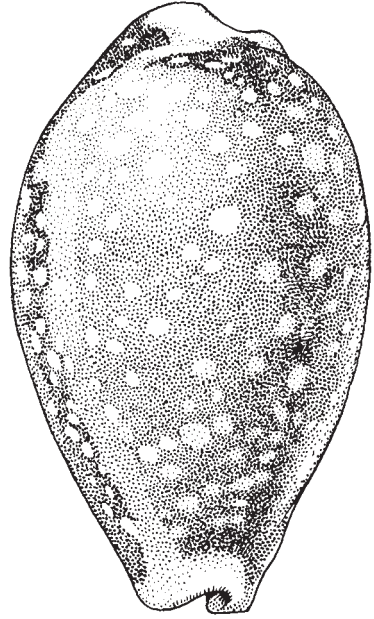
FAO names: **En** - Pacific deer cowrie; **Fr** - Porcelaine daim du Pacifique.

Diagnostic characters: Shell moderately large, **tumid, ovate to pear-shaped** in outline. Lateral sides strongly convex, more or less pinched in at the anterior extremity. Shell sometimes strongly callous and irregularly rhomboidal in shape, with the anterior and posterior extremities produced (form *polynesiae* Schilder and Schilder, 1939). Dorsal side inflated, the **mantle groove indistinct**. Ventral side slightly convex, with a narrow aperture. Teeth of the outer lip moderately strong, often extending outward as very shallow, transverse undulations. Teeth of the inner lip finer, extending deep into the aperture. Anterior longitudinal furrow of inner lip poorly distinct. **Colour: dorsal side** of shell yellowish **brown** to fawn, usually with 2 obscure transverse bands of paler colour, and **with a scattering of prominent white spots** of varying size. **Lateral sides** characteristically striated **with minute, transverse** and cloudy **whitish stripes** which are generally best developed on the right side of shell. **Ventral side creamy white, with white teeth.**

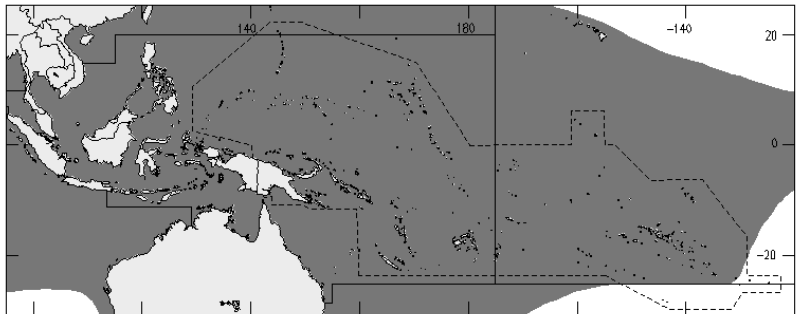
Size: Maximum shell length 10 cm, commonly to 7 cm.

Habitat, biology, and fisheries: In coral reef and rocky habitats, common in shallow water and tide pools, under coral slabs and stones, or among seaweeds, sometimes half-buried in sand. Intertidal and sublittoral zones to a depth of about 25 m. Egg capsules laid in a cluster about 6.5 cm across. Collected for food and shell trade in many areas.

Distribution: Widespread in the Indo-Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia and Clipperton Island off Central America; north to Japan, Midway and Hawaii, and south to central New South Wales and New Zealand.



dorsal view

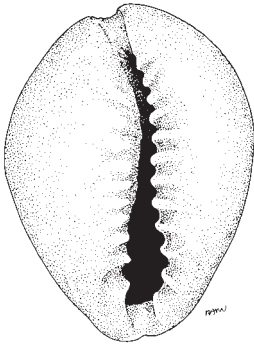


***Cypraea annulus* Linnaeus, 1758**

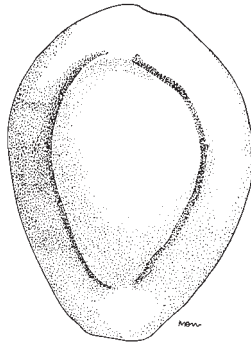
Frequent synonyms / misidentifications: *Erosaria annulus* (Linnaeus, 1758); *Monetaria annulus* (Linnaeus, 1758) / None.

En - Gold ring cowrie; **Fr** - Porcelaine anneau d'or.

Maximum shell length 4 cm, commonly to 3 cm. Widespread in shallow water, occurring in every kind of habitat, even sandy bottoms. Most common in shallow tidal pools under and in vegetation and stones. This very common species is collected in large quantities from the intertidal zone, mainly for shellcraft. Formerly used as a currency in many areas of the world, the shell is also still used as a divinatory item by some animist tribes, particularly in tropical Africa. Widespread in the Indo-West Pacific, from East and Southeast Africa, including Madagascar, the Red Sea and Persian Gulf, to western Polynesia; north to Midway and southern Japan, and south to New South Wales. Empty shells of *Cypraea annulus* collected outside of this area were carried there by ships when this cowrie was used as currency.



ventral view



dorsal view

(after Lorenz and Hubert, 1993)



***Cypraea argus* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Arestorides argus* (Linnaeus, 1758); *Cypraea contrastriata* Perry, 1811; *Lyncina argus* (Linnaeus, 1758) / None.

En - Eyed cowrie; **Fr** - Porcelaine argus.

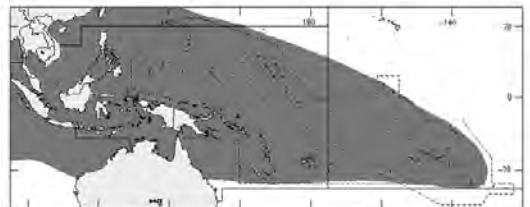
Maximum shell length 11.5 cm, commonly to 8 cm. Under stones, rocks and coral slabs, or in crevices, in coral reef areas. Intertidal and sublittoral zones, from low tide levels to a depth of about 10 m. Collected for food. Shells collected for local shellcraft industries or sold for collections. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, but not in the Red Sea nor the Persian Gulf, to eastern Polynesia; north to southern Japan, and south to central Queensland and New Caledonia.



ventral view



dorsal view

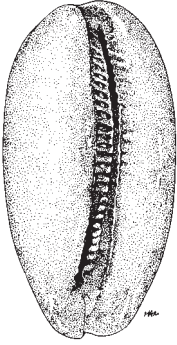


***Cypraea bouteti* Burgess and Arnette, 1981**

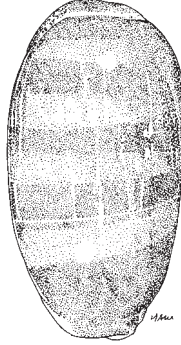
Frequent synonyms / misidentifications: *Lyncina leviathan bouteti* (Burgess and Arnette, 1981); *Ponda bouteti* (Burgess and Arnette, 1981) / *Cypraea carneola* Linnaeus, 1758.

En - Boutet's cowrie; **Fr** - Porcelaine de Boutet.

Maximum shell length 9 cm, commonly to 6.5 cm. Mainly in lagoons and on sheltered rock platforms of coral reefs, occasionally on the exposed algal crests. Shallow subtidal waters. Active at night. Collected for food or for shell trade in Polynesia. Restricted to the tropical Central Pacific, from Tonga (and possibly Fiji) islands to eastern Polynesia.

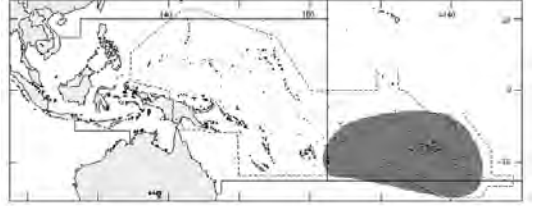


ventral view



dorsal view

(after Burgess, 1985)

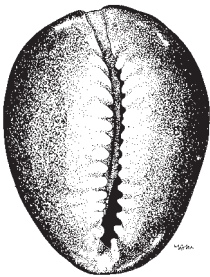


***Cypraea caputserpentis* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Erosaria caputserpentis* (Linnaeus, 1758); *Ravitrona caputserpentis* (Linnaeus, 1758) / None.

En - Serpent's head cowrie; **Fr** - Porcelaine tête de serpent.

Maximum shell length 4.5 cm, commonly to 3.5 cm. Abundant in coral reefs and rock platforms exposed to wave action. Mainly active at night, crawling out of crevices and boulders, but can also be found in the open during the day. Intertidal and shallow subtidal waters. Frequently collected throughout the Indo-Pacific, mainly for its shell which is used in local handicrafts. Widespread in the entire Indo-Pacific, in both tropical and temperate areas, from East and South Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia, Clipperton and the Cocos islands off Central America; north to Japan, Midway and Hawaii, and south to southern New South Wales and Lord Howe Island.



ventral view

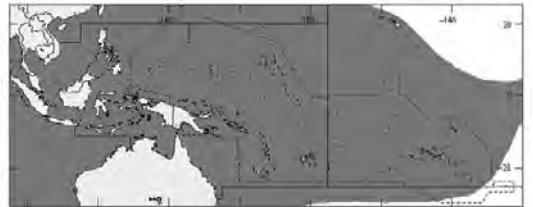


dorsal view



lateral view

(after Lorenz and Hubert, 1993)

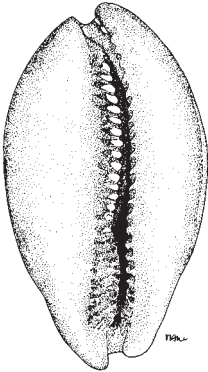


***Cypraea carneola* Linnaeus, 1758**

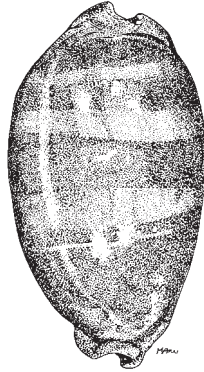
Frequent synonyms / misidentifications: *Cypraea propinqua* Garrett, 1879; *Lyncina carneola* (Linnaeus, 1758); *Ponda carneola* (Linnaeus, 1758) / None.

En - Carnelian cowrie; **Fr** - Porcelaine carnéole.

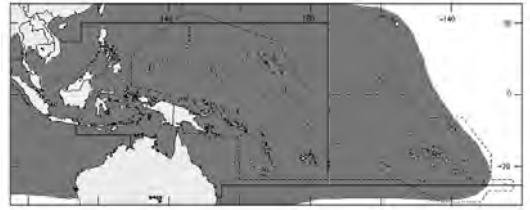
Maximum shell length 6 cm, commonly to 4 cm. Under slabs and small corals in reefs, frequently occurring in groups. Intertidal and shallow subtidal waters. In the tropical West Pacific (Melanesia and Australia to Hawaii and eastern Polynesia), specimens of this very variable species tend to be more rhomboidal in outline, with the lateral margins somewhat calloused and the extremities produced. This form might represent a distinct species or subspecies (*Cypraea carneola propinqua*). Locally collected for food and shell trade. Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan, Midway and Hawaii, and south to northern New South Wales and possibly northern New Zealand.



ventral view



ventral view



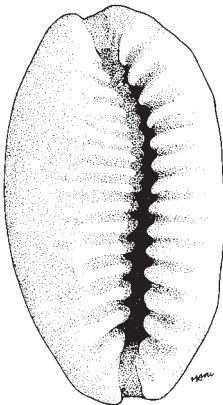
(after Lorenz and Hubert, 1993)

***Cypraea caurica* Linnaeus, 1758**

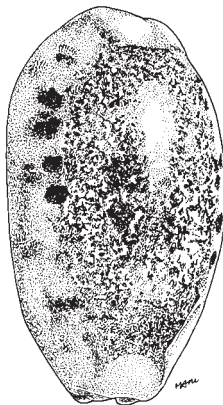
Frequent synonyms / misidentifications: *Cypraea dracaena* Born, 1778; *Erronea caurica* (Linnaeus, 1758) / None.

En - Dragon cowrie; **Fr** - Porcelaine dragon.

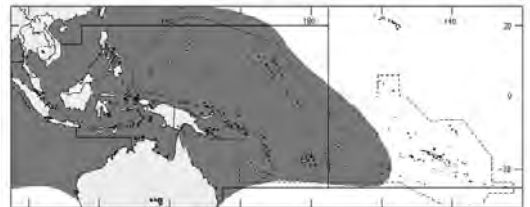
Maximum shell length 7 cm, commonly to 4.5 cm. Abundant in all kinds of habitats, especially under rocks in turbid water near vital reefs. Populations living in quiet waters tend to develop thinner, more inflated and less callous shells than those inhabiting rough waters. Intertidal and shallow sublittoral waters, down to about 30 m. Collected in some areas for food and local shellcraft. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to western Polynesia; north to Japan and south to northern New South Wales and New Caledonia.



ventral view



dorsal view



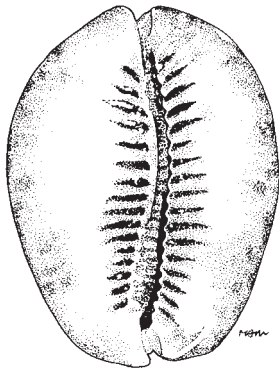
(after Burgess, 1985)

***Cypraea depressa* Gray, 1824**

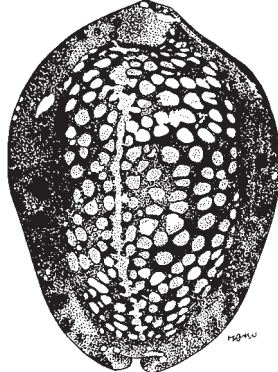
Frequent synonyms / misidentifications: *Arabica depressa* (Gray, 1824); *Mauritia depressa* (Gray, 1824) / None.

En - Depressed cowrie; **Fr** - Porcelaine déprimée.

Maximum shell length 6 cm, commonly to 4.5 cm. In rather rough waters of reef areas, under slabs and stones or in hollow corals near the wave swept edge. Active at night on algal crests and rock platforms. Intertidal and shallow subtidal zones. Locally collected for food or for its shell. Widespread in the Indo-Pacific, from East Africa, including Madagascar, but not in the Red Sea, the Aden and Persian gulfs, to eastern Polynesia and Clipperton Island off Central America; north to southern Japan and Hawaii, and south to New Caledonia; absent from Australia, apart from some oceanic coral reefs off northwestern Australia.



ventral view



dorsal view

(after Lorenz and Hubert, 1993)

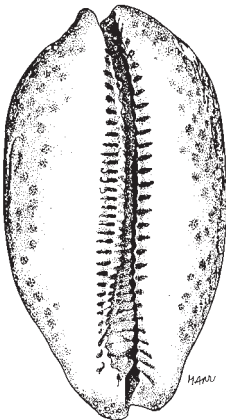


***Cypraea eglantina* Duclos, 1833**

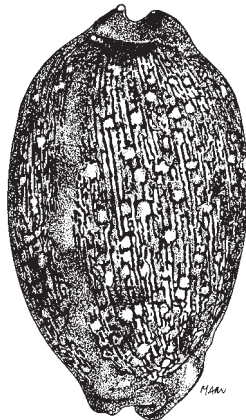
Frequent synonyms / misidentifications: *Arabica eglantina* (Duclos, 1833); *Mauritia eglantina* (Duclos, 1833); *Peribolus eglantininus* (Duclos, 1833) / *Cypraea arabica* Linnaeus, 1758.

En - Eglantine cowrie; **Fr** - Porcelaine églantine.

Maximum shell length 8.5 cm, commonly to 6.5 cm. Under slabs and stones, in coral reef and rocky habitats. Shallow subtidal waters. Locally collected for food and for the shell. Tropical eastern Indian Ocean and western Pacific, from western Indonesia and Cocos (Keeling) Islands, to western Polynesia; north to southern Japan and south to southern Queensland and Lord Howe Island.

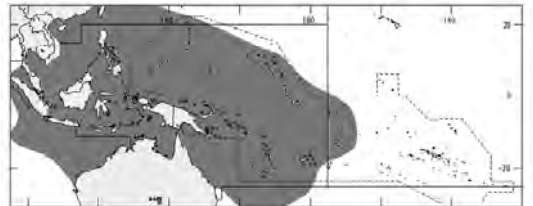


ventral view



dorsal view

(after Lorenz and Hubert, 1993)



***Cypraea erosa* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Erosaria erosa* (Linnaeus, 1758) / None.

En - Eroded cowrie; **Fr** - Porcelaine érodée.

Maximum shell length 7.5 cm, commonly to 4.5 cm. Abundant either in quiet or moderately high-energy environments. Usually occurring under stones and coral slabs or on the underside of rocks, sometimes also on algal crests of reefs or in muddy conditions. Intertidal and subtidal zones, in shallow waters. Collected mainly for its shell, sometimes also for food. Widespread in the Indo-Pacific, from South and East Africa to eastern Polynesia and Cocos Islands off Central America; north to Japan and Hawaii, and south to northern New South Wales and Lord Howe Island.



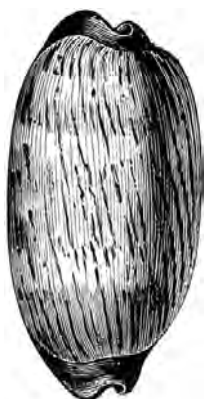
dorsal view

***Cypraea isabella* Linnaeus, 1758**

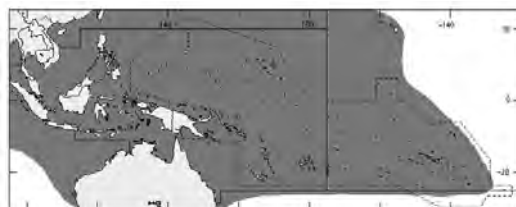
Frequent synonyms / misidentifications: *Basilitrana isabella* (Linnaeus, 1758); *Luria isabella* (Linnaeus, 1758); *Talparia isabella* (Linnaeus, 1758) / None.

En - Isabelle cowrie; **Fr** - Porcelaine isabelle.

Maximum shell length 5.5 cm, commonly to 4 cm. Coral reef and rock environments. Common in littoral and shallow subtidal zones, but also occurring sublittorally to a depth of about 35 m. Locally collected for food. Shell used for shellcraft. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea and the Persian Gulf, to eastern Polynesia; north to southern Japan, Midway and Hawaii, and south to central New South Wales and New Caledonia.



dorsal view

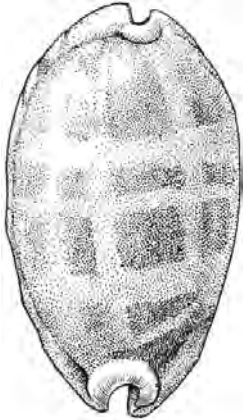


Cypraea leviathan (Schilder and Schilder, 1937)

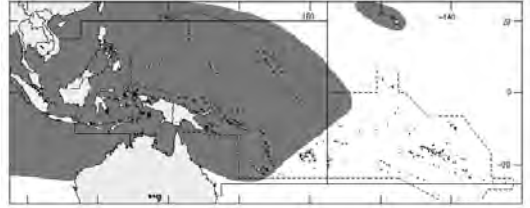
Frequent synonyms / misidentifications: *Lyncina leviathan* (Schilder and Schilder, 1937); *L. titan* Schilder and Schilder, 1962; *Mystaponda leviathan* (Schilder and Schilder, 1937) / *Cypraea carneola* Linnaeus, 1758.

En - Monster cowrie; **Fr** - Porcelaine léviathan.

Maximum shell length 13 cm, commonly to 7 cm. Under boulders and slabs or in crevices, often in small groups, in coral reef and rocky environments. Sublittoral, from shallow water to a depth of about 35 m. Locally collected for food. Shell used in the shellcraft industry. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to western Polynesia; north to Japan and Hawaii, and south to Queensland and New Caledonia.



dorsal view

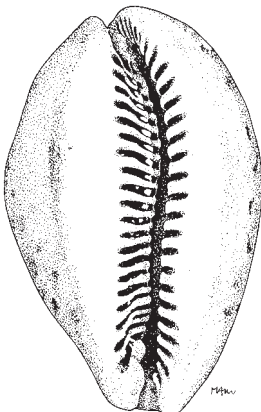


Cypraea lynx Linnaeus, 1758

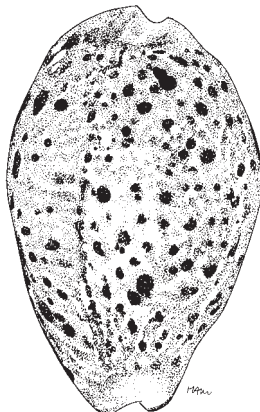
Frequent synonyms / misidentifications: *Cypraea caledonica* Crosse, 1869; *C. vanelli* Linnaeus, 1758; *Lyncina lynx* (Linnaeus, 1758) / None.

En - Lynx cowrie; **Fr** - Porcelaine lynx.

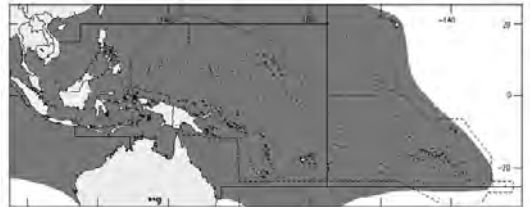
Maximum shell length 9 cm, commonly to 5 cm. In coral reef and rocky habitats, mostly under coral slabs and stones, or half exposed in crevices. Often found in small groups. Intertidal and sublittoral zones, to a depth of about 20 m. Collected for food and for its shell. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and Hawaii, and south to northern New South Wales and Lord Howe Island.



ventral view



dorsal view



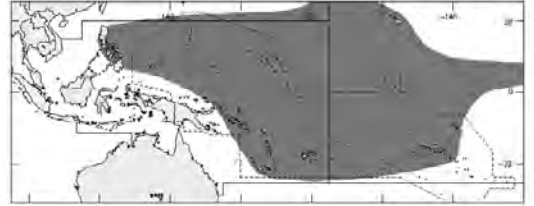
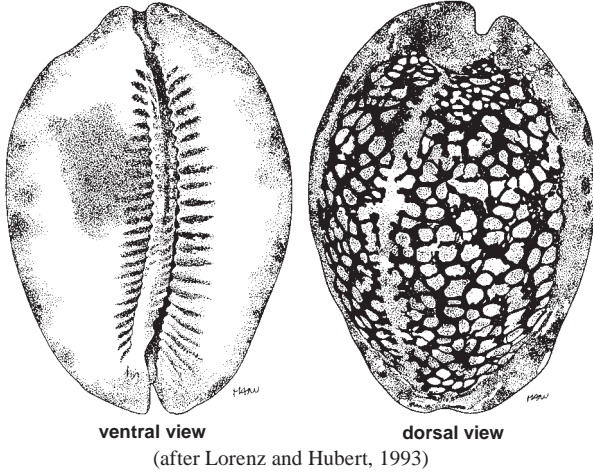
(after Lorenz and Hubert, 1993)

Cypraea maculifera Schilder, 1932

Frequent synonyms / misidentifications: *Arabica maculifera* (Schilder, 1932); *Cypraea reticulata* Martyn, 1784 (Invalid name); *Mauritia maculifera* (Schilder, 1932) / *Cypraea arabica* Linnaeus, 1758.

En - Reticulated cowrie; **Fr** - Porcelaine réticulée.

Maximum shell length 10 cm, commonly to 7 cm. In coral reefs, under slabs and rocks, or in gullies and holes of the algal crests. Collected mainly for its shell. Tropical Pacific islands, from the Philippines to eastern Polynesia and Clipperton Island off Central America; north to Midway and Hawaii, and south to New Caledonia.

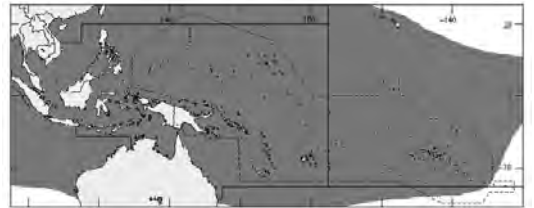
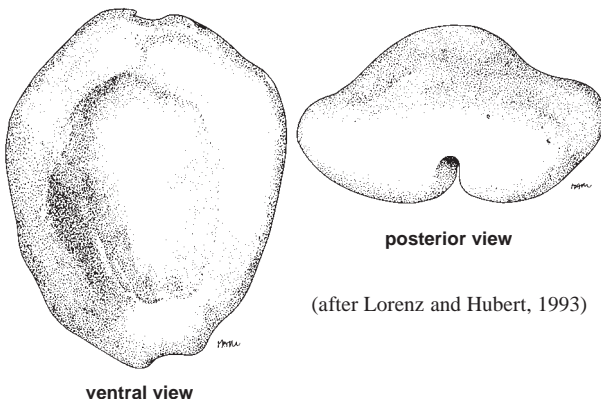


Cypraea moneta Linnaeus, 1758

Frequent synonyms / misidentifications: *Erosaria moneta* (Linnaeus, 1758); *Monetaria moneta* (Linnaeus, 1758) / None.

En - Money cowrie; **Fr** - Porcelaine monnaie.

Maximum shell length 4.5 cm, commonly to 3 cm. Abundant in various environments, especially in shallow tide pools, among sea weeds, and under stones, coral remains or empty bivalve shells. Frequently occurring in the open, from high in the intertidal zone to shallow subtidal depths. Commonly collected in large quantities for shellcraft. Once used as a currency in Pacific and Indian Ocean countries, the shell remains as a divinatory item by some animist tribes in tropical Africa. Widespread in the Indo-Pacific, from East and South Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia, the Galapagos, Clipperton and Cocos islands off Central America; north to southern Japan, Midway and Hawaii, and south to northern New South Wales and Lord Howe Island.

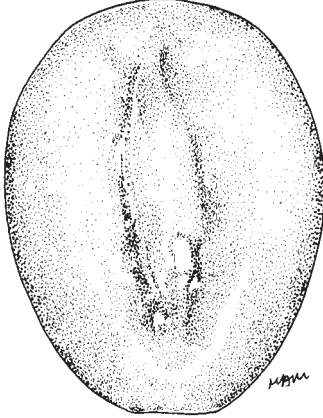


***Cypraea obvelata* Lamarck, 1810**

Frequent synonyms / misidentifications: *Erosaria obvelata* (Lamarck, 1810); *Monetaria obvelata* (Lamarck, 1810) / *Cypraea annulus* Linnaeus, 1758.

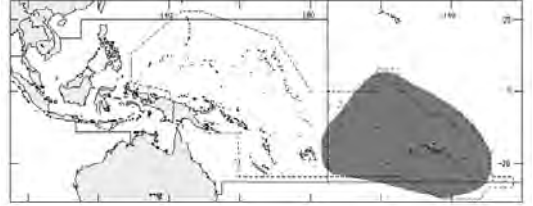
En - Walled cowrie; **Fr** - Porcelaine anneau d'or de Tahiti.

Maximum shell length 3.5 cm, commonly to 2.5 cm. Under stones, inside holes of small corals or among vegetation within the protecting reef. Intertidal and sublittoral zones to a depth of about 10 m. This common species is frequently collected in large quantities for the local Polynesian shellcraft industries. Restricted to Polynesia, from Samoa and Tonga to Pitcairn Island; north to Palmyra and south to Rapa Iiti.



dorsal view

(after Lorenz and Hubert, 1993)

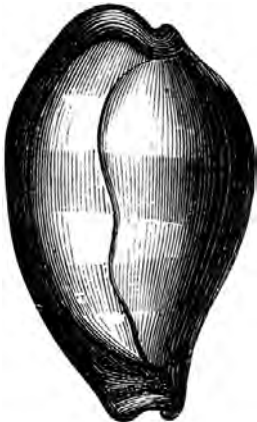


***Cypraea onyx* Linnaeus, 1758**

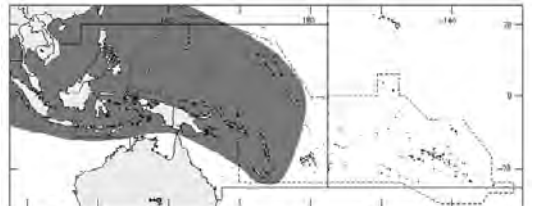
Frequent synonyms / misidentifications: *Adusta onyx* (Linnaeus, 1758); *Cypraea adusta* Lamarck, 1810; *C. nymphae* Jay, 1850; *C. succinta* Linnaeus, 1758; *Erronea onyx* (Linnaeus, 1758) / The taxonomy of *C. onyx* is rather confusing: *C. adusta*, *C. nymphae*, and *C. succinta* may represent distinct subspecies or species.

En - Onyx cowrie; **Fr** - Porcelaine onyx.

Maximum shell length 5.7 cm, commonly to 4 cm. In reefs under coral slabs and rocks, or in muddy areas. Often found exposed during the day on rocks or among the roots in mangrove swamps. Intertidal and sublittoral waters to a depth of about 30 m. Incidentally collected in trawls. Used for subsistence and shell trade. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Persian Gulf, to Micronesia; north to Japan and south to New Caledonia, but not in Australia.



dorsal view

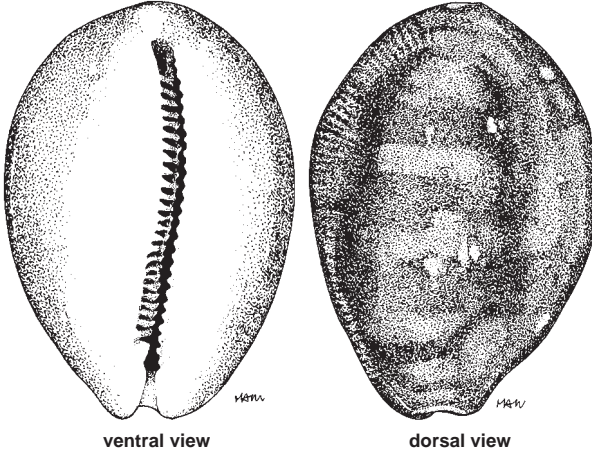


***Cypraea schilderorum* Iredale, 1939**

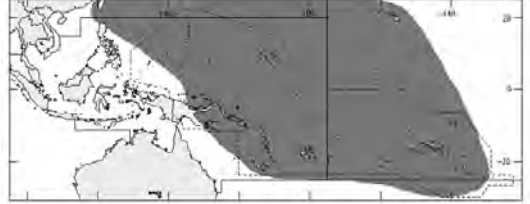
Frequent synonyms / misidentifications: *Lyncina schilderorum* (Iredale, 1939); *Ponda schilderorum* (Iredale, 1939) / None.

En - Schilders' cowrie; **Fr** - Porcelaine des Schilder.

Maximum shell length 4.5 cm, commonly to 4 cm. Coral reef areas, under stones and slabs of the reef table, on the algal crest or in gullies of the outer slope among rubble. Often hidden under soft corals or sponges. Intertidal and sublittoral zones to a depth of about 30 m. Collected locally for food and shell trade. Tropical western Pacific islands, from Taiwan Province of China to eastern Polynesia; north to southern Japan, Midway and Hawaii, and south to New Caledonia and Rapa Iti. Also in Clipperton Island, off Central America.



(after Lorenz and Hubert, 1993)

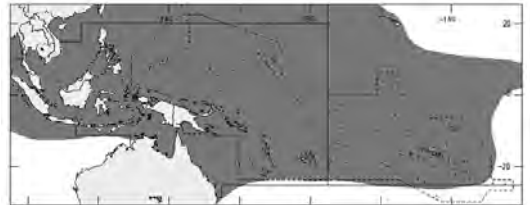
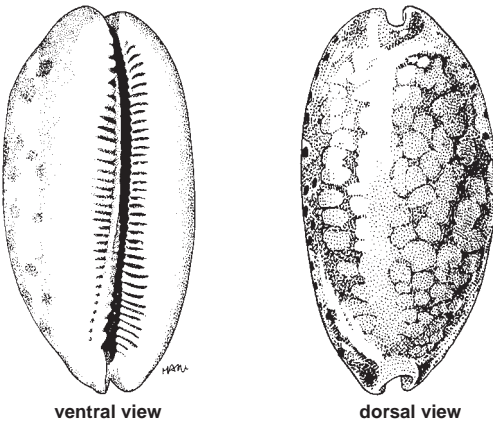


***Cypraea scurra* Gmelin, 1791**

Frequent synonyms / misidentifications: *Arabica scurra* (Gmelin, 1791); *Mauritia scurra* (Gmelin, 1791); *Peribolus scurra* (Gmelin, 1791) / None.

En - Jester cowrie; **Fr** - Porcelaine bouffon.

Maximum shell length 6 cm, commonly to 5 cm. Often deeply buried in dead coral rubble within reefs, or under coral heads over the reef edge. Lower intertidal zone and shallow sublittoral water to a depth of about 10 m. Locally collected for food or shell trade. Widespread in the Indo-Pacific, from East Africa and Madagascar, but not in the Red Sea nor the Persian Gulf, to eastern Polynesia and Clipperton Island off Central America; north to southern Japan, Midway and Hawaii, and south to northern New South Wales and New Caledonia.

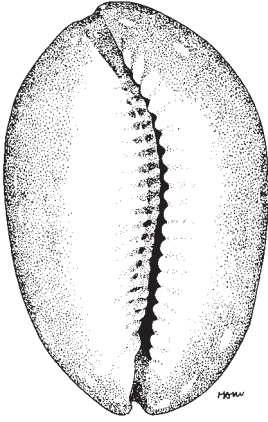


***Cypraea ventriculus* Lamarck, 1810**

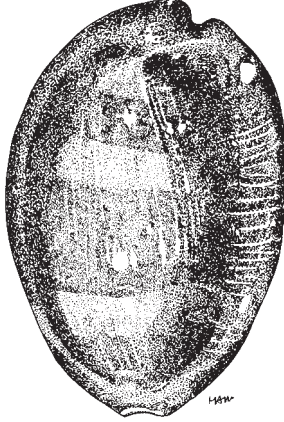
Frequent synonyms / misidentifications: *Lyncina ventriculus* (Lamarck, 1810); *Ponda ventriculus* (Lamarck, 1810) / None.

En - Tummy cowrie; **Fr** - Porcelaine gésier.

Maximum shell length 7.5 cm, commonly to 5.5 cm. In coral reef areas, under coral slabs of lagoons, in gullies or on algal crests. Active during both day and night. Intertidal and sublittoral zones to a depth of about 30 m. Locally collected for food and shell trade. Tropical West Pacific islands, from South China Sea to eastern Polynesia; north to Taiwan Province of China, Guam, Wake and Hawaii, and south to New Caledonia. Also known in the eastern Indian Ocean; in Cocos (Keeling) and Christmas Islands.

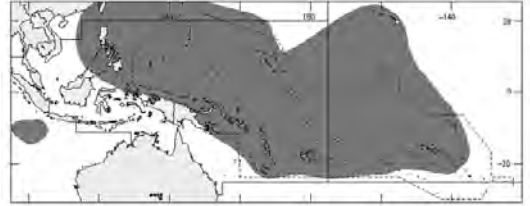


ventral view



dorsal view

(after Lorenz and Hubert, 1993)



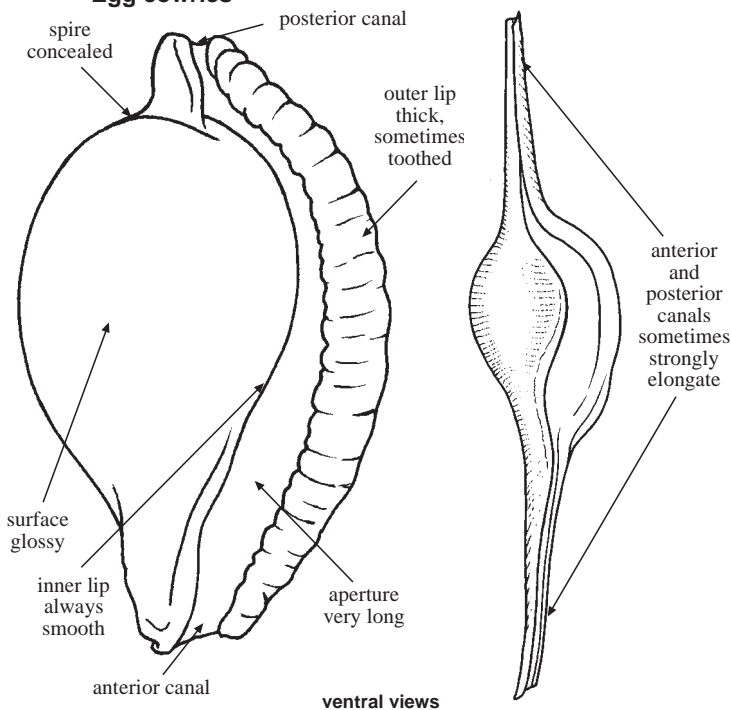
OVULIDAE

Egg cowries

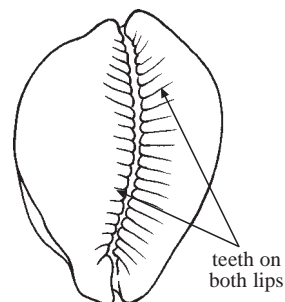
Diagnostic characters: Shell globular to spindle-shaped, with more or less expanded extremities. Spire often smooth and polished, **porcelaneous**, sometimes with fine transverse grooves. Periostracum absent. **Aperture very long** and narrow, inrolled on both sides and **channeled at both ends**. Outer lip thickened and sometimes toothed, **inner lip smooth**. **No operculum**. Mantle very large, with 2 lobes expanding in life over the entire shell. Mantle lobes often brightly coloured, smooth or marked with pustules and various outgrowths. Fleshy siphon distinct, with a smooth edge.

Habitat, biology, and fisheries:

Living in association with various coelenterates such as true corals, gorgonians or soft corals on which they feed by biting off the polyps. Mantle of the animals very often mimic hosts, both in colour patterns and shape of the pustules which reflects the form of the polyps. Larger species of egg cowries are locally collected for food and for the shells, which have long been used as ceremonial or ornamental items among tribes in the oceanic islands of the western Pacific. Now mainly collected for shell trade.



examples showing diversity of shape



ventral view
Cypraeidae

Similar families occurring in the area


Cypraeidae: anterior and posterior ends of shell not strongly produced; teeth developed on both lips of the aperture.


Key to species of interest to fisheries occurring in the area

- 1a. Shell spindle-shaped in outline; anterior and posterior extremities very long and slender; outer lip smooth *Volva volva*
- 1b. Shell globular in outline; anterior and posterior extremities short and stout; outer lip irregularly dentate *Ovula ovum*

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

 *Ovula ovum* (Linnaeus, 1758)

 *Volva volva* (Linnaeus, 1758)

References

Cate, C.N. 1973. A systematic revision of the recent cypraeid family Ovulidae (Mollusca: Gastropoda). *Veliger*, 15(Suppl.):1-116.

Cate, C.N. 1974. The Ovulidae: A key to the genera, and other pertinent notes (Mollusca: Gastropoda). *Veliger*, 16(3):307-313.

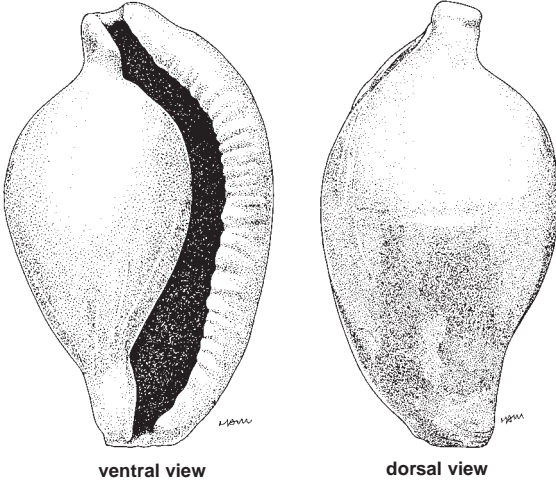
Cernohorsky, W.O. 1968. The Ovulidae, Pediculariidae and Triviidae of Fiji (Mollusca: Gastropoda). *Veliger*, 10(4):353-374.

Ovula ovum (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Amphiperas ovum* (Linnaeus, 1758) / None.

En - Common egg cowrie; **Fr** - Ovule commune.

Maximum shell length 11 cm, commonly to 8 cm. Rather common on the large fleshy soft coral *Sarcophyton* to a depth about 20 m. Traditionally used in Melanesia for the decoration of boats. Occasionally used as food, but mainly collected for its shell. Widespread in the Indo-West Pacific, from East Africa to western Polynesia; north to Japan and south to northern New South Wales and New Caledonia.



(after Wilson, 1993)

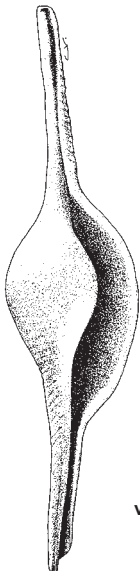


Volva volva (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / None.

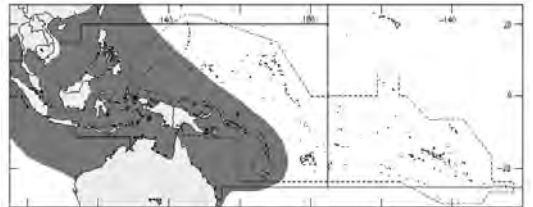
En - Shuttlecock volva; **Fr** - Ovule navette.

Maximum shell length 14 cm, commonly to 12 cm. Common near coral reefs, on large sea whips. Sublittoral zone, to depths of about 20 m. Mainly collected for its elegant shell. Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to Japan and south to northern New South Wales.



ventral view

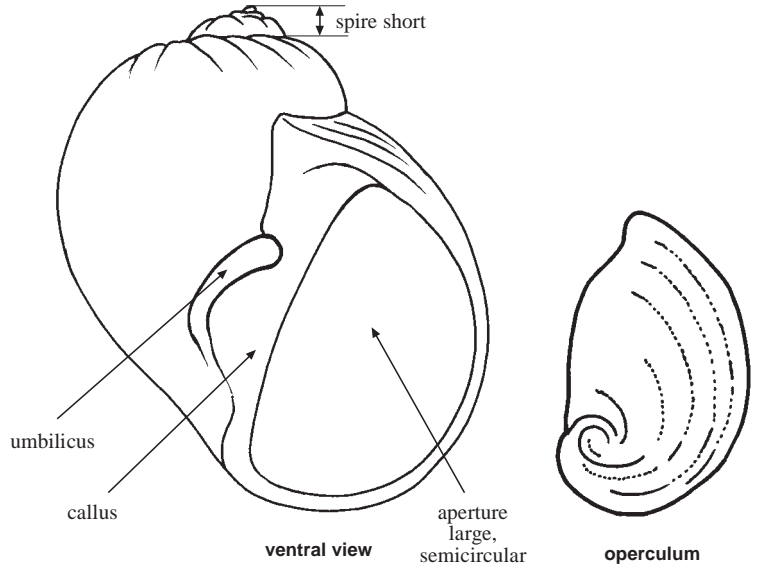
(after Lindner, 1976)



NATICIDAE

Moon snails

DDiagnostic characters: **Shell** globular to ovate-conical or somewhat ear-like in shape, **outer surface** generally smooth and glossy or with reduced sculpture. Spire low, obtuse to conical with few whorls, body whorl large and often inflated. **Aperture large, semicircular**, with a thin outer lip and a more or less developed callus on the inner lip. Anterior **siphonal canal absent**. **Umbilicus open or closed, sometimes with an internal rib (= funicle)**. **Operculum** entirely **corneous** or externally **calcified** and sculptured, with an eccentric nucleus and a few spiral coils. Head with moderately small, widely spaced tentacles. Eyes reduced to absent, behind the tentacles. Foot highly developed, reflecting over the head and much of the shell when expanded.



Habitat, biology, and fisheries: Sand or mud-dwelling animals, ploughing through the substrate with the expanded foot. Active predators, feeding mainly on burrowing bivalves or gastropods. Drills a circular hole with bevelled edges in the shell of the prey by means of an enzymatic secretion and the scraping action of the radula, before rasping the soft parts. Sexes separate, fertilization internal. Egg capsules generally embedded in a large collar-like ribbon that is hardened by grains of sand or mud. Eggs hatching as free-swimming, planktonic larvae or as crawling juveniles. In the area, moon snails are commonly collected by hand or with nets, and sold as food on the local markets. The consumers often resell the empty shells which are widely used in shellcraft. In Southeast Asia, the shells are also used in gambling games, both as counters and in a game which involves looking at a pile of them and betting on the number being odd or even.

Similar families occurring in the area

None. Shell characters and habits are very distinctive.

Key to species of interest to fisheries occurring in the area

- 1a. Operculum calcareous → 2
- 1b. Operculum corneous → 7

- 2a. Shell pear-shaped, with relatively tall spire; surface covered with many red-brown dots which may be spirally elongate and sometimes more or less transversally aligned (Fig. 1) *Natica tigrina*
- 2b. Shell ovate-conic, with low spire; surface differently coloured, not covered with brown dots → 3

- 3a. Umbilicus partially filled by a strong internal rib. → 5
- 3b. Internal rib of the umbilicus reduced to absent → 4

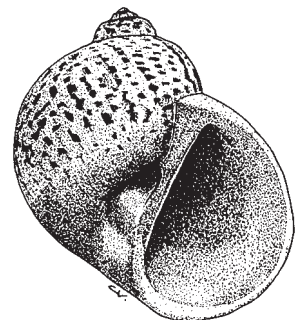


Fig. 1 *Natica tigrina* (ventral view)

- 4a. Colour of body whorl bright orange or yellow, with a darker central band and 2 spiral rows of cloudy white blotches (Fig. 2) *Natica stellata*
- 4b. Colour of body whorl brown to creamy, with 1 to 3 broad and distinct spiral bands of brown (Fig. 3) *Natica vitellus*

- 5a. Surface with a series of short axial grooves under the suture (Fig. 4) *Natica gualteriana*
- 5b. Surface without a series of short axial grooves under the suture → 6

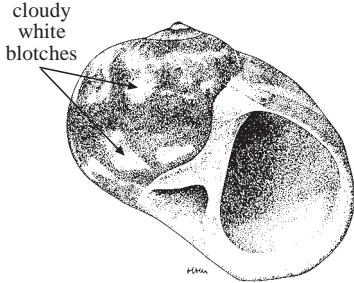


Fig. 2 *Natica stellata* (ventral view)

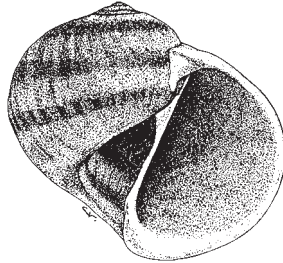


Fig. 3 *Natica vitellus* (ventral view)

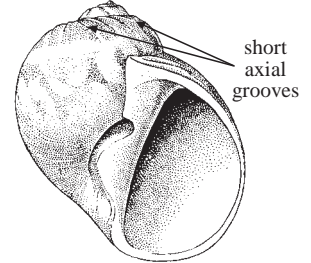


Fig. 4 *Natica gualteriana* (ventral view)

- 6a. Colour pattern of wavy, axial orange-brown lines, becoming thicker, less numerous and strongly pointing forward within 3 spiral bands (Fig. 5) *Natica euzona*
- 6b. Colour pattern of straightish, axial orange-brown lines, not becoming differently shaped within spiral bands (Fig. 6) *Natica lineata*

- 7a. Shell globular → 8
- 7b. Shell pear-shaped → 10

- 8a. Umbilical callus dark brown, with a strong median groove (Fig. 7) *Polinices didyma*
- 8b. Umbilical callus white, without a median groove. → 9

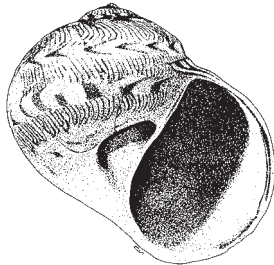


Fig. 5 *Natica euzona* (ventral view)

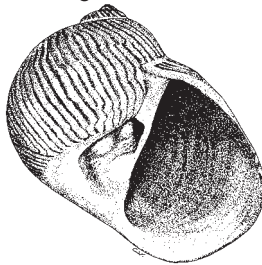


Fig. 6 *Natica lineata* (ventral view)

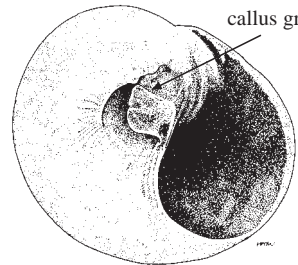


Fig. 7 *Polinices didyma* (basal view)

- 9a. Shell compressed, with a very flat spire; umbilicus almost hidden by a very large internal ridge (Fig. 8) *Neverita albumen*

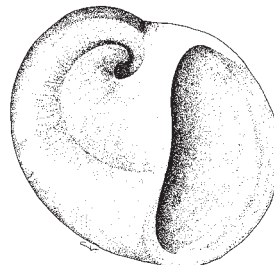


Fig. 8 *Neverita albumen* (basal view)

- 9b. Shell moderately compressed, with a low conical spire; umbilicus only partly hidden by a large internal ridge (Fig. 9) *Neverita peselephanti*

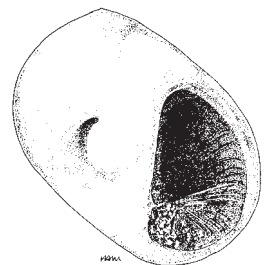


Fig. 9 *Neverita peselephanti* (ventral view)

- 10a.** Shell thick, entirely white; umbilicus completely filled by callus (Fig. 10). *Polinices mammilla*
- 10b.** Shell rather thin, with dark brown inner lip and more or less coloured spiral band; umbilicus not completely filled by callus → **11**
- 11a.** Shell very thin, semitransparent, with 3 spiral rows of brown spots on body whorl (Fig. 11). *Polinices sebae*
- 11b.** Shell moderately thin, opaque, with 3 to 4 pale fawn or grey spiral bands on body whorl (Fig. 12). *Polinices melanostomus*

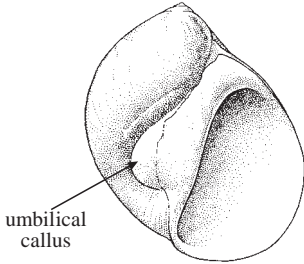


Fig. 10 *Polinices mammilla*
(ventral view)

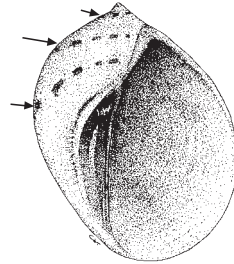


Fig. 11 *Polinices sebae*
(ventral view)

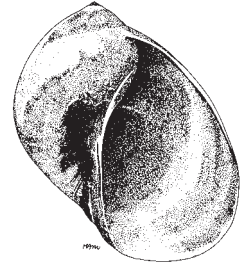














Fig. 12 *Polinices melanostomus*
(ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Natica euzona* Récluz, 1844
-  *Natica gualteriana* Récluz, 1844
-  *Natica lineata* (Röding, 1798)
-  *Natica stellata* Hedley, 1913
-  *Natica tigrina* (Röding, 1798)
-  *Natica vitellus* (Linnaeus, 1758)
-  *Neverita albumen* (Linnaeus, 1758)
-  *Neverita peselephanti* (Link, 1807)
-  *Polinices didyma* (Röding, 1798)
-  *Polinices mammilla* (Linnaeus, 1758)
-  *Polinices melanostomus* (Gmelin, 1791)
-  *Polinices sebae* (Récluz, 1844)

References

- Cernohorsky, W.O. 1971. The family Naticidae (Mollusca: Gastropoda) in the Fiji Islands. *Rec. Auckl. Inst. Mus.*, 8:169-208.
- Kabat, A.B. 1990. Species of Naticidae (Mollusca: Gastropoda) described by Linnaeus in the Systema Naturae (1758). *Zool. J. linn. Soc.*, 100:1-25.
- Marincovich, L. Jr. 1977. Cenozoic Naticidae (Mollusca: Gastropoda) of the North eastern Pacific. *Bull. Am. Paleont.*, 70(294):169-494.
- Streitz, M. 1992a. Les Natices de Thaïlande. 1^{ère} partie. *Xenophora*, 57:8-22.
- Streitz, M. 1992b. Les Natices de Thaïlande. Seconde partie. *Xenophora*, 60:15-25.

Natica euzona Récluz, 1844

Frequent synonyms / misidentifications: *Natica decora* Philippi, 1851; *N. elegans* Récluz, 1850 (not of Sowerby, 1850); *N. picta* Récluz, 1844; *Notocochlis euzona* (Récluz, 1844); *Tanea euzona* (Récluz, 1844) / *Natica cothurnata* Iredale, 1936; *N. sagittata* Menke, 1843.

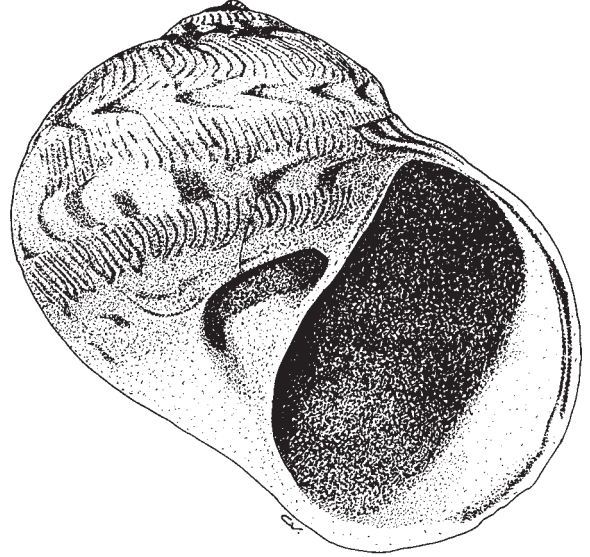
FAO names: En - Beautifully-banded moon snail; Fr - Natices à belles bandes.

Diagnostic characters: Shell small (up to 3 cm long), **ovate-conic** in shape, with globose body whorl, **short conical spire**, convex whorls and **moderately impressed suture**. Outer surface smoothish. **Umbilicus deep and narrowly open**, U-shaped, **partly occluded centrally by a broad and rounded internal rib** forming a callus at columellar margin. Calloused margin of posterior part of inner lip poorly developed, not confluent with the central callus of umbilicus. **Operculum calcareous**, with a single spiral groove along its outer margin. **Colour:** outside of shell creamy white, with a dense pattern of wavy, axial orange-brown lines, becoming thicker, less numerous and strongly pointing forward within 3 spiral bands, those below the suture and near periphery being strongest. Base and umbilical area white, with a single spiral row of short, orange-brown streaks.

Size: Maximum shell length 3 cm, commonly to 2 cm.

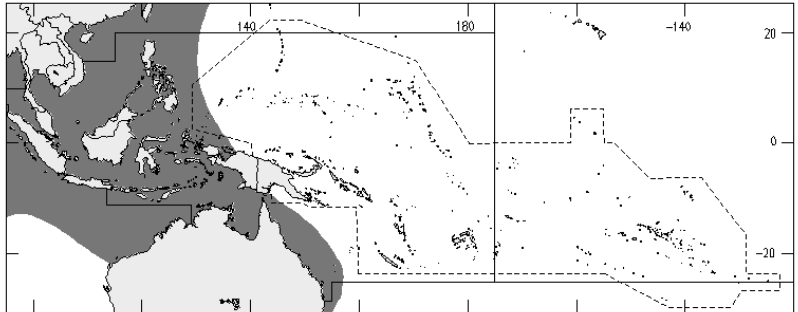
Habitat, biology, and fisheries: On sandy bottoms. Sublittoral and offshore to a depth of 60 m. Sold on local markets in the northern Philippines. Shell used in shellcraft.

Distribution: Widespread in the Indo-West Pacific, from East Africa to the Philippines; north to Japan, and south to New South Wales.



ventral view

(after Kilburn, 1976)



Natica stellata Hedley, 1913

Frequent synonyms / misidentifications: *Natica stellata* (Martyn, 1786) (Invalid name); *N. stellata* "Chenu" of authors / *Natica vitellus* (Linnaeus, 1758).

FAO names: En - Starry moon snail; Fr - Natices étoilée.

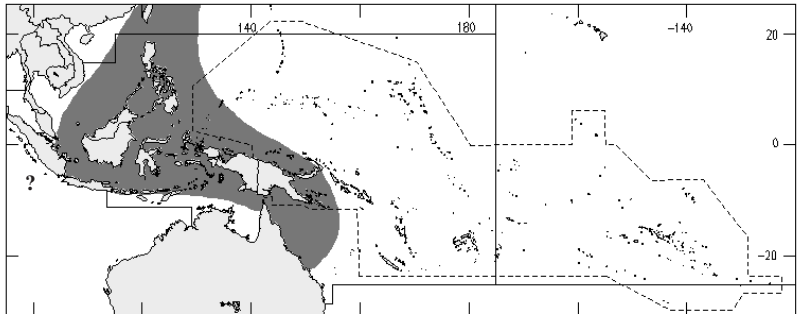


Diagnostic characters: Shell moderately thick, **ovate-conic** in shape and about as long as wide, with a **short spire**, broadly convex whorls and **well-defined suture**. **Outer surface smoothish**, apart from fine growth marks which tend to be stronger at the sutures of early whorls. **Umbilicus narrowly open anteriorly**, partially **covered posteriorly by a thin, tongue-like callus extending from the posterior half of inner lip**. Internal rib of umbilicus strongly reduced to absent. Anterior end of aperture often slightly flaring. **Operculum calcareous**, with 2 or 3 spiral ridges along its outer margin and a slightly serrated inner margin. **Colour:** outside of shell **bright orange, with a darker central band and 2 spiral rows of cloudy white blotches on body whorl**. Aperture and umbilical area whitish.

Size: Maximum shell length 4 cm, commonly to 3 cm.

Habitat, biology, and fisheries: Sandy bottoms. Sublittoral, from lowtide mark to about 20 m. Collected for food and for the shell.

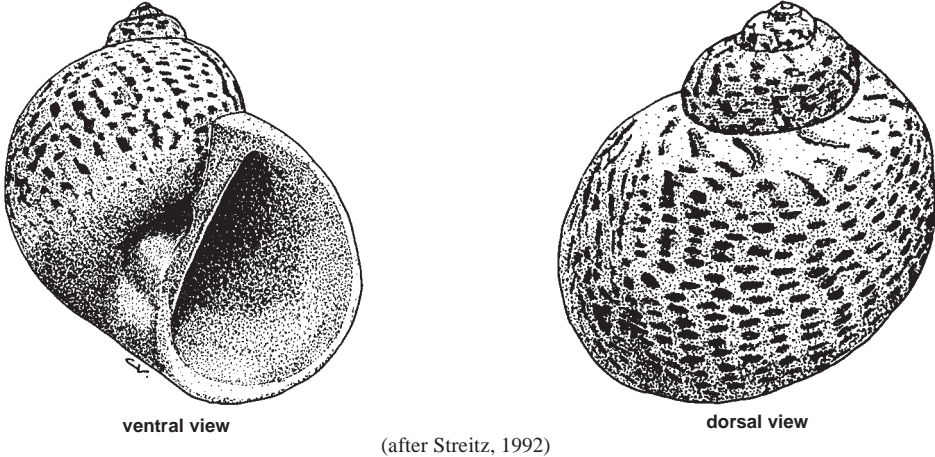
Distribution: Imperfectly known because of long confusion with *Natica vitellus*. Occurs in the tropical West Pacific, from Indonesia to Melanesia; north to southern Japan and south to Queensland. Presence in the Indian Ocean still uncertain.



Natica tigrina (Röding, 1798)

Frequent synonyms / misidentifications: *Natica javana* Lamarck, 1822; *N. maculata* Perry, 1811; *N. maculosa* Lamarck, 1822; *N. pellistigrina* Dunker, 1882; *Tanea tigrina* (Röding, 1798); *Tectonica tigrina* (Röding, 1798) / In the FAO Species Identification Sheets for the Eastern Central Atlantic, Abbott (1981) erroneously used the name *Natica tigrina* (Röding) for a different West African species, *N. fanel* (Röding, 1798).

FAO names: **En** - Tiger moon snail; **Fr** - Natice tigrée; **Sp** - Natica atigrada.

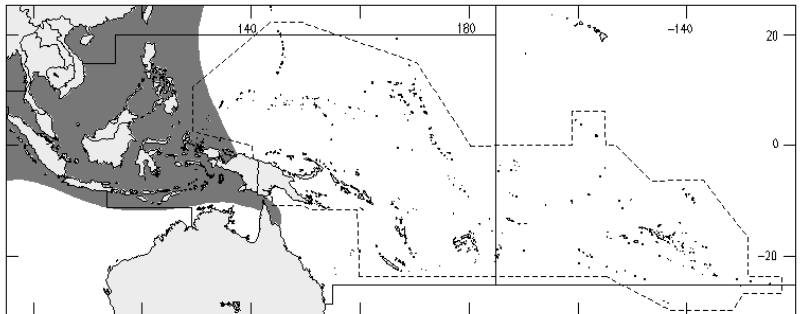


Diagnostic characters: Shell moderately thin, roughly pear-shaped in outline, distinctly longer than wide, with a relatively tall spire, convex whorls and deeply impressed suture. Outer surface smooth, devoid of axial grooves under the suture. Umbilicus deep and narrow, partly filled by a strong internal rib on middle part of its columellar side. Callus of the inner lip poorly developed, mainly posterior to the umbilicus. Operculum calcareous, with 2 spiral grooves along its outer margin. **Colour:** outside of shell creamy white, covered with many spiral rows of red brown dots (about 14 to 16 on body whorl), which may be spirally elongate and sometimes more or less transversely aligned. Umbilical area and margins of the aperture white. Aperture stained with brown inside.

Size: Maximum shell length 4 cm, commonly to 3 cm.

Habitat, biology, and fisheries: On sandy bottoms, sometimes in dense populations (most numerous populations recorded in Malaysia, numbering more than 10 000 specimens). Mainly sublittoral, from shallow subtidal waters to a depth of about 30 m. Collected for food and shell trade where abundant, especially in Japan, Malaysia, and Indonesia.

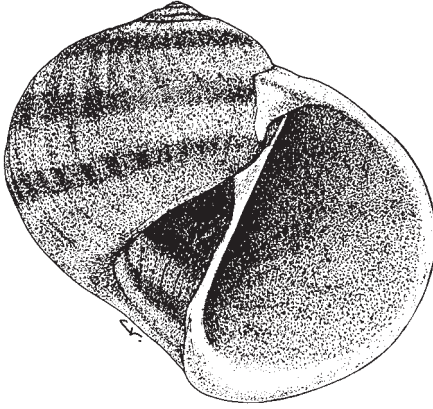
Distribution: Indo-West Pacific, from the Mascareign Islands and India to Queensland.



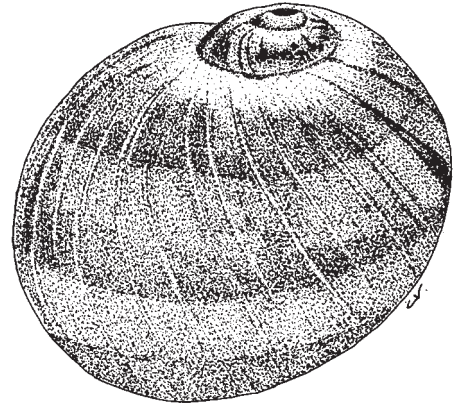
Natica vitellus (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Natica globosa* (Chemnitz, 1781) (Invalid name); *N. helvacea* Lamarck, 1822; *N. rufa* (Born, 1778); *N. spadicea* (Gmelin, 1791) / *Natica orientalis* (Gmelin, 1791).

FAO names: En - Calf moon snail; Fr - Natices châtain.



ventral view



dorsal view

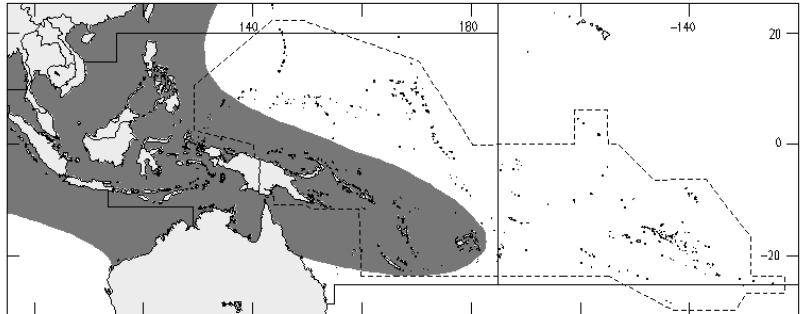
(after Streitz, 1992)

Diagnostic characters: Shell moderately thick, **ovate-conic** in shape and about as long as wide, with a **short spire**, convex whorls and **well-defined suture**. **Outer surface smoothish**, apart from fine growth marks which tend to be stronger at the sutures of early whorls. **Umbilicus large and deeply open**, with an ill-defined, weak to nearly absent internal rib, and **slightly covered posteriorly** by the thick and narrow **callus of inner lip**. Anterior end of aperture often slightly flaring. **Operculum calcareous**, with 2 spiral ridges along its outer margin and a finely serrated inner margin. **Colour: outside of shell variable**, white or light brown to yellowish, with **1 to 3 usually broad and distinct spiral bands of darker brown on body whorl**. Umbilical area whitish. Columellar side of the aperture often with brown shades.

Size: Maximum shell length 4.5 cm, commonly to 3 cm.

Habitat, biology, and fisheries: Sublittoral, from shallow subtidal levels to a depth of about 40 m. Used as food and for its shell. In Thailand, commonly collected by fishing nets from depths of 2 to 10 m.

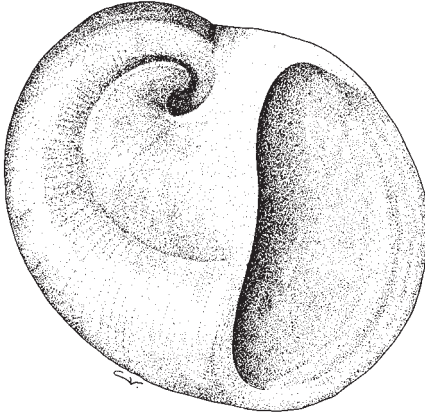
Distribution: Indo-West Pacific, from Madagascar and the Persian Gulf, to eastern Melanesia; north to Japan and south to Queensland and New Caledonia.



Neverita albumen (Linnaeus, 1758)

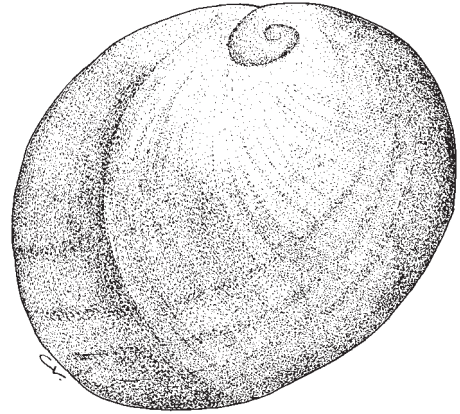
Frequent synonyms / misidentifications: *Polinices albumen* (Linnaeus, 1758) / None.

FAO names: En - Eggwhite moon snail; Fr - Natice blanc d'oeuf.



basal view

(after Dance, 1993)



apical view

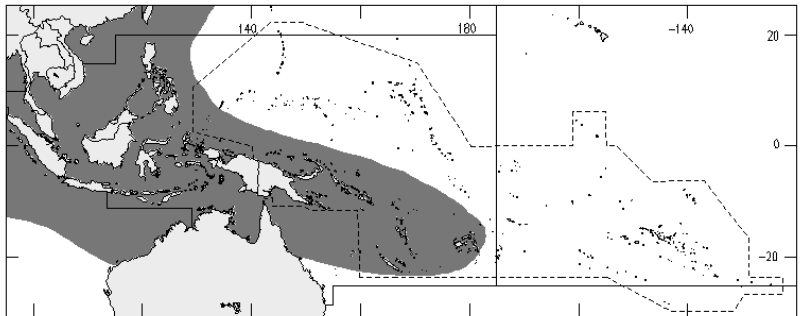
(after Kira, 1962)

Diagnostic characters: Shell heavy, **globular** in shape, **compressed anteroposteriorly** and markedly wider than long, **with an almost flat spire**, very low sutures and greatly expanded body whorl. **Outer surface smooth and glossy**, apart from very fine lines of growth. **Umbilicus very large, almost hidden by a massive internal ridge** that leaves a regularly rounded depressed area at periphery. **Operculum corneous. Colour: outside of shell cream or pale yellow to brown, base and umbilical area white.** In darker specimens, a broad spiral band of white runs along the suture. **Interior of the aperture white to light purple.** Operculum reddish or yellowish brown.

Size: Maximum shell width 6 cm, commonly to 4 cm.

Habitat, biology, and fisheries: On clean sand bottoms. Infralittoral and offshore, from shallow subtidal levels to a depth of about 70 m. Used as food and for the shell. In Thailand, commonly collected by fishing nets from depths of 2 to 10 m. Known also to be sold as food in the markets of Kyushu (Japan).

Distribution: Widespread in the Indo-West Pacific, from South Africa and Madagascar, but apparently not in the northwestern part of the Indian Ocean, to eastern Melanesia; north to Japan and south to Queensland and New Caledonia.



Neverita peselephanti (Link, 1807)

Frequent synonyms / misidentifications: *Mammillaria lactea* Swainson, 1840; *Natica alba* Gray, 1827; *Polinices peselephanti* (Link, 1807) / *Polinices powisianus* (Récluz, 1843).

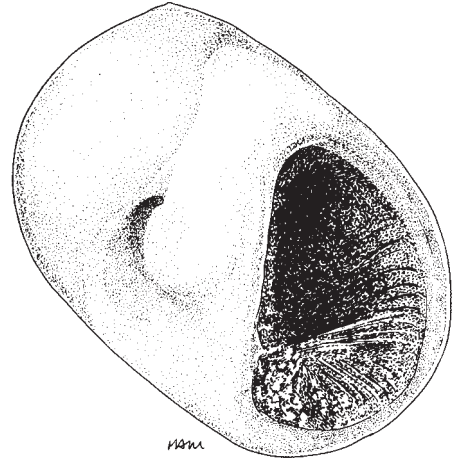
FAO names: En - Elephant's-foot moon snail; Fr - Natice patte-d'éléphant.

Diagnostic characters: Shell heavy, globular in shape, somewhat compressed anteroposteriorly and slightly wider than long, with a low conical spire and shallow sutures. Outer surface smooth and glossy, apart from very fine lines of growth. Umbilicus large, partly hidden by a thick internal ridge that leaves a comma-shaped structure at periphery. Operculum corneous. Colour: outside of shell cream, yellow or light orange, white on early spire whorls and umbilical area. Interior of the aperture white. Operculum dark orange-brown.

Size: Maximum shell width 5 cm, commonly to 3.5 cm.

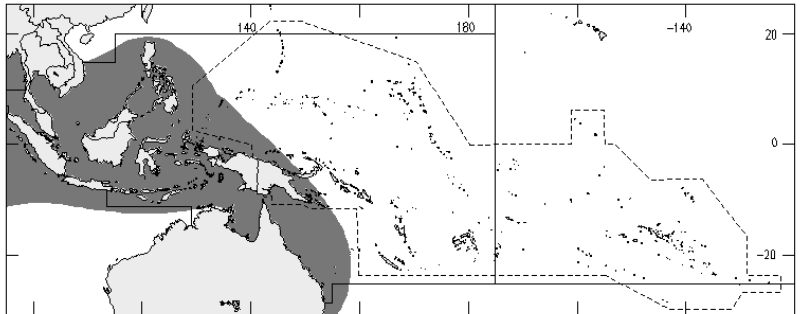
Habitat, biology, and fisheries: On sand bottoms. Sublittoral, from low tide mark to a depth of about 10 m. Used as food and for shell trade. In Thailand, commonly collected by fishing nets at depths between 2 and 10 m.

Distribution: Widespread in the Indo-West Pacific, from South Africa and the Red Sea, to Papua New Guinea; north to the Philippines and south to New South Wales.



ventral view

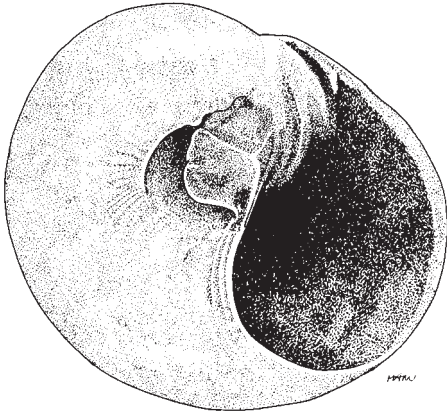
(after Wilson, 1993)



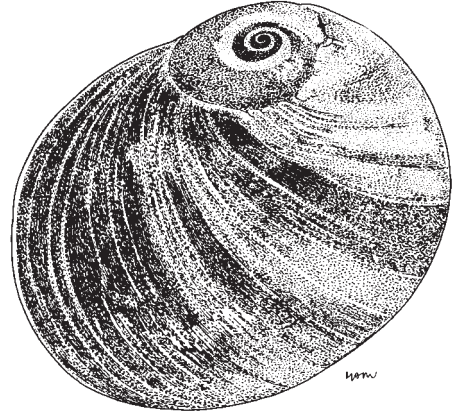
Polinices didyma (Röding, 1798)

Frequent synonyms / misidentifications: *Glossaulax didyma* (Röding, 1798); *Neverita didyma* (Röding, 1798); *Polinices bicolor* (Philippi, 1848); *P. chemnitzii* (Reeve, 1855); *P. lamarckiana* (Reeve, 1855) / None.

FAO names: En - Bladder moon snail; Fr - Natice bicolore.



basal view



apical view

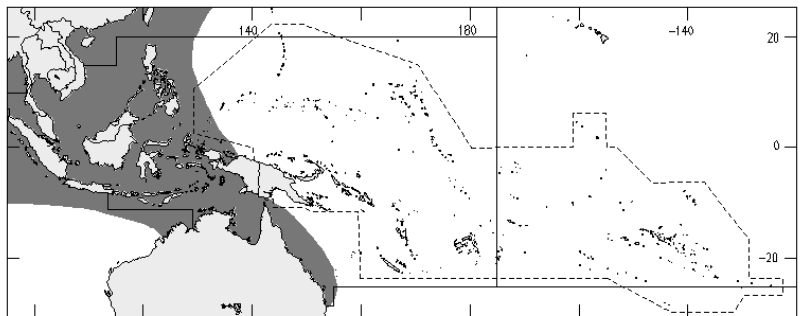
(after Short and Potter, 1987)

Diagnostic characters: **Shell quite large** (up to 8.5 cm wide), relatively thin and light for its size but solid, **globular** in shape and decidedly wider than long. **Spire short, poorly protruding**, with slightly convex whorls and shallow sutures. **Outer surface** of shell **smooth** apart from fine lines of growth. **Umbilicus wide and deeply open**, with a thin internal thread anteriorly, partially covered posteriorly by a strong callus protruding from the posterior half of inner lip. **Umbilical callus with a deep median groove**. Operculum corneous. **Colour:** **outside** of shell **variable, bluish grey to light brown** or fawn, **whitish on base** and umbilicus, and sometimes with faint spiral banding. **Interior** of the aperture **brown**, inner lip spirally banded with shades of brown and white, with the **umbilical callus** orange-brown or **deep chocolate brown**. Operculum yellowish brown.

Size: Maximum shell width 8.5 cm, commonly to 5 cm.

Habitat, biology, and fisheries: On sandy to muddy bottoms. Intertidal to shelf zones, to a depth of about 100 m. Used as food and for shell trade. In Thailand, commonly collected by fishing nets at depths from 2 to 10 m.

Distribution: Indo-West Pacific, from South Africa to eastern Indonesia; north to Japan and south to southern Queensland.



Polinices mammilla (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Polinices albus* Montfort, 1810; *P. pyriformis* (Récluz, 1844); *P. tumidus* (Swainson, 1840); *Polynices mamilla* (Linnaeus, 1758) (Spelling errors) / *Polinices aurantius* (Röding, 1798).

FAO names: **En** - Pear-shaped moon snail; **Fr** - Naticé pyriforme.

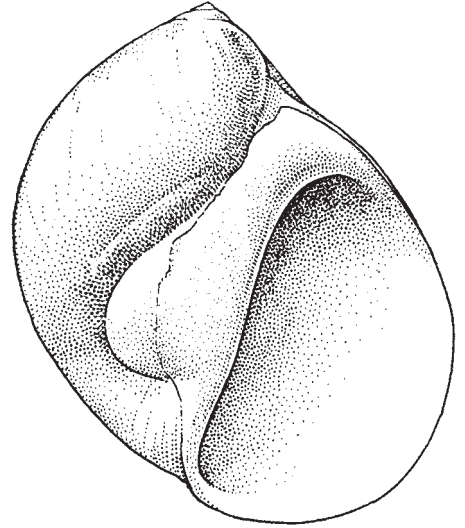
Diagnostic characters: **Shell thick** and heavy, **pear-shaped**, distinctly longer than wide, **with a moderately high conical spire**, nearly flat-sided whorls and shallow sutures. **Outer surface smooth and glossy**, with only fine lines of growth. **Umbilicus closed, entirely filled by a heavy callus** (a slight umbilical groove occasionally present anterior to callus in juvenile specimens). **Operculum corneous. Colour: shell porcelaneous white externally and internally**, occasionally with ill-defined spots or band of darker colour at the sutures, or with a yellowish hue on columellar callus. Operculum yellowish brown, usually with a darker zone adjoining its inner margin.

Size: Maximum shell length 6 cm, commonly to 5 cm.

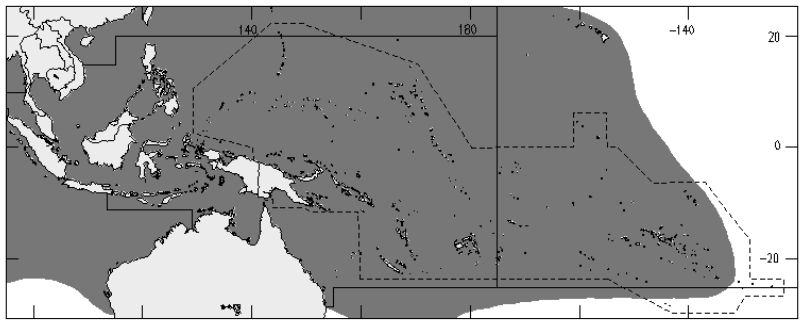
Habitat, biology, and fisheries: Abundant on sandy bottoms, often associated with coral reefs. Intertidal and sublittoral, from low tide zone to a depth of about 20 m. Collected in large quantities, for food and for the shell. In Thailand, actively collected by hand at low tide; shells sold by weight for the shellcraft industry, in batches often comprising 5 000 to 10 000 specimens.

Distribution: Widespread in the Indo-West Pacific, from East and South Africa to eastern Polynesia; north to Japan and Hawaii, and south to southern Queensland and Lord Howe Island.

Remarks: Until recently, the Linnean name of that species was generally discarded as a dubious name. However, Kabat (1990) studied the original collections of Linnaeus and designated a type specimen for the species, then identifying it with the common Indo-West Pacific species generally known as *Polinices tumidus* (Swainson).



ventral view

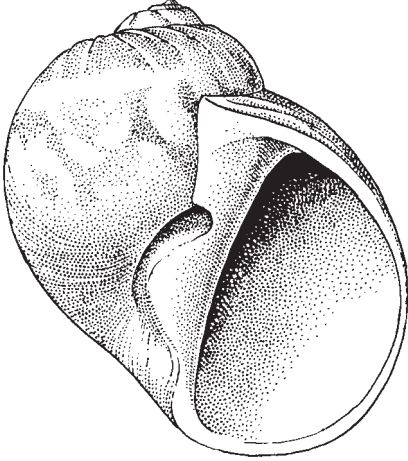


***Natica gualteriana* Récluz, 1844**

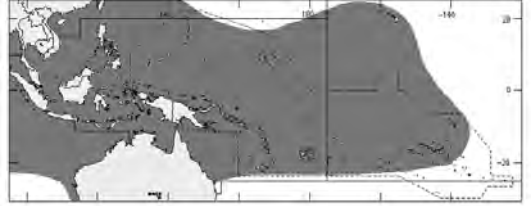
Frequent synonyms / misidentifications: *Natica antonii* Philippi, 1851; *N. asellus* Reeve, 1855; *N. tessellata* Philippi, 1849 / *Natica marochiensis* (Gmelin, 1791).

En - Gualteri's moon snail; **Fr** - Natice de Gualteri.

Maximum shell length 2.5 cm, commonly to 2 cm. Common on sandy to muddy flats. Intertidal and sublittoral zones to a depth of about 25 m. Abundant in sheltered bays and near estuaries. Leaves meandering tracks at low tide on sandy shores. Collected for food and for its shell. Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and Hawaii, and south to southern Queensland.



ventral view

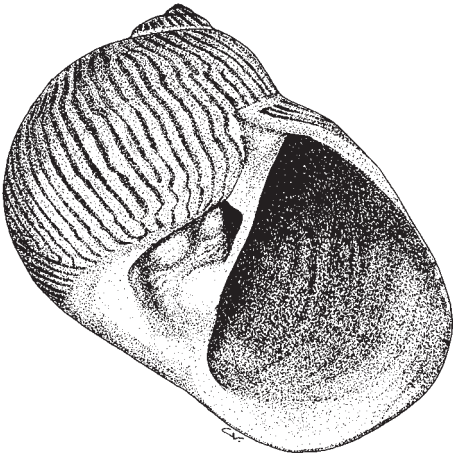


***Natica lineata* (Röding, 1798)**

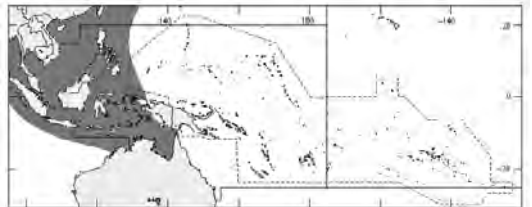
Frequent synonyms / misidentifications: *Natica lineata* Lamarck, 1822; *Naticarius lineatus* (Lamarck, 1822); *Notocochlis lineatus* (Lamarck, 1822); *Tanea lineata* (Röding, 1798) / None.

En - Lined moon snail; **Fr** - Natice lignée.

Maximum shell length 4 cm, commonly to 3 cm. On fine sandy to muddy bottoms. Sublittoral, mainly from depths of 10 to about 50 m. Collected in trawls. Used as food and for shellcraft. Eastern Indian Ocean and the tropical West Pacific, from the Bay of Bengal and Sri Lanka to Indonesia; north to southern Japan and south to northern Queensland.



ventral view (after Habe, 1964)

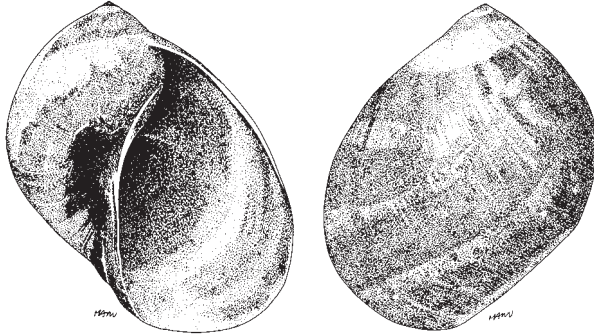


Polinices melanostomus (Gmelin, 1791)

Frequent synonyms / misidentifications: *Mammilla melanostoma* (Gmelin, 1791); *M. opaca* (Récluz, 1851) / None.

En - Blackmouth moon snail; **Fr** - Natice bouche-noire.

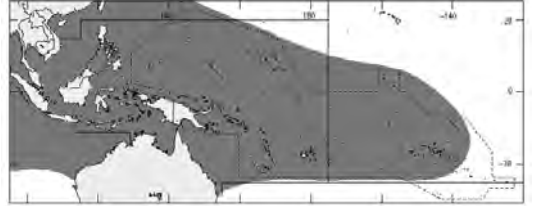
Maximum shell length 5.5 cm, commonly to 4.5 cm. On sandy bottoms. Sublittoral, from shallow subtidal levels to a depth of about 20 m. Collected for food and for the shell. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Gulf of Oman, to eastern Polynesia; north to Japan and south to southern Queensland.



ventral view

dorsal view

(after Dance, 1993)

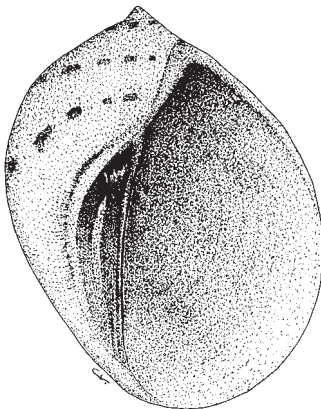


Polinices sebae (Récluz, 1844)

Frequent synonyms / misidentifications: *Mammilla sebae* (Récluz, 1844); *Polinices sebae* (Souleyet, 1852) / *Polinices melanostomoides* (Quoy and Gaimard, 1833).

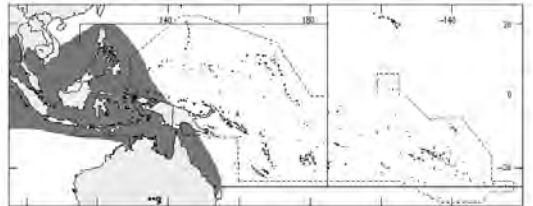
En - Seba's moon snail; **Fr** - Natice de Seba.

Maximum shell length 5 cm, commonly to 3.5 cm. On sandy bottoms, in sublittoral shallow water. Collected for food and shell trade. Indo-West Pacific, from southeastern Africa, including the Red Sea and the Gulf of Oman to Papua New Guinea; north to the Philippines and south to southern Queensland.



ventral view

(after Kensley, 1973)

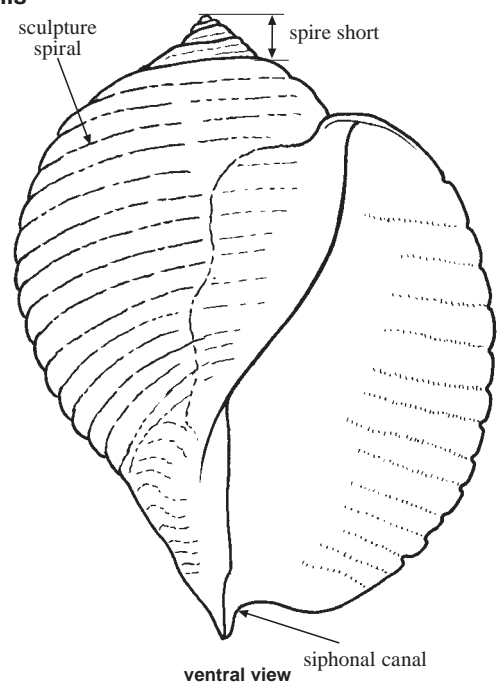


TONNIDAE

Tun shells

Diagnostic characters: Shell thin, globose, with a short spire and very inflated, large body whorl. Sculpture only spiral, of relatively flat ribs or cords. No axial varices. Periostracum a thin smooth sheet. Aperture broad and extensive. Anterior siphonal canal short, a U-shaped notch. Outer lip generally thin, sometimes reflected and denticulate, in adults only. Inner lip with a more or less developed, glazed callosity, usually covering the umbilicus. Columella sometimes twisted. **Operculum absent** in the adult. Head with a relatively short but extremely extensible snout. Cephalic tentacles elongate, usually bearing eyes on bulges of their outer bases. Foot very large and wide, moderately flat. Fleshy siphon long.

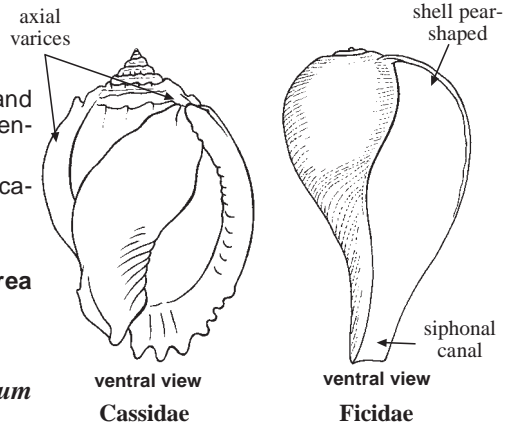
Habitat, biology, and fisheries: Tropical and warm temperate, mainly living on sandy bottoms, often where seagrasses abound. Can quickly bury themselves completely in the sand, except for the tip of the fleshy siphon. Feeds mainly on holothurians, which are first paralysed by a salivary secretion containing sulphuric acid, then swallowed whole. Sexes separate, fertilization internal. Eggs laid in masses of broad, gelatinous ribbons. Free-swimming, planktonic stage very long, lasting 3 to 8 months. Occasionally collected for food in the Indo-West Pacific. Shells often used as decorative items.



Similar families occurring in the area

Cassidae: easily distinguishable by their axial varices and operculum; columellar callus often developed in a thick extensive shield.

Ficidae: shell pear-shaped, with a long, tapering siphonal canal.



Key to species of interest to fisheries occurring in the area

- 1a. Outer lip strongly reflected, giving a rather narrow aperture; columella with a few folds on either side of a median excavation; umbilicus absent (Fig. 1) *Malea pomum*
- 1b. Outer lip thin or slightly reflected, aperture broad; columella without excavation and folds; umbilicus present → 2
- 2a. Outer lip thin and sharp (Figs 2 to 4) → 3
- 2b. Outer lip thickened to more or less reflected (Figs 5 to 8). → 5
- 3a. Spire short, suture deeply channeled → 4
- 3b. Spire tall, suture incised but not deeply channeled (Fig. 2) *Tonna perdix*

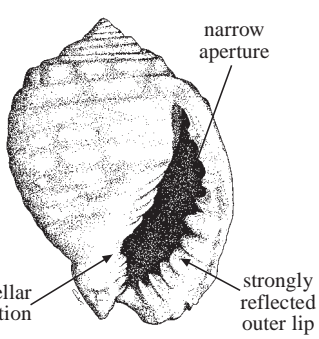


Fig. 1 *Malea pomum* (ventral view)

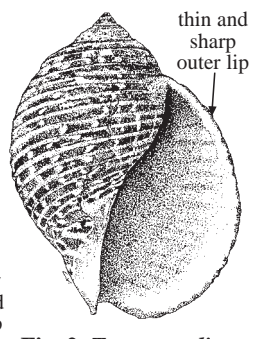


Fig. 2 *Tonna perdix* (ventral view)

- 4a. Ribs of body whorl with narrow interstices (Fig. 3) *Tonna canaliculata*
- 4b. Ribs of body whorl with 1 to 3 fine threads in the interstices (Fig. 4) *Tonna olearium*
- 5a. Body whorl white, with 4 or 5 spiral bands of brown (Fig. 5) *Tonna sulcosa*
- 5b. Body whorl differently coloured → 6

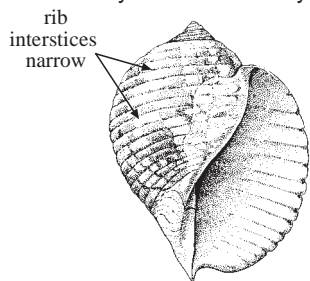


Fig. 3 *Tonna canaliculata*
(ventral view)

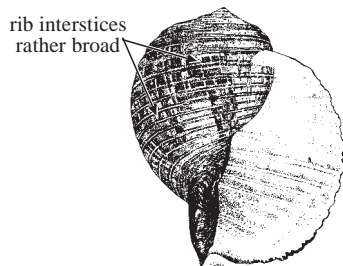


Fig. 4 *Tonna olearium*
(ventral view)

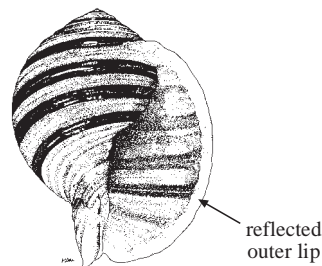


Fig. 5 *Tonna sulcosa*
(ventral view)

- 6a. Spiral ribs with large squarish brown blotches. → 7
- 6b. Spiral ribs without squarish brown blotches (Fig. 6) *Tonna allium*

- 7a. Outer lip with 9 or 10 pairs of denticles interiorly; columellar callus covering the umbilicus (Fig. 7) *Tonna tessellata*
- 7b. Outer lip without denticles interiorly; columellar callus reduced, not covering the umbilicus (Fig. 8) *Tonna dolium*



Fig. 6 *Tonna allium*
(ventral view)

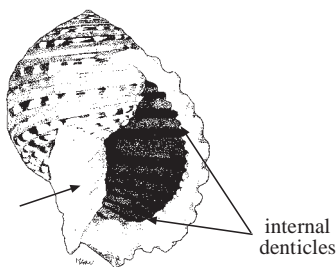


Fig. 7 *Tonna tessellata*
(ventral view)

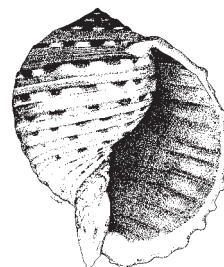










Fig. 8 *Tonna dolium*
(ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Malea pomum* (Linnaeus, 1758)
-  *Tonna allium* (Dillwyn, 1817)
-  *Tonna canaliculata* (Linnaeus, 1758)
-  *Tonna dolium* (Linnaeus, 1758)
-  *Tonna olearium* (Linnaeus, 1758)
-  *Tonna perdix* (Linnaeus, 1758)
-  *Tonna sulcosa* (Born, 1778)
-  *Tonna tessellata* (Lamarck, 1816)

References

Beu, A.G. 1981. Australian gastropods of the family Bursidae. Part 1. The families of Tonnacea, the genera of Bursidae, and revision of species previously assigned to *Tutufa* Jousseaume, 1881. *Rec. Aust. Mus.*, 33(4-5):248-324.

Okutani, T., M. Tagawa, and H. Horikawa. 1988. *Gastropods from continental shelf and slope around Japan. The intensive research of unexploited fishery resources on continental slopes.* Tokyo, Japan Fisheries Resource Conservation Association, 203 p.

Qi, Z.Y. and X.T. Ma. 1984. Studies on the family Tonnidae (Prosobranchia, Gastropoda) of China. *Stud. Mar. Sin.*, 23:131-141.

Tonna allium (Dillwyn, 1817)

Frequent synonyms / misidentifications: *Tonna costata* (Menke, 1828) / None.

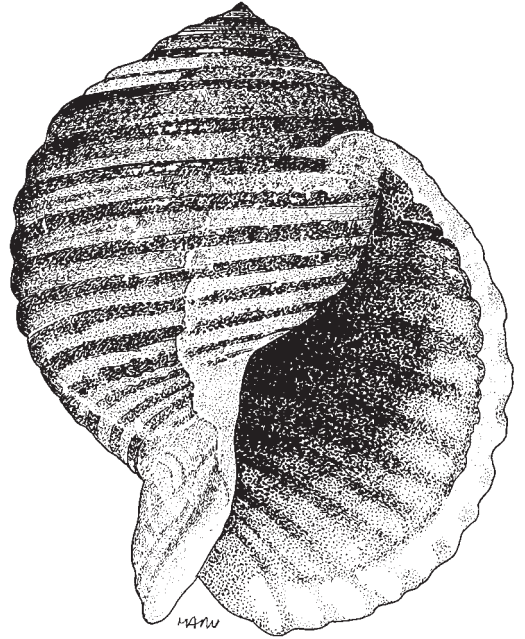
FAO names: En - Costate tun; Fr - Tonne côtelée.

Diagnostic characters: Shell medium sized, moderately thick, **globose-ovate with a quite low spire** and channeled suture. Outer **sculpture of strong, narrow and rounded spiral ribs separated by wide, shallow interspaces**, cut by axial growth lines on early whorls, but quite smooth on later whorls. **Body whorl lustrous, with 13 to 15 spiral ribs**, spire whorls with 3 ribs. Aperture broad. **Outer lip somewhat thickened and slightly reflected, crenulated** by the external spiral sculpture, and **with about 28 denticles** which tend to be paired **along its inner side**. Columella strongly twisted, with a thin callus glaze expanded over the small but deep umbilicus and over posterior part of inner lip. Anterior **siphonal canal rather deeply notched**. **Colour:** outside of shell **cream or fawn, slightly darker on spiral ribs**, and dark purplish brown at the apex. Aperture similarly coloured inside though often lighter, **outer lip and columella white**.

Size: Maximum shell length 10 cm, commonly to 7 cm.

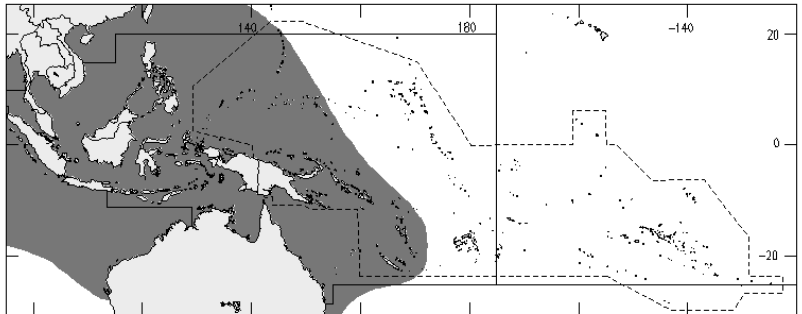
Habitat, biology, and fisheries: On sandy bottoms. Sublittoral zone, at depths of 10 to 50 m. Incidentally collected in shrimp trawl nets. Appearing occasionally in markets of the northern Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to Japan and south to New South Wales.



ventral view

(after Dance, 1993)



Tonna perdx (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / None.

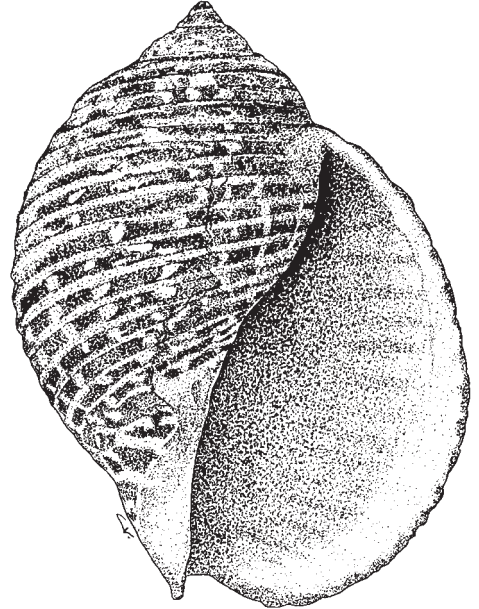
FAO names: En - Pacific partridge tun; Fr - Tonne perdrix.

Diagnostic characters: Shell large, lightweight and thin, roughly pear-shaped. Spire relatively tall, with 2 smooth whorls at the apex, about 8 small spiral cords on later whorls and an incised but not deeply channeled suture. **Body whorl** smoothly sculptured, with about 20 regular, shallow, rounded spiral ribs separated by low and rather broad grooves. Aperture very large. **Outer lip rather thin and sharp**, finely fluted by the outer sculpture. Inner lip gently curved, columellar callus thin, moderately wide and reflected over the deep umbilicus. Anterior **siphonal canal a wide, very shallow and oblique notch** at the end of a broad but low ridge bordering the umbilical depression. **Colour:** outside of shell generally purplish brown, with whitish lines in spiral grooves and many, crescent-shaped white markings on the ribs. Interior yellow-brown, with the outer colour pattern showing through, becoming white near the outer lip and siphonal canal that are narrowly rimmed with brown. Columellar callus white, semi-translucent.

Size: Maximum shell length 20 cm, commonly to 13 cm.

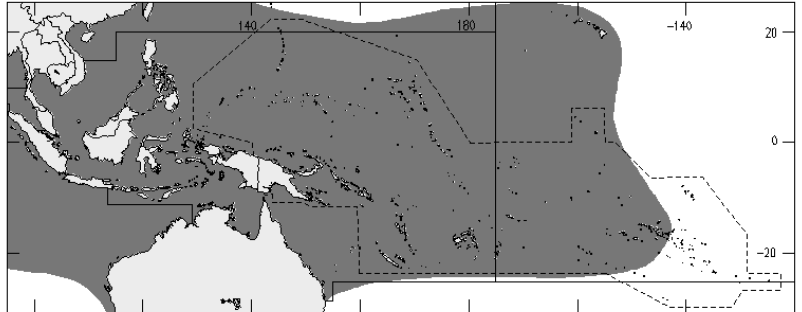
Habitat, biology, and fisheries: On sandy bottoms. Sublittoral zone, to a depth of about 20 m. Most common in shallow waters, at 5 to 10 m. Caught in trawl nets or in fish traps. Sometimes found in local markets of the northern Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan and Hawaii, and south to southern Queensland.



ventral view

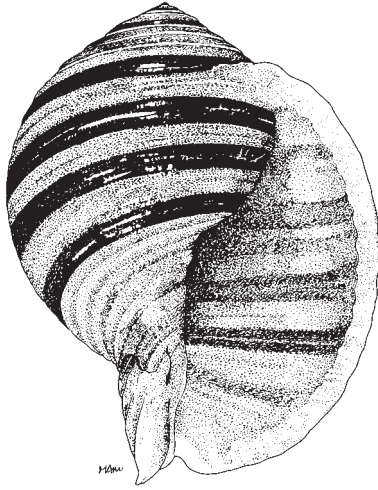
(after Dance, 1993)



Tonna sulcosa (Born, 1778)

Frequent synonyms / misidentifications: *Dolium fasciatum* Bruguière, 1792 / None.

FAO names: En - Banded tun; Fr - Tonne fasciée.



ventral view



dorsal view

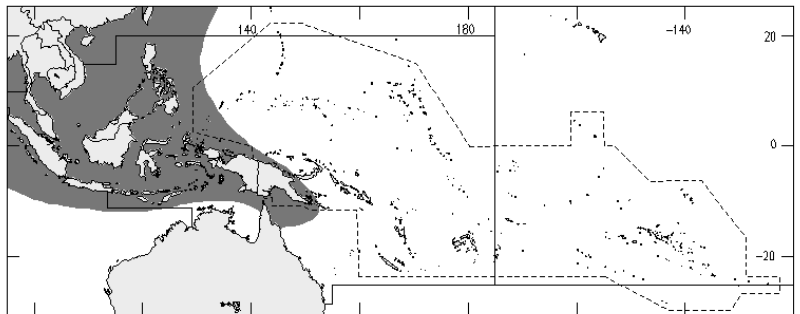
(after Okutani et al., 1988)

Diagnostic characters: Shell medium sized, rather thick, **globose-ovate** with a quite low spire and impressed suture. **Outer sculpture** of evenly spaced, **flat spiral ribs**, with finely raised axial lines on the early spire whorls only. Spiral ribs 4 or 5 in number on the penultimate whorl, **about 20 on body whorl**. Aperture broad. **Outer lip somewhat thickened and reflected, with 15 to 17 pairs of denticles** along its inner side. Columella with a thin callus glaze, strongly twisted anteriorly. Anterior **siphonal canal moderately deep**. **Colour:** outside of shell **creamy white**, with a dark brown apex and **with 3 or 4 broad spiral bands of brown** on body whorl that are as wide as 1.5 to 2 ribs. **Aperture white**, with the external brown banding showing through.

Size: Maximum shell length 13 cm, commonly to 10 cm.

Habitat, biology, and fisheries: On fine sand and mud bottoms. Sublittoral zone, at depths of 10 to 70 m. Collected in shrimp trawls. Occasionally marketed in the northern Philippines.

Distribution: Central Indian Ocean and the tropical West Pacific, from Sri Lanka to Melanesia; north to Japan and south to northern Queensland.

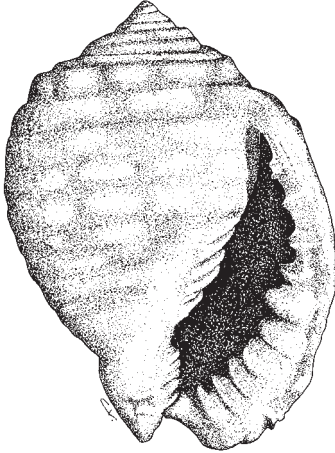


***Malea pomum* (Linnaeus, 1758)**

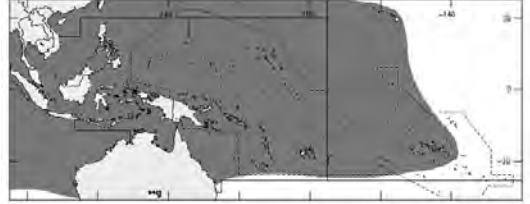
Frequent synonyms / misidentifications: *Quimalea pomum* (Linnaeus, 1758) / None.

En - Grinning tun; **Fr** - Tonnelet lippu.

Maximum shell length 8 cm, commonly to 6 cm. On fine sandy bottoms. Sublittoral, mainly between depths of 5 and 30 m. Incidentally collected in fish traps and trawls, where common. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Mascareign Islands, to eastern Polynesia; north to southern Japan and Hawaii, and south to southern Queensland.



ventral view
(after Habe, 1964)

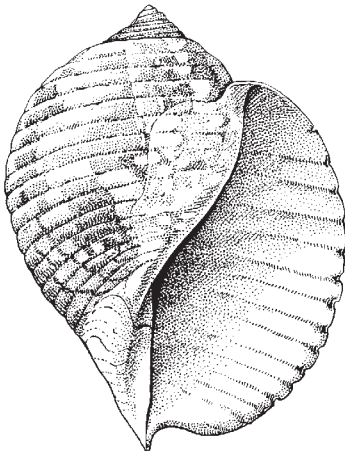


***Tonna canaliculata* (Linnaeus, 1758)**

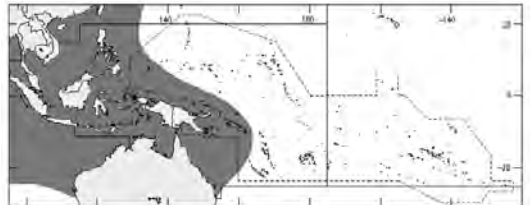
Frequent synonyms / misidentifications: *Tonna cepa* (Röding, 1798) / None.

En - Channeled tun; **Fr** - Tonne canaliculée.

Maximum shell length 14.5 cm, commonly to 11 cm. On fine sandy bottoms. Intertidal and sublittoral, from low tide levels to a depth of about 30 m. No precise data available on fisheries in the area, but the species is currently sold in markets of East Africa. Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to Japan and south to southern Queensland.



ventral view

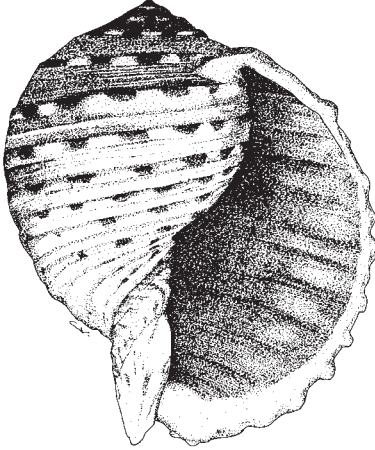


Tonna dolium (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / None.

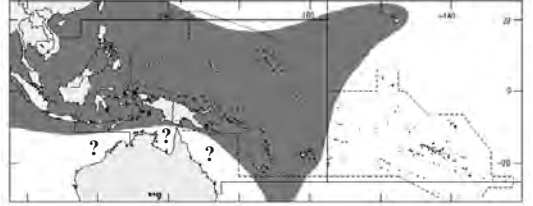
En - Spotted tun; **Fr** - Tonne tachetée.

Maximum shell length 15 cm, commonly to 13 cm. On fine sand and mud bottoms. Sublittoral. Common at depths of about 10 m and more. In Hawaii, found on the outer edge of fringing reefs, at depths more than 30 m. Incidental bycatch in fishing nets. Widespread in the Indo-West Pacific, from East Africa, including the Gulf of Oman, to the islands of the Central Pacific; north to Japan and Hawaii, and south to southern Melanesia and New Zealand; might also occur in northern Australia.



ventral view

(after Springsteen and Leobrera, 1986)

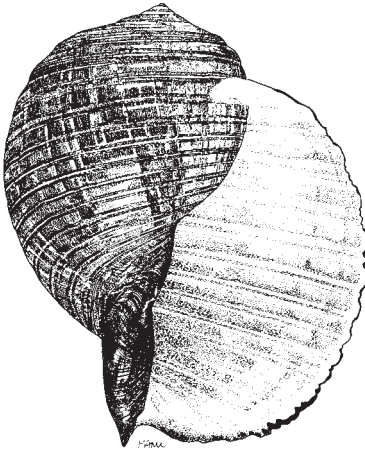


Tonna olearium (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / *Tonna galea* (Linnaeus, 1758).

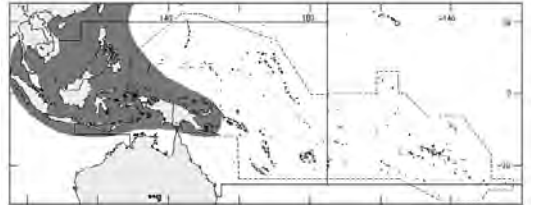
En - Oily tun; **Fr** - Tonne huilée.

Maximum shell length 23 cm, commonly to 18 cm. On sandy to muddy bottoms. Sublittoral and shelf zones, from depths of about 10 to 100 m. Incidental bycatch of shrimp trawlers. Western Pacific and the eastern part of the Indian Ocean, from the Andaman Sea to Papua New Guinea; north to Japan and south to Indonesia.



ventral view

(after Springsteen and Leobrera, 1986)

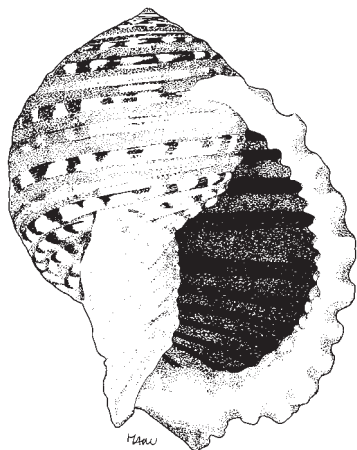


Tonna tessellata (Lamarck, 1816)

Frequent synonyms / misidentifications: None / None.

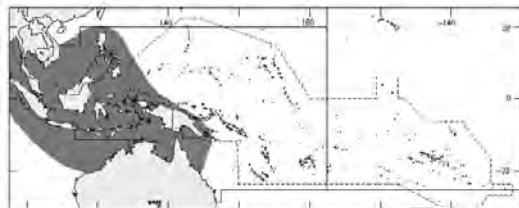
En - Mosaic tun; **Fr** - Tonne mosaïque.

Maximum shell length 10 cm, commonly to 7 cm. On sandy bottoms. Sublittoral, to a depth of about 40 m. Occasionally collected in fishing nets. Central part of the Indian Ocean and the tropical West Pacific, from Sri Lanka to Papua New Guinea; north to the Philippines and south to Queensland.



ventral view

(after Springsteen and Leobrero, 1986)

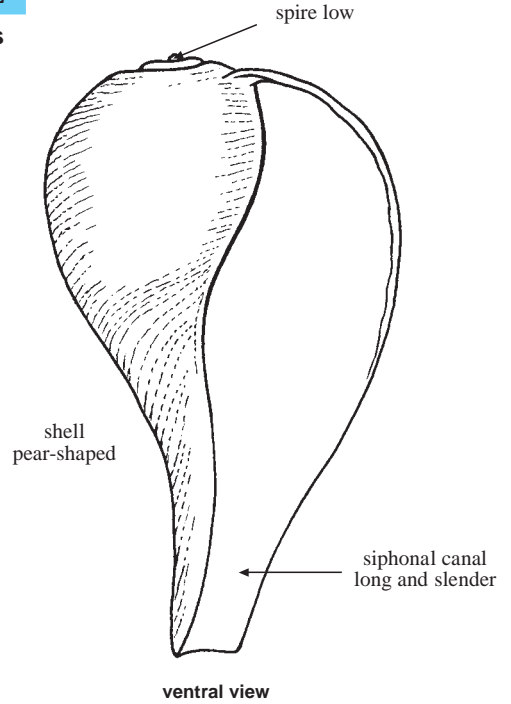


FICIDAE

Fig shells

Diagnostic characters: Shell large and thin, pear-shaped, about the size and shape of a large fig fruit. Spire low, body whorl inflated and very large, drawn out anteriorly into a long, tapered and gracefully curved siphonal canal. Main sculpture of spiral riblets, sometimes crossed by fine axial striations to form a cancellate surface. Aperture broad, with thin and smooth outer lip and sinuous columella. **Operculum absent.** Head small, with long snout and pointed tentacles bearing eyes at their outer bases. Foot large, irregularly rounded posteriorly, somewhat truncate and laterally pointed anteriorly. Fleshy siphon very long and narrow. Mantle lobes partially extending over the shell in living specimens.

Habitat, biology, and fisheries: On sandy bottoms in warm temperate and tropical environments, from low in the intertidal zone to depths over 1 000 m. Active animals, gliding about on the sand with their large foot to search for sea urchins and other echinoderms on which they feed. Bury themselves in the sand at low tide. Sexes separate, fertilization internal. Female often larger than male. Eggs laid in stacked masses, probably hatching as planktonic larvae. Occasionally collected in shrimp trawl nets.

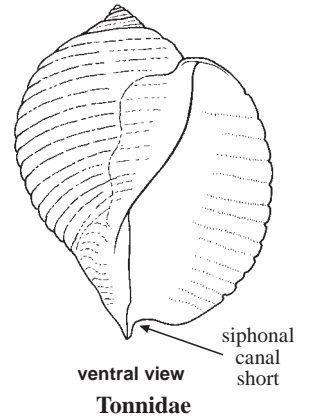


Similar families occurring in the area

Tonnidae: siphonal canal short, an U-shaped notch of the apertural margin; no axial sculpture.

Key to species of interest to fisheries occurring in the area

- 1a. Shell large sized (up to 20 cm in length); spire slightly elevated; outer colour light brown, often with many alternately lighter and darker spiral or axial lines . . . *Ficus gracilis*
- 1b. Shell medium sized (up to 13 cm in length); spire depressed; outer colour variegated, generally with several spiral bands containing light and dark brown spots
 *Ficus subintermedia*



List of species of interest to fisheries occurring in the area

The symbol is given when species accounts are included.

- Ficus gracilis* (Sowerby, 1825)
- Ficus subintermedia* (Orbigny, 1852)

References

Arakawa, K.J. and S. Hayashi. 1972. On sexual dimorphism of fig shell, *Ficus subintermedius* (d'Orbigny). *Venus*, 31(2):63-70.

Beu, A.G. 1981. Australian gastropods of the family Bursidae. Part 1. The families of Tonnacea, the genera of Bursidae, and revision of species previously assigned to *Tutufa* Jousseaume, 1881. *Rec. Aust. Mus.*, 33(4-5):248-324.

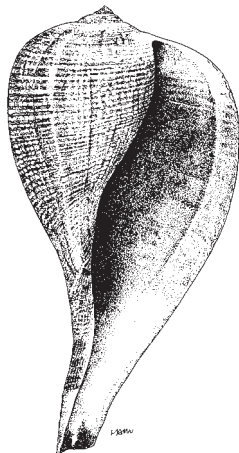
Okutani, T., M. Tagawa, and H. Horikawa. 1988. *Gastropods from continental shelf and slope around Japan. The intensive research of unexploited fishery resources on continental slopes*. Tokyo, Japan Fisheries Resource Conservation Association, 203 p.

Ficus gracilis (Sowerby, 1825)

Frequent synonyms / misidentifications: None / None.

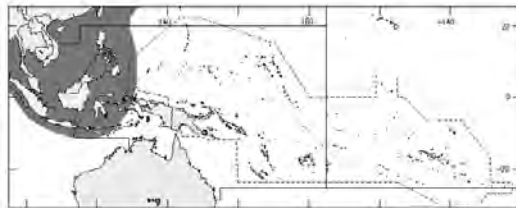
En - Graceful fig shell; **Fr** - Pyrule gracile.

Maximum shell length 20 cm, commonly to 13 cm. On muddy-sand bottoms. Sublittoral and shelf zones, to depths of about 200 m. Occasional bycatch of shrimp trawlers. Central Indo-West Pacific, from the Andaman Sea to eastern Indonesia; north to Japan and south to Indonesia.



ventral view

(after Springsteen and Leobrero, 1986)

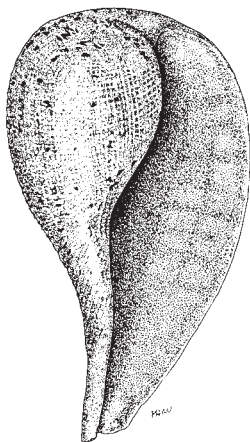


Ficus subintermedia (Orbigny, 1852)

Frequent synonyms / misidentifications: *Ficus ficoides* (Lamarck, 1822) (Not of Brocchi, 1814) / *Ficus ficus* (Linnaeus, 1758).

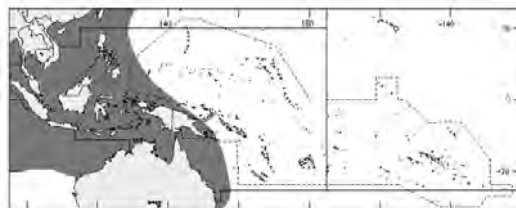
En - Underlined fig shell; **Fr** - Pyrule ficoïde.

Maximum shell length 13 cm, commonly to 10 cm. On sandy bottom. Low tide fringe and sublittoral zone to a depth of about 40 m. Common in shallow water. Occasional bycatch. Widespread in the Indo-West Pacific, from East and South Africa, including the Red Sea and the Persian Gulf, to Melanesia; north to Japan, and south to New South Wales.



ventral view

(after Short and Potter, 1987)



CASSIDAE

Helmet and bonnet shells

Diagnostic characters: Shell medium sized to very large, often thick and solid, elongate-ovate to cylindrical or globose in shape, with a large body whorl and rather small, conical spire. Sculpture variable, ranging from nearly smooth to ridged or nodular, with both axial and spiral elements; axial varices sometimes present. Periostracum very weak to absent. Aperture elongate, with a short siphonal canal recurved dorsally. Outer lip thickened, often denticulate inside. Inner lip with a well-developed, usually shield-like callous which may be confined to the columellar area or forms a flange along left side of body whorl. Operculum quite small and thin, corneous, narrowly oval with nucleus near the anterior end, or fan-shaped with nucleus halfway down the inner margin. Head large, with a narrow and short extensible snout and filiform tentacles with the eyes at their outer bases. Foot large, more or less rounded anteriorly and posteriorly, with a thick epidermis.

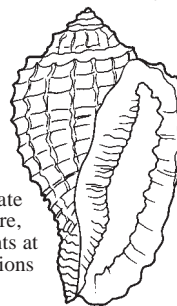
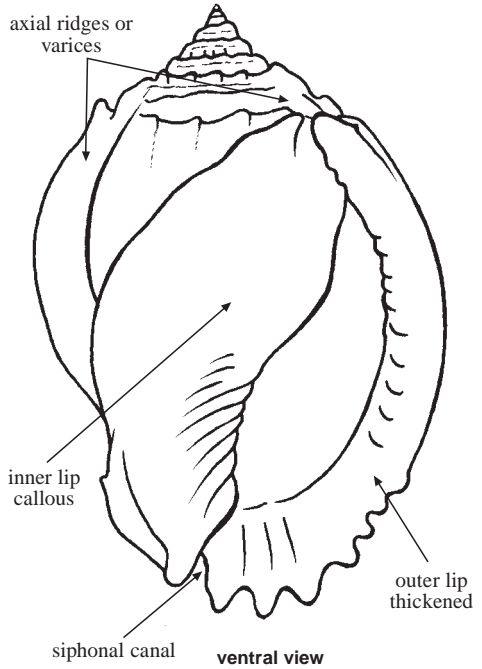
Habitat, biology, and fisheries: Sand dwelling, slow moving carnivorous animals, ranging from intertidal levels to considerable depths. Feed almost exclusively on echinoderms, sea urchins or starfish, mainly at night and often while both predator and prey are buried in the sand. Cassids first squirt neurotoxic saliva over their prey to paralyse the spines, protected by the thick skin of their foot. Then, the snout of predator is pushed through the unprotected anus, or through a hole rasped by radula in the test of the victim which may also be crushed under the weight of its predator. Sexes separate, fertilization internal; shell of the female frequently larger than that of the male. Eggs laid in large masses of numerous, small horny capsules, forming irregular or cylindrical, tower-like structures. Each capsule contains several hundred eggs, most of which often serve as food for the developing embryos. Hatching gives planktonic larvae, or crawling juveniles, depending upon the species. Cassids are commonly collected for food and their large decorative shells are popular in the shell trade. Some of the larger species are used as raw material for lime or for cameo-carving.

Similar families occurring in the area:

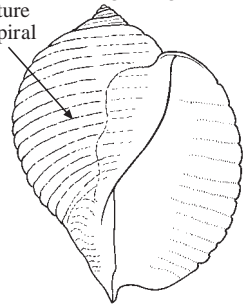
Harpidae: shell features of the genus Morum very similar to those of the Cassidae, but anterior siphonal canal not strongly upturned dorsally, axial varices absent, and axial and spiral ribs forming sharp, up-turned points at intersections.

Key to species of interest to fisheries occurring in the area

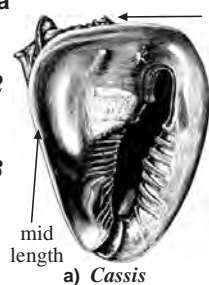
- 1a. Aperture heavily calloused, produced over the spire; maximum width markedly posterior to midlength of shell (Fig. 1a) → 2
1b. Aperture moderately calloused, not produced over the spire; maximum width at about midlength of shell (Fig. 1b) → 3



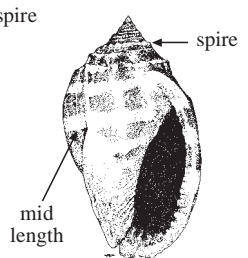
ventral view Harpidae (genus Morum)



ventral view Tonnidae



a) Cassis



b) Phalium

Fig. 1 ventral view

- 2a. Axial varices prominent, at approximate right angles to each other; body whorl pitted, with 3 or 4 spiral rows of large tubercles, those at shoulder being much longer and stouter than the others (Fig. 2) *Cassis cornuta*
- 2b. Axial varices lacking; body whorl not pitted, with 3 or 4 spiral rows of low knobs, those at shoulder being not longer and stouter than the others (Fig. 3) *Cypraecassis rufa*

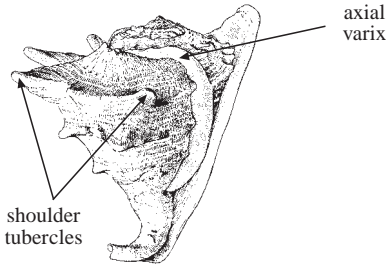


Fig. 2 *Cassis cornuta* (lateral view)

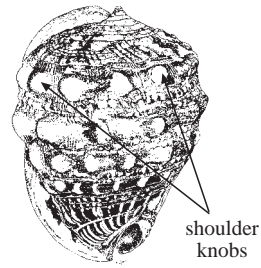
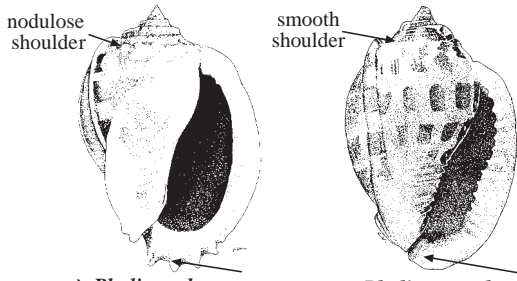


Fig. 3 *Cypraecassis rufa* (dorsal view)

- 3a. Shoulder nodulose; outer lip with a few more or less developed spines on the external edge of its anterior end (Fig. 4a) → 4
- 3b. Shoulder smooth and rounded; outer lip without spines on the external edge of its anterior end (Fig. 4b). *Phalium areola*
- 4a. Shell shape rather globose, with a relatively short spire; surface of body whorl with obscure axial and spiral ribbing; spines of outer lip usually sharp and projecting, 3 or 4 in number (Fig. 5) *Phalium glaucum*
- 4b. Shell shape rather elongate, with a relatively tall spire; surface of body whorl smooth, or with spiral grooves towards the base; spines of outer lip usually poorly developed, 2 or 3 in number (Fig. 6) *Phalium bandatum*



a) *Phalium glaucum* b) *Phalium areola*
Fig. 4 ventral view

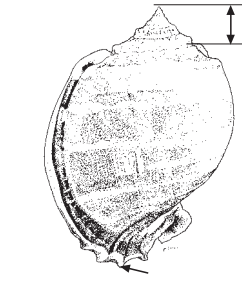


Fig. 5 *Phalium glaucum* (dorsal view)

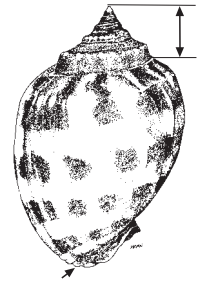







Fig. 6 *Phalium bandatum* (dorsal view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Cassis cornuta* (Linnaeus, 1758)
-  *Cypraecassis rufa* (Linnaeus, 1758)
-  *Phalium areola* (Linnaeus, 1758)
-  *Phalium bandatum* (Perry, 1811)
-  *Phalium glaucum* (Linnaeus, 1758)

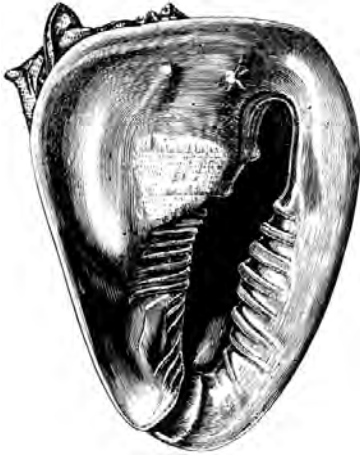
Reference

Abbott, R.T. 1968. The helmet shells of the world (Cassidae). Part 1. *Indo-Pac. Moll.*, 2(9):1-201.

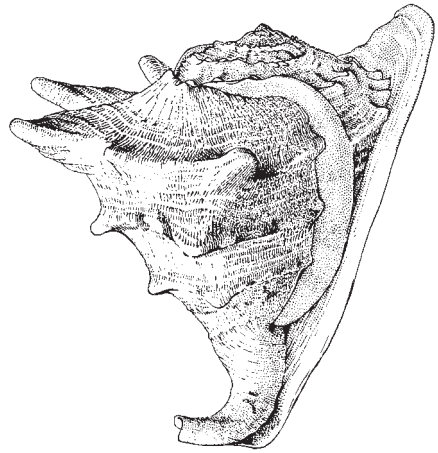
Cassis cornuta (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / None.

FAO names: En - Horned helmet; Fr - Casque cornu.



ventral view



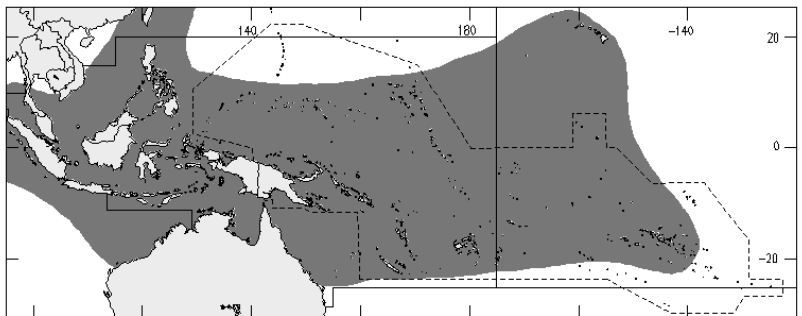
lateral view

Diagnostic characters: Shell massive, globose with a wide and flat apertural side, attaining a very large size. Outer surface of whorls finely pitted, from numerous intersecting axial and spiral threads. Spire low, coronate, with prominent axial varices at approximate right angle to each other. Body whorl with 3 or 4 spiral rows of large tubercles, those at shoulder being much longer and stouter than the others. Aperture long and narrow, heavily calloused. Outer lip thickened in a broad and flat shelf, with a dorsally recurved outer edge and with 5 to 7 strong teeth on its inner edge. Inner lip with an extensive calloused shield, forming a flange along left side of body whorl, and produced over the spire to join the outer lip at its posterior end. Columella with irregular spiral ridges. Operculum elongate-ovate, about 1/4 the length of aperture. **Colour:** dorsal side and spire greyish white, often somewhat spotted with light brown. Calloused ventral side glossy cream or orange, with 2 spiral rows of brown spots in the central region. Teeth and ridges of the aperture white. Outer lip with 6 or 7 broad patches of brown on its dorsal side and outer edge.

Size: Maximum shell length 35 cm, commonly to 22 cm.

Habitat, biology, and fisheries: Living in colonies in coral reef areas, on sand and coral rubble bottoms. Sublittoral, from depths of 2 to about 30 m. During periods of activity, lift their shell straight up to move forward, then drop it down. Often partially buried below the surface of sand when inactive or during feeding. Preys on the crown-of-thorns *Acanthaster planci*, a big starfish feeding on corals, recently responsible for devastation of many coral reefs. For that reason, *Cassis cornuta* is now totally protected in Queensland. Frequently collected in the area for food and for the shell which is traditionally used as decorative item in many parts of the world, or as container for liquids by the natives of the South Seas.

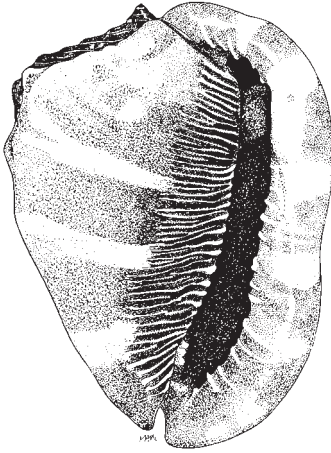
Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea to eastern Polynesia; north to Japan and Hawaii, and south to southern Queensland and New Caledonia.



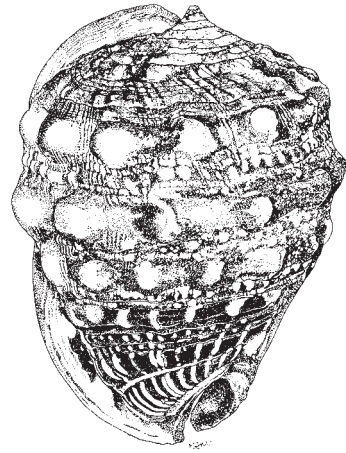
Cypraecassis rufa (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / None.

FAO names: En - Bullmouth helmet; Fr - Casque rouge.



ventral view



dorsal view

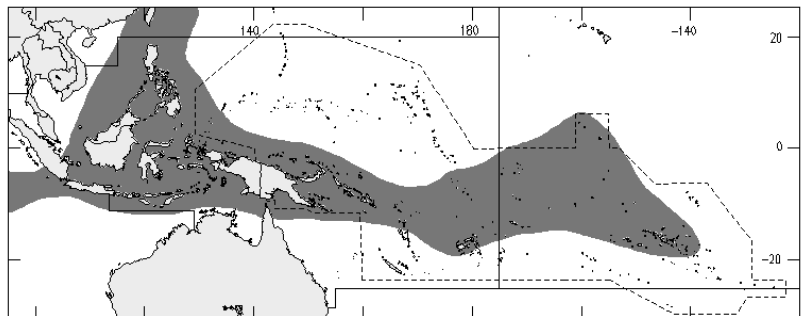
(after Wilson and Gillett, 1971)

Diagnostic characters: Shell thick and heavy, ovate with a strongly callous apertural side. Spire short, with channeled sutures and fine nodulose spiral ribs, but lacking axial varices. Body whorl with rounded shoulder, 3 or 4 spiral rows of rounded knobs posteriorly, 2 spiral rows of axial ridges anteriorly, and with 2 or 3 nodulose axial riblets between them. Knobs at shoulder not longer and stouter than the others. Aperture long and narrow, with an oblique furrow at posterior end. Outer lip very thick, produced over the spire, with strong teeth along the inner edge. Inner lip strongly lirate, with an extensive, thick and convex callous shield. Columellar margin with an axial swelling bearing strong teeth. Operculum rounded-ovate, small, about 1/10 the length of aperture. **Colour:** dorsal side and spire orange-brown or reddish, mottled and blotched with dark and light brown and grey. Callous ventral side glossy, creamy orange, becoming deep red around and inside the aperture, and stained with dark brown between the ridges of the inner lip. Teeth and ridges of the aperture whitish.

Size: Maximum shell length 18 cm, commonly to 15 cm.

Habitat, biology, and fisheries: Most common in fairly sheltered areas, on bottoms of coarse coral sand and algae near coral reef areas. Intertidal and shallow subtidal waters to a depth of about 12 m. Preys on short-spined sea urchins. Species abundant only at the extreme western and eastern parts of its wide range, becoming rarer in its central part, corresponding with the Southeast Asian region. Shell well known as the main raw material from which cameos are cut.

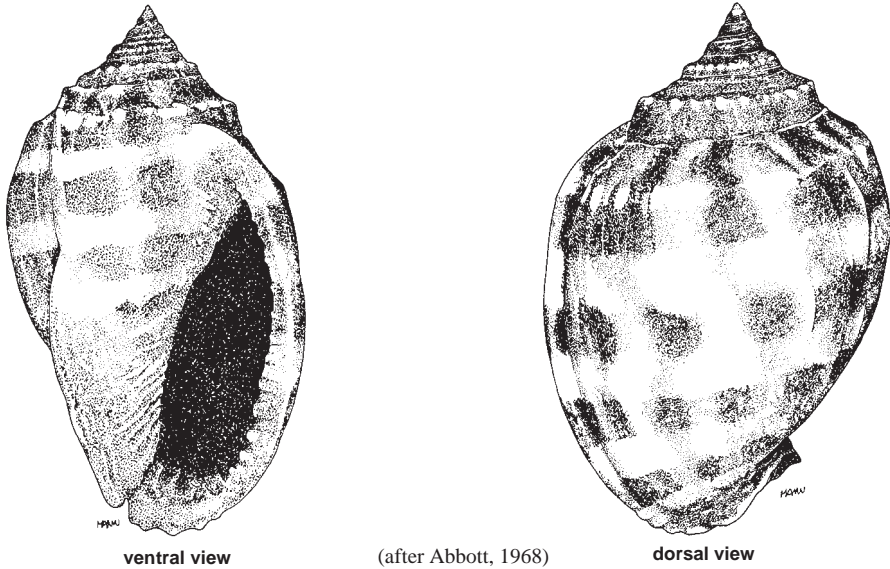
Distribution: Widespread in the Indo-West Pacific, though rare to absent in areas of the northern Indian Ocean and of southeastern Asia. Ranging from East Africa, including Madagascar, Sri Lanka and the tropical islands of Indian Ocean, through Indonesia and Melanesia, to eastern Polynesia; north to Taiwan Province of China and southern Japan, and south to northern Queensland and the Fiji Islands.



Phalium bandatum (Perry, 1811)

Frequent synonyms / misidentifications: *Cassidea coronulata* (Sowerby, 1825); *Phalium exaratum* (Reeve, 1848) / None.

FAO names: En - Banded bonnet; Fr - Casque rubanné.



ventral view

(after Abbott, 1968)

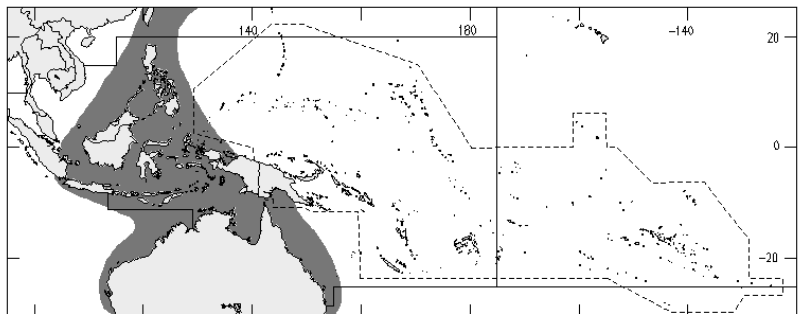
dorsal view

Diagnostic characters: Shell solid, elongate-ovate, with a relatively tall, pointed spire and a large, inflated body whorl. Spire whorls with a nodular sculpture, bearing 1, 2 or no axial varices. Surface of **body whorl smooth** or with spiral grooves towards the base, and **with a row of nodules on the** slightly angulate shoulder. Aperture elongated, rather wide, narrowing posteriorly. **Outer lip** recurved, toothed along the inner edge, **with 2 or 3 poorly developed spines on the external edge of its anterior end. Inner lip with a moderately developed** and thin **callous shield**, forming **anteriorly an expanded blade over the umbilicus** and the upturned siphonal canal. Columellar edge with a series of irregular spiral wrinkles. Operculum fan-shaped, about half the length of the aperture. **Colour: outside of shell pale grey to cream**, with axial flames of tan below the suture, and **with 5 broad, more or less interrupted, spiral bands of tan** in front of the shoulder of body whorl. Outer surface of **siphonal canal stained with purplish brown**. Ventral surface of outer lip with 6 tan or orange blotches. Columellar callus whitish to translucent often with a light orange-brown hue anteriorly. Interior whitish to light brown, with the external colour pattern frequently showing through.

Size: Maximum shell length 12 cm, commonly to 9 cm.

Habitat, biology, and fisheries: Common on sand to muddy-sand bottoms. Sublittoral and shelf zones, to a depth of about 75 m. Sometimes captured in great quantities in deep-water prawn nets.

Distribution: The tropical West Pacific, from Japan and the Philippines, south through Indonesia to the northern half of Australia. In western Indian Ocean occurs the subspecies *exaratum* (Reeve), which is restricted to the Mascareign islands.

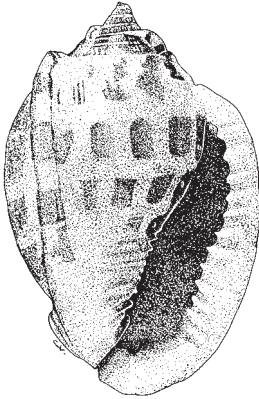


Phalium areola (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Bezoardicella areola* (Linnaeus, 1758); *Cassidea areola* Bruguière, 1792; *Phalium agnitum* Iredale, 1927 / None.

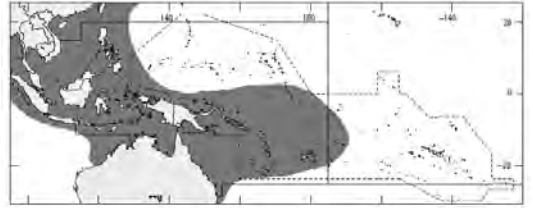
En - Checkerboard bonnet; **Fr** - Casque à damier.

Maximum shell length 12 cm, commonly to 9 cm. In sandy-mud bottoms. Intertidal and shallow subtidal waters to a depth of about 7 m. Collected for food and for the shell trade. Indian Ocean and the tropical West Pacific, from East and South Africa, including Mauritius and Réunion Islands, the Seychelles, Sri Lanka, and India, but not in the central islands nor in the northwestern part of the Indian Ocean, to Melanesia and Samoa Islands; north to Japan and south to New South Wales and New Caledonia.



ventral view

(after Short and Potter, 1987)

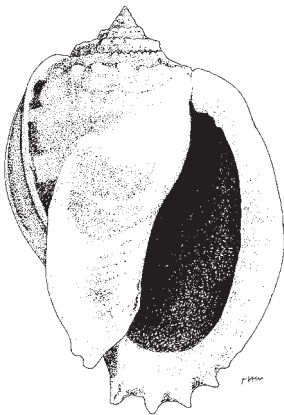


Phalium glaucum (Linnaeus, 1758)

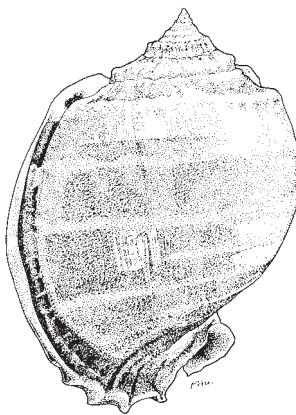
Frequent synonyms / misidentifications: *Bezoardica vulgaris* Schumacher, 1817 / None.

En - Grey bonnet; **Fr** - Casque gris.

Maximum shell length 12 cm, commonly to 9 cm. Common on sandy bottoms, especially on exposed sand flats and close to dead coral areas. Intertidal and shallow subtidal zones to a depth of about 10 m. Feed on sea urchins of the "sand dollar" group. Egg capsules forming an irregular mass which is the result of several females spawning together. Collected for food and for shell trade. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, to Melanesia; north to Japan and south to northern Queensland.

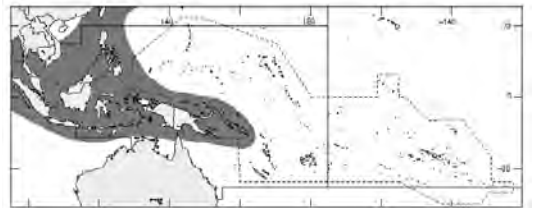


ventral view



dorsal view

(after Dance, 1974)



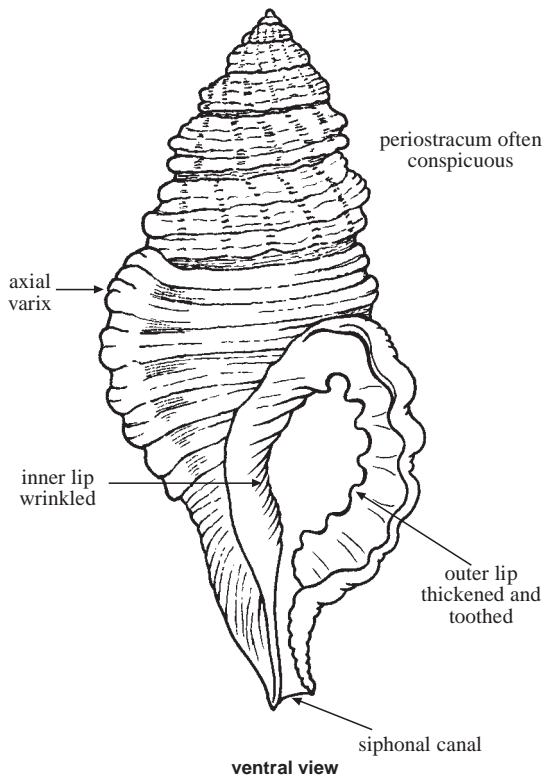
RANELLIDAE

(= Cymatiidae)

Triton shells

Dagnostic characters: Shell ovate to fusiform, thick and solid, with a raised spire and strong sculpture composed of nodules, spiral ribs and axial varices. Periostracum frequently well developed and fibrous to hairy. Aperture with a short to long siphonal canal anteriorly. Outer lip prominently thickened, often denticulate inside. Inner lip commonly wrinkled and with a columellar callus. Operculum thick and corneous, rounded to trigonal. Head with a moderately stout, extensible snout and filiform tentacles bearing eyes on protuberances of their outer bases. Foot rather short, somewhat truncated posteriorly.

Habitat, biology, and fisheries: Active predators, living on sandy or rocky bottoms from the intertidal zone to depths of a few hundred meters. Ranellidae have a variety of diets including molluscs (bivalves and gastropods), echinoderms (starfishes and sea urchins) or even ascidians, depending upon the species. Prey is often first paralysed with an acidic salivary secretion, then devoured. Sexes separate, fertilization internal. Eggs laid on the substrate in large capsules clustered in masses. Planktonic larval stage sometimes very long, hence the very wide geographical distribution of some species. Since ancient times, certain species of Ranellidae have been fished, in the area as well as in other parts of the world, for their beautiful shell or their edible flesh, the large shells of genus *Charonia* being traditionally used as a kind of horn.

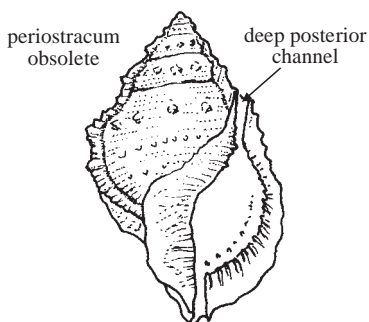


Similar families occurring in the area

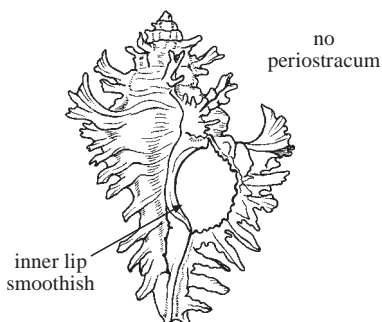
Bursidae: periostracum obsolete to absent; aperture with a deep posterior canal.

Muricidae: axial varices, when developed, 3 or more in number on each whorl (only 2 per whorl in Ranellidae); no periostracum.

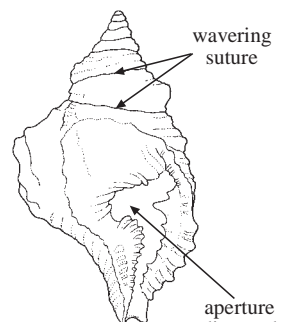
Personidae: spire whorls irregular, with a wavering suture; aperture distorted; inner lip strongly sinuous, with an extensive, shield-like callus.



ventral view
Bursidae



ventral view
Muricidae



ventral view
Personidae

Key to species of interest to fisheries occurring in the area

- 1a. Shell very large, attaining 45 cm in length; periostracum indistinct (Fig. 1). *Charonia tritonis tritonis*
- 1b. Shell relatively small, not exceeding 18 cm in length; periostracum conspicuous → 2
- 2a. Inner lip with 2 large blackish brown blotches on its posterior half (Fig. 2) *Cymatium lotorium*
- 2b. Inner lip without large blackish brown blotches on its posterior half. → 3
- 3a. Inner lip extensively calloused and nearly smooth (Fig. 3). *Cymatium muricinum*
- 3b. Inner lip narrowly calloused and ridged → 4



Fig. 1 *Charonia tritonis tritonis* (ventral view)



Fig. 2 *Cymatium lotorium* (ventral view)

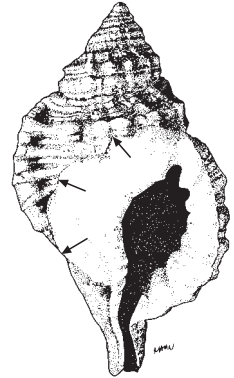


Fig. 3 *Cymatium muricinum* (ventral view)

- 4a. Siphonal canal rather long (Fig. 4); nucleus of operculum on mid-inner margin. *Cymatium pyrum*
- 4b. Siphonal canal rather short (Fig. 5); nucleus of operculum near anterior end → 5
- 5a. Shell small (up to 6 cm in length); interspaces of inner-lip folds tinged with black (Fig. 5) *Cymatium intermedium*
- 5b. Shell medium sized (up to 9 cm in length, or more); interspaces of inner-lip folds not tinged with black → 6
- 6a. Inner side of the outer lip with 7 pairs of ridges → 7
- 6b. Inner side of the outer lip with 7 single ridges (Fig. 6) *Cymatium nicobaricum*

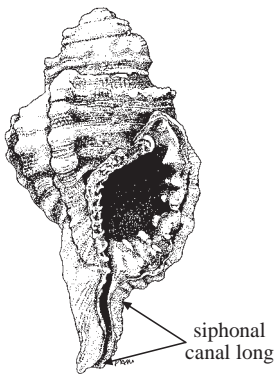


Fig. 4 *Cymatium pyrum* (ventral view)

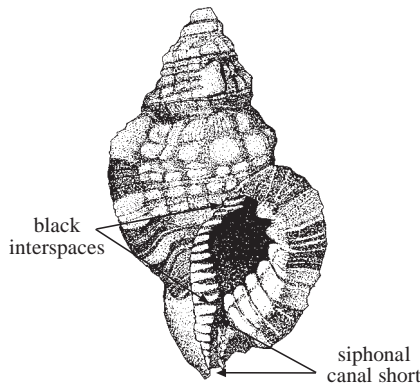


Fig. 5 *Cymatium intermedium* (ventral view)

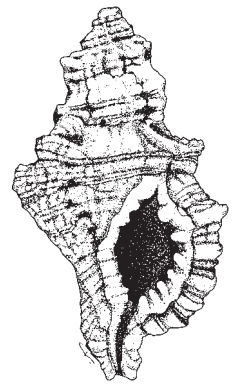


Fig. 6 *Cymatium nicobaricum* (ventral view)

- 7a. Outer sculpture relatively fine; inner ridges of the outer lip long, extending deep into the aperture (Fig. 7) *Cymatium pileare*
- 7b. Outer sculpture relatively rough; inner ridges of the outer lip short, not extending deep into the aperture (Fig. 8) *Cymatium aquatile*

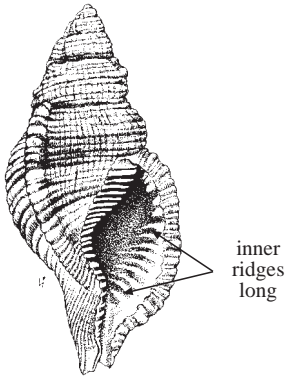


Fig. 7 *Cymatium pileare* (ventral view)

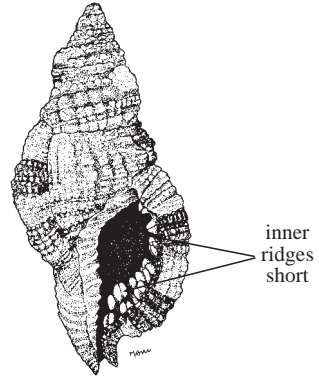










Fig. 8 *Cymatium aquatile* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Charonia tritonis tritonis* (Linnaeus, 1758)
-  *Cymatium aquatile* (Reeve, 1844)
-  *Cymatium intermedium* (Pease, 1869)
-  *Cymatium lotorium* (Linnaeus, 1758)
-  *Cymatium muricinum* (Röding, 1798)
-  *Cymatium nicobaricum* (Röding, 1798)
-  *Cymatium pileare* (Linnaeus, 1758)
-  *Cymatium pyrum* (Linnaeus, 1758)

References

- Beu, A.G. 1970. The mollusca of the genus *Charonia* (Family Cymatiidae). *Trans. R. Soc. N.Z. (Biol. Sci.)*, 11(16):205-223.
- Beu, A.G. 1981. Australian gastropods of the family Bursidae. Part 1. The families of Tonnacea, the genera of Bursidae, and revision of species previously assigned to *Tutufa* Jousseaume, 1881. *Rec. Aust. Mus.*, 33(4-5):248-324.
- Beu, A.G. 1985. A classification and catalogue of living world Ranellidae (= Cymatiidae) and Bursidae. *Conchol. Amer. Bull.*, 13(4):55-66.
- Beu, A.G. 1987. Taxonomy of gastropods of the families Ranellidae (= Cymatiidae) and Bursidae. Part 2. Descriptions of 14 new modern Indo-West Pacific species and subspecies, with revisions of related taxa. *N.Z. J. Zool.*, 13(2):273-355.
- Beu, A.G. and E.A. Kay. 1988. Taxonomy of gastropods of the families Ranellidae (= Cymatiidae) and Bursidae. Part IV. The *Cymatium pileare* complex. *J. r. Soc. N.Z.*, 18(2):185-223.
- Cernohorsky, W.O. 1967. The Bursidae, Cymatiidae and Colubrariidae of Fiji (Mollusca: Gastropoda). *Veliger*, 9(3):310-329.
- Henning, T. and J. Hemmen. 1993. *Ranellidae and Personidae of the world*. Hemmen, Wiesbaden, 263 p.
- Kilius, R. 1979. Gastropoda / Prosobranchia. Cymatiidae. In *Das Tierreich. Eine Zusammenstellung und Kennzeichnung der rezenten Tierformen. Lieferung 92*, edited by R. Mertens and W. Henning. Berlin and New York, De Gruyter, 237 p.

Charonia tritonis tritonis (Linnaeus, 1758)

Frequent synonyms / misidentifications: None / None.

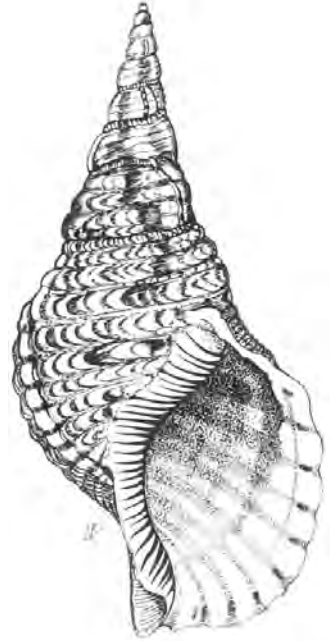
FAO names: En - Trumpet triton; Fr - Triton conque.

Diagnostic characters: Shell reaching a **very large** size (up to 45 cm in length), elongate **with a tall spire, strongly inflated body whorl and short anterior siphonal canal. Whorls rounded, with** slightly undulating suture and wide, smooth and **rounded axial varices** spaced about **every 270°** around the shell. Sculpture of broad flat **spiral ridges** with a single narrow cord in each interspace, and a **spiral row of rounded granules under the suture. Periostracum un-**conspicuous. Aperture large, elongate-ovate. **Outer lip** markedly **flaring**, interiorly **with paired teeth** that are weak to absent over central portion. **Inner lip** rather broad, slightly detached anteriorly, **bearing many prominent transverse folds with narrower interspaces** over its whole length. Operculum thick, oval, with a central nucleus and completely concentric growth lines. **Colour: outside of shell extremely glossy, with crescent-shaped markings of purple brown on a cream to fawn background.** Aperture cream, flushed with orange or pink interiorly. **Inner lip with white transverse folds and dark brown interstices.**

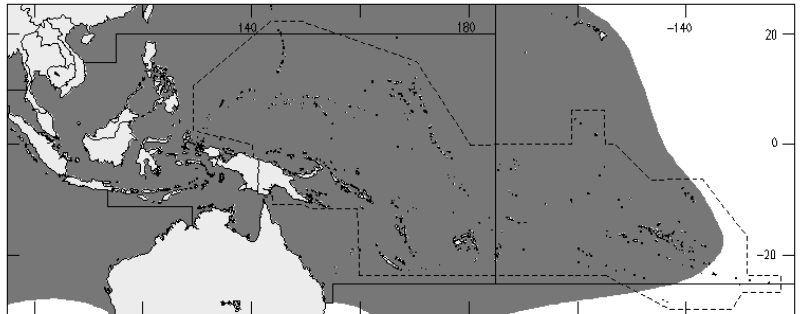
Size: Maximum shell length 45 cm, commonly to 30 cm.

Habitat, biology, and fisheries: In coral reef areas. Low intertidal and shallow sublittoral zones, to a depth of about 30 m. Preys on the large coral-eating starfish "Crown-of-thorns" (*Acanthaster planci*). Actively collected in many areas since ancient times, both for its edible flesh and large, highly decorative shell. Frequently overcollected. Collections and sale of this species now banned in some countries with coral reefs, as an attempt to fight against the recent expansion of the "Crown-of-thorn" starfish, which has devastated many coral reefs.

Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan, Midway and Hawaii, and south to southern Queensland, Lord Howe Island and northern New Zealand. A distinct subspecies, *Charonia tritonis variegata* (Lamarck, 1816), is distributed on both sides of the central Atlantic and in the Mediterranean Sea.



ventral view
(after Clench and Turner, 1957)



Cymatium muricinum (Röding, 1798)

Frequent synonyms / misidentifications: *Cymatium tuberosum* (Lamarck, 1822); *Guttarium muricinum* (Röding, 1798) / None.

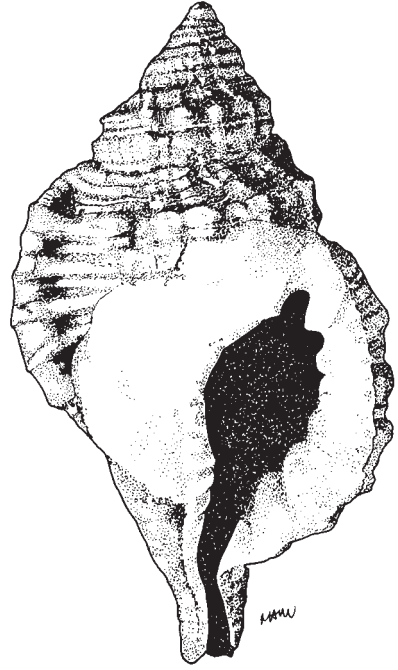
FAO names: En - Shortneck triton; Fr - Triton bosselé.

Diagnostic characters: Shell moderately small (up to 7.5 cm in length), solid and stout, conical-ovate in shape with a moderately high, stepped spire, inflated body whorl and relatively long siphonal canal. Outer sculpture strong, with thick axial varices every 225° of spire and with heavy, nodulose axial ridges (5 or 6 in number between 2 consecutive varices) crossed by irregularly granulate spiral ribs and grooves. Body whorl with about 6 larger spiral ribs, thickening on axial varices and ridges that become almost spiny at shoulder. Periostracum thick and prominently bristled. Aperture ovate, calloused at periphery. Outer lip thickened and marginally dentate, with 6 or 7 folds, often more or less divided in 2 series by a shallow axial groove. Inner lip almost smooth centrally and extensively calloused over ventral side of body whorl. Anterior siphonal canal rather slender, bent dorsalward, its ventral side narrowly open. **Colour:** outside of shell blue-grey to creamy-grey, flecked or blotched with brown, sometimes dark brown with a spiral band of white under the shoulder. Aperture glossy white on outer lip and calloused columellar area, red or purple-brown deep inside.

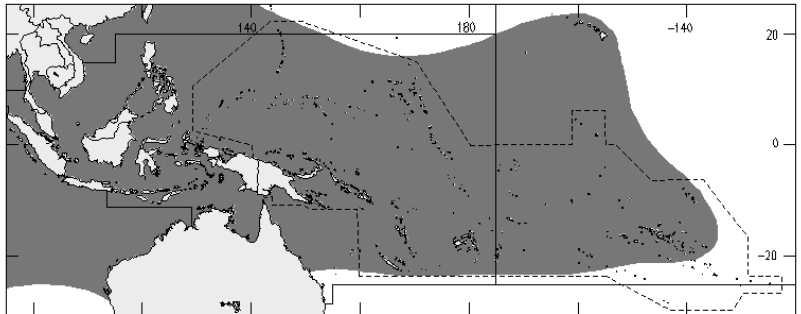
Size: Maximum shell length 7.5 cm, commonly to 5 cm.

Habitat, biology, and fisheries: On reef flats and in sandy to coarse detritic coral bottoms. Littoral and sublittoral zones, very common in shallow waters. Collected by hand or trawled. Appears in the local markets of the northern Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and Hawaii, and south to Queensland. Also in the western and eastern tropical Atlantic.



ventral view
(after Beu, 1987)



***Cymatium nicobaricum* (Röding, 1798)**

Frequent synonyms / misidentifications: *Cymatium chlorostomum* (Lamarck, 1822); *Lampusia nicobaricum* (Röding, 1798) / None.

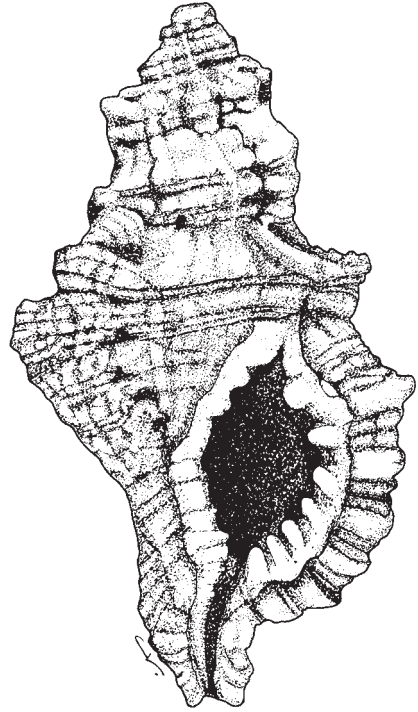
FAO names: En - Nicobar hairy triton; Fr - Triton bouche-d'or.

Diagnostic characters: **Shell medium sized** (up to 9 cm in length), solid, roughly fusiform in shape **with an elevated spire, inflated body whorl and well developed but rather short siphonal canal**. Spire whorls with angulate shoulders and moderately impressed sutures. Outer **sculpture strong, with thick axial varices every 240° of spire and with heavy, nodulose axial ridges** (4 to 7 in number between 2 consecutive varices) **crossed by spiral ribs and cords** which are separated by narrow, deeply incised grooves. Body whorl with about 6 larger spiral ribs, thickening where they ascend the varices and with 2 fine but raised cords in the interspaces. **Periostracum thick and prominently bristled**. Aperture ovate, narrowed at posterior end. **Outer lip thickened and strongly dentate, with 7 single ridges on its inner side. Inner lip with a fold** beside posterior end of aperture, followed by **a series of rather straight transverse lirae** on its whole surface. Anterior siphonal canal moderately bent dorsalward, its ventral side narrowly open. Operculum ovate, with nucleus close to the anterior end. **Colour: outside of shell ashy grey, blotched or flecked with brown. Aperture orange to yellow, lips with white rim, ridges and lirae.**

Size: Maximum shell length 9 cm, commonly to 6.5 cm.

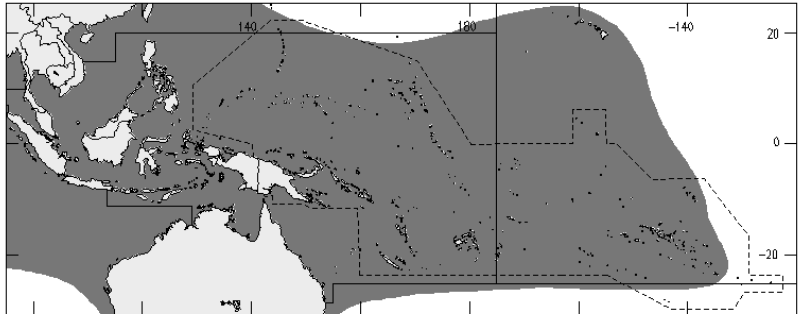
Habitat, biology, and fisheries: On sand and rock bottoms, usually associated with coral reefs. Intertidal, sublittoral and shelf zones, to a depth of about 100 m. Most common between tide marks and in shallow subtidal waters. Locally collected by hand, where common, by native people of the Pacific islands. Appears also in local markets of the northern Philippines, often mixed with small species of Strombidae.

Distribution: Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and Hawaii, and south to New South Wales.



ventral view

(after Habe, 1964)

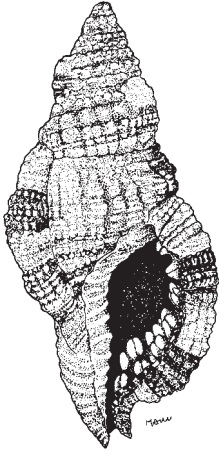


Cymatium aquatile (Reeve, 1844)

Frequent synonyms / misidentifications: *Lampusia aquatile* (Reeve, 1844); *Septa aquatile* (Reeve, 1844) / *Cymatium martinianum* (Orbigny, 1846); *C. pileare* (Linnaeus, 1758).

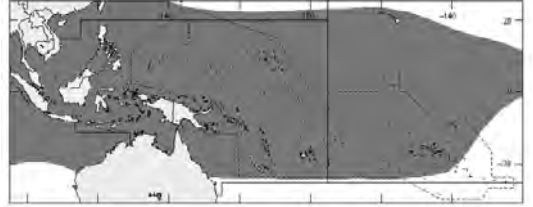
En - Aquatile hairy triton; **Fr** - Triton aquatile.

Maximum shell length 11 cm, commonly to 8 cm. In coral reef areas. Common under coral slabs. Low tide marks and shallow sublittoral waters to a depth of about 15 m. Locally collected for food and for the shell. Circumtropical (Indo-West Pacific, East Central Pacific, West and East Central Atlantic). Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to southern Japan and Hawaii, and south to Queensland and New Caledonia.



ventral view

(after Beu and Kay, 1988)

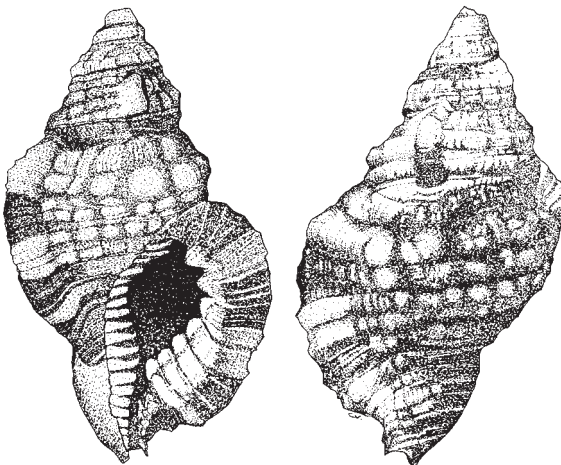


Cymatium intermedium (Pease, 1869)

Frequent synonyms / misidentifications: *Lampusia intermedia* (Pease, 1869); *L. kikaiensis* Shikama, 1970; *Septa intermedia* (Pease, 1869) / *Cymatium aquatile* (Reeve, 1844); *C. pileare* (Linnaeus, 1758).

En - Intermediate hairy triton; **Fr** - Triton intermédiaire.

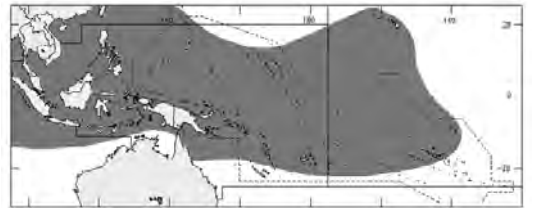
Maximum shell length 6 cm, commonly to 4 cm. In coral reef areas. Sublittoral, mostly in shallow water. Locally collected for food and shell trade, where abundant. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to southern Japan and south to northern Queensland.



ventral view

dorsal view

(after Beu and Kay, 1988)



Cymatium lotorium (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Lotoria lotorium* (Linnaeus, 1758) / None.

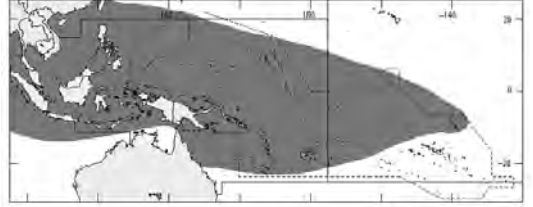
En - Black-spotted triton; **Fr** - Triton tacheté.

Maximum shell length 17 cm, commonly to 13 cm. In coral reef areas. Generally hidden under stones and coral slabs during the day. Lower littoral zone and shallow sublittoral waters. Locally collected by coastal populations. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Taiwan Province of China and south to Queensland.



ventral view

(after Short and Potter, 1987)

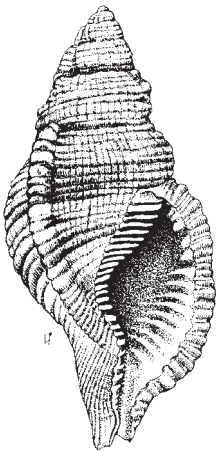


Cymatium pileare (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Lampusia pileare* (Linnaeus, 1758); *Septa pilearis* (Linnaeus, 1758) / None.

En - Common hairy triton; **Fr** - Triton poilu.

Maximum shell length 13 cm, commonly to 9 cm. On hard and coarse detritic bottoms, in coral reef areas. Intertidal and sublittoral zones to a depth of about 50 m. In the area, most common in shallow waters. Locally collected and marketed for food and for the shell. Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to southern Japan and Hawaii, and south to southern Queensland.



ventral view

(after Clench and Turner, 1957)

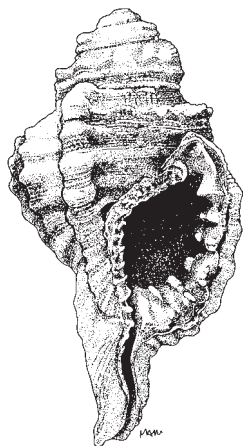


Cymatium pyrum (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Ranularia pyrum* (Linnaeus, 1758) / None.

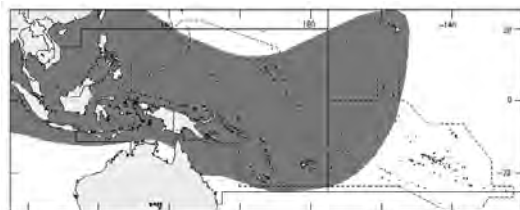
En - Pear triton; **Fr** - Triton poire.

Maximum shell length 11.5 cm, commonly to 10 cm. On rocks and coral reef flats. Low tide and sublittoral waters to a depth of about 25 m. Locally collected for food and shell trade. Indo-West Pacific, from East Africa to Polynesia; north to Japan and Hawaii, and south to Queensland.



ventral view

(after Short and Potter, 1987)

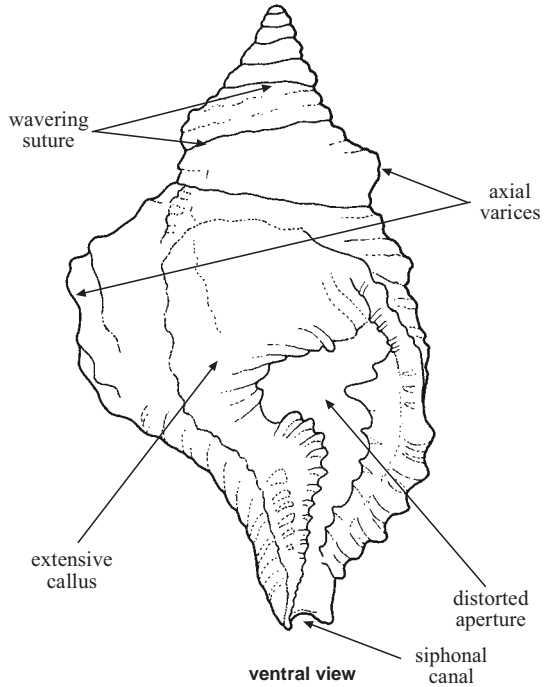


PERSONIDAE

Distorsios

Diagnostic characters: Shell fusiform, inflated, moderately long and roughly sculptured. Spire whorls irregular, **bumped, with a wavering suture**. Sculpture with nodulous axial and spiral ribs, **and with low axial varices** every 270°. Peripheral ribs often forming a wide shoulder keel. **Periostracum** conspicuous, **fibrous to hairy**. **Aperture distorted, narrowed by strong tuberculous teeth** arising from the outer and inner lips. **Inner lip** strongly sinuous, deeply excavated in the middle, **with an extensive shield-shaped callus**. Outer lip often flared. **Siphonal canal** short to quite long, dorsally **recurved** anteriorly. **Operculum corneous**, irregularly ovate, its nucleus near the anterior end. Snout very long and slender, coiled when retracted. Foot rather short, subdued backwards.

Habitat, biology, and fisheries: The natural history of distorsios is poorly known. Animals probably carnivorous, mainly subtidal, often associated with coral reef areas. Sexes separate. Eggs hatching as free-swimming larvae. Collected in subsistence harvest by fishermen in some areas. Shells are used in the local shellcraft industries of Southeast Asian countries.

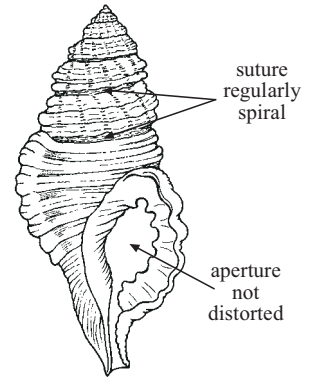


Similar families occurring in the area

Ranellidae (= Cymatiidae): suture regularly spiral; aperture not distorted; inner lip callus confined generally to the apertural margin.

Key to species of interest to fisheries occurring in the area



- 1a. Siphonal canal short and strongly recurved; apertural callus extremely large, expanded in a flattened, oval base with a broad, frilled rim . . . *Distorsio anus*
- 1b. Siphonal canal rather long and slightly recurved; apertural callus moderately developed, not expanded in a flattened base with a frilled rim . . . *Distorsio reticularis*



ventral view
Ranellidae

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Distorsio anus* (Linnaeus, 1758)
-  *Distorsio reticularis* (Linnaeus, 1758)

References

Beu, A.G. 1985. A classification and catalogue of living world Ranellidae (= Cymatiidae) and Bursidae. *Conchol. Amer. Bull.*, 13(4):55-66.

Beu, A.G. 1988. Taxonomy of gastropods of the families Ranellidae (= Cymatiidae) and Bursidae. Part 5. Early history of the families, with four new genera and recognition of the family Personidae. *Saito Ho-on Kai spec. Publ.*, (Prof. T. Kotaka Commem. Vol.), pp. 69-96.

Emerson, W.K. and W.E. Sage III. 1990a. *Distorsio ridens* (Reeve, 1844): A synonym of *Distorsio clathrata* (Lamarck, 1816) (Gastropoda: Personidae). *Nautilus*, 103(4):131-135.

Emerson, W.K. and W.E. Sage III. 1990b. Addenda to "*Distorsio ridens* (Reeve, 1844): A synonym of *Distorsio clathrata* (Lamarck, 1816) (Gastropoda: Personidae)". *Nautilus*, 104(3):108-110.

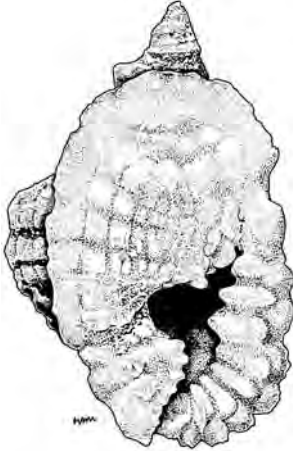
Henning, T. and J. Hemmen. 1993. *Ranellidae and Personidae of the world*. Wiesbaden, Hemmen, 263 p.

Distorsio anus (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Distorta rotunda* Perry, 1811; *D. rugosa* Schumacher, 1817; *Distortrix anus* (Linnaeus, 1758) / None.

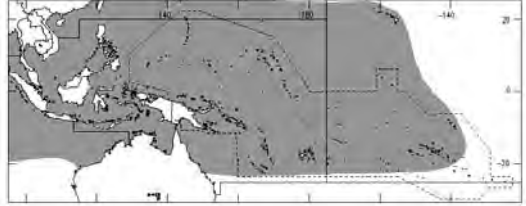
En - Common distorsio; **Fr** - Distortie commune.

Maximum shell length 10 cm, commonly to 8 cm. On reef substrate under corals and blocks. Shallow subtidal water to a depth of about 30 m. Collected for subsistence and shell trade. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to southern Japan and Hawaii, and south to Queensland.



ventral view

(after Short and Potter, 1987)

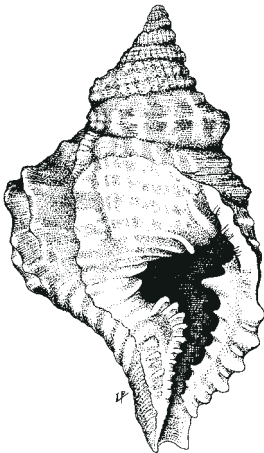


Distorsio reticularis (Linnaeus, 1758)

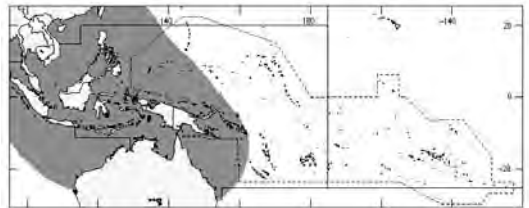
Frequent synonyms / misidentifications: *Distortio francesae* Iredale, 1931; *D. reticulata* Röding, 1798 / *Distorsio ridens* (Reeve, 1844) (= *D. clathrata* (Lamarck, 1816)).

En - Reticulate distorsio; **Fr** - Distortie réticulée.

Maximum shell length 9.5 cm, commonly to 6 cm. Often in coral reef areas. Sublittoral, at depths of about 10 to 100 m. Commonly trawled offshore in the tropical West Pacific. Locally consumed by fishermen and used for shellcraft. Indo-West Pacific, from northwestern Indian Ocean, including the Persian Gulf, to Melanesia; north to Japan and south to Queensland.



ventral view



BURSIDAE

Frog shells

Diagnostic characters: Shell ovate to slightly elongate, often dorsoventrally compressed. Sculpture coarsely knobbed to finely beaded, with 2 strong axial varices per whorl. Varices frequently aligned up sides of spire. Periostracum obsolete to absent, not hairy or shaggy. Aperture with a short anterior siphonal canal and a distinct, slot-like posterior canal. Outer lip usually thick and denticulate inside, inner lip more or less calloused, with transverse ridges or granules (rarely smooth). Operculum corneous, its nucleus at the mid-inner margin or at the anterior end. Head with an extensible, distally flattened snout, and slender filiform tentacles bearing eyes at their outer bases. Foot rather short and thick. Mantle with a short respiratory siphon anteriorly and a very short, permanent anal siphon posteriorly.

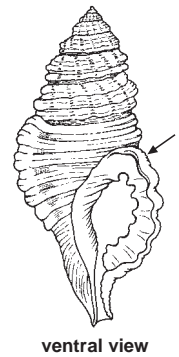
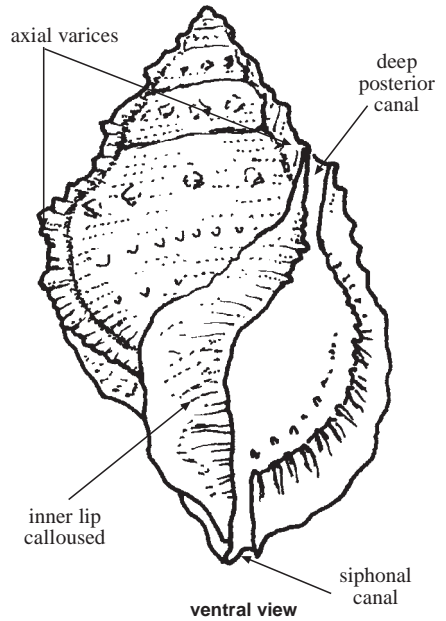
Habitat, biology, and fisheries: Active predators, living on tropical, shallow water coral reefs and rocks, to deeper waters on the continental shelf, on sand and mud bottoms. Mainly feeding on sedentary polychaete worms, which are anaesthetized with an acidic saliva, removed from their tubes and swallowed whole. Sexes separate, fertilization internal. Eggs laid in a gelatinous matrix, sometimes brooded by the female with its foot, hatching as free-swimming planktonic larvae. Locally collected for food and shell trade, either at low tide or with trawls, depending on the species.

Similar families occurring in the area

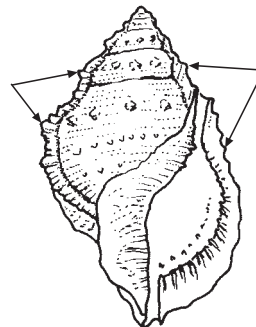
Ranellidae (= Cymatiidae): periostracum often conspicuous, fibrous to hairy; aperture without a posterior canal.

Key to species of interest to fisheries occurring in the area

- 1a. Shell dorsoventrally compressed; axial varices every 180°, then aligned up sides of spire (Fig. 1a) → 2
- 1b. Shell not dorsoventrally compressed; axial varices every 240°, then not aligned up sides of spire (Fig. 1b) → 4
- 2a. Shell thick, with coarse knobbed sculpture; nucleus of the operculum near the anterior end *Bursa bufonia*
- 2b. Shell rather thin, with fine beaded sculpture; nucleus of the operculum near the middle of inner margin → 3
- 3a. Anterior siphonal canal relatively long; columellar callus poorly developed *Bufonaria rana*
- 3b. Anterior siphonal canal relatively short; columellar callus well developed *Bufonaria crumena*
- 4a. Shell moderately large (up to 11 cm in length); aperture reddish in colour, with 2 rows of denticles inside the outer lip *Tutufa rubeta*
- 4b. Shell very large (up to 30 cm in length); aperture whitish in colour, with only 1 row of denticles inside the outer lip *Tutufa bubo*



ventral view
Ranellidae




a) aligned





b) not aligned


Fig. 1 distribution of axial varices along the spire


List of species of interest to fisheries occurring in the area


The symbol  is given when species accounts are included.

 *Bufonaria crumena* (Lamarck, 1816)

 *Bufonaria rana* (Linnaeus, 1758)

 *Bursa bufonia* (Gmelin, 1791)

 *Tutufa bubo* (Linnaeus, 1758)

 *Tutufa rubeta* (Linnaeus, 1758)

References

Beu, A.G. 1981. Australian gastropods of the family Bursidae. Part 1. The families of Tonnacea, the genera of Bursidae, and revision of species previously assigned to *Tutufa* Jousseaume, 1881. *Rec. Aust. Mus.*, 33(4-5):248-324.

Beu, A.G. 1985. A classification and catalogue of living world Ranellidae (= Cymatiidae) and Bursidae. *Conchol. Amer. Bull.*, 13(4):55-66.

Beu, A.G. 1987. Taxonomy of gastropods of the families Ranellidae (= Cymatiidae) and Bursidae. Part 2. Descriptions of 14 new modern Indo-West Pacific species and subspecies, with revisions of related taxa. *N.Z. J. Zool.*, 13(2):273-355.

Cernohorsky, W.O. 1967. The Bursidae, Cymatiidae and Colubrariidae of Fiji (Mollusca : Gastropoda). *Veliger*, 9(3):310-329.

Cossignani, F. 1994. *Bursidae of the world*. Ancona, L'Informatore Piceno, 119 p.

Bufonaria crumena (Lamarck, 1816)

Frequent synonyms / misidentifications: *Bufonaria crumenoides* (Valenciennes, 1832); *Bursa crumena* (Lamarck, 1816); *Ranella cavitensis* Reeve, 1844 / None.

En - Purse frog shell; **Fr** - Ranelle bourse.

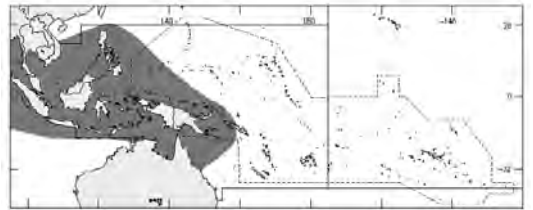
Maximum shell length 9 cm, commonly to 6 cm. On sand or mud, often among protected, submerged rocks. Sublittoral, from shallow water to a depth of about 50 m. Collected in trawls. Indo-West Pacific, from East and South Africa to Melanesia; north to the Philippines and south to Queensland.



ventral view



dorsal view



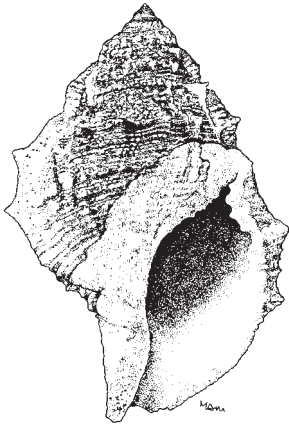
(after Beu, 1987)

Bufonaria rana (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Bursa rana* (Linnaeus, 1758); *Gyrineum rana* (Linnaeus, 1758) / *Gyrineum cavitensis* (Reeve, 1844) (= *Bufonaria crumena* (Lamark, 1816)).

En - Common frog shell; **Fr** - Ranelle commune.

Maximum shell length 9 cm, commonly to 7.5 cm. Mud and muddy-sand bottoms. Sublittoral and continental shelf. Commonly collected in trawls. Tropical West Pacific, from Indonesia to Polynesia; north to Japan and south to southern Queensland; apparently not in the Philippines.

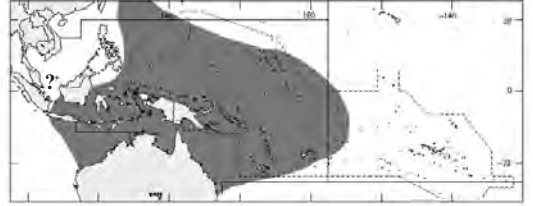


ventral view



dorsal view

(after Beu, 1987)

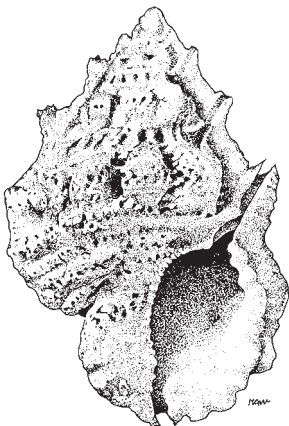


Bursa bufonia (Gmelin, 1791)

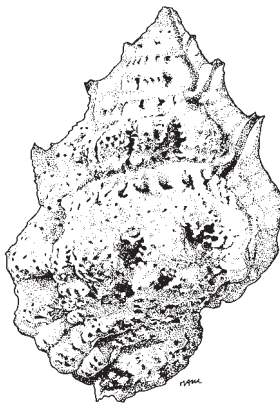
Frequent synonyms / misidentifications: *Bursa mammata* Röding, 1798 / None.

En - Warty frog shell; **Fr** - Ranelle mamelonnée.

Maximum shell length 8 cm, commonly to 6.5 cm. Common on coral reefs. Low tide levels and shallow sublittoral zone to about 20 m. Locally collected for food and shell trade. Indo-West Pacific, from East Africa, to Polynesia; north to Japan and Hawaii, and south to Queensland.

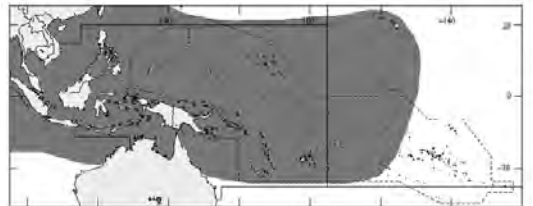


ventral view



dorsal view

(after Beu, 1986)

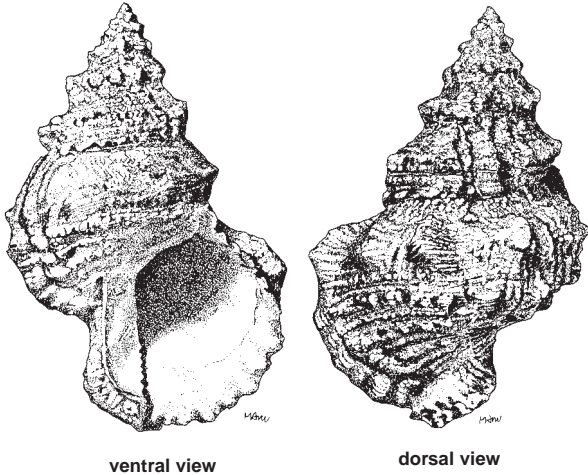


Tutufa bubo (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Bursa bubo* (Linnaeus, 1758); *B. subeta gigantea* (E.A. Smith, 1914) / *Triton lampas* (Linnaeus, 1758)(= *Charonia lampas* (Linnaeus, 1758)).

En - Giant frog shell; **Fr** - Ranelle hibou.

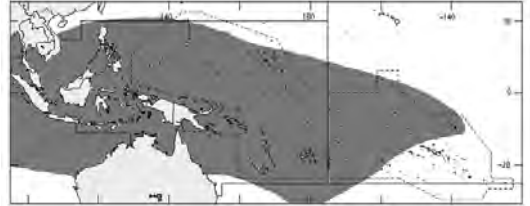
Maximum shell length 30 cm, commonly to 18 cm. On coral reefs, but also in deeper water on sandy bottoms. Intertidal and sublittoral to a depth of about 50 m. Most common in shallow subtidal waters. Collected at low tide on reefs, by snorkeling or scuba diving, or occasionally in trawls and dredges. Widespread in the Indo-West Pacific, from East Africa, including the Oman Gulf, to eastern Polynesia; north to the Philippines and south to Queensland and Kermadec Islands.



ventral view

dorsal view

(after Beu, 1987)

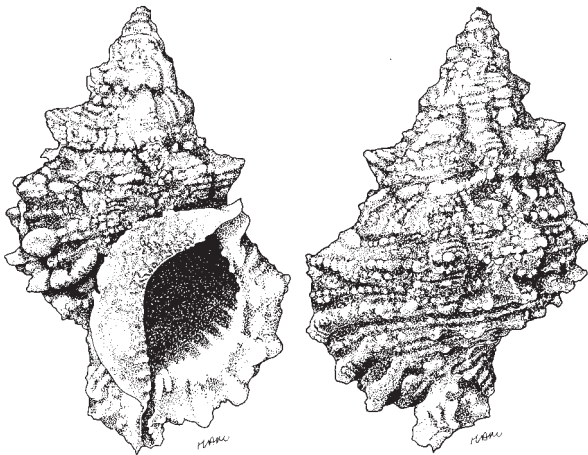


Tutufa rubeta (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Bursa bubo rubeta* (Linnaeus, 1758); *B. rubeta* (Linnaeus, 1758) / None.

En - Reddish frog shell.

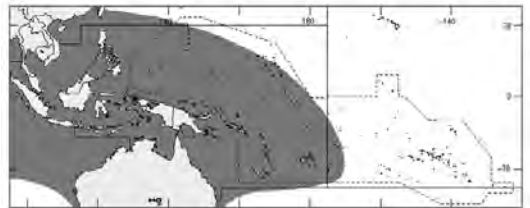
Maximum shell length 11 cm, commonly to 9 cm. Common on coral reefs. Intertidal and shallow sublittoral zones. Collected by divers in shallow water. Indo-West Pacific, from the Mascareign Islands to western Polynesia; north to Taiwan Province of China and south to northern New South Wales.



ventral view

dorsal view

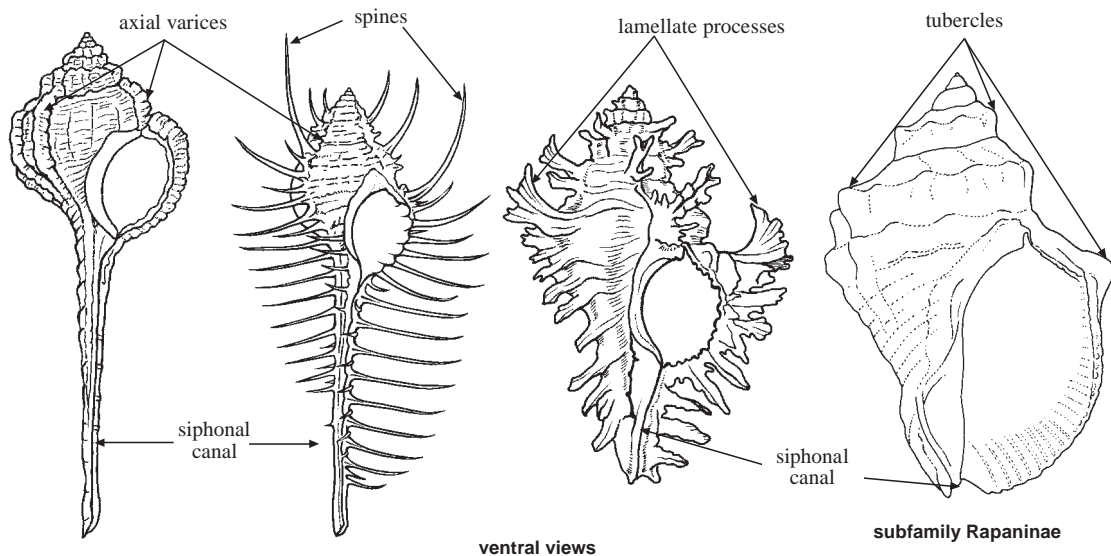
(after Beu, 1987)



MURICIDAE

Purpuras, murex and rock shells

Diagnostic characters: Shell variably shaped, generally with a raised spire and strong sculpture with spiral ridges and often axial varices (3 or more in number on each whorl), frequently bearing spines, tubercles or blade-like processes. Periostracum absent. Aperture variable, ovate to more or less contracted, with a well-marked anterior siphonal canal that may be very long. Outer lip often denticulate inside, sometimes with a tooth-like process on margin. Columella smoothish to weakly ridged. Operculum corneous, thin to thick (reinforced by a heavy and polished internal rib in subfamily Rapaninae), with nucleus near the anterior end or at about midlength of outer margin. Head with a long, retractable snout and elongate, pointed tentacles bearing eyes at or slightly above their outer bases. Foot moderately long and somewhat truncated anteriorly. Fleishy siphon moderately short to very long.



examples showing diversity of shape and sculpture

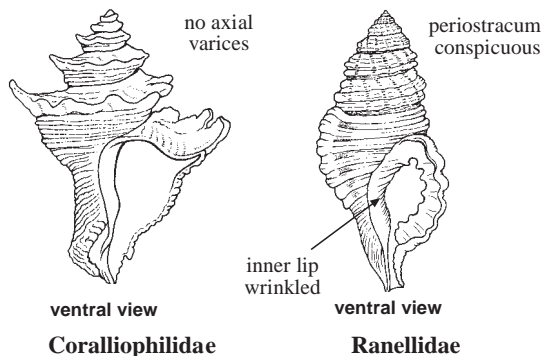
Habitat, biology, and fisheries: The Muricidae constitute a highly diverse group of species, most common in tropical and subtropical shallow waters. Active predators, generally feeding on other molluscs and barnacles. Typically, access to the soft parts of the prey is obtained by boring a hole through the shell by means of a softening secretion and the scraping action of the radula. In many species, the secretion, produced to anaesthetize the prey or for defense, turns to purple on exposure to light and air, and it has been used as a natural dye. Sexes separate, fertilization internal. Eggs laid in protective corneous capsules (the size and shape of which vary with species), hatching usually as crawling juveniles or more rarely as planktonic larvae. Muricidae are commonly collected in the area, for their edible flesh or for their beautiful shell which is used for shellcraft and is popular among shell collectors. Hand collected in shallow waters, especially by divers, or caught with fish traps and bottom trawls. Some species are frequent in local markets. Because of their carnivorous mode of life, a few species are considered pests, as they may cause substantial destruction in exploited natural beds and areas of culture of commercial bivalves.

Remarks: The family is here considered in a rather wide sense, and includes the less typical species (purpuras and rock shells) in the subfamily Rapaninae (=Thaidinae).

Similar families occurring in the area

Coralliophilidae: shell similar to Muricidae, but usually without axial varices and sculptured by spiral threads and sometimes lobe-like spines at the shoulder; differ essentially by a parasitic mode of life on corals and sea-anemones; no radula.

Ranellidae (= Cymatiidae): periostracum often conspicuous, thick and hairy; inner lip wrinkled.



Key to species of interest to fisheries occurring in the area

- 1a. Outer surface of shell with axial varices; siphonal canal medium sized to very long; operculum with subcentral to terminal nucleus (i.e., near or at the anterior end) (Fig. 1a) → 2
- 1b. Outer surface of shell without axial varices; siphonal canal generally short (rarely medium-sized); operculum with lateral nucleus (i.e., at the right side margin of its external surface) (Fig. 1b) (subfamily Rapaninae) → 10

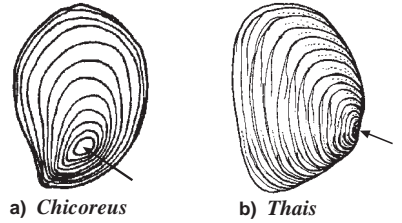


Fig. 1 operculum (external view)

- 2a. Siphonal canal elongate, as long as or longer than the length of the spire and aperture (Fig. 2a) → 3
- 2b. Siphonal canal medium sized, much shorter than the length of the spire and aperture (Fig. 2b) → 7
- 3a. Spines of axial varices usually well developed; margin of the outer lip with a prominent tooth-like process (Fig. 3a) → 4
- 3b. Spines of axial varices reduced to absent; margin of the outer lip without a tooth-like process (Figs 3b and 4) *Haustellum haustellum*

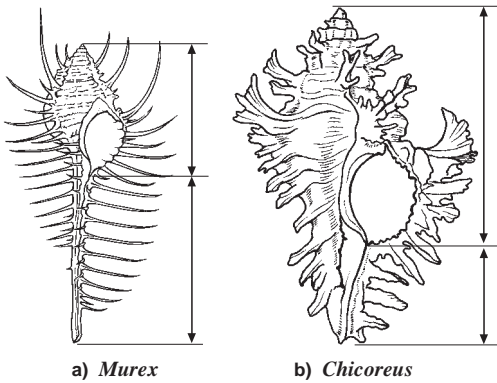


Fig. 2 ventral view

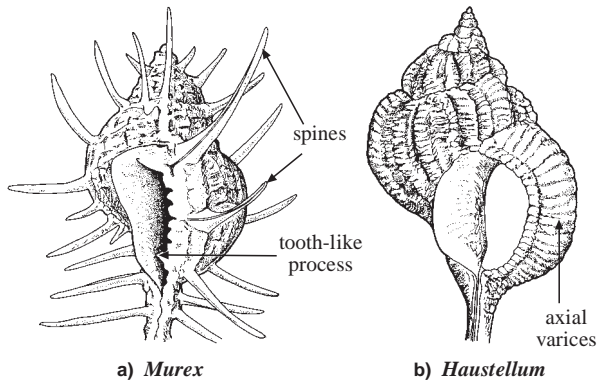


Fig. 3 lateroventral view

- 4a. Three to 4 short spines, restricted to the basal half of siphonal canal (Fig. 5) *Murex trapa*
- 4b. Several (at least 5) to many long spines developed on more than half of siphonal canal → 5
- 5a. Spines of siphonal canal disposed in single axial rows (Fig. 6) *Murex ternispina*
- 5b. Spines of siphonal canal disposed in double axial rows → 6

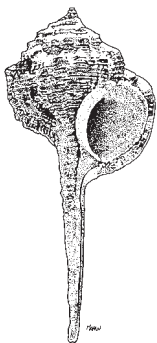


Fig. 4 *Haustellum haustellum* (ventral view)

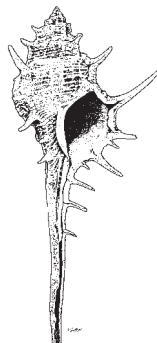


Fig. 5 *Murex trapa* (ventral view)

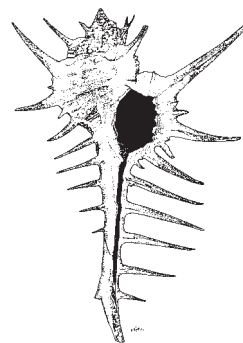


Fig. 6 *Murex ternispina* (ventral view)

- 6a. Primary spines of siphonal canal 6 or 7 in number; secondary spines progressively diverging in direction from primary spines from base to anterior end of canal; nucleus of operculum subterminal (Fig. 7) *Murex tribulus*
- 6b. Primary spines of siphonal canal about 12 in number; secondary spines at right angle to primary spines; nucleus of operculum subcentral (Fig. 8) *Murex pecten*
- 7a. Body whorl with 6 to 8 axial varices (Fig. 9) *Hexaplex cichoreus*
- 7b. Body whorl with about 3 axial varices → 8
- 8a. Shell large sized (up to 30 cm in length), whitish in colour; outer lip margin with a tooth-like process (Fig. 10) *Chicoreus ramosus*
- 8b. Shell medium sized (up to 12 cm in length), generally brownish in colour; outer lip margin without a tooth-like process → 9

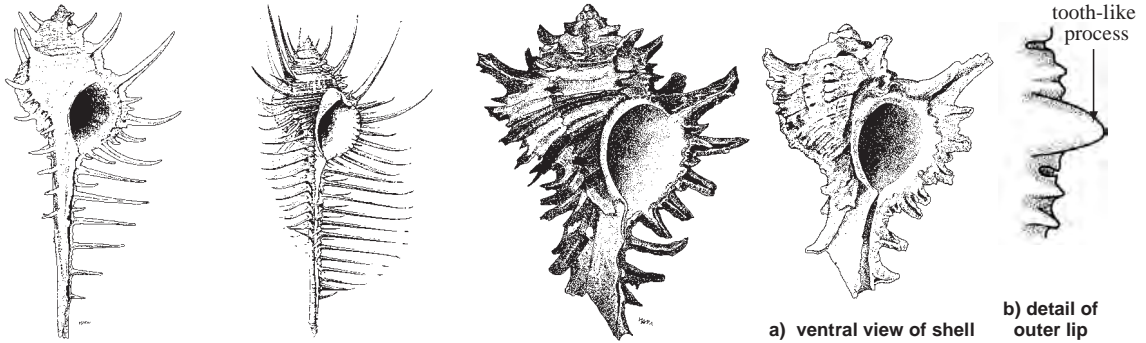


Fig. 7 *Murex tribulus* (ventral view) Fig. 8 *Murex pecten* (ventral view) Fig. 9 *Hexaplex cichoreus* (ventral view) Fig. 10 *Chicoreus ramosus* (ventral view)

- 9a. Two or more nodes between axial varices of body whorl; apertural lips light yellow to orange in colour (Fig. 11) *Chicoreus torrefactus*
- 9b. A single node between axial varices of body whorl; apertural lips deep pink in colour (Fig. 12) *Chicoreus brunneus*
- 10a. Shell relatively large (up to 15 cm in length); siphonal canal rather long; umbilicus widely open (Fig. 13) *Rapana rapiformis*
- 10b. Shell relatively small (up to 9 cm in length); siphonal canal short, merely a broad notch of the anterior margin → 11
- 11a. Body whorl with spiral rows of stout conical tubercles → 17
- 11b. Body whorl without spiral rows of stout conical tubercles → 12

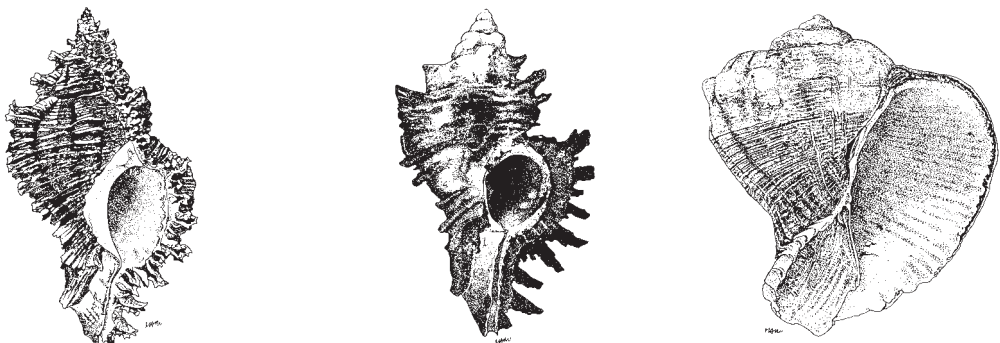


Fig. 11 *Chicoreus torrefactus* (ventral view) Fig. 12 *Chicoreus brunneus* (ventral view) Fig. 13 *Rapana rapiformis* (ventral view)

- 12a. Shell small, not exceeding 2.5 cm in length; outer surface with whitish spiral banding on a dark brown background (Fig. 14) *Vexilla vexillum*
- 12b. Shell comparatively large, widely exceeding 2.5 cm in length; outer surface differently coloured; whitish spiral banding, if present, of interrupted spots. → 13
- 13a. Shoulders of spire and body whorls with a strongly keeled spiral ridge; inner lip of the aperture more or less detached posteriorly from body whorl (Fig. 15) *Cymia lacera*
- 13b. Shoulders of spire and body whorls without a keeled ridge; inner lip of the aperture strongly adherent posteriorly to body whorl → 14
- 14a. Spire whorls with a wide, shallow, subsutural groove; posterior end of aperture constricted by prominent inner and outer lip denticles; outer lip smooth inside → 15
- 14b. Spire whorls without subsutural groove; posterior end of aperture not constricted by prominent denticles; outer lip lirate inside → 16
- 15a. Outer surface finely beaded (Fig. 16) *Nassa sarta*
- 15b. Outer surface not beaded (Fig. 17) *Nassa francolina*

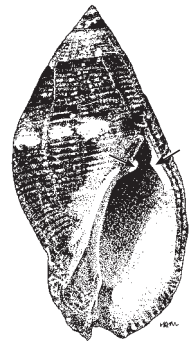
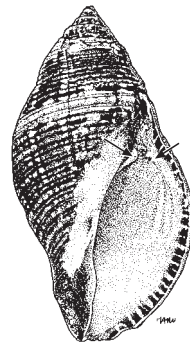
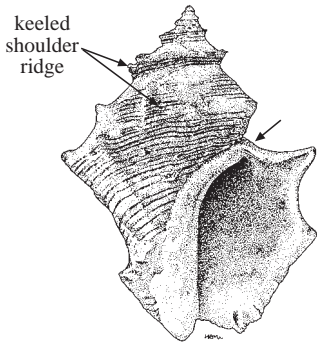
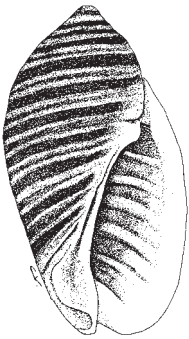


Fig. 14 *Vexilla vexillum* (ventral view) Fig. 15 *Cymia lacera* (ventral view) Fig. 16 *Nassa sarta* (ventral view) Fig. 17 *Nassa francolina* (ventral view)

- 16a. Body whorl with 5 spiral rows of low nodules (Fig. 18) *Purpura panama*
- 16b. Body whorl without spiral rows of low nodules (Fig. 19) *Purpura persica*
- 17a. Tubercles of the most posterior row finger-shaped and very large (Fig. 20) *Thais armigera*
- 17b. Tubercles of the most posterior row not finger-shaped nor very large → 18
- 18a. Tubercles relatively low; outer lip of aperture smooth inside (Fig. 21) *Thais bufo*
- 18b. Tubercles relatively strong; outer lip of aperture lirate inside → 19

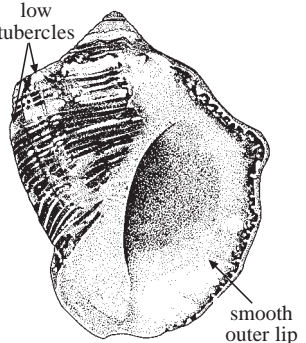
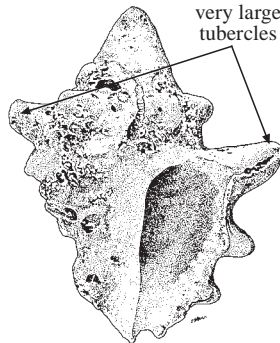
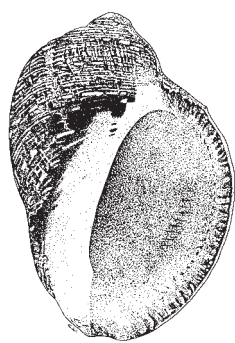
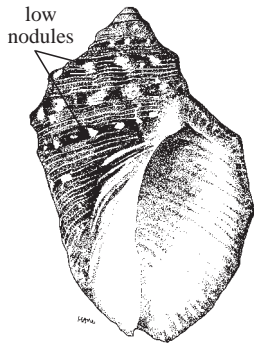


Fig. 18 *Purpura panama* (ventral view) Fig. 19 *Purpura persica* (ventral view) Fig. 20 *Thais armigera* (ventral view) Fig. 21 *Thais bufo* (ventral view)

- 19a. Body whorl with 3 rows of tubercles (Fig. 22) *Thais tuberosa*
 19b. Body whorl with 4 rows of tubercles (Fig. 23) *Thais aculeata*
 19c. Body whorl with 5 rows of tubercles (Fig. 24) *Thais alouina*

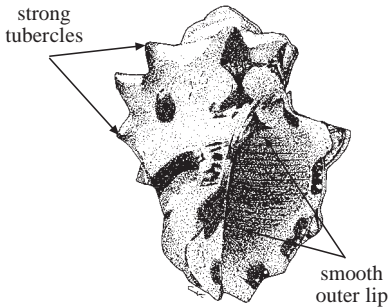


Fig. 22 *Thais tuberosa*
(ventral view)












Fig. 23 *Thais aculeata*
(ventral view)















Fig. 24 *Thais alouina*
(ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Chicoreus brunneus* (Link, 1807)
-  *Chicoreus ramosus* (Linnaeus, 1758)
-  *Chicoreus torrefactus* (Sowerby, 1841)
-  *Haustellum haustellum* (Linnaeus, 1758)
-  *Hexaplex cichoreum* (Gmelin, 1791)
-  *Murex pecten* Lightfoot, 1786
-  *Murex ternispina* Lamarck, 1822
-  *Murex trapa* Röding, 1798
-  *Murex tribulus* Linnaeus, 1758

Subfamily Rapaninae

-  *Cymia lacera* (Born, 1778)
-  *Nassa francolina* (Bruguière, 1789)
-  *Nassa sarta* (Bruguière, 1789)
-  *Purpura panama* (Röding, 1798)
-  *Purpura persica* (Linnaeus, 1758)
-  *Rapana rapiformis* (Born, 1778)
-  *Thais aculeata* (Deshayes and Milne Edwards, 1844)
-  *Thais alouina* (Röding, 1798)
-  *Thais armigera* (Link, 1807)
-  *Thais bufo* (Lamarck, 1822)
-  *Thais tuberosa* Röding, 1798
-  *Vexilla vexillum* (Gmelin, 1791)

References

- Cernohorsky, W.O. 1967. The Muricidae of Fiji (Mollusca: Gastropoda). Part I. Subfamilies Muricinae and Tritonaliinae. *Veliger*, 10(2):111-132.
- Cernohorsky, W.O. 1969. The Muricidae of Fiji. Part II. Subfamily Thaidinae. *Veliger*, 11(4):293-315.
- Houart, R. 1992. The genus *Chicoreus* and related genera (Gastropoda: Muricidae) in the Indo-West Pacific. *Mém. Mus. Nat. Hist. Nat.*, (A)154:1-188.
- Kool, S.P. 1993. Phylogenetic analysis of the Rapaninae (Neogastropoda: Muricidae). *Malacologia*, 35(2):155-259.
- Ponder, W.F. and E.H. Vokes. 1988. A revision of the Indo-west Pacific fossil and recent species of *Murex* s.s. and *Haustellum* (Muricidae: Gastropoda: Mollusca). *Rec. Aust. Mus.*, (Suppl.)8:1-160.
- Radwin, G.E. and A. D'Attilio. 1976. *Murex shells of the world. An illustrated guide to the Muricidae*. Stanford, Stanford University, 284 p.

Chicoreus brunneus (Link, 1807)

Frequent synonyms / misidentifications: *Murex adustus* Lamarck, 1822; *M. brunneus* Link, 1807; *M. despectus* A. Adams, 1854 / None.

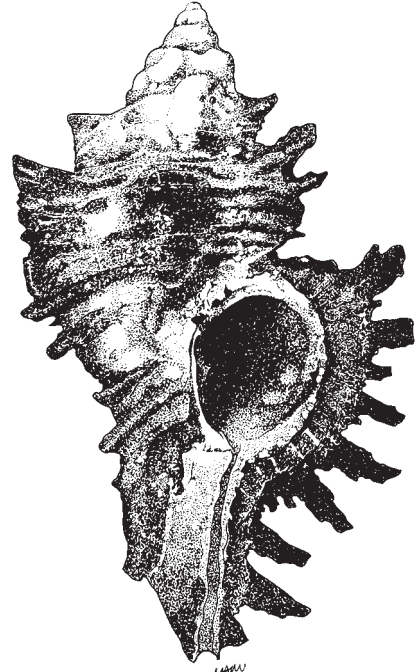
FAO names: En - Adusta murex; Fr - Murex bruni.

Diagnostic characters: Shell moderately large, stout and heavy, roughly rhomboidal in outline, with a tall conical spire and inflated body whorl. About 3 strong and prominent, spinose axial varices per whorl, with a single broad axial node between them, well-marked spiral cords (about 12 on body whorl) and many fine, intermediate spiral threads. Spines of varices thick, branched, leaf-like and close-set, about 6 in number on body whorl. Posteriormost 3 or 4 spines rather long, progressively more dorsally recurved towards the anterior end of shell, thus forming a gradual arc in that direction. Last 2 spines of body whorl straight. Aperture rounded ovate, with a deep and narrow notch at posterior end. Outer lip crenulate but without a tooth-like process, shortly lirate interiorly. Inner lip smooth, almost completely adherent. Anterior siphonal canal broad and relatively short, narrowly open, slightly recurved distally, with 3 or 4 straight spines of which the basal one is bent dorsally. **Colour:** outside of shell usually brown, with darker brown to almost black spiral cords and spines, sometimes orange. Aperture white or light pink, with deep pink lips.

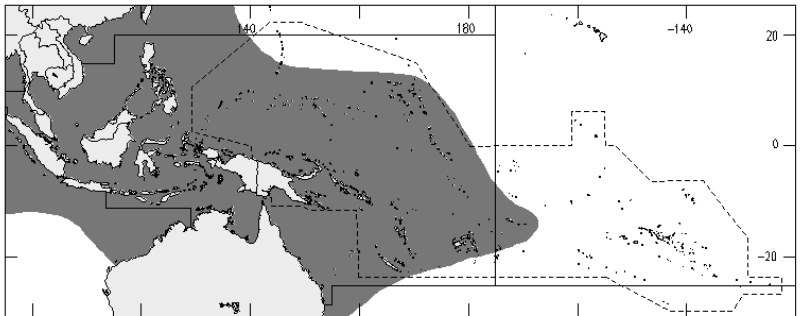
Size: Maximum shell length 11.5 cm, commonly to 7 cm.

Habitat, biology, and fisheries: Common in various shallow water habitats, rocks, coral reefs, or clean to muddy sand bottoms. Intertidal and sublittoral zones, to a depth of about 20 m. This common species is frequently collected by coastal people for food and shellcraft.

Distribution: Widespread in the Indo-West Pacific, from East Africa to western Polynesia; north to Japan and south to northern New South Wales and New Caledonia.



ventral view
(after Houart, 1992)



Chicoreus ramosus (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Murex ramosus* Linnaeus, 1758 / None.

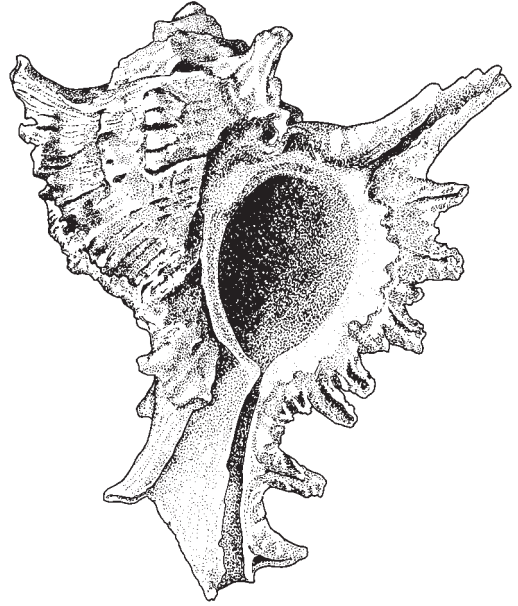
FAO names: En - Ramose murex; Fr - Murex rameux.

Diagnostic characters: Shell large, solid, globose-ovate with a moderately low spire and tumid body whorl. About 3 spinose axial varices per whorl, with 2 unequal, axially elongate nodes between them (one prominent and narrow to the right, one smaller to the left), weak spiral cords and numerous, fine intermediate spiral threads. Spines leaf-like, moderately short, open and recurved, strongest and often longest at shoulder. Aperture large, roundly ovate, with a moderately broad notch at posterior end. Outer lip crenulate and with a prominent tooth-like process anteriorly, smooth or shortly lirate inside. Inner lip with a small spiral ridge posteriorly, otherwise smooth, adherent or sometimes shortly erect anteriorly. Anterior siphonal canal moderately long, broad, narrowly open and slightly recurved dorsally, with 2 or 3 spines. **Colour:** outside of shell whitish, sometimes stained rusty pink near sutures and along spiral lines. Aperture white interiorly, with pink margins.

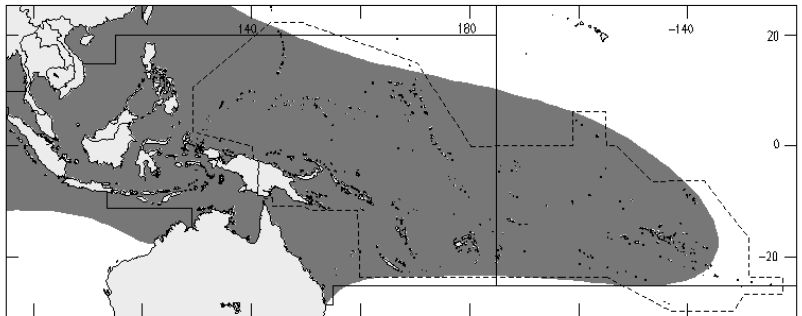
Size: Maximum shell length 33 cm, commonly to 20 cm.

Habitat, biology, and fisheries: Common on coral reef areas, often on clean coarse sand and rubble bottoms in which large individuals partially bury themselves. Preys on bivalves and other gastropods. Intertidal and shallow sublittoral zones to a depth of about 10 m. This large and common species is actively collected in many parts of the Indo-West Pacific realm. In India, it is an important commercial species.

Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, the Red Sea and the Gulf of Oman, to eastern Polynesia; north to Japan and south to southern Queensland and New Caledonia.



ventral view
(after Lindner, 1976)



Chicoreus torrefactus (Sowerby, 1841)

Frequent synonyms / misidentifications: *Chicoreus kilburni* Houart and Pain, 1982; *C. rubiginosus* (Reeve, 1845); *Murex torrefactus* Sowerby, 1841 / *Chicoreus carneolus* (Röding, 1798); *C. maurus* (Broderip, 1833); *C. microphyllus* (Lamarck, 1816); *C. palmiferus* (Sowerby, 1841); *C. saulii* (Sowerby, 1834).

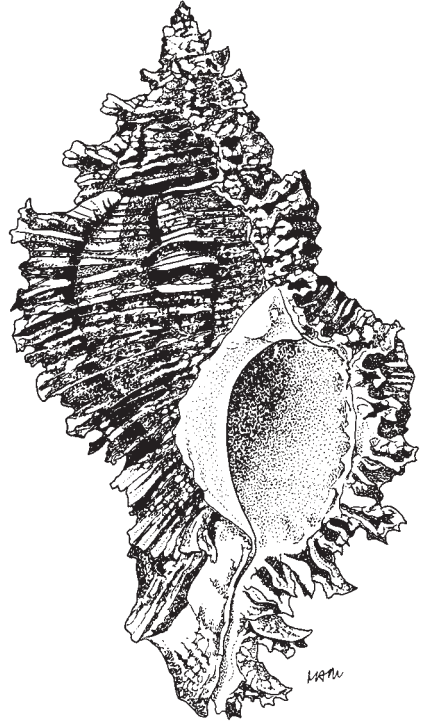
FAO names: En - Firebrand murex; Fr - Murex torréfié.

Diagnostic characters: Shell moderately large, solid, fusiform and moderately slender in outline, with a high, acute spire and large, elongate body whorl. Three spinose axial varices per whorl, with usually 2 or 3 axial nodes between them, and finely crenulated spiral cords interspersed with many fine spiral threads. Spines of varices short and branched, with smaller intermediate spines. About 5 major spines on body whorl, the shoulder spine and 2 anteriormost spines strongest. Aperture broadly ovate, with a large and deep notch at posterior end. Outer lip crenulate but without a tooth-like process, shortly lirate inside. Inner lip adherent, calloused posteriorly, usually smooth. Siphonal canal moderately short, broad, narrowly open and slightly recurved, with 3 or 4 spines which are separated from the body-whorl spines by a spineless space. **Colour:** outside of shell usually brown, with darker spiral cords and spines. Aperture white, often with yellow to orange lips.

Size: Maximum shell length 14 cm, commonly to 8 cm.

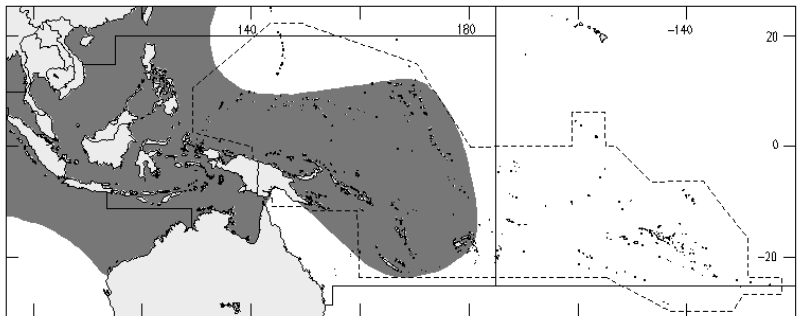
Habitat, biology, and fisheries: Among rocks or on muddy-sand bottoms, near rocks and under corals. Littoral and shallow subtidal waters. This common species is frequently collected for food and shellcraft. In some localities, populations have been greatly reduced because of overcollecting.

Distribution: Widespread in the Indo-West Pacific, from south-east Africa to Micronesia and Melanesia; north to Japan and south to New Caledonia and Fiji Islands.



ventral view

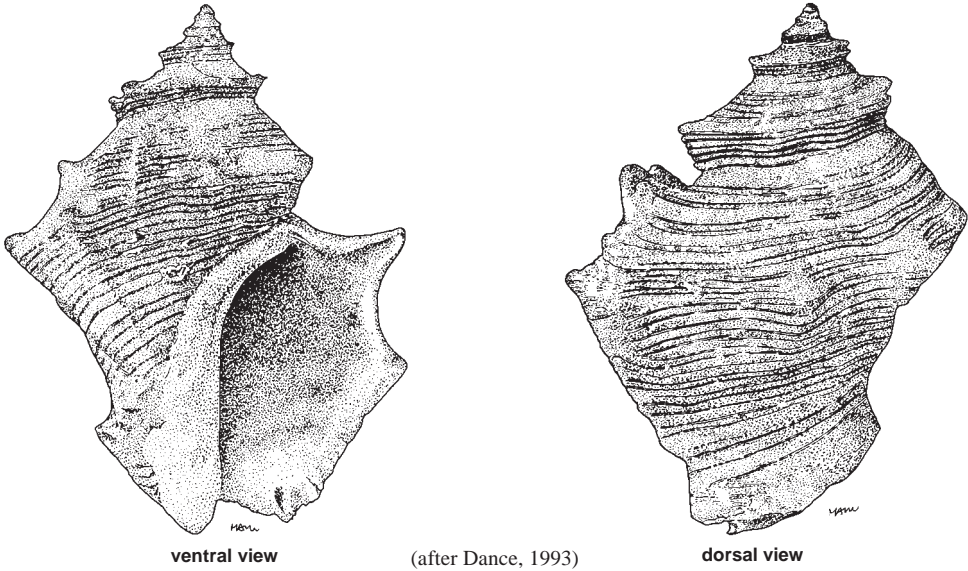
(after Kilburn and Rippey, 1982)



Cymia lacera (Born, 1778)

Frequent synonyms / misidentifications: *Cuma carinifera* (Lamarck, 1816); *C. lacera* (Born, 1778); *Purpura carinifera* Lamarck, 1816; *Thais carinifera* (Lamarck, 1816); *T. mutabilis* (Link, 1807) / None.

FAO names: En - Carinate rock shell; Fr - Pourpre carénée.

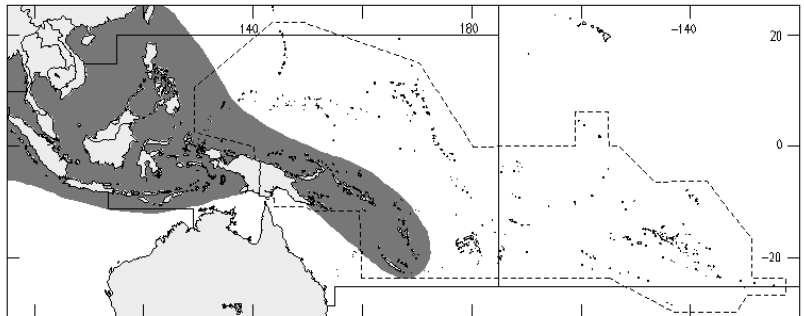


Diagnostic characters: Shell thick and heavy for its size, almost biconical in outline, with a moderately tall, conical spire and large, strongly angulated body whorl. Surface of shell with many narrow, irregular spiral cords all over, and a sharply angular spiral ridge bearing spiny tubercles at periphery of each whorl. Some of the spiral cords may be stronger on body whorl and give rise to secondary spines on shoulder slope. Base of body whorl with a prominent spiral ridge bordering the umbilical excavation. Posterior part of aperture often almost free from the body whorl. Outer lip strongly dentate posteriorly. Columella smooth and straight. Anterior siphonal canal short and deep, widely open. **Colour:** outside of shell pale grey, cream or yellowish brown, often with quadrangular brown mottling. Aperture flesh-coloured inside, becoming pale cream to orange on margins.

Size: Maximum shell length 5 cm, commonly to 4 cm.

Habitat, biology, and fisheries: On muddy littoral rocks. Collected for food in various parts of the Indo-West Pacific, notably in Indonesia, Indo-China, and India.

Distribution: Indo-West Pacific, from India to Melanesia; north to Taiwan Province of China and south to southern Indonesia and New Caledonia.



Hexaplex cichoreum (Gmelin, 1791)

Frequent synonyms / misidentifications: *Chicoreus cichoreum* (Gmelin, 1791); *Hexaplex foliata* Perry, 1811; *Murex cichoreus* Gmelin, 1791; *M. endivia* Lamarck, 1822 / None.

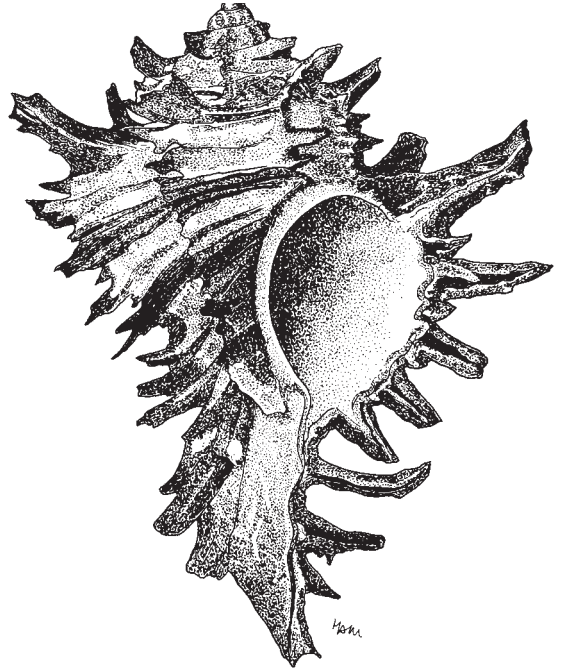
FAO names: En - Endive murex; Fr - Murex endive.

Diagnostic characters: **Shell large** and stout, **globose-ovate** with a **broad conical spire** and wide body whorl. **Six to 8 strongly spinose axial varices on body whorl**, alternating with a low axial ridge, and **crossed by unequal spiral ridges**. **Spines** of varices also developed along the siphonal canal, open, **branched and crimped**, the major ones long and **strongly recurved backward** with respect to the direction of growth. **Aperture subcircular, with a small posterior canal and a broad, moderately developed, anterior siphonal canal**, which is narrowly open along its right side and slightly bent to the right and dorsally. Umbilicus deep and rounded. **Outer lip of aperture strongly crenulate** and with a tooth-like process toward the base. Inner lip with a narrow, somewhat detached anteriorly, columellar callus and a small tubercle at posterior end. **Colour: outside of shell dull white, with 3 spiral bands of brown on body whorl**, one on shoulder slope, another on mid-body, and a third on the base and siphonal canal. Spines dark brown to almost black. **Aperture porcelainous white, narrowly rimmed with pink-orange on margins.**

Size: Maximum shell length 15 cm, commonly to 10 cm.

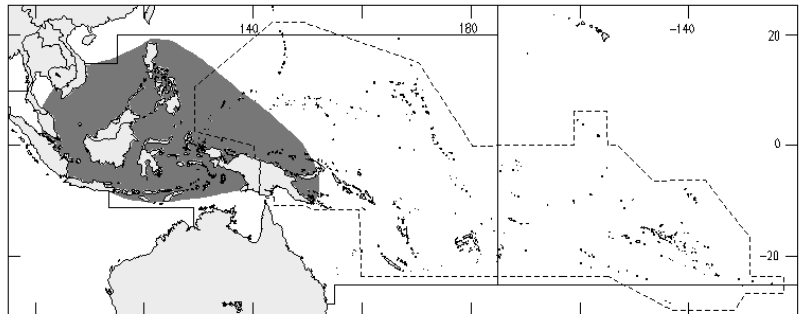
Habitat, biology, and fisheries: Abundant in rocky to muddy areas. Low tide and sublittoral zone. Collected for food in the Philippines. Shell used in local shellcraft.

Distribution: Restricted to the tropical West Pacific, from Indonesia to Papua New Guinea and the Philippines.



ventral view

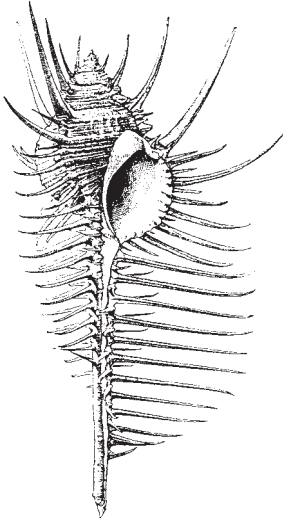
(after Abbott, 1962)



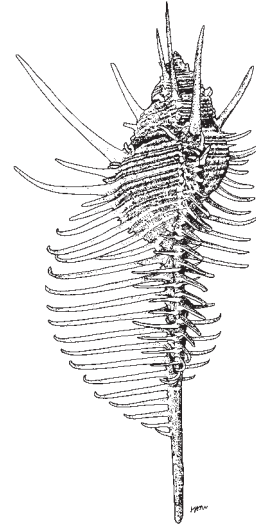
Murex pecten Lightfoot, 1786

Frequent synonyms / misidentifications: *Acupurpura triremis* (Perry, 1811); *Murex pecten* Montfort, 1810; *M. tenuispina* Lamarck, 1822; *M. triremis* Perry, 1811 / None.

FAO names: En - Venus comb murex; Fr - Murex peigne-de-Vénus.



ventral view
(after Grassé, 1968)



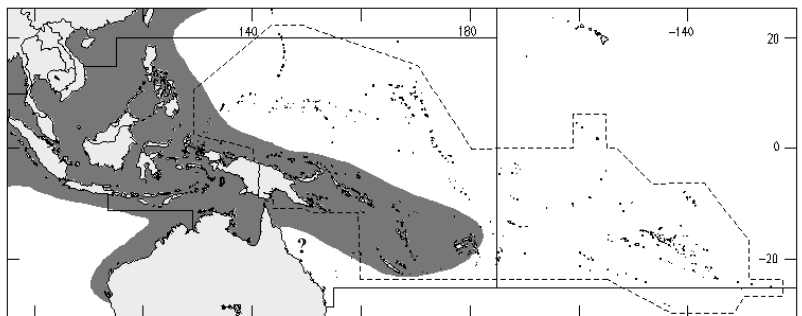
dorsal view
(after Ponder and Vokes, 1988)

Diagnostic characters: Shell fairly thin but solid, highly spinose, club-shaped with a moderately tall conical spire, an inflated body whorl and an almost straight, elongate siphonal canal which is longer than the length of the spire and aperture. Main sculpture of 3 axial varices per whorl and many, slightly beaded, unequal spiral ridges which form a complicated arrangement of acute, long, curved spines on varices. Major spines strongest at shoulder and inclined toward the apex, those at periphery almost as strong, not quite so inclined. Intervarical axial sculpture reduced to minute threads on later whorls. Aperture ovate, outer lip crenulated, with a tooth-like process anteriorly. Inner lip adherent and calloused posteriorly, detached and erect anteriorly. Siphonal canal tubular, almost closed, with 3 double rows of spines which diminish in size anteriorly. Primary (major) spines about 12 in number, ventrally curved and perpendicular to coiling axis. Secondary (minor) spines much smaller, at right angle to primary spines. Anterior 1/4 of siphonal canal devoid of spines. **Colour:** outside of shell creamy white to tan. Aperture porcelainous white, often with red-brown spots in marginal notches of the outer lip.

Size: Maximum shell length 15 cm, commonly to 10 cm.

Habitat, biology, and fisheries: On sandy to muddy bottoms of coral reef areas and on the continental shelf. Littoral, sublittoral and offshore, to a maximum depth of about 340 m. The numerous and long spines provide an efficient protection against predators. Collected for the edible flesh and the elegant shell which is much favoured among collectors.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Mascarene Islands, to eastern Melanesia; north to Japan and south to Queensland and New Caledonia. In Western Australia, there is a distinct subspecies *Murex pecten soelae* Ponder and Vokes, 1988.

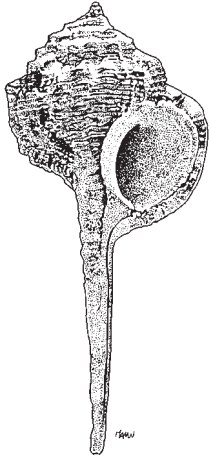


***Haustellum haustellum* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Haustellum vicdani* Kosuge, 1980; *Murex haustellum* Linnaeus, 1758; *M. kurodai* Shikama, 1964; *M. longicaudus* (Baker, 1891) / None.

En - Snipe's bill murex; **Fr** - Murex bec-de-bécassine.

Maximum shell length 15 cm, commonly to 10 cm. On sand and coral-rubble bottoms. Littoral and sublittoral zones, to a depth of about 90 m. Most common in moderately shallow water. Collected locally for food and shell trade. Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to Japan and south to Queensland and New Caledonia.



ventral view
(after Short and Potter, 1987)

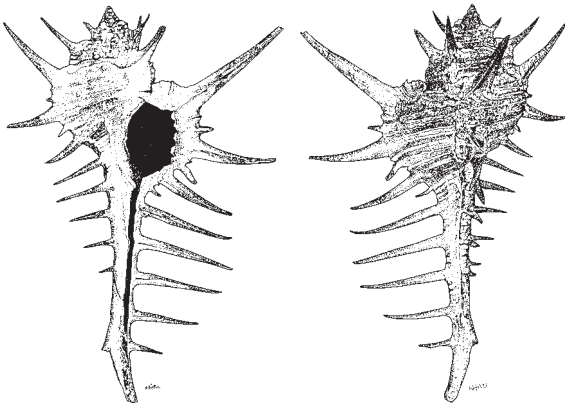


***Murex ternispina* Lamarck, 1822**

Frequent synonyms / misidentifications: *Acupurpura nigrispinosa* (Reeve, 1845); *Murex nigrispinosa* Reeve, 1845 / *Murex tribulus* Linnaeus, 1758.

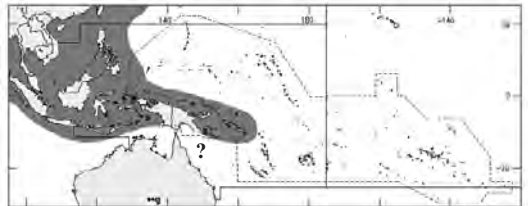
En - Black-spined murex; **Fr** - Murex noire-épine.

Maximum shell length 12 cm, commonly to 9 cm. On soft sublittoral bottoms, from shallow water to a depth of about 60 m. Collected and locally marketed for food and shell trade. Indo-West Pacific, from Sri Lanka to Melanesia; north to Japan and south to southern Indonesia and probably eastern Queensland.



ventral view dorsal view

(after Ponder and Vokes, 1988)

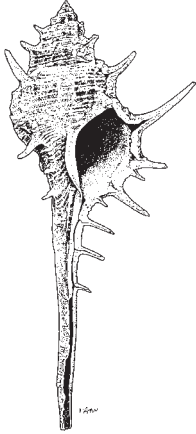


Murex trapa Röding, 1798

Frequent synonyms / misidentifications: *Murex martinianus* Reeve, 1845; *M. rarispina* Lamarck, 1822; *M. unidentatus* Sowerby, 1834 / *Murex ternispina* Lamarck, 1822.

En - Raespined murex; **Fr** - Murex rare-épine.

Maximum shell length 11.5 cm, commonly to 10 cm. Muddy-sand bottoms. Low tide and shallow sublittoral depths. Used locally as food, or collected for shell trade. Widespread in the Indo-West Pacific, from Madagascar and Mascareign Islands, India, Sri Lanka and the Andaman Sea, to the Philippines; north to southern Japan and south to southern Indonesia.



ventral view

(after Ponder and Vokes, 1988)

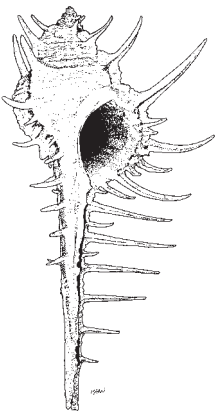


Murex tribulus Linnaeus, 1758

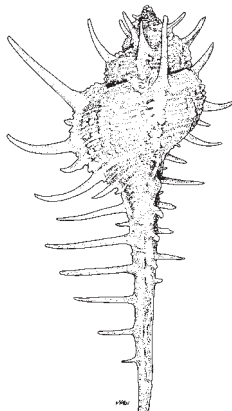
Frequent synonyms / misidentifications: *Murex crassispina* Lamarck, 1822 / *Murex ternispina* Lamarck, 1822; *M. tenuispina* Lamarck, 1822 (= *M. pecten* Lightfoot, 1786).

En - Caltrop murex; **Fr** - Murex tribule.

Maximum shell length 10.5 cm, commonly to 8 cm. On clean or muddy sand, or coral-rubble bottoms. Sublittoral, mainly in shallow water between depths of 1 to 15 m. Used as food locally, the empty shell sold for collections. Indo-West Pacific, in southeastern Africa and Madagascar, and from the easternmost part of the Indian Ocean to Melanesia; north to southern Japan and south to northern Queensland and New Caledonia; also probably present in the Marshall Islands. Specimens from the Arabian region usually referred to this species actually belong to the distinct species *Murex forskoehlii* Röding, 1798.

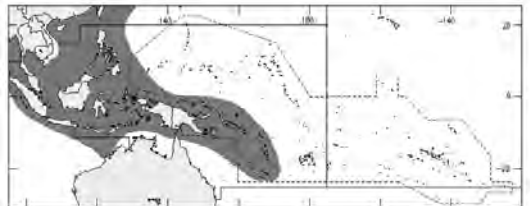


ventral view



dorsal view

(after Ponder and Vokes, 1988)



Nassa francolina (Bruguière, 1789)

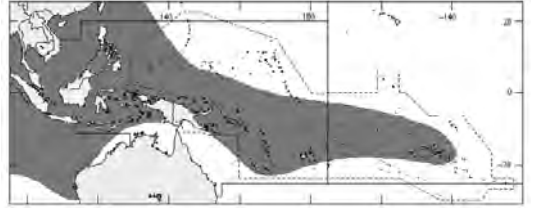
Frequent synonyms / misidentifications: *Iopas francolinus* (Bruguière, 1789) / *Nassa sarta* (Bruguière, 1789).

En - Francolina jopas; **Fr** - Jopas francolin.

Maximum shell length 7 cm, commonly to 5 cm. On coarse sand and rubble, or under stones and corals, in coral reef areas. Littoral and shallow subtidal waters. Occasionally collected for subsistence by coastal populations. Distribution imperfectly known, because of frequent misidentification with *Nassa sarta*. Probably widely distributed in the Indo-West Pacific, though more common in the Indian Ocean, from East Africa to eastern Polynesia; north to Japan, and south to southern Indonesia and New Caledonia.



ventral view
(after Kira, 1962)

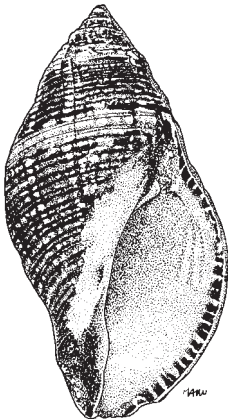


Nassa sarta (Bruguière, 1789)

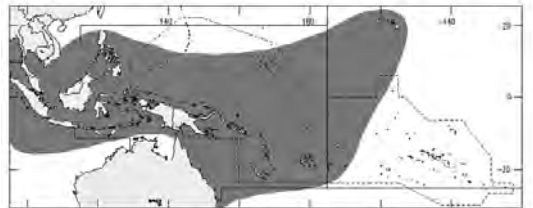
Frequent synonyms / misidentifications: *Iopas sertum* (Bruguière, 1789) / *Nassa francolina* (Bruguière, 1789).

En - Wreath jopas; **Fr** - Jopas guirlande.

Maximum shell length 7 cm, commonly to 5 cm. On rocky areas or under corals, slabs, and stones. Intertidal and shallow subtidal zones. Used as food by some coastal populations. Distribution imperfectly known, because of frequent confusions with *Nassa francolina*. Mainly in the tropical West Pacific realm, from the eastern end of Indian Ocean to western Polynesia; north to the Philippines and Hawaii, and south to northern New South Wales.



ventral view
(after Short and Potter, 1987)

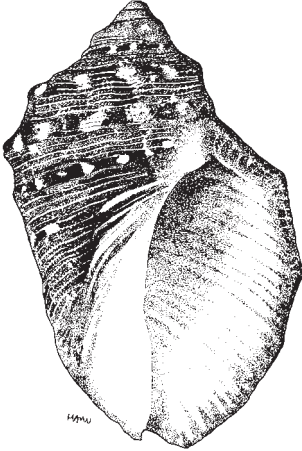


Purpura panama (Röding, 1798)

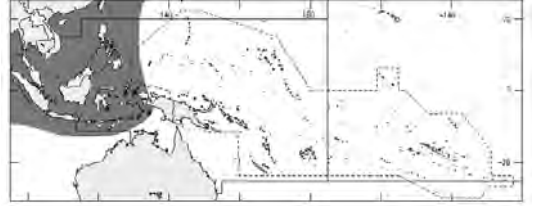
Frequent synonyms / misidentifications: *Purpura rudolphi* Lamarck, 1822; *Thais rudolphi* (Lamarck, 1822) / None.

En - Rudolph's purpura; **Fr** - Pourpre de Rudolphe.

Maximum shell length 7 cm, commonly to 5 cm. Rocky areas, at tidal and shallow subtidal depths. Common from mid-tidal pools to the low-tide fringe where it preys on oysters, barnacles and limpets. Occasionally used as food in the area, this species is commonly marketed and eaten in India. Widespread in the Indo-West Pacific, from East and South Africa to eastern Indonesia; north to Japan and south to southern Indonesia.



ventral view
(after Kira, 1962)

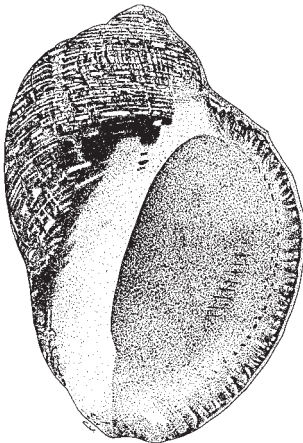


Purpura persica (Linnaeus, 1758)

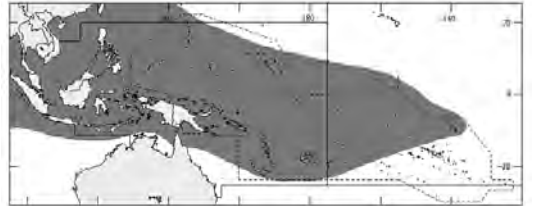
Frequent synonyms / misidentifications: *Thais persica* (Linnaeus, 1758) / None.

En - Persian purpura; **Fr** - Pourpre persique.

Maximum shell length 9 cm, commonly to 7 cm. Under corals and stones, or on rocks exposed to surf action. Collected locally for food in Southeast Asia. Widespread in the Indo-West Pacific, from Madagascar and the Mascareign Islands to eastern Polynesia; north to Japan and south to northern Queensland and New Caledonia.



ventral view
(after Short and Potter, 1987)

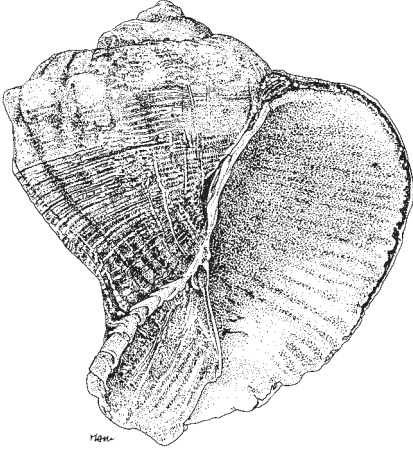


Rapana rapiformis (Born, 1778)

Frequent synonyms / misidentifications: *Rapana bulbosa* (Lightfoot, 1786) / None.

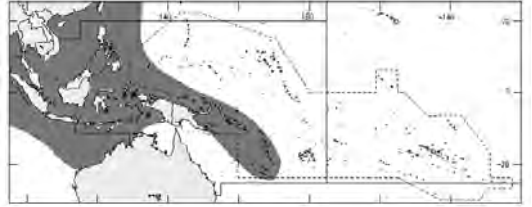
En - Turnish shaped rapa; **Fr** - Rapane bulbeuse.

Maximum shell length 15 cm, commonly to 10 cm. On sandy bottoms. Sublittoral, to a depth of 30 m. Reasonably common in shrimp trawls. Indo-West Pacific, from Madagascar and Sri Lanka to Melanesia; north to Japan and south to New Caledonia.



ventral view

(after Short and Potter, 1987)



Thais aculeata (Deshayes and Milne Edwards, 1844)

Frequent synonyms / misidentifications: *Mancinella aculeata* (Deshayes and Milne Edwards, 1844); *Murex hippocastanum* Linnaeus, 1758 (suppressed name); *Purpura pseudohippocastanum* Dautzenberg, 1929 / *Mancinella aculeata* Link, 1807 (= *Thais alouina* (Röding, 1798)).

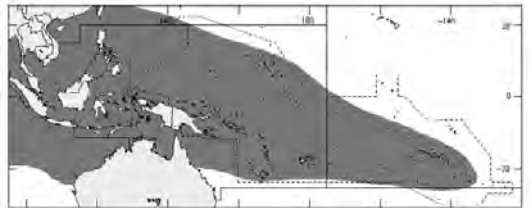
En - Aculeate rock shell; **Fr** - Pourpre aiguillonnée.

Maximum shell length 6 cm, commonly to 5 cm. On rocky shores and coral reef flats. Intertidal zone. Often common among rock oysters. Frequently collected for food by coastal inhabitants. Distribution imperfectly known because of frequent confusion with similar species. Probably widespread in the Indo-West Pacific, from Madagascar to eastern Polynesia; north to Taiwan Province of China and



south to Queensland, ventral view

(after Salvat and Rives, 1975)

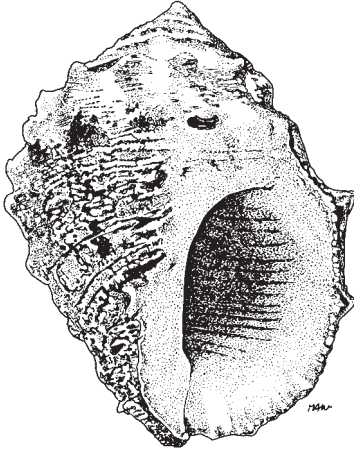


Thais alouina (Röding, 1798)

Frequent synonyms / misidentifications: *Mancinella aculeata* Link, 1807; *M. alouina* (Röding, 1798); *Murex mancinella* Linnaeus, 1758 (rejected name); *Purpura gemmulata* Lamarck, 1816 / None.

En - Alou rock shell; **Fr** - Pourpre petit-bourgeon.

Maximum shell length 6 cm, commonly to 5 cm. On rocks, usually among marine growths and algae in sheltered areas. Littoral and shallow subtidal zones. Locally collected for food by coastal populations. Widespread in the Indo-West Pacific, from East and South Africa to Melanesia; north to Japan and south to northern New South Wales.



ventral view

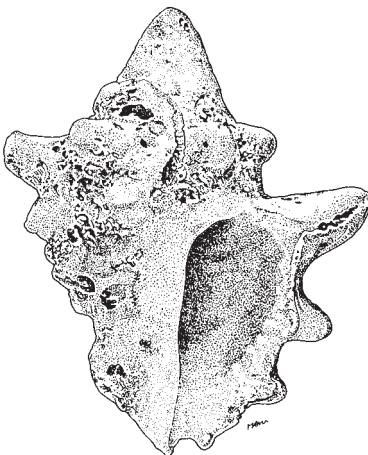
(after Short and Potter, 1987)

***Thais armigera*** (Link, 1807)

Frequent synonyms / misidentifications: *Mancinella armigera* (Link, 1807); *Purpura affinis* Reeve, 1846 / None.

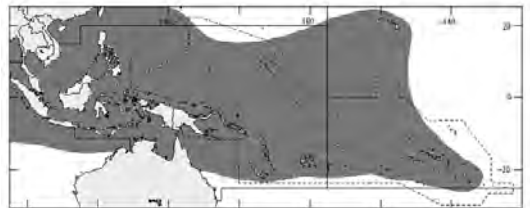
En - Belligerent rock shell; **Fr** - Pourpre armée.

Maximum shell length 9 cm, commonly to 7.5 cm. On rocky shores and coral reefs. Intertidal and shallow subtidal zones. Collected for food by coastal populations. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and Hawaii, and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

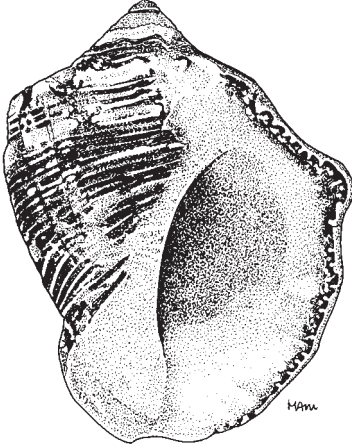


Thais bufo (Lamarck, 1822)

Frequent synonyms / misidentifications: *Mancinella bufo* (Lamarck, 1822); *Purpura bufo* (Lamarck, 1822) / None.

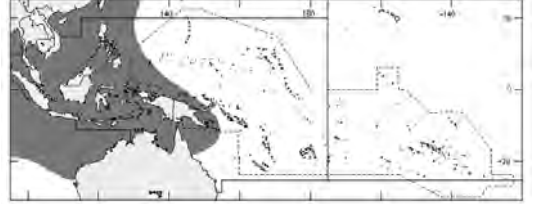
En - Toad purpura; **Fr** - Pourpre crapaud.

Maximum shell length 8 cm, commonly to 6 cm. On littoral rocks in sandy pools, and in estuaries. Preys on oysters and barnacles. Females usually gather for spawning, depositing the stalked egg capsules together in large sheets. Collected for food at low tide, where common. An important species in India. Widespread in the Indo-West Pacific, from East and South Africa to Papua New Guinea; north to Japan and south to Queensland.



ventral view

(after Short and Potter, 1987)

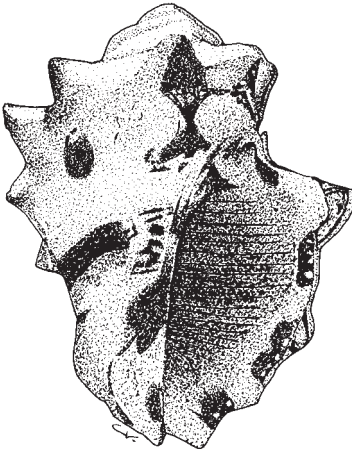


Thais tuberosa Röding, 1798

Frequent synonyms / misidentifications: *Mancinella tuberosa* (Röding, 1798); *Thais pica* (Blainville, 1832) / None.

En - Tuberosa rock shell; **Fr** - Pourpre tubéreuse.

Maximum shell length 6 cm, commonly to 5 cm. On rocks and coral reefs, near the open sea. Intertidal and shallow subtidal waters. Collected at low tide for subsistence. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Mascareign Islands, to eastern Polynesia; north to Japan and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

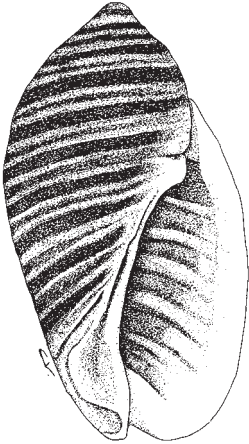


Vexilla vexillum (Gmelin, 1791)

Frequent synonyms / misidentifications: *Purpura vexillum* (Gmelin, 1791) / None.

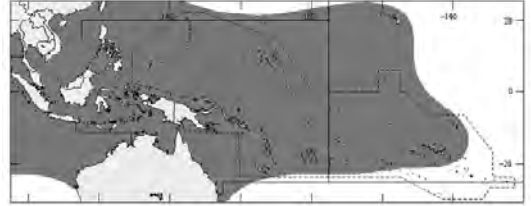
En - Vexillate jopas; **Fr** - Jopas vexillaire

Maximum shell length 3 cm, commonly to 2.5 cm. On rock and coral reef areas. Low tidal zone and shallow subtidal waters. Living parasitically on sea urchins on which they feed by protruding a long snout between the spines. Often collected for its brightly coloured shell. Used also as food in Indochinese countries. Widespread in the Indo-West Pacific, from East and South Africa to eastern Polynesia; north to Japan and Hawaii, and south to northern New South Wales.



ventral view

(after Kilburn and Rippey, 1982)

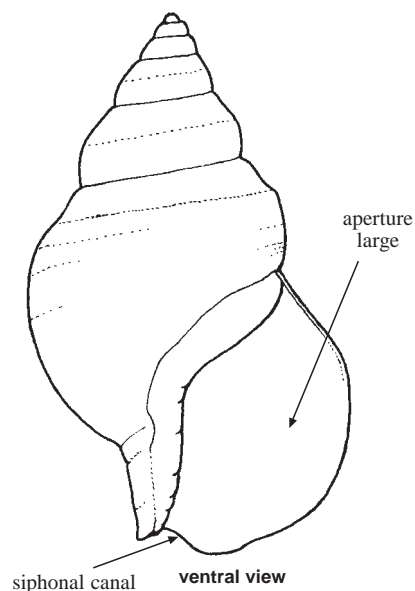


BUCCINIDAE

Whelks

Diagnostic characters: Shell globose, ovate-conical to fusiform in shape, generally with a fairly high spire and large body whorl. Outer surface smooth or with axial and spiral elements of sculpture; without axial varices and developed spines. Periostracum usually prominent. Aperture ovate to rounded, anterior siphonal canal broadly open and short. Operculum corneous, with its nucleus near the anterior end or submedian. Head with long snout and eyes at the outer bases of the tentacles. Foot large, broad and truncate anteriorly. Fleishy siphon well developed.

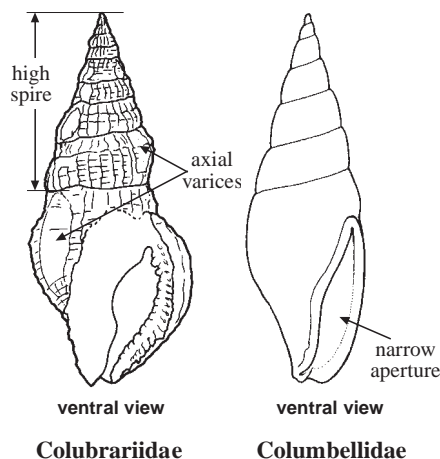
Habitat, biology, and fisheries: This large family contains numerous species living in various boreal, temperate and tropical environments, from intertidal and shallow waters to depths of more than 3 000 m. Mostly carnivores and scavengers, feeding on worms or other molluscs, or on dead fishes and crabs. Sexes separate, fertilization internal. Eggs laid in horny capsules, either singly or in masses. In capsules, some eggs may provide food for the developing embryos. Hatching occurring generally at the crawling stage, but a planktonic free-swimming larval stage may exist in some species. In the area, as well as in other parts of the world, the flesh is served for food and the shell is utilized in the shellcraft industries. Caught by fishermen in traps baited with fish heads or putrid meat.



Similar families occurring in the area

Colubrariidae: spire high, with many whorls; axial varices present; aperture short.

Columbellidae: aperture narrow, inner and/or outer lips denticulate; operculum small to absent. (Best distinguishable on the basis of radular characters).



Key to species of interest to fisheries occurring in the area

- 1a. Outer surface of shell smooth and polished → 2
- 1b. Outer surface of shell with conspicuous spiral ribs *Cantharus undosus*
- 2a. Body whorl with distinct, large brown spots; spire whorls with 1 row of such spots *Babylonia areolata*
- 2b. Body whorl with indistinct yellowish bands and spots; spire whorls with whitish spots on the shoulder *Babylonia lutosa*

List of species of interest to fisheries occurring in the area

The symbol is given when species accounts are included.

- Babylonia areolata* (Link, 1807)
- Babylonia lutosa* (Lamarck, 1822)
- Cantharus undosus* (Linnaeus, 1758)

References

Cernohorsky, W.O. 1971. Indo-Pacific Pisaniinae (Mollusca: Gastropoda) and related buccinid genera. *Rec. Auckl. Inst. Mus.*, 8:137-167.

Habe, T. 1965. Notes on the ivory shell genus *Babylonia* Schlüter (Mollusca). *Bull. Nat. Sci. Mus.*, 8(2):115-124.

Babylonia areolata (Link, 1807)

Frequent synonyms / misidentifications: None / *Babylonia spirata* (Linnaeus, 1758).

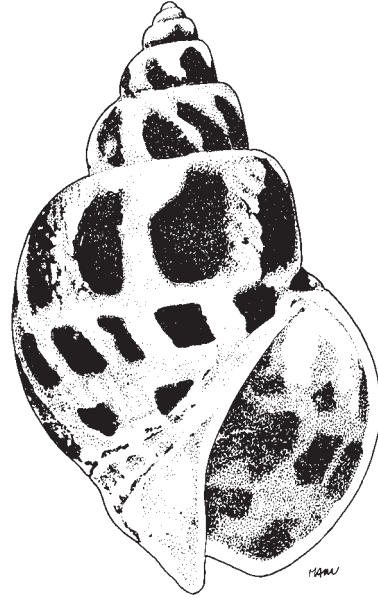
FAO names: En - Maculated ivory whelk; Fr - Buccin à carreaux.

Diagnostic characters: Shell rather thin but solid, elongate-ovate in shape, with a high, conical spire and large, inflated body whorl. Spire whorls convex, distinctly shouldered below the sutures. Outer surface smooth and polished, under the prominent, velvety periostracum. Aperture large and ovate, somewhat pointed at posterior end, with a broadly open and short siphonal canal anteriorly. Outer lip rather thin, inner lip more or less thickened and calloused. Umbilicus deeply perforated, surrounded by a well-marked siphonal ridge. Operculum large and thick, with its nucleus near the anterior end. **Colour:** outside of shell white, with 3 spiral rows of large, squarish brown spots on body whorl, and 1 row of such spots on spire whorls. Periostracum brownish. Inner side of the aperture purplish white, with the outer colour pattern showing through.

Size: Maximum shell length 6.5 cm, commonly to 5 cm.

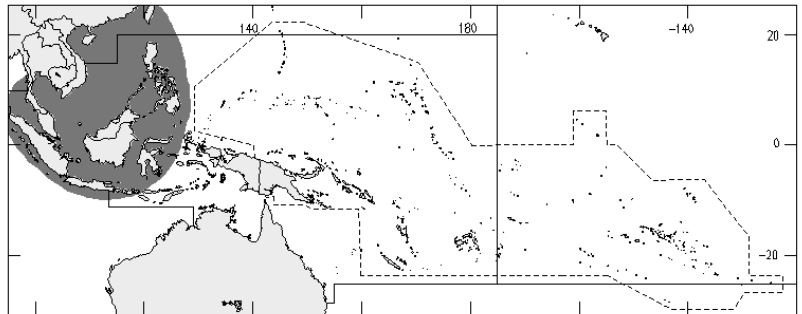
Habitat, biology, and fisheries: On sand and mud bottoms. Sublittoral, mainly between depths of 10 and 20 m. An economically important species in Thailand.

Distribution: Eastern part of the Indian Ocean, from the Andaman Sea to Indonesia; north to Taiwan Province of China and south to southern Indonesia.



ventral view

(after Habe, 1965)

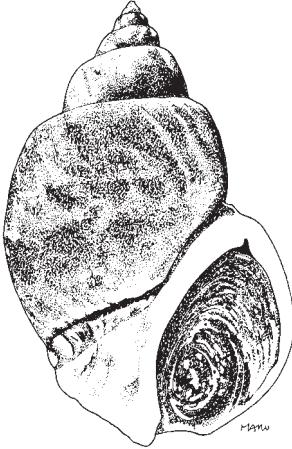


Babylonia lutosa (Lamarck, 1822)

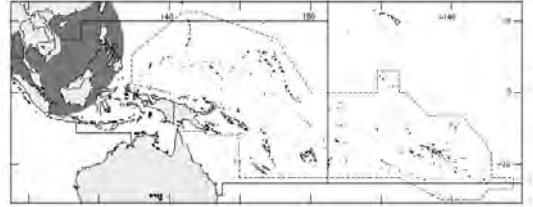
Frequent synonyms / misidentifications: None / *Babylonia spirata* (Linnaeus, 1758).

En - Mud ivory whelk; **Fr** - Buccin de vase.

Maximum shell length 6.5 cm, commonly to 5 cm. On mud bottoms. Sublittoral, to a depth of about 20 m. No data on fisheries in the area. This species is imported in Japan from Taiwan Province of China and adjacent countries, as a substitute for the overexploited *Babylonia japonica* (Reeve, 1842). Indo-West Pacific, from Sri Lanka to Indonesia and Taiwan Province of China.



ventral view
(after Habe, 1965)

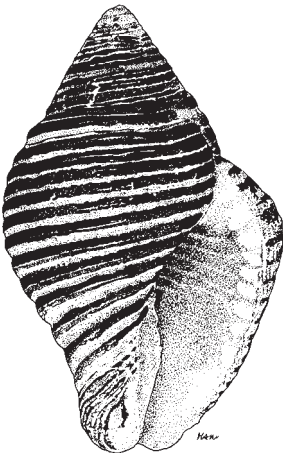


Cantharus undosus (Linnaeus, 1758)

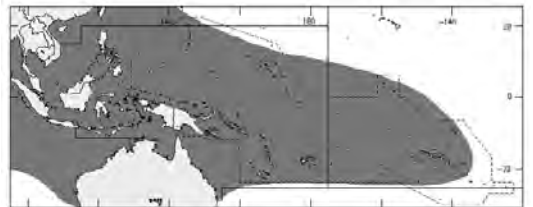
Frequent synonyms / misidentifications: *Pollia undosa* (Linnaeus, 1758) / None.

En - Waved goblet; **Fr** - Buccin houleux.

Maximum shell length 4 cm, commonly to 3 cm. On muddy rocks or in sand, under dead corals, in reef areas. Intertidal and shallow subtidal zones. Locally collected where abundant. Indo-West Pacific, from the Mascareign Islands and the Gulf of Oman to eastern Polynesia; north to Japan and south to southern Queensland.



ventral view
(after Short and Potter, 1987)



COLUMBELLIDAE

(= Pyrenidae)

Dove shells

Diagnostic characters: Shell generally **small, fusiform to biconical** in shape, with a conical, more or less elongate spire. Outer surface without axial varices, ribbed or smoothish, **often boldly coloured**. Periostracum variably developed to absent. **Aperture long and narrow, with a rather short, anterior siphonal canal**. Outer lip commonly thick, smooth or denticulate inside, sometimes with a shallow groove or slit posteriorly. **Inner lip** smooth or denticulate, but **not folded**. **Operculum corneous, thin and small** to absent, with an apical nucleus. Head with long and slender tentacles, bearing eyes at their outer bases. Foot rather strong and narrow, pointed behind. Fleshy siphon very long.

Habitat, biology, and fisheries: Very active, omnivorous crawlers, living in warm temperate and tropical marine environments. Often abundant in intertidal and shallow subtidal zones. Sexes separate, fertilization internal. Eggs protected by corneous capsules attached singly or in groups to the substrate by a flat basal disc. Hatching as free-swimming planktonic larvae, or directly as crawling juveniles. Though sometimes used as food, dove shells are mainly collected for their brightly coloured, elegant shells.

Similar families occurring in the area

Buccinidae: aperture rather wide, lips usually not denticulate inside (best distinguishable on the basis of radular characters).

Nassariidae: a deep groove at the base of the shell; siphonal canal very short; inner lip often with a strong callus, sometimes forming an extensive shield.

Reference

Tryon, G.W. Jr. 1883. *Manual of conchology: structural and systematic. With illustrations of the species. Vol.V. Columbelloidae*. Philadelphia, Academy of Natural Sciences, pp. 100-198.

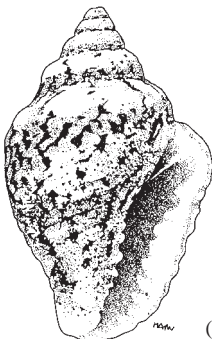
A single species of interest to fisheries in the area

Pyrene scripta (Lamarck, 1822)

Frequent synonyms / misidentifications: *Columbella scripta* Lamarck, 1822; *Euplica versicolor* (Sowerby, 1832); *Pyrene versicolor* (Sowerby, 1832) / None.

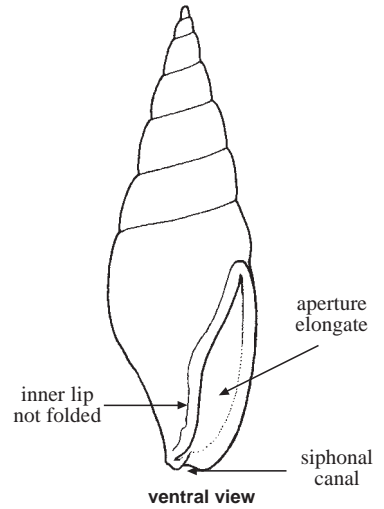
En - Dotted dove shell; **Fr** - Colombelle bigarrée.

Maximum shell length 2 cm, commonly to 1.5 cm. Among stones and weeds, common in coral reef areas. Intertidal and shallow subtidal waters. Regularly collected in the northern Philippines. The shell is used commonly to make decorative items. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and Hawaii, and south to New South Wales.

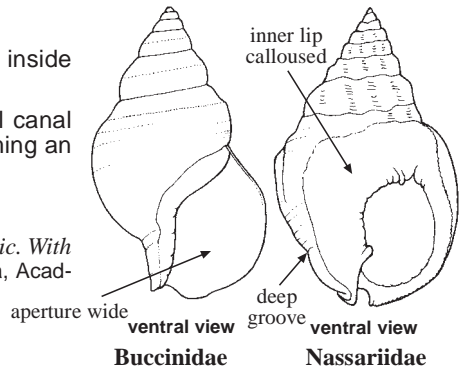


ventral view

(after Short and Potter, 1987)

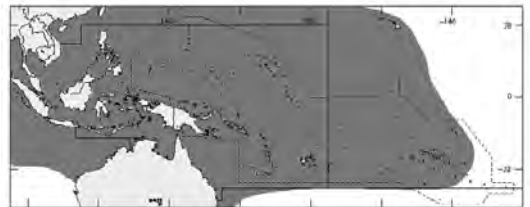


ventral view



Buccinidae

Nassariidae

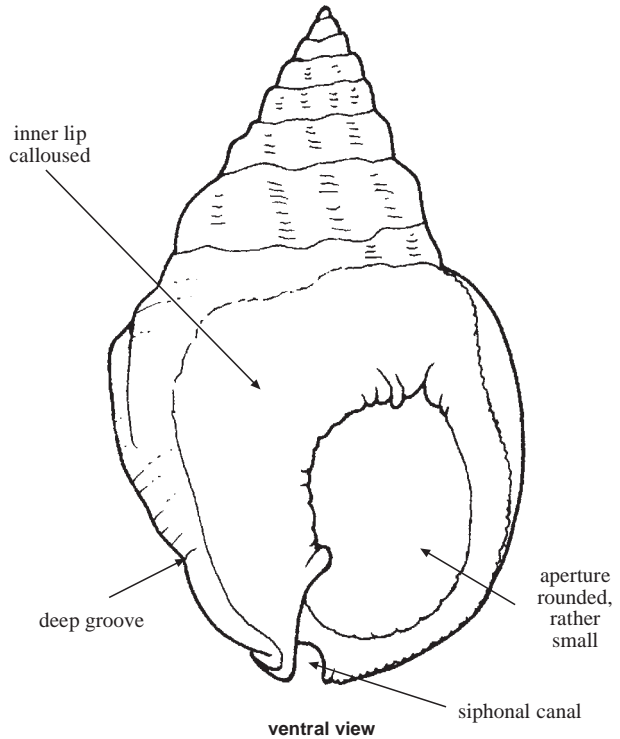


NASSARIIDAE

Nassa mud snails

Diagnostic characters: Shell ovately rounded, usually with a fairly high, conical spire and large body whorl anteriorly bordered by a strong spiral groove. Outer surface sculptured with axial ribs and spiral cords, sometimes smooth. No umbilicus. Aperture rather small and irregularly rounded, with a very short, recurved siphonal canal. Outer lip often somewhat thickened, smooth or denticulate inside, sometimes with a shallow groove or slot posteriorly. Inner lip smooth or weakly ridged but not folded, calloused and more or less expanded into a smooth shield. Operculum corneous, smaller than the aperture, with a subterminal nucleus and often serrate along margins. Head with long and slender tentacles bearing eyes on swellings at their outer bases. Snout long and extensible. Foot large, with lateral points anteriorly and typically a pair of posterior tentacles. Fleshy siphon very long.

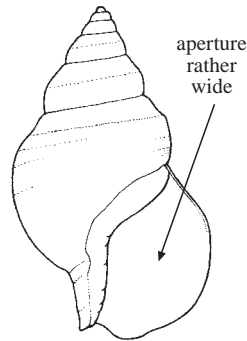
Habitat, biology, and fisheries: Most common on intertidal and sublittoral, temperate to tropical, soft bottoms, in marine or brackish water environments. Mainly carrion-feeding, active animals. Can slide rapidly on sand or mud, with the fleshy siphon expanded as they search for food, or quickly bury themselves in the substrate. Often living in colonies. Sexes separate, fertilization internal. Eggs laid in corneous capsules, usually hatching as free-swimming larvae that persist relatively long (for 1 or 2 months) in the plankton before settlement. Though abundant, Nassariidae are not much exploited in the area. They can be locally used as food or bait by coastal populations, and the shells are utilized in shellcraft. Sometimes found on local markets in the northern Philippines.



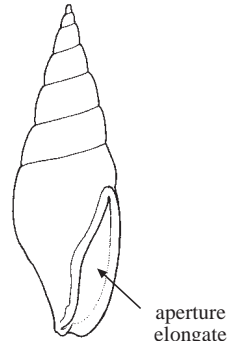
Similar families occurring in the area

Buccinidae: aperture rather wide; outer sculpture, when developed, essentially concentric.

Columbellidae: no deep groove at base of shell; aperture elongate; inner lip without an extensive callus.



ventral view
Buccinidae



ventral view
Columbellidae

Key to species of interest to fisheries occurring in the area

- 1a. Columellar callus large, forming a smooth shield over the ventral side of shell → 2
- 1b. Columellar callus narrow, not forming a smooth shield over the ventral side of shell → 3

2a. Spire whorls with thick axial ribs; columellar callus very wide on mature specimens, forming a flat base with a thickened outer rim (Fig. 1)

. *Nassarius arcularius*

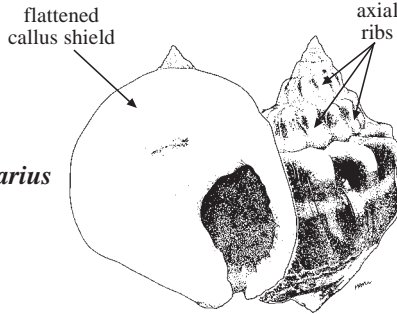


Fig. 1 *Nassarius arcularius*

2b. Spire whorls with prominent shoulder nodules; columellar callus wrapped around the ventral side of body whorl, not forming a flat base (Fig. 2)

. *Nassarius coronatus*

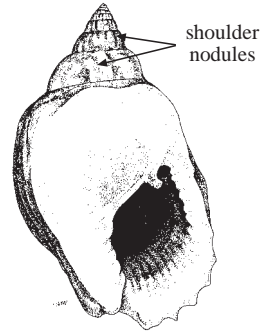


Fig. 2 *Nassarius coronatus* (ventral view)

3a. Outer lip not backed by a varix; outer surface ornamented with fine spiral brown lines (Fig. 3)

. *Nassarius glans*

3b. Outer lip backed by a varix (Fig. 4a); outer surface not ornamented with spiral brown lines → 4

4a. Later spire whorls and body whorl smooth and glossy, with only spiral grooves at the anterior end (Fig. 4)

. *Nassarius dorsatus*

4b. Spire and body whorl with both axial and spiral sculpture of ribs and cords (Fig. 5)

. *Nassarius crematus*

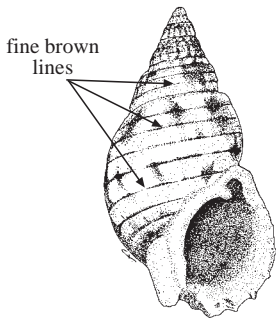
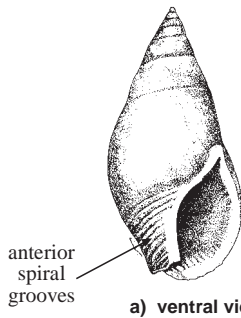
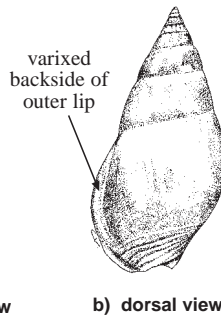


Fig. 3 *Nassarius glans* (ventral view)



a) ventral view



b) dorsal view

Fig. 4 *Nassarius dorsatus*

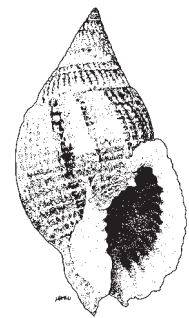







Fig. 5 *Nassarius crematus* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Nassarius arcularius* (Linnaeus, 1758)
-  *Nassarius coronatus* (Bruguière, 1789)
-  *Nassarius crematus* (Hinds, 1844)
-  *Nassarius dorsatus* (Röding, 1798)
-  *Nassarius glans* (Linnaeus, 1758)

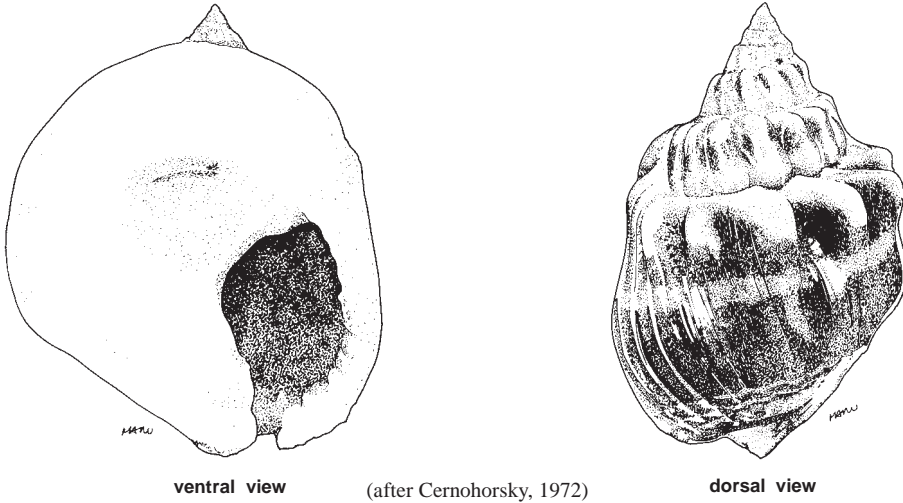
References

Cernohorsky, W.O. 1972. Indo-Pacific Nassariidae (Mollusca: Gastropoda). *Rec. Auckl. Inst. Mus.*, 9:125-194.
 Cernohorsky, W.O. 1984. Systematics of the family Nassariidae. *Bull. Auckl. Inst. Mus.*, 9:1-356.

Nassarius arcularius (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Nassa arcularia* (Linnaeus, 1758); *Nassarius plicatus* (Röding, 1798) / *Nassarius coronatus* (Bruguière, 1789).

FAO names: En - Cake nassa; Fr - Nasse coffret.

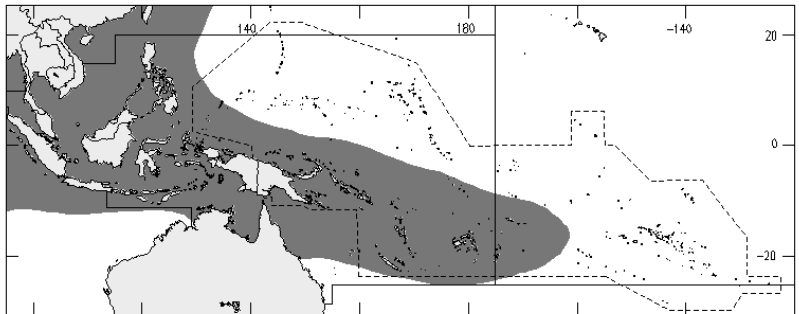


Diagnostic characters: Shell stout and solid, with a fairly high, stepped spire, an inflated, dorsally humped, body whorl and a broadly calloused ventral side. Spire whorls with coarse axial ribs and shallow spiral grooves, forming a granulated pattern towards the apex. Dorsal side of body whorl with reduced spiral ribbing, a row of heavy nodules on the shoulder and a few spiral cords at the base. Aperture conspicuously lirate inside. Inner lip with a prominent tooth-like nodule posteriorly and some small ridges anteriorly. Columellar callus very thick and wide in mature specimens, broadly confluent with the thickened outer lip, and forming a flat base with thickened outer rim over most of ventral side of shell. Operculum with serrated margin. **Colour:** outside of shell cream, yellow or greyish brown, often with a median spiral band of brown and brown spots between the shoulder nodules. Interior of the aperture uniformly creamy yellow or banded with purplish brown. Outer lip and ventral callus glossy white.

Size: Maximum shell length 4 cm, commonly to 3 cm.

Habitat, biology, and fisheries: On clean sand bottoms, often associated with coral reefs. Intertidal and shallow subtidal zones. Sometimes found in local markets, notably in the northern Philippines.

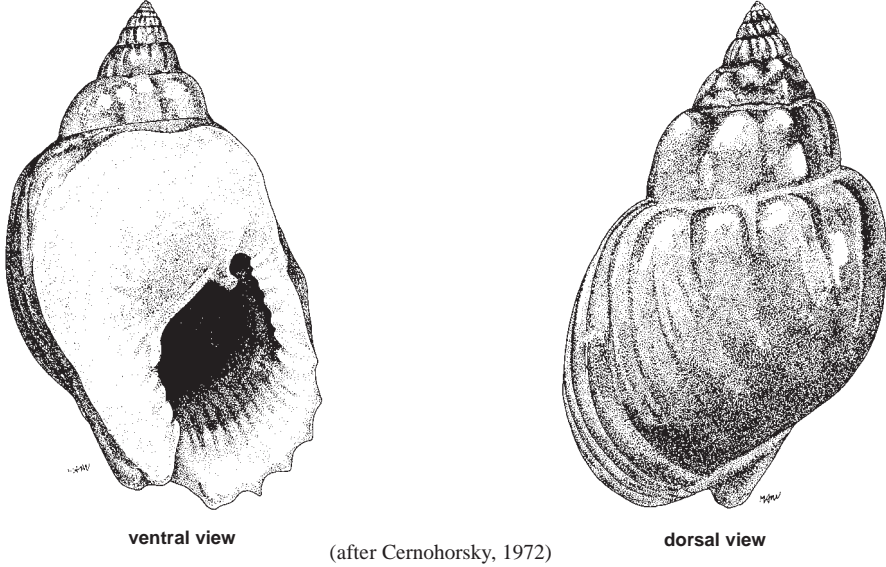
Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar, the Red Sea and the Persian Gulf, to western Polynesia; north to Japan and south to central Queensland and New Caledonia.



Nassarius coronatus (Bruguière, 1789)

Frequent synonyms / misidentifications: *Arcularia coronata* (Bruguière, 1789); *Nassa coronata* (Bruguière, 1789) / None.

FAO names: En - Coronate nassa; Fr - Nasse couronnée.

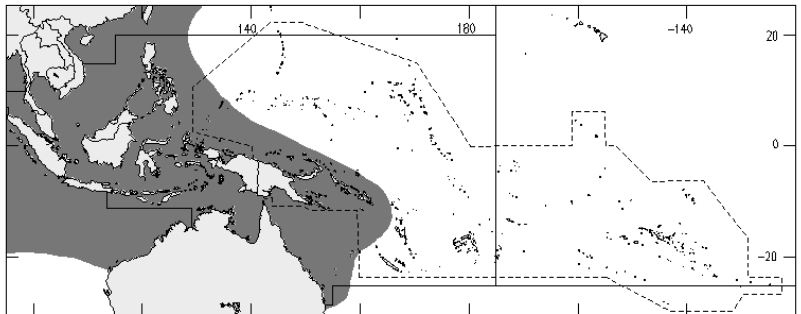


Diagnostic characters: Shell squat and thick, with a fairly high, stepped spire and inflated body whorl. Early spire whorls with intersecting axial and spiral cords, giving a granulated pattern. Later whorls smooth, but for a row of prominent rounded nodules on the shoulder and a few spiral cords at the base of body whorl. Aperture lirate inside, outer lip thickened and often with a few small spines on its anterior outer edge in mature specimens. Inner lip with a prominent tooth-like nodule posteriorly. **Columellar callus** thick, forming a smooth shield wrapped around ventral side of body whorl and posteriorly connected to the outer lip. Operculum with serrated margin. **Colour:** outside of shell variously coloured, cream to tan, grey or brown, often with lighter and darker spiral bands. Shoulder nodules pale, with dark interstices. Aperture purplish brown inside, frequently with 2 pale spiral lines. Outer lip and ventral callus glossy white.

Size: Maximum shell length 3.5 cm, commonly to 2.5 cm.

Habitat, biology, and fisheries: On sandy to silty bottoms. Intertidal and shallow sublittoral zones, to a depth of about 10 m. Occasionally present in local markets, especially in the northern Philippines where it is sold mixed with other species of small gastropods.

Distribution: Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar and the Red Sea, to Melanesia; north to southern Japan and south to southern Queensland.

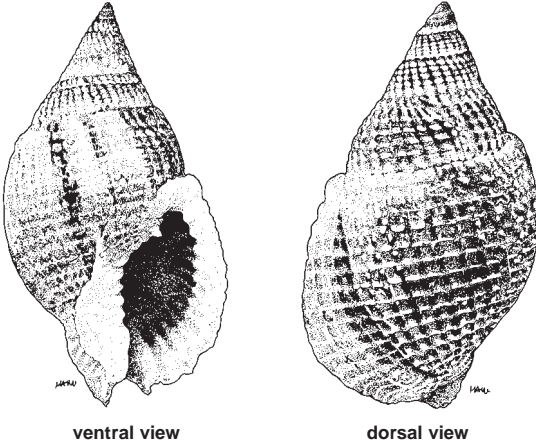


***Nassarius crematus* (Hinds, 1844)**

Frequent synonyms / misidentifications: *Nassa crenata* Hinds, 1844 (Spelling error); *Nassarius siquijorensis* (A. Adams, 1852); *Zeuxis crematus* (Hinds, 1844) / *Nassarius caelatus* (A. Adams, 1852); *N. dorsatus* (Röding, 1798).

En - Burned nassa; **Fr** - Nasse brûlée.

Maximum shell length 4 cm, commonly to 3 cm. On fine sandy or muddy bottoms. Intertidal, sublittoral and shelf zones to a depth of about 200 m. Often occurring in rather large populations. Occasionally used as food. Shell utilized in shellcraft. Widespread in the Indo-West Pacific, from East Africa to Hawaii; north to Japan and south to central Queensland.



(after Cernohorsky, 1972)

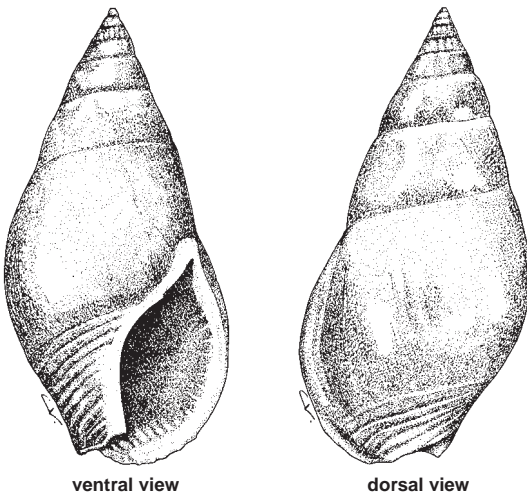


***Nassarius dorsatus* (Röding, 1798)**

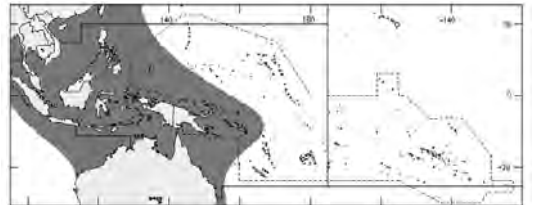
Frequent synonyms / misidentifications: *Nassa canaliculata* (Lamarck, 1822); *Tarazeuxis unicolorus* (Kiener, 1841); *Zeuxis dorsata* (Röding, 1798) / None.

En - Channeled nassa; **Fr** - Nasse canaliculée.

Maximum shell length 4.5 cm, commonly to 3.5 cm. Very common on muddy sand flats. Locally collected as food and for the shell, which is utilized in shellcraft. Eastern part of the Indian Ocean and the tropical West Pacific, from the Andaman Sea to Melanesia; north to Japan and south to northern New South Wales.



(after Cernohorsky, 1972)

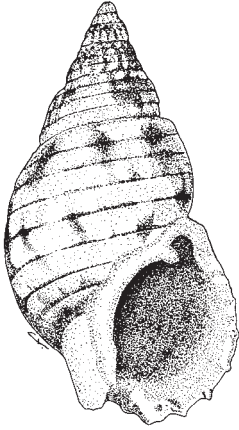


Nassarius glans (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Alectrion glans* (Linnaeus, 1758); *A. suturalis* (Lamarck, 1822); ? *Arcularia particeps* Hedley, 1915; *Nassa glans* (Linnaeus, 1758) / None.

En - *Glans nassa*; **Fr** - *Nasse rayée*.

Maximum shell length 5.5 cm, commonly to 4 cm. Abundant on sandy bottoms. Intertidal and sublittoral zones to a depth of about 20 m. Sometimes used as food, but mainly collected for its elegantly coloured shell. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and south to southern Queensland and New Caledonia. The form occurring in the southern half of Australia (*Nassarius particeps* (Hedley, 1915)) may represent a distinct subspecies or species.



ventral view

(after Cernohorsky, 1972)

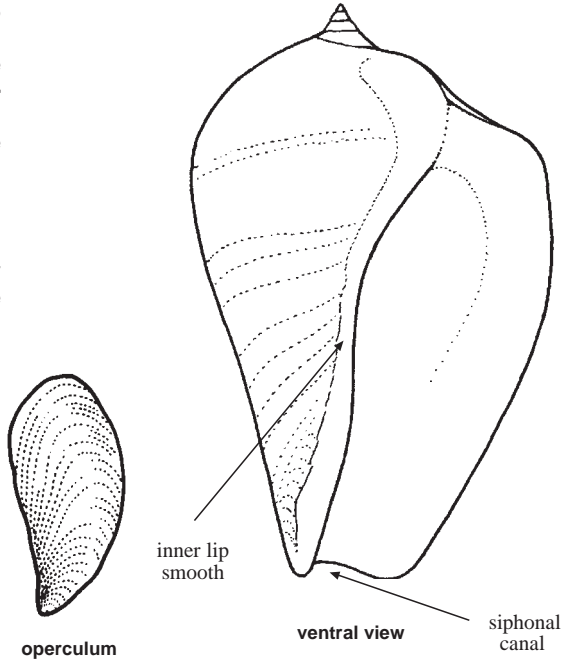


MELONGENIDAE

Melongenas

Diagnostic characters: Shell pear-shaped to fusiform in outline, with variously developed spire and expanded body whorl. Outer surface often more or less nodular to spiny on the shoulder of the whorls, with spiral cords and sometimes axial ridges. Periostracum thick. Aperture large and ovate, anteriorly narrowing into an open, short to long, siphonal canal. Columella smooth. Operculum thick and corneous, claw-shaped, with an apical nucleus. Head long and narrow, with moderately short tentacles bearing eyes at their bases, and a very long, extensible snout. Foot large and powerful.

Habitat, biology, and fisheries: On sand and mud bottoms, in marine and brackish waters. Common in littoral and shallow sublittoral zones, but also in deeper areas of the continental shelf. Mainly feeding on bivalves and various carrion. Sometimes considered as pests, when occurring in commercial beds of clams and oysters. Sexes separate, fertilization internal. Eggs laid in clusters or strings, hatching generally as crawling juveniles. Marketed and used for food in various areas of the western Pacific, the empty shells being often utilized for making lime.



Similar families occurring in the area

Fascioliariidae: generally distinguishable by the longer and slender siphonal canal, low folds on columella and the bright red coloration of the animal.

Key to species of interest to fisheries occurring in the area

- 1a. Shell relatively small (up to 8 cm in length), spinose at the suture; siphonal canal short (Fig. 1) Volema myristica
1b. Shell relatively large (up to 12 cm in length, or more), not spinose at the suture; siphonal canal moderately long to long -> 2
2a. Shell broadly fusiform in outline; siphonal canal moderately long (Fig. 2) Pugilina cochlidium
2b. Shell elongate-fusiform in outline; siphonal canal long. -> 3

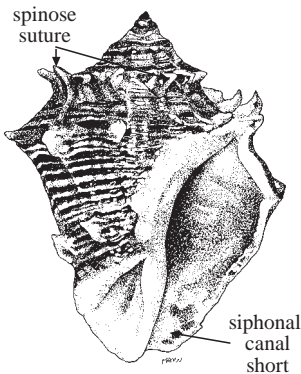
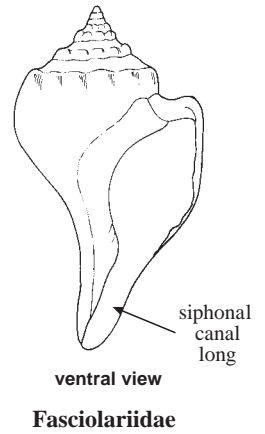


Fig. 1 Volema myristica (ventral view)

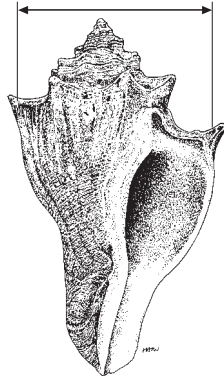


Fig. 2 Pugilina cochlidium (ventral view)

- 3a. Shoulder of body whorl rounded, with obsolete nodules (Fig. 3) *Pugilina colosseus*
- 3b. Shoulder of body whorl angulate, with acute nodules (Fig. 4) *Pugilina ternatana*

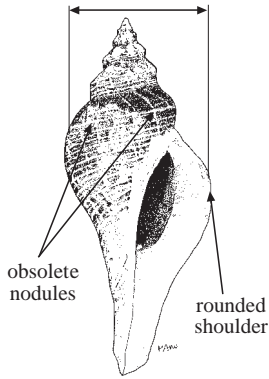


Fig. 3 *Pugilina colosseus* (ventral view)

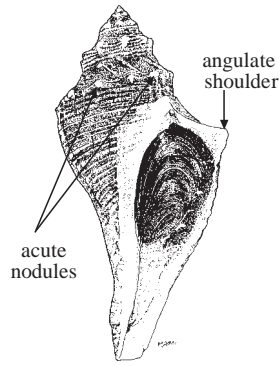






Fig. 4 *Pugilina ternatana* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Pugilina cochlidium* (Linnaeus, 1758)
-  *Pugilina colosseus* (Lamarck, 1816)
-  *Pugilina ternatana* (Gmelin, 1791)
-  *Volema myristica* (Röding, 1798)

References

Harasewich, M.G. and R.E. Petit. 1989. The nomenclatural status and phylogenetic affinities of *Syrinx aruanus* Linné, 1758 (Prosobranchia: Turbinellidae). *Nautilus*, 103(2):83-84.

Okutani, T., M. Tagawa, and H. Horikawa. 1988. *Gastropods from continental shelf and slope around Japan. The intensive research of unexploited fishery resources on continental slopes*. Tokyo, Japan Fisheries Resource Conservation Association, 203 p.

Pugilina cochlidium (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Hemifusus pugilinus* (Born, 1778); *Melongena pugilina* (Born, 1778); *Volegalea wardiana* Iredale, 1938; *Volema cochlidium* (Linnaeus, 1758) / None.

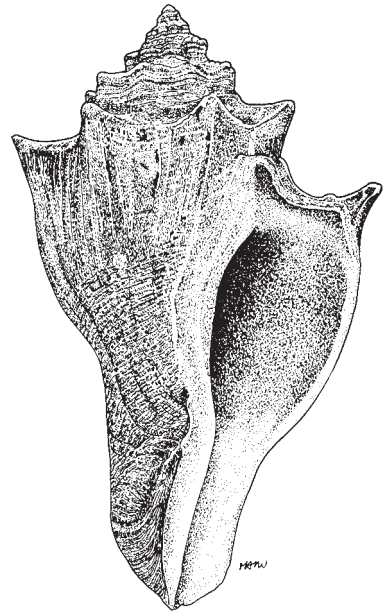
FAO names: En - Spiral melongena; Fr - Mélongène spirallée.

Diagnostic characters: Shell relatively large (up to 15 cm long), solid and heavy, **broadly fusiform** in outline and markedly longer than wide. **Spire** conical and moderately tall, **with angulate shoulders** and deeply incised sutures. Spire whorls sculptured with many fine and rough spiral cords, and with broad axial folds **bearing bluntly spinose nodules** at shoulder of later whorls. **Body whorl** well inflated in its median part, **with a distinctly concave shoulder slope**, rather **prominent shoulder nodules** and **with spiral cording mainly developed on its anterior half**. Periostracum thick and finely wrinkled, becoming somewhat hairy on shoulder slope. Aperture elongate-ovate but rather wide, anterior **siphonal canal broad and moderately long**. Outer lip of aperture angulate at shoulder, strongly sinuated posteriorly, broadly convex anteriorly and with obscure denticulation at inner edge. Inner lip smooth and calloused, often somewhat detached from shell surface anteriorly and along the siphonal canal, then forming an elongate umbilical slit. **Colour:** **outside** of shell **beige to fawn or purplish brown** under a dull, olive brown periostracum, occasionally with obscure darker brown spiral banding. **Aperture polished orange cream**, sometimes dark brown marginally.

Size: Maximum shell length 15 cm, commonly to 12 cm.

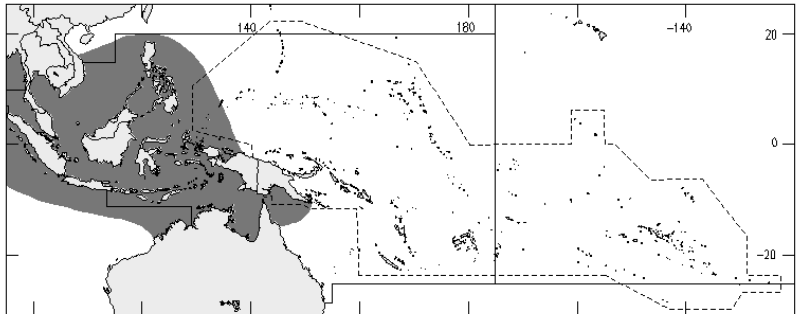
Habitat, biology, and fisheries: In muddy areas, often in brackish waters, near estuaries and mangroves. Sometimes very common near bivalve beds on which they prey. Intertidal and shallow subtidal zones. Frequently appearing in local markets of Indonesia, Malaysia, and the Philippines. In the latter country, the meat is cooked and eaten plain or with a sauce or vegetables. The shell is utilized for making lime.

Distribution: Indo-West Pacific, from Sri Lanka to Papua New Guinea; north to the Philippines and south to northern Queensland.



ventral view

(after Short and Potter, 1987)



***Volema myristica* (Röding, 1798)**

Frequent synonyms / misidentifications: *Melongena galeodes* (Lamarck, 1822) / None.

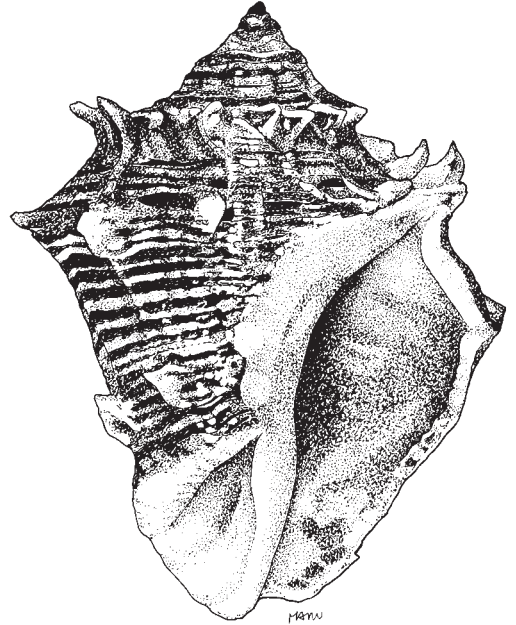
FAO names: En - Nutmeg melongena; Fr - Mélongène muscade.

Diagnostic characters: Shell relatively small (up to 8 cm long), solid and heavy, **very variable, roughly biconical and quite short** in shape, being only somewhat longer than wide. Spire conical and moderately tall, body whorl capacious, progressively narrowing toward the anterior end of shell. **Spire** whorls sculptured with axial folds, weaker interstitial threads and rather thick spiral cords, **nodulose in the apical region, becoming spinose at the sutures of later whorls**. Sculpture of **body whorl** variable, the axial folds low, with strong knobs to acute spines at the shoulder, and **with an occasional spiral row of spines around the base**. **Aperture** widely ovate, **narrowing anteriorly in a broad and short siphonal canal**. Inner lip smooth, heavily glazed, recurved over a deeply channeled umbilicus which is bordered posteriorly by a stout oblique ridge. Outer lip of aperture thick, angulate at the shoulder and weakly lirate interiorly. **Colour:** **outside** of shell **variable** under a yellowish brown periostracum, from **off-white to pale brown or orange, with or without a dense spiral banding of darker brown**. Calloused inner lip, umbilical area and **aperture white to orange**, sometimes with obscure brown bands inside the outer lip.

Size: Maximum shell length 8 cm, commonly to 7 cm.

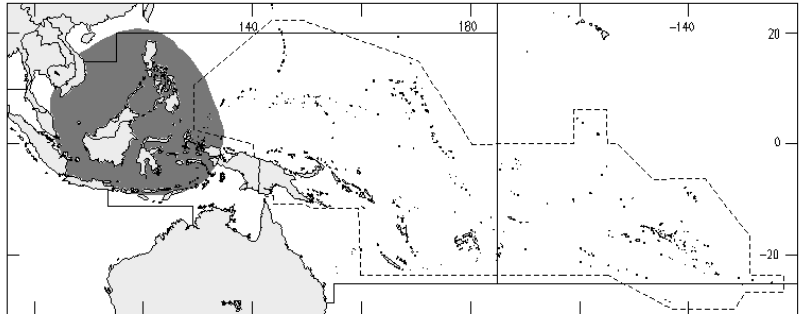
Habitat, biology, and fisheries: Common in sandy mud areas, often in nearly brackish waters and near bivalve beds on which they feed. Intertidal and shallow subtidal zones. Frequently appearing in local markets of the Philippines. The flesh is eaten steamed or boiled, and the empty shell used for making lime.

Distribution: Restricted to the tropical West Pacific, from Indonesia to the Philippines.



ventral view

(after Springsteen and Leobrera, 1986)

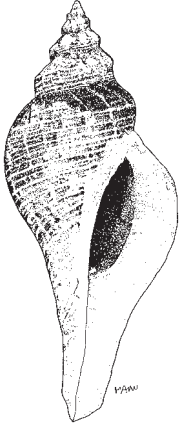


***Pugilina colosseus* (Lamarck, 1816)**

Frequent synonyms / misidentifications: *Hemifusus colosseus* (Lamarck, 1816) / None.

En - Colossal melongena; **Fr** - Mélongène colossale.

Maximum shell length 25 cm, commonly to 20 cm. On soft bottoms of the infralittoral zone, to depths of about 50 m. Incidental bycatch of shrimp trawlers, may represent a potential resource in Southeast Asia. Restricted to the tropical West Pacific, from Indonesia to the Philippines and East China Sea.

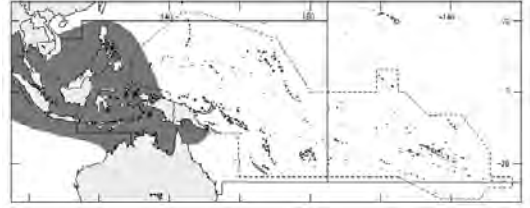


ventral view



dorsal view

(after Okutani et al., 1988)

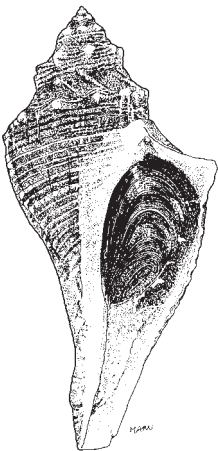


***Pugilina ternatana* (Gmelin, 1791)**

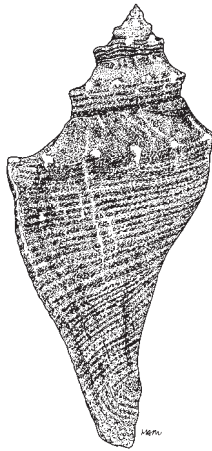
Frequent synonyms / misidentifications: *Hemifusus ternatanus* (Gmelin, 1791) / *Pugilina tuba* (Gmelin, 1791).

En - Ternate melongena; **Fr** - Mélongène ternée.

Maximum shell length 15 cm, commonly to 12 cm. Common on soft bottoms. Sublittoral and offshore, mainly at depths between 10 to 50 m. Trawled for food in Japan and neighbouring areas. Of potential interest in the Southeast Asian region. Restricted to the tropical West Pacific and eastern Indian Ocean, probably from the Andaman Sea to eastern Indonesia; north to Japan and south to Indonesia. There has been much confusion in the identification of *Pugilina ternatana*, which belongs to a group of closely related species which is in need of a systematic revision.

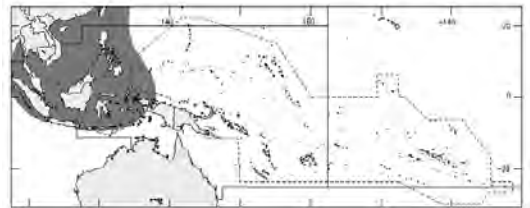


ventral view



dorsal view

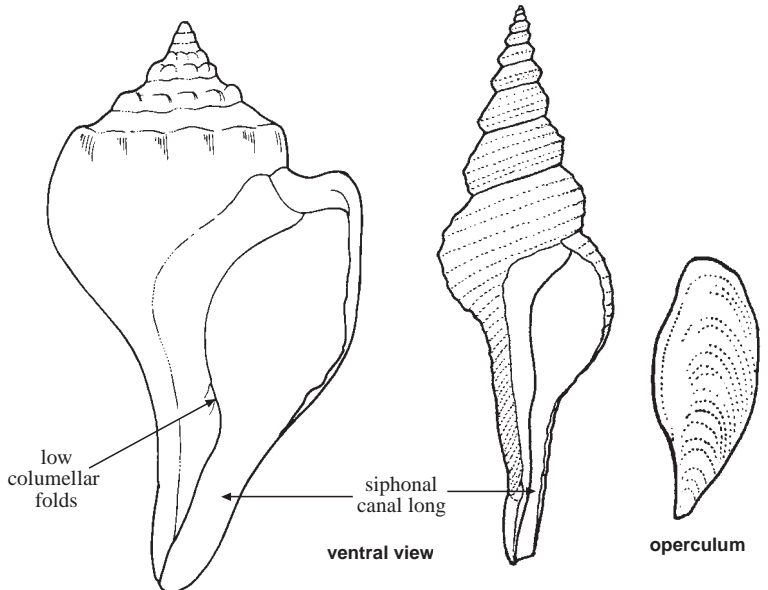
(after Okutani et al., 1988)



FASCIOLARIIDAE

Horse conchs, spindle shells

Diagnostic characters: **Shell** more or less elongate, **fusi-form**, with a generally elevated spire and a **well-developed**, sometimes very long, **siphonal canal**. Sculpture variable, often strong and nodular or composed of spiral threads and axial ribs. Periostracum very thin to thick and fibrous. Aperture long and ovate. Outer lip smooth or with numerous inner spiral lirae. **Columella often with a few low basal threads**. **Operculum** thick and **corneous**, ovate to claw-shaped, with a terminal nucleus. **Soft parts** of the animal **brilliant scarlet**. Head small and narrow, with short tentacles bearing eyes on their outer bases. Snout extensible, very long. Foot bluntly truncate anteriorly. Fleshy siphon well developed.



examples showing diversity of shape

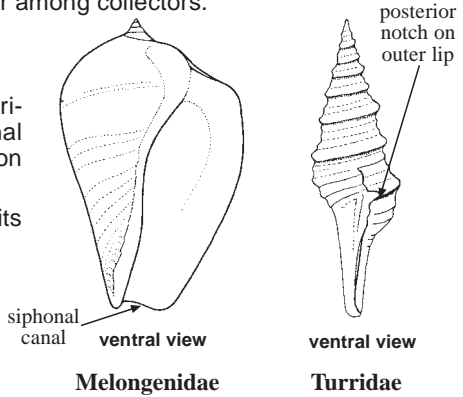
Habitat, biology, and fisheries:

Large members of the Fasciolaridae mainly occur on sublittoral bottoms of sand, mud or rubble, sometimes forming large populations. Active predators, feeding on tube worms, vermetid and other molluscs. Sexes separate, fertilization internal. Eggs produced in capsules typically anchored to the substrate by a thin stalk, and hatching often as crawling juveniles, but sometimes also as planktonic, free-swimming larvae. Shallow-water, rock-dwelling fasciolarids are collected at low tide by coastal people, while other species are sometimes trawled in large quantities on soft bottoms of the continental shelf. These represent a potential resource in some areas. Used as food and for the shell trade, their elegantly shaped shell being popular among collectors.

Similar families occurring in the area

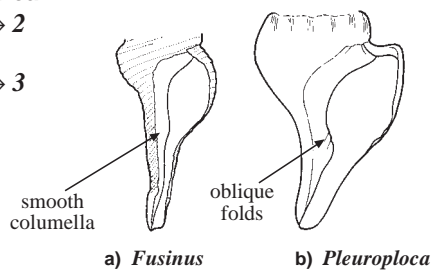
Melongenidae: sometimes convergent in shape with the Fasciolaridae, but usually distinguishable by the shorter and wider siphonal canal, the smooth inner lip and the absence of bright red coloration of the soft parts.

Turridae: outer lip of aperture with a notch-like sinus at or near its posterior end.



Key to species of interest to fisheries occurring in the area

- 1a. Columella without folds (Fig. 1a) → 2
- 1b. Columella with a few low oblique folds (Fig. 1b) → 3



a) *Fusinus* b) *Pleuroploca*

Fig. 1 ventral view of aperture

- 2a. Siphonal canal moderately long; shoulder nodules strong on body whorl; outer colour conspicuously blotched with brown throughout (Fig. 2) *Fusinus nicobaricus*
- 2b. Siphonal canal long; shoulder nodules low to obsolete on body whorl; brown patches, when present, mainly restricted to the interstices of nodules and tip of siphonal canal (Fig. 3) *Fusinus colus*
- 3a. Siphonal canal relatively short; shoulders rounded, not nodulose (Fig. 4) . . . *Latirolagena smaragdula*
- 3b. Siphonal canal relatively long; shoulders nodulose → 4

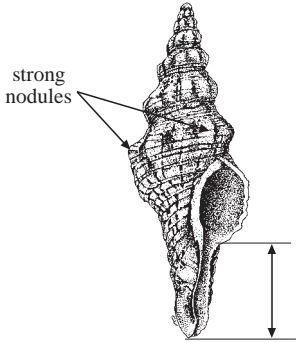


Fig. 2 *Fusinus nicobaricus* (ventral view)

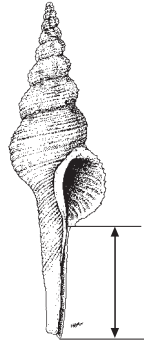


Fig. 3 *Fusinus colus* (ventral view)

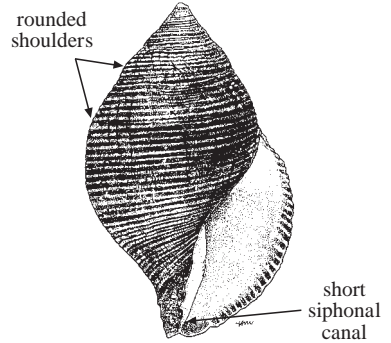


Fig. 4 *Latirolagena smaragdula* (ventral view)

- 4a. Shell relatively small (up to 9 cm in length); body whorl with 2 spiral rows of nodules (Fig. 5) *Latirus polygonus*
- 4b. Shell relatively large (up to 15 cm in length, or more); body whorl with only 1 spiral row of nodules → 5
- 5a. Shell very large (up to 28 cm in length), broadly fusiform in shape; shoulder angulate, with prominent nodules (Fig. 6) *Pleuroploca trapezium*
- 5b. Shell large (up to 15 cm in length), narrowly fusiform in shape; shoulder rounded, with low nodules (Fig. 7) *Pleuroploca filamentosa*

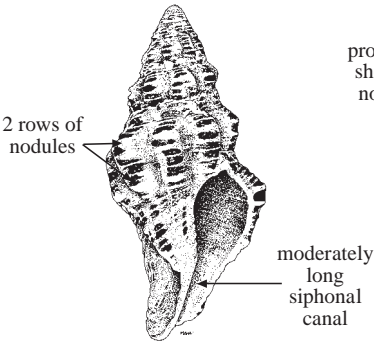


Fig. 5 *Latirus polygonus* (ventral view)

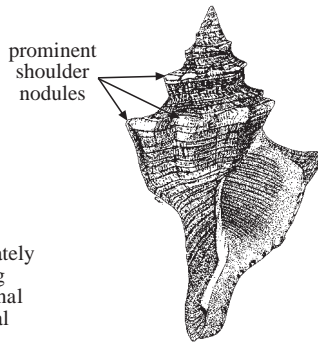


Fig. 6 *Pleuroploca trapezium* (ventral view)

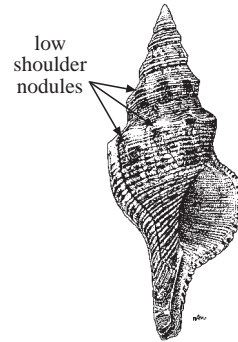








Fig. 7 *Pleuroploca filamentosa* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Fusinus colus* (Linnaeus, 1758)
-  *Fusinus nicobaricus* (Röding, 1798)
-  *Latirolagena smaragdula* (Linnaeus, 1758)
-  *Latirus polygonus* (Gmelin, 1791)
-  *Pleuroploca filamentosa* (Röding, 1798)
-  *Pleuroploca trapezium* (Linnaeus, 1758)

***Pleuroploca filamentosa* (Röding, 1798)**

Frequent synonyms / misidentifications: *Fasciolaria filamentosa* (Röding, 1798) / None.

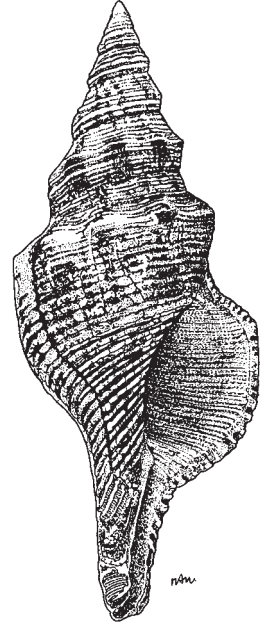
FAO names: En - Filamentous horse conch; Fr - Fasciolaire filamenteuse.

Diagnostic characters: Shell moderately strong, reaching a **large** size (up to 15 cm long), **narrowly fusiform in shape**, with a high, pointed spire and **moderately long siphonal canal**. **Whorls rounded** to moderately shouldered in profile, sometimes slightly concave under the suture. Sculpture of **numerous**, thin **spiral threads throughout** the entire surface and a row of **low** to obsolete **axial nodules at the shoulders**. Aperture ovate, with **many fine spiral threads inside the outer lip** which has a slightly serrate, sharp margin. **Columella** with a slight elbow at its basal end, bearing **3 oblique folds**. Anterior siphonal canal straight and broadly open. **Colour:** **outside** of shell generally **dark brown**, sometimes orange-brown, with **lighter brown spiral lines** and cream to nearly **white irregular patches**, mainly **between the shoulder nodules**. Interior of the **outer lip orange cream**, **inner lip orangish brown** with **pale columellar folds**.

Size: Maximum shell length 15 cm, commonly to 12 cm.

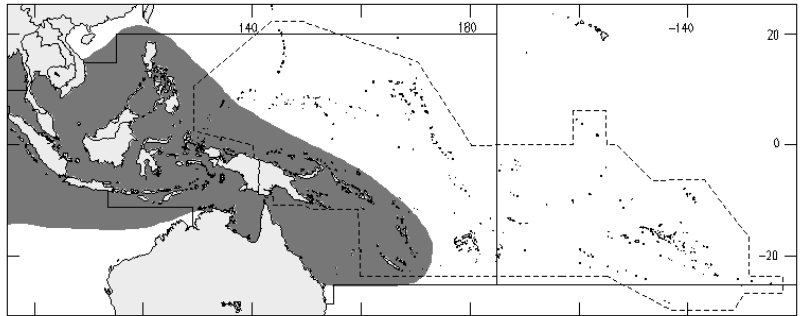
Habitat, biology, and fisheries: Common in coral reef areas and sandy bottoms. Sublittoral, mainly in shallow water. Sold in local markets of the northern Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Melanesia; north to the Philippines and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)



Pleuroploca trapezium (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Fasciolaria trapezium* (Linnaeus, 1758) / None.

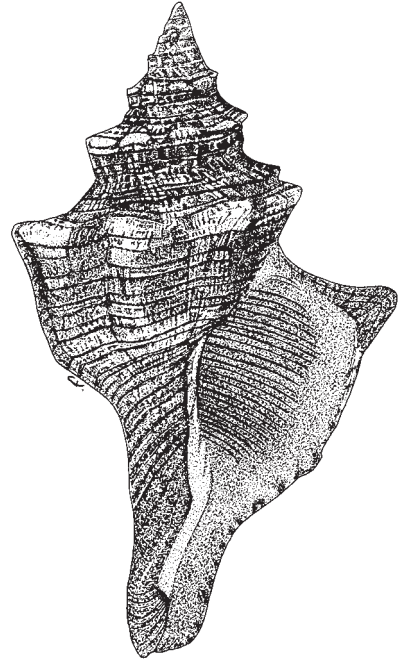
FAO names: En - Trapezium horse conch; Fr - Fasciolaire ferrugineuse.

Diagnostic characters: Shell thick and heavy, reaching a **very large** size (up to 28 cm long), **broadly fusiform in shape, with a high conical spire and stout, moderately long siphonal canal. Whorls angulate at the shoulders, with a row of thick and prominent axial nodules**, most pronounced on the last 2 whorls. Body whorl swollen, subangulate at the base. Spiral sculpture reduced, of fine paired grooves, most visible on last whorl and siphonal canal. **Aperture** roughly quadrate, **finely lirate inside** the outer lip which has sharp paired denticles at the margin. **Columella with about 3 weak oblique folds** anteriorly. Siphonal canal straightish, broadly open. **Colour: outside of shell off-white to light fawn, with paired, darker brown spiral lines**, under a thin brown periostracum. **Interior of aperture light purple with deep red denticles and lirae. Inner lip and columellar side of siphonal canal purplish brown.** Anterior end of siphonal canal often tinged dark greyish brown.

Size: Maximum shell length 28 cm, commonly to 20 cm.

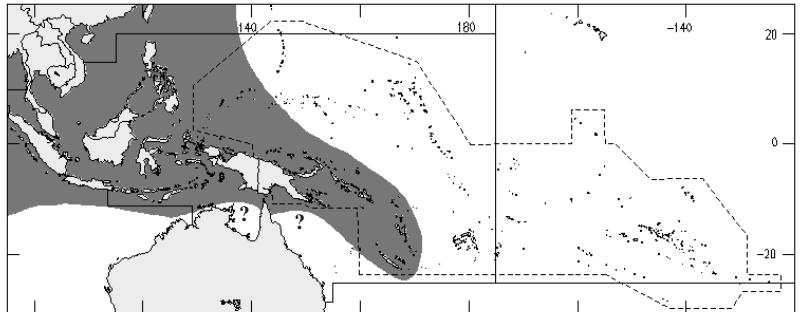
Habitat, biology, and fisheries: On sand and rubble bottoms. Common on inner reef flats and in shallow water near rocky areas, but frequent also offshore. Low tide levels to a depth of about 40 m. Collected for food and for the large, heavy shell in many areas. Mature shell is traditionally used as a trumpet when tip of the spire is cut off. Sold in local markets of the northern Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including the Red Sea and the Persian Gulf, to Melanesia; north to Japan, and south to northern Queensland and New Caledonia. Apparently rare in Australia.



ventral view

(after Short and Potter, 1987)



***Fusinus colus* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Fusus colus* (Linnaeus, 1758) / *Fusinus longicaudus* (Lamarck, 1822).

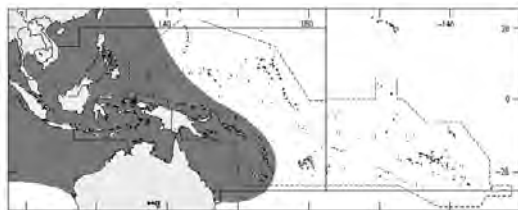
En - Distaff spindle; **Fr** - Fuseau quenouille.

Maximum shell length 20 cm, commonly to 15 cm. On sandy bottoms. Intertidal and sublittoral zones to a depth of about 40 m. Commonly collected in the area by shrimp trawlers, sometimes in large quantities. Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to southern Japan, and south to southern Queensland.



ventral view

(after Short and Potter, 1987)

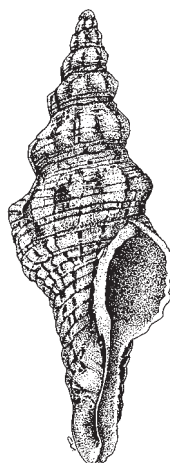


***Fusinus nicobaricus* (Röding, 1798)**

Frequent synonyms / misidentifications: *Fusus laticostatus* Deshayes, 1830 / None.

En - Nicobar spindle; **Fr** - Fuseau de Nicobar.

Maximum shell length 18 cm, commonly to 11 cm. On sandy bottoms. Sublittoral, from shallow subtidal water to a depth of about 40 m. Incidental catch of shrimp trawlers. Widespread in the Indo-West Pacific, from Sri Lanka to Polynesia; north to Japan and Hawaii, and south to northern New South Wales.



ventral view

(after Short and Potter, 1987)

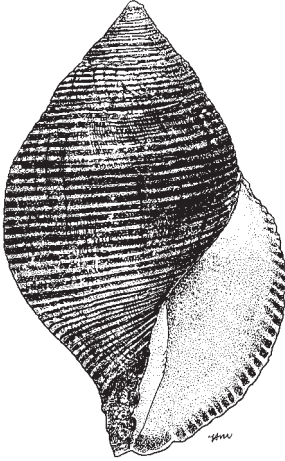


***Latirolagena smaragdula* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Latirus crassus* (Schumacher, 1817); *L. rusticus* (Lamarck, 1822); *Lathyrus smaragdulus* (Linnaeus, 1758); *Paralagena smaragdula* (Linnaeus, 1758) / None.

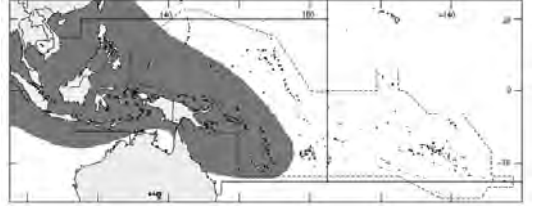
En - Precious stone shell; **Fr** - Fasciolaire rustique.

Maximum shell length 6 cm, commonly to 4 cm. Common on coral reefs and rocky shores. Intertidal and shallow subtidal waters, to a depth of about 10 m. Locally collected for food and for the shell. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Melanesia; north to southern Japan, and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

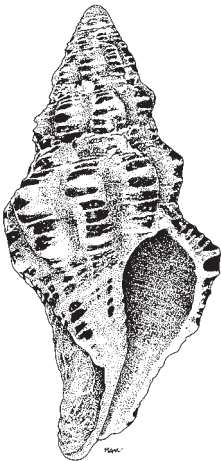


***Latirus polygonus* (Gmelin, 1791)**

Frequent synonyms / misidentifications: *Lathyrus angulatus* (Röding, 1798) / *Latirus belcheri* (Reeve, 1847).

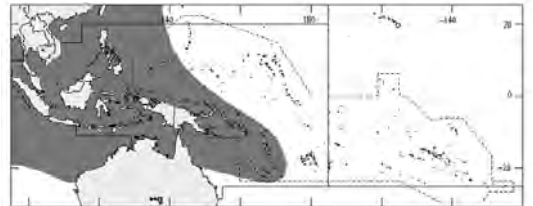
En - Many-angled spindle; **Fr** - Fasciolaire polygonale.

Maximum shell length 9 cm, commonly to 7 cm. Common on coral reefs and rocky shores. Intertidal and sublittoral zones, to a depth of about 40 m. Collected locally for food and shell trade. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Melanesia; north to Japan, and south to central Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)



COLUBRARIIDAE

Dwarf tritons

Diagnostic characters: Shell thick, elongate-fusiform in shape. Spire tall, with many convex whorls. Outer sculpture of **discontinuous axial varices**, and intersecting axial and spiral cords producing a **finely granulate or reticulated surface**. **Aperture** rather small, with a **short**, recurved, anterior **siphonal canal** and an indistinct posterior sinus. **Outer lip thickened**, toothed inside. **Inner lip** glazed and **calloused**, often somewhat flaring anteriorly. **Operculum corneous**, with an anterior nucleus. Head with a small mouth and vestigial or absent radula. Cephalic tentacles bearing eyes on swellings of their outer bases. Foot bluntly truncate anteriorly.

Habitat, biology, and fisheries: Found among rocks or corals, and often burying themselves in sand. Low intertidal to shelf zones, mainly in the tropics. Biology poorly known. Prey probably swallowed by suction. Sexes separate. Development likely with a planktonic larval stage. Locally collected for subsistence.

Similar families occurring in the area

Buccinidae: axial varices absent; aperture and body whorl relatively large.

Ranellidae (= Cymatiidae): siphonal canal well developed; periostracum often conspicuous and hairy.

References

Cernohorsky, W.O. 1967. The Bursidae, Cymatiidae and Colubrariidae of Fiji (Mollusca: Gastropoda). *Veliger*, 9(3):310-329.

Ponder, W.F. 1968. Anatomical notes on two species of the Colubrariidae (Mollusca Prosobranchia). *Trans. R. Soc. N. Z. (Zool.)*, 10(24):217-223.

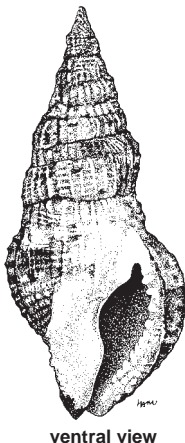
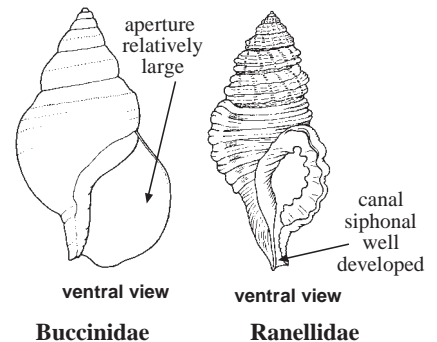
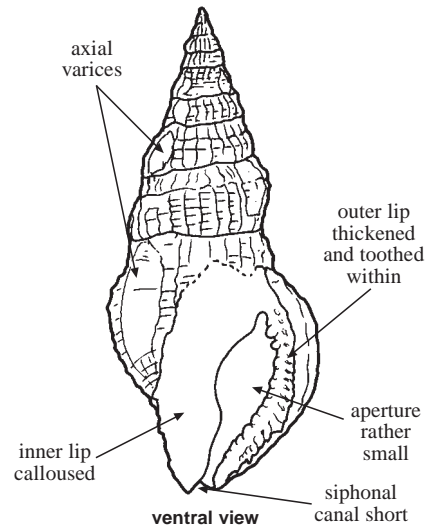
A single species of interest to fisheries occurring in the area

Colubraria muricata (Lightfoot, 1786)

Frequent synonyms / misidentifications: *Colubraria maculosa* (Gmelin, 1791) / None.

En - Maculated dwarf triton; **Fr** - Couleuvreau tacheté.

Maximum shell length 10 cm, commonly to 8 cm. On sand and rock bottoms. In coral reef areas, often under coral boulders or in crevices. Low tide levels and shallow subtidal zone. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to southern Japan and south to Queensland.



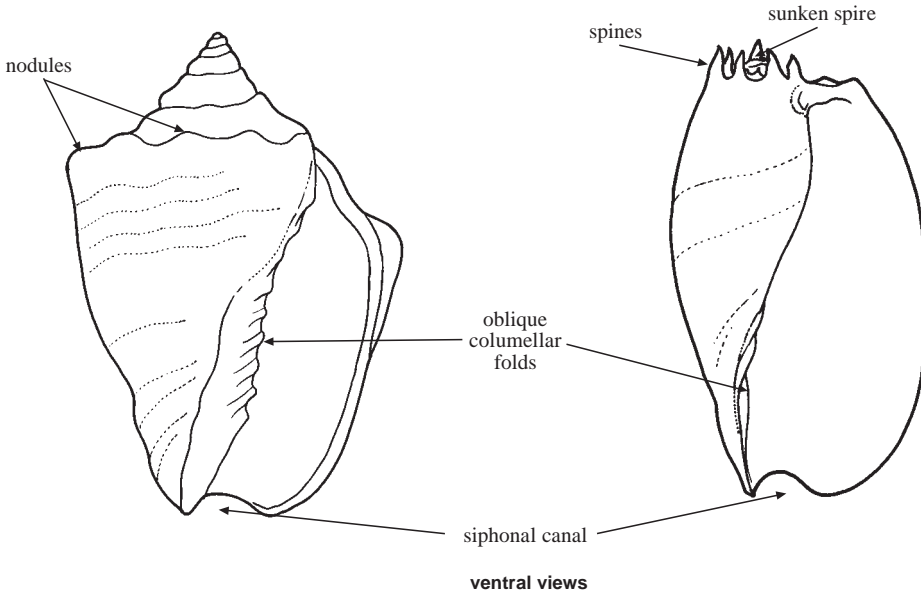
(after Kira, 1962)



VOLUTIDAE

Volutes

Diagnostic characters: Shell variable in shape, subcylindric or fusiform to swollen and globose with a sunken spire. Surface of shell often smooth, glossy and brightly coloured, sometimes nodulose to spinose on shoulder, or with axial ribs or cancellate sculpture. Aperture long, with a short and wide siphonal canal anteriorly. Inner lip usually with strong, oblique folds, the weaker ones situated posteriorly. Operculum corneous, often absent. Head small, with thin tentacles and sometimes eyes at their bases. Snout moderately short, covered by a hood. Foot broad and large, often colourfully patterned. Mantle well developed, with a long fleshy siphon anteriorly and partially enveloping the shell in life.

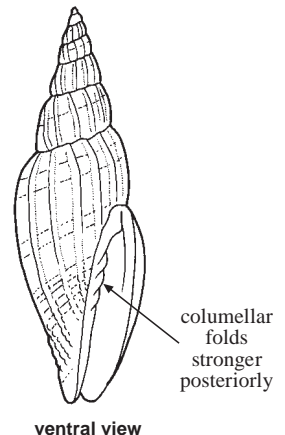


ventral views
examples showing diversity in shape

Habitat, biology, and fisheries: Active, living on sandy or muddy bottoms, from intertidal flats to deep waters of the continental shelf and slope. Can crawl very quickly over the substrate or bury themselves completely, except for the tip of the long fleshy siphon. Scavengers or carnivores, feeding on a variety of invertebrates, including other molluscs. Sexes separate, fertilization internal. Eggs laid in tough, horny capsules. Each capsule contains many eggs, but only 1 or a few develop, consuming the others for growth. Embryos generally hatching directly as crawling juveniles. As cones and cowries, volutes are popular with collectors, and their shells can attain high prices. As the planktonic larval stage is absent, there is a great variation in shell form and colour pattern among many species, hence the inflated values demanded for the rare or localized forms. Some of the larger and more common species are also valued for their edible flesh in the tropical Pacific. These are not frequently found in the markets, but fishermen retain all for food. Empty shells are traditionally used in local markets as scoops for sugar, salt, and, flour.

Similar families occurring in the area

Costellariidae and Mitridae: columellar folds stronger posteriorly.



ventral view
Costellariidae and Mitridae

Key to species of interest to fisheries occurring in the area

- 1a. Shell moderately large (up to 11.5 cm in length), elongate-ovate in shape; spire conical and prominent (Fig. 1) *Cymbiola vesperilio*
- 1b. Shell large to very large (exceeding 20 cm in length), globose-ovate in shape; spire low and more or less enveloped by body whorl → 2
- 2a. Spire completely enveloped by body whorl; shoulder smooth (Fig. 2). *Melo melo*
- 2b. Apex of the spire not enveloped by body whorl; shoulder with elevated, furrowed spines (Fig. 3) *Melo amphora*

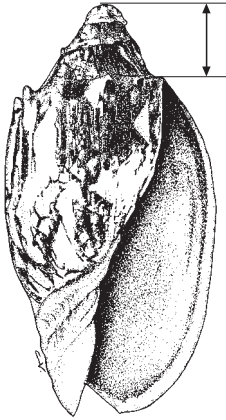


Fig. 1 *Cymbiola vesperilio*
(ventral view)

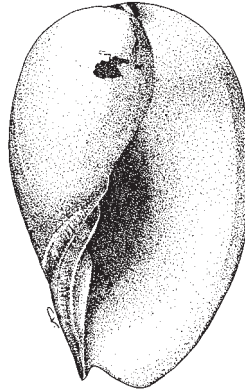


Fig. 2 *Melo melo*
(ventral view)

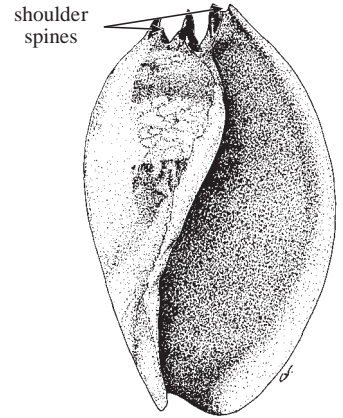





Fig. 3 *Melo amphora*
(ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Cymbiola vesperilio* (Linnaeus, 1758)
-  *Melo amphora* (Lightfoot, 1786)
-  *Melo melo* (Lightfoot, 1786)

References

Poppe, G.T. and Y. Goto. 1992. *Volutes*. Ancona, L'Informatore Piceno, 348 p.
 Weaver, C.S. and J.E. Dupont. 1970. *Living volutes. A monograph of the recent Volutidae of the world*. Greenville, Museum of natural History, 375 p.

***Cymbiola vesperilio* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Scapha vesperilio* (Linnaeus, 1758); *Vesperilio vesperilio* (Linnaeus, 1758) / None.

FAO names: En - Bat volute; Fr - Volute chauve-souris.

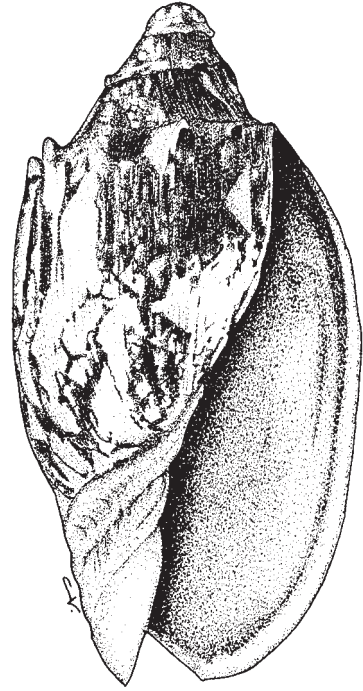
Diagnostic characters: Shell medium sized, heavy, with a variable, **elongate-ovate** shape. **Spire short and conical, markedly protruding** beyond posterior end of the large, inflated body whorl. Apex of spire blunt. **A spiral row of axially elongate, spiny tubercles on shoulder** of body whorl and just above sutures of spire whorls. Tubercles strong to obsolete, depending on the specimen. Outer surface of shell glossy, with fine axial growth lines. Aperture wide and long, about 80% the total length of shell, or more. Outer lip widely convex, obtusely angled on the shoulder. **Columella with 4 oblique folds.** Anterior siphonal canal a wide and rather deep notch. No operculum. **Colour: outer coloration highly variable, mostly pale cream to olive brown, with darker overlays of zigzag lines, blotches or streaks,** occasionally plain white or black. **Interior generally greyish cream,** often tinged light orange on columella and outer lip margin.

Size: Maximum shell length 11.5 cm, commonly to 8 cm.

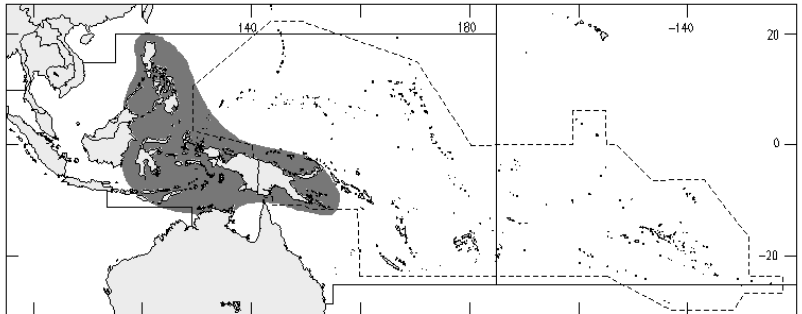
Habitat, biology, and fisheries: On muddy sand or mud bottoms. Littoral and sublittoral zones, to a depth of about 20 m. Appears in local markets of the northern and central Philippines.

Distribution: Restricted to the tropical West Pacific, from the Philippines to eastern Indonesia, Papua New Guinea and Northern Territory.

Remark: Many names have been attributed to the varietal forms of this polymorphic species.



ventral view
(after Lindner, 1976)



Melo amphora (Lightfoot, 1786)

Frequent synonyms / misidentifications: *Voluta diadema* Lamarck, 1816 / *Melo miltonis* (Griffith and Pidgeon, 1834).

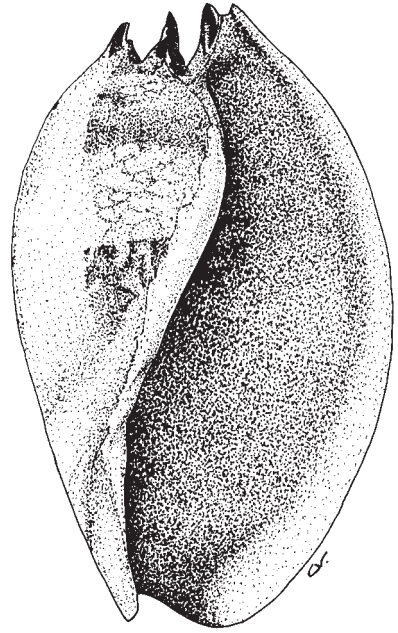
FAO names: En - Diadem volute; Fr - Volute diadème.

Diagnostic characters: Shell large to very large, **globose-ovate** in shape. **Spire short and blunt, hardly protruding beyond** the very large, inflated and posteriorly expanded **body whorl**. Apex smooth, large and dome-shaped. Outer surface of shell with axial growth lines, **shoulder with elevated, furrowed spines** tending to be straight or curved outwards and **becoming obsolete in later stages of growth** of the adult specimens. Aperture wide, nearly as long as the shell. Outer lip rather thin and regularly arched, sometimes slightly flared at posterior end. **Columella with 3 strong oblique folds**. Anterior siphonal canal a wide and shallow notch. No operculum. **Colour: outer coloration highly variable**, most commonly **white or creamy orange, with zigzag axial lines of orange to chocolate brown** enclosing pale triangular patches, **and often with 2 broad spiral bands of darker brown blotches**. Axial lines crowded, widely spaced or almost lacking. Spiral brown bands sometimes continuous. **Interior glossy, creamy to pinky orange**, sometimes lighter coloured on the outer lip margin.

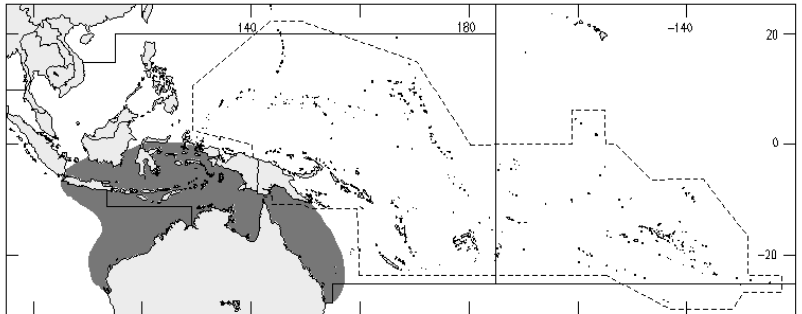
Size: Maximum shell length 50 cm, commonly to 30 cm.

Habitat, biology, and fisheries: On sand or sand and mud bottoms. Littoral and shallow sublittoral zones, to a depth of about 10 m. Used as food by native fishermen. Shell traditionally utilized as water carrier or for bailing canoes; also used as a decorative item.

Distribution: Restricted to the tropical Southwest Pacific, from southern Indonesia and Papua New Guinea to the northern half of Australia.



ventral view
(after Lindner, 1976)



Melo melo (Lightfoot, 1786)

Frequent synonyms / misidentifications: *Cymbium melo* (Lightfoot, 1786); *Melo indica* (Gmelin, 1791); *Yetus indicus* (Gmelin, 1791) / None.

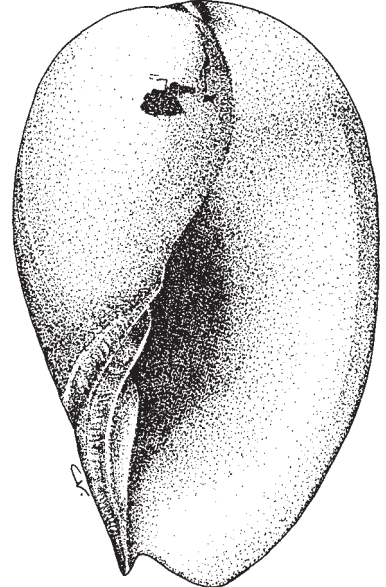
FAO names: En - Indian volute; Fr - Volute melon.

Diagnostic characters: Shell large to very large, **globose-ovate** in shape. **Spire completely enveloped by** posterior end of the very large, inflated **body whorl**. Apex smooth. Outer surface of shell smooth, only with axial lines of growth. Shoulder of body whorl rounded, **devoid of spines**. Aperture wide, as long as the shell, with a thin, regularly arched outer lip. **Columella with 3 or 4 long and prominent oblique folds**. Anterior siphonal canal a wide and shallow notch. No operculum. **Colour:** outside of shell **pale orange**, sometimes with irregular spiral banding of brown spots. **Interior glossy cream** with a light yellowish margin.

Size: Maximum shell length 27.5 cm, commonly to 17.5 cm.

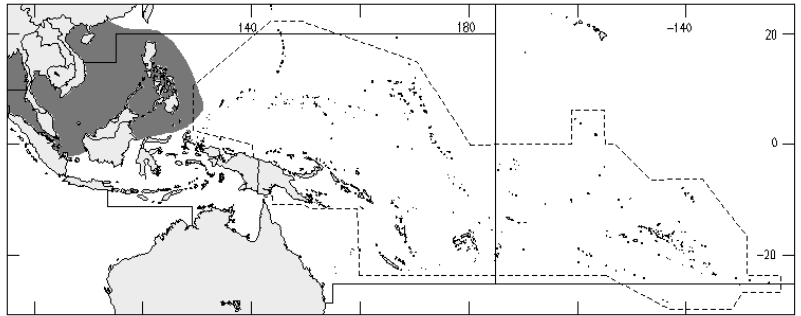
Habitat, biology, and fisheries: On muddy bottoms. Littoral and shallow sublittoral zones, to a depth of about 20 m. Collected for food by fishermen. Shells used as decorative items, or as scoops for salt, sugar and flour in the local markets. Also traditionally utilized by the native fishermen to bail out their boats.

Distribution: Restricted to the Southeast Asian region, from Burma, Thailand, and Malaysia to the South China Sea and the Philippines.



ventral view

(after Lindner, 1986)



HARPIDAE

Harp shells

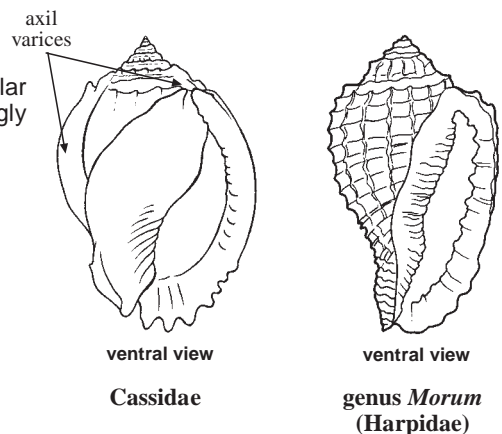
Diagnostic characters: Shell globular-ovate to potbel-
 lied in shape, with an inflated body whorl and small
 conical spire. Surface glossy, with usually vivid colour
 patterns, and with strong axial ribs ending in sharp points
 on the shoulder. Spiral sculpture mostly lacking. Perios-
 tracum absent. Aperture large, elongate-ovate, inner lip
 covered by a generally smooth, glossy callus. Columella
 without folds. Anterior siphonal canal a well marked, short
 and wide notch. Operculum absent or vestigial. Head small,
 with a long siphon between 2 slender tentacles that bear
 conspicuous eyes on their external lateral base. Foot very
 large and fleshy, divided into 2 parts: anterior part greatly
 expanded laterally, posterior part elongate and pointed be-
 hind.

Habitat, biology, and fisheries: Active, burrowing animals,
 living in sandy bottoms in depths ranging from low tide levels
 to the deep shelf zone. Harps can glide rapidly over the
 substrate by means of the huge, leaf-shaped foot, or can use
 the anterior part of the foot to burrow, forming a low mound
 from which the siphon protrudes. Carnivores or occasionally
 scavengers, preying on small crabs and shrimps, which are
 trapped by the foot, then coated with mucus and adhering
 sand grains, and probably killed and partially digested by
 salivary secretions. When disturbed or attacked, the animal
 can cast off the hind part of the foot, which continues wrig-
 gling to distract the predator. Sexes separate. Eggs laid in
 capsules connected in a row on a hard substrate, hatching
 as free swimming planktonic larvae (genus *Harpa*) or as
 crawling juveniles (genus *Morum*). Although still locally
 eaten, harps are nowadays mainly collected for their beau-
 tiful, highly prized shells.

Remarks: Until recently, species of the genus *Morum* Röding, 1798 (which have the typical internal anatomy of the Harpidae) have been erroneously placed in the family Cassidae, exclusively on the basis of their unusual shell features: Shell elongate-ovate in shape, ornamented with axial and spiral ribs that form sharp, upturned points at intersections. Outer lip thickened and dentate inside, inner lip callus shield-like and pustulose. Anterior siphonal canal narrow, moderately produced. Operculum vestigial. No representatives of this genus are included here because they are not of interest to fisheries.

Similar families occurring in the area

Cassidae: shell of *Morum* species (Harpidae) very similar to the Cassidae, but the latter generally possess a strongly upturned siphonal canal, and often axial varices.



Key to species of interest to fisheries occurring in the area

- 1a. An undivided, dark brown blotch nearly covering the ventral side of body whorl (Fig. 1) *Harpa articularis*
- 1b. Dark brown ventral blotch of body whorl divided into 2 or 3 parts. → 2
- 2a. Shell relatively large (up to 11 cm in length); ventral side of body whorl with a brown blotch more or less deeply divided in the middle into 2 parts (Fig. 2) *Harpa major*
- 2b. Shell relatively small (up to 7.5 cm in length); ventral side of body whorl with 3 separate brown blotches (Fig. 3) *Harpa harpa*

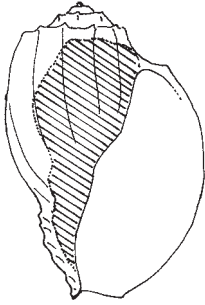


Fig. 1 *Harpa articularis*
(ventral view)

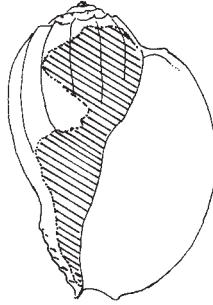


Fig. 2 *Harpa major*
(ventral view)

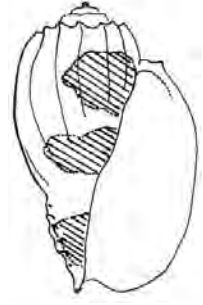





Fig. 3 *Harpa harpa*
(ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Harpa articularis* Lamarck, 1822
-  *Harpa harpa* (Linnaeus, 1758)
-  *Harpa major* Röding, 1798

References

Hughes, R.N. and W.K. Emerson. 1987. Anatomical and taxonomic characteristics of *Harpa* and *Morum* (Neogastropoda: Harpidae). *Veliger*, 29(4):349-358.

Rehder, H.A. 1973. The family Harpidae of the world. *Indo-Pac. Moll.*, 3(16):207-274.

Walls, J.G. 1977. Another viewpoint on the living harps. *The Pariah*, 4:1-4.

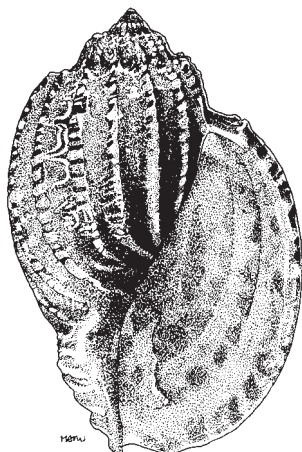
Walls, J.G. 1980. *Conchs, tibias, and harps*. T.F.H., Reigate, 191 p.

***Harpa articularis* Lamarck, 1822**

Frequent synonyms / misidentifications: *Harpa nobilis* Lamarck, 1816 (not of Röding, 1798) / *Harpa davidis* Röding, 1798.

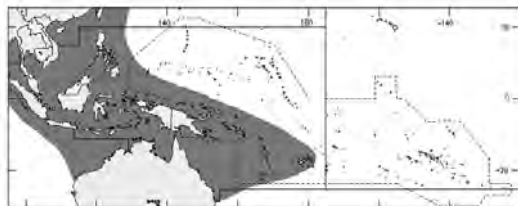
En - Articulate harp; **Fr** - Harpe articulée.

Maximum shell length 11 cm, commonly to 8.5 cm. Common on sublittoral and offshore sandy bottoms to depths of about 250 m. Collected by shrimp trawlers, mainly for shell trade. Eastern Indian Ocean and the tropical West Pacific, from Burma and eastern Indonesia to Fiji Islands; north to southern Japan and south to southern Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

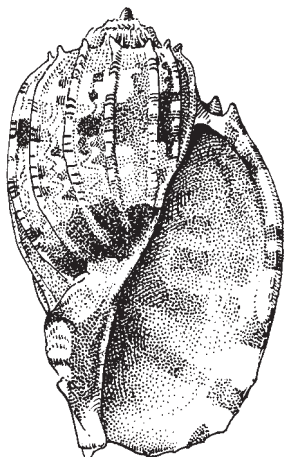


***Harpa harpa* (Linnaeus, 1758)**

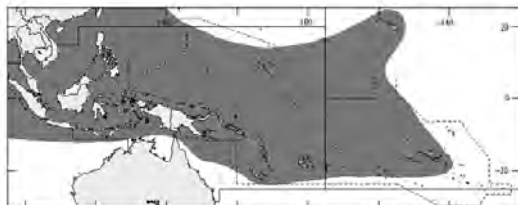
Frequent synonyms / misidentifications: *Harpa nobilis* Röding, 1798 / None.

En - True harp; **Fr** - Harpe noble.

Maximum shell length 7.5 cm, commonly to 6 cm. Common on sandy bottoms. Lower intertidal fringe and sublittoral to shelf zones. Collected mainly for shell trade in trawls. Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan and Hawaii, and south to New Caledonia.



ventral view

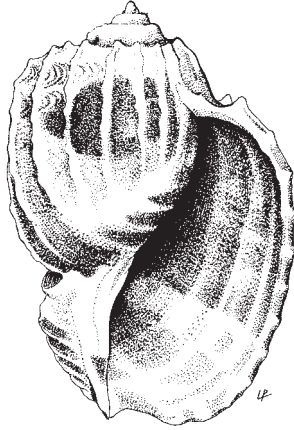


***Harpa major* Röding, 1798)**

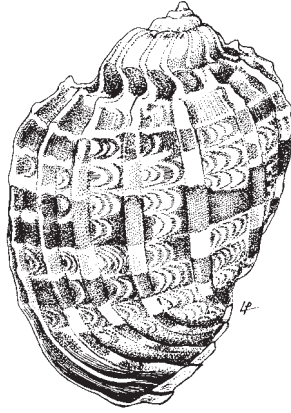
Frequent synonyms / misidentifications: *Harpa conoidalis* Lamarck, 1822 / *Harpa davidis* Röding, 1798; *H. ventricosa* Lamarck, 1816.

En - Major harp; **Fr** - Harpe majeure.

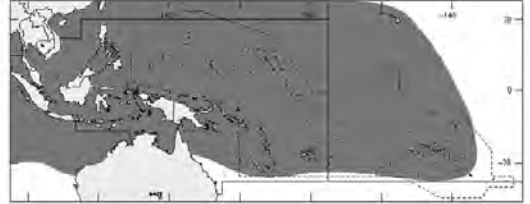
Maximum shell length 10 cm, commonly to 8.5 cm. Common on sandy bottoms. Lower intertidal fringe and sublittoral to shelf zones. Mainly collected for shell trade by shrimp trawlers. Widespread in the Indo-West Pacific, from East and South Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan and Hawaii, and south to Queensland and New Caledonia.



ventral view



dorsal view



TURBINELLIIDAE

(= Vasidae)

Vase shells

Diagnostic characters: Shell thick and heavy, biconical to fusiform, generally roughly sculptured. Outer sculpture mainly spiral, often nodulose to spinose on shoulder. Periostracum conspicuous. Siphonal canal present, long to short. Inner lip of aperture mostly with several strong folds. Operculum thick and corneous, claw-like with a terminal nucleus. Head small, with a long snout and eyes at the outer bases of tentacles. Foot broad, sometimes bifid anteriorly.

Habitat, biology, and fisheries: Most common in littoral to shallow tropical and subtropical waters, on reefs, coral rubble or sandy bottoms. Carnivorous animals, preying on clams, sipunculid or polychaete worms. Sexes separate, fertilization internal. Eggs laid in series of thick, horny capsules, forming ribbons or twisted masses. Vase shells are commonly collected for food by coastal peoples and their thick shells are used as a source of lime or as ornaments.

Remarks: Since recently, the gigantic species *Syrinx aruanus* has been considered as a representative of the Melongenidae. However, its anatomical and radular features prove it belongs to the Turbinelliidae.

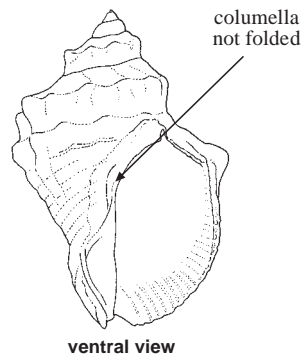
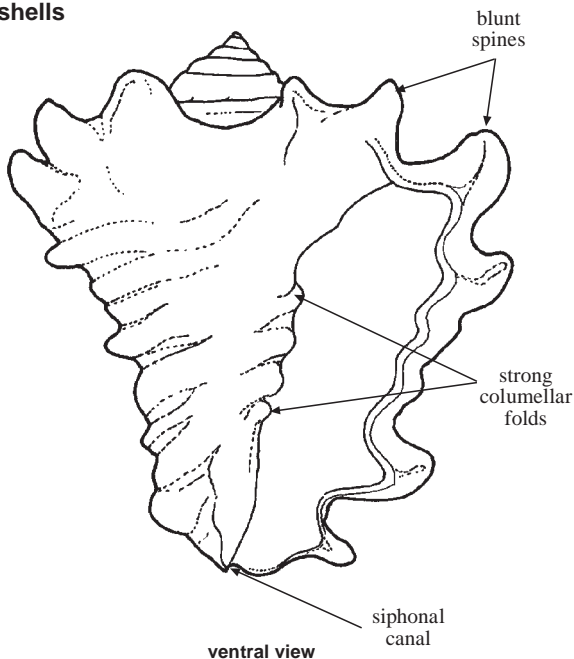
Similar families occurring in the area

Melongenidae: shell features very similar to those of *Syrinx aruanus*; the latter species can be distinguished by its size, as being the largest living gastropod of the world; young stages are characterized by the very tall, turret-shaped embryonic shell on the apex (usually lost in adult stages).

Muricidae (Rapaninae): columellar folds absent. No periostracum.

Key to species of interest to fisheries occurring in the area

- 1a. Shell very large (up to 80 cm in length), fusiform in shape; siphonal canal long and narrow; columellar folds absent (Fig. 1)
 *Syrinx aruanus*
- 1b. Shell rather small (up to 16 cm in length), biconical in shape; siphonal canal short and broad; columellar folds present → 2



Muricidae (Rapaninae)

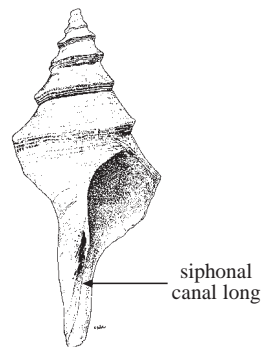


Fig. 1 *Syrinx aruanus* (ventral view)

- 2a. Spire relatively high; 3 equal-sized columellar folds (Fig. 2) *Vasum ceramicum*
- 2b. Spire relatively low; 4 or 5 unequal columellar folds (Fig. 3) *Vasum turbinellus*

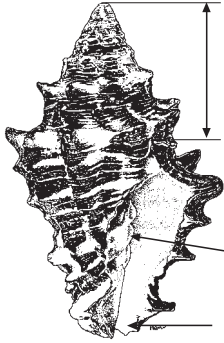


Fig. 2 *Vasum ceramicum*
(ventral view)

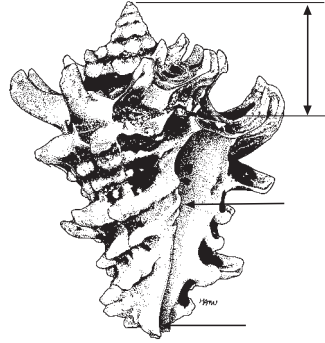





Fig. 3 *Vasum turbinellus*
(ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Syrinx aruanus* (Linnaeus, 1758)
-  *Vasum ceramicum* (Linnaeus, 1758)
-  *Vasum turbinellus* (Linnaeus, 1758)

References

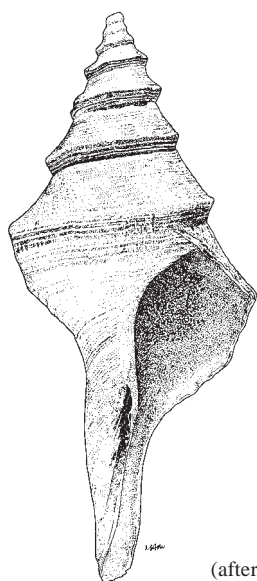
Abbott, R.T. 1959. The family Vasidae in the Indo-Pacific. *Indo-Pac. Moll.*, 1(1):15-32.

Harasewich, M.G. and R.E. Petit. 1989. The nomenclatural status and phylogenetic affinities of *Syrinx aruanus* Linné, 1758 (Prosobranchia: Turbinellidae). *Nautilus*, 103(2):83-84.

Syrinx aruanus (Linnaeus, 1758)

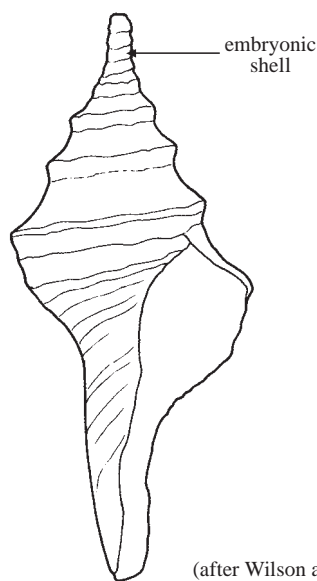
Frequent synonyms / misidentifications: *Megalatractus aruanus* (Linnaeus, 1758) / None.

FAO names: En - Australian trumpet; Fr - Trompette australienne.



ventral view

(after Short and Potter, 1987)

ventral view of
juvenile shell

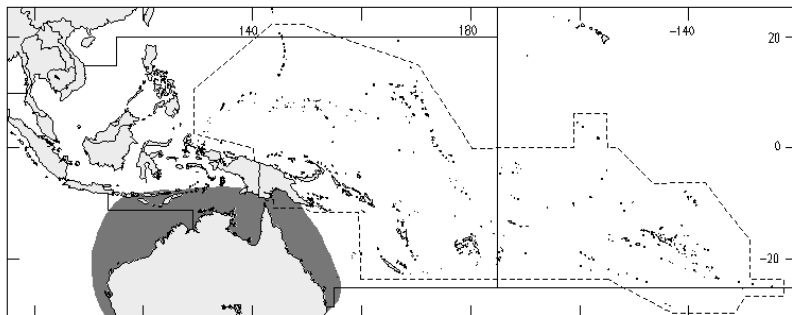
(after Wilson and Gillett, 1971)

Diagnostic characters: Shell reaching an **extremely large** size (up to 80 cm in length), **fusiform in shape**, with a moderately low to high conical spire and **long siphonal canal**. **Apex** of the spire with a **very tall, turret-shaped embryonic shell**, of about 5 rounded whorls and **usually lost in adults**. Spire whorls **strongly slanting**, each with a wide, straight-sided to slightly concave slope **above the angular shoulder**, which may bear a row of low, rounded nodules. **Body whorl** moderately inflated, **somewhat angulate at the base**. Whole surface of shell covered with fine spiral cords, a few of which appear slightly coarser on body whorl, anterior to shoulder. **Periostracum thick**. **Aperture** wide, irregularly ovate, **smooth within** outer and inner lips. **Columellar folds absent**. Umbilicus represented by an elongate slit. Anterior siphonal canal rather narrow and straight, broadly open. **Colour:** exterior and interior of **shell unicolorous apricot**, fading to creamy yellow. **Periostracum brown**.

Size: Maximum shell length 80 cm, commonly to 60 cm.

Habitat, biology, and fisheries: On sandy bottoms. Intertidal and sublittoral zones, to a depth of about 30 m. Feeds on sedentary polychaete worms. Traditionally fished for its gigantic shell and edible flesh. Once common on intertidal and shallow subtidal sand flats in northern Australia, this species has suffered from frequent local overcollecting. Deeper populations seem to occur in the northern part of its geographical range.

Distribution: Restricted to northern half of Australia and adjacent areas.



Vasum ceramicum (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Turbinellus spinosus* G. Fischer, 1807 / *Vasum turbinellus* (Linnaeus, 1758).

En - Ceram vase; **Fr** - Turbinelle épineuse.

Maximum shell length 16 cm, commonly to 12 cm. On shallow reefs. Intertidal and shallow sublittoral zones, to a depth of about 20 m. The flesh is used as food or as bait by fishermen, and the thick shell as a source of lime. It is also sold for shell collections. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and Sri Lanka, but apparently not in the Red Sea nor the Persian Gulf, to eastern Polynesia; north to southern Japan and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

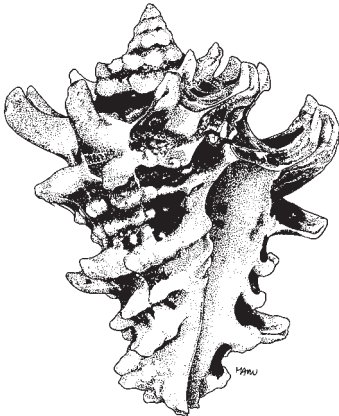


Vasum turbinellus (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Turbinella cornigera* Lamarck, 1822; *T. variolaris* Lamarck, 1822 / None.

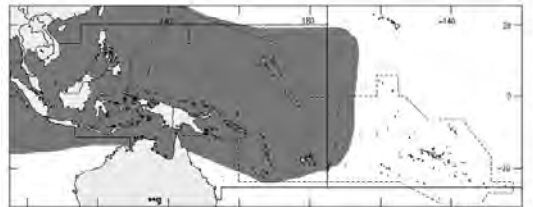
En - Top vase; **Fr** - Turbinelle cornue.

Maximum shell length 10 cm, commonly to 8 cm. On rocky bottoms; common on reef flats. Intertidal and shallow subtidal waters. Collected for subsistence or bait. Shell used in shellcrafts. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to western Polynesia; north to southern Japan and south to northern Queensland and New Caledonia.



ventral view

(after Sharabati, 1984)



OLIVIDAE

Olive shells

Diagnostic characters: Shell thick and porcelaneous, **elongate-ovate**, with a **short spire**, a **large body whorl** and usually deeply **channeled sutures**. **Surface smooth, highly polished** and often vividly coloured. No periostracum. **Aperture elongate**, with a wide and **short** anterior **siphonal canal** and an indistinct posterior notch. Outer lip slightly thickened in adult stage, smooth. **Inner lip calloused**, often with fine transverse lirae, and with **oblique**, columellar **grooves anteriorly**. Columellar callus usually bordered posteriorly by a distinct, calloused spiral band. **Operculum absent**. Head broad but poorly defined, with an extensible snout and reduced tentacles. Eyes small to absent. Foot large and wide, with a distinct, more or less triangular to shield shaped anterior part. Posterior part of the foot voluminous, partially reflecting over the shell when expanded. Mantle with a long, cylindrical fleshy siphon anteriorly.

Habitat, biology, and fisheries: Sand-dwelling, active animals, inhabiting the intertidal and shallow sublittoral areas of most tropical or subtropical seas. Crawl on top of the substrate, or most commonly below the surface, with only the tip of the fleshy siphon exposed, leaving a characteristic trail. Carnivores or scavengers, mostly feeding on various invertebrates which are captured and held with the large foot. Sexes separate, fertilization internal. Eggs released in small capsules which may be free-floating, attached together and half buried in the sediment, or even fixed with mucus to the shell of a living, burrowing bivalve.

Though sometimes collected for food, olives are mostly sought for their glossy and vividly coloured shells which are much favoured by shell collectors. To find olives, fishermen commonly look for their conspicuous trails in the sand, or bait them with fish remains or other rotting meat. No precise data have been found about the commercialisation of most species of Olividae that are collected in the area.

Similar families occurring in the area

Marginellidae: columella with 3 or 4 strong oblique folds, most prominent anteriorly.

Key to species of interest to fisheries occurring in the area

- 1a. Spire relatively low to depressed; body whorl calloused at the posterior end → 4
- 1b. Spire relatively high and conical; body whorl not calloused at the posterior end → 2
- 2a. Shell relatively small (up to 4 cm in length); inner lip lirae confined to the anterior half of aperture (Fig. 1) *Oliva oliva*
- 2b. Shell relatively large (up to 6 cm in length); inner lip lirae extending on the posterior half of aperture (Fig. 2) → 3

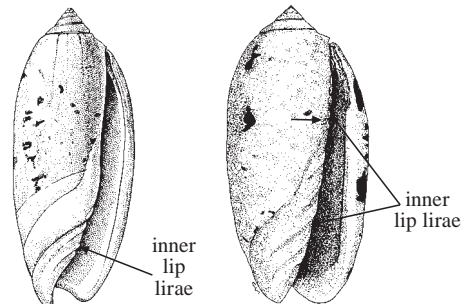
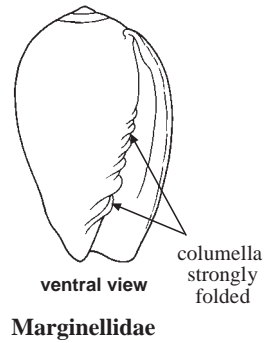
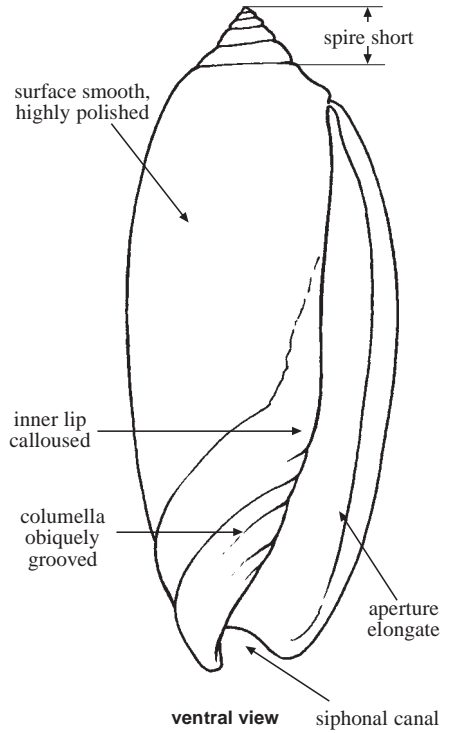


Fig. 1 *Oliva oliva* (ventral view)

Fig. 2 *Oliva caerulea* (ventral view)

- 3a. Inner lip callus reaching about halfway to the posterior end of aperture; interior of shell dark purple (Fig. 2) *Oliva caerulea*
- 3b. Inner lip callus reaching almost to the posterior end of aperture; interior of shell yellowish orange (Fig. 3) *Oliva annulata*
- 4a. Columellar callus bright orange-red in colour (Fig. 4) *Oliva reticulata*
- 4b. Columellar callus differently coloured → 5
- 5a. Shell relatively large (up to 9 cm in length); interior often deep orange in colour (Fig. 5) *Oliva miniacea*
- 5b. Shell relatively small (up to 7 cm in length); interior whitish in colour → 6

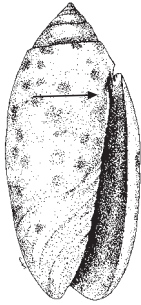


Fig. 3 *Oliva annulata* (ventral view)

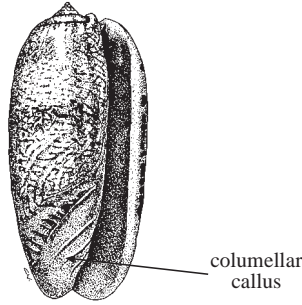


Fig. 4 *Oliva reticulata* (ventral view)

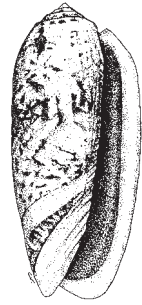


Fig. 5 *Oliva miniacea* (ventral view)

- 6a. Shell shape not swollen posteriorly; spire rather low, with oblique, orange-tinged black lines; outer colour with a combination of blue, orange, and often green spots (Fig. 6) *Oliva tricolor*
- 6b. Shell shape swollen posteriorly; spire very low to depressed, without oblique, orange-tinged black lines; outer colour differently patterned (Fig. 7) *Oliva vidua*

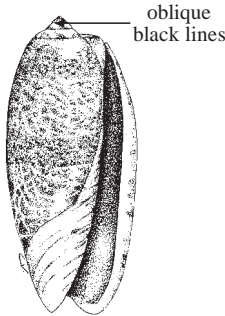









Fig. 6 *Oliva tricolor* (ventral view)



Fig. 7 *Oliva vidua* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Oliva annulata* (Gmelin, 1791)
-  *Oliva caerulea* (Röding, 1798)
-  *Oliva miniacea* (Röding, 1798)
-  *Oliva oliva* (Linnaeus, 1758)
-  *Oliva reticulata* (Röding, 1798)
-  *Oliva tricolor* Lamarck, 1811
-  *Oliva vidua* (Röding, 1798)

References

Petuch, E.J. and D.M. Sargent. 1986. *Atlas of the living olive shells of the world*. Charlottesville, Coastal Education and Research Foundation, 253 p.

Zeigler, R.F. and H.C. Porreca. 1969. *Olive shells of the world*. Rochester, Rochester Polychrome Press, 96 p.

Oliva miniacea (Röding, 1798)

Frequent synonyms / misidentifications: *Oliva erythrostroma* (Meuschen, 1787) (Invalid name); *O. erythrostroma* Lamarck, 1811 / *Oliva sericea* (Röding, 1798).

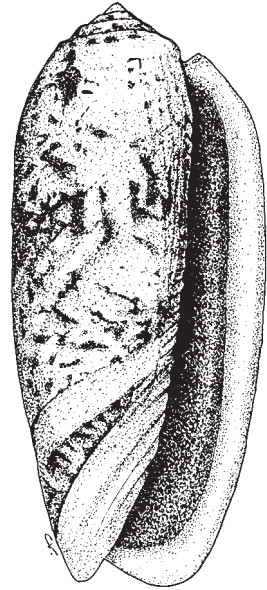
FAO names: En - Redmouth olive; Fr - Olive à bouche rouge.

Diagnostic characters: Shell large, heavy, more or less cylindrical with a relatively low, pointed spire and thick outer lip. Sides of the spire flat to feebly concave, **sutures deeply channeled**, bordered by a narrow, sharp ridge which ends in a **slightly protruding callus at posterior end of inner lip**. Surface of body whorl often with a few low and rounded axial marks of growth near the outer lip of mature specimens. **Inner lip lirate along its whole length**. **Columellar callus reaching at least 2/3 of the way to posterior end of the aperture, with about 3 deep, angulate oblique grooves anteriorly**. Oblique spiral band bordering posteriorly the columellar callus smooth and slightly raised, with a sharp posterior edge. **Colour: outside of shell generally creamy white, with irregular, wavy axial lines of orange and grey, blue green, purple or brown, and 2 or 3 spiral bands of dark brown blotches on body whorl**; sometimes almost entirely dark brown, black, golden brown or pale coloured. Spire whorls with crowded purplish brown spots. **Interior of the aperture deep orange, columellar callus and margin of the outer lip cream**.

Size: Maximum shell length 9 cm, commonly to 7.5 cm.

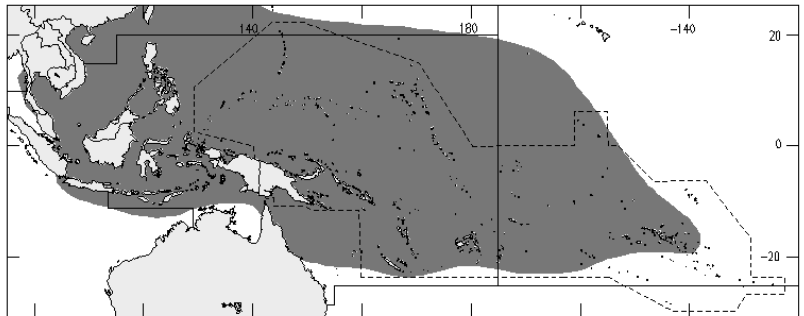
Habitat, biology, and fisheries: Burrowing in sand bottoms, at shallow subtidal depths. Mainly collected for its large, colourful shell, this species is also sold for food in local markets of the central Philippines.

Distribution: Widespread in the tropical West Pacific, from western Indonesia to eastern Polynesia; north to Japan and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

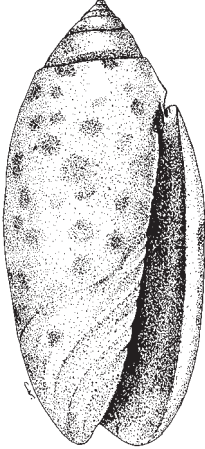


Oliva annulata (Gmelin, 1791)

Frequent synonyms / misidentifications: *Oliva amethystina* (Röding, 1798); *O. emicator* (Meuschen, 1787) (Invalid name) / None.

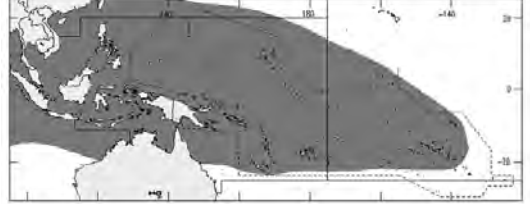
En - Amethyst olive; **Fr** - Olive mouchetée.

Maximum shell length 6 cm, commonly to 4 cm. Burrowing in sandy bottoms, in shallow subtidal water. Mainly collected for its shell. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, but not in the Red Sea nor the Persian Gulf, to eastern Polynesia; north to Japan and south to central Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

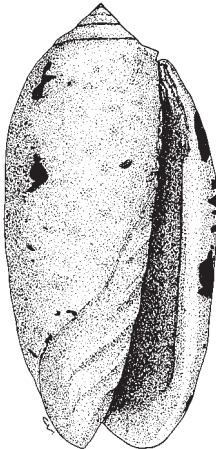


Oliva caerulea (Röding, 1798)

Frequent synonyms / misidentifications: *Oliva episcopalis* Lamarck, 1811 / None.

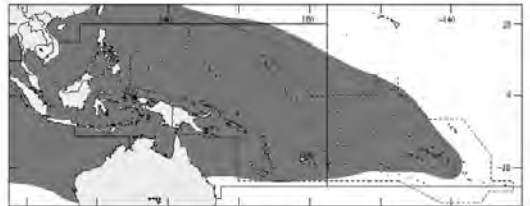
En - Purplemouth olive; **Fr** - Olive épiscopale.

Maximum shell length 6 cm, commonly to 4 cm. Burrowing in sand flats of the shallow sublittoral zone. Mainly collected for its shell. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, but not in the Red Sea nor the Persian Gulf, to eastern Polynesia; north to Japan and south to central Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

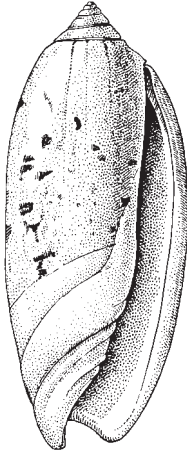


Oliva oliva (Linnaeus, 1758)

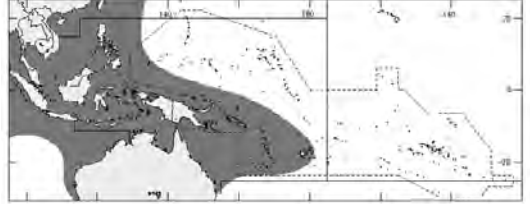
Frequent synonyms / misidentifications: *Oliva ispida* (Röding, 1798) / *Oliva ispidula* (Linnaeus, 1758).

En - Common olive; **Fr** - Olive commune.

Maximum shell length 4 cm, commonly to 3 cm. Burrowing in sand flats. Littoral and shallow subtidal zones. This common species is mainly collected for its shell. Widespread in the Indo-West Pacific, from East Africa to eastern Melanesia; north to Japan and south to southern Queensland and New Caledonia.



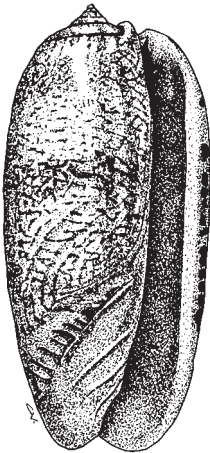
ventral view

***Oliva reticulata*** (Röding, 1798)

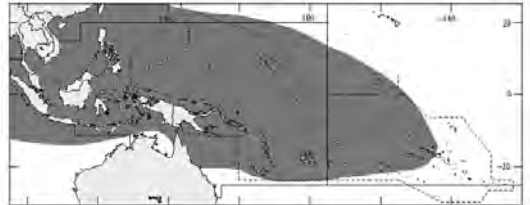
Frequent synonyms / misidentifications: *Oliva sanguinolenta* Lamarck, 1811 / None.

En - Blood olive; **Fr** - Olive sanguine.

Maximum shell length 5 cm, commonly to 3.5 cm. Burrowing in sandy bottoms. Shallow sublittoral zone. Mainly collected for its shell. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, but not in the Red Sea nor the Persian Gulf, to eastern Polynesia; north to southern Japan and south to Queensland and New Caledonia.



ventral view



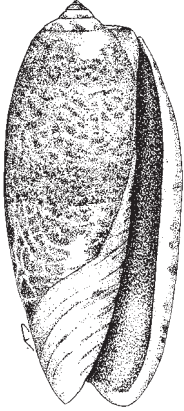
(after Short and Potter, 1987)

Oliva tricolor Lamarck, 1811

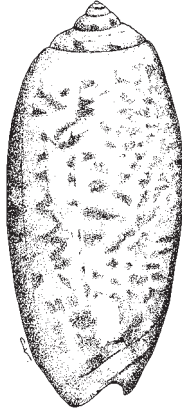
Frequent synonyms / misidentifications: None / None.

En - Tricolor olive; **Fr** - Olive tricolore.

Maximum shell length 6 cm, commonly to 4 cm. Burrowing in sand flats, at low tide and shallow sublittoral depths. Mainly collected for its shell. The tropical West Pacific, from Indonesia to western Polynesia; north to southern Japan and south to Queensland and New Caledonia.

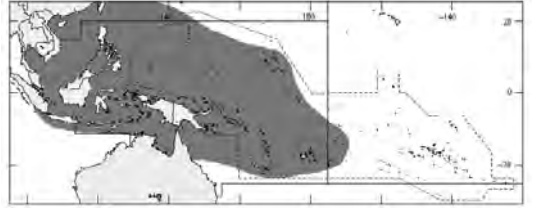


ventral view



dorsal view

(after Springsteen and Leobrera, 1986)

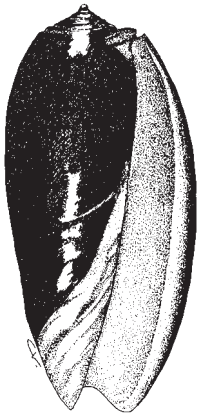


Oliva vidua (Röding, 1798)

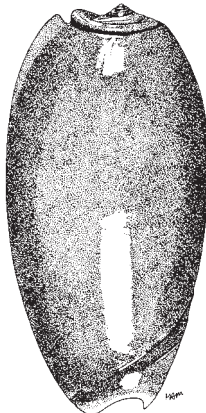
Frequent synonyms / misidentifications: *Oliva maura* Lamarck, 1810 / *Oliva oliva* (Linnaeus, 1758).

En - Black olive; **Fr** - Olive noire.

Maximum shell length 7 cm, commonly to 5.5 cm. Burrowing in sandy bottoms. Shallow sublittoral zone. Mainly collected for its shell. Restricted to the tropical West Pacific, from central Indonesia to Melanesia; north to the Philippines and south to Queensland.

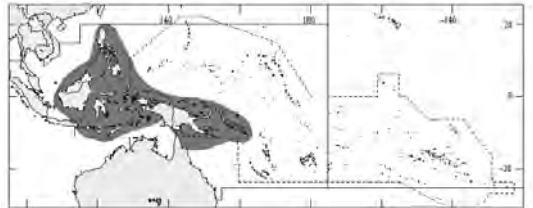


ventral view



dorsal view

(after Springsteen and Leobrera, 1986)

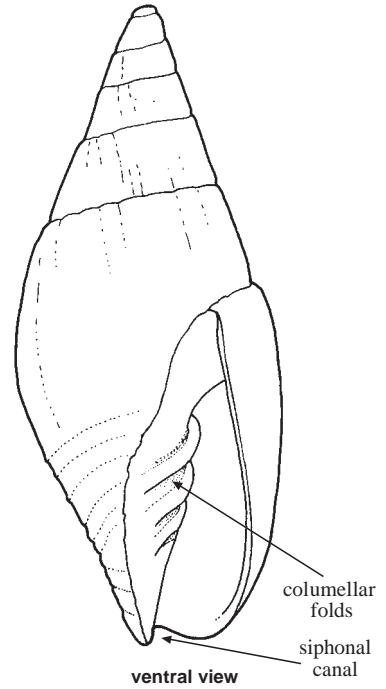


MITRIDAE

Miter shells

Diagnostic characters: Shell fusiform-ovate, with a high, tapering spire and a rather narrow aperture. Surface smooth or with a **predominantly spiral sculpture**. Periostracum thin or absent. **Aperture** elongate, anteriorly **notched by a short siphonal canal**. **Outer lip** smooth to crenulate on the margin, **not lirate inside**. **Columella** with a few **strong spiral folds**, the larger ones situated **posteriorly**. **No operculum**. Head relatively small and narrow, with a pair of closely set, elongate tentacles bearing eyes on their outer sides. Snout extensible, very long, with a large mouth. Foot small, triangular, usually truncate anteriorly.

Habitat, biology, and fisheries: Mostly inhabiting littoral and shallow waters of tropical and subtropical seas, but also occurring deeper on the continental shelf and slope. Sometimes living on hard bottoms in coral reefs (resting in rock crevices or under stones and corals during the day), but more often burrowing in sand and leaving behind a conspicuous trail. Carnivores or carrion-feeders, mainly feeding on sipunculid worms and other gastropods which are swallowed whole or in chunks. Some species can secrete a pungent purple fluid from a mantle gland, as a defence mechanism. Sexes separate, fertilization internal. Eggs laid in tall and oblong capsules with a short and narrow stalk, attached to stones or shells by a flat disk. Numerous eggs enclosed in each capsule, generally hatching as free-swimming, planktonic larvae. Mitridae are mostly collected for their beautiful shells which are prized among collectors and currently utilized in the shellcraft industries. No precise data on their utilization is available in the area.

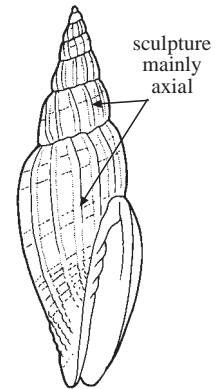


Similar families occurring in the area

Costellariidae: shell almost identical to Mitridae, but sculpture mainly axial and aperture finely lirate inside.

Key to species of interest to fisheries occurring in the area




- 1a. Spire strongly shouldered, with a spiral row of prominent, pointed nodules under the suture *Mitra stictica*
- 1b. Spire not strongly shouldered, at the most with a beaded spiral cord under the suture → 2
- 2a. Surface of shell with closely spaced, flat or rounded spiral cords and grooves in between; colour yellowish brown, with broad brown axial streaks *Mitra eremitarum*
- 2b. Surface of shell smooth, except for a few weak, spiral grooves towards the anterior end; colour white, with spiral rows of large, irregular orange or red spots. *Mitra mitra*



ventral view
Costellariidae

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Mitra eremitarum* Röding, 1798
-  *Mitra mitra* (Linnaeus, 1758)
-  *Mitra stictica* (Link, 1807)

References

Cernohorsky, W.O. 1970. Systematics of the families Mitridae and Volutomitridae (Mollusca: Gastropoda). *Bull. Auckl. Inst. Mus.*, 8:1-190.

Cernohorsky, W.O. 1976. The Mitridae of the world. Part I. The subfamily Mitrinae. *Indo-Pac. Moll.*, 3(7):273-528.

Cernohorsky, W.O. 1991. The Mitridae of the world. Part 2. The subfamily Mitrinae concluded and subfamilies Imbricariinae and Cylindromitridae. *Monogr. Mar. Moll.*, 4:1-164.

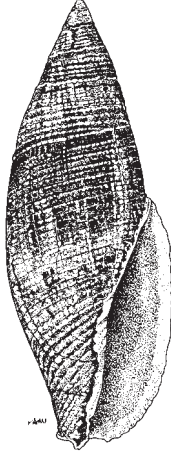
Pechar, P., C. Prior and B. Parkinson. 1980. *Mitre shells from the Pacific and Indian oceans*. Milton, Brown, 130 p.

***Mitra eremitarum* Röding, 1798**

Frequent synonyms / misidentifications: *Chrysame eremitarum* (Röding, 1798); *Mitra adusta* Lamarck, 1811 / *Mitra incompta* (Lightfoot, 1786).

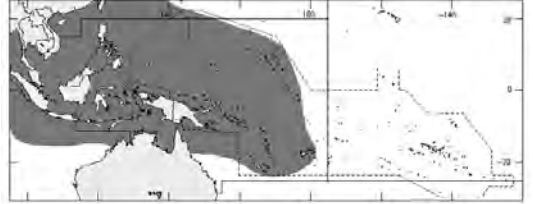
En - Adusta miter; **Fr** - Mitre brûlée.

Maximum shell length 8 cm, commonly to 6 cm. On coral reefs, usually under stones and corals on a sand substrate. Abundant in the intertidal zone. Mainly collected for its shell in the area. The central Indo-West Pacific, from the Andaman Sea and Cocos (Keeling) Islands to eastern Micronesia and Melanesia; north to southern Japan and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

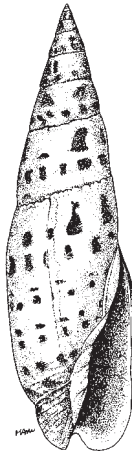


***Mitra mitra* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Mitra episcopalis* (Linnaeus, 1758) (Suppressed name) / None.

En - Episcopal miter; **Fr** - Mitre épiscopale.

Maximum shell length 18 cm, commonly to 14 cm. In coralline and silty sand, usually buried during the day and semi-active at the turn of tide; leaving large tracks when it moves with a partial covering of sand. Most active at night when it crawls upon the sand. Intertidal and sublittoral zones, to a depth of about 80 m. One of the best known and most popular species of miter shells. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to southern Japan, Wake Island and Hawaii, and south to southern Queensland and Kermadec Islands.



ventral view

(after Kira, 1962)



Mitra stictica (Link, 1807)

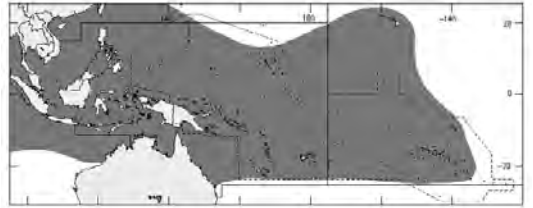
Frequent synonyms / misidentifications: *Mitra cardinalis* Röding, 1798 (not of Gmelin, 1791); *M. pontificalis* Lamarck, 1811 / *Mitra papalis* (Linnaeus, 1758).

En - Pontifical miter; **Fr** - Mitre pontificale.

Maximum shell length 8 cm, commonly to 6.5 cm. On reef platforms, on the underside of rocks and in coral crevices; generally on hard substrates. Intertidal, sublittoral and shelf zones, to a depth of about 200 m. Mainly collected for its shell in the area. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and southeastern India, but not in the northwestern part of the Indian Ocean nor the Red Sea, to eastern Polynesia; north to southern Japan and Hawaii, and south to southern Queensland and New Caledonia.



ventral view
(after Kira, 1962)



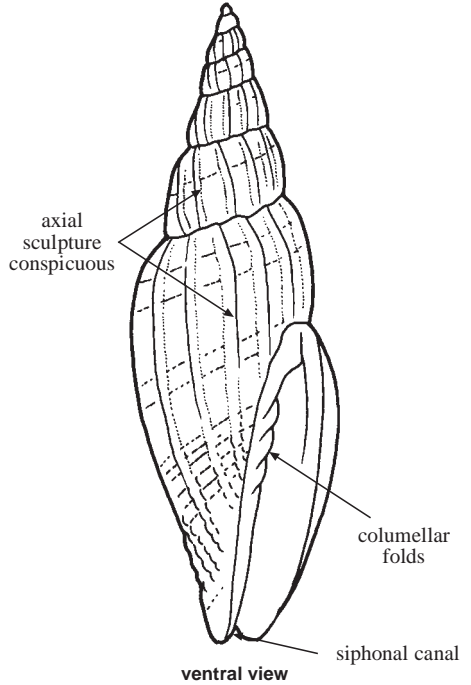
COSTELLARIIDAE

(= Vexillidae)

Costate miters

Distinctive characters: Shell fusiform-ovate, with a high, tapering spire and a rather narrow aperture. Surface with a **predominantly axial sculpture**. Periostracum thin or absent. **Aperture** elongate, anteriorly **notched by a short siphonal canal**. **Outer lip** generally smooth on the margin, **finely lirate deeply inside**. **Columella** with a few **strong spiral folds**, the **larger** ones situated **posteriorly**. **No operculum**. Head relatively small and narrow, with a pair of closely set, elongate tentacles bearing eyes on their outer sides. Snout extensible, moderately long to short, with a small mouth. Foot small, triangular, usually truncate anteriorly.

Habitat, biology, and fisheries: Mostly living in littoral and shallow subtidal, tropical or subtropical habitats. Smaller species usually in rock crevices or hard coral areas, larger ones burrowing in sand. Active predators or scavengers, sucking up soft tissues and body fluids of their prey. Sexes separate, fertilization internal. Eggs released in blister-shaped capsules attached by a flat base, each capsule containing only a few eggs. Hatching generally occurring at the crawling young stage. Mostly collected for shell trade. No precise data available in the area about the utilization of the species included here.

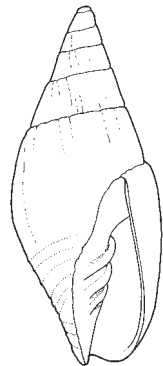


Similar families occurring in the area

Mitridae: shell almost identical to Costellariidae, but sculpture predominantly spiral; aperture not lirate inside.

Key to species of interest to fisheries occurring in the area

- 1a. Shell relatively slender in shape; axial ribs becoming low, widely spaced axial folds on body whorl, crossed by fine spiral grooves, and by weak spiral cords anteriorly *Vexillum vulpeculum*
- 1b. Shell relatively broad in shape; axial ribs strong, forming prominent shoulder nodules on body whorl, crossed by deep spiral grooves which produce a rough surface texture *Vexillum rugosum*





ventral view

Mitridae

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Vexillum rugosum* (Gmelin, 1791)
-  *Vexillum vulpeculum* (Linnaeus, 1758)

References

Cernohorsky, W.O. 1970. Systematics of the families Mitridae and Volutomitridae (Mollusca: Gastropoda). *Bull. Auckl. Inst. Mus.*, 8:1-190.

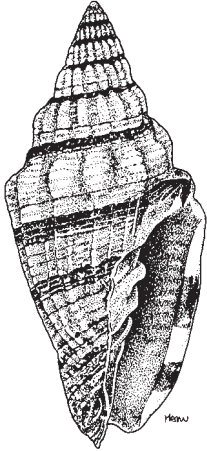
Pechar, P., C. Prior, and B. Parkinson. 1980. *Mitre shells from the Pacific and Indian oceans*. Milton, Brown, 130 p.

Vexillum rugosum (Gmelin, 1791)

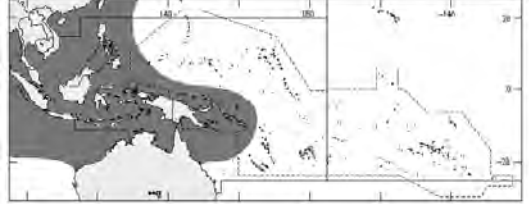
Frequent synonyms / misidentifications: *Mitra corrugata* Lamarck, 1811; *Turricula rugosa* (Gmelin, 1791) / *Vexillum plicarium* (Linnaeus, 1758).

En - Rugose miter; **Fr** - Mitre francée.

Maximum shell length 5 cm, commonly to 4 cm. In sandy bottoms. Shallow sublittoral zone, from low tide levels to a depth of about 10 m. No data on fisheries in the area. Widespread in the Indo-West Pacific, from East Africa, including the Red Sea, to Melanesia; north to southern Japan, and south to central Queensland.



ventral view
(after Short and Potter, 1987)



Vexillum vulpeculum (Linnaeus, 1758)

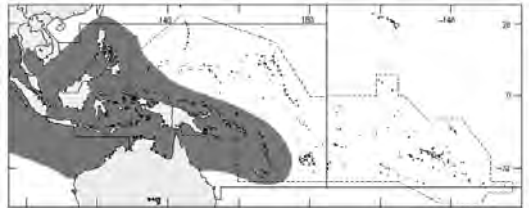
Frequent synonyms / misidentifications: *Turricula vulpecula* (Linnaeus, 1758) / *Vexillum caffrum* (Linnaeus, 1758).

En - Little-fox miter; **Fr** - Mitre petit-renard.

Maximum shell length 7 cm, commonly to 5 cm. In sandy bottoms. Shallow sublittoral zone, from low tide levels to a depth of about 10 m. No data on fisheries in the area. Widespread in the Indo-West Pacific, from East Africa to Melanesia; north to the Philippines, and south to central Queensland and New Caledonia.



ventral view
(after Short and Potter, 1987)

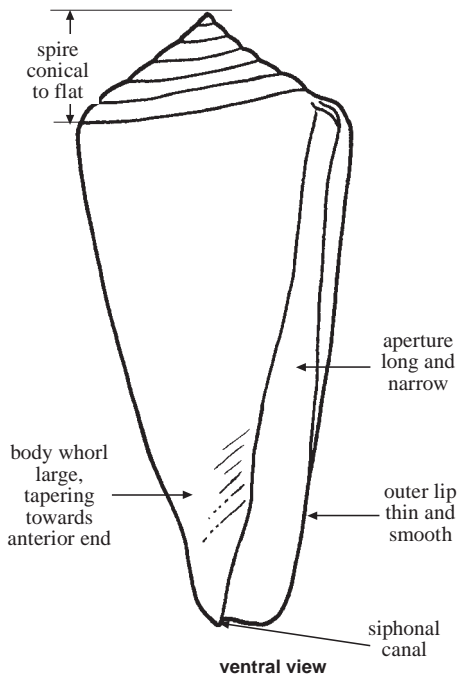


CONIDAE

Cone shells

Diagnostic characters: Shell cone-shaped, with a moderately low, conical to flat spire and a well-developed body whorl tapering towards the narrow anterior end. Sculpture variable but generally reduced, sometimes tuberculate on shoulder. Periostracum thin to thick and fibrous, sometimes obscuring the external colour patterns. Aperture very long and narrow, with a small notch at the posterior end and a short, wide siphonal canal anteriorly. Outer lip thin and smooth, inner lip without callus and folds. Operculum corneous, quite small, ovate to claw-shaped and with a terminal nucleus, sometimes absent. Head with a produced tubular sheath covering the snout which is capable of considerable distension, and with eyes on small stalks near the extremities of the tentacles. Foot long and rather narrow, rounded or truncated anteriorly and obtusely pointed posteriorly. Fleshy siphon of the mantle well developed.

Habitat, biology, and fisheries: Mostly reef-dwellers, living in clean or muddy-sand bottoms under rocks or corals, or in silty crevices. Most common in intertidal and shallow sublittoral zones, but also occurring deeper on the continental shelf and slope to a depth of about 600 m. Often partly or completely buried in the sediment, emerging when the tide turns or at night to search for food. Active predators, armed with sharp arrow-like teeth and a poisonous gland which secretes a powerful nerve toxin. Most species feed on marine worms, but others prey on molluscs or even on small fishes. Sexes separate, fertilization internal. Eggs laid in compressed corneous capsules attached in rows or groups by a flat basal disk. Females often gather for spawning. Planktonic larval stage of variable duration, rarely absent. The Conidae is a favourite family of shell collectors, and the group is best represented in the tropical Indo-West Pacific, with several hundred species. Cones are commercially important in the area and are actively collected for shell trade. Living cones must be handled with great care, for their bites may be painful or even occasionally fatal to humans. Due to the temperature sensitivity of the venom, cones are however edible without danger after cooking. They are known to be locally used as food in the Indo-West Pacific.



Similar families occurring in the area

None. Shell characters are very distinctive.

Key to species of interest to fisheries occurring in the area

- 1a. Shell colour with a pattern of triangular white patches (Fig. 1a) → 2
- 1b. Shell colour without a pattern of triangular white patches → 3

- 2a. Spire moderately high, smoothish; sides of body whorl convex; background colour orange-brown, with undulating axial lines (Fig. 1) *Conus textile*
- 2b. Spire low, coronate; sides of body whorl nearly straight; background colour black (Fig. 2). *Conus marmoreus*

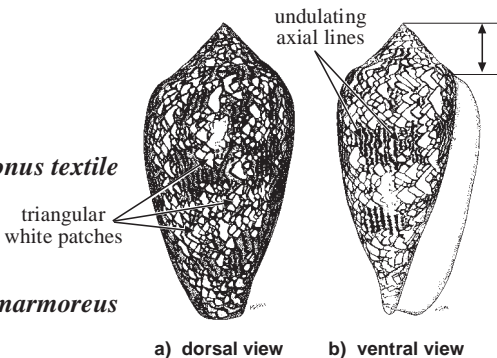


Fig. 1 *Conus textile*

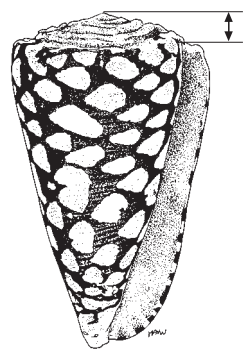


Fig. 2 *Conus marmoreus* (ventral view)

- 3a. Sculpture of body whorl mainly composed of widely spaced, deep spiral grooves on its anterior half; outer colour light to dark brown, with a whitish spiral band on shoulder (Fig. 3) *Conus radiatus*
- 3b. Sculpture of body whorl with only shallow spiral grooves anteriorly, or with beaded spiral cords; outer colour differently patterned → 4
- 4a. Body whorl with finely beaded spiral cords, which are stronger anteriorly → 5
- 4b. Body whorl nearly smooth, except for several spiral grooves anteriorly → 7
- 5a. Sides of body whorl convex; interior blue-white, becoming purple-brown near the margin (Fig. 4) *Conus coronatus*
- 5b. Sides of body whorl nearly straight; interior purple → 6
- 6a. Shoulder nodulose (Fig. 5) *Conus lividus*
- 6b. Shoulder smooth (Fig. 6) *Conus flavidus*

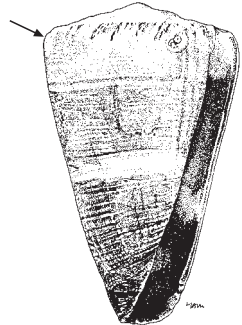
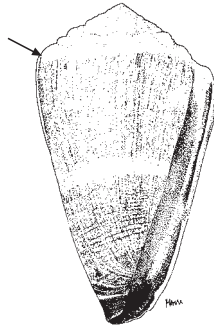
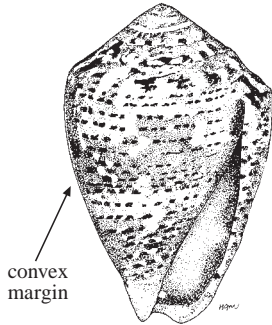
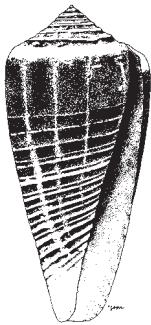


Fig. 3 *Conus radiatus* (ventral view)

Fig. 4 *Conus coronatus* (ventral view)

Fig. 5 *Conus lividus* (ventral view)

Fig. 6 *Conus flavidus* (ventral view)

- 7a. Apical part of the spire strongly protruding; outer colour fawn to brown, with 3 irregular spiral bands of white marked with dark axial streaks (Fig. 7) *Conus generalis*
- 7b. Apical part of the spire slightly protruding or flat; outer colour differently patterned → 8
- 8a. Outer colour plain yellow, sometimes with many fine light brown spiral lines (Fig. 8) *Conus quercinus*
- 8b. Outer colour differently patterned, with various axial or spiral rows of spots → 9
- 9a. Spots of body whorl orange-red in colour, most dense in 2 large, central spiral bands (Fig. 9) *Conus tessulatus*
- 9b. Spots of body whorl dark brown or black, not forming 2 large and more dense central spiral bands → 10

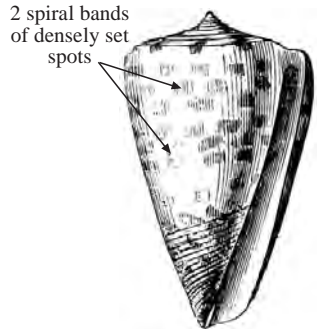
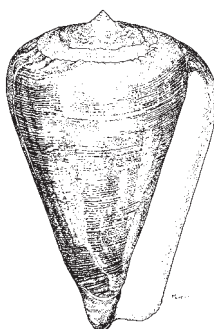
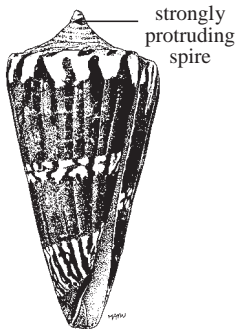


Fig. 7 *Conus generalis* (ventral view)

Fig. 8 *Conus quercinus* (ventral view)

Fig. 9 *Conus tessulatus* (ventral view)

- 10a. Spire low, with slightly elevated apex; shoulder rounded (Figs 10 and 11) → 11
- 10b. Spire flattish, with the apex not protruding; shoulder sharply angulate (Figs 12 and 13) → 12
- 11a. Dark spots smaller, reduced to narrow transverse dashes, more numerous, arranged in irregular axial bands (Fig. 10) *Conus suratensis*
- 11b. Dark spots larger, squarish or rounded, fewer, arranged in regular spiral rows (Fig. 11) *Conus betulinus*
- 12a. Shell large, up to 15 cm in length; body whorl usually with 3 spiral bands of yellow and with many dark spots which are in general relatively large, regular and squarish; anterior end of shell rounded, tinged dark violet (Fig. 12) *Conus litteratus*
- 12b. Shell very large, up to 22 cm in length; body whorl always without spiral bands of yellow and with many dark spots which are in general relatively small, irregular and axially elongated; anterior end of shell somewhat truncated, not tinged dark violet (Fig. 13) *Conus leopardus*

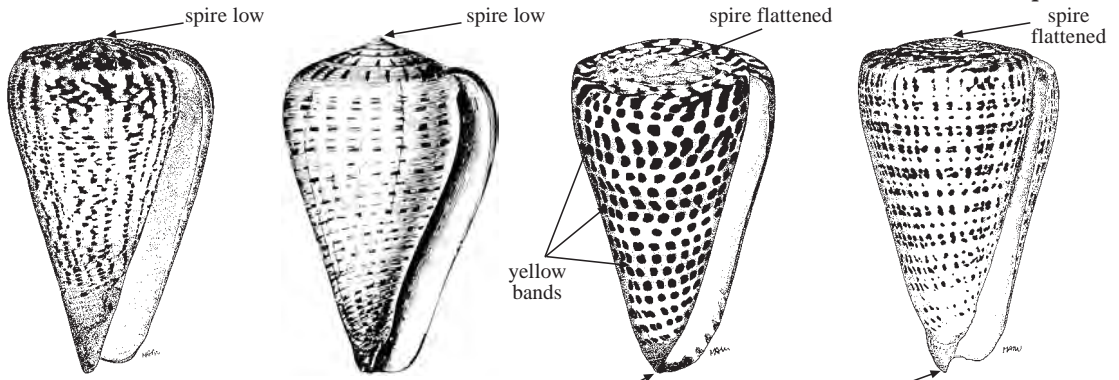


Fig. 10 *Conus suratensis* (ventral view) Fig. 11 *Conus betulinus* (ventral view) Fig. 12 *Conus litteratus* (ventral view) Fig. 13 *Conus leopardus* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol is given when species accounts are included.

- Conus betulinus* Linnaeus, 1758
- Conus coronatus* Gmelin, 1791
- Conus flavidus* Lamarck, 1810
- Conus generalis* Linnaeus, 1767
- Conus leopardus* (Röding, 1798)
- Conus litteratus* Linnaeus, 1758
- Conus lividus* Hwass, 1792
- Conus marmoreus* Linnaeus, 1758
- Conus quercinus* Lightfoot, 1786
- Conus radiatus* Gmelin, 1791
- Conus suratensis* Hwass, 1792
- Conus tessulatus* Born, 1778
- Conus textile* Linnaeus, 1758

References

Cabrera, J.J. 1984. The cone shells of Tayabas Bay (Neogastropoda: Toxoglossa). *Zool. Pap. natn. Mus. Manila*, 13:1-117.

Da Motta, A.J. 1991. *A systematic classification of the gastropod family Conidae at the generic level*. Rome, La Conchiglia, 48 p.

Estival, J.C. 1991. *Cônes de Nouvelle Calédonie et du Vanuatu*. Papeete, Editions du Pacifique, 126 p.

Röckel, D., W. Korn, and A.J. Kohn. 1995. *Manual of the living Conidae. Volume 1: Indo-Pacific Region*. Wiesbaden, Hemmen, 517 p.

Walls, J.G. 1978. *Cone shells: a synopsis of the living conidae*. Neptune City, T.F.H., 1011 p.

Conus litteratus Linnaeus, 1758

Frequent synonyms / misidentifications: *Conus arabicus* Lamarck, 1810; *C. pardus* (Röding, 1798); *Lithoconus litteratus* (Linnaeus, 1758) / *Conus eburneus* Hwass, 1792; *C. leopardus* (Röding, 1798).

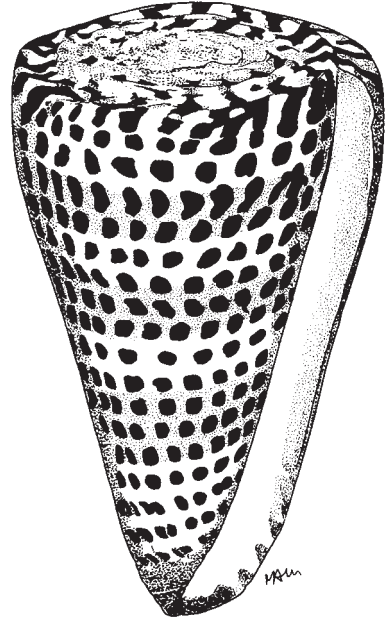
FAO names: En - Lettered cone; Fr - Cône imprimé.

Diagnostic characters: **Shell large**, thick and heavy, with a **flattish** or slightly concave **spire** and usually eroded, **non-protruding apex**. **Shoulder sharply angular**, forming a **concave surface near the suture**. Spire whorls shallowly concave, with reduced sculpture of weak to indistinct spiral threads (mostly visible with a hand lens on juvenile stages, when not eroded). **Body whorl polished, nearly smooth** except for several fine spiral grooves anteriorly. Periostracum finely wrinkled, closely applied to the shell. Aperture fairly narrow, somewhat broader anteriorly. Outer lip nearly straight, sometimes slightly concave at midlength in larger specimens. Columella anteriorly connected to the outer lip through a smooth and continuous curve, making the **anterior end of shell distinctly rounded**. **Colour:** **outside of shell white, usually with 3 spiral bands of yellow or orange on body whorl and many spiral rows of numerous dark brown to black spots which are in general relatively large, regular and squarish** (occasionally smaller, rounder and more numerous). Spots near shoulder often axially elongated and extending onto the spire. Spire whorls with numerous dark brown to black radiating lines. **Anterior end of shell tinged dark violet or blackish brown**. Periostracum light yellowish brown, semitranslucent. **Aperture porcelaneous white, with a brown to blackish rim at anterior end.**

Size: Maximum shell length 17 cm, commonly to 13 cm.

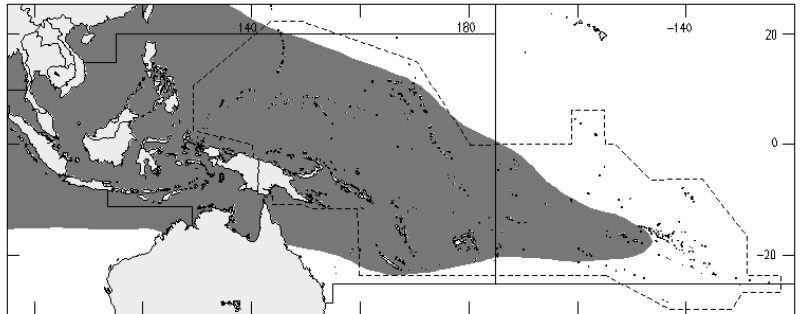
Habitat, biology, and fisheries: In coral reefs, in sandy patches and among coral rubble. Intertidal and shallow sublittoral zones, to a depth of about 20 m. Locally collected for food. Shell frequently used in the Philippines by artisanal jewelry.

Distribution: Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to southern Japan, and south to Queensland and New Caledonia.



ventral view

(after Wilson and Gillett, 1971)



Conus quercinus Lightfoot, 1786

Frequent synonyms / misidentifications: *Cleobula quercina* (Lightfoot, 1786) / None.

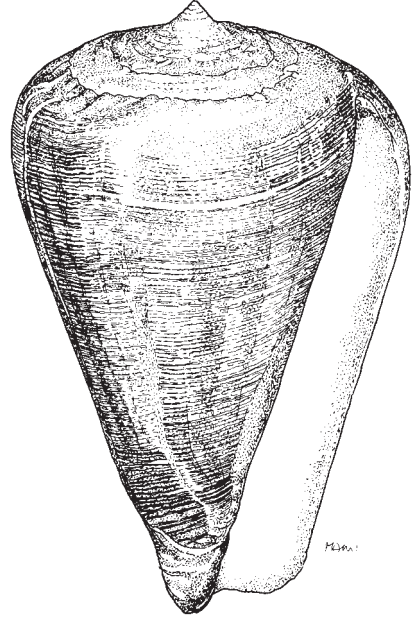
FAO names: En - Oak cone; Fr - Cône petit-chêne.

Diagnostic characters: Shell medium sized, very heavy, with a moderately low, conical spire and pointed apex. Spire whorls flat, spirally striate. Shoulder broad and rounded to somewhat angulate. Body whorl with a low gloss, smoothish but for a number of fine spiral grooves in the anterior half. Anterior end of columella often slightly calloused. **Colour:** outside of shell plain yellow (occasionally whitish), sometimes with crowded fine light brown spiral lines under a prominent and rough, dark brown periostracum. Spire with a darker brown apex. Aperture pure white inside.

Size: Maximum shell length 12 cm, commonly to 8 cm.

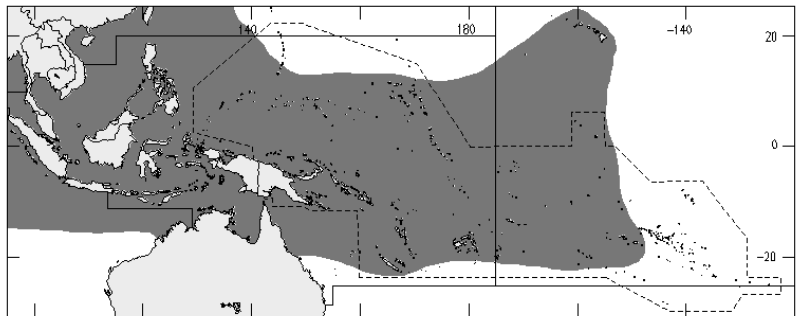
Habitat, biology, and fisheries: Sandy bottoms. Usually buried in the sand during the day but actively foraging for food during evening and early dawn hours. Preys on annelid worms. Occasionally present in the local markets of the northern Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and Hawaii, and south to Queensland and New Caledonia.



ventral view

(after Wilson and Gillett, 1971)



Conus suratensis Hwass, 1792

Frequent synonyms / misidentifications: *Cleobula suratensis* (Hwass, 1792); *Conus agrestis* Mörch, 1850 / *Conus betulinus* Linnaeus, 1758.

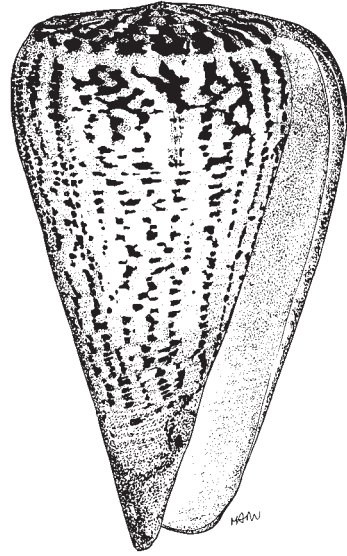
FAO names: En - Suratan cone; Fr - Cône de Surat.

Diagnostic characters: **Shell large**, thick and heavy, inflated, with a very low spire and slightly elevated apex. **Spire whorls** flat to slightly concave, without distinct sculpture. **Shoulder broad and rounded**, flat to shallowly concave below suture. **Body whorl moderately glossy, nearly smooth** except for several spiral grooves anteriorly and a rather broad and low spiral ridge on columella. **Colour:** outside of shell cream to white, with numerous, small dark brown spots on body whorl, reduced to narrow, transverse dashes and arranged in irregular axial bands. Dark spots sometimes more or less fused into short axial flammules towards the shoulder. **Anterior end of shell broadly tinged bright orange** or light fawn. Spire whorls white, often with orange hue, and with curved, blackish brown radiating lines. Aperture entirely white inside.

Size: Maximum shell length 15 cm, commonly to 10 cm.

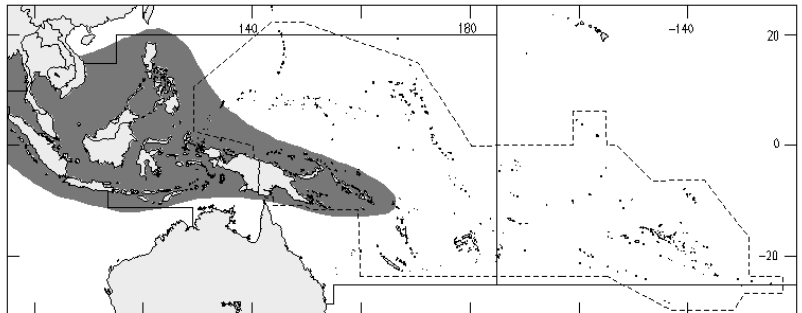
Habitat, biology, and fisheries: In sandy bottoms. Littoral and shallow sublittoral zones to a depth of about 20 m. Occasionally present in the local markets of the northern Philippines.

Distribution: Imperfectly known because of frequent confusion with *Conus betulinus*. Indo-West Pacific, from East Africa, southern India and Sri Lanka to Melanesia; north to the Philippines and south to Indonesia.



ventral view

(after Springsteen and Leobrera, 1986)

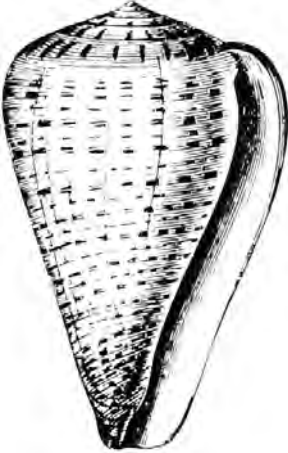


***Conus betulinus* Linnaeus, 1758**

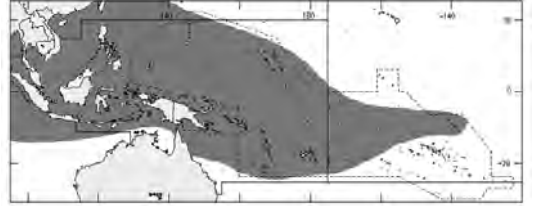
Frequent synonyms / misidentifications: *Cleobula betulina* (Linnaeus, 1758); *Dendroconus betulinus* (Linnaeus, 1758); *Gastridium betulinus* (Linnaeus, 1758) / None.

En - Beech cone; **Fr** - Cône bouleau.

Maximum shell length 17.5 cm, commonly to 12 cm. Sand flats, especially in sheltered areas and near seagrasses. Littoral and shallow sublittoral zones to a depth of about 20 m. Locally collected for food. Considered a commercial resource off the Coromandel coast of India. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to southern Japan and south to Queensland and New Caledonia.



ventral view

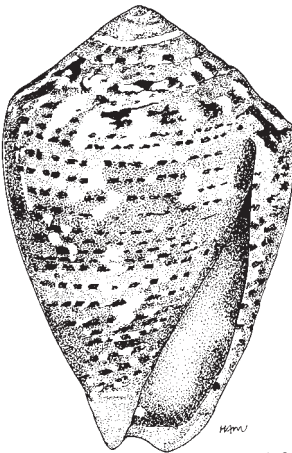


***Conus coronatus* Gmelin, 1791**

Frequent synonyms / misidentifications: *Conus aristophanes* Sowerby, 1857; *Dendroconus coronatus* (Gmelin, 1791); *Virroconus coronatus* (Gmelin, 1791) / *Conus miliaris* Hwass, 1792.

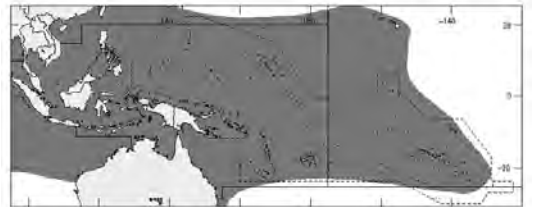
En - Crowned cone; **Fr** - Cône couronné.

Maximum shell length 4 cm, commonly to 3 cm. Abundant in coral reef areas, in sand pockets among corals or exposed on rocks. Intertidal and shallow sublittoral zones to a depth of about 10 m. Sometimes present in local markets of the northern Philippines. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and Hawaii, and south to northern New South Wales.



ventral view

(after Wilson and Gillett, 1971)

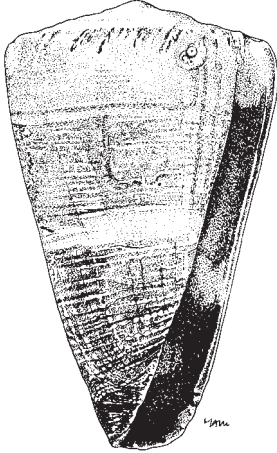


***Conus flavidus* Lamarck, 1810**

Frequent synonyms / misidentifications: *Virgiconus flavidus* (Lamarck, 1810) / *Conus lividus* Hwass, 1792.

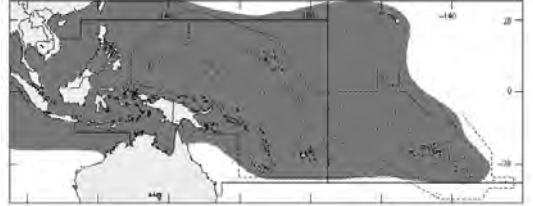
En - Yellow Pacific cone; **Fr** - Cône flave.

Maximum shell length 6 cm, commonly to 4 cm. Common on reef areas, usually under boulders and corals during the day. Mainly feeding on small coral fishes. Intertidal and shallow sublittoral zones to a depth of about 10 m. Occasionally marketed in the northern Philippines. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and Hawaii, and south to northern Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

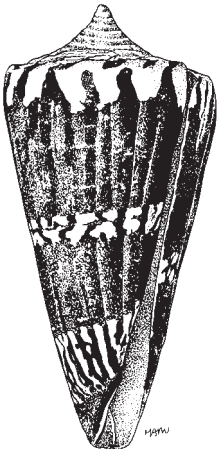


***Conus generalis* Linnaeus, 1767**

Frequent synonyms / misidentifications: *Leptoconus generalis* (Linnaeus, 1767) / None.

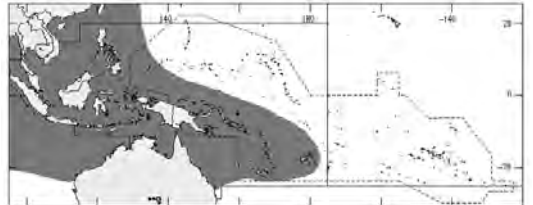
En - General cone; **Fr** - Cône général.

Maximum shell length 9.5 cm, commonly to 8 cm. In sandy bottoms. Intertidal and shallow sublittoral zones to a depth of about 10 m. Locally collected for food. Widespread in the Indo-West Pacific, from East Africa to eastern Melanesia; north to southern Japan, and south to southern Queensland and New Caledonia. Indian Ocean populations generally considered as a distinct subspecies (*Conus generalis maldivus* (Hwass, 1792)).



ventral view

(after Dance, 1993)



***Conus leopardus* (Röding, 1798)**

Frequent synonyms / misidentifications: *Conus millepunctatus* Lamarck, 1822 (not of Röding, 1798); *C. pardus* Link, 1807 (not of Röding, 1798); *Lithoconus leopardus* (Röding, 1798) / *Conus litteratus* Linnaeus, 1758.

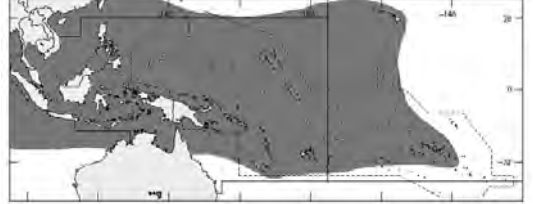
En - Leopard cone; **Fr** - Cône léopard.

Maximum shell length 22 cm, commonly to 17 cm. In sand among corals of reef areas. Intertidal and shallow sublittoral zones to a depth of about 20 m. Locally collected for food. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to southern Japan and Hawaii, and south to Queensland and New Caledonia.



ventral view

(after Wilson and Gillett, 1971)

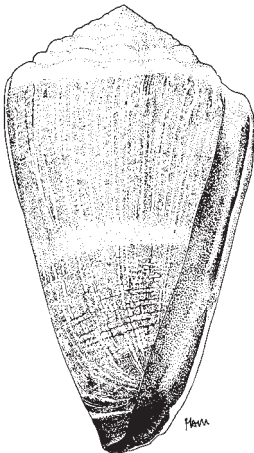


***Conus lividus* Hwass, 1792**

Frequent synonyms / misidentifications: *Conus monachus* (Röding, 1798); *C. plebejus* Link, 1807; *C. virgineus* Link, 1807; *Virgiconus lividus* (Hwass, 1792) / *Conus flavidus* Lamarck, 1810.

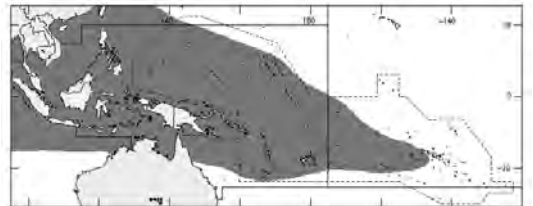
En - Livid cone; **Fr** - Cône livide.

Maximum shell length 6 cm, commonly to 4 cm. Common in coral reef areas. Intertidal and shallow sublittoral zones to a depth of about 10 m. Occasionally appearing in the local markets of the northern Philippines. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and Hawaii, and south to northern New South Wales.



ventral view

(after Short and Potter, 1987)

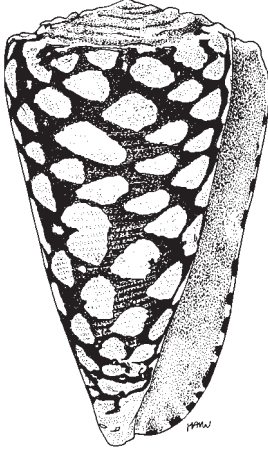


***Conus marmoreus* Linnaeus, 1758**

Frequent synonyms / misidentifications: *Conus bandanus* Hwass, 1792 / None.

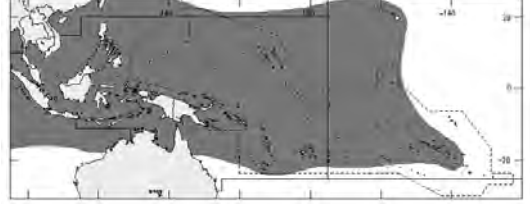
En - Marble cone; **Fr** - Cône marbré.

Maximum shell length 15 cm, commonly to 10 cm. Common in coral reefs. Intertidal and sublittoral zones to a depth of about 10 m. Occasionally used as food. Must be carefully handled, as it can inflict painful bites with its poisonous, arrow-like teeth. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to southern Japan and Hawaii, and south to Queensland and New Caledonia.



ventral view

(after Short and Potter, 1987)

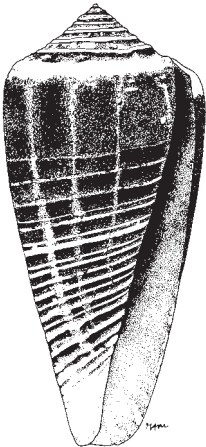


***Conus radiatus* Gmelin, 1791**

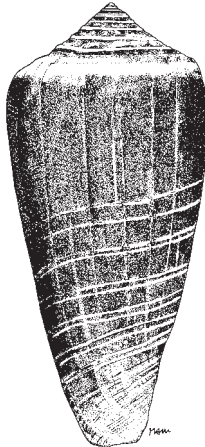
Frequent synonyms / misidentifications: *Conus martinianus* Reeve, 1844; *Phasmoconus radiatus* (Gmelin, 1791) / None.

En - Rayed cone; **Fr** - Cône rayé.

Maximum shell length 8 cm, commonly to 6 cm. Common on sublittoral bottoms. Collected in fairly large quantities in the Philippines, mainly for shell trade. Restricted to the tropical West Pacific, from southern Japan and the Philippine Archipelago to eastern Melanesia.



ventral view



dorsal view

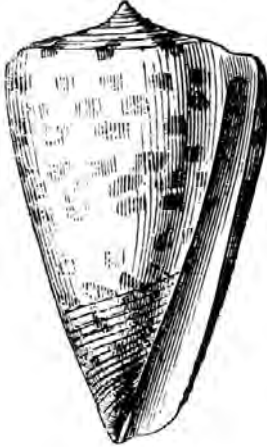


Conus tessulatus Born, 1778

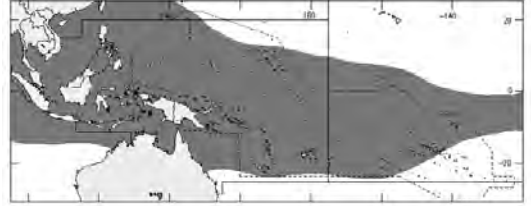
Frequent synonyms / misidentifications: *Dendroconus tessulatus* (Born, 1778); *Lithoconus tessulatus* (Born, 1778) / None.

En - Tessellate cone; **Fr** - Cône mosaïque.

Maximum shell length 6.5 cm, commonly to 5 cm. Coral reef areas. Usually in muddy sand and gravel flats of sheltered environments. Intertidal and sublittoral zones, to a depth of about 20 m. Locally used as food. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and south to Queensland and New Caledonia; also occurring in the tropical eastern Pacific, on the offshore islands and mainland, from Mexico to Costa Rica.



ventral view

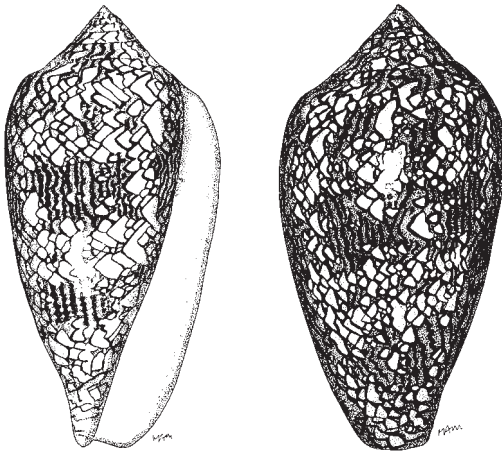


Conus textile Linnaeus, 1758

Frequent synonyms / misidentifications: *Cylinder textile* (Linnaeus, 1758); *Darioconus textile* (Linnaeus, 1758) / None.

En - Textile cone; **Fr** - Cône textile.

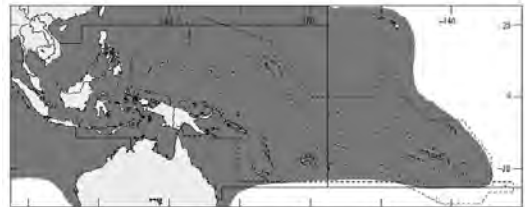
Maximum shell length 15 cm, commonly to 10 cm. Common in clean sand, under stones and coral slabs. Intertidal and shallow sublittoral zones to a depth of about 10 m. Mainly feeding on small coral fishes. This species is **very poisonous**, and can inflict painful, and perhaps fatal bites. Locally used as food. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and Hawaii, and south to New South Wales.



ventral view

(after Kira, 1962)

dorsal view

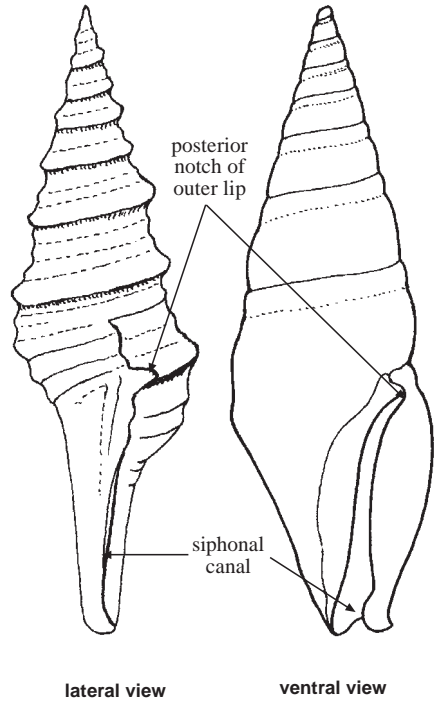


TURRIDAE

Turrids

Diagnostic characters: Shell variable in shape, generally fusiform, with a high slender spire. Outer surface with many sculptural patterns, composed of spiral or axial to oblique ribs and cords, grooves, nodules or spines. Periostracum often present. Aperture more or less elongate, siphonal canal well marked, short to long. Outer lip generally thin and sharp. A characteristic slit or notch along the posterior part of the outer lip, which is reflected in the growth lines made by the lip. Inner lip mostly smooth. Operculum corneous, with a terminal or lateral nucleus, sometimes absent. Head with a long snout and widely separated tentacles bearing eyes at or near their bases. Fleshy siphon well developed.

Habitat, biology, and fisheries: Mostly living in soft substrates, but some species also occurring in rock and coral reef habitats. May abound in sublittoral and shelf zones. Active predators, rasping prey with their radula or stabbing it with detachable, needle-like teeth charged with venom. Sexes generally separate, fertilization internal. Eggs produced in lens-shaped or triangular corneous capsules with a flat attachment base, hatching as planktonic larvae or as crawling juveniles. Though turrids may be caught in numbers by shrimp trawlers on the continental shelf, they have yet not been used much. However, they represent a potential resource for fisheries in this area, and may contribute significantly to the local consumption of seashells. Research on the exploitable species has been undertaken in some West Pacific countries. A few species are also occasionally collected in coastal, shallow water environments.




Similar families occurring in the area




None. The notch-like posterior sinus at the outer lip of aperture mostly distinguishes Turridae from other fusiform gastropods exhibiting an anterior siphonal canal, such as Fasciolaridae, Mitridae, or Terebridae.

Key to species of interest to fisheries occurring in the area

- 1a. Shell strongly keeled at the shoulder; sides of the whorls angulated → 2
- 1b. Shell not keeled at the shoulder; sides of the whorls rounded *Turris babylonia*
- 2a. Shell unicoloured (somewhat paler on the shoulder nodules); posterior notch of outer lip on shoulder slope *Turricula javana*
- 2b. Shell off-white in colour, with numerous, prominent brown streaks and spots; posterior notch of outer lip on shoulder *Lophiotoma indica*

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Lophiotoma indica* (Röding, 1798)
-  *Turricula javana* (Linnaeus, 1758)
-  *Turris babylonia* (Linnaeus, 1758)

References

Powell, A.W.B. 1964. The family Turridae in the Indo-Pacific. Part 1. The subfamily Turrinae. *Indo-Pac. Moll.*, 1(5):227-346.

Powell, A.W.B. 1966. The molluscan families Speightiidae and Turridae. An evaluation of the valid taxa, both recent and fossil, with lists of characteristic species. *Bull. Auckl. Inst. Mus.*, 5:1-184.

Powell, A.W.B. 1967. The family Turridae in the Indo-Pacific. Part 1a. The subfamily Turrinae concluded. *Indo-Pac. Moll.*, 1(7):409-444.

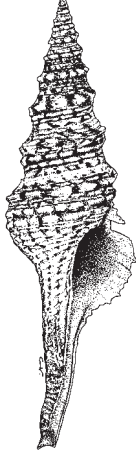
Powell, A.W.B. 1969. The family Turridae in the Indo-Pacific. Part 2. The subfamily Turriculinae. *Indo-Pac. Moll.*, 2(10):207-416.

Lophiotoma indica (Röding, 1798)

Frequent synonyms / misidentifications: *Pleurotoma marmorata* Lamarck, 1822 / None.

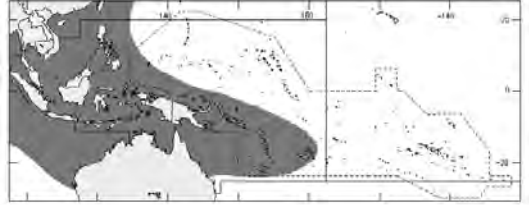
En - Indian turrid; **Fr** - Pleurotome marbré.

Maximum shell length 9.5 cm, commonly to 7 cm. Common on muddy bottoms. Shallow sublittoral zone and offshore to a depth of about 50 m. Incidentally collected in shrimp trawls. Indo-West Pacific, from East Africa to eastern Melanesia; north to Japan and south to Queensland.



ventral view

(after Short and Potter, 1987)



Turricula javana (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Pleurotoma nodifera* Lamarck, 1822; *Surcula javana* (Linnaeus, 1758) / None.

En - Javanese turrid; **Fr** - Pleurotome de Java.

Maximum shell length 7.5 cm, commonly to 6 cm. Common on sublittoral muddy bottoms, to a depth of about 30 m. Incidentally collected in shrimp trawls. Indo-West Pacific, from Pakistan, India and Sri Lanka to the Philippines; north to Japan and south to Indonesia.



ventral view

(after Dance, 1974)



Turris babylonia (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Lophiotoma babylonia* (Linnaeus, 1758) / None.

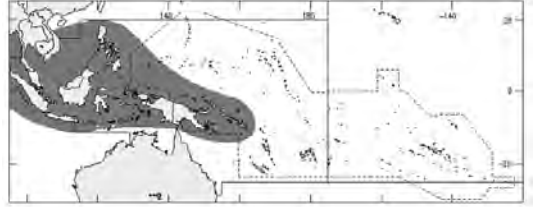
En - Babylonia turrid; **Fr** - Pleurotome Babylone.

Maximum shell length 10 cm, commonly to 7 cm. On soft sublittoral bottoms. Incidentally collected in shrimp trawls. Indo-West Pacific, from India to Melanesia; north to the Philippines and south to Indonesia.



ventral view

(after Short and Potter, 1987)



TEREBRIDAE

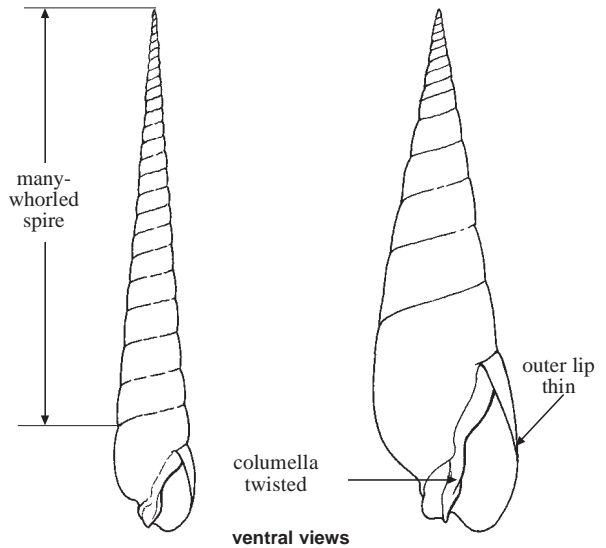
Auger shells

Diagnostic characters: Shell elongate and sharply conical, more or less slender, with a high, many-whorled spire and relatively small aperture. Outer surface smooth or with a low sculpture of axial or spiral cords and often a spiral groove near the suture. No periostracum. Anterior siphonal canal short and wide. Outer lip of the aperture thin. Inner lip thickened, with a twisted columella. Operculum corneous, small and ovate to claw-shaped, with a terminal nucleus. Head with a thin, long, and cylindrical snout. Eyes, when present, at the tips of short tentacles. Foot often small, rounded anteriorly and elongate posteriorly. Fleishy siphon well developed.

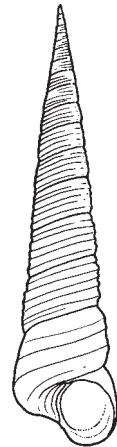
Habitat, biology, and fisheries: Common in shallow water, tropical to subtropical marine environments such as sandy shores and coral-reef flats. Bury themselves in clean to muddy-sand bottoms, with only the apical tip of the spire and the fleshy siphon exposed. Active, carnivorous animals, feeding on polychaetes or enteropneusts which are located by touch, with the aid of the sensitive front edge of the foot and the snout. Some species have sharp, arrow-like radular teeth and a poisonous gland to paralyse their prey before it is swallowed. Sexes separate, fertilization internal. Eggs released in corneous capsules, hatching either as planktonic larvae or as crawling juveniles. Some of the larger species are occasionally consumed by the sea shore inhabitants, but Terebridae are now mainly collected for their elegant shells which are highly prized among collectors.

Similar families occurring in the area

Turritellidae: general shape of shell similar to Terebridae, but aperture devoid of the notched siphonal canal and outer sculpture only spiral; operculum rounded, with a central nucleus.



examples showing diversity of shape



ventral view

Turritellidae

Key to species of interest to fisheries occurring in the area

- 1a.** Shell shape relatively short and broad → **2**
- 1b.** Shell shape long and slender → **3**
- 2a.** Shell relatively large (up to 27.5 cm in length); aperture quadrate, with a medially angular inner lip (Fig. 1) ***Terebra maculata***
- 2b.** Shell relatively small (up to 9 cm in length); aperture triangular, with an almost straight columella (Fig. 2) ***Hastula hectica***
- 3a.** Early whorls of spire with axial cords; a spiral groove under the suture of later whorls; 4 spiral bands of brown spots on the body whorl, and 3 on the others (Fig. 3) . . . ***Terebra areolata***
- 3b.** Early whorls of spire without axial cords; no spiral groove under the suture of later whorls; 3 spiral bands of brown spots on the body whorl, and 2 on the others (Fig. 4). ***Terebra subulata***



Fig. 1 *Terebra maculata*
(ventral view)



Fig. 2 *Hastula hectica*
(ventral view)

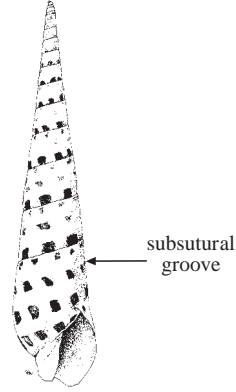






Fig. 3 *Terebra areolata*
(ventral view)



Fig. 4 *Terebra subulata*
(ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Hastula hectica* (Linnaeus, 1758)
-  *Terebra areolata* (Link, 1807)
-  *Terebra maculata* (Linnaeus, 1758)
-  *Terebra subulata* (Linnaeus, 1767)

References

- Bratcher, T. and W.O. Cernohorsky. 1987. *Living terebras of the world. A monograph of the recent Terebridae of the world.* Melbourne, American Malacologists, 240 p.
- Cernohorsky, W.O. and A. Jennings. 1966. The Terebridae of Fiji (Mollusca: Gastropoda). *Veliger*, 9(1):37-67.

Terebra maculata (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Oxymoris maculata* (Linnaeus, 1758); *Subula maculata* (Linnaeus, 1758); *Terebra roosevelti* Bartsch and Rehder, 1939 / None.

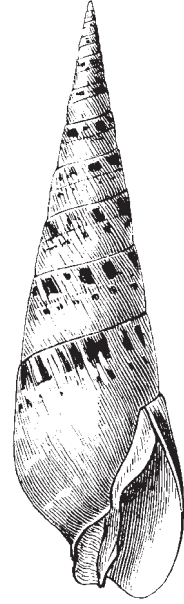
FAO names: **En** - Marlinspike; **Fr** - Térébre épissoire.

Diagnostic characters: **Shell large, thick and heavy, with a relatively short and broad shape.** Early whorls of spire with numerous small axial cords, later whorls **smooth.** Outline of spire whorls almost straight. **Aperture large** (about 1/3 the total length of shell), **roughly quadrate** in outline, **with a medially angular inner lip.** Columellar thickening axially striate, with a sharp spiral ridge at its posterior margin. Operculum ovate, brownish. **Colour: outside of shell cream, with 2 unequal spiral bands of axially elongated dark brown patches on each whorl.** Anterior half of body whorl with spiral bands of squarish light tan patches. **Inner side of aperture creamy,** often with the outer colour pattern showing through. Columellar margin white.

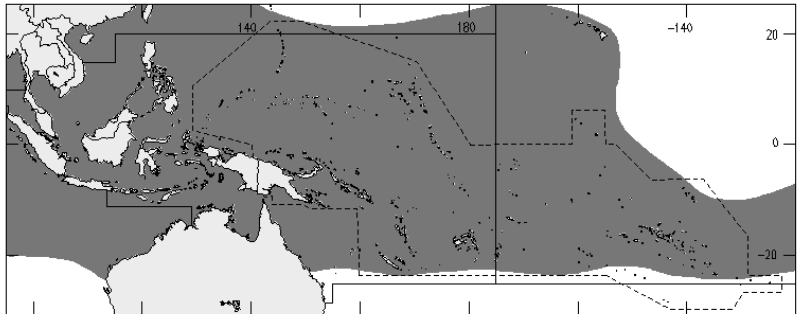
Size: Maximum shell length 27.5 cm, commonly to 16 cm.

Habitat, biology, and fisheries: On sandy bottoms, from low tide to a depth of about 210 m. Leaves characteristic wide tracks on sand when moving. Commonly collected in many areas, both for its edible flesh and for its shell which has been used as a tool in many of the South Pacific cultures.

Distribution: Widespread in the Indo-Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to southern Japan and Hawaii, and south to Queensland; also occurring in Socorro and Cocos islands, off East Central America.



ventral view



Hastula hectica (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Impages hectica* (Linnaeus, 1758); *Terebra caerulescens* Lamarck, 1822; *T. hectica* (Linnaeus, 1758) / None.

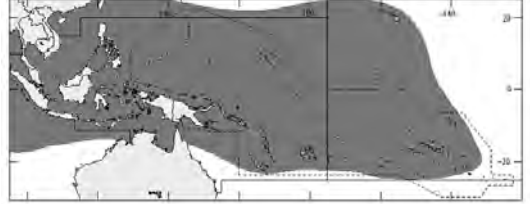
En - Sandbeach auger; **Fr** - Térébre châtaigne.

Maximum shell length 9 cm, commonly to 7 cm. Sandy beaches under the action of surf. Mainly collected for its shell in the area. This species is commercially important on the Coromandel coast of India. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to Japan and Hawaii, and south to northeastern Queensland.



ventral view

(after Springsteen and Leobrera, 1986)



Terebra areolata (Link, 1807)

Frequent synonyms / misidentifications: *Subula areolata* (Link, 1807); *Terebra muscaria* Lamarck, 1822; *T. subulata* Lamarck, 1816 (not of Linnaeus, 1767) / None.

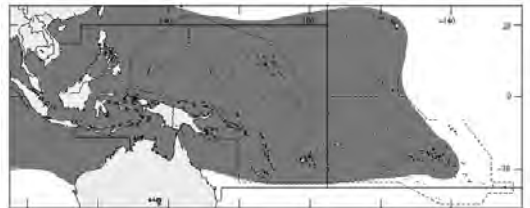
En - Fly spotted auger; **Fr** - Térébre mouchetée.

Maximum shell length 18 cm, commonly to 13 cm. On sandy bottoms. Low tide and sublittoral zone to a depth of about 20 m. Mainly collected for its shell. Widespread in the Indo-West Pacific, from East Africa, including Madagascar and the Red Sea, to eastern Polynesia; north to southern Japan and Hawaii, and south to Queensland.



ventral view

(after Short and Potter, 1987)



Terebra subulata (Linnaeus, 1767)

Frequent synonyms / misidentifications: None / None.

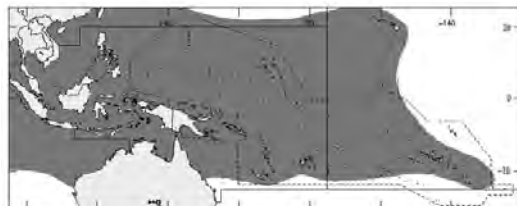
En - Subulate auger; **Fr** - Térébre subulée.

Maximum shell length 17 cm, commonly to 13 cm. On sandy bottoms. Intertidal and shallow sublittoral zone to a depth of about 10 m. Mainly collected for its shell. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, to eastern Polynesia; north to Japan and Hawaii, and south to Queensland.



ventral view

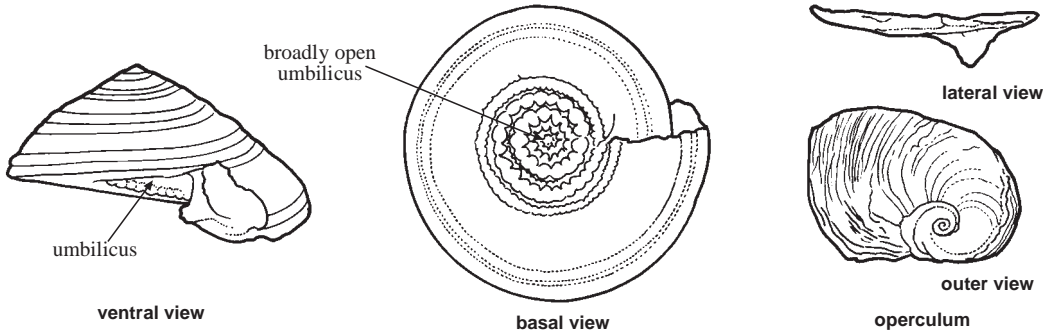
(after Short and Potter, 1987)



ARCHITECTONICIDAE

Sundial shells

Diagnostic characters: Shell usually wider than long, low-conical to discoidal in shape, with a large, rather flat base. Umbilicus broadly open, within which can be seen the spiral coiling of the whorls and the inverted larval shell. Sculpture of regular spiral ridges intersected by axial grooves, usually with 1 or 2 keels at periphery and a nodular spiral rib bordering the umbilicus. Periostracum thin and translucent, easily eroded. Aperture rounded to angular, without a siphonal canal. Operculum corneous, with a tubercle internally, either flat and paucispiral or high conical and multispiral. Head with a short snout and a pair of long, tapering and very slender tentacles bearing eyes at their outer bases. Anterior portion of the foot produced into 2 pointed lobes. Soft body coloration resulting from a combination of black and white markings in the epidermis, and from the internal organ coloration showing through; most developed on tentacles and the anterior part of the foot.



Habitat, biology, and fisheries: Tropical and warm-temperate species, associated with coelenterates such as sea-anemones, corals, or zoanths on which they feed. Mouth region lined with a tough cuticle as a protection against stings of coelenterates. Shell shape reflecting the habitat of species: depressed with a sharp peripheral keel allowing easy burrowing for sand-dwellers, more or less rounded for species of hard substrates. Simultaneous hermaphrodites. Eggs numerous, laid in capsules and embedded in a gelatinous mass anchored to the substrate, hatching as planktonic larvae. Pelagic larval stages often long, hence a very wide distribution. Sundials are occasionally collected by shrimp trawlers, consumed by fishermen and used as decorative items in the shellcraft industry.

Similar families occurring in the area



Xenophoridae: base concave; periphery with a lobed marginal flange, hollow spines, or cemented debris of shells, corals, or stones.

Key to species of interest to fisheries occurring in the area

- 1a. Median area of the shoulder slope divided by a distinct spiral groove into 2 ribs (Fig. 1a) *Architectonica maxima*
- 1b. Median area of the shoulder slope undivided (Fig. 1b) *Architectonica perspectiva*

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Architectonica maxima* (Philippi, 1849)
-  *Architectonica perspectiva* (Linnaeus, 1758)

Reference

Bieler, R. 1993. Architectonicidae of the Indo-Pacific (Mollusca, Gastropoda). *Abhandl. Naturwiss. Ver. Hamburg* (n. F.), 30:1-365.

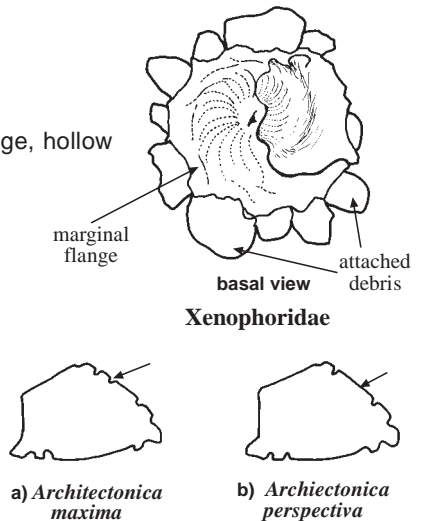


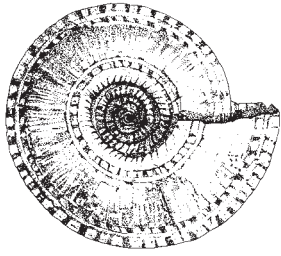
Fig. 1 outline of aperture

***Architectonica maxima* (Philippi, 1849)**

Frequent synonyms / misidentifications: *Solarium maximum* Philippi, 1849; *S. perspectivum* Lamarck, 1810 (not of Linnaeus, 1758) / *Architectonica trochlearis* (Hinds, 1844).

En - Giant sundial; **Fr** - Solarium géant.

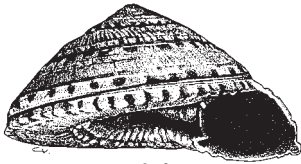
Maximum shell width 6 cm, commonly to 5 cm. On sandy and muddy sublittoral bottoms, in depths of 10 to 165 m, rarely to 280 m. Most common in shallow water from 10 to 50 m. Occasional bycatch of shrimp trawlers. Widespread in the Indo-West Pacific, from East Africa, including the Persian Gulf but not the Red Sea, to the Society Islands; north to Japan, and south to New Caledonia, New South Wales, and possibly New Zealand.



basal view



apical view



ventral view

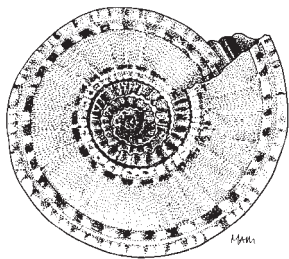
(after Bieler, 1993)

***Architectonica perspectiva* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Architectonica australe* (Philippi, 1849); *A. cumingii* (Hanley, 1862); *A. formosum* (Hinds, 1844); *A. fuliginosum* (Hinds, 1844); *A. hanleyi* (Sowerby, 1863); *A. maculatum* (Reeve, 1848); *Solarium peryspectivum* (Linnaeus, 1758) / *Solarium perspectivum* Lamarck, 1810 (= *Architectonica maxima* (Philippi, 1849)).

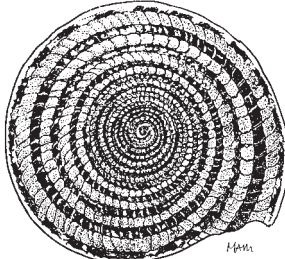
En - Clear sundial; **Fr** - Solarium clair.

Maximum shell width 6 cm, commonly to 5 cm. Sublittoral, on sandy and muddy bottoms, from depths of 10 to 120 m, mostly between 10 and 65 m. Occasional bycatch of shrimp trawlers. Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and Hawaii, and south to eastern South Australia and Tasmania.

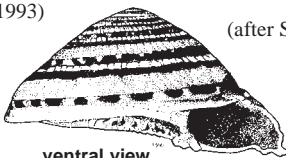
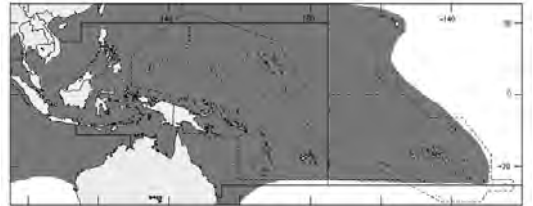


basal view

(after Dance, 1993)



apical view



ventral view

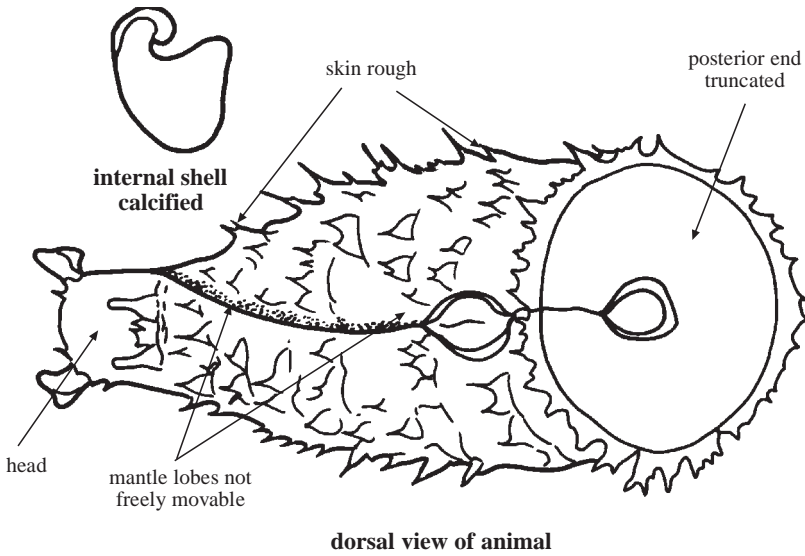
(after Bieler, 1993)

(after Short and Potter, 1987)

DOLABELLIDAE

Sea cats

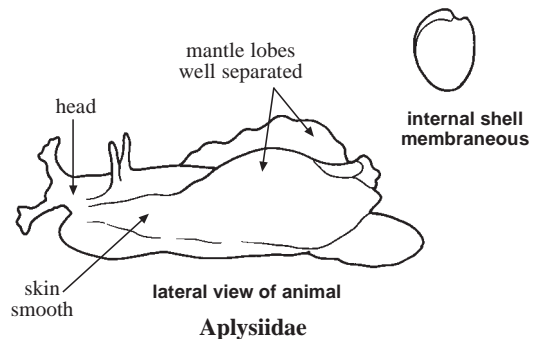
Diagnostic characters: Shell nearly internal, reduced but well calcified, forming a flat asymmetrical plate which is not visible externally and which cannot accommodate more than a small part of the body. Shell **spirally coiled, conspicuously concave on the right side**, with the apex curved and covered by a heavily thickened axial edge. Opening very large, **flattened**. Animal somewhat resembling to a crouching cat in shape, with 2 large, **ear-like processes on the head**. Body larger posteriorly, smaller anteriorly and somewhat truncate behind, **with a rough, warty and often highly coloured skin**. Head with 2 pairs of tentaculate processes, the posterior ones lying behind the eyes. **Foot long, with 2 symmetrically expanded outgrowths embracing the body laterally**, united posteriorly and enclosing a large branchial cavity dorsally. Gill conspicuous, arched, folded.



Habitat, biology, and fisheries: Herbivorous animals, common in algal zones of coastal environments. Hermaphroditic, with a very long, protrusible penis under the right cephalic tentacles, and a female genital opening under the gill. Copulation in chains. Eggs laid in a long cordon of thin, jelly-like strands, and hatching as planktonic larvae.

Similar families occurring in the area

Aplysiidae: shell thin, membranous, not conspicuously coiled nor strongly concave on the right side; lateral expansions of the foot very broad, often forming swimming lobes; body skin smooth.



References

- Thompson, T.E. 1976. *Biology of opisthobranch molluscs. Vol. 1.* London, Ray Society, 207 p.
 Macfarland, F.M. 1918. The Dolabellinae. *Mem. Mus. Comp. Zool.*, 35:297-348.

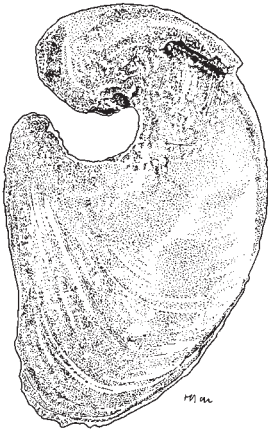
At least one species of local interest to fisheries in the area

***Dolabella auricularia* (Lightfoot, 1786)**

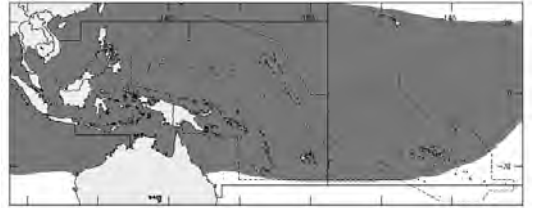
Frequent synonyms / misidentifications: *Dolabella scapula* (Martyn, 1786) (Invalid name) / None.

En - Shoulderblade sea cat; **Fr** - Dolabelle commune.

Maximum body length 15 cm, commonly to 12 cm; shell length to 6 cm. Common among seaweeds and grass flats in shallow water environments, especially in sheltered bays and lagoons. Collected for food at least in the Society and Fiji Islands. Egg masses of *Dolabella* are cooked and eaten in the Central Philippines. Outside the area, this species is considered an economically important resource on the eastern coast of India. Another, unidentified species is reported to be exploited in the Fiji Islands. Widespread in the Indo-Pacific, from East and South Africa, including Madagascar and the Red Sea, to eastern Polynesia and the tropical eastern Pacific coasts of America; north to Japan and south to Queensland.



dorsal view of internal shell
(after Short and Potter, 1987)

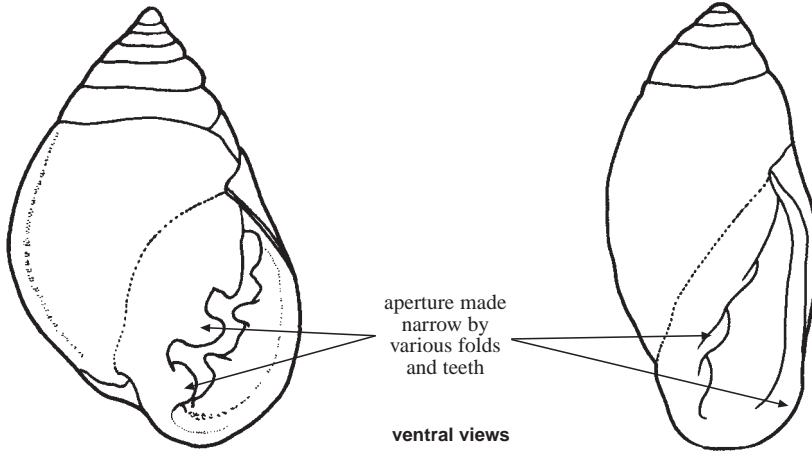


MELAMPIDAE

(= Ellobiidae)

Cassidula and pythia snails

Diagnostic characters: Shell moderately solid, ovate to cylindrical or fusiform in shape, with a rather short conical spire and large body whorl. Outer surface smooth or with low sculpture. Aperture somewhat like an ear in shape, often narrowed by folds, teeth and other constrictions on 1 or both lips. No anterior siphonal canal. Inner walls of the spire mostly resorbed (dissolved by the adult animal). Operculum absent. Animal completely retractable inside the shell. Head flap-like, with 1 pair of tentacles bearing eyes at their bases. Foot well developed, sometimes divided by a transverse groove into anterior and posterior portions. Pallial cavity modified into a primitive lung. Respiratory orifice opening along the posterior edge of mantle.



examples showing diversity of shape

Habitat, biology, and fisheries: Most of the species of Melampidae live amphibiously in nipa palm and mangrove swamps or in littoral marine environments. Coastal populations of the Southeast Asian region traditionally used larger species for food; still consumed locally in Indonesia.

Similar families occurring in the area

None. The aperture characteristically narrowed by folds and other constrictions, and the absence of an operculum easily distinguish this family of pulmonate snails from other marine and brackishwater gastropods with a coiled shell that lack an anterior siphonal canal (e.g., Littorinidae).

Key to species of interest to fisheries occurring in the area

- 1a. Shell compressed dorsoventrally, with flat lateral varices continuing from body whorl towards the apex; outer lip flattened, with 4 or 5 denticles protruding inside the aperture (Fig. 1) Pythia scarabaeus
1b. Shell not compressed dorsoventrally, without flat lateral varices continuing towards the apex; outer lip flattened, with, at most, a slight median thickening interiorly -> 2

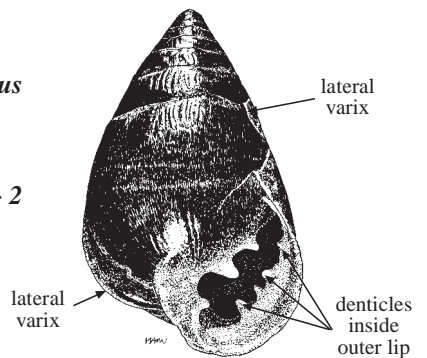


Fig. 1 Pythia acarabaeus (ventral view)

- 2a. Shell relatively swollen, obtusely shouldered; sculpture coarsely latticed on shoulder slope, becoming obsolete on the remainder of body whorl (Fig. 2) *Ellobium aurismidae*
- 2b. Shell relatively slender, not shouldered; sculpture finely latticed throughout (Fig. 3) *Ellobium aurisjudae*

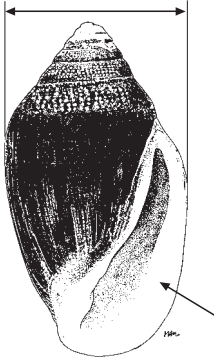





Fig. 2 *Ellobium aurismidae* (ventral view)

Fig. 3 *Ellobium aurisjudae* (ventral view)

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Ellobium aurisjudae* (Linnaeus, 1758)
-  *Ellobium aurismidae* (Linnaeus, 1758)
-  *Pythia scarabaeus* (Linnaeus, 1758)

References

Brandt, R. 1974. The non-marine aquatic mollusca of Thailand. *Arch. Moll.*, 105:1-423.

Morrison, J.P.E. 1964. Notes on American Melampidae. *Nautilus*, 77(4):119-121.

Morton, J.E. 1955. The evolution of the Ellobiidae with a discussion on the origin of the Pulmonata. *Proc. Zool. Soc. Lond.*, 125:127-168.

Ellobium aurisjudae (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Auricula auris-judae* (Linnaeus, 1758); *Auricula judae* Lamarck, 1822; *Ellobium labrosum* Röding, 1798; *E. subtile* Röding, 1798 / None.

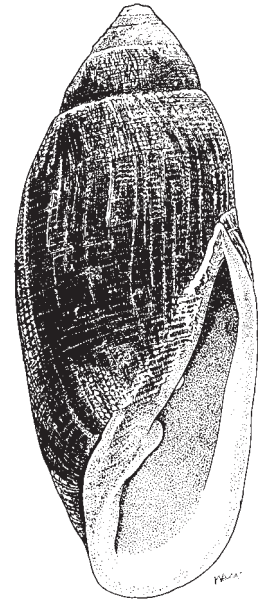
FAO names: **En** - Judas ear cassidula; **Fr** - Auricule de Judas.

Diagnostic characters: Shell medium sized, solid, **elongate-ovate** in outline, **not shouldered**. Spire apex blunt, often corroded in mature specimens. **Sculpture** of numerous axial grooves and fine spiral lines, causing a **finely latticed** pattern **throughout** the surface of shell, though it is somewhat stronger on posterior half of body whorl than on anterior half. **Periostracum tough**, closely applied to shell. **Outer lip** of the aperture **thick and smooth inside**, with a low swelling at about the middle. **Inner lip glazed, with 3 folds**; posterior fold tooth-like, centre fold oblique, large and angular, anterior fold weak and almost axial in direction. **Colour: outside of shell whitish under the dark brown periostracum. Aperture porcelaneous white.**

Size: Maximum shell length 6 cm, commonly to 5 cm.

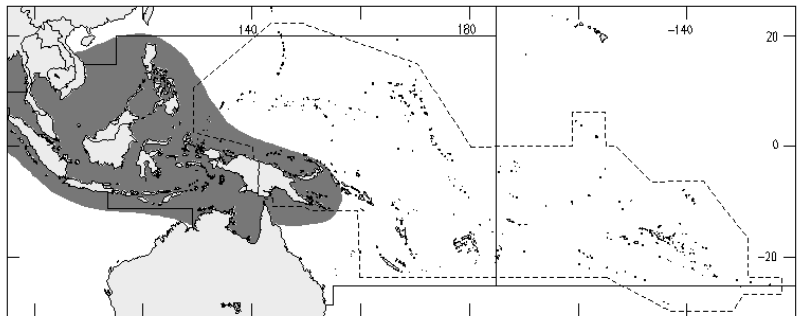
Habitat, biology, and fisheries: Mangrove swamps, nipa palm forests and mud flats near the coast. Traditionally used as food by villagers in Indonesia.

Distribution: Indian Ocean and tropical western Pacific, from India to Papua New Guinea; north to the Philippines and south to northern Australia.



ventral view

(after Short and Potter, 1987)



Ellobium aurismidae (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Auricula auris-midae* (Linnaeus, 1758); *A. midae* Lamarck, 1801; *Ellobium ceramense* Röding, 1798; *E. midae* Röding, 1798 / None.

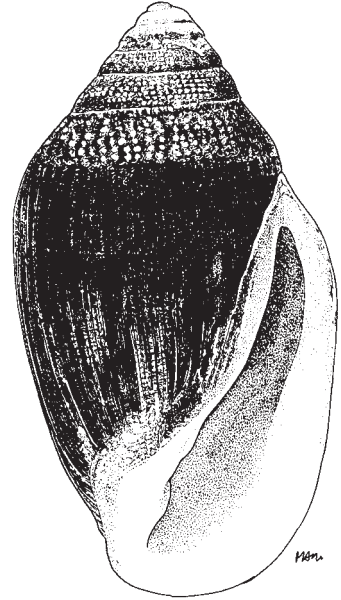
FAO names: En - Midas ear cassidula; Fr - Auricule de Midas.

Diagnostic characters: Shell large, thick and solid, inflated-ovate in outline, obtusely angulated on shoulder of body whorl. Spire apex blunt, often corroded to truncated in mature specimens. A low, rounded varix on left side of body whorl. Sculpture of numerous axial and spiral grooves, causing a coarsely latticed pattern on spire whorls, shoulder slope and anterior end of shell, becoming obsolete on the remainder of body whorl. Periostracum tough, closely applied to shell. Outer lip of the aperture thick and smooth inside, with a low swelling in the middle. Inner lip glazed, with a long axial ridge on its posterior 2/3, and with 2 folds on columella; anterior fold oblique, posterior fold larger and almost at right angle to the aperture. Colour: outside of shell whitish under the dark brown periostracum. Aperture porcelaneous white, sometimes brown.

Size: Maximum shell length 10 cm, commonly to 7.5 cm.

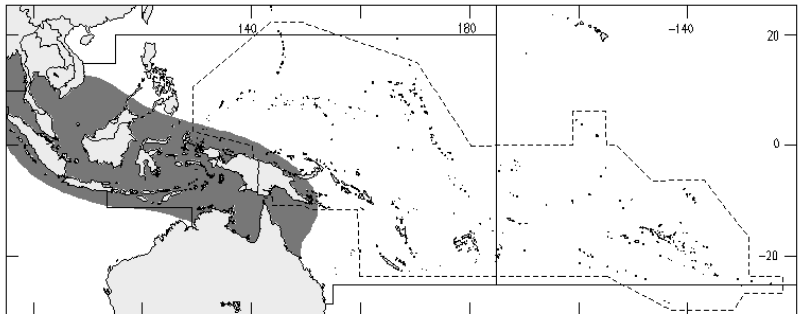
Habitat, biology, and fisheries: On mud flats with vegetation, in nipa palm and mangrove swamps and at the muddy banks of rivers in the estuarine area. Traditionally used as food by villagers in Indonesia.

Distribution: Eastern part of the Indian Ocean and the tropical western Pacific, from Burma and the Andaman Sea to Papua New Guinea; north to southern Viet Nam, but apparently not in the Philippines, and south to Queensland.



ventral view

(after Short and Potter, 1987)



Pythia scarabaeus (Linnaeus, 1758)

Frequent synonyms / misidentifications: *Pythia helicina* Röding, 1798; *P. pantherina* A. Adams, 1851; *P. reeveana* Pfeiffer, 1853; ? *P. scabreus* (spelling error) / None.

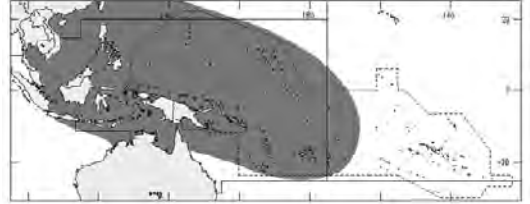
En - Common pythia; **Fr** - Pythie scarabée.

Maximum shell length 3.5 cm, commonly to 3 cm. Common on coastal environments, especially near forests. Sometimes collected for subsistence by some villagers in Indonesia. Tropical West Pacific, from western Indonesia to Polynesia; north to southern Japan and Taiwan Province of China, and south to northern Australia.



ventral view

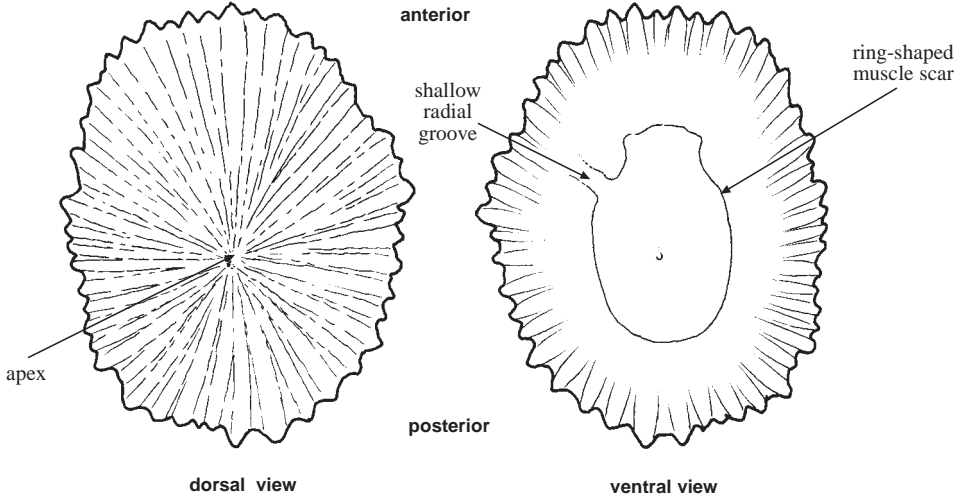
(after Springsteen and Leobrera, 1986)



SIPHONARIIDAE

False limpets

Diagnostic characters: Shell conical, not coiled, mostly dark in colour, often with a weak marginal lobe on the right side. Apex subcentral or somewhat posterior. Sculpture more or less developed, essentially radial. Outline of the aperture irregularly ovate. Interior non-nacreous, often shining, with a ring-like muscle scar, interrupted on the right side where there is a shallow siphonal radial groove. No operculum. Head wide, devoid of tentacles. Foot large and rounded, very strong. Mantle cavity modified into a pulmonary chamber opening on the right side of the body, along the internal radial groove of the shell.

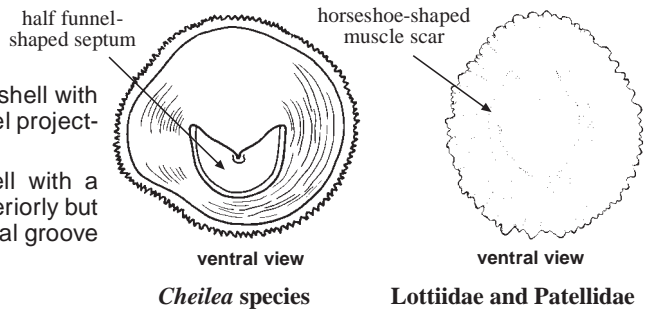


Habitat, biology, and fisheries: Sedentary, air-breathing animals, common on intertidal rocks where they clamp by means of their strong foot. Graze on encrusting lichens and algae with a powerful radula. Mostly hermaphrodites. Eggs laid in a gelatinous ribbon, hatching as free-swimming larvae or as crawling juveniles. Siphonariidae are locally collected for food by coastal populations in the western Pacific.

Similar families occurring in the area

Crepidulidae (*Cheila* species): inner side of shell with a calcareous septum shaped like a half funnel projecting vertically from the apex.

Lottiidae and Patellidae: inner side of shell with a horseshoe-shaped muscle scar, opened anteriorly but not on the right side which is devoid of a radial groove and marginal lobe.







Key to species of interest to fisheries occurring in the area

- 1a. Marginal lobe of the right side comprising 2 radial ribs → 2
- 1b. Marginal lobe of the right side comprising only 1 radial rib *Siphonaria sirius*

- 2a. Sculpture of 10 to 15 major radial ribs markedly projecting at periphery and numerous fine riblets in the interspaces; outer colour grey or deep brown with paler ribs; inner margin dark brown with whitish bars *Siphonaria laciniosa*
- 2b. Sculpture of up to 40 unequal radial ribs slightly projecting at periphery; outer colour brownish with white ribs (at least the major ones) and dark apex; inner margin mainly white *Siphonaria javanica*

List of species of interest to fisheries occurring in the area

The symbol  is given when species accounts are included.

-  *Siphonaria javanica* (Lamarck, 1819)
-  *Siphonaria laciniosa* (Linnaeus, 1758)
-  *Siphonaria sirius* Pilsbry, 1894

References

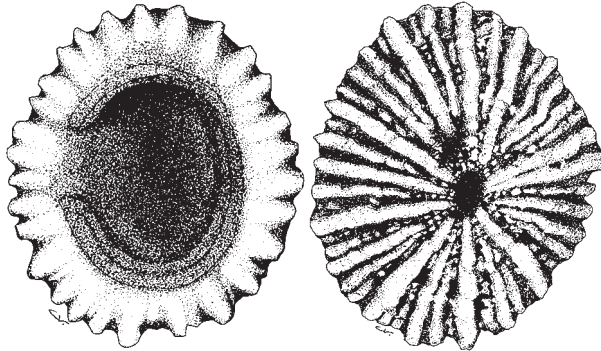
- Christiaens, J. 1980. The limpets of Hong Kong with descriptions of seven new species and subspecies. In *Proceedings of the first international workshop on the malacofauna of Hong Kong and southern China, 23 March-8 April 1977, Hong Kong*, edited by B.S. Morton. Hong Kong, Hong Kong University, 61-83 p.
- Hubendick, B. 1946. Systematic monograph of the Patelliformia. *Kungl. Svenska Vetensk. Handl.*, (3)23(5):1-93.
- Morrison, J.P.E. 1972. Mediterranean Siphonaria: west and east, old and new. *Argamon*, 3(1-4):51-62.

Siphonaria javanica (Lamarck, 1819)

Frequent synonyms / misidentifications: *Siphonaria exigua* Sowerby, 1824; *S. sipho* Sowerby, 1824 / *Siphonaria kurracheensis* Reeve, 1856; *S. laciniosa* (Linnaeus, 1758).

En - Javanese false limpet; **Fr** - Siphonaire de Java.

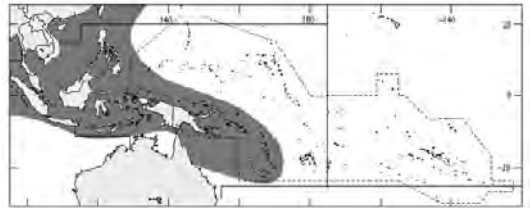
Maximum shell length 4 cm, commonly to 3 cm. Common on stones or rocks. Intertidal. Occasionally collected for food by coastal populations in the Southeast Asian region. Indo-West Pacific, from Madagascar to Melanesia; north to Japan and south to Queensland and New Caledonia.



ventral view

dorsal view

(after Springsteen and Leobrera, 1986)

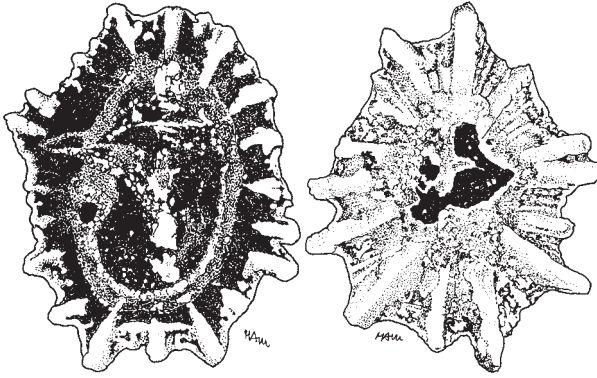


***Siphonaria laciniosa* (Linnaeus, 1758)**

Frequent synonyms / misidentifications: *Siphonaria atra* Quoy and Gaimard, 1833 / *Siphonaris javanica* (Lamarck, 1819).

En - Fringed false limpet; **Fr** - Siphonaire laciniée.

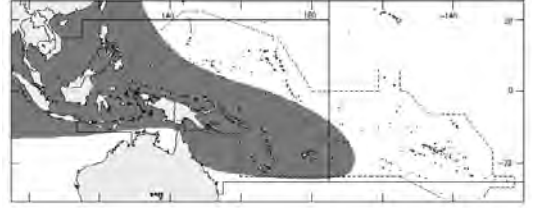
Maximum shell length 3.5 cm, commonly to 2.5 cm. Common on rocky shores. Intertidal. Occasionally used as food by coastal populations in the Southeast Asian region. Distribution imperfectly known because of frequent confusion with other species of the genus, but probably widespread in the Indo-West Pacific, from East Africa to western Polynesia; north to Japan and south to Queensland.



ventral view

dorsal view

(after Hubendick, 1946)

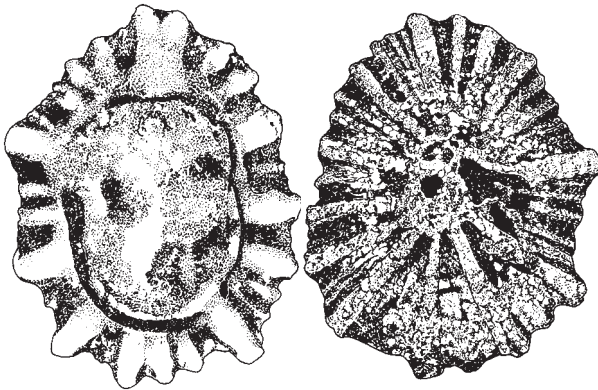


***Siphonaria sirius* Pilsbry, 1894**

Frequent synonyms / misidentifications: *Anthosiphonaria sirius* (Pilsbry, 1894) / *Siphonaria atra* Quoy and Gaimard, 1833 (= *S. laciniosa* (Linnaeus, 1758)).

En - Sirius false limpet; **Fr** - Siphonaire de Sirius.

Maximum shell length 3.5 cm, commonly to 3 cm. Common on rocky shores. Intertidal. Occasionally collected for food by coastal populations in the Southeast Asian region. Eastern part of the Indian Ocean and the tropical West Pacific, from the west coast of Thailand to the Philippines; north to Japan and south to Indonesia.



ventral view

dorsal view

(after Hubendick, 1946)



INDEX OF SCIENTIFIC AND VERNACULAR NAMES

Explanation of the System

Italics : Valid scientific names (genera and species).

Italics : Synonyms (genera and species), misidentifications.

ROMAN : Family names.

ROMAN : Names of divisions, classes, subclasses, orders, suborders, and subfamilies.

Roman : FAO and local names.

A	
Abalones	383
Abanico amarillo	62-63
<i>abbreviatus</i> , <i>Azorinus</i>	313
<i>abbreviatus</i> , <i>Solen</i>	313
<i>Acacia pennata</i>	406
<i>Acanthaster planci</i>	534, 541
<i>Acanthophora muscoides</i>	96
<i>Acanthophora spicifera</i>	97
<i>acerosa</i> , <i>Gelidiella</i>	79
<i>Acesta</i>	220
<i>Acesta rathbuni</i>	221
<i>Acetabularia</i>	60
<i>Acetabularia major</i>	60
<i>achatina</i> , <i>Maetra</i>	279
<i>Acmaea bombayana</i>	396
<i>Acmaea travancorica</i>	396
ACMAEIDAE	390
<i>Acropora</i>	90
<i>Acropora florida</i>	110
<i>Acropora formosa</i>	110
<i>Acropora humilis</i>	111
<i>Acropora hyacinthus</i>	111
<i>Acropora palifera</i>	112
ACROPORIDAE	110
<i>Acrosterigma angulata</i>	258
<i>Acrosterigma rugosa</i>	256
<i>Acrosterigma subrugosa</i>	259
<i>aculeata</i> , <i>Mancinella</i>	568-569
<i>aculeata</i> , <i>Thais</i>	568
Aculeate rock shell	568
<i>Acupurpura nigrispinosa</i>	564
<i>Acupurpura triremis</i>	563
<i>acutangula</i> , <i>Turritella</i>	457
<i>acutangulus</i> , <i>Trochus</i>	403
<i>acutidens</i> , <i>Azorinus</i>	286
<i>acutidens</i> , <i>Pharella</i>	286-287
<i>adpersa</i> , <i>Maetra</i>	279
<i>Adusta miter</i>	614
<i>Adusta murex</i>	558
<i>Adusta onyx</i>	504
<i>adusta</i> , <i>Cypraea</i>	504
<i>adusta</i> , <i>Mitra</i>	614
<i>adustus</i> , <i>Murex</i>	558
<i>aegagropila</i> , <i>Valonia</i>	41
<i>aegrota</i> , <i>Venus</i>	340
<i>aequilatera</i> , <i>Gomphina</i>	345
<i>Aequipecten flabellatus</i>	208
<i>aerata</i> , <i>Pinctada</i>	187
<i>affinis</i> , <i>Purpura</i>	569
AGARICIIDAE	112
Agate troughshell	279
<i>agnitum</i> , <i>Phalium</i>	537
<i>agrestis</i> , <i>Conus</i>	623
<i>agripetus</i> , <i>Modiolus</i>	175
Aile d'ange orientale	356
<i>alba</i> , <i>Natica</i>	517
<i>albicilla</i> , <i>Nerita</i>	423
<i>albicilla</i> , <i>Theliostyla</i>	423
<i>albumen</i> , <i>Neverita</i>	516
<i>albumen</i> , <i>Polinices</i>	516
<i>albus</i> , <i>Malleus</i>	196
<i>albus</i> , <i>Polinices</i>	519
<i>Alectrion glans</i>	581
<i>Alectrion suturalis</i>	581
<i>Alectryonella haliotidea</i>	227
<i>Alectryonella plicatula</i>	227
<i>allium</i> , <i>Tonna</i>	524
Almond ark	156
Alou rock shell	569
<i>alouina</i> , <i>Mancinella</i>	569
<i>alouina</i> , <i>Thais</i>	568-569
<i>alta</i> , <i>Venus</i>	351
<i>alternatum</i> , <i>Trachycardium</i>	258
<i>alternatum</i> , <i>Vasticardium</i>	258
<i>Aluco vertagus</i>	446
<i>aluco</i> , <i>Cerithium</i>	446
<i>aluco</i> , <i>Pseudovertagus</i>	446
<i>aluco</i> , <i>Rhinoclavis</i>	446
<i>aluco</i> , <i>Vertagus</i>	446
<i>alvarezii</i> , <i>Kappaphycus</i>	93
Amande de Reeve	163
Amande pétoncle	164
<i>amasa</i> , <i>Saxostrea</i>	232
<i>amboinensis</i> , <i>Glycymeris</i>	164
<i>americana</i> , <i>Martesia</i>	358
<i>americanus</i> , <i>Modiolus</i>	175
Amethyst olive	610
<i>amethystina</i> , <i>Oliva</i>	610
<i>amiculum</i> , <i>Comptopallium</i>	205
<i>amiculum</i> , <i>Decatopecten</i>	205
<i>Amphinerita polita</i>	426
<i>Amphiperas ovum</i>	508
<i>amphora</i> , <i>Melo</i>	597
<i>ampliata</i> , <i>Merulina</i>	117
<i>Amusium balloti</i>	202
<i>Amusium japonicum</i>	202
<i>Amusium japonicum balloti</i>	202
<i>Amusium japonicum formosum</i>	202
<i>Amusium japonicum japonicum</i>	202
<i>Amusium japonicum taiwanense</i>	202
<i>Amusium pleuronectes</i>	203
<i>Amusium pleuronectes australiae</i>	203
<i>Amusium pleuronectes pleuronectes</i>	203
<i>amygdalumtostum</i> , <i>Barbatia</i>	156
<i>Anadara</i>	142, 147
<i>Anadara antiquata</i>	146
<i>Anadara binakayanensis</i>	151
<i>Anadara bisenensis</i>	147
<i>Anadara chalcantum</i>	153
<i>Anadara cornea</i>	150
<i>Anadara ferruginea</i>	154
<i>Anadara globosa</i>	151
<i>Anadara granosa</i>	147
<i>Anadara gubernaculum</i>	153
<i>Anadara inaequalis</i>	152
<i>Anadara indica</i>	153
<i>Anadara japonica</i>	153
<i>Anadara maculosa</i>	146
<i>Anadara nodifera</i>	148
<i>Anadara pilula</i>	156
<i>Anadara scapha</i>	146
<i>Anadara tricenicosta</i>	154
<i>Anadara ursus</i>	151
<i>Anadara vetula</i>	146

<i>Anaitis foliacea</i>	351	<i>aratus, Modiolus</i>	174
<i>Anatina truncata</i>	362	<i>Arca arabica</i>	154
Anatine tronquée	362	<i>Arca avellana</i>	154
<i>Anchomasa manilensis</i>	357	<i>Arca cepoides</i>	151
Angel wings	354	<i>Arca cuneata</i>	154
<i>angulata, Acrosterigma</i>	258	<i>Arca granosa</i>	147
<i>angulata, Crassostrea</i>	233	<i>Arca maculata</i>	154
Angulate cockle	258	<i>Arca navicularis</i>	155
<i>angulatum, Trachycardium</i>	258	<i>Arca noae</i>	155
<i>angulatus, Lathyrus</i>	592	<i>Arca truncata</i>	149
<i>angulifera, Littorina</i>	433	<i>Arca ventricosa</i>	149
<i>angulinum, Ehippium</i>	219	<i>Arca zebra</i>	149
<i>Annachlamys flabellata</i>	208	Arche antique	146
<i>Annachlamys kuhnoltzi</i>	208	Arche bicolore	156
<i>Annachlamys leopardus rena</i>	208	Arche cornée	150
<i>Annachlamys melica</i>	208	Arche croisée	155
<i>annulata, Oliva</i>	610	Arche globuleuse	151
<i>annulus, Cypraea</i>	497, 504	Arche gouvernail	153
<i>annulus, Erosaria</i>	497	Arche granuleuse	147
<i>annulus, Monetaria</i>	497	Arche hélice	157
<i>Anodontia edentula</i>	237-238	Arche inéquivalve	152
<i>Anodontia hawaiiensis</i>	237	Arche lippue	158
<i>Anodontia pila</i>	237	Arche navicule	155
<i>Anomalocardia squamosa</i>	328	Arche noduleuse	148
<i>Anomalodiscus squamosus</i>	328	Arche noisette	154
ANOMIIDAE	216	Arche olive	160
<i>Anthosiphonaria sirius</i>	648	Arche pilule	156
ANTHOZOA	109	Arche rouillée	154
<i>Antigona clathrata</i>	349	Arche semitorte	157
<i>Antigona puerpera</i>	340	Arche ventrue	149
<i>Antigona reticulata</i>	349	<i>Architectonica australe</i>	638
<i>antiquata, Anadara</i>	146	<i>Architectonica cumingii</i>	638
<i>antiquata, Cardita</i>	249	<i>Architectonica formosum</i>	638
<i>antiquata, Mactra</i>	278	<i>Architectonica fuliginosum</i>	638
Antique ark	146	<i>Architectonica hanleyi</i>	638
<i>antonii, Natica</i>	520	<i>Architectonica maculatum</i>	638
<i>anus, Distorsio</i>	548	<i>Architectonica maxima</i>	638
<i>anus, Distortrix</i>	548	<i>Architectonica perspectiva</i>	638
<i>aperta, Fulvia</i>	257	<i>Architectonica trochlearis</i>	638
<i>apicina, Mactra</i>	276	ARCHITECTONICIDAE	484, 637
APLYSIIDAE	639	ARCIDAE	142, 158-159, 161
<i>Apolymetis ehippium</i>	295	Arco del Pacifico occidental	147
<i>Apolymetis papyracea</i>	295	<i>arcuata, Gracilaria</i>	84
Aquatile hairy triton	544	Arcuate gracilaria	84
<i>aquatile, Cymatium</i>	544	Arcuate mussel	168
<i>aquatile, Lampusia</i>	544	<i>Arcuatula arcuatula</i>	168
<i>aquatile, Septa</i>	544	<i>Arcuatula</i> spp.	171
Arabian cowrie	491	<i>Arcuatula, Arcuatula</i>	168
<i>Arabica arabica</i>	491	<i>arcuatula, Modiola</i>	168
<i>Arabica depressa</i>	500	<i>arcuatula, Musculista</i>	168
<i>Arabica eglantina</i>	500	<i>Arcularia coronata</i>	579
<i>Arabica maculifera</i>	503	<i>Arcularia particeps</i>	581
<i>Arabica scurra</i>	505	<i>arcularia, Nassa</i>	578
<i>arabica, Arabica</i>	491	<i>arcularius, Nassarius</i>	578
<i>arabica, Arca</i>	154	<i>areola, Phalium</i>	537
<i>arabica, Cypraea</i>	491, 500, 503	<i>areola, Bezoardicella</i>	537
<i>arabica, Mauritia</i>	491	<i>areola, Cassidea</i>	537
<i>arabicum, Codium</i>	49	<i>areolata, Babylonia</i>	573
<i>arabicus, Conus</i>	621	<i>areolata, Subula</i>	635
<i>arabicus, Peribolus</i>	491	<i>areolata, Terebra</i>	635
<i>arata, Modiolus</i>	174	<i>Arestorides argus</i>	497
<i>aratrum, Strombus</i>	469	<i>argentea, Udotea</i>	56
<i>aratrum, Strombus aurisdiana</i>	469	<i>argenteus, Pecten</i>	206

<i>argus, Arestorides</i>	497	<i>Auricule de Midas</i>	644
<i>argus, Cypraea</i>	497	<i>auriculifera, Cucullaea</i>	158
<i>argus, Lyncina</i>	497	<i>auris-judae, Auricula</i>	643
<i>argyrostoma, Marmarostoma</i>	412	<i>auris-midae, Auricula</i>	644
<i>argyrostomus, Turbo</i>	412, 416	<i>aurisdianae aratrum, Strombus</i>	469
<i>aristophanes, Conus</i>	624	<i>aurisdianae, Euprotomus</i>	469
Ark shells	142	<i>aurisdianae, Strombus</i>	469-470
<i>armigera, Mancinella</i>	569	<i>aurisjudae, Ellobium</i>	643
<i>armigera, Thais</i>	569	<i>aurismidae, Ellobium</i>	644
<i>arnoldii, Eucheuma</i>	90	<i>australe, Architectonica</i>	638
<i>arrecta, Penepatella</i>	398	<i>australiae, Amusium pleuronectes</i>	203
<i>Artemis orientalis</i>	345	Australian trumpet	605
<i>arthritica, Lambis chiragra</i>	477	<i>australiana, Pitaria</i>	350
<i>articularis, Harpa</i>	601	<i>australiense, Cardium</i>	262
Articulate harp	601	<i>australiensis, Hemidonax donaciformis</i>	262
<i>articulatus, Helcioniscus</i>	396	<i>australis, Calobates</i>	360
<i>aruanus, Megalatractus</i>	605	<i>Austriella corrugata</i>	237-238
<i>aruanus, Syrinx</i>	603, 605	<i>Austriella sordida</i>	238
<i>Asaphis deflorata</i>	307	<i>avellana, Arca</i>	154
<i>Asaphis dichotoma</i>	307	<i>avicular, Pteria</i>	189
<i>Asaphis violascen</i>	307	Avicule épaisse	188
Ascaris	98	Avicule martinet	189
<i>aselae, Corculum</i>	257	<i>Avrainvillea erecta</i>	54
<i>asellus, Natica</i>	520	<i>Azorinus abbreviatus</i>	313
Asian brown mussel	172	<i>Azorinus acutidens</i>	286
Asian moon scallop	203	<i>Azorinus chamasolen</i>	313
Asiatic cockle	260	<i>Azorinus coarctatus</i>	313
Asiatic hard clam	337	<i>Azorinus minutus</i>	313
<i>asiaticum, Cardium</i>	260	<i>Azumapecten squamatus</i>	209
<i>asiaticum, Trachycardium</i>	260		
<i>asiaticum, Vepricardium</i>	260		
<i>asinina, Haliotis</i>	385		
<i>Asparagopsis taxiformis</i>	77	B	
<i>aspera, Clava</i>	446	<i>Babylonia areolata</i>	573
<i>aspera, Rhinoclavis</i>	446	<i>Babylonia japonica</i>	574
<i>asperum, Cerithium</i>	446	<i>Babylonia lutosa</i>	574
<i>aster, Patella</i>	396	<i>Babylonia spirata</i>	573-574
<i>Astrarium calcar</i>	417	<i>Babylonia turrid</i>	631
<i>Astrea calcar</i>	417	<i>babylonia, Lophiotoma</i>	631
<i>Atactodea glabrata</i>	283	<i>babylonia, Turris</i>	631
<i>Atactodea striata</i>	283	<i>Bactronophorus edulis</i>	360
<i>ater, Vermetus</i>	461	<i>Bactronophorus filoteoi</i>	360
<i>athenius, Strombus</i>	482	<i>Bactronophorus subaustralis</i>	360
<i>atra, Siphonaria</i>	648	<i>Bactronophorus thoracites</i>	360
<i>Atrina fragilis</i>	178	<i>balloti, Amusium</i>	202
<i>Atrina pectinata</i>	178	<i>balloti, Amusium japonicum</i>	202
<i>Atrina pectinata zelandica</i>	178	<i>bandanus, Conus</i>	627
<i>Atrina vexillum</i>	179	<i>bandatum, Cerithium</i>	444
<i>atropurpurea, Pinna</i>	180	<i>bandatum, Phalium</i>	536
Auger shells	632	Banded bonnet	536
<i>aurantia, Pterocera</i>	477	Banded tun	526
<i>aurantius, Pecten</i>	204	Banded vertagus	444
<i>aurantius, Polinices</i>	519	<i>Barbatia amygdalumtostum</i>	156
<i>aurantius, Spondylus</i>	215	<i>Barbatia bicolorata</i>	156
<i>aureomaculatus, Solen</i>	288	<i>Barbatia candida</i>	155
<i>Auricula auris-judae</i>	643	<i>Barbatia decussata</i>	155
<i>Auricula auris-midae</i>	644	<i>Barbatia foliata</i>	155
<i>Auricula judae</i>	643	<i>Barbatia fusca</i>	156
<i>Auricula midae</i>	644	<i>Barbatia helblingi</i>	155
<i>auricularia, Dolabella</i>	640	<i>Barbatia lima</i>	155
<i>auriculata, Modiolus</i>	175	<i>Barbatia trapezina</i>	155
<i>auriculatus, Modiolus</i>	175	<i>Barbatia velata</i>	155
<i>Auricule de Judas</i>	643	<i>barbatus, Spondylus</i>	214
		<i>Barnea dilatata</i>	357
		<i>Barnea elongata</i>	357

<i>Barnea inornata</i>	357	Black-spotted triton	545
<i>Barnea japonica</i>	357	Blacklip pearl oyster	185
<i>Barnea manilensis</i>	357	Blackmouth moon snail	521
<i>bartlettii</i> , <i>Codium</i>	50	Bladder moon snail	518
<i>Basilitrana isabella</i>	501	Blood cockle	147
Basket lucinas	242	Blood cockles	142
Bat volute	596	Blood olive	611
<i>batillariaeformis</i> , <i>Clypeomorus</i>	443	Blue coral	104, 121
<i>Batissa</i>	315	<i>boergesenii</i> , <i>Hypnea</i>	94
<i>Batissa violacea</i>	319	<i>bombayana</i> , <i>Acmaea</i>	396
Bear paw clam	266	BONNEMAISONIACEAE	77
Bearded thorny oyster	214	BONNEMAISONIALES	77
Beautifully-banded moon snail	512	Bonnet shells	532
<i>beckii</i> , <i>Solen</i>	288	<i>borneensis</i> , <i>Patelloida</i>	393
Beech cone	624	<i>Bornetella oligospora</i>	58
<i>Beguina semiorbiculata</i>	249	<i>Bornetella sphaerica</i>	59
Belcher's venus	352	Boutet's cowrie	498
<i>belcheri</i> , <i>Latirus</i>	592	<i>bouteti</i> , <i>Cypraea</i>	498
<i>belcheri</i> , <i>Tapes</i>	352	<i>bouteti</i> , <i>Lyncina leviathan</i>	498
Bell-bladed sargassum	72	<i>bouteti</i> , <i>Ponda</i>	498
<i>bella</i> , <i>Ctena</i>	241	Bowl coral	116
<i>bella</i> , <i>Epicodakia</i>	241	Box mussel	173
<i>bellatula</i> , <i>Patelloida</i>	392	Box scallop	209
Belligerent rock shell	569	<i>Brachidontes senhousia</i>	171
<i>bengalensis</i> , <i>Geloina</i>	319	<i>brachypus</i> , <i>Caulerpa</i>	42, 47
<i>bengalensis</i> , <i>Polymesoda</i>	319	<i>Bractechlamys evecta</i>	208
Bengali geloina	319	<i>Bractechlamys vexillum</i>	208
Bénitier allongé	271	Brain coral	114
Bénitier arasé	269	Brain root coral	118
Bénitier crocus	268	Brain trumpet coral	113
Bénitier écailleux	272	Branch coral	110
Bénitier géant	270	Branched halymenia	81
Bénitier porcelaine	267	Branched sea cushion	51
Bénitier tacheté	266	<i>bresia</i> , <i>Ostrea (Pretostrea)</i>	229
<i>betulina</i> , <i>Cleobula</i>	624	Bright green nori	38
<i>betulinus</i> , <i>Conus</i>	623- 624	Broad cockle	258
<i>betulinus</i> , <i>Dendroconus</i>	624	Broad geloina	318
<i>betulinus</i> , <i>Gastroidium</i>	624	Brown algae	20, 61
<i>Bezoardica vulgaris</i>	537	Brown mussel	172
<i>Bezoardicella areola</i>	537	Brown Pacific turban	417
Bicolor pen shell	180	Brown sea fan	64
<i>bicolor</i> , <i>Cardita</i>	249	<i>bruguieri</i> , <i>Tapes</i>	342
<i>bicolor</i> , <i>Cardites</i>	249	<i>bruneus</i> , <i>Marmarostoma</i>	417
<i>bicolor</i> , <i>Donax</i>	301	<i>bruneus</i> , <i>Turbo</i>	417
<i>bicolor</i> , <i>Pinna</i>	180	<i>brunneus</i> , <i>Chicoreus</i>	558
<i>bicolor</i> , <i>Polinices</i>	518	<i>brunneus</i> , <i>Murex</i>	558
<i>bicolor</i> , <i>Tectarius</i>	436	Brush coral	111
<i>bicolor</i> , <i>Venericardia</i>	249	<i>bryonia</i> , <i>Lambis</i>	468
<i>bicolorata</i> , <i>Barbatia</i>	156	BRYOPSIDALES	42
<i>bifasciata</i> , <i>Clypeomorus</i>	443	Bubble conch	470
<i>bifurcata</i> , <i>Tapes</i>	341	<i>bubo rubeta</i> , <i>Bursa</i>	552
<i>bilocularis</i> , <i>Septifer</i>	173-174	<i>bubo</i> , <i>Bursa</i>	552
<i>binakayanensis</i> , <i>Anadara</i>	151	<i>bubo</i> , <i>Tutufa</i>	552
<i>bipartita</i> , <i>Psammobia</i>	311	Bucarde à collier	253
<i>bipennis</i> , <i>Margaritifera</i>	196	Bucarde à ornières	259
Birdsnest coral	120	Bucarde anguleuse	258
<i>bisenensis</i> , <i>Anadara</i>	147	Bucarde asiatique	260
Bittersweet clams	161	Bucarde chinoise	260
<i>bizonalis</i> , <i>Nerita</i>	424	Bucarde coeur	257
Black coral	104	Bucarde demi-coeur	254
Black hammer oyster	196	Bucarde fraise	255
Black olive	612	Bucarde large	258
Black-spined murex	564	Bucarde papier	257

Bucarde ridée	259	<i>caputserpentis</i> , <i>Cypraea</i>	498
Bucarde rugueuse	256	<i>caputserpentis</i> , <i>Erosaria</i>	498
Buccin à carreaux	573	<i>caputserpentis</i> , <i>Ravitronea</i>	498
Buccin de vase	574	CARDIIDAE	248, 250 , 299
Buccin houleux	574	<i>cardinalis</i> , <i>Mitra</i>	615
BUCCINIDAE	572, 575-576, 593	<i>cardissa</i> , <i>Corculum</i>	257
<i>bufo</i> , <i>Mancinella</i>	570	<i>Cardita antiquata</i>	249
<i>bufo</i> , <i>Purpura</i>	570	<i>Cardita bicolor</i>	249
<i>bufo</i> , <i>Thais</i>	570	<i>Carditas</i>	248
<i>Bufo</i> , <i>crumena</i>	550-551	<i>Cardite bicolor</i>	249
<i>Bufo</i> , <i>crumenoides</i>	550	<i>Cardite hémicirculaire</i>	249
<i>Bufo</i> , <i>rana</i>	551	<i>Cardites bicolor</i>	249
<i>bufonia</i> , <i>Bursa</i>	551	CARDITIDAE	248 , 250
<i>bulbosa</i> , <i>Rapana</i>	568	<i>Cardium asiaticum</i>	260
<i>bullata</i> , <i>Euprotomus</i>	470	<i>Cardium australiense</i>	262
<i>bullata</i> , <i>Strombus</i>	470	<i>Cardium donaciforme</i>	262
<i>bullatus</i> , <i>Tectarius</i>	434	<i>Cardium flavum</i>	256
Bullmouth helmet	535	<i>Cardium imbricatum</i>	253
Burned nassa	580	<i>Cardium latum</i>	258
<i>burnupi</i> , <i>Vepricardium</i>	260	<i>Cardium natalense</i>	257
<i>Bursa bubo</i>	552	<i>Cardium orbita</i>	259
<i>Bursa bubo rubeta</i>	552	<i>Cardium papyraceum</i>	257
<i>Bursa bufonia</i>	551	<i>Cardium pectiniforme</i>	256
<i>Bursa crumena</i>	550	<i>Cardium philippinense</i>	259
<i>Bursa mammata</i>	551	<i>Cardium rugosum</i>	256
<i>Bursa rana</i>	551	<i>Cardium sinense</i>	260
<i>Bursa rubeta</i>	552	Carinate rock shell	561
<i>Bursa subeta gigantea</i>	552	<i>carinifera</i> , <i>Thais</i>	561
BURSIDAE	538, 549	<i>carinifera</i> , <i>Cuma</i>	561
Butler's thorny oyster	214	<i>carinifera</i> , <i>Purpura</i>	561
<i>butleri</i> , <i>Spondylus</i>	214	Carnelian cowrie	499
C		<i>carneola propinqua</i> , <i>Cypraea</i>	499
Cactus coral	112	<i>carneola</i> , <i>Cypraea</i>	498, 499 , 502, 499
<i>caelatus</i> , <i>Nassarius</i>	580	<i>carneola</i> , <i>Lyncina</i>	499
<i>caerulea</i>, <i>Oliva</i>	610	<i>carneola</i> , <i>Ponda</i>	499
<i>caerulescens</i> , <i>Psammobia</i>	311	<i>arneolus</i> , <i>Chicoreus</i>	560
<i>caerulescens</i> , <i>Terebra</i>	635	Carrier shells	484
<i>caffrum</i> , <i>Vexillum</i>	617	CARYOPHYLLIIDAE	113
Cake nassa	578	Casque à damier	537
<i>calcar</i>, <i>Astrarium</i>	417	Casque cornu	534
<i>calcar</i> , <i>Astrea</i>	417	Casque gris	537
Calcified sea moss	82	Casque rouge	535
<i>caledonica</i> , <i>Cypraea</i>	502	Casque rubanné	536
<i>caledonica</i> , <i>Tapes</i>	346	CASSIDAE	522, 532 , 599
Calf moon snail	515	<i>Cassidea areola</i>	537
<i>caliendrum</i>, <i>Seriatopora</i>	120	<i>Cassidea coronulata</i>	536
<i>Calobates australis</i>	360	Cassidula shells	641
Caltrap murex	565	<i>Cassis cornuta</i>	534
Camp pitar venus	335	<i>castrensis</i> , <i>Lioconcha</i>	335
<i>canaliculata</i> , <i>Nassa</i>	580	Cat's tongue tellin	296
<i>canaliculata</i>, <i>Tonna</i>	527	Catch bowl coral	112
<i>Canarium dentatum</i>	479	<i>Caulerpa</i>	44
<i>Canarium labiatum</i>	473	<i>Caulerpa brachypus</i>	42 , 47
<i>Canarium mutabilis</i>	481	<i>Caulerpa cupressoides</i>	43
<i>Canarium urceus</i>	476	<i>Caulerpa lentillifera</i>	44
<i>canarium</i> , <i>Laevistrombus</i>	471	<i>Caulerpa peltata</i>	45
<i>canarium</i>, <i>Strombus</i>	471	<i>Caulerpa racemosa</i>	46
<i>candida</i> , <i>Barbatia</i>	155	<i>Caulerpa sertularioides</i>	47
<i>Cantharus undosus</i>	574	<i>Caulerpa taxifolia</i>	48
<i>capillacea</i>, <i>Meropesta</i>	280	CAULERPACEAE	42
<i>capillacea</i> , <i>Spisula</i>	280	Cauliflower coral	109
<i>capillacea</i> , <i>Standella</i>	280	<i>caurica</i> , <i>Cypraea</i>	499
		<i>caurica</i> , <i>Erronea</i>	499

- cavitensis, Gyryneum* 551
cavitensis, Ranella 550
 Cayado andrajoso 95
Cellana enneagona 396
Cellana eudora 396
Cellana radiata 396
Cellana rota **396-397**
Cellana testudinaria **397**
cepa, Tonna 527
cepoides, Arca 151
 Ceram vase 606
ceramense, Ellobium 644
CERAMIALES 96
ceramicum, Vasum **606**
Cérithé aluco 446
Cérithé collier 443
Cérithé corail 440
Cérithé épineux 441
Cérithé fascié 444
Cérithé noduleux 442
Cérithé obélisque 447
Cérithé rèche 446
Cérithé vautre 445
Cerithidea cingulata 440, **454**
cerithidea obtusa **450, 454**
Cerithidea quadrata 454
Cerithidea rhizophorarum 454
CERITHIIDAE **437, 448**
Cerithium aluco 446
Cerithium asperum 446
Cerithium bandatum 444
Cerithium chinensis 447
Cerithium coralium **440**
Cerithium echinatum **441**
Cerithium erythraeonense 442
Cerithium fasciatum 444
Cerithium granosum 440
Cerithium humilis 443
Cerithium lineatum 446
Cerithium moniliferum 443
Cerithium morus 443
Cerithium mutatum 441
Cerithium nodulosum **442**
Cerithium obeliscus 447
Cerithium procerum 444
Cerithium rubus 441
Cerithium ruppelli 440
Cerithium tuberculatum 443
Cerithium vertagus 445
Cerithium erythraeonense 442
 Ceriths 437
 Chaffweed 79
chalcantum, Anadara 153
Chama damaecornis 246
Chama divaricata 246
Chama foliacea 246
Chama imbricata 247
Chama lazarus **246**
Chama pacifica **246**
Chama plinthota 247
Chama reflexa 246
Chama savignyi **247**
chamasolen, Azorinus 313
 Chame de Lazare 246
 Chame de Savigny 247
 Chame réfléchie 246
 Chameleon nerite 424
chameleon, Nerita **424, 429**
chameleon, Ritena 424
CHAMIDAE **245**
 Channeled nassa 580
 Channeled tun 527
Charonia 538
Charonia lampas 552
Charonia tritonis tritonis **541**
Charonia tritonis variegata 541
 Checkerboard bonnet 537
Cheila species 646
Cheilea species 390, 394
Cheilosporum cultratum **82**
chemnitzii, Polinices 518
chemnitzii, Pinna 178
Chiazacmea striata 393
Chicoreus brunneus **558**
Chicoreus carneolus 560
Chicoreus cichoreum 562
Chicoreus kilburni 560
Chicoreus maurus 560
Chicoreus microphyllus 560
Chicoreus palmiferus 560
Chicoreus ramosus **559**
Chicoreus rubiginosus 560
Chicoreus saulii 560
Chicoreus torrefactus **560**
 China clam 267
chinensis, Cerithium 447
chinensis, Cyclina 345
 Chinese cockle 260
chiragra arthritica, Lambis 477
chiragra chiragra, Lambis **477**
 Chiragra spider conch 477
chiragra, Harpago 477
chiragra, Lambis chiragra **477**
Chlamys distans 208
Chlamys leopardus 208
Chlamys nobilis 204
Chlamys pallium 207
Chlamys senatoria **204**
Chlamys singaporina 210
Chlamys squamata **209**
CHLOROPHYTA **20, 38**
chlorostomum, Cymatium 543
chloroticus, Lyrodus 360
Chrysame eremitarum 614
chrysostoma, Marmarostoma 413
chrysostoma, Nerita 430
chrysostomus, Strombus 469
chrysostomus, Turbo **413**
cichoreum, Chicoreus 562
cichoreum, Hexaplex **562**
cichoreus, Murex 562
ciliatus, Spondylus 215
cinerea, Tapes 342
cinereus, Turbo **418**
cingulata, Cerithidea 440, **454**
cingulatus, Potamides 454

Circé divariquée	331
Circé gibbeuse	333
<i>Circe gibbia</i>	333
Circé mouchetée	330
<i>Circe pectinata</i>	332
Circé pectinée	332
<i>Circe scripta</i>	329
Circé violette	329
<i>cirenea, Lunella</i>	418
<i>citrina, Pitaria</i>	350
<i>citrinus, Pitar</i>	350
<i>Cladopoda colubrina</i>	461
<i>clathrata, Antigona</i>	349
<i>clathrata, Distorsio</i>	548
<i>clathrata, Enteromorpha</i>	38
<i>clathrata, Periglypta</i>	349
<i>clathrata, Venus</i>	349
Clathrate venus	349
<i>clathratus, Hydroclathrus</i>	65
<i>Clausinella foliacea</i>	351
<i>Clava aspera</i>	446
<i>Clava fasciata</i>	444
<i>Clava vertagus</i>	445
Clawed sea moss	83
Clear sundial	638
<i>Cleobula betulina</i>	624
<i>Cleobula quercina</i>	622
<i>Cleobula suratensis</i>	623
Cloak scallop	205
<i>Clypeomorus batillariaeformis</i>	443
<i>Clypeomorus bifasciata</i>	443
<i>Clypeomorus coralium</i>	440
<i>Clypeomorus obeliscus</i>	447
<i>coarctatus, Azorinus</i>	313
Coarse seagrape	46
<i>coaxans, Geloia</i>	317
<i>coaxans, Polymesoda</i>	317
<i>cochlidium, Pugilina</i>	584
<i>cochlidium, Volema</i>	584
Cock's comb oyster	230
Cockles	250
<i>Codakia divergens</i>	241
<i>Codakia interrupta</i>	240
<i>Codakia punctata</i>	240
<i>Codakia tigerina</i>	239
CODIACEAE	49
<i>Codium arabicum</i>	49
<i>Codium bartlettii</i>	50
<i>Codium edule</i>	51
<i>Codakia punctata</i>	240
<i>Codakia tigerina</i>	239
<i>Coelomactra violacea</i>	280
COENOTHECALIA	121
<i>coerulea, Heliopora</i>	121
<i>Collisellina saccharina</i>	392
Colombelle bigarrée	575
<i>Colorimactra florens</i>	279
Colossal melongena	586
<i>colosseus, Hemifusus</i>	586
<i>colosseus, Pugilina</i>	586
<i>Colpomenia sinuosa</i>	65
<i>Colubraria maculosa</i>	593
<i>Colubraria muricata</i>	593

COLUBRARIIDAE	572, 593
<i>colubrina, Cladopoda</i>	461
<i>colubrinus, Serpularia</i>	461
<i>colubrinus, Vermetus</i>	461
<i>Columbella scripta</i>	575
COLUMBELLIDAE	572, 575-576
<i>colus, Fusinus</i>	591
<i>colus, Fusus</i>	591
Comb bittersweet	164
Comb pen shell	178
Comb venus	332
Commercial top	405
<i>commercialis, Saxostrea</i>	232
Common basket lucina	243
Common button top	406
Common distorsio	548
Common egg cowrie	508
Common file shell	221
Common frog shell	551
Common geloin	317
Common hairy triton	545
Common hemidonax	262
Common mushroom coral	115
Common olive	611
Common Pacific sargassum	66
Common pythia	645
Common spider conch	467
Common vertagus	445
<i>communis, Vertagus</i>	445
<i>compressa, Donax</i>	303
<i>Comptopallium amiculum</i>	205
<i>Comptopallium pauciplicatum</i>	206
<i>Comptopallium radula</i>	206
<i>Comptopallium radula griggi</i>	206
<i>Comptopallium vexillum</i>	208
Conchs	462
<i>concinna, Haliotis</i>	389
<i>concinna, Sunetta</i>	352
Cône bouleau	624
Cône couronné	624
Cône de Surat	623
Cône flave	625
Cône général	625
Cône imprimé	621
Cône léopard	626
Cône livide	626
Cône marbré	627
Cône mosaïque	628
Cône petit-chêne	622
Cône rayé	627
Cone shells	618
Cône textile	628
Cone-shaped top	403
CONIDAE	618
<i>conoidalis, Harpa</i>	602
<i>conoïdes, Turbinaria</i>	73
<i>Conomurex luhuanus</i>	475
<i>contrastrata, Cypraea</i>	497
<i>Conus agrestis</i>	623
<i>Conus arabicus</i>	621
<i>Conus aristophanes</i>	624
<i>Conus bandanus</i>	627
<i>Conus betulinus</i>	623-624

- Conus coronatus* **624**
Conus eburneus 621
Conus flavidus **625-626**
Conus generalis **625**
Conus generalis maldivus 625
Conus leopardus 621, **626**
Conus litteratus **621, 626**
Conus lividus **625-626**
Conus marmoreus **627**
Conus martinianus 627
Conus miliaris 624
Conus millepunctatus 626
Conus monachus 626
Conus pardus 621, 626
Conus plebejus 626
Conus quercinus **622**
Conus radiatus **627**
Conus suratensis **623**
Conus tessulatus **628**
Conus textile **628**
Conus virgineus 626
conus, Tectus 403
conus, Trochus **403**
 Coquille Saint-Jacques pyxide 209
 Corail choufleur 109
 Corail lime 119
 Coral cerith 440
 Coral coliflor 109
 Coral raspa 119
 Coral-eating starfish 541
coralium, Cerithium **440**
coralium, Clypeomorus 440
CORALLINACEAE **82**
CORALLINALES 82
CORALLIOPHILIDAE 553
CORBICULIDAE **315**
Corbis elegans 244
Corbis élégant 244
Corbis fimbriata 243
Corbis soverbii 244
Corculum aselae 257
Corculum cardissa **257**
Corculum dionaeum 257
Corculum fragum 253
Corculum hemiscardium 254
Corculum kirai 257
Corculum laevigatum 257
Corculum obesum 257
Corculum unedo 255
Corculum unimaculatum 257
corensis, Turbo 418
cornea, Anadara 150
cornea, Neritodryas 430
cornea, Scapharca **150, 152**
 Corneous ark 150
cornigera, Turbinella 606
cornucopiae, Ostrea 232
cornucopiaeformis, Ostrea 232
cornuta, Cassis **534**
coronarius, Tectarius 434
coronata, Arcularia 579
coronata, Lunella 418
coronata, Nassa 579
 Coronate moon turban 418
 Coronate nassa 579
 Coronate prickly-winkle 435
coronatum, Vepricardium 260
coronatus, Conus **624**
coronatus, Dendroconus 624
coronatus, Nassarius 578-**579**
coronatus, Tectarius **435**
coronatus, Turbo **418**
coronatus, Virroconus 624
coronulata, Cassidea 536
corrugata, Austriella 237-**238**
corrugata, Eamesiella 238
corrugata, Lucina 238
corrugata, Mitra 617
corrugata, Pseudomithla 238
 Corrugate lucine 238
corymbosa, Lobophyllia **118**
costata, Cyrtopleura 356
costata, Nerita **428**
costata, Ritena 428
costata, Tonna 524
 Costate button top 408
 Costate miters 616
 Costate nerite 428
 Costate tun 524
costatum, Umbonium **408**
COSTELLARIIDAE 594, 613, **616**
cothurnata, Natica 512
cotinga, Veletuceta 163
 Couleuvreau tacheté 593
 Courtesan sunset clam 309
 Couteau à points roses 289
 Couteau de Lamarck 289
 Couteau javanais 287
 Couteau tranchant 286
 Cowries 486
 Crass turban 419
crassa, Marmarostoma 419
CRASSATELLIDAE 273
crassifolium, Sargassum **66-68, 72**
crassispina, Murex 565
Crassostrea angulata 233
Crassostrea cucullata 232
Crassostrea discoidea 231
Crassostrea gigas 171, **233, 341**
Crassostrea iredalei **228**
Crassostrea laperousii 233
Crassostrea plicatula 227
Crassostrea rivularis 231
Crassostrea sikamea 233
Crassostrea talienwhensis 233
crassus, Latirus 592
crassus, Turbo 416, **419**
cratitia, Tellina 297
crebricostatus, Pecten 209
crematus, Nassarius **580**
crematus, Zeuxis 580
crenata, Nassa 580
CREPIDULIDAE 390, 394, 646
cristaeifolium, Sargassum **67**
cristagalli, Loph **230**
cristagalli, Loph folium var. 230

<i>cristagalli, Ostrea</i>	230	<i>Cymatium aquatile</i>	544
<i>cristatus, Strombus</i>	481	<i>Cymatium chlorostomum</i>	543
<i>crocata pilsbryi, Lambis</i>	477	<i>Cymatium intermedium</i>	544
<i>crocata, Lambis</i>	477	<i>Cymatium lotorium</i>	545
<i>crocata, Pterocera</i>	467	<i>Cymatium martinianum</i>	544
<i>crocea, Tridacna</i>	268	<i>Cymatium muricinum</i>	542
Crocus giant clam	268	<i>Cymatium nicobaricum</i>	543
Cross tellin	293	<i>Cymatium pileare</i>	544-545
Crown-of-thorn starfish	541	<i>Cymatium pyrum</i>	546
Crown-of-thorns	541	<i>Cymatium tuberosum</i>	542
Crowned cone	624	<i>Cymbiola vespertilio</i>	596
Crowned sea bell	75	<i>Cymbium melo</i>	598
<i>crucigera, Tellina</i>	293	<i>Cymia lacera</i>	561
<i>crumena, Bufonaria</i>	550-551	<i>Cypraea adusta</i>	504
<i>crumena, Bursa</i>	550	<i>Cypraea annulus</i>	497, 504
<i>crumenoides, Bufonaria</i>	550	<i>Cypraea arabica</i>	491, 500, 503
<i>ryptodon eutornus</i>	237	<i>Cypraea argus</i>	497
<i>Cryptodon globulosum</i>	237	<i>Cypraea bouteti</i>	498
<i>Cryptodon philippinarum</i>	238	<i>Cypraea caledonica</i>	502
CRYPTONEMIACEAE	80	<i>Cypraea caputserpentis</i>	498
CRYPTONEMIALES	80	<i>Cypraea carneola</i>	498-499, 502
<i>Cryptopecten pallium</i>	207	<i>Cypraea carneola propinqua</i>	499
<i>Ctena bella</i>	241	<i>Cypraea caurica</i>	499
<i>Ctena divergens</i>	241	<i>Cypraea contrastriata</i>	497
<i>Ctenactis echinata</i>	115	<i>Cypraea depressa</i>	500
<i>cucullata, Crassostrea</i>	232	<i>Cypraea dracaena</i>	499
<i>cucullata, Saccostrea</i>	232	<i>Cypraea eglantina</i>	500
<i>Cucullaea auriculifera</i>	158	<i>Cypraea erosa</i>	501
<i>Cucullaea cucullata</i>	158	<i>Cypraea grayana</i>	491
<i>Cucullaea granulosa</i>	158	<i>Cypraea isabella</i>	501
<i>Cucullaea labiata</i>	158	<i>Cypraea leviathan</i>	502
<i>Cucullaea labiosa</i>	158	<i>Cypraea lynx</i>	502
<i>Cucullaea vaga</i>	158	<i>Cypraea maculifera</i>	503
<i>Cucullaeid ark shells</i>	158	<i>Cypraea mappa</i>	492
CUCULLAEIDAE	142, 158-159, 161	<i>Cypraea mauritiana</i>	493
<i>cucullata, Cucullaea</i>	158	<i>Cypraea moneta</i>	503
CULTELLIDAE	284	<i>Cypraea nymphae</i>	504
<i>cultratum, Cheilosporum</i>	82	<i>Cypraea obvelata</i>	504
<i>Cuma carinifera</i>	561	<i>Cypraea onyx</i>	504
<i>Cuma lacera</i>	561	<i>Cypraea polynesiae</i>	496
<i>cumingiana, Ostrea</i>	227	<i>Cypraea propinqua</i>	499
<i>cumingiana, Sanguinolaria</i>	310	<i>Cypraea reticulata</i>	503
<i>cumingiana, Saxostrea</i>	227	<i>Cypraea schilderorum</i>	505
<i>cumingiana, Soletellina</i>	310	<i>Cypraea scurra</i>	505
<i>cumingii, Architectonica</i>	638	<i>Cypraea succinta</i>	504
<i>cumingii, Pecten</i>	210	<i>Cypraea talpa</i>	494
<i>cumingii, Vertagus</i>	446	<i>Cypraea tigris</i>	495
<i>cuneata, Arca</i>	154	<i>Cypraea vanelli</i>	502
<i>cuneata, Latona</i>	301	<i>Cypraea ventriculus</i>	506
<i>cuneata, Mactra</i>	279	<i>Cypraea vitellus</i>	496
Cuneate donax	301	<i>Cypraecassis rufa</i>	535
<i>cuneatus, Donax</i>	301	CYPRAEIDAE	486, 507
<i>cupressoides, Caulerpa</i>	43	<i>cypsellus, Pteria</i>	189
CUSPIDARIIDAE	127	<i>Cyrena ceylonica</i>	318
<i>Cyclina chinensis</i>	345	<i>Cyrena eximia</i>	319
<i>Cyclina sinensis</i>	345	<i>Cyrena impressa</i>	319
<i>Cycline orientale</i>	345	<i>Cyrena moussoni</i>	317
<i>Cyclosunetta menstrialis</i>	351	<i>Cyrena sumatrensis</i>	319
<i>Cyclosunetta truncata</i>	352	<i>Cyrena turgida</i>	319
<i>Cyclotellina remies</i>	297	<i>Cyrena zeylanica</i>	317, 319
Cylinder date mussel	174	<i>Cyrène bengali</i>	319
<i>Cylinder textile</i>	628	<i>Cyrène érodée</i>	317
CYMATIIDAE	547, 549, 553, 593	<i>Cyrène large</i>	318

- Cyrène violette 319
Cyrtopleura costata 356
Cytherea ornata **335**
 Cythérée commune 337
 Cythérée lyre 336
- D**
- daedalea, Platygyra* **114**
damaecornis, Chama 246
damicornis, Pocillopora **109**, 119
danai, Fungia **114**
Darioconus textile 628
DASYCLADACEAE **58**
DASYCLADALES 58
 Datte de mer polie 174
davidis, Harpa 601-602
Decatopecten amiculum **205**
Decatopecten radula **206**
declivis, Tapes 348
decora, Natica 512
decurrens, Turbinaria **74**
decurtatus, Malleus 197
decussata, Barbatia 155
decussata, Pavona **112**
 Decussate ark 155
deflorata, Asaphis 307
delsa, Quantulopinna 180
deltodes, Pinna 180
deltoides, Donax **303**
deltoides, Plebidonax 303
Dendostrea folium **229-230**
Dendostrea frons 229
Dendroconus betulinus 624
Dendroconus coronatus 624
Dendroconus tessulatus 628
Dendropoma maximum **460**
dentatum, Canarium 479
dentatus, Strombus **479**
denticulatum, Eucheuma **91**
depressa, Arabica 500
depressa, Cypraea **500**
depressa, Mactra 281
depressa, Mauritia 500
 Depressed cowrie 500
derasa, Tridacna **269**
despectus, Murex 558
 Diadem volute 597
diadema, Voluta 597
 Diana conch 469
dichotoma, Asaphis 307
dichotoma, Dictyota **62-63**
 Dichotomously branched gracilaria 85
Dictyopteris jamaicensis **61**
Dictyota dichotoma **62-63**
Dictyota mertensii **63**
DICTYOTACEAE **61**
DICTYOTALES 61
didyma, Glossaulax 518
didyma, Neverita 518
didyma, Polinices **518**
diegensis, Teredops 360
Digenea simplex **98**
dilatata, Barnea **357**
- Dilate piddock 357
dilitata, Halymenia **80**
Diluvarca ferruginea 154
dionaeum, Corculum 257
 Diphos sanguin 310
diphos, Hiatula 310
diphos, Sanguinolaria 310
diphos, Soletellina **310**
discoidea, Crassostrea 231
discrepans, Helcioniscus rota var. 397
 Discrepant venus 330
dispar, Gafrarium **330**
 Distaff spindle 591
distans, Chlamys 208
 Distant scallop 208
Distorsio anus **548**
Distorsio clathrata 548
Distorsio reticularis **548**
Distorsio ridens 548
 Distorsios 547
Distorta rotunda 548
Distorta rugosa 548
 Distorted mussel 175
 Distortie commune 548
 Distortie réticulée 548
Distortio francesae 548
Distortio reticulata 548
Distortrix anus 548
divaricata, Chama 246
 Divaricate short razor 314
divaricatu, Solecurtus **314**
divaricatum, Gafrarium **331**
divergens, Codakia 241
divergens, Ctena 241
divergens, Epicodakia 241
 Divergent lucine 241
 Dog conch 471
Dolabella 640
Dolabella auricularia **640**
 Dolabelle commune 640
DOLABELLIDAE **639**
Dolavella scapula 640
Dolium fasciatum 526
dolium, Tonna **528**
Dolomena marginata 480
Dolomena variabilis 482
DONACIDAE 261, 282, 290, **299**
donaciforme, Cardium 262
donaciformis australiensis, Hemidonax 262
donaciformis, Hemidonax **262**
Donax 303
Donax bicolor 301
 Donax clams 299
Donax compressa 303
Donax cuneatus **301**
Donax deltoides **303**
Donax epidermia 303
Donax faba **302**
Donax granosus 301
Donax incarnatus **303**
Donax obscurus 301
Donax pubescens 304
Donax radians 302

<i>Donax radiatus</i>	301
<i>Donax scortum</i>	304
<i>Donax trigonalis</i>	303
Donkey's ear abalone	385
<i>dorsata</i> , <i>Zeuxis</i>	580
<i>dorsatus</i>, <i>Nassarius</i>	580
<i>dorsatus</i>, <i>Tapes</i>	343
Dotted dove shell	575
Double-bladed sargassum	67
Dove shells	575
<i>dracaena</i> , <i>Cypraea</i>	499
Dragon cowrie	499
Ducal thorny oyster	213
<i>ducalis</i> , <i>Spondylus</i>	213
<i>dunkeri</i> , <i>Solecurtus</i>	314
<i>duplicata</i>, <i>Turritella</i>	457
<i>duplicata</i> , <i>Zaria</i>	457
Duplicate turret	457
<i>dupuchense</i> , <i>Trachycardium</i>	256
<i>dura</i> , <i>Tapes</i>	352
<i>durvillaei</i>, <i>Halymenia</i>	81
Dwarf tritons	593

E

<i>Eamesiella corrugata</i>	238
Eared horse mussel	175
<i>eburneus</i> , <i>Conus</i>	621
<i>echinata</i> , <i>Ctenactis</i>	115
<i>echinata</i>, <i>Fungia</i>	115
<i>echinata</i> , <i>Ostrea</i>	232
<i>echinatum</i>, <i>Cerithium</i>	441
<i>edentula</i>, <i>Anodontia</i>	237-238
<i>edentula</i> , <i>Lucina</i>	237
Edible shipworm	360
<i>edmondsoni</i> , <i>Periglypta</i>	349
<i>edule</i>, <i>Codium</i>	51
<i>edulis</i> , <i>Bactronophorus</i>	360
<i>edulis</i>, <i>Gracilaria</i>	85
Egg cowries	507
Eggwhite moon snail	516
<i>eglantina</i> , <i>Arabica</i>	500
<i>eglantina</i>, <i>Cypraea</i>	500
<i>eglantina</i> , <i>Mauritia</i>	500
Eglantine cowrie	500
<i>eglantinus</i> , <i>Peribolus</i>	500
<i>elegans</i> , <i>Corbis</i>	244
<i>elegans</i> , <i>Natica</i>	512
<i>elegans</i> , <i>Turbo</i>	415
Elegant basket lucina	244
Elephant's ear	54
Elephant's-foot moon snail	517
Elkhorn sea moss	93
ELLOBIIDAE	641
<i>Ellobium aurisjudae</i>	643
<i>Ellobium aurismidae</i>	644
<i>Ellobium ceramense</i>	644
<i>Ellobium labrosum</i>	643
<i>Ellobium midae</i>	644
<i>Ellobium subtile</i>	643
<i>elongata</i> , <i>Barnea</i>	357
<i>elongata</i>, <i>Gari</i>	308
<i>elongata</i> , <i>Hiatula</i>	308
<i>elongata</i> , <i>Psammotaea</i>	308
<i>elongata</i> , <i>Sanguinolaria</i>	308
<i>elongata</i> , <i>Soletellina</i>	308, 310
<i>elongata</i> , <i>Tridacna</i>	271
Elongate giant clam	271
Elongate mushroom coral	116
Elongate sunset clam	308
<i>elongatus</i> , <i>Modiolus</i>	174
<i>emicator</i> , <i>Oliva</i>	610
Endive murex	562
<i>endivia</i> , <i>Murex</i>	562
<i>Enhalus</i>	49
<i>enneagona</i> , <i>Cellana</i>	396
<i>Enteromorpha clathrata</i>	38
<i>Enteromorpha intestinalis</i>	39
Entéromorphe creuse	39
Entéromorphe vert claire	38
<i>Ehippium angulinum</i>	219
<i>Ehippium polonicum</i>	219
<i>Ehippium transparens</i>	218
<i>ehippium</i>, <i>Apolymetis</i>	295
<i>ehippium</i>, <i>Isognomon</i>	191
<i>ehippium</i> , <i>Leporimetis</i>	295
<i>ehippium</i> , <i>Melina</i>	191
<i>ehippium</i> , <i>Placenta</i>	219
<i>ehippium</i>, <i>Placuna</i>	219
<i>ehippium</i> , <i>Psammotreta</i>	295
<i>Epicodakia bella</i>	241
<i>Epicodakia divergens</i>	241
<i>epidermia</i> , <i>Donax</i>	303
<i>epidromis</i> , <i>Labiostrabus</i>	479
<i>epidromis</i>, <i>Strombus</i>	479
<i>epidromus</i> , <i>Strombus</i>	479
Episcopal miter	614
<i>episcopalis</i> , <i>Mitra</i>	614
<i>episcopalis</i> , <i>Oliva</i>	610
Equilateral venus	345
Erect sea cactus	52
Erect sea moss	97
<i>erecta</i>, <i>Avrainvillea</i>	54
<i>eremitarum</i> , <i>Chrysame</i>	614
<i>eremitarum</i>, <i>Mitra</i>	614
Eroded cowrie	501
<i>erosa</i>, <i>Cypraea</i>	501
<i>erosa</i> , <i>Erosaria</i>	501
<i>erosa</i> , <i>Geloina</i>	317
<i>erosa</i>, <i>Polymesoda</i>	317
<i>Erosaria annulus</i>	497
<i>Erosaria caputserpentis</i>	498
<i>Erosaria erosa</i>	501
<i>Erosaria moneta</i>	503
<i>Erosaria obvelata</i>	504
<i>Erronea caurica</i>	499
<i>Erronea onyx</i>	504
<i>erythraensis</i> , <i>Lithophaga</i>	174
<i>erythraeonense</i> , <i>Cerithium</i>	442
<i>erythraeonense</i> , <i>Cerithiumm</i>	442
<i>erythrostroma</i> , <i>Oliva</i>	609
<i>Estellacar galactodes</i>	160
<i>Estellacar olivacea</i>	160
<i>Estellacar saga</i>	160
<i>Estellarca olivacea</i>	160
<i>Eucheuma</i>	93
<i>Eucheuma arnoldii</i>	90

- Eucheuma denticulatum* **91**
Eucheuma gelatinae **92**
eucheumoides, Gracilaria **86**
eudora, Cellana 396
Euphyllia glabrescens **113**
Euplica versicolor 575
Euprotomus aurisdianae 469
Euprotomus bulla 470
eutornus, Cryptodon 237
euzona, Natica **512**
euzona, Notocochlis 512
ezona, Tanea 512
evecta, Bractechlamys 208
exaratum, Phalium 536
exasperata, Lucina 239
excavata, Sunetta 351
exigua, Siphonaria 647
eximia, Cyrena 319
eximia, Polymesoda 317
expansa, Geloina 318
expansa, Polymesoda **317-318**
expeditionis, Tydemania **55**
exquisita, Pinna 180
extra, Tucetona 164
 Eyed cowie 497
- F**
- faba, Donax* **302**
faba, Latona 302
 False limpets 646
fanel, Natica 514
farinosa, Liagora **76**
fasciata, Clava 444
fasciata, Rhinoclavis **444**
fasciatum, Cerithium 444
fasciatum, Dolium 526
 Fasciolaire ferrugineuse 590
 Fasciolaire filamenteuse 589
 Fasciolaire polygonale 592
 Fasciolaire rustique 592
Fasciolaria filamentosa 589
Fasciolaria trapezium 590
FASCIOLARIIDAE 582, **587**, 629
Favia fava **113**
FAVIIDAE **113**
favus, Favia **113**
 Feather coral 117
 Fenestrate top 407
fenestratus, Tectus **407**
fenestratus, Trochus 407
ferruginea, Anadara **154**
ferruginea, Diluvarca 154
ferruginea, Paphia 346
 Fertile venus 347
fibula, Lucina 241
FICIDAE 522, **530**
ficoides, Ficus 531
Ficus ficoides 531
Ficus ficus 531
Ficus gracilis **531**
Ficus subintermedia **531**
ficus, Ficus 531
 Fig shells 530
- filamentosa, Fasciolaria* 589
filamentosa, Pleuroploca **589**
 Filamentous horse conch 589
 File shells 220
 Filiform sea moss 88
filoteoi, Bactronophorus 360
Fimbria fimbriata **243**
Fimbria soverbii **244**
Fimbria sowerbii 244
Fimbria sowerbyi 244
fimbriata, Corbis 243
fimbriata, Fimbria **243**
fimbriatum, Vepricardium **260**
FIMBRIIDAE 234, **242**
 Finger coral 111
 Fingerprint oyster 227
 Fire coral 104
 Firebrand murex 560
FISSURELLIDAE 390, **394**
flabellata, Annachlamys **208**
flabellatus, Aequipecten 208
flabelloides, Pecten 205
 Flag pen shell 179
 Flat-stemmed sargassum 69
 Flatribbed scallop 206
 Flatspired nerite 429
 Flattop seagrape 45
flavidus, Conus **625-626**
flavidus, Virgiconus 625
flavum, Cardium 256
flavum, Fragum 253
 Fleshy donax 303
flexuosa, Patella 398
flexuosus, Helcioniscus 398
 Flion bicolore 301
 Flion deltoïde 303
 Flion incarnat 303
 Flion radieux 302
 Flion tanné 304
florens, Colorimactra 279
florida, Acropora **110**
FLORIDEOPHYCIDAE 21, 23
FLORIDEOPHYSIDAE 76
floridus, Strombus 481
 Fluted giant clam 272
fluviatilis, Tympanotonos 454
 Fly spotted auger 635
foliacea, Anaitis 351
foliacea, Chama 246
foliacea, Clausinella 351
foliacea, Phylloda 295
foliacea, Tellina **295**
foliacea, Venus 351
foliata, Barbatia **155**
foliata, Hexaplex 562
 Foliated telli 295
folium, Dendostrea **229-230**
folium, Loph 229
folium, Ostrea 229
folium var. cristagalli, Loph 230
 Forked ribbons 62-63
 Forked venus 331
formosa, Acropora **110**

<i>formosum, Amusium japonicum</i>	202	<i>gari, Tellina</i>	311
<i>formosum, Architectonica</i>	638	GARIIDAE	305
<i>forskaelii, Ostrea</i>	232	<i>Gastridium betulinus</i>	624
<i>forskalli, Ostrea</i>	232	<i>gelatinae, Eucheuma</i>	92
<i>forskoehlii, Murex</i>	565	GELIDIAEACE	79
<i>fragilis, Atrina</i>	178	GELIDIALES	79
<i>fragilis, Pholas</i>	357	<i>Gelidiella acerosa</i>	79
<i>fragilis, Standella</i>	281	<i>Geloina bengalensis</i>	319
<i>Fragum flavum</i>	253	<i>Geloina coaxans</i>	317
Fragum fragum	253	<i>Geloina erosa</i>	317
Fragum hemicardium	254	<i>Geloina expansa</i>	318
Fragum unedo	255	<i>gemmaata, Purpura</i>	569
<i>fragum, Corculum</i>	253	General cone	625
fragum, Fragum	253	<i>generalis maldivus, Conus</i>	625
<i>francesae, Distortio</i>	548	generalis, Conus	625
Francolina jopas	566	<i>generalis, Leptoconus</i>	625
francolina, Nassa	566	geppii, Udotea	57
<i>francolinus, Iopas</i>	566	Giant clam	270
Fringed false limpet	648	Giant clams	263
<i>fringila, Glycymeris</i>	163	Giant cupped oyster	233
Frog shells	549	Giant frog shell	552
<i>frons, Dendostrea</i>	229	Giant knobbed cerith	442
FUCALES	21, 66	Giant spider conch	468
<i>fucata martensii, Pinctada</i>	187	Giant sundial	638
<i>fucata, Pinctada</i>	187	<i>Gibberulus gibberulus</i>	472
<i>fuliginosum, Architectonica</i>	638	<i>Gibberulus gibbosus</i>	472
<i>Fulvia aperta</i>	257	<i>gibberulus gibbosus, Strombus</i>	472
Fulvia papyracea	257	<i>gibberulus, Gibberulus</i>	472
<i>Fundella lioyi</i>	197	gibberulus, Strombus	472
Fungia danai	114	<i>gibbia, Circe</i>	333
Fungia echinata	115	Gibbose conch	472
Fungia fungites	114-115	<i>gibbosus, Gibberulus</i>	472
Fungia paumotensis	116	<i>gibbosus, Strombus gibberulus</i>	472
FUNGIIDAE	114	<i>gigantea, Bursa subeta</i>	552
<i>fungites, Fungia</i>	114-115	GIGARTINALES	83
Furrowed horse mussel	174	<i>gigas, Crassostrea</i>	171, 233 , 341
<i>fusca, Barbatia</i>	156	<i>gigas, Tridacna</i>	270
Fuseau de Nicobar	591	Girdled horn shell	454
Fuseau quenouille	591	glabra, Haliotis	386
Fusinus colus	591	<i>glabra, Schismotis</i>	386
<i>Fusinus longicaudus</i>	591	<i>glabrata, Atactodea</i>	283
Fusinus nicobaricus	591	glabrescens, Euphyllia	113
<i>Fusus colus</i>	591	Glans nassa	581
<i>Fusus laticostatus</i>	591	<i>glans, Alectrion</i>	581
fusus, Tibia	483	<i>glans, Nassa</i>	581
G		glans, Nassarius	581
Gafrarium dispar	330	<i>Glaucanome rugosa</i>	353
Gafrarium divaricatum	331	Glaucanome virens	309, 353
<i>Gafrarium pectinatum</i>	330-332-333	GLAUCONOMIDAE	320, 353
Gafrarium tumidum	333	<i>Glauconomya virens</i>	353
<i>Gafrarium undulatum</i>	333	Glauconomyas	353
<i>galactodes, Estellacar</i>	160	Glauconomye verte	353
GALAXAURACEAE	78	glaucum, Phalium	537
<i>galea, Tonna</i>	528	Glistening abalone	386
<i>galeodes, Melongena</i>	585	<i>globosa, Anadara</i>	151
gallus, Paphia	348	<i>globosa, Natica</i>	515
<i>gallus, Protapes</i>	348	globosa, Scapharca	151-152
Gari elongata	308	Globose ark	151
<i>Gari minor</i>	308	<i>globulosum, Cryptodon</i>	237
Gari squamosa	311	<i>glomerata, Ostrea</i>	232
Gari togata	309, 353	Gloripallium pallium	207
Gari truncata	311	<i>Glossaulax didyma</i>	518
		GLYCYMERIDIDAE	142, 159, 161

<i>Glycymeris amboinensis</i>	164	<i>Guildfordia</i>	484
<i>Glycymeris fringila</i>	163	<i>guttatus, Strombus</i>	470
<i>Glycymeris hanleyi</i>	163	<i>guttulata, Paphia</i>	344
<i>Glycymeris pectiniformis</i>	164	<i>Gutturnium muricinum</i>	542
<i>Glycymeris pectunculus</i>	164	GYMNOMORPHA	365
<i>Glycymeris reevei</i>	163	<i>Gyrineum cavitensis</i>	551
Gold ring cowrie	497	<i>Gyrineum rana</i>	551
Golden thorny oyster	215		
Goldlip pearl oyster	186	H	
Goldmouth turban	413	Hailstorm prickly-winkle	434
<i>Gomphina aequilatera</i>	345	Half-propellor ark	157
<i>Gomphina melanaegis</i>	345	Halfround cardita	249
<i>Gomphina veneriformis</i>	345	<i>Halimeda macroloba</i>	52
Goolwa donax	303	<i>Halimeda opuntia</i>	53
Graceful fig shell	531	HALIMEDACEAE	52
<i>Gracilaria arcuata</i>	84	HALIOTIDAE	383
<i>Gracilaria edulis</i>	85	<i>haliotidea, Alectryonella</i>	227
<i>Gracilaria euchemoides</i>	86	<i>Haliotis asinina</i>	385
<i>Gracilaria heteroclada</i>	87	<i>Haliotis concinna</i>	389
<i>Gracilaria manilaensis</i>	88	<i>Haliotis glabra</i>	386
<i>Gracilaria salicornia</i>	89	<i>Haliotis latilabris</i>	387
GRACILARIACEAE	84	<i>Haliotis ovina</i>	387
Gracile sargassum	68	<i>Haliotis picta</i>	386
<i>gracilis, Ficus</i>	531	<i>Haliotis planata</i>	388
<i>gracillimum, Sargassum</i>	68	<i>Haliotis semistriata</i>	389
<i>Grammatomya squamosa</i>	311	<i>Haliotis varia</i>	389
Grand corbis	243	<i>Haliotis viridis</i>	389
Grand couteau	288	<i>Halomitra pileus</i>	116
Grand razor shell	288	<i>Halymenia dilitata</i>	80
Grand strombe du Pacifique	480	<i>Halymenia durvillaei</i>	81
Grand vermet	460	Hammer oysters	194
<i>grandinatus, Tectarius</i>	434	<i>hanleyanus, Trochus</i>	408
<i>grandis, Mactra</i>	278	<i>hanleyi, Architectonica</i>	638
<i>grandis, Solen</i>	288	<i>hanleyi, Glycymeris</i>	163
<i>granosa, Anadara</i>	147	Hard corals	104
<i>granosa, Arca</i>	147	Harp shells	599
<i>granosa, Tegillarca</i>	147	<i>Harpa</i>	599
<i>granosum, Cerithium</i>	440	<i>Harpa articularis</i>	601
<i>granosus, Donax</i>	301	<i>Harpa conoidalis</i>	602
Granular ark	147	<i>Harpa davidis</i>	601-602
<i>granulatus, Vertagus</i>	446	<i>Harpa harpa</i>	601
<i>granulosa, Cucullaea</i>	158	<i>Harpa major</i>	602
<i>grata, Tapes</i>	352	<i>Harpa nobilis</i>	601
<i>gravida, Saxostrea</i>	232	<i>Harpa ventricosa</i>	602
<i>grayana, Cypraea</i>	491	<i>harpa, Harpa</i>	601
Great worm shell	460	<i>Harpago chiragra</i>	477
Green algae	20, 38	Harpe articulée	601
Green sea antler	50	Harpe majeure	602
Green sea beads	55	Harpe noble	601
Green sea cushion	49	HARPIDAE	532, 599
Green sea feather	47	<i>Hastula hectica</i>	635
Green sea palm	48	<i>Haustellum haustellum</i>	564
Green sea vesicles	41	<i>Haustellum vicdani</i>	564
Green turban	414	<i>haustellum, Haustellum</i>	564
Greenish glaucomomya	353	<i>haustellum, Murex</i>	564
Grey bonnet	537	<i>hawaiiensis, Martesia</i>	358
<i>griggi, Comptopallium radula</i>	206	<i>hawaiiensis, Pinna</i>	180
Grinning tun	527	<i>hawaiiensis, Trachycardium</i>	259
<i>grossa, Nerita</i>	428	<i>hawaiiensis, Anodontia</i>	237
GRYPHAEIDAE	125, 222, 224	Hazelnut ark	154
Gualteri's moon snail	520	Head coral	113
<i>gualteriana, Natica</i>	520	<i>hectica, Hastula</i>	635
<i>gubernaculum, Anadara</i>	153	<i>hectica, Impages</i>	635

<i>hectica</i> , <i>Terebra</i>	635	Huître palmée	231
<i>Hecuba scortum</i>	304	Huître plicatule	227
<i>helblingi</i> , <i>Barbatia</i>	155	<i>humilis</i>, <i>Acropora</i>	111
<i>Helcioniscus articulatus</i>	396	<i>humilis</i> , <i>Cerithium</i>	443
<i>Helcioniscus flexuosus</i>	398	Humpback cowrie	493
<i>Helcioniscus rota</i>	396	<i>hyacinthus</i>, <i>Acropora</i>	111
<i>Helcioniscus rota</i> var. <i>discrepans</i>	397	Hydroclathrus	65
<i>Helcioniscus testudinaria</i>	397	<i>Hydroclathrus clathratus</i>	65
<i>helicina</i> , <i>Pythia</i>	645	HYDROZOA	122
<i>Heliopora coerulea</i>	121	<i>hyotis</i> , <i>Hyotissa</i>	223 , 227
HELIOPORIDAE	121	<i>hyotis</i> , <i>Pycnodonte</i>	223
Helmet shells	532	<i>Hyotissa hyotis</i>	223 , 227
HELMINTHOCLADIACEAE	76	<i>Hyotissa sinensis</i>	223
<i>helvacea</i> , <i>Natica</i>	515	<i>Hypnea boergesenii</i>	94
<i>hemicardia</i> , <i>Lunulicardia</i>	254	<i>Hypnea pannosa</i>	95
<i>hemicardium</i> , <i>Corculum</i>	254	<i>hystrix</i>, <i>Seriatopora</i>	120
<i>hemicardium</i>, <i>Fragum</i>	254		
HEMIDONACIDAE	261 , 299	I	
Hemidonax clams	261	<i>imbricata</i> , <i>Chama</i>	247
Hémidonax commun	262	<i>imbricata</i> , <i>Pinctada</i>	187
<i>Hemidonax donaciformis</i>	262	<i>imbricatum</i> , <i>Cardium</i>	253
<i>Hemidonax donaciformis australiensis</i>	262	<i>Impages hectica</i>	635
<i>Hemidonax pictus</i>	262	<i>imperfecta</i> , <i>Nerita</i>	423
<i>Hemifusus colosseus</i>	586	Imperial thorny oyster	215
<i>Hemifusus pugilinus</i>	584	<i>imperialis</i>, <i>Spondylus</i>	215
<i>Hemifusus ternatanus</i>	586	<i>impressa</i> , <i>Cyrena</i>	319
<i>hemprichii</i>, <i>Lobophyllia</i>	118	<i>inaequivalvis</i> , <i>Anadara</i>	152
<i>heteroclada</i>, <i>Gracilaria</i>	87	<i>inaequivalvis</i>, <i>Scapharca</i>	151-152
<i>Hexaplex cichoreum</i>	562	<i>incarnata</i> , <i>Latona</i>	303
<i>Hexaplex foliata</i>	562	<i>incarnatus</i>, <i>Donax</i>	303
Hiant venus	334	<i>incompta</i> , <i>Mitra</i>	614
<i>hiantina</i>, <i>Katylisia</i>	334	Indian turrid	630
<i>hiantina</i> , <i>Marcia</i>	334	Indian volute	598
<i>hiantina</i> , <i>Paphia</i>	334	<i>indica</i> , <i>Anadara</i>	153
<i>Hiata infelix</i>	358	<i>indica</i>, <i>Lophiotoma</i>	630
<i>Hiatula diphos</i>	310	<i>indica</i> , <i>Melo</i>	598
<i>Hiatula elongata</i>	308	<i>indica</i>, <i>Scapharca</i>	153
<i>Hiatula togata</i>	309	<i>indicus</i> , <i>Yetus</i>	598
<i>hippocastanum</i> , <i>Murex</i>	568	Indo-Pacific ark	155
<i>Hippopus</i>	263-264	<i>indomaris</i> , <i>Lambis scorpius</i>	478
<i>Hippopus hippopus</i>	266-267	Inequivalve ark	152
<i>Hippopus maculatus</i>	266	<i>infelix</i> , <i>Hiata</i>	358
<i>Hippopus porcellanus</i>	266-267	<i>inornata</i> , <i>Barnea</i>	357
<i>hippopus</i>, <i>Hippopus</i>	266-267	<i>inquisitor</i> , <i>Penepatella</i>	398
Hisopo de mar	98	<i>insignis</i> , <i>Patella</i>	397
Hollow green nori	39	<i>intercostalis</i> , <i>Turbo</i>	417
Honeycomb oyster	223	<i>intermedia</i> , <i>Lampusia</i>	544
Honeycomb oysters	222	<i>intermedia</i> , <i>Septa</i>	544
Hooded oyster	232	Intermediate hairy triton	544
Hooked ark	158	<i>intermedium</i>, <i>Cymatium</i>	544
<i>hormoides</i>, <i>Scinaia</i>	78	<i>interrupta</i>, <i>Codakia</i>	240
Horn shells	448	<i>interrupta</i> , <i>Lentillaria</i>	240
Horned helmet	534	<i>interrupta</i> , <i>Lucina</i>	240
<i>hornemanni</i>, <i>Portieria</i>	83	Interrupted lucine	240
<i>horrida</i> , <i>Stavelia</i>	175	<i>intestinalis</i>, <i>Enteromorpha</i>	39
Horse conchs	587	<i>intraurea</i> , <i>Penepatella</i>	398
Houlette déguénillée	95	<i>intusgranosa</i> , <i>Mesopholas</i>	358
<i>hubbardi</i> , <i>Standella</i>	281	<i>Iopas francolinus</i>	566
Huître capuchon	232	<i>Iopas sertum</i>	566
Huître crête-de-coq	230	<i>iredalei</i>, <i>Crassostrea</i>	228
Huître creuse	233	<i>iredalei</i> , <i>Ostrea</i>	228
Huître creuse chausson	228	<i>iridescens</i> , <i>Ostrea</i>	227
Huître feuille	229	<i>isabella</i> , <i>Basilitrona</i>	501

<i>isabella, Cypraea</i>	501
<i>isabella, Luria</i>	501
<i>isabella, Strombus</i>	471
<i>isabella, Talparia</i>	501
Isabelle cowrie	501
Isognomon ehippium	191
Isognomon isognomum	192, 197
<i>Isognomon legumen</i>	193
Isognomon perna	193
ISOGNOMONIDAE	181, 190, 194
isognomum, Isognomon	192, 197
<i>isognomum, Isogonum</i>	192
<i>Isogonum isognomum</i>	192
<i>ispida, Oliva</i>	611
<i>ispidula, Oliva</i>	611

J

<i>jamaicensis, Dictyopteris</i>	61
Jambonneau bicolore	180
Jambonneau épineux	180
Jambonneau noir	179
Jambonneau pectiné	178
Japan venus	346
Japanese carpet shell	341
<i>japonica, Anadara</i>	153
<i>japonica, Babylonia</i>	574
<i>japonica, Barnea</i>	357
<i>japonica, Katelysia</i>	346
<i>japonica, Marcia</i>	346
<i>japonica, Pinna</i>	178
<i>japonica, Tapes</i>	341-342
<i>japonica, Venerupis</i>	341
<i>japonicum balloti, Amusium</i>	202
<i>japonicum formosum, Amusium</i>	202
<i>japonicum japonicum, Amusium</i>	202
<i>japonicum taiwanense, Amusium</i>	202
<i>japonicum, Amusium</i>	202
<i>japonicum, Amusium japonicum</i>	202
<i>japonicus, Spondylus</i>	214
<i>javana, Natica</i>	514
<i>javana, Surcula</i>	630
<i>javana, Turricula</i>	630
Javanese false limpet	647
Javanese razor clam	287
Javanese turrid	630
<i>javanica, Pharella</i>	286-287
<i>javanica, Siphonaria</i>	647
<i>javanica, Siphonaris</i>	648
Jellyfish worm shell	461
Jester cowrie	505
Jewel box shells	245
Jopas francolin	566
Jopas guirlande	566
Jopas vexillaire	571
<i>judae, Auricula</i>	643
Judas ear cassidula	643

K

<i>Kappaphycus alvarezii</i>	93
<i>Katelysia hiantina</i>	334
<i>Katelysia japonica</i>	346
<i>Katelysia marmorata</i>	346
<i>Katelysia opima</i>	347

<i>kikaiensis, Lampusia</i>	544
<i>kilburni, Chicoreus</i>	560
<i>kirai, Corculum</i>	257
Knife clams	284
<i>kuhnholtzi, Annachlamys</i>	208
<i>kurodai, Murex</i>	564
<i>kurracheensis, Siphonaria</i>	647

L

<i>labiata, cucullaea</i>	158
<i>labiatum, Canarium</i>	473
<i>labiatus, Strombus</i>	473
Labio monodont	407
<i>labio, Monodonta</i>	407
<i>labiosa, Cucullaea</i>	158
<i>Labiostrombus epidromis</i>	479
<i>labrosum, Ellobium</i>	643
<i>lacera, Cuma</i>	561
<i>lacera, Cymia</i>	561
<i>lacerata, Venus</i>	340
Laciniate conch	481
<i>laciniosa, Siphonaria</i>	647-648
<i>lactea, Mammillaria</i>	517
<i>lactuca, Pectinia</i>	119
<i>lactuca, Ulva</i>	40
<i>lacunata, Pinctada</i>	187
<i>Laevicardium papyraceum</i>	257
<i>laevigatum, Corculum</i>	257
<i>Laevistrombus canarium</i>	471
<i>Laevistrombus turturella</i>	471
Laitue de mer	40
Lamarck's razor shell	289
<i>lamarckiana, Polinices</i>	518
<i>lamarckii, Meretrix</i>	337
<i>lamarckii, Solen</i>	289
<i>Lambis bryonia</i>	468
<i>Lambis chiragra arthritica</i>	477
<i>Lambis chiragra chiragra</i>	477
<i>Lambis crocata</i>	477
<i>Lambis crocata pilsbryi</i>	477
<i>Lambis lambis</i>	467-468
<i>Lambis millepeda</i>	478
<i>Lambis rugosa</i>	477
<i>Lambis scorpius</i>	477-478
<i>Lambis scorpius indomaris</i>	478
<i>Lambis sebae</i>	468
<i>Lambis truncata</i>	468
<i>Lambis truncata sebae</i>	468
<i>lambis, Lambis</i>	467-468
<i>lampas, Charonia</i>	552
<i>lampas, Triton</i>	552
<i>Lampusia aquatile</i>	544
<i>Lampusia intermedia</i>	544
<i>Lampusia kikaiensis</i>	544
<i>Lampusia nicobaricum</i>	543
<i>Lampusia pileare</i>	545
Lantern clams	361
<i>lanx, Patelloida</i>	392
<i>laperousii, Crassostrea</i>	233
Large sea fan tail	56
Largebrain root coral	118
<i>laterata, Tapes</i>	344
<i>Laternula rostrata</i>	362

<i>Laternula truncata</i>	362	Lime commune	221
LATERNULIDAE	361	Lime géante de Rathbun	221
<i>Lathyrus angulatus</i>	592	LIMIDAE	198, 220
<i>Lathyrus smaragdulus</i>	592	<i>lincolnii</i> , <i>Placuna</i>	218
<i>laticostatus</i> , <i>Fusus</i>	591	lineata , <i>Natica</i>	520
<i>latilabris</i> , <i>Haliotis</i>	387	<i>lineata</i> , <i>Tanea</i>	520
Latirolagena smaragdula	592	<i>lineatum</i> , <i>Cerithium</i>	446
<i>Latirus belcheri</i>	592	<i>lineatus</i> , <i>Naticarius</i>	520
<i>Latirus crassus</i>	592	<i>lineatus</i> , <i>Notocochlis</i>	520
Latirus polygonus	592	<i>lineatus</i> , <i>Trochus</i>	408
<i>Latirus rusticus</i>	592	Lined moon snail	520
<i>latissima</i> , <i>Pholas</i>	357	Lined top	408
latissimus , Strombus	480	<i>linguafelis</i> , <i>Scutarcopagia</i>	296
<i>latissimus</i> , <i>Tricornis</i>	480	linguafelis , Tellina	296
<i>Latona cuneata</i>	301	Lioconcha castrensis	335
<i>Latona faba</i>	302	Lioconcha ornata	347
<i>Latona incarnata</i>	303	<i>Lioconcha picta</i>	347
<i>Latona variabilis</i>	301	<i>Liotribella staurella</i>	293
<i>latum</i> , <i>Cardium</i>	258	<i>lioyi</i> , <i>Fundella</i>	197
Laurencia	23	<i>lischkeana</i> , <i>Pinna</i>	178
Laurencia papillosa	99	<i>literata</i> , <i>Paphia</i>	344
<i>Laurencia picante</i>	99	literatus , Tapes	344
<i>Laurencia poivrée</i>	99	<i>Lithoconus leopardus</i>	626
Lazarus jewel box	246	<i>Lithoconus litteratus</i>	621
lazarus , Chama	246	<i>Lithoconus tessulatus</i>	628
Leaf oyster	229	<i>Lithophaga erythraensis</i>	174
Leather donax	304	Lithophaga teres	174
Lechuga de mar	40	litteratus , Conus	621, 626
<i>legumen</i> , <i>Isognomon</i>	193	<i>litteratus</i> , <i>Lithoconus</i>	621
<i>lentiginosus</i> , <i>Lentigo</i>	474	Little pitcher conch	476
lentiginosus , Strombus	474	Little-fox miter	617
<i>Lentigo lentiginosus</i>	474	Littoraria scabra	433
<i>Lentillaria interrupta</i>	240	<i>Littorina angulifera</i>	433
lentillifera , Caulerpa	44	<i>Littorina monilifera</i>	435
<i>leone</i> , <i>Solecurtus</i>	314	<i>Littorina pyramidalis</i>	435
Leopard cone	626	<i>Littorina scabra</i>	433
Leopard scallop	208	Littorine couronnée	435
<i>leopardus rena</i> , <i>Annachlamys</i>	208	Littorine grêlée	434
<i>leopardus</i> , <i>Chlamys</i>	208	Littorine pagode	436
leopardus , Conus	621, 626	Littorine pyramidale	435
<i>leopardus</i> , <i>Lithoconus</i>	626	Littorine rugueuse	433
<i>Leporicypraea mappa</i>	492	LITTORINIDAE	431 , 641
<i>Leporimetis ephippium</i>	295	<i>Littorinopsis scabra</i>	433
<i>Leptoconus generalis</i>	625	Livid cone	626
Lettered cone	621	lividus , Conus	625- 626
Lettered venus	344	<i>lividus</i> , <i>Virgiconus</i>	626
Lettuce coral	119	Lobophyllia	118
Leucine interrompue	240	Lobophyllia corymbosa	118
Leucine ponctuée	240	Lobophyllia hemprichii	118
<i>leviathan bouteti</i> , <i>Lyncina</i>	498	<i>longicaudus</i> , <i>Fusinus</i>	591
leviathan , Cypraea	502	<i>longicaudus</i> , <i>Murex</i>	564
<i>leviathan</i> , <i>Lyncina</i>	502	<i>longitudinalis</i> , <i>Spondylus</i>	214
<i>leviathan</i> , <i>Mystaponda</i>	502	Lopha cristagalli	230
Liagora farinosa	76	<i>Lopha folium</i>	229
<i>Lima lima</i>	221	<i>Lopha folium</i> var. <i>cristagalli</i>	230
<i>Lima lima vulgaris</i>	221	<i>Lophiotoma babylonica</i>	631
<i>Lima nipponica</i>	221	Lophiotoma indica	630
<i>Lima rathbuni</i>	221	<i>Lotoria lotorium</i>	545
<i>Lima sowerbyi</i>	221	lotorium , Cymatium	545
Lima vulgaris	221	<i>lotorium</i> , <i>Lotoria</i>	545
<i>lima vulgaris</i> , <i>Lima</i>	221	<i>lotorium</i> , <i>Pteria</i>	188
<i>lima</i> , <i>Barbatia</i>	155	Lottiid limpets	390
<i>lima</i> , <i>Lima</i>	221	LOTTIIDAE	390 , 395 , 646

<i>Lucina corrugata</i>	238	<i>Mactra maculata</i>	277
<i>Lucina edentula</i>	237	<i>Mactra maculosa</i>	279
<i>Lucina exasperata</i>	239	<i>Mactra mera</i>	278
<i>Lucina fibula</i>	241	<i>Mactra ornata</i>	279
<i>Lucina interrupta</i>	240	<i>Mactra pellucida</i>	281
<i>Lucina munda</i>	241	<i>Mactra reevei</i>	277
<i>Lucina ovum</i>	237	<i>Mactra squalida</i>	277
<i>Lucina simplex</i>	240	<i>Mactra violacea</i>	280
Lucinas	234	Mactre achatine	279
Lucine divergente	241	Mactre cunéiforme	279
Lucine édentule	237	Mactre de Luçon	276
Lucine ridée	238	Mactre pure	278
Lucine tigre	239	Mactre tachetée	277
LUCINIDAE	234, 242, 248	Mactre violette	280
<i>lugubris, Turbo</i>	418	MACTRIDAE	273, 282
<i>luhuanus, Conomurex</i>	475	<i>maculata, Arca</i>	154
luhuanus, Strombus	475	<i>maculata, Mactra</i>	277
<i>Lunatica marmorata</i>	414	<i>maculata, Natica</i>	514
<i>Lunella cirenea</i>	418	<i>maculata, Oxymuris</i>	634
<i>Lunella coronata</i>	418	<i>maculata, Pinctada</i>	184
<i>Lunulicardia hemicardia</i>	254	<i>maculata, Pteria</i>	184
<i>Lunulicardia tumorifera</i>	254	<i>maculata, Subula</i>	634
<i>Luria isabella</i>	501	<i>maculata, Terebra</i>	634
<i>lurida, Pinna</i>	178	Maculated dwarf triton	593
<i>lusoria, Meretrix</i>	337	Maculated ivory whelk	573
lutosa, Babylonica	574	Maculated top	404
Lutraire capillaire	280	Maculated troughshell	277
Lutraire déprimée	281	<i>maculatum, Architectonica</i>	638
Luzon troughshell	276	<i>maculatus, Hippopus</i>	266
luzonica, Mactra	276	<i>maculatus, Trochus</i>	404, 408
<i>luzonica, Patella</i>	396	<i>maculifera, Arabica</i>	503
<i>luzonica, Telemactra</i>	276	<i>maculifera, Cypraea</i>	503
<i>Lyncina argus</i>	497	<i>maculifera, Mauritia</i>	503
<i>Lyncina carneola</i>	499	<i>maculosa, Anadara</i>	146
<i>Lyncina leviathan</i>	502	<i>maculosa, Colubraria</i>	593
<i>Lyncina leviathan bouteti</i>	498	<i>maculosa, Mactra</i>	279
<i>Lyncina lynx</i>	502	<i>maculosa, Natica</i>	514
<i>Lyncina schilderoorum</i>	505	MADREPORARIA	104
<i>Lyncina titan</i>	502	<i>Magnavicula penguin</i>	188
<i>Lyncina ventriculus</i>	506	Maidenhair mactra	280
<i>Lyncina vitellus</i>	496	Major harp	602
Lynx cowrie	502	major, Acetabularia	60
lynx, Cypraea	502	major, Harpa	602
<i>lynx, Lyncina</i>	502	<i>malabarica, Paphia</i>	348
lyrata, Meretrix	336	<i>malabonensis, Ostrea</i>	232
Lyrate hard clam	336	<i>maldivus, Conus generalis</i>	625
<i>Lyrodus chloroticus</i>	360	Malea pomum	527
Lyrodus pedicellatus	360	MALLEIDAE	181, 190, 194
<i>Lyrodus siamensis</i>	360	Malleus albus	196
<i>Lyrodus taiwanensis</i>	360	<i>Malleus decurtatus</i>	197
<i>Lyrodus yatsui</i>	360	Malleus malleus	196
M		Malleus regula	192, 197
macroloba, Halimeda	52	<i>Malleus tigrinus</i>	197
<i>macroptera, Pteria</i>	188	<i>Malleus vulgaris</i>	196
Mactra achatina	279	malleus, Malleus	196
<i>Mactra adspersa</i>	279	<i>Malvifundus regulus</i>	197
<i>Mactra antiquata</i>	278	<i>mamilla, Polynices</i>	519
<i>Mactra apicina</i>	276	<i>mammata, Bursa</i>	551
Mactra cuneata	279	<i>Mammilla melanostoma</i>	521
<i>Mactra depressa</i>	281	<i>Mammilla opaca</i>	521
<i>Mactra grandis</i>	278	<i>Mammilla sebae</i>	521
Mactra luzonica	276	mammilla, Polinices	519
		<i>Mammillaria lactea</i>	517

<i>Mancinella aculeata</i>	568-569	<i>Mauritia arabica</i>	491
<i>Mancinella alouina</i>	569	<i>Mauritia depressa</i>	500
<i>Mancinella armigera</i>	569	<i>Mauritia eglantina</i>	500
<i>Mancinella bufo</i>	570	<i>Mauritia maculifera</i>	503
<i>Mancinella tuberosa</i>	570	<i>Mauritia mappa</i>	492
<i>mancinella</i> , <i>Murex</i>	569	<i>Mauritia mauritiana</i>	493
Manila piddock	357	<i>Mauritia scurra</i>	505
manilaensis , <i>Gracilaria</i>	88	mauritiana , <i>Cypraea</i>	493
<i>manilensis</i> , <i>Anchomasa</i>	357	<i>mauritiana</i> , <i>Mauritia</i>	493
manilensis , <i>Barnea</i>	357	<i>mauritianus</i> , <i>Peribolus</i>	493
<i>manilensis</i> , <i>Pholas</i>	357	<i>mauritsi</i> , <i>Telescopium</i>	451
Many-angled spindle	592	<i>maurus</i> , <i>Chicoreus</i>	560
<i>Maoricardium pseudolatam</i>	258	Mauve sunetta	351
Map cowrie	492	maxima , <i>Architectonica</i>	638
mappa , <i>Cypraea</i>	492	maxima , <i>Pinctada</i>	186
<i>mappa</i> , <i>Leporicypraea</i>	492	axima , <i>Tridacna</i>	271
<i>mappa</i> , <i>Mauritia</i>	492	maximum , <i>Dendropoma</i>	460
Marble cone	627	<i>maximum</i> , <i>Siphonium</i>	460
Marbled venus	346	<i>maximum</i> , <i>Solarium</i>	638
<i>Marcia hiantina</i>	334	<i>maximus</i> , <i>Trochus</i>	405
<i>Marcia japonica</i>	346	<i>maximus</i> , <i>Vermetus</i>	460
Marcia opima	347	medusae , <i>Serpulorbis</i>	461
<i>Marcia pinguis</i>	347	<i>medusae</i> , <i>Thylacodes</i>	461
<i>Marcia recens</i>	346	<i>medusae</i> , <i>Vermetus</i>	461
<i>Marcia rimularis</i>	334	<i>Megalatractus aruanus</i>	605
<i>marerubrum</i> , <i>Trachycardium</i>	256	MELAMPIDAE	641
<i>Margaritifera bipennis</i>	196	<i>melanaegis</i> , <i>Gomphina</i>	345
<i>margaritifera</i> , <i>Meleagrina</i>	185-186	<i>melanostoma</i> , <i>Mammilla</i>	521
margaritifera , <i>Pinctada</i>	185	<i>melanostomoides</i> , <i>Polinices</i>	521
<i>marginata</i> , <i>Dolomena</i>	480	melanostomus , <i>Polinices</i>	521
Marginate conch	480	<i>Meleagrina margaritifera</i>	185-186
marginatus , <i>Strombus</i>	480	<i>melica</i> , <i>Annachlamys</i>	208
MARGINELLIDAE	607	<i>Melina ehippium</i>	191
Marlinspike	634	<i>Melina perna</i>	193
<i>Marmarostoma argyrostoma</i>	412	Melo amphora	597
<i>Marmarostoma bruneus</i>	417	<i>Melo indica</i>	598
<i>Marmarostoma chrysostoma</i>	413	Melo melo	598
<i>Marmarostoma crassa</i>	419	<i>Melo miltonis</i>	597
<i>Marmarostoma setosa</i>	416	<i>melo</i> , <i>Cymbium</i>	598
marmorata , <i>Katelysia</i>	346	melo , <i>Melo</i>	598
<i>marmorata</i> , <i>Lunatica</i>	414	<i>Melongena galeodes</i>	585
<i>marmorata</i> , <i>Paphia</i>	346	<i>Melongena pugilina</i>	584
<i>marmorata</i> , <i>Pleurotoma</i>	630	Melongenas	582
marmoratus , <i>Turbo</i>	414	Mélongène colossale	586
marmoreus , <i>Conus</i>	627	Mélongène muscade	585
<i>marochiensis</i> , <i>Natica</i>	520	Mélongène spiralee	584
Marsh clams	315	Mélongène ternée	586
Marteau blanc	196	MELONGENIDAE	582, 587, 603
Marteau droit	197	<i>menstrualis</i> , <i>Cyclosunetta</i>	351
Marteau noir	196	menstrualis , <i>Sunetta</i>	351
<i>martensii</i> , <i>Pinctada</i>	187	Menue paille marine	79
<i>martensii</i> , <i>Pinctada fucata</i>	187	mera , <i>Maetra</i>	278
Martesia	354, 359	<i>Meretrix lamarckii</i>	337
<i>Martesia americana</i>	358	<i>Meretrix lusoria</i>	337
<i>Martesia hawaiiensis</i>	358	Meretrix lyrata	336
<i>Martesia pulchella</i>	358	<i>Meretrix meretrix</i>	337
Martesia striata	358	<i>Meretrix petechialis</i>	337
<i>Martesia tokyoensis</i>	358	Meretrix , <i>Meretrix</i>	337
Martésie striée	358	Méroë mauve	351
<i>martinianum</i> , <i>Cymatium</i>	544	Méroë tronquée	352
<i>martinianus</i> , <i>Conus</i>	627	Meropesta capillacea	280
<i>martinianus</i> , <i>Murex</i>	565	Meropesta pellucida	281
<i>maura</i> , <i>Oliva</i>	612	mertensii , <i>Dictyota</i>	63

<i>Merulina ampliata</i>	117	<i>Modiolus auriculata</i>	175
Merulina coral	117	<i>Modiolus auriculatus</i>	175
MERULINIDAE	117	<i>Modiolus elongatus</i>	174
<i>Mesodesma trigonum</i>	283	<i>Modiolus metcalfei</i>	169, 174
MESODESMATIDAE	261, 273, 282 , 299	<i>Modiolus philippinarum</i>	170
Mésodesme glabre	283	<i>Modiolus senhousia</i>	171
<i>Mesopholas intusgranosa</i>	358	<i>Modiolus tulipa</i>	175
<i>Mesopholas nucicola</i>	358	Mole cowrie	494
<i>metcalfei, Modiolus</i>	169, 174	<i>monachus, Conus</i>	626
<i>microphyllus, Chicoreus</i>	560	<i>moneta, Cypraea</i>	503
<i>midae, Auricula</i>	644	<i>moneta, Erosaria</i>	503
<i>midae, Ellobium</i>	644	<i>moneta, Monetaria</i>	503
Midas ear cassidula	644	<i>Monetaria annulus</i>	497
<i>miliaris, Conus</i>	624	<i>Monetaria moneta</i>	503
Milleped spider conch	478	<i>Monetaria obvelata</i>	504
<i>millepeda, Lambis</i>	478	Money cowrie	503
<i>millepeda, Millepes</i>	478	<i>monilifera, Littorina</i>	435
<i>Millepes millepeda</i>	478	<i>moniliferum, Cerithium</i>	443
<i>Millepora platyphylla</i>	122	<i>moniliferum, Umbonium</i>	408
MILLEPORIDAE	122	Moniliform sea moss	78
MILLEPORINA	122	Monnaie de poseidon	52
<i>millepunctatus, Conus</i>	626	<i>Monodonta labio</i>	407
<i>milleri, Teredo</i>	360	Monodonte lippue	407
<i>Milligaretta togata</i>	309	<i>Monothyra orientalis</i>	356
<i>miltonis, Melo</i>	597	Monster cowrie	502
<i>Mimachlamys senatoria</i>	204	<i>montrouzieri, Soletellina</i>	309
<i>miniacea, Oliva</i>	609	Moon snails	509
<i>Minnivola pyxidata</i>	209	<i>mordax, Ostrea</i>	232
<i>minor, Gari</i>	308	<i>Morum</i>	532, 599
<i>minor, Padina</i>	64	<i>Morum species</i>	599
<i>minor, Psammotaea</i>	308	<i>morus, Cerithium</i>	443
Minute sea club	58	Mosaic tun	529
<i>minutus, Azorinus</i>	313	Moss stripe	38, 79
Miter shells	613	Mottled sea club	90
<i>Mitra adusta</i>	614	Moule verte asiatique	172
<i>Mitra cardinalis</i>	615	<i>moussoni, Cyrena</i>	317
<i>Mitra corrugata</i>	617	Mud creeper	452
<i>Mitra episcopalis</i>	614	Mud ivory whelk	574
<i>Mitra eremitarum</i>	614	<i>munda, Lucina</i>	241
<i>Mitra incompta</i>	614	<i>Murex adustus</i>	558
<i>Mitra mitra</i>	614	<i>Murex bec-de-bécassine</i>	564
<i>Mitra papalis</i>	615	<i>Murex bruni</i>	558
<i>Mitra pontificalis</i>	615	<i>Murex brunneus</i>	558
<i>Mitra stictica</i>	615	<i>Murex cichoreus</i>	562
<i>mitra, Mitra</i>	614	<i>Murex crassispina</i>	565
Mitre brûlée	614	<i>Murex despectus</i>	558
Mitre épiscopale	614	<i>Murex endive</i>	562
Mitre francée	617	<i>Murex endivia</i>	562
Mitre petit-renard	617	<i>Murex forskoehlII</i>	565
Mitre pontificale	615	<i>Murex haustellum</i>	564
MITRIDAE	594, 613 , 616, 629	<i>Murex hippocastanum</i>	568
<i>Modiola arcuatula</i>	168	<i>Murex kurodai</i>	564
Modiolaire arquée	168	<i>Murex longicaudus</i>	564
Modiolaire de Senhouse	171	<i>Murex mancinella</i>	569
Modiole à bande jaune	169	<i>Murex martinianus</i>	565
Modiole auriculée	175	<i>Murex nigrispinosus</i>	564
Modiole des Philippines	170	<i>Murex noire-épine</i>	564
Modiole sillonnée	174	<i>Murex pecten</i>	563, 565
Modiole tordue	175	<i>Murex pecten soelae</i>	563
<i>Modiolus agripetus</i>	175	<i>Murex peigne-de-Vénus</i>	563
<i>Modiolus americanus</i>	175	<i>Murex rameux</i>	559
<i>Modiolus arata</i>	174	<i>Murex ramosus</i>	559
<i>Modiolus aratus</i>	174	<i>Murex rare-épine</i>	565

<i>Murex rarispina</i>	565	<i>Nassarius particeps</i>	581
Murex shells	553	<i>Nassarius plicatus</i>	578
<i>Murex tenuispina</i>	563, 565	<i>Nassarius siquijorensis</i>	580
<i>Murex ternispina</i>	564-565	Nasse brûlée	580
<i>Murex torrefactus</i>	560	Nasse canaliculée	580
Murex torréfié	560	Nasse coffret	578
<i>Murex trapa</i>	565	Nasse couronnée	579
Murex tribule	565	Nasse rayée	581
<i>Murex tribulus</i>	564-565	<i>natalense, Cardium</i>	257
<i>Murex triremis</i>	563	<i>Natica alba</i>	517
<i>Murex unidentatus</i>	565	<i>Natica antonii</i>	520
<i>muricata, Colubraria</i>	593	<i>Natica asellus</i>	520
<i>muricata, Pinna</i>	180	<i>Natica atigrada</i>	514
<i>muricata, Quantulopinna</i>	180	<i>Natica cothurnata</i>	512
MURICIDAE	538, 553 , 603	<i>Natica decora</i>	512
<i>muricinum, Cymatium</i>	542	<i>Natica elegans</i>	512
<i>muricinum, Gutturium</i>	542	<i>Natica euzona</i>	512
<i>muscaria, Terebra</i>	635	<i>Natica fanel</i>	514
<i>muscoides, Acanthophora</i>	96	<i>Natica globosa</i>	515
<i>Musculista arcuatula</i>	168	<i>Natica gualteriana</i>	520
<i>Musculista senhousia</i>	171	<i>Natica helvacea</i>	515
<i>Musculista species.</i>	168, 171	<i>Natica javana</i>	514
<i>Musculus senhaisii</i>	171	<i>Natica lineata</i>	520
<i>Musculus senhauseni</i>	171	<i>Natica maculata</i>	514
<i>Musculus senhauseni</i>	171	<i>Natica maculosa</i>	514
<i>Musculus senhausia</i>	171	<i>Natica marochiensis</i>	520
<i>Musculus senhausii</i>	171	<i>Natica orientalis</i>	515
<i>Musculus senhousea</i>	171	<i>Natica pellistigrina</i>	514
<i>Musculus senhousei</i>	171	<i>Natica picta</i>	512
<i>Musculus senhousi</i>	171	<i>Natica rufo</i>	515
<i>Musculus senhousia</i>	171	<i>Natica sagittata</i>	512
<i>Musculus senhusi</i>	171	<i>Natica spadicea</i>	515
<i>musica, Tubipora</i>	122	<i>Natica stellata</i>	513
MUSSIDAE	118	<i>Natica tessellata</i>	520
<i>mutabilis, Strombus</i>	481	<i>Natica tigrina</i>	514
<i>mutabilis, Thais</i>	561	<i>Natica vitellus</i>	513, 515
<i>mutabilism, Canarium</i>	481	<i>Naticarius lineatus</i>	520
Mutable conch	481	Natrice à belles bandes	512
<i>mutatum, Cerithium</i>	441	Natrice bicolore	518
<i>myristica, Volema</i>	585	Natrice blanc d'oeuf	516
<i>Mystaponda leviathan</i>	502	Natrice bouche-noire	521
<i>Mystaponda vitellus</i>	496	Natrice châtain	515
MYTILIDAE	126, 165 , 176	Natrice de Gualteri	520
<i>Mytilus nicobaricus</i>	173	Natrice de Seba	521
<i>Mytilus smaragdinus</i>	172	Natrice étoilée	513
<i>Mytilus viridis</i>	172	Natrice lignée	520
N			
<i>Nassa arcularia</i>	578	Natrice patte-d'éléphant	517
<i>Nassa canaliculata</i>	580	Natrice pyriforme	519
<i>Nassa coronata</i>	579	Natrice tigrée	514
<i>Nassa crenata</i>	580	NATICIDAE	509
<i>Nassa francolina</i>	566	<i>navicularis, Arca</i>	155
<i>Nassa glans</i>	581	Necklace cerith	443
<i>Nassa mud snails</i>	576	NEMALIALES	76
<i>Nassa sarta</i>	566	<i>Neosilqua winteriana</i>	288
NASSARIIDAE	575- 576	<i>Nerita albicilla</i>	423
<i>Nassarius arcularius</i>	578	<i>Nerita bizonalis</i>	424
<i>Nassarius caelatus</i>	580	<i>Nerita chameleon</i>	424, 429
<i>Nassarius coronatus</i>	578-579	<i>Nerita chrysostoma</i>	430
<i>Nassarius crematus</i>	580	<i>Nerita costata</i>	428
<i>Nassarius dorsatus</i>	580	<i>Nerita grossa</i>	428
<i>Nassarius glans</i>	581	<i>Nerita imperfecta</i>	423
		<i>Nerita picea</i>	428
		<i>Nerita planospira</i>	429

<i>Nerita plicata</i>	425	Noetiid ark shells	159
<i>Nerita polita</i>	426	NOETIIDAE	158-159, 161
<i>Nerita scabricosta</i>	428	<i>Notocochlis euzona</i>	512
<i>Nerita squamulata</i>	429	<i>Notocochlis lineatus</i>	520
<i>Nerita striata</i>	430	<i>novaeaguinae, Pecten</i>	207
<i>Nerita turrita</i>	427	<i>novaeahollandiae, Vermetus</i>	460
<i>Nerita undata</i>	430	<i>nucicola, Mesopholas</i>	358
<i>Nerita ustulata</i>	423	Nutmeg melongena	585
<i>Nerita venusta</i>	423	<i>nymphae, Cypraea</i>	504
<i>Nerita versicolor</i>	425		
Nérite à spire plate	429	O	
Nérite brûlée	423	Oak cone	622
Nérite chaméléon	424	<i>obeliscus, Cerithium</i>	447
Nérite côtelée	428	<i>obeliscus, Clypeomorvus</i>	447
Nérite ébène	428	<i>obeliscus, Tectus</i>	402
Nérite écailleuse	429	<i>obeliscus, Trochus</i>	402
Nérite lustrée	426	Obelisk vertagus	447
Nérite ondée	430	<i>obesum, Corculum</i>	257
Nérite plissée	425	<i>obscurata, Tapes</i>	352
Nérite sillonnée	430	<i>obscurus, Donax</i>	301
Nérite tourelle	427	<i>obtusa, Cerithidea</i>	450, 454
Nerites	420	Obtuse horn shell	450
NERITIDAE	420	<i>obtusus, Potamides</i>	450
<i>Neritina semiconica</i>	427	<i>obelata, Cypraea</i>	504
<i>Neritina strigilata</i>	427	<i>obelata, Erosaria</i>	504
<i>Neritina subsulcata</i>	430	<i>obelata, Monetaria</i>	504
<i>Neritina turrita</i>	427	<i>Ochetoclava sinensis</i>	447
<i>Neritodryas cornea</i>	430	Oily tun	528
<i>Neritodryas subsulcata</i>	430	<i>olearium, Tonna</i>	528
NERITOPSIDAE	420	<i>oligocystum, Sargassum</i>	69
<i>Neverita albumen</i>	516	<i>oligospora, Bornetella</i>	58
<i>Neverita didyma</i>	518	<i>Oliva amethystina</i>	610
<i>Neverita peselephanti</i>	517	<i>Oliva annulata</i>	610
Nicobar hairy triton	543	<i>Oliva caerulea</i>	610
Nicobar spindle	591	<i>Oliva emicator</i>	610
<i>nicobaricum, Cymatium</i>	543	<i>Oliva episcopalis</i>	610
<i>nicobaricum, Lampusia</i>	543	<i>Oliva erythrostoma</i>	609
<i>nicobaricus, Fusinus</i>	591	<i>Oliva ispida</i>	611
<i>nicobaricus, Mytilus</i>	173	<i>Oliva ispidula</i>	611
<i>nigrispinosa, Acupurpura</i>	564	<i>Oliva maura</i>	612
<i>nigra, Pinna</i>	179	<i>Oliva miniacea</i>	609
<i>nigrispinosa, Murex</i>	564	<i>Oliva oliva</i>	611-612
<i>nigromarginata, Pinctada</i>	185	<i>Oliva reticulata</i>	611
<i>nigropunctatum, Vasticardium</i>	256	<i>Oliva sanguinolenta</i>	611
<i>niloticus, Tectus</i>	405	<i>Oliva sericea</i>	609
<i>niloticus, Trochus</i>	405	<i>Oliva tricolor</i>	612
<i>nipponica, Lima</i>	221	<i>Oliva vidua</i>	612
<i>noae, Arca</i>	155	<i>oliva, Oliva</i>	611-612
<i>nobilis, Chlamys</i>	204	<i>olivacea, Estellacar</i>	160
<i>nobilis, Harpa</i>	601	<i>olivacea, Estellarca</i>	160
<i>nobilis, Ostrea</i>	223	<i>olivacea, Striarca</i>	160
<i>nocturna, Venus</i>	344	Olive à bouche rouge	609
<i>nodifera, Anadara</i>	148	Olive ark	160
<i>nodifera, Pleurotoma</i>	630	Olive commune	611
<i>nodifera, Tegillarca</i>	148	Olive épiscopale	610
<i>Nodilittorina pascua</i>	435	Olive mouchetée	610
<i>Nodilittorina pyramidalis</i>	435	Olive noire	612
<i>nodosa, Pterocera</i>	478	Olive sanguine	611
Nodular ark	148	Olive shells	607
<i>noduliferus, Tectus</i>	402	Olive tricolore	612
<i>nodulosum, Cerithium</i>	442	OLIVIDAE	607
<i>nodulosus, Trochus</i>	435	Ombrelli de Venus	60
Noetiid	159	Onyx cowrie	504

<i>onyx, Adusta</i>	504
onyx, Cypraea	504
<i>onyx, Erronea</i>	504
<i>opaca, Mammilla</i>	521
<i>opima, Katelysia</i>	347
opima, Marcia	347
OPISTHOBRANCHIA	365
<i>optima, Penepatella</i>	398
opuntia, Halimeda	53
Orange spider conch	477
<i>orbicularis, Placenta</i>	218
Orbit cockle	259
<i>orbita, Cardium</i>	259
orbita, Trachycardium	259
<i>orbita, Vasticardium</i>	259
Organ-pipe coral	104
Organpipe coral	122
Oriental angel wing	356
Oriental cyclina	345
<i>orientalis, Artemis</i>	345
<i>orientalis, Monothyr</i>	356
<i>orientalis, Natica</i>	515
orientalis, Pholas	356
Ormeau aplati	388
Ormeau bigarré	389
Ormeau glabre	386
Ormeau oreille-d'âne	385
Ormeau ovale	387
<i>ornata, Cytherea</i>	335
ornata, Lioconcha	347
<i>ornata, Mactra</i>	279
ornata, Turbinaria	75
Ornate pitar venus	347
<i>orrae, Strombus urceus</i>	476
Ostión capuchón	232
Ostión japonés	233
<i>Ostrea (Pretostrea) bresia</i>	229
<i>Ostrea cornucopiae</i>	232
<i>Ostrea cornucopiaeformis</i>	232
<i>Ostrea cristagalli</i>	230
<i>Ostrea cumingiana</i>	227
<i>Ostrea echinata</i>	232
<i>Ostrea folium</i>	229
<i>Ostrea forskaelii</i>	232
<i>Ostrea forskalli</i>	232
<i>Ostrea glomerata</i>	232
<i>Ostrea iredalei</i>	228
<i>Ostrea iridescens</i>	227
<i>Ostrea malabonensis</i>	232
<i>Ostrea mordax</i>	232
<i>Ostrea nobilis</i>	223
<i>Ostrea palmipes</i>	231
<i>Ostrea paulucciae</i>	231
<i>Ostrea pestigris</i>	231
<i>Ostrea plicata</i>	227
<i>Ostrea spinosa</i>	232
Ostrège cuissarde	192
Ostrège miellée	191
Ostrège sillonnée	193
OSTREIDAE	125, 222, 224
Oval abalone	387
<i>ovalis, Placuna</i>	218
ovina, Haliotis	387

<i>ovina, Ovinotis</i>	387
<i>Ovinotis ovina</i>	387
Ovula ovum	508
<i>ovulaea, Tapes</i>	343
Ovule commune	508
Ovule navette	508
OVULIDAE	486, 507
<i>ovum, Amphiperas</i>	508
<i>ovum, Lucina</i>	237
ovum, Ovula	508
<i>Oxpalate nerite</i>	423
<i>Oxymeris maculata</i>	634
Oysters	224

P

Pacific asaphis	307
Pacific bean donax	302
Pacific deer cowrie	496
Pacific half cockle	254
Pacific partridge tun	525
Pacific strawberry cockle	255
Pacific sugar limpet	392
Pacific tiger lucine	239
Pacific yellow cockle	256
pacifica, Chama	246
Padina minor	64
Pagoda prickly-winkle	436
pagodus, Tectarius	436
Pajilla marina	79
<i>palatam, Quidnipagus</i>	296
palatam, Tellina	296
Palate tellin	296
palifera, Acropora	112
<i>Pallium senatoris</i>	204
<i>pallium, Chlamys</i>	207
<i>pallium, Cryptopecten</i>	207
pallium, Gloripallium	207
Palmate oyster	231
<i>palmiferus, Chicoreus</i>	560
<i>palmipes, Ostrea</i>	231
Palourde bigarrée	342
Palourde coq	348
Palourde de Belcher	352
Palourde écriture	344
Palourde enflée	343
Palourde japonaise	341
Palourde ondulée	339
Palourde semirugueuse	348
Palourde textile	338
<i>palustris, Potamides</i>	452
<i>palustris, Pyrazus</i>	452
palustris, Terebralia	452
panama, Purpura	567
<i>panasesae, Pinctada</i>	184
paniculatum, Sargassum	70
pannosa, Hypnea	95
<i>pantherina, Pythia</i>	645
<i>papalis, Mitra</i>	615
Paper cockle	257
Paphia	338
<i>Paphia ferruginea</i>	346
Paphia gallus	348
<i>Paphia guttulata</i>	344

- Paphia hiantina* 334
Paphia literata 344
Paphia malabarica 348
Paphia marmorata 346
Paphia schnelli 348
Paphia semirugata **348**
Paphia sinuata 348
Paphia striata 346
Paphia textile **338-339**
Paphia turgida 343
Paphia undulata **338-339**
Paphia vernicosa 348
Paphies striata 283
papillosa, Laurencia **99**
papillosus, Tectarius 435
papyracea, Apolymetis 295
papyracea, Fulvia **257**
papyracea, Placuna 219
papyraceum, Cardium 257
papyraceum, Laevicardium 257
Paralagena smaragdula 592
Paratapes scordalus 339
Paratapes wellsi 348
pardus, Conus 621, 626
paropsis, Patelloida 392
particeps, Arcularia 581
particeps, Nassarius 581
pascua, Nodilittorina 435
Patella aster 396
Patella flexueuse 398
Patella flexuosa **398**
Patella insignis 397
Patella luzonica 396
Patella stellaeformis 398
Patelle à rayons 396
Patelle striée 393
Patelle sucrée 392
Patelle tortue 397
Patellid limpets 394
PATELLIDAE 390, **394**, 646
Patelloida bellatula 392
Patelloida borneensis 393
Patelloida lanx 392
Patelloida paropsis 392
Patelloida pentagona 392
Patelloida saccharina **392**
Patelloida saccharinoides 392
Patelloida stella 392
Patelloida stellaris 392
Patelloida striata **393**
pauciplicatum, Comptopallium 206
paucispinosa, Stellaria 485
paulucciae, Ostrea 231
paumotensis, Fungia **116**
Pavona decussata **112**
Pear triton 546
Pear-shaped moon snail 519
Pearl oysters 181
peasei, Pteria 189
Pecten argenteus 206
Pecten aurantius 204
Pecten crebricostatus 209
Pecten cumingii 210
Pecten flabelloides 205
Pecten novaeguinae 207
Pecten pyxidatus 209
Pecten rastellum 209
Pecten soelae, Murex 563
Pecten speciosus 207
Pecten tranquebaricus 210
pecten, Murex **563**, 565
pectinata zelandica, Atrina 178
pectinata, Atrina **178**
pectinata, Circe 332
pectinata, Pinna 178
pectinatum, Gafrarium **330-332-333**
Pectinia lactucam **119**
PECTINIDAE 126, **198**, 220
pectiniforme, Cardium 256
pectiniformis, Glycymeris 164
PECTINIIDAE **119**
pectunculus, Glycymeris 164
pectunculus, Tucetona **164**
pedicellatus, Lyrodus **360**
Peigne lisse asiatique 203
Peigne lisse de Nouvelle-Calédonie 202
pellistigrina, Natica 514
Pellucid mactra 281
Pellucid pitar venus 350
pellucida, Mactra 281
pellucida, Meropesta **281**
pellucida, Pitaria 350
pellucida, Spisula 281
pellucida, Standella 281
pellucidus, Pitar **350**
Pelo de piedra verde 39
Pelo de piedra verde claro 38
peltata, Caulerpa **45**
Pen shells 176
Penepatella arrecta 398
Penepatella inquisitor 398
Penepatella intraurea 398
Penepatella optima 398
Penguin wing oyster 188
penguin, Magnavlicula 188
penguin, Pteria **188**
pennata, Acacia 406
pentagona, Patelloida 392
Pepper dulce 99
Percurrent gracilaria 87
perdix, Tonna **525**
Peribolus arabicus 491
Peribolus eglantininus 500
Peribolus mauritanus 493
Peribolus scurra 505
Periglypta clathrata **349**
Periglypta edmondsoni 349
Periglypta puerpera **340**, 349
Periglypta reticulata **349**
PERIPLOMATIDAE 361
Periwinkles 431
Perna sulcata 193
Perna viridis **172**
perna, Isognomon **193**
perna, Melina 193
Persian purpura 567

<i>persica, Purpura</i>	567	<i>pictus, Hemidonax</i>	262
<i>persica, Thais</i>	567	Piddocks	354
<i>Persikima whitleyi</i>	269	<i>pila, Anodontia</i>	237
PERSONIDAE	538, 547	<i>pileare, Cymatium</i>	544-545
<i>perspectiva, Architectonica</i>	638	<i>pileare, Lampusia</i>	545
<i>perspectivum, Solarium</i>	638	<i>pilearis, Septa</i>	545
<i>perviridis, Pinctada</i>	187	<i>pileus, Halomitra</i>	116
<i>perypectivum, Solarium</i>	638	Pill ark	156
<i>peselephanti, Neverita</i>	517	<i>pilosus, Septifer</i>	173
<i>peselephanti, Polinices</i>	517	<i>pilsbryi, Lambis crocata</i>	477
<i>pestigris, Ostrea</i>	231	<i>pilula, Anadara</i>	156
<i>pestigris, Planostrea</i>	231	<i>pilula, Potiarca</i>	156
<i>petechialis, Meretrix</i>	337	<i>pilula, Scapharca</i>	156
<i>petholatus, Turbo</i>	415	<i>Pinctada aerata</i>	187
Petit solécourte	313	<i>Pinctada fucata</i>	187
Pétoncle de Singapour	210	<i>Pinctada fucata martensii</i>	187
Pétoncle écailleux	209	<i>Pinctada imbricata</i>	187
Pétoncle étendard	208	<i>Pinctada lacunata</i>	187
Pétoncle léopard	208	<i>Pinctada maculata</i>	184
Pétoncle manteau	207	<i>Pinctada margaritifera</i>	185
Pétoncle mantelet	205	<i>Pinctada martensii</i>	187
Pétoncle râpe	206	<i>Pinctada maxima</i>	186
Pétoncle sénateur	204	<i>Pinctada nigromarginata</i>	185
PETRICOLIDAE	320	<i>Pinctada panasesae</i>	184
PHAEOPHYTA	20, 61	<i>Pinctada perviridis</i>	187
<i>Phalium agnitum</i>	537	<i>Pinctada pitcairnsensis</i>	184
<i>Phalium areola</i>	537	<i>Pinctada radiata</i>	187
<i>Phalium bandatum</i>	536	<i>Pinctada vulgaris</i>	187
<i>Phalium exaratum</i>	536	<i>pinguis, Marcia</i>	347
<i>Phalium glaucum</i>	537	Pink-spotted razor shell	289
<i>Pharella</i>	309, 353	<i>Pinna atropurpurea</i>	180
<i>Pharella acutidens</i>	286-287	<i>Pinna bicolor</i>	180
<i>Pharella javanica</i>	286-287	<i>Pinna chemnitzii</i>	178
PHARIDAE	284	<i>Pinna deltodes</i>	180
PHASIANELLIDAE	409	<i>Pinna exquisita</i>	180
<i>Phasmoconus radiatus</i>	627	<i>Pinna hawaiiensis</i>	180
PHENACOLEPADIDAE	391, 395	<i>Pinna japonica</i>	178
<i>phenax, Tapes</i>	352	<i>Pinna lischkeana</i>	178
<i>philippinensis, Pinna</i>	180	<i>Pinna lurida</i>	178
<i>philippinarum, Cryptodon</i>	238	<i>Pinna muricata</i>	180
<i>philippinarum, Modiolus</i>	170	<i>Pinna nigra</i>	179
<i>philippinarum, Ruditapes</i>	341	<i>Pinna pectinata</i>	178
<i>philippinarum, Tapes</i>	341	<i>Pinna philippinensis</i>	180
<i>philippinarum, Venerupis</i>	341	<i>Pinna vexillum</i>	179
Philippine cupped oyster	228	PINNIDAE	165, 176
Philippine horse mussel	170	<i>Pintadina radiata</i>	187
<i>philippinense, Cardium</i>	259	<i>Pintadine à lèvres dorées</i>	186
<i>philippinensis, Pinna</i>	180	<i>Pintadine à lèvres noires</i>	185
Pholade de Manille	357	<i>Pintadine radiée</i>	187
Pholade dilatée	357	<i>Pintadine tachetée</i>	184
PHOLADIDAE	125, 127, 354 , 359	<i>pistillata, Stylophora</i>	121
<i>Pholas fragilis</i>	357	Pitar aide-de-camp	335
<i>Pholas latissima</i>	357	<i>Pitar citrinus</i>	350
<i>Pholas manilensis</i>	357	Pitar citron	350
<i>Pholas orientalis</i>	356	Pitar orné	347
<i>Phylloda foliacea</i>	295	Pitar pellucide	350
Phytoplankton	20	<i>Pitar pellucidus</i>	350
<i>pica, Thais</i>	570	<i>Pitar striatus</i>	350
<i>picea, Nerita</i>	428	<i>Pitaria australica</i>	350
<i>picta, Haliotis</i>	386	<i>Pitaria citrina</i>	350
<i>picta, Lioconcha</i>	347	<i>Pitaria pellucida</i>	350
<i>picta, Natica</i>	512	<i>Pitaria ustulata</i>	350
<i>picta, Turbo</i>	418	<i>pitcairnsensis, Pinctada</i>	184

Pitchy nerite	428	<i>Polinices lamarekiana</i>	518
Placamen tiara	351	<i>Polinices mammilla</i>	519
<i>Placenta ehippium</i>	219	<i>Polinices melanostomoides</i>	521
<i>Placenta orbicularis</i>	218	<i>Polinices melanostomus</i>	521
placenta, Placuna	218	<i>Polinices peselephanti</i>	517
Placuna ehippium	219	<i>Polinices powisianus</i>	517
<i>Placuna lincolnii</i>	218	<i>Polinices pyriformis</i>	519
<i>Placuna ovalis</i>	218	<i>Polinices sebae</i>	521
<i>Placuna papyracea</i>	219	<i>Polinices tumidus</i>	519
Placuna placenta	218	Polished nerite	426
<i>Placuna quadrangula</i>	219	<i>polita, Amphinerita</i>	426
<i>Placuna sella</i>	219	<i>polita, Nerita</i>	426
Placune ovale	218	<i>polita, Tapes</i>	348
Placune papier	219	<i>Pollia undosa</i>	574
PLACUNIDAE	216	<i>polonicum, Ehippium</i>	219
Plagiocardium pseudolatum	258	Polychaetes	458
<i>Plagiocardium setosum</i>	258	<i>polycystum, Sargassum</i>	71
Plain troughshell	278	<i>polygonus, Latirus</i>	592
planata, Haliotis	388	<i>Polymesoda bengalensis</i>	319
<i>planata, Sanhaliotis</i>	388	<i>Polymesoda coxans</i>	317
Planate abalone	388	<i>Polymesoda erosa</i>	317
PLANAXIDAE	431	<i>Polymesoda eximia</i>	317
<i>planci, Acanthaster</i>	534, 541	<i>Polymesoda expansa</i>	317-318
planospira, Nerita	429	<i>Polymesoda proxima</i>	317-318
<i>planospira, Theliostyla</i>	429	<i>polynesia, Cypraea</i>	496
Planostrea pestigris	231	<i>Polynices mamilla</i>	519
<i>Platygyra daedalea</i>	114	<i>Polyphyllia talpina</i>	117
platyphylla, Millepora	122	POLYPHYSACEAE	60
<i>plebejus, Conus</i>	626	<i>pomum, Malea</i>	527
<i>Plebidonax deltooides</i>	303	<i>pomum, Quimalea</i>	527
<i>pleuronectes australiae, Amusium</i>	203	<i>Ponda bouteti</i>	498
<i>pleuronectes pleuronectes, Amusium</i>	203	<i>Ponda carneola</i>	499
<i>pleuronectes, Amusium</i>	203	<i>Ponda schildererum</i>	505
<i>pleuronectes, Amusium pleuronectes</i>	203	<i>Ponda ventriculus</i>	506
<i>Pleuroploca filamentosa</i>	589	Pontifical miter	615
<i>Pleuroploca trapezium</i>	590	<i>pontificalis, Mitra</i>	615
<i>Pleurotoma marmorata</i>	630	Porcelaine anneau d'or	497
<i>Pleurotoma nodifera</i>	630	Porcelaine anneau d'or de Tahiti	504
Pleurotome Babylone	631	Porcelaine arabe	491
Pleurotome de Java	630	Porcelaine argus	497
Pleurotome marbré	630	Porcelaine bossue	493
<i>plicarium, Vexillum</i>	617	Porcelaine bouffon	505
<i>plicata, Nerita</i>	425	Porcelaine carnéole	499
<i>plicata, Ostrea</i>	227	Porcelaine carte	492
<i>plicata, Ritena</i>	425	Porcelaine daim du Pacific	496
Plicate conch	473	Porcelaine de Boutet	498
Plicate nerite	425	Porcelaine déprimée	500
<i>plicatula, Alectryonella</i>	227	Porcelaine des Schilder	505
<i>plicatula, Crassostrea</i>	227	Porcelaine dragon	499
PLICATULIDAE	211	Porcelaine églantine	500
<i>plicatus, Nassarius</i>	578	Porcelaine érodée	501
<i>plicatus, Strombus</i>	476	Porcelaine gésier	506
<i>plinthota, Chama</i>	247	Porcelaine isabelle	501
Plumet de Nérée	98	Porcelaine léviathan	502
<i>Pocillopora damicornis</i>	109, 119	Porcelaine lynx	502
<i>Pocillopora verrucosa</i>	119	Porcelaine monnaie	503
POCILLOPORIDAE	109, 119	Porcelaine onyx	504
<i>Polinices albumen</i>	516	Porcelaine réticulée	503
<i>Polinices albus</i>	519	Porcelaine taupe	494
<i>Polinices aurantius</i>	519	Porcelaine tête de serpent	498
<i>Polinices bicolor</i>	518	Porcelaine tigre	495
<i>Polinices chemnitzii</i>	518	<i>porcellanus, Hippopus</i>	266-267
<i>Polinices didyma</i>	518	<i>porphyres, Turbo</i>	418

<i>Portieria hornemannii</i>	83	<i>Pteria penguin</i>	188
Potamide des marais	452	PTERIIDAE	181, 190, 194
Potamide équarri	454	<i>Pterocera aurantia</i>	477
Potamide obtus	450	<i>Pterocera crocata</i>	467
Potamide sanglé	454	<i>Pterocera nodosa</i>	478
Potamide sillonné	453	<i>Pterocera scorpio</i>	478
Potamide télescope	451	Ptérocère commun	467
<i>Potamides cingulatus</i>	454	Ptérocère géant	468
<i>Potamides obtusus</i>	450	Ptérocère millepattes	478
<i>Potamides palustris</i>	452	Ptérocère orange	477
<i>Potamides quadratus</i>	454	Ptérocère rugueux	477
<i>Potamides telescopium</i>	451	Ptérocère scorpion	478
POTAMIDIDAE	437, 448	<i>pubescens, Donax</i>	304
<i>Potiarca pilulam</i>	156	<i>puerpera, Antigona</i>	340
Pourpre aiguillonnée	568	<i>puerpera, Periglypta</i>	340, 349
Pourpre armée	569	<i>puerpera, Venus</i>	340
Pourpre carénée	561	Pugilina cochlidium	584
Pourpre crapaud	570	Pugilina colosseus	586
Pourpre de Rudolphe	567	Pugilina ternatana	586
Pourpre persique	567	<i>Pugilina tuba</i>	586
Pourpre petit-bourgeon	569	<i>pugilina, Melongena</i>	584
Pourpre tubéreuse	570	<i>pugilinus, Hemifusus</i>	584
<i>powisianus, Polinices</i>	517	<i>pulchella, Martesia</i>	358
Praire chagrinée	340	<i>pulcher, Turbo</i>	417
Praire corbeille	349	PULMONATA	365
Praire grillagée	349	punctata, Codakia	240
Precious stone shell	592	<i>punctata, Codakia</i>	240
Prickly pen shell	180	<i>punctata, Venus</i>	344
<i>prismatica, Striostrea</i>	227	Punctate lucine	240
<i>procerum, Cerithium</i>	444	<i>punicae, Tapes</i>	342
Propellor ark	157	Purple spiny sea moss	96
<i>propinqua, Cypraea</i>	499	Purplemouth olive	610
<i>propinqua, Cypraea carneola</i>	499	<i>Purpura affinis</i>	569
PROSOBRANCHIA	365	<i>Purpura bufo</i>	570
Prostrate eucheuma	92	<i>Purpura carinifera</i>	561
Prostrate gracilaria	86	<i>Purpura gemmulata</i>	569
Prostrate sea cactus	53	Purpura panama	567
<i>Protapes gallus</i>	348	Purpura persica	567
<i>proxima, Polymesoda</i>	317-318	<i>Purpura pseudohippocastanum</i>	568
<i>Psammobia bipartita</i>	311	<i>Purpura rudolphi</i>	567
<i>Psammobia caerulescens</i>	311	<i>Purpura vexillum</i>	571
Psammobie allongée	308	Purpuras	553
Psammobie courtisane	309	Purse frog shell	550
Psammobie écailléeuse	311	Pycnodonte géante	223
Psammobie tronquée	311	<i>Pycnodonte hyotis</i>	223
PSAMMOBIIDAE	290, 305, 312, 353	Pyramid top	402
<i>Psammotaea elongata</i>	308	Pyramidal prickly-winkle	435
<i>Psammotaea minor</i>	308	<i>pyramidalis, Littorina</i>	435
<i>Psammotaea togata</i>	309	pyramidalis, Nodilittorina	435
<i>Psammotaea violacea</i>	308, 310	pyramis, Tectus	402
<i>Psammotreta ehippium</i>	295	<i>pyramis, Trochus</i>	402
<i>pseudohippocastanum, Purpura</i>	568	<i>Pyrazus palustris</i>	452
<i>pseudolatam, Maoricardium</i>	258	<i>Pyrazus sulcatus</i>	453
pseudolatam, Plagiocardium	258	Pyrene scripta	575
<i>Pseudomithla corrugata</i>	238	<i>Pyrene versicolor</i>	575
Pseudovertagus aluco	446	PYRENIDAE	575
<i>Pseudovertagus sinensis</i>	447	<i>pyriformis, Polinices</i>	519
Pteria avicular	189	Pyrule ficoïde	531
<i>Pteria cypsellus</i>	189	Pyrule gracile	531
<i>Pteria lotorium</i>	188	pyrum, Cymatium	546
<i>Pteria macroptera</i>	188	<i>pyrum, Ranularia</i>	546
<i>Pteria maculata</i>	184	<i>Pythia helicina</i>	645
<i>Pteria peasei</i>	189	<i>Pythia pantherina</i>	645

- Pythia reeveana* 645
Pythia scabreus 645
Pythia scarabaeus **645**
 Pythia snails 641
 Pythie scarabée 645
pyxidata, Minnivola **209**
pyxidatus, Pecten 209
- Q**
- quadrangula, Placuna* 219
quadrata, Cerithidea **454**
 Quadrate horn shell 454
quadratus, Potamides 454
quadriradiata, Tapes 352
Quantulopinna delsa 180
Quantulopinna muricata 180
quercina, Cleobula 622
quercinus, Conus **622**
Quidnipagus palatam 296
Quimalea pomum 527
- R**
- racemosa, Caulerpa*** **46**
radians, Donax 302
radiata, Cellana 396
radiata, Pinctada **187**
radiata, Venus 344
radiatus, Conus **627**
radiatus, Donax 301
radiatus, Phasmoconus 627
radula griggi, Comptopallium 206
radula, Comptopallium 206
radula, Decatopecten **206**
 Ramose murex 559
ramosus, Chicoreus **559**
ramosus, Murex 559
rana, Bufonaria **551**
rana, Bursa 551
rana, Gyrineum 551
Ranella cavitensis 550
 Ranelle bourse 550
 Ranelle commune 551
 Ranelle hibou 552
 Ranelle mamelonnée 551
RANELLIDAE **538, 547, 549, 553, 593**
Ranularia pyrum 546
Rapana bulbosa 568
Rapana rapiformis **568**
Rapane bulbeuse 568
 RAPANINAE 553
rapiformis, Rapana **568**
 Rarespined murex 565
rarispina, Murex 565
 Rasp coral 119
 Rasp tellin 297
rastellum, Pecten 209
 Rathbun's giant file shell 221
rathbuni, Acesta **221**
rathbuni, Lima 221
Ravitrona caputserpentis 498
 Rayed cone 627
 Rayed limpet 396
 Rayed pearl oyster 187
- Rayed tree oyster 193
 Razor clams 284
recens, Marcia 346
 Red algae 20, 76
 Red sea lettuce 80
 Red sea plume 77
 Red seabroom 98
 Reddish frog shell 552
 Redmouth olive 609
 Reeve's bittersweet 163
reeveana, Pythia 645
reevei, Glycymeris **163**
reevei, Mactra 277
reevei, Turbo 415
reflexa, Chama 246
 Reflexed jewel box 246
regenfussi, Turbo 414
regula, Malleus **192, 197**
regulus, Malvifundus 197
 Remies tellin 297
remies, Cyclotellina 297
remies, Tellina **297**
rena, Annachlamys leopardus 208
reticularis, Distorsio **548**
reticulata, Antigona 349
reticulata, Cypraea 503
reticulata, Distortrio 548
reticulata, Oliva **611**
reticulata, Periglypta **349**
reticulata, Venus 340, 349
 Reticulate distorsio 548
 Reticulated cowrie 503
 Reticulated venus 349
Rhinoclavis aluco 446
Rhinoclavis aspera **446**
Rhinoclavis fasciata **444**
Rhinoclavis sinensis **447**
Rhinoclavis vertagus **445**
rhizophorarum, Cerithidea 454
RHIZOPHYLLIDACEAE **83**
RHODOMELACEAE **96**
 RHODOPHYTA 20, 21, **76**
 Ribbed sea saphir 61
ridens, Distorsio 548
rimularis, Marcia 334
Ritena chameleon 424
Ritena costata 428
Ritena plicata 425
Ritena squamulata 429
Ritena undata 430
rivularis, Crassostrea 231
robustus, Strombus 480
 Rock shells 553
roosevelti, Terebra 634
 Rooster venus 348
roseomaculatus, Solen **289**
 Rostellaire fuselée 483
Rostellaria serrata 483
rostrata, Laternula 362
rota var. discrepans, Helcioniscus 397
rota, Cellana **396-397**
rota, Helcioniscus 396
 Rotelle commune 406

Rotelle costulée	408
<i>rotunda, Distorta</i>	548
Rough feather coral	115
Rough periwinkle	433
Rough turban	416
Rough vertagus	446
Rough-stemmed sargassum	71
Round worm	98
Royal cloak scallop	207
Rubanier céruléen	62-63
Rubanier forchu	62
<i>rubeta, Tutufa</i>	552
<i>rubeta, Bursa</i>	552
<i>rubeta, Bursa bubo</i>	552
<i>rubiginosu, Chicoreus</i>	560
<i>rubus, Cerithium</i>	441
Rudder ark	153
<i>Ruditapes philippinarum</i>	341
<i>Ruditapes variegatus</i>	342
Rudolph's purpura	567
<i>rudolphi, Purpura</i>	567
<i>rudolphi, Thais</i>	567
<i>rufa, Cypraecassis</i>	535
<i>rufa, Natica</i>	515
<i>rugosa, Acrosterigma</i>	256
<i>rugosa, Distorta</i>	548
<i>rugosa, Glauconome</i>	353
<i>rugosa, Lambis</i>	477
<i>rugosa, Tellina</i>	296
<i>rugosa, Turricula</i>	617
Rugose miter	617
<i>rugosum, Cardium</i>	256
<i>rugosum, Trachycardium</i>	256, 259
<i>rugosum, Vexillum</i>	617
<i>rugosus, Tectarius</i>	435
<i>ruppelli, Cerithium</i>	440
<i>rusticus, Latirus</i>	592
Rusty ark	154

S

<i>saccharina, Collisellina</i>	392
<i>saccharina, Patelloida</i>	392
<i>saccharinoides, Patelloida</i>	392
<i>Saccostrea</i>	232
<i>Saccostrea cucullata</i>	232
Saddle grooved macoma	295
Saddle oyster	219
Saddle tree oyster	191
<i>saga, Estellacar</i>	160
<i>sagittata, Natica</i>	512
<i>salicornia, Gracilaria</i>	89
Samar conch	479
Sand dollar	537
Sandbeach auger	635
Sanguinolaire diphos	310
Sanguinolaire rugueuse	307
<i>Sanguinolaria cumingiana</i>	310
<i>Sanguinolaria diphos</i>	310
<i>Sanguinolaria elongata</i>	308
<i>Sanguinolaria togata</i>	309
<i>sanguinolenta, Oliva</i>	611
Sanguins	305
<i>Sanhaliotis planata</i>	388

<i>Sanhaliotis varia</i>	389
<i>Sarcophyton</i>	508
SARGASSACEAE	66
<i>Sargassum</i>	40
<i>Sargassum crassifolium</i>	66-70, 72
<i>Sargassum cristaeifolium</i>	67
<i>Sargassum gracillimum</i>	68
<i>Sargassum oligocystum</i>	69
<i>Sargassum paniculatum</i>	70
<i>Sargassum polycystum</i>	71
<i>Sargassum turbinarioides</i>	72
Saucer scallop	202
<i>saulii, Chicoreus</i>	560
Savigny's jewel box	247
<i>savignyi, Chama</i>	247
<i>Saxostrea amasa</i>	232
<i>Saxostrea commercialis</i>	232
<i>Saxostrea cumingiana</i>	227
<i>Saxostrea gravida</i>	232
<i>scabra, Littoraria</i>	433
<i>scabra, Littonia</i>	433
<i>scabra, Littorinopsis</i>	433
<i>scabreus, Pythia</i>	645
<i>scabricosta, Nerita</i>	428
<i>Scaechlamys squamata</i>	209
Scallops	198
Scaly nerite	429
Scaly Pacific scallop	209
<i>Scapha vespertilio</i>	596
<i>scapha, Anadara</i>	146
<i>scapha, Tridacna</i>	272
<i>Scapharca</i>	142, 147
<i>Scapharca cornea</i>	150, 152
<i>Scapharca globosa</i>	151-152
<i>Scapharca inaequalis</i>	151-152
<i>Scapharca indica</i>	153
<i>Scapharca pilula</i>	156
<i>Scapharca subcrenata</i>	150
<i>scapula, Dolabella</i>	640
<i>scarabaeus, Pythia</i>	645
<i>schilderorum, Cypraea</i>	505
<i>schilderorum, Lyncina</i>	505
<i>schilderorum, Ponda</i>	505
Schilders' cowrie	505
<i>Schismotis glabra</i>	386
<i>schnelliana, Paphia</i>	348
<i>Scinia hormoides</i>	78
SCLERACTINIA	104, 109
Scleractinian corals	104
<i>scobinata, Scutarcopagia</i>	297
<i>scobinata, Tellina</i>	297
<i>scordalus, Paratapes</i>	339
Scorpio spider conch	478
<i>scorpio, Pterocera</i>	478
<i>scorpius indomaris, Lambis</i>	478
<i>scorpius, Lambis</i>	477-478
<i>scortum, Donax</i>	304
<i>scortum, Hecuba</i>	304
Screw turret	456
Script venus	329
<i>scripta, Circe</i>	329
<i>scripta, Columbella</i>	575
<i>scripta, Pyrene</i>	575

<i>scurra</i> , Arabica	505	<i>Serpulorbis medusae</i>	461
scurra, Cypraea	505	<i>serrata</i> , Rostellaria	483
<i>scurra</i> , Mauritia	505	Serrate sargassum	70
<i>scurra</i> , Peribolus	505	<i>serrifera</i> , Tridacna	269
<i>Scutarcopagia linguafelis</i>	296	serta, Nassa	566
<i>Scutarcopagia scobinata</i>	297	sertularioides, Caulerpa	47
SCYTOSIPHONACEAE	65	<i>sertum</i> , Iopas	566
SCYTOSIPHONALES	65	<i>setosa</i> , Marmarostoma	416
Sea bell	73	<i>setosum</i> , Plagiocardium	258
Sea cats	639	setosus, Turbo	416, 419
Sea lettuce	40	Sharp razor clam	286
Sea mussels	165	Shinbone tibia	483
Sea mustard	42	Shipworms	359
Seagrasses	20	Short razor clams	312
Seaweeds	20	Shortneck triton	542
Seba's moon snail	521	Shoulderblade sea cat	640
<i>sebae</i> , Lambis	468	Shuttlecock volva	508
<i>sebae</i> , Lambis truncata	468	<i>siamensis</i> , Lyrodus	360
<i>sebae</i> , Mammilla	521	<i>siamensis</i> , Teredo	360
sebae, Polinices	521	Siamese shipworm	360
Segmented gracilaria	89	<i>sikamea</i> , Crassostrea	233
<i>sella</i> , Placuna	219	Siliqua winteriana	288
SEMELIDAE	290	SILICUARIIDAE	458
<i>semiconica</i> , Neritina	427	Silique de Winter	288
<i>semidecussatus</i> , Tapes	341	Silver conch	474
<i>semidecussatus</i> , Venerupis	341	Silvermouth turban	412
Semigrooved venus	348	simplex, Digenea	98
semiorbiculata, Beguina	249	<i>simplex</i> , Lucina	240
<i>Semipallium vexillum</i>	208	<i>sinense</i> , Cardium	260
semirugata, Paphia	348	sinense, Vepricardium	260
<i>semistriata</i> , Haliotis	389	sinensis, Cyclina	345
semitorta, Trisidos	157	<i>sinensis</i> , Hyotissa	223
senatoria, Chlamys	204	<i>sinensis</i> , Ochetoclava	447
<i>senatoria</i> , Mimachlamys	204	<i>sinensis</i> , Pseudovertagus	447
Senatorial scallop	204	sinensis, Rhinoclavis	447
<i>senatoris</i> , Pallium	204	<i>sinensis</i> , Spondylus	214
<i>senhaisii</i> , Musculus	171	Singapore scallop	210
<i>senhauseni</i> , Musculus	171	<i>singaporina</i> , Chlamys	210
<i>senhausenii</i> , Musculus	171	singaporina, Volachlamys	210
<i>senhausia</i> , Musculus	171	<i>Sinovacula virens</i>	353
<i>senhausi</i> , Musculus	171	<i>sinuata</i> , Paphia	348
Senhouse horse mussel	171	sinuatus, Strombus	481
<i>senhousea</i> , Musculus	171	<i>sinuatus</i> , Tricornis	481
<i>senhousei</i> , Musculus	171	<i>sinuosa</i> , Colpomenia	65
<i>senhousi</i> , Musculus	171	<i>sipho</i> , Siphonaria	647
<i>senhousia</i> , Brachidontes	171	Siphonaire de Java	647
<i>senhousia</i> , Modiolus	171	Siphonaire de Sirius	648
senhousia, Musculista	171	Siphonaire laciniée	648
<i>senhousia</i> , Musculus	171	Siphonaria atra	648
<i>senhusi</i> , Musculus	171	<i>Siphonaria exigua</i>	647
<i>Septa aquatile</i>	544	Siphonaria javanica	647-648
<i>Septa intermedia</i>	544	<i>Siphonaria kurracheensis</i>	647
<i>Septa pilearis</i>	545	Siphonaria laciniosa	647-648
Septifer bilocularis	173-174	<i>Siphonaria sipho</i>	647
<i>Septifer pilosus</i>	173	Siphonaria sirius	648
Septifère commun	173	SIPHONARIIDAE	391, 395, 646
<i>septimus</i> , Strombus	480	<i>Siphonaris javanica</i>	648
Seriatopora caliendrum	120	<i>Siphonium maximum</i>	460
Seriatopora hystrix	120	SIPHONOCLADALES	41
<i>sericea</i> , Oliva	609	<i>siquijorensis</i> , Nassarius	580
Serpent's head cowrie	498	Sirius false limpet	648
SERPULIDAE	458	<i>sirius</i> , Anthosiphonaria	648
<i>Serpulorbis colubrinus</i>	461	sirius, Siphonaria	648

Slimy liagora	76	<i>Spisula pellucida</i>	281
Small sea fan tail	57	Spondyle barbu	214
Small seagrape	44	Spondyle de Butler	214
Small short razor	313	Spondyle doré	215
<i>smaragdinus</i> , <i>Mytilus</i>	172	Spondyle ducal	213
<i>smaragdula</i>, <i>Latirolagena</i>	592	Spondyle imperial	215
<i>smaragdula</i> , <i>Paralagena</i>	592	SPONDYLIDAE	198, 211, 220
<i>smaragdulus</i> , <i>Lathyrus</i>	592	<i>Spondylus aurantius</i>	215
Smooth cauliflower coral	121	<i>Spondylus barbatus</i>	214
Smooth giant clam	269	<i>Spondylus butleri</i>	214
Smooth moon turban	418	<i>Spondylus ciliatus</i>	215
Snake-like worm shell	461	<i>Spondylus ducalis</i>	213
Snipe's bill murex	564	<i>Spondylus imperialis</i>	215
<i>soelae</i> , <i>Murex pecten</i>	563	<i>Spondylus japonicus</i>	214
<i>solaris</i> , <i>Stellaria</i>	485	<i>Spondylus longitudinalis</i>	214
<i>solaris</i> , <i>Xenophora</i>	485	<i>Spondylus sinensis</i>	214
Solarium clair	638	<i>Spondylus spathuliferus</i>	213
Solarium géant	638	<i>Spondylus squamosus</i>	213
<i>Solarium maximum</i>	638	<i>Spondylus versicolor</i>	215
<i>Solarium perspectivum</i>	638	Spotted pearl oyster	184
<i>Solarium perypectivum</i>	638	Spotted tun	528
Solécourte divergent	314	Spurred turban	417
SOLECURTIDAE	284, 290, 305, 312	<i>squalida</i> , <i>Macra</i>	277
<i>Solecurtus divaricatus</i>	314	<i>squamata</i>, <i>Chlamys</i>	209
<i>Solecurtus dunkeri</i>	314	<i>squamata</i> , <i>Scaeo-chlamys</i>	209
<i>Solecurtus leone</i>	314	<i>squamatus</i> , <i>Azumapecten</i>	209
<i>Solen abbreviatus</i>	313	<i>squamosa</i>, <i>Anomalocardia</i>	328
<i>Solen aureomaculatus</i>	288	<i>squamosa</i>, <i>Gari</i>	311
<i>Solen beckii</i>	288	<i>squamosa</i> , <i>Grammatomya</i>	311
<i>Solen grandis</i>	288	<i>squamosa</i>, <i>Tridacna</i>	272
<i>Solen lamarckii</i>	289	Squamose sunset clam	311
<i>Solen roseomaculatus</i>	289	Squamose venus	328
<i>Solen violaceus</i>	310	<i>squamosus</i> , <i>Anomalodiscus</i>	328
SOLENIDAE	284, 312	<i>squamosus</i>, <i>Spondylus</i>	213
<i>Soletellina</i>	310	<i>squamulata</i>, <i>Nerita</i>	429
<i>Soletellina cumingiana</i>	310	<i>squamulata</i> , <i>Ritena</i>	429
<i>Soletellina diphos</i>	310	<i>squamulata</i> , <i>Theliostyla</i>	429
<i>Soletellina elongata</i>	308, 310	Staghorn coral	110
<i>Soletellina montrouzieri</i>	309	<i>Standella capillacea</i>	280
<i>Soletellina togata</i>	309	<i>Standella fragilis</i>	281
SOLIERIACEAE	90	<i>Standella hubbardi</i>	281
Sombrilla de Venus	60	<i>Standella pellucida</i>	281
<i>sordida</i> , <i>Austriella</i>	238	Star-shaped limpet	398
<i>soverbii</i>, <i>Corbis</i>	244	Starry moon snail	513
<i>soverbii</i>, <i>Fimbria</i>	244	<i>staurella</i> , <i>Liotribella</i>	293
<i>sowerbii</i> , <i>Fimbria</i>	244	<i>staurella</i>, <i>Tellina</i>	293
<i>sowerbyi</i> , <i>Fimbria</i>	244	<i>staurella</i> , <i>Tellinella</i>	293
<i>sowerbyi</i> , <i>Lima</i>	221	<i>Stavelia horrida</i>	175
<i>spadicea</i> , <i>Natica</i>	515	<i>Stavelia subdistorta</i>	175
<i>spathuliferus</i> , <i>Spondylus</i>	213	<i>Stavelia torta</i>	175
<i>speciosus</i> , <i>Pecten</i>	207	<i>stella</i> , <i>Patelloida</i>	392
<i>sphaerica</i>, <i>Bornetella</i>	59	<i>stellaeformis</i> , <i>Patella</i>	398
Spherical turtle shell	59	<i>Stellaria paucispinosa</i>	485
<i>spicifera</i>, <i>Acanthophora</i>	97	<i>Stellaria solaris</i>	485
Spindle shells	587	<i>stellaris</i> , <i>Patelloida</i>	392
<i>spinosa</i> , <i>Ostrea</i>	232	<i>stellata</i>, <i>Natica</i>	513
Spinose cerith	441	<i>stellatus</i> , <i>Trochus</i>	404
<i>spinus</i> , <i>Turbinellus</i>	606	<i>stictica</i>, <i>Mitra</i>	615
Spiny eucheuma	91	STOLONIFERA	122
Spiny mushroom coral	114	Stony corals	104
Spiral melongena	584	Straight hammer oyster	197
<i>spirata</i> , <i>Babylonia</i>	573-574	Strawberry conch	475
<i>Spisula capillacea</i>	280	<i>Striarca olivacea</i>	160

- striata, Atactodea* **283**
striata, Chiazacmea 393
striata, Martesia **358**
striata, Nerita 430
striata, Paphia 346
striata, Paphies 283
striata, Patelloida **393**
 Striate beach clam 283
 Striate limpet 393
 Striate martesia 358
striatus, Pitar 350
strigilata, Neritina 427
Striostrea prismatica 227
 Strombe à crête 481
 Strombe aile-de-cygne 479
 Strombe cruchon 476
 Strombe de Diane 469
 Strombe fleuri 481
 Strombe fraise 475
 Strombe gibbeux 472
 Strombe isabelle 471
 Strombe lentigineux 474
 Strombe marginé 480
 Strombe plissé 473
 Strombe tacheté 470
 Strombe trident 479
 Strombe variable 482
STROMBIDAE **462, 543**
Strombus aratum 469
Strombus athenius 482
trombus aurisdianae **469-470**
Strombus aurisdianae aratum 469
Strombus bulla **470**
Strombus canarium **471**
Strombus chrysostomus 469
Strombus cristatus 481
Strombus dentatus **479**
Strombus epidromis **479**
Strombus epidromus 479
Strombus floridus 481
Strombus gibberulus **472**
Strombus gibberulus gibbosus 472
Strombus guttatus 470
Strombus isabella 471
Strombus labiatus **473**
Strombus latissimus **480**
Strombus lentiginosus **474**
Strombus luhuanus **475**
Strombus marginatus **480**
Strombus mutabilis **481**
Strombus plicatus 476
Strombus robustus 480
Strombus septimus 480
Strombus sinuatus **481**
Strombus species 480
Strombus succintus 480
Strombus urceus 473, **476**
Strombus urceus orrae 476
Strombus variabilis **482**
Stylophora pistillata **121**
subaustralis, Bactronophorus 360
subcrenata, Scapharca 150
subdistorta, Stavelia **175**
subeta gigantea, Bursa 552
subintermedia, Ficus **531**
subrugosa, Acrosterigma 259
subrugosum, Trachycardium **259**
subsulcata, Neritina 430
subsulcata, Neritodryas **430**
subtile, Ellobium 643
Subula areolata 635
Subula maculata 634
subulata, Terebra 635-**636**
 Subulate auger 636
succinta, Cypraea 504
succintus, Strombus 480
sulcata, Perna 193
sulcata, Tellina 297
sulcata, Terebralia **453**
 Sulcate swamp cerith 453
ulcatus, Pyrazus 453
sulcosa, Tonna **526**
sumatrensis, Cyrena 319
 Sunburst carrier shell 485
 Sundial shells 637
Sunetta concinna 352
Sunetta excavata 351
Sunetta menstrualis **351**
Sunetta truncata **352**
 Sunset clams 305
 Suratan cone 623
suratensis, Cleobula 623
suratensis, Conus **623**
Surcula javana 630
suturalis, Alectrion 581
 Swamp-ceriths 448
 Swan conch 479
 Swift wing oyster 189
Syrinx aruanus 603, **605**
- T**
 Table coral 111
Taenia 98
 Taitiao 38
taiwanense, Amusium japonicum 202
taiwanensis, Lyrodus 360
talienwhenensis, Crassostrea 233
talpa, Cypraea **494**
talpa, Talparia 494
Talparia isabella 501
Talparia talpa 494
talpina, Polyphyllia **117**
Tanea euzona 512
Tanea lineata 520
Tanea tigrina 514
Tanysiphon virens 353
Tapes 338
Tapes belcheri **352**
Tapes bifurcata 341
Tapes bruguieri 342
Tapes caledonica 346
Tapes cinerea 342
Tapes declivis 348
Tapes dorsatus **343**
Tapes dura 352
Tapes grata 352

<i>Tapes japonica</i>	341-342	<i>Telline foliacée</i>	295
<i>Tapes laterata</i>	344	<i>Telline lacuneuse</i>	295
<i>Tapes literatus</i>	344	<i>Telline langue-de-chat</i>	296
<i>Tapes obscurata</i>	352	<i>Telline râpe</i>	297
<i>Tapes ovulaea</i>	343	<i>Telline rugueuse</i>	296
<i>Tapes phenax</i>	352	<i>Telline sillonnée</i>	297
<i>Tapes philippinarum</i>	341	<i>Telline vergée</i>	294
<i>Tapes polita</i>	348	<i>Tellinella staurella</i>	293
<i>Tapes punicea</i>	342	<i>Tellinella virgata</i>	294
<i>Tapes quadriradiata</i>	352	TELLINIDAE	126, 290 , 299
<i>Tapes semidecussatus</i>	341	<i>Tellinides timorensis</i>	298
<i>Tapes tatrix</i>	338	<i>Tellins</i>	290
<i>Tapes turgida</i>	343	<i>tenuispina, Murex</i>	563, 565
<i>Tapes variegata</i>	342	Térébelle	482
<i>Tapes watlingi</i>	343	<i>Terebellum conch</i>	482
Tapestry turban	415	<i>Terebellum terebellum</i>	462, 482
Tapeworm	98	<i>terebellum, Terebellum</i>	462, 482
<i>Tarazeuxis unicolorus</i>	580	<i>Terebra areolata</i>	635
Taret comestible	360	<i>Terebra caeruleascens</i>	635
Taret siamois	360	<i>Terebra hectica</i>	635
Tattered sea moss	95	<i>Terebra maculata</i>	634
<i>taxifolia, Caulerpa</i>	48	<i>Terebra muscaria</i>	635
<i>taxiformis, Asparagopsis</i>	77	<i>Terebra roosevelti</i>	634
<i>Tectarius bicolor</i>	436	<i>Terebra subulata</i>	635- 636
<i>Tectarius bullatus</i>	434	<i>terebra, Turritella</i>	456
<i>Tectarius coronarius</i>	434	<i>Terebralia palustris</i>	452
<i>Tectarius coronatus</i>	435	<i>Terebralia sulcata</i>	453
<i>Tectarius grandinatus</i>	434	Térébre châtaigne	635
<i>Tectarius pagodus</i>	436	Térébre épissoire	634
<i>Tectarius papillosus</i>	435	Térébre mouchetée	635
<i>Tectarius rugosus</i>	435	Térébre subulée	636
<i>Tectarius tectumperspicum</i>	435	TEREBRIDAE	455, 629, 632
<i>Tectonica tigrina</i>	514	TEREDINIDAE	127, 354, 359
<i>tectumperspicum, Tectarius</i>	435	<i>Teredo milleri</i>	360
<i>Tectus conus</i>	403	<i>Teredo siamensis</i>	360
<i>Tectus fenestratus</i>	407	<i>Teredops diegensis</i>	360
<i>Tectus niloticus</i>	405	<i>teres, Lithophaga</i>	174
<i>Tectus noduliferus</i>	402	<i>ternatana, Pugilina</i>	586
<i>Tectus obeliscus</i>	402	<i>ternatanus, Hemifusus</i>	586
<i>Tectus pyramis</i>	402	Ternate melongena	586
<i>Tegillarca granosa</i>	147	<i>ternispina, Murex</i>	564-565
<i>Tegillarca nodifera</i>	148	<i>tesselata, Natica</i>	520
Telescope snail	451	Tesselate cone	628
Telescopium mauritsi	451	<i>tessellata, Tonna</i>	529
<i>Telescopium telescopium</i>	451	<i>tessulatus, Conus</i>	628
<i>telescopium, Potamides</i>	451	<i>tessulatus, Dendroconus</i>	628
<i>telescopium, Telescopium</i>	451	<i>tessulatus, Lithoconus</i>	628
<i>Tellina cratitia</i>	297	<i>testudinaria, Cellana</i>	397
<i>Tellina crucigera</i>	293	<i>testudinaria, Helcioniscus</i>	397
<i>Tellina foliaceae</i>	295	Textile cone	628
<i>Tellina gari</i>	311	Textile venus	338
<i>Tellina linguafelis</i>	296	<i>textile, Conus</i>	628
<i>Tellina palatam</i>	296	<i>textile, Cylinder</i>	628
<i>Tellina remies</i>	297	<i>textile, Darioconus</i>	628
<i>Tellina rugosa</i>	296	<i>textile, Paphia</i>	338-339
<i>Tellina scobinata</i>	297	<i>tatrix, Tapes</i>	338
<i>Tellina staurella</i>	293	THAIDINAE	553, 603
<i>Tellina sulcata</i>	297	<i>Thais aculeata</i>	568
<i>Tellina timorensis</i>	298	<i>Thais alouina</i>	568- 569
<i>Tellina tridentata</i>	298	<i>Thais armigera</i>	569
<i>Tellina virgata</i>	294	<i>Thais bufo</i>	570
<i>Telline croisetite</i>	293	<i>Thais carinifera</i>	561
<i>Telline de Timor</i>	298	<i>Thais mutabilis</i>	561

- Thais persica* 567
Thais pica 570
Thais rudolphi 567
Thais tuberosa **570**
Theliostyla albicilla 423
Theliostyla planospira 429
Theliostyla squamulata 429
Thin birdsnest coral 120
thoracites, Bactronophorus **360**
Thorny oysters 211
THRACIIDAE 361
THYASIRIDAE 234
Thylacodes medusae 461
Tiar venus 351
tiara, Placamen **351**
Tibia fusus **483**
ticaonicus, Turbo 417
Tiger cowrie 495
Tiger moon snail 514
tigerina, Codakia **239**
tigerina, Codokia 239
tigrina, Natica **514**
tigrina, Tanea 514
tigrina, Tectonica 514
igrinus, Malleus 197
tigris, Cypraea **495**
Timor tellin 298
timorensis, Tellina **298**
timorensis, Tellinides 298
titian, Lyncina 502
Toad purpura 570
togata, Gari **309, 353**
togata, Hiattula 309
togata, Milligaretta 309
togata, Psammotaea 309
togata, Sanguinolaria 309
togata, Soletellina 309
tokoensis, Martesia 358
Tonna allium **524**
Tonna canaliculata **527**
Tonna cepa 527
Tonna costata 524
Tonna dolium **528**
Tonna galea 528
Tonna olearium **528**
Tonna perdix **525**
Tonna sulcosa **526**
Tonna tessellata **529**
Tonne canaliculée 527
Tonne côtelée 524
Tonne fasciée 526
Tonne huilée 528
Tonne mosaïque 529
Tonne perdrix 525
Tonne tachetée 528
Tonnelet lippu 527
TONNIDAE **522, 530**
Toothed stolon 43
Toothless lucine 237
Top shells 399
Top vase 606
torrefactus, Chicoreus **560**
torrefactus, Murex **560**
torta, Stavelia 175
tortuosa, Trisidos **157**
Trachycardium alternatum 258
rachycardium angulatum **258**
Trachycardium asiaticum 260
Trachycardium dupuchense 256
Trachycardium hawaiiensis 259
Trachycardium marerubrum 256
Trachycardium orbita **259**
Trachycardium rugosum **256, 259**
Trachycardium subrugosum **259**
tranquebaricus, Pecten 210
transparens, Ehippium 218
trapa, Murex **565**
trapezina, Barbatia 155
Trapezium horse conch 590
trapezium, Fasciolaria 590
trapezium, Pleuroploca **590**
travancorica, Acmaea 396
Tree oysters 190
Triangular sea bell 74
tribulus, Murex **564-565**
tricenicoستا, Anadara 154
Trichuris 98
Tricolor olive 612
tricolor, Oliva **612**
Tricornis latissimus 480
Tricornis sinuatus 481
Tridacna **263**
Tridacna crocea **268**
Tridacna derasa **269**
Tridacna elongata 271
Tridacna gigas **270**
Tridacna maxima **271**
Tridacna scapha 272
Tridacna serrifera 269
Tridacna squamosa **272**
TRIDACNIDAE **263**
tridentata, Tellina 298
trigonalis, Donax 303
trigonum, Mesodesma 283
triremis, Acupurpura 563
triremis, Murex 563
Trisidos semitorta **157**
Trisidos tortuosa **157**
Trisidos yongei 157
Triton aquatile 544
Triton bosselé 542
Triton bouche-d'or 543
Triton conque 541
Triton intermédiaire 544
Triton lampas 552
Triton poilu 545
Triton poire 546
Triton shells 538
Triton tacheté 545
tritonis tritonis, Charonia **541**
tritonis variegata, Charonia 541
tritonis, Charonia tritonis **541**
TRIVIIDAE 486
Trocha nacrier 405
TROCHIDAE **399, 409, 431**
trochiformis, Turbo 435

<i>trochlearis, Architectonica</i>	638	<i>Turbinelle cornue</i>	606
<i>Trochus acutangulus</i>	403	<i>Turbinelle épineuse</i>	606
<i>Trochus conus</i>	403	TURBINELLIIDAE	603
<i>Trochus fenestratus</i>	407	<i>Turbinellus spinosus</i>	606
<i>Trochus hanleyanus</i>	408	<i>turbinellus, Vasum</i>	606
<i>Trochus lineatus</i>	408	TURBINIDAE	399, 409 , 416, 484
<i>Trochus maculatus</i>	404 , 408	<i>Turbo argyrostomus</i>	412 , 416
<i>Trochus maximus</i>	405	<i>Turbo bouche-d'argent</i>	412
<i>Trochus niloticus</i>	405	<i>Turbo bouche-d'or</i>	413
<i>Trochus nodulosus</i>	435	<i>Turbo brun</i>	417
<i>Trochus obeliscus</i>	402	<i>Turbo bruneus</i>	417
<i>Trochus pyramis</i>	402	<i>Turbo cendré</i>	418
<i>Trochus species</i>	405	<i>Turbo chrysostomus</i>	413
<i>Trochus stellatus</i>	404	<i>Turbo cinereus</i>	418
<i>Trochus verrucosus</i>	404	<i>Turbo coreensis</i>	418
Trompette australienne	605	<i>Turbo coronatus</i>	418
Troque conique	403	<i>Turbo couronné</i>	418
Troque fenestré	407	<i>Turbo crassus</i>	416, 419
Troque obélisque	402	<i>Turbo elegans</i>	415
Troque rayé	408	<i>Turbo épais</i>	419
Troque tacheté	404	<i>Turbo éperonné</i>	417
Troughshells	273	<i>Turbo intercostalis</i>	417
True harp	601	<i>Turbo lugubris</i>	418
True heart cockle	257	<i>Turbo marmoratus</i>	414
Trumpet triton	541	<i>Turbo petholatus</i>	415
<i>truncata sebae, Lambis</i>	468	<i>Turbo picta</i>	418
<i>truncata, Anatina</i>	362	<i>Turbo porphyres</i>	418
<i>truncata, Arca</i>	149	<i>Turbo pulcher</i>	417
<i>truncata, Cyclosunetta</i>	352	<i>Turbo reevei</i>	415
<i>truncata, Gari</i>	311	<i>Turbo regenfussi</i>	414
<i>truncata, Lambis</i>	468	<i>Turbo setosus</i>	416 , 419
<i>truncata, Laternula</i>	362	<i>Turbo soyeux</i>	416
<i>truncata, Sunetta</i>	352	<i>Turbo species</i>	419
Truncate lantern clam	362	<i>Turbo tapisserie</i>	415
Truncate sunetta	352	<i>Turbo ticaonicus</i>	417
Truncate sunset clam	311	<i>Turbo trochiformis</i>	435
<i>tuba, Pugilina</i>	586	<i>Turbo versicolor</i>	418
<i>tuberculatum, Cerithium</i>	443	<i>Turbo vert</i>	414
<i>tuberosa, Mancinella</i>	570	<i>Turgid venus</i>	343
<i>tuberosa, Thais</i>	570	<i>turgida, Cyrena</i>	319
Tuberose rock shell	570	<i>turgida, Paphia</i>	343
<i>tuberosum, Cymatium</i>	542	<i>turgida, Tapes</i>	343
<i>Tubipora musica</i>	122	Turnish shaped rapa	568
TUBIPORIDAE	122	Turret shells	455
<i>Tucetona extra</i>	164	Turreted nerite	427
<i>Tucetona pectunculus</i>	164	<i>Turricula javana</i>	630
Tufted sea moss	94	<i>Turricula rugosa</i>	617
<i>tulipa, Modiolus</i>	175	<i>Turricula vulpecula</i>	617
Tumid venus	333	TURRIDAE	587, 629
<i>tumidum, Gafrarium</i>	333	Turrids	629
<i>tumidus, Polinices</i>	519	<i>Turris babylonica</i>	631
Tummy cowrie	506	<i>turrita, Nerita</i>	427
<i>tumorifera, Lunulicardia</i>	254	<i>turrita, Neritina</i>	427
Tun shells	522	<i>turrita, Vittina</i>	427
Tuna del mar	52	<i>Turritella acutangula</i>	457
Turban shells	409	<i>Turritella duplicata</i>	457
<i>Turbinaria</i>	30, 72, 74	<i>Turritella terebra</i>	456
<i>Turbinaria conoides</i>	73	<i>Turritelle anguleuse</i>	457
<i>Turbinaria decurrens</i>	74	<i>Turritelle vis</i>	456
<i>Turbinaria ornata</i>	75	TURRITELLIDAE	455 , 632
<i>turbinarioides, Sargassum</i>	72	<i>Turtle limpet</i>	397
<i>Turbinella cornigera</i>	606	<i>turturella, Laevistrombus</i>	471
<i>Turbinella variolaris</i>	606	<i>Tutufa bubo</i>	552

<i>Tutufa rubeta</i>	552
Twotoned cardita	249
<i>Tydemania expeditionis</i>	55
<i>Tympanotonos fluviatilis</i>	454

U

<i>Udotea argentea</i>	56
<i>Udotea geppii</i>	57
UDOTEACEAE	54
<i>Ulva lactuca</i>	40
ULVACEAE	38
ULVALES	38
Clear sundial	638
<i>Umbonium</i>	399
<i>Umbonium costatum</i>	408
<i>Umbonium moniliferum</i>	408
<i>Umbonium vestiarium</i>	406
Umbrella weed	60
<i>undata, Nerita</i>	430
<i>undata, Ritena</i>	430
Underlined fig shell	531
<i>undosa, Pollia</i>	574
<i>undosus, Cantharus</i>	574
<i>undulata, Paphia</i>	338-339
Undulate venus	339
<i>undulatum, Gafrarium</i>	333
<i>unedo, Corculum</i>	255
<i>unedo, Fragum</i>	255
UNGULINIDAE	234
<i>unicolorus, Tarazeuxis</i>	580
<i>unidentatus, Murex</i>	565
<i>unimaculatum, Corculum</i>	257
UNIONIDAE	315
<i>urceus orrae, Strombus</i>	476
<i>urceus, Canarium</i>	476
<i>urceus, Strombus</i>	473, 476
<i>ursus, Anadara</i>	151
<i>ustulata, Nerita</i>	423
<i>ustulata, Pitaria</i>	350

V

<i>vaga, Cucullaea</i>	158
<i>Valonia aegagropila</i>	41
VALONIACEAE	41
<i>vanelli, Cypraea</i>	502
<i>varia, Haliotis</i>	389
<i>varia, Sanhaliotis</i>	389
<i>variabilis, Dolomena</i>	482
<i>variabilis, Latona</i>	301
<i>variabilis, Strombus</i>	482
Variable abalone	389
Variable conch	482
<i>variegata, Charonia tritonis</i>	541
<i>variegata, Tapes</i>	342
<i>variegata, Venerupis</i>	342
Variiegated carpet shell	342
<i>variiegatus, Ruditapes</i>	342
<i>variolaris, Turbinella</i>	606
Vase shells	603
VASIDAE	603
<i>Vasticardium alternatum</i>	258
<i>Vasticardium nigropunctatum</i>	256
<i>Vasticardium orbita</i>	259

<i>Vasum ceramicum</i>	606
<i>Vasum turbinellus</i>	606
<i>velata, Barbatia</i>	155
<i>Veletuceta cotinga</i>	163
<i>Venericardia bicolor</i>	249
VENERIDAE	126, 315, 320, 353
<i>veneriformis, Gomphina</i>	345
<i>Venerupis japonica</i>	341
<i>Venerupis philippinarum</i>	341
<i>Venerupis semidecussatus</i>	341
<i>Venerupis variegata</i>	342
<i>ventricosa, Arca</i>	149
<i>ventricosa, Harpa</i>	602
Ventricose ark	149
<i>ventriculus, Cypraea</i>	506
<i>ventriculus, Lyncina</i>	506
<i>ventriculus, Ponda</i>	506
<i>Venus aegrota</i>	340
<i>Venus alta</i>	351
Venus clams	320
<i>Venus clathrata</i>	349
Venus comb murex	563
Vénus écailleuse	328
Vénus équilatérale	345
Vénus fertile	347
<i>Venus foliacea</i>	351
Vénus japonaise	346
<i>Venus lacerata</i>	340
Vénus marbrée	346
<i>Venus nocturna</i>	344
<i>Venus puerpera</i>	340
<i>Venus punctata</i>	344
<i>Venus radiata</i>	344
<i>Venus reticulata</i>	340, 349
Vénus sillonnée	334
Vénus tiare	351
<i>venusta, Nerita</i>	423
<i>Vepricardium asiaticum</i>	260
<i>Vepricardium burnupi</i>	260
<i>Vepricardium coronatum</i>	260
<i>Vepricardium fimbriatum</i>	260
<i>Vepricardium sinense</i>	260
Vermet méduse	461
Vermet serpentini	461
VERMETIDAE	458
<i>Vermetus ater</i>	461
<i>Vermetus colubrinus</i>	461
<i>Vermetus maximus</i>	460
<i>Vermetus medusae</i>	461
<i>Vermetus novaehollandiae</i>	460
<i>vernicaosa, Paphia</i>	348
<i>verrucosa, Pocillopora</i>	119
<i>verrucosus, Trochus</i>	404
<i>versicolor, Euplica</i>	575
<i>versicolor, Nerita</i>	425
<i>versicolor, Pyrene</i>	575
<i>versicolor, Spondylus</i>	215
<i>versicolor, Turbo</i>	418
<i>Vertagus aluco</i>	446
<i>Vertagus communis</i>	445
<i>Vertagus cumingii</i>	446
<i>Vertagus granulatus</i>	446
<i>vertagus, Cerithium</i>	445

<i>vertagus, Clava</i>	445	<i>Volva volva</i>	508
vertagus, Rhinoclavis	445	<i>volva, Volva</i>	508
<i>Vespertilio vespertilio</i>	596	<i>vulgaris, Bezoardica</i>	537
vespertilio, Cymbiola	596	vulgaris, Lima	221
<i>vespertilio, Scapha</i>	596	<i>vulgaris, Lima lima</i>	221
<i>vespertilio, Vespertilio</i>	596	<i>vulgaris, Malleus</i>	196
vestiarium, Umbonium	406	<i>vulgaris, Pinctada</i>	187
<i>vetula, Anadara</i>	146	<i>vilpecula, Turricula</i>	617
Vexilla vexillum	571	vulpeculum, Vexillum	617
<i>Vexillate jopas</i>	571		
VEXILLIDAE	616	W	
<i>Vexillum cafferum</i>	617	Wader tree oyster	192
<i>Vexillum plicarium</i>	617	Walled cowrie	504
Vexillum rugosum	617	<i>wardiana, Volegalea</i>	584
Vexillum vulpeculum	617	Warty frog shell	551
<i>vexillum, Atrina</i>	179	<i>watlingi, Tapes</i>	343
<i>vexillum, Bractechlamys</i>	208	Waved goblet	574
<i>vexillum, Comptopallium</i>	208	Waved nerite	430
<i>vexillum, Pinna</i>	179	Weakly cut nerite	430
<i>vexillum, Purpura</i>	571	Wedge clams	282
<i>vexillum, Semipallium</i>	208	Wedge troughshell	279
vexillum, Vexilla	571	Wello fire coral	122
<i>vicdani, Haustellum</i>	564	<i>wellsi, Paratapes</i>	348
vidua, Oliva	612	Whelks	572
violacea, Batissa	319	Whip worm	98
<i>violacea, Coelomactra</i>	280	White hammer oyster	196
violacea, Mactra	280	White strawberry cockle	253
<i>violacea, Psammotaea</i>	308, 310	<i>whitleyi, Persikima</i>	269
<i>violaceus, Solen</i>	310	Widest Pacific conch	480
violascen, Asaphis	307	Windowpane oyster	218
Violet batissa	319	Windowpane shells	216
Violet troughshell	280	Winter's razor clam	288
virens, Glauconome	309, 353	<i>winteriana, Neosiliqua</i>	288
<i>virens, Glauconomya</i>	353	winteriana, Siliqua	288
<i>virens, Sinovacula</i>	353	Worm shells	458
<i>virens, Tanysiphon</i>	353	Wreath jopas	566
virgata, Tellina	294	Wrinkled cockle	259
<i>virgata, Tellinella</i>	294		
Virgate tellin	294	X	
<i>Virgiconus flavidus</i>	625	<i>Xenophora solaris</i>	485
<i>Virgiconus lividus</i>	626	Xénophore solaire	485
<i>virgineus, Conus</i>	626	XENOPHORIDAE	484, 637
<i>viridis, Haliotis</i>	389		
<i>viridis, Mytilus</i>	172	Y	
viridis, Perna	172	<i>yatsui, Lyrodus</i>	360
<i>Virroconus coronatus</i>	624	Yellow Pacific cone	625
vitellus, Cypraea	496	Yellow pitar venus	350
<i>vitellus, Lyncina</i>	496	Yellowbanded horse mussel	169
<i>vitellus, Mystaponda</i>	496	<i>Yetus indicus</i>	598
vitellus, Natica	513, 515	<i>yongei, Trisidos</i>	157
<i>Vittina turrata</i>	427	Youthful venus	340
Volachlamys singaporina	210		
<i>Volegalea wardiana</i>	584	Z	
<i>Volema cochlidium</i>	584	<i>Zaria duplicata</i>	457
Volema myristica	585	<i>zebra, Arca</i>	149
<i>Voluta diadema</i>	597	<i>zelandica, Atrina pectinata</i>	178
<i>Volute chauve-souris</i>	596	<i>Zeuxis crematus</i>	580
<i>Volute diadème</i>	597	<i>Zeuxis dorsata</i>	580
<i>Volute melon</i>	598	<i>zeylanica, Cyrena</i>	317, 319
<i>Volutes</i>	594		
VOLUTIDAE	594		

W7191E