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JSPS

FIELD GUIDE to the
JELLYFISH
of WESTERN PACIFIC

• BANGLADESH • INDONESIA • MALAYSIA
• PHILIPPINES • SINGAPORE • SRI LANKA • THAILAND



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Centre for Marine and Coastal Studies (CEMACS)
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FOREWORD I

WENXI ZHU

Head
IOC Sub-Commission for the
Western Pacific
UNESCO

Healthy oceans are essential for a healthy planet and a healthy future for all. The COVID-19 pandemic inspires reflections and evokes difficult questions about humanity's relationship with the natural world. As the world adjusts to a new normal, the ocean will need to play a central role in promoting a sustainable recovery.

Being the most densely populated and most rapidly developing region, the Western Pacific and its adjacent areas hold great social economic importance to human lives and prosperity. The region is faced with the ever increasing challenges for sustainable development. Among other challenges, many countries in the region have seen an increase in the occurrence of jellyfish blooms, and their significant negative impacts on multiple ocean industries such as fishery, aquaculture and coastal tourism.

The UNESCO/IOC Sub-Commission for the Western Pacific (WESTPAC) responded to the needs of its member states and set to study the jellyfish blooms in the region. Owing to PROF. DATO' AILEEN TAN SHAU HWAI's leadership and tremendous efforts among countries in the region, a regional research network was established with collaborative research and public awareness campaigns launched to develop knowledge on jellyfish blooms and mitigate their negative impacts. This Field Guide for Jellyfish Sampling and Identification indeed represents an essential solid foundation for not only ocean scientific communities, but also other relevant ocean stakeholders in the region to further address the harmful jellyfish issue for the ocean and human health. I would also acknowledge with our deep appreciation the support of our partner, JSPS, for this product.

We need to act immediately to reverse the decline in ocean health and continue to rely on the ocean for our needs without compromising the needs of our future generations. On occasion of the beginning of the UN Decade of Ocean Science for Sustainable Development (2021–2030), I congratulate on this tangible deliverable to our society, and would like to further call upon all ocean stakeholders to engage in the development of transformative ocean science solution to the ocean we want!



FOREWORD II

PROF. HIROAKI SAITO

Program Coordinator
JSPS Core-to-Core Project CREPSUM
The University of Tokyo

The waters of Southeast Asia are the sea of fertility. Our societies receive various services from the marine ecosystems, and people enjoy various seafood including jellyfish. The marine ecosystems are, however, under the pressure of human activities. The degradation of marine ecosystems is an emergent issue of our society. With eutrophication, coastal development and increasing material transportation, invasion of toxic jellyfish and unexpected jellyfish blooms occur in many countries which influence various human activity such as fisheries, tourism, coastal power plant operation, etc. At the same time, it is revealed the diversity of jellyfish and their important roles on marine ecosystem dynamics.

The publication of this Jellyfish Field Guide of the Western Pacific has been awaited by many researchers and citizen scientists. The publication is timely response from jellyfish researchers to progress the study of jellyfish and solve the societal issued related to jellyfish. This field guide is produced to assist in implementing the IOC-WESTPAC program and the Japan Society for the Promotion of Science (JSPS) Core-to-Core Program CREPSUM (Collaboration Research and Education Project in Southeast Asia for Sustainable Use of Marine Ecosystems). The goal of JSPS Core-to-Core CREPSUM is to progress marine ecosystem studies on emergent issues for conservation and sustainable use of marine ecosystem services in Southeast Asia. It is also expected to contribute to the UN Decade of Ocean Sciences and UN SDG 14 “Life below water” through preparing scientific knowledge to society in a timely manner. It is a great pleasure to publish this book, which is expected to contribute to the achievement of the goal of CREPSUM.

Thanks to financial support from JSPS Core-to-Core program CREPSUM, the field guide of jellyfish in the Western Pacific could be published in February 2021. This field guide is contributed by members from various countries namely Bangladesh, Indonesia, Malaysia, Philippines, Singapore, Sri Lanka, and Thailand, covering one of the most harmful and amazing marine creatures, jellyfish. I hope this field guide will be useful for not only for scientists but also to the public for outreach and education purposes.



FOREWORD III

PROF. DATO' DR. AILEEN TAN SHAU HWAI
Principal Investigator of IOC-WESTPAC Project
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The status of jellyfish invasion in WESTPAC countries is becoming an emerging threat to human as well as a nuisance to the fishery industry. There have been increasing cases of jellyfish stings reported in particularly Indonesia, Malaysia, Singapore and Thailand. Although there is no formal report or scientific research describing the relationship between the fishery and jellyfish blooms, jellyfish has also brought havoc on the tourism industry, in particular those areas, which promote beaches as their tourism attraction. Following these concerns, the environmental triggers of jellyfish blooms and the understanding of the conditions leading this is indispensable for forecasting such blooms. This is an essential step in avoiding harmful jellyfish stings in coastal areas. Currently, we still do not know the species composition and characteristics of such blooms. The presence of a particular jellyfish species vital to be identified as some possesses fatal venomous sting.

There is a need to collaborate among the WESTPAC countries and partners to look into the jellyfish research with the aim to fill up these knowledge gaps. Following these, there seems to be an important need for capacity building in jellyfish science and social awareness to translate the scientific findings for the benefit of the community at large.

IOC-WESTPAC has supported the project entitled "Enhancement of Sustainable Harmful Jellyfish Research and Networking in Western Pacific Region" with members from Bangladesh, China, Indonesia, Korea, Malaysia, Philippines, Singapore, Sri Lanka, Thailand and Vietnam since 2017. A joint-publication entitled "Harmful Jellyfish Country Report in Western Pacific" was published in 2019, contributed by all country members.

During the course of the project, all members found that identification of jellyfish sampled through the field work is one of the big obstacles necessary to overcome. IOC-WESTPAC recognized that a printed field guide is very useful, because this field guide can serve as information source for the scientists living in the countries affected by the jellyfish blooms. Field guides are also useful to the public for awareness and education.

This field guide of jellyfish in Western Pacific region is a joint effort of all country members under the project by IOC-WESTPAC and supported by Japan Society for Promotion of Science (JSPS) under the program of Core-to-Core Program: Collaborative Research and Education Project in Southeast Asia for Sustainable Use of Marine Ecosystems (Core-to-Core CREPSUM).

Contributing Authors & Institutions

This field guide has been produced to assist in implementing the IOC-WESTPAC project entitled “Enhancement of Sustainable Harmful Jellyfish Research and Networking in Western Pacific Region”. This field guide is a joint-effort by all member countries involved in the project. Below are the contributing authors of the field guide:

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We would like to pay our gratitude and our respects to our fellow researcher, Dr. Zulfikar. After being part of the 1st WESTPAC workshop on Harmful Jellyfish, Dr. Zulfikar passed away in February 2020. He was a dedicated professor and head of Malikussaleh University's Marine Centre.

Last but not least, we also thank everyone who had contributed the species descriptions and photographs to this publication and Universiti Sains Malaysia (USM) for their generous support that helped us make this project a reality.

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Scope of the Field Guide

This book is designed to be a simple guide to jellyfish in Western Pacific (**Bangladesh, Indonesia, Philippines, Malaysia, Singapore, Sri Lanka and Thailand**). The jellyfish species (77 species: 13 species from Class Hydrozoa, 51 species from Class Scyphozoa and 13 species from Class Cubozoa) presented in this field guide were collected from:

Country	Location of Sampling and Collection (Area Coverage)
Bangladesh	Cox's Bazar and St. Martin's Island, Northern Bay of Bengal
Indonesia	Java; Bali; Sumbawa; Makassar Strait; Misool Lake, Papua and Kakaban Lake, Borneo Island
Malaysia	Straits of Malacca (Penang; Manjung, Perak; Langkawi, Kedah; Selangor and Kukup, Johor); South China Sea (Pahang; Kelantan and Terengganu) and Sulu-Sulawesi Sea (Sabah)
Philippines	Manila Bay; Iligan Bay; Panguil Bay; Saranggani Bay; Davao Gulf; Carigara Bay; Visayan Sea; Leyte Gulf; Malampaya Sound; TayTay Bay; Jolo Island and Coron Island
Singapore	Singapore Strait and the Straits of Johor
Sri Lanka	Laccadive Sea region; Western Bay of Bengal and Indian Ocean region of the Exclusive Economic Zone
Thailand	The Gulf of Thailand and The Andaman Sea

We have largely restricted the content of this book to jellyfish species that are most frequently encountered, which are mostly illustrated by colour photographs, taken in their natural habitats and in laboratory. The taxonomic positions of the jellyfish are indicated, brief descriptions will be provided and together with the details of their known geographic distribution to assist the readers/users for clear visual identification of the jellyfish they encountered.

Each taxonomic group of jellyfish will be introduced with a short description of their major features. The use of scientific terminologies is inevitable but is kept to a minimum for the benefit of readers/users from non-sciences background. The various groups and species are dealt with a taxonomic sequence, and common names are given. However, common names are not given for species that do not have them. The use of scientific names is subjected to certain rules and, for the benefit of non-scientists; a brief explanation of the scientific names is as follows: a scientific name consists of two words, the first is the genus in which the organism belongs (generic name) and the second word is the specific epithet (specific name). Combination of the generic and specific names formed the *species* name.



INTRODUCTION

Mastigias papua
(Singapore)
Photograph credit: Sim Yee Kwang

Introduction

About The Jellyfish (Subphylum Medusozoa)

The jellyfish is composed of 97% of water, which contributes to their gelatinous nature. They usually refer to general pelagic, free-swimming jelly-like zooplankton. The term 'jellyfish' is frequently not used pedantically, even non-stinging gelatinous counterparts such as comb jellyfish (Phylum Ctenophora) and salps (Phylum Chordata: Subphylum Tunicata) are referred to as jellyfish. This field guide, however, will focus primarily on medusae from the phylum Cnidaria, where members bear stinging organelles (cnidae/ nematocysts).

According to Collins (2002), the phylum Cnidaria is monophyletic and composed of Anthozoa and Medusozoa (Fig. 1). While Cubozoa and Hydrozoa are well supported clades, Scyphozoa appears to be paraphyletic. Staurozoa is possibly the sister group of either Cubozoa or all other medusozoans. Based on current consensus, there are three major classes of jellyfish under Cnidaria, namely Scyphozoa (true jellyfish), Hydrozoa (water jellyfish) and Cubozoa (box jellyfish). Amongst the three, jellyfish under the class Hydrozoa records the most speciose of sea jellies, with over 3,500 described species. There are up to 39 Cubozoan species and over 220 Scyphozoan species, but studies estimate that there may be up to 400 species of Scyphozoan jellyfish (Daly et al., 2007).

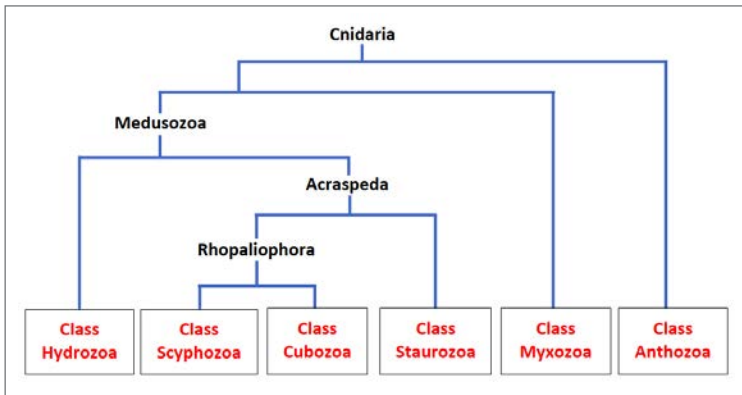


Fig. 1 Classification of Phylum Cnidaria.

Medusozoans are one of the oldest extant organisms, their fossil snapshots revealed that they might have existed since 500 to 600 million years ago. While some species are regarded as cosmopolitan with varying degrees of seasonal time scales, others may have limited geographical and temporal ranges of occurrence. There is currently a lack of baseline knowledge of many species' biology and occurrence, contributing to the difficulties of studying jellyfish in the face of limited resources. This can be due to low genetic variations amongst a large geographic range, which results in inconsistent populations throughout the world. Moreover, these creatures can be found floating or being carried away by currents on the surface, or in the deep blue, regardless whether the water temperature is cold or warm, especially when the conditions for blooming are ideal. Despite that, due to research limitations, these organisms are barely studied in Southeast Asia as opposed to the rest of the world, and records of past publications are only limited to local envenomation and fisheries. Therefore, the jellyfish fisheries that are local to this region are pretty much unknown, save for several species that were recorded in historical articles dating back to the early 1900s.

Jellyfish from the phylum Cnidaria contain stinging organelles called cnidae or nematocysts. Such organelles can be found in their tentacles, oral arms and even the bell of the jellyfish. The effects of some nematocysts on humans may be innocuous, but a combination of others such as those belonging to box jellyfish (Class Cubozoa) are known to confer more harmful, systemic effects. The stings from Irukandji jellyfish, may cause complications to humans, such as hypertension, and may even lead to death.

Beyond individual harm, jellyfish in smacks or blooms can negatively disrupt economy-driven operations such as those in fisheries, aquaculture and industrial power plants (Purcell et al., 2007). To mitigate the problems, researchers are continually studying fundamental biology, occurrence patterns and triggers (both natural and anthropogenic) for jellyfish proliferation. It is also important to note that these jelly-like creatures are quite fragile, and disappear as fast as they appear after blooming season ends. Jellyfish are still relatively understudied in Western Pacific Region (WPR), with limited documentation.

On the other hand, jellyfish are useful to human societies in a variety of ways. They contain some useful chemical compounds, such as the green fluorescent protein (GFP) extracted from hydromedusa *Aequorea victoria*, mucin from *Nemopilema nomurai* have greatly contributed to medical sciences (Shimomura, 2005). Additionally, some jellyfish that form aggregations are considered environmental indicators of global climate change (Richardson et al., 2009).

Life Cycle of Jellyfish

Jellyfish have first appeared approximately 600 million years ago. Jellyfish are found in all aquatic environments on Earth, from freshwater to seawater, from coastal to open ocean, and from surface waters to the deep sea. This is possible because jellyfish have a life cycle that adjusts to its environment and they can adapt to environmental changes.

The life cycle of jellyfish has an alternation of generations between the medusa stage, which is the sexual generation with a planktonic life and the polyp stage, which is the asexual generation with a benthic life (Arai, 1997; Bouillon et al., 2006; Jarms & Morandini, 2019). If we compare the life history of cherry blossoms, jellyfish are flowers, and polyps are cherry blossom trees. The tree will continue to live after it has bloomed, and will bloom again the following year. In the same way, after jellyfish blooms, polyps continue to be polyps, and the polyp reproduces asexually cloning polyps by budding (Fig. 2). Each of these new polyps results in the reproduction of jellyfish. Based on this, jellyfish have established a life history adapted to the environment in which each species inhabits.

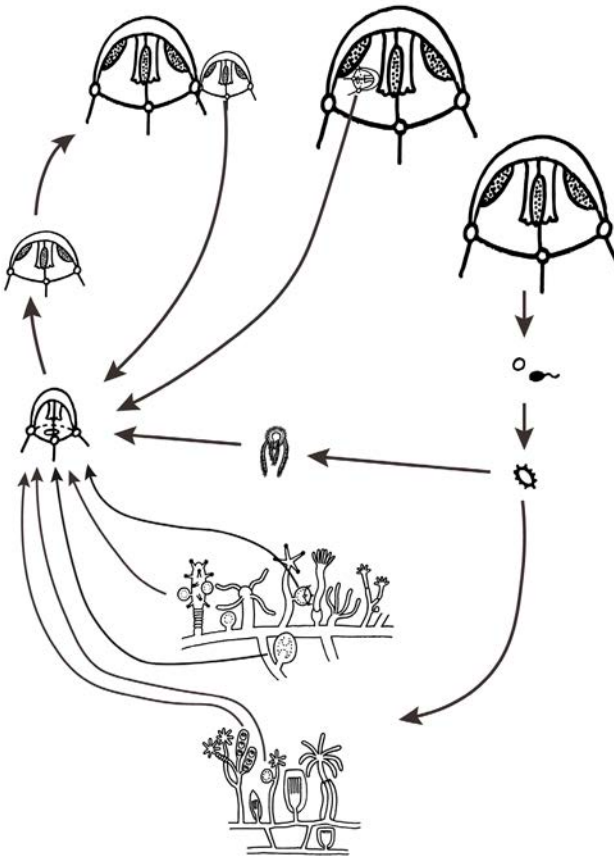


Fig. 2 The hydrozoan life cycle (exception Siphonophora).

Illustration: Hiroshi Miyake and Mai Watabe.

The class Hydrozoa has two subfamilies, Hydroidolina and Trachylina. Hydroidolina has three orders: Anthoathecata, Leptothecata, and Siphonophorae. The Trachylina has four orders: Actinulida, Limnomedusae, Narcomedusae, and Trachymedusae. Several of the species in the subfamily Hydroidolina have reduced the medusa stage and formed gonophores. On the other hand, most Trachylina species have no polyp stage.

Hydromedusae reproduce and release sperms and eggs into the water column, then fertilized eggs develop into planulae within a day. Planula swims in the water column by the ciliary movement for a while. Planula attaches to suitable substrates (rock, seaweed, seagrass, shell, man-made structure and litter on the seafloor) and develops into a polyp (Fig. 3A–F). Planula of some species develops into medusa directly in the Trachylina subfamily, for example, *Aglaura hemistoma*, *Liriope tetraphylla*, and *Solmundella bitentaculata* (Bentlage et al., 2018). Polyyps of Leptothecata are covered by a firm chitinous periderm around the body and colonial forms (Fig. 3C). Anthoathecata has no periderm and occurs in solitary or colonial forms (Fig. 3A, B, D–F) (Bouillon et al., 2006). Polyyps reproduce asexually by budding and making a colony. Polyyps in some species are polymorphic. Gastrozooids are used for feeding and digestion, gonozooids are for reproduction, dactylozooids are used for defence and prey capture (Fig. 3D). Grown polyyps reproduce the medusa bud under the hydranth, on the hydrocaulus, hydrorhizas, and in the gonotheca (Fig. 3G–I). In the medusa stage, some species reproduce medusae by budding from the manubrium or tentacular bulbs of the umbrella and direct fission (Fig. 3J–K).

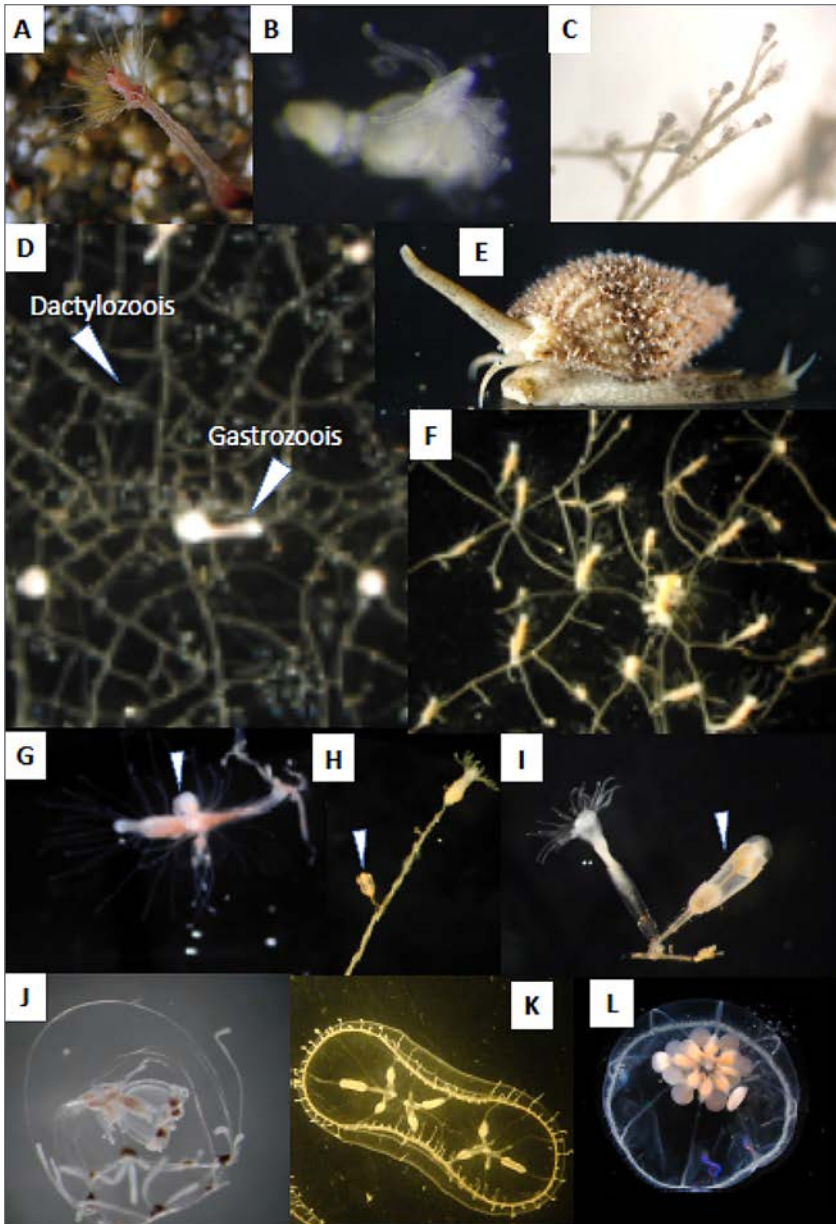


Fig. 3 Life cycle of hydromedusa.

A: solitary polyp of *Corymorpha* sp., B: solitary polyp of *Nemopsis dolleini*, C: colonial polyp of *Obelia* sp., D: a colony of polymorphic polyps, E: polyp colony of *Cytaeis uchidae* on a snail, F: grown colony of Anthoathecata, G: medusa bud of Anthoathecata, H–I: medusa bud in a gonotheca, J: medusa bud in the medusa stage, K: direct fission of medusa, L: medusa bud in the medusa stage.

The class Scyphozoa includes two subclasses: Coronamedusae and Discomedusae. The Coronamedusae has an order Coronatae and the Discomedusae has two orders, namely Rhizostomeae and Semaestomeae (WoRMS, 2021).

Planulae are produced by external or internal fertilization in species of Scyphozoa (Fig. 4). For example, internal fertilization can be found in *Aurelia* spp., *Netrostoma setouchianum*, and *Anomalorhiza shawi*. These species have a brooding pouch around the base of the oral arms (Fig. 5A). The spawning is triggered by the transition from dark to light conditions in most species of Scyphozoa. Planula attaches to the suitable substrate mentioned above and develops into a polyp, which is called a scyphistoma. Planula of *Pelagia* in Semaestomeae and several Coronatae (Atollidae, Paraphyllidae, and Periphyllidae), which inhabit the deep-sea, develop directly into ephyra from the planula (Fig. 5B) (Jarms & Morandini, 2019). Direct development was also found in *Aurelia aurita* and *Aurelia coerulea* in Japan (Fig. 5C). A large-sized planula (approximately 550–900 μm) attaches to a suitable substrate, and then the planula metamorphoses into an ephyra and the residuum develops into a polyp. In some species, the planula attached to the substrate forms a planulocyst.

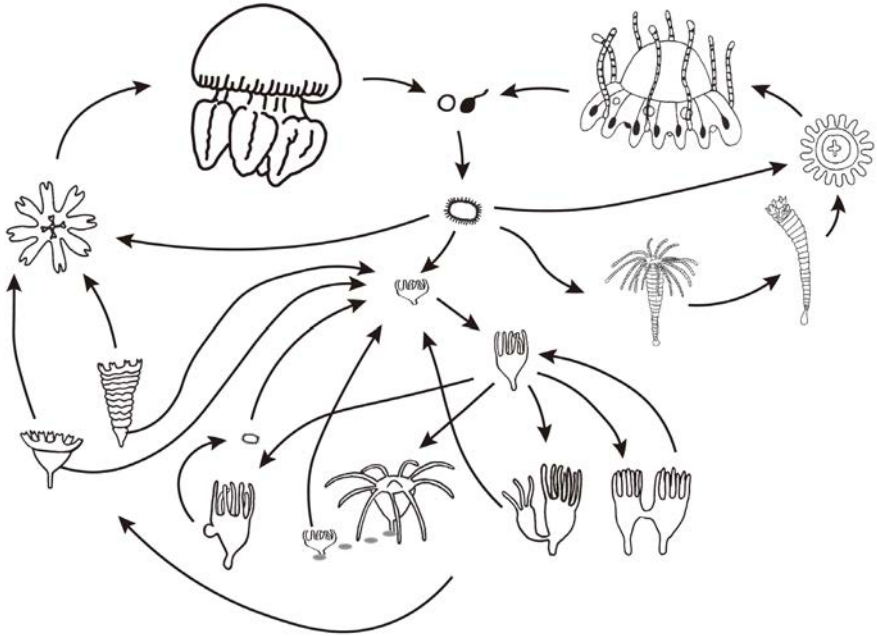


Fig. 4 The Scyphozoan life cycle. Illustration: Hiroshi Miyake and Mai Watabe.

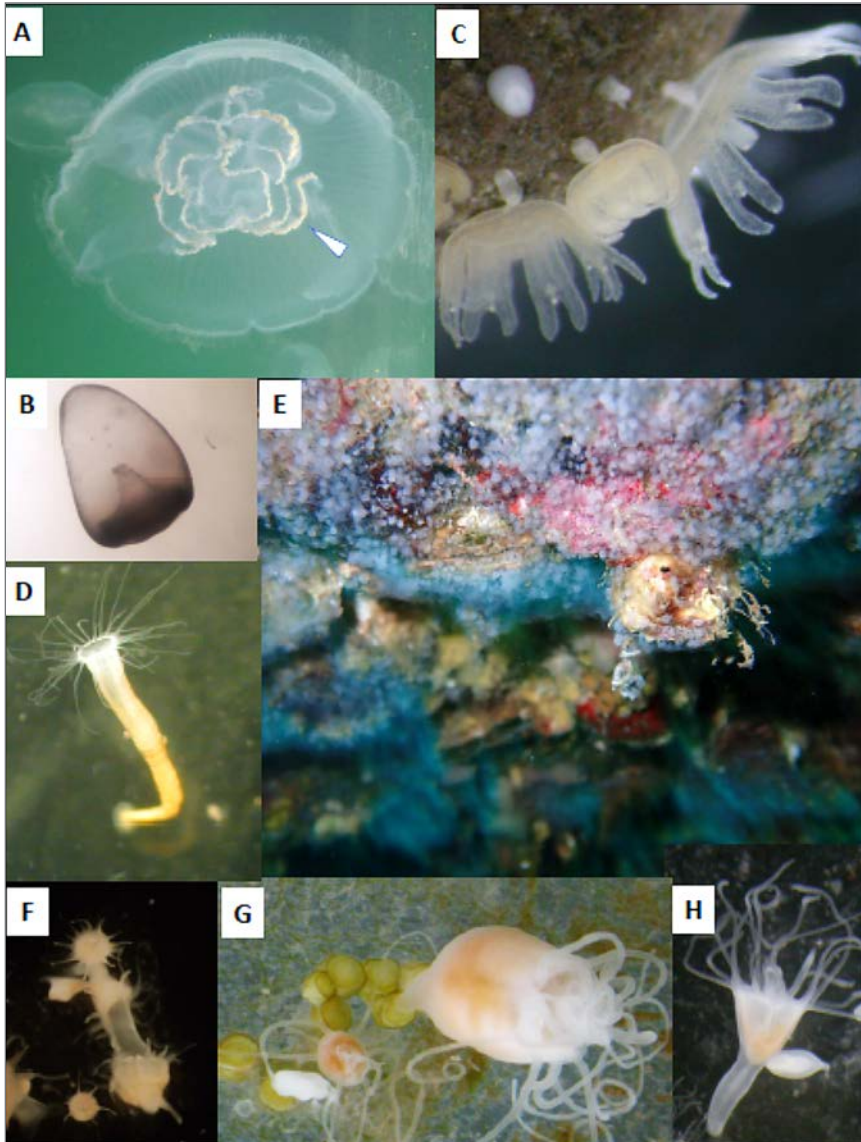


Fig. 5 Life cycle of scyphomedusa.

A: brooding pouch of *Aurelia coerulea*, B: direct development of *Pelagia noctiluca*, C: direct development in *Aurelia coerulea*, D: polyp of *Nausithoe* sp., E: polyp colony of *Aurelia coerulea* on the underside of a floating pier, F: budding and fission, G: podocyst, H: planuloid.

Polyps of Coronatae are solitary and colonial, with their body covered with chitinous firm periderm tubes (Fig. 5D) (Jarms & Morandini, 2019). Polyps of other Scyphozoans are solitary. It is difficult to find scyphozoan polyps in nature. Scyphozoan polyps were found on the underside of floating piers, aquaculture rafts, shells, and anthropogenic litters, etc. (Fig. 5E) (Matsumura et al., 2005; Miyake et al., 2004; Miyake et al., 1997; Miyake et al., 2002; Miyake & Lindsay, 2003; Shibata et al., 2015; Toyokawa, 2011; Toyokawa et al., 2011). Polyps reproduce asexually by direct budding,

fission, and planuloid, and podocyst production (Fig. 5F–H). In general, the asexual reproduction methods of polyps are budding, fission, podocyst and planulocyst in Semaestomeae and are podocyst and planuloid in Rhizostomeae (Brewer & Feingold 1991; Jarms & Morandini 2019). In particular, planuloids are found in Cassiopeidae, Cepheidae, and Mastigiidae.

Scyphozoan polyps reproduce ephyra asexually by transverse fission, which is called strobilation. Strobilation and ephyra, which are considered to be juvenile medusa, are characteristics of Scyphozoa. There are two types of strobila: monodisc strobila and polydisc strobila (Fig. 6A, B). Strobilae of almost all Semaestomeae and Coronatae are polydisc strobila, but *Sanderia malayensis* is a monodisc strobila. In Rhizostomae, strobilae of almost all Rhizostomatidae are polydisc, and monodisc strobilae are found in Cassiopeidae, Cepheidae, and Mastigiidae. The residuum, which is the base of the strobila, regenerates into a polyp. The polyp gives rise to more polyps asexually again and releases ephyrae next season.

The ephyrae of most Semaestomeae and Rhizostomeae have eight marginal lobes with a rhopalium between lappets. Ephyrae of *S. malayensis*, *Phacellophora camtschatica*, *Cassiopea* spp., and Coronatae have more than eight marginal lobes (Fig. 6C–E). Ephyra can be identified by their morphological characteristics (Straehler-Pohl & Jarms, 2010). Ephyra grows into young medusa for about a month through the metephyra stage.

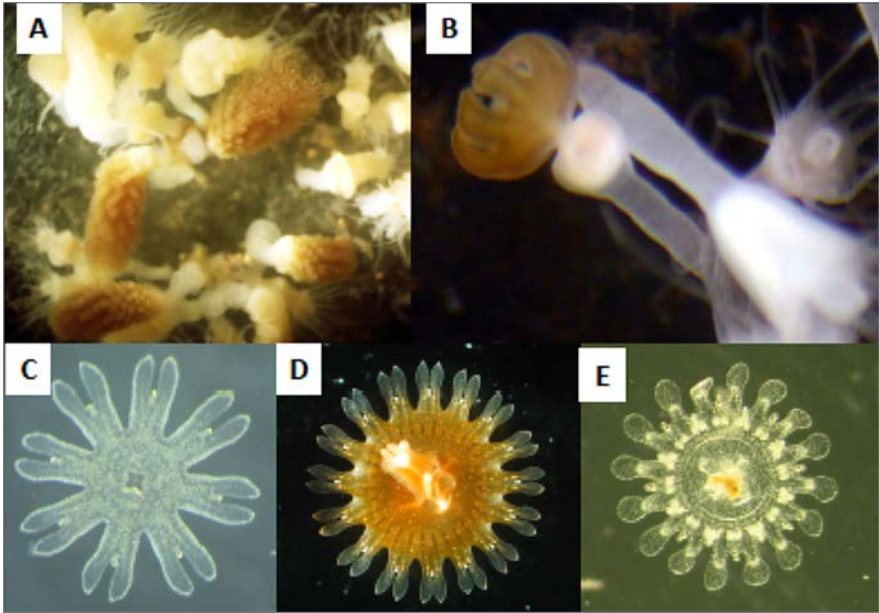


Fig. 6 Life cycle of scyphomedusa.

A: polydisc strobila, B: monodisc strobila, C: ephyra of *Aurelia coerulea*, D: ephyra of *Sanderia malayensis*, E: ephyra of *Nausithoe* sp.

The class Cubozoa has two orders: Carybdeida and Chirodropida. The Carybdeida has five families: Alatinidae, Carukiidae, Carybdeidae, Tamoyidae, and Tripedaliidae. Chirodropida has three families: Chirodropidae, Chiropsalmidae, and Chiropsellidae (Collins & Jarms, 2021).

The spawning is triggered by the transition from light to dark conditions in most species in Cubozoa. Fertilization is external in most species (Fig. 7). However, internal fertilization by copulation has been observed in *Copula sivickisi*, *Tripedalia cystophora* and *T. binata* (family Tripedaliidae) (Toshino et al., 2014; Toshino et al., 2017; Werner et al., 1971). The planula has larval ocelli around the equatorial plane (Fig. 8A). The larval ocelli are characteristic of the cubozoan planulae. However, the planula of *Morbakka virulenta* (Carukiidae) lacks them (Toshino et al., 2013). Planulae attached on suitable substrates develop into settled primary polyps (Fig. 8B). Settled primary polyps are transformed into a creeping primary polyp (Fig. 8B). If the creeping polyp finds a suitable place to settle, it is transformed into a secondary polyp (Fig. 8C). These polyps have one or some nematocysts at the tip of the tentacle. Secondary polyps reproduce by budding (Fig. 8D). Newly reproduced polyps can transform into creeping polyps and cysts (Fig. 8E). Polyp metamorphoses into a single medusa (Fig. 8F). This medusa formation is the characteristic of Cubozoa. On the other hand, some species of Alatinidae and Carukiidae form medusae by monodisc strobilation (Fig. 8G). This implies a phylogenetic similarity between Cubozoa and Scyphozoa.

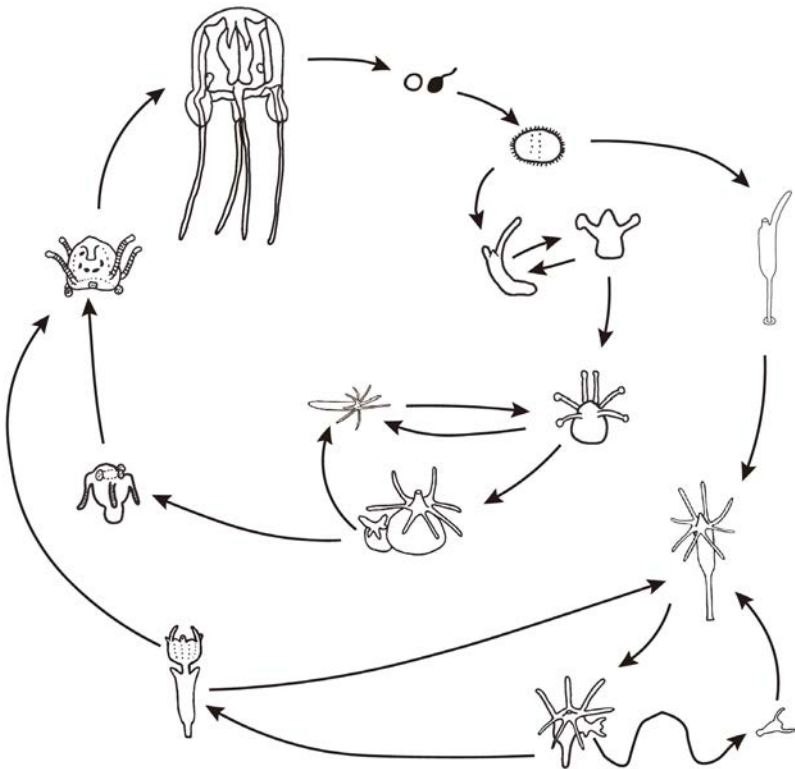


Fig. 7 The cubozoan life cycle. Illustration: Hiroshi Miyake and Mai Watabe.

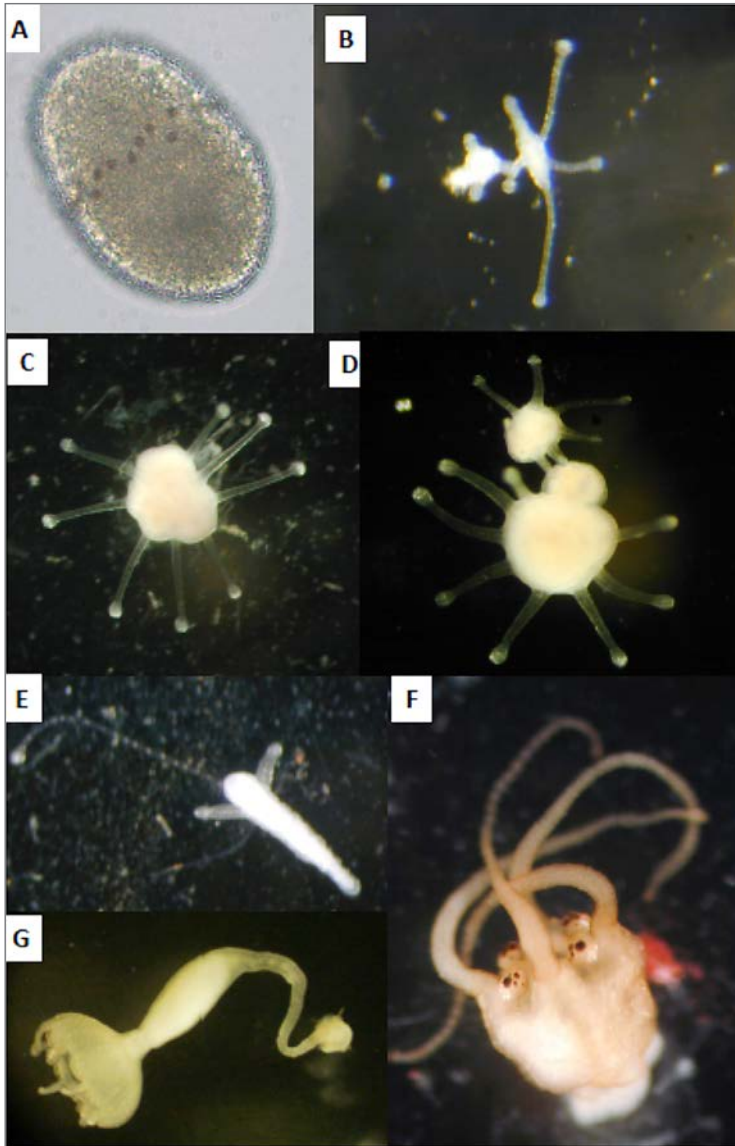


Fig. 8 Life cycle of cubozoan.

A: planula with larval ocelli, B: settled primary polyp (left) and creeping primary polyp (right), C: secondary polyp, D: budding of secondary polyp, E: creeping polyp, F: polyp metamorphosing into a single medusa, G: strobila of *Morbakka virulenta*.

Collection and Preservation

The purpose of this section would be to discuss the sampling protocols that were derived during the 1st WESTPAC workshop on the “Harmful Jellyfish Sampling Protocol & Data Analysis in the Western Pacific”, which was held in year 2017. We found a varying level of monitoring and fieldwork methods adapted by the researchers from the participating countries. Variation in the sampling protocols was very much based on the resource availability in their respective countries.

In terms of monitoring effort, samplings were done monthly, intensively during a specific season, during jellyfish bloom or upon a report of jellyfish sting cases or opportunistic trips. The jellyfish medusae collection method comprises of various fishing gears such as shrimp trammel net, beach seines, bag nets, beam trawls, gill nets, plankton net and scoop nets; and also handpicked of stranded samples by the beach. Generally, the samples that were collected using bag and scoop net were found to be in good condition where most of the parts were intact with least damage. However, the collection methods were modified according to the target species and the marine environment.

Formalin preservation was still adapted widely among the countries, where three to five percent formalin was used for jellyfish fixation before being transferred into 10% ethanol for long term preservation. Meanwhile, species identification was done through both classical and molecular methods. Tissue samples from the exumbrella and oral arms were collected and preserved in absolute ethanol for molecular analysis.

Classically, identification was based mainly on the taxonomic descriptions of Kramp (1961), Mayer (1910), Gershwin (2005, 2008), Chuah et al. (2010), Morandini & Marques (2010), Holst & Laakmann (2013), Gul & Morandini (2015), Rizman et al. (2016), and Low (2017). Morphological features, e.g., exumbrella shape, live colouration, surface texture, pattern mark, number and shape of oral arms, and presence of marginal tentacles were used for identification. Importantly, photographs of live jellyfish specimens were taken immediately upon collection to preserve the original colouration or underwater via snorkelling and scuba diving.

Photography and Identification Methods

There are only a handful of reliable taxonomic keys available due to the lack of well-preserved specimens and polymorphism among species (Rizman et al., 2016). Species identification is also challenging on juvenile individuals due to either a lack of developed features or morphological similarities between closely related species. Hence, the combination of morphological and molecular identification is necessary. Also, it is crucial that the individual specimens of each taxon were photographed alive underwater or in the laboratory in a glass aquarium and further examined under a stereomicroscope.

Species identification of a hydrozoan specimen was done through the polyps, medusae (or equivalent reproductive structures), and other morphological structures following the taxonomic identification key by Browne (1905), Kramp (1961), and Bouillon et al. (2006). For example, the morphological characteristics of *Physalia physalis*, also known as the Portuguese man o' war, bluebottle, or floating terror, a species from the class hydrozoa has a crest, pneumatophore (gas-filled polyp), gonozooids (for reproduction), gastrozooids (for digestion), dactylozooids (polyp for locating and catching prey) and coiled tentacles bearing nematocysts as shown in Fig. 9.

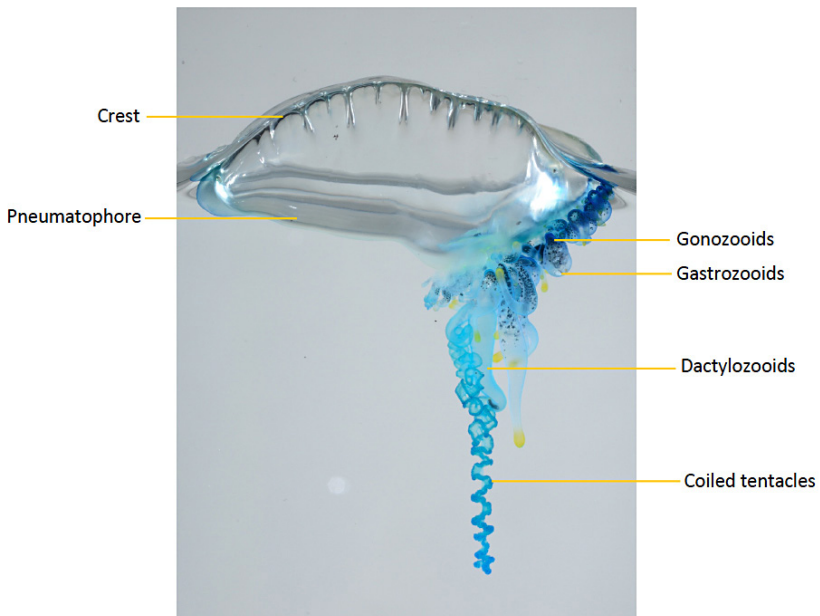


Fig. 9 Morphological features of a hydrozoan jellyfish (*Physalia physalis*).

Meanwhile, morphological identification of a scyphozoan can be achieved by examining the shape and colouration of the umbrella, number and relative length of tentacles, length of the manubrium and oral arms, shape, and number of marginal lappets, presence and shape of gonads, presence of quadralinga, and possibly other variations (Morandini & Marques, 2010). For instance, the morphological features of a scyphozoan jellyfish, *Chrysaora chinensis*, include the umbrella, gonads, marginal lappets, manubrium, tentacles, and oral arms as shown in Fig. 10.

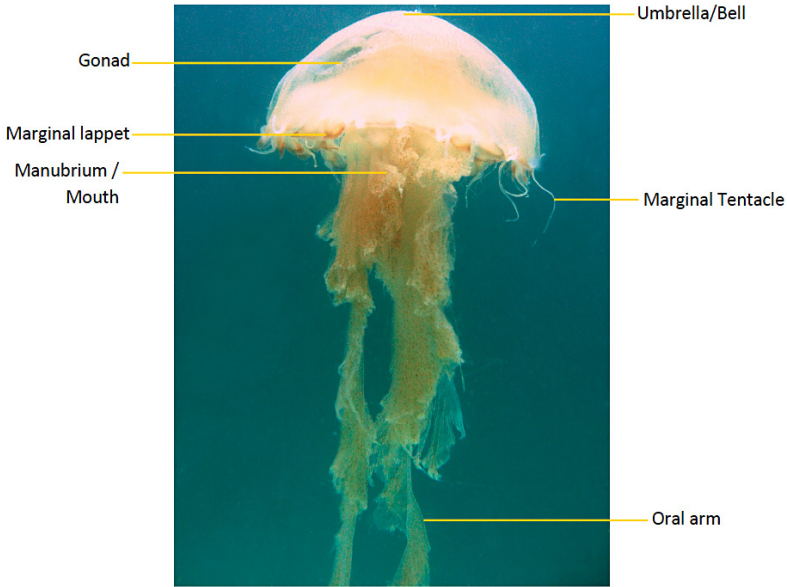


Fig. 10 Morphological features of a scyphozoan jellyfish (*Chrysaora chinensis*).

On the other hand, several characteristics involving the bell shape and dimensions, presence and distribution of nematocyst warts, the structure of pedalia and pedial canals, tentacles, gonads, rhopalial horns, perradial lappets, gastric saccules, and colour patterns were used to facilitate the identification of a cubozoan (box jellyfish) specimen (Gershwin, 2005). The morphological characteristics of a cubozoan jellyfish, *Chiropsoides buitendijki*, would be gonads, bell, gastric saccules, pedial bend, pedalia, perradial lappets, and tentacles as shown in Fig. 11.

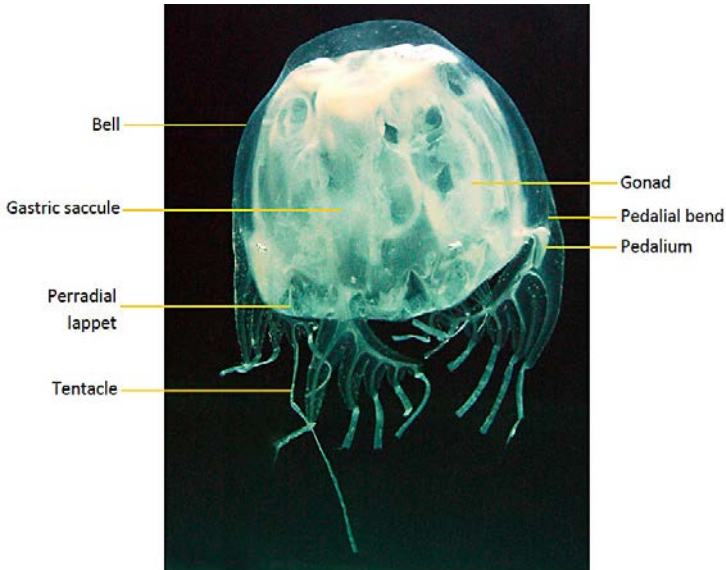


Fig. 11 Morphological features of a cubozoan jellyfish (*Chiropsoides buitendijki*).

Mapping to Taxonomic Groups

Phylum Cnidaria

- **Class Anthozoa** (Hard and soft corals, zoanthids, sea and tube-dwelling anemones, sea pens, Gorgonian sea fans)

- **Class Hydrozoa** (diverse group related to jellyfish; such as Portuguese man-of-war, blue buttons, by-the-wind sailor, hydroids, siphonophores)

- **Class Myxozoa** (microscopic parasites with multicellular spores and nematocyst like capsules)

- **Class Cubozoa** (Box Jellyfish)
 - **Order Carybdeida**
 - **Family Alatinidae**
 - Genus *Alatina*
 - Genus *Keesingia*
 - Genus *Manokia*
 - **Family Carukiidae**
 - Genus *Carukia*
 - Genus *Gerongia*
 - Genus *Malo*
 - Genus *Morbakka*
 - **Family Carybdeidae**
 - Genus *Carybdea*
 - **Family Tamoyidae**
 - Genus *Tamoya*
 - **Family Tripedaliidae**
 - Genus *Copula*
 - Genus *Tripedalia*
 - **Order Chiropodida**
 - **Family Chiropodidae**
 - Genus *Chiroadectes*
 - Genus *Chiropodus*
 - Genus *Chironex*
 - **Family Chiropsalmidae**
 - Genus *Chiropsoides*
 - **Family Chiropsellidae**
 - Genus *Chiropsella*
 - Genus *Meteorona*

- **Class Scyphozoa** (True Jellyfish)
 - **Subclass Coronamedusae**
 - **Order Coronatae**
 - **Family Atollidae**
 - Genus *Atolla*
 - **Family Atorellidae**
 - Genus *Atorella*
 - **Family Linuchidae**
 - Genus *Linantha*
 - Genus *Linerges*
 - Genus *Linuche*
 - **Family Nausithoidae**
 - Genus *Nausithoe*
 - Genus *Palephyra*
 - Genus *Thecoscyphus*
 - **Order Paraphyllinida**
 - **Family Paraphyllinidae**
 - Genus *Paraphyllina*
 - **Family Periphyllidae**
 - Genus *Nauphanthopsis*
 - Genus *Pericolpa*
 - Genus *Periphylla*
 - Genus *Periphyllopsis*

- Subclass **Discomedusae**

- Order **Rhizostomeae**

- Family **Catostylidae**
 - Genus *Acromitoides*
 - Genus *Acromitus*
 - Genus *Catostylus*
 - Genus *Crambione*
 - Genus *Crambionella*
 - Family **Lobonemidae**
 - Genus *Lobonema*
 - Genus *Lobonemoides*
 - Family **Lychnorhizidae**
 - Genus *Anomalorhiza*
 - Genus *Lychnorhiza*
 - Genus *Pseudorhiza*
 - Family **Rhizostomatidae**
 - Genus *Eupilema*
 - Genus *Nemopilema*
 - Genus *Rhizostoma*
 - Genus *Rhopilema*
 - Family **Stomolophidae**
 - Genus *Stomolophus*

- Order **Semaeostomeae**

- Family **Cyaneidae**
 - Genus *Cyanea*
 - Genus *Desmonema*
 - Family **Drymonematidae**
 - Genus *Drymonema*
 - Family **Pelagiidae**
 - Genus *Chrysaora*
 - Genus *Mawia*
 - Genus *Pelagia*
 - Genus *Sanderia*
 - Family **Phacellophoridae**
 - Genus *Phacellophora*

- Family **Cepheidae**
 - Genus *Cephea*
 - Genus *Cotylorhiza*
 - Genus *Marivagia*
 - Genus *Netrostoma*
 - Genus *Polyrhiza*
 - Family **Cassiopeidae**
 - Genus *Cassiopea*
 - Family **Leptobrachiidae**
 - Genus *Leptobrachia*
 - Genus *Thysanostoma*
 - Family **Mastigiidae**
 - Genus *Mastigias*
 - Genus *Mastigietta*
 - Genus *Phyllorhiza*
 - Family **Versurigidae**
 - Genus *Versuriga*
 - Family **Bazingidae**
 - Genus *Bazinga*

- Family **Ulmaridae**
 - Genus *Aurelia*
 - Genus *Aurosa*
 - Genus *Deepstaria*
 - Genus *Poralia*
 - Genus *Stellamedusa*
 - Genus *Sthenonia*
 - Genus *Stygiomedusa*
 - Genus *Tiburonia*
 - Genus *Diplulmaris*
 - Genus *Discomedusa*
 - Genus *Floresca*
 - Genus *Parumbrosa*
 - Genus *Ulmaris*

- Class **Staurozoa** (Stalked Jellyfish)

- Order **Stauromedusae**

- Family **Craterolophidae**
 - Genus *Craterolophus*
 - Family **Kishinouyeidae**
 - Genus *Calvadosia*



CLASS HYDROZOA

Hydrozoa (hydrozoans, from ancient Greek ὑδῶρ, hydōr, “water” and ζῷον, zōion, “animal”) are a taxonomic class of individually very small, predatory animals, some solitary and some colonial, most living in salt water.

The colonies of the colonial species can be large, and in some cases the specialized individual animals cannot survive outside the colony. A few genera within this class live in fresh water. Hydrozoans are related to jellyfish and corals and belong to the phylum Cnidaria.

Physalia physalis
(Indian Ocean)
Photograph credit: Iffah Iesa

Introduction to Class Hydrozoa

The Hydrozoa being a subgroup of cnidarians comprises of two subclasses namely Hydroidolina and Trachylinae. The subclass Hydroidolina comprises of three orders, 97 families, 486 genera, and approximately 3,700 species. Meanwhile, subclass Trachylinae comprises of four orders, 18 families, 62 genera and about 142 species (WoRMS, 2021). Hydrozoan is known to be the most diverse group with siphonophores, hydroids, fire corals, and many medusae. It is distinguished by its tendency to form colonies of hydroids that may be small and inconspicuous.

Hydrozoans are found in marine habitats, most abundant and diverse in warm shallow waters. A few genera within this class were reported to live in freshwater, in both lotic and lentic habitat (Bouillon et al., 2006; Jankowski et al., 2007). Example of freshwater jellyfish would be *Craspedacusta sowerbii* (Lankerster, 1880) that was first described from specimens from a water-lily tank in London. This species easily identified from its small and bell-shape feature, known as a hydromedusa. The presence of a velum, thin, circular membrane on the underside of the bell differentiates it from 'true' jellyfish, class Scyphozoa (Jankowski, 2001; Silva & Roche, 2001) (Fig. 12).



Fig. 12 The freshwater jellyfish *Craspedacusta* sp. found in Singapore. Subumbrella view, scale 0.5 cm (left); close-up detail on different levels of tentacles (middle); statocysts on velum (right). Photograph credit: Ifah Iesa.

Most hydrozoan species have both polypoid and medusoid stage in their lifecycles; however, a number of them have only one or the other. Each colony has a base, a stalk, and one or more polyps. Polyps are described to be radially symmetrical, conical, cylindrical, or club-shaped. The Hydrozoan polyps reproduce asexually by budding, creating daughter polyps, medusae, or both. Some species also reproduce medusae asexually, by fission or budding. The new medusae or polyps mature and spawn, releasing gametes. Most hydrozoan species are dioecious, where they have separate sexes; all the polyps in each colony are either male or female. A few are sequential hermaphrodites. Eggs and sperm are released freely into the water column and fertilization occurs externally. Some species retain the egg and fertilizes internally, where embryos are released as larvae or retained until further developed (Bouillon et al., 2006; Jankowski et al., 2007).

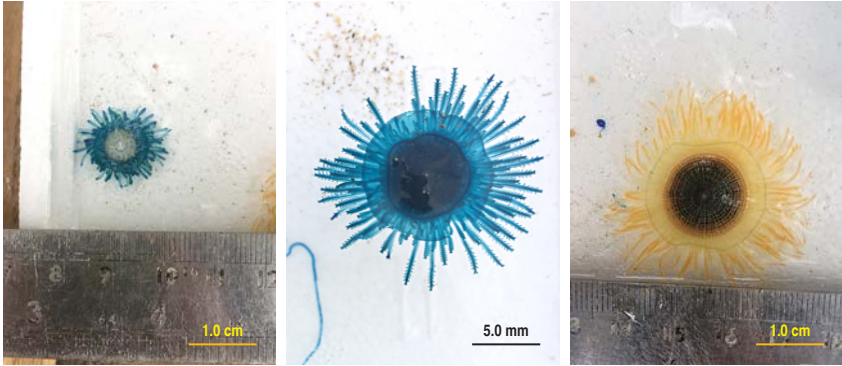
The hydrozoan is known to combine sessile or sedentary polyp stages and free-swimming solitary stages in their life cycles. Polyps can be solitary or colonial; a great number of species in this class are colonial. In the Siphonophora and a few other groups of hydrozoans, colonies of polyps are pelagic and float at the surface through a gas-filled tissue. They frequently retain medusae as part of the colony. Many free-swimming hydrozoans follow diel migration pattern, where they stay in deep waters during daylight and rise to the surface after sunset (Mills, 2009).

All hydrozoans have tactile and chemical sensing structures. Some also have eyespots that detect light and statocysts that detect gravity. Communication is mainly by chemical cues. Nearly all hydrozoans protect themselves with their cnidocytes. Some colonial species have specialised polyps that grow large tentacles armed with dense batteries of these stinging cells. Despite their protective stinging cells, hydrozoans are prey for many types of predators, such as fish, sea turtles, ctenophores and including larger hydrozoans (Purcell, 1997; Dunn, 2009; Mills, 2009). This class includes the notorious Portuguese man-of-war from family Physaliidae, a siphonophore, a colonial organism made up of specialised minute individual organisms called polyps. The tentacles that are armed with nematocysts and venom can be lethal to humans. The tentacles typically reach up to 10 to 30 m in length.

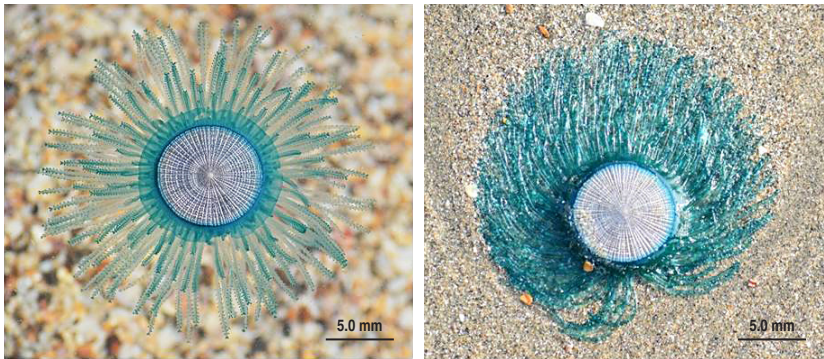
Class Hydrozoa

Order Anthoathecata

Family Porpitidae

Porpita porpita (Linnaeus, 1758)**Common Name** Blue Button Jellyfish**Distribution** Bangladesh (Northern Bay of Bengal); Indonesia (Bali); Malaysia (Penang); Philippines; Sri Lanka and Thailand (Gulf of Thailand and Andaman Sea)*Porpita porpita* also locally known as the blue button jellyfish. It is native to tropical and sub-tropical waters of the Pacific, Atlantic and Indian oceans.

Photograph credit: Widiastuti.



Photograph credit: M. Shah Nawaz Chowdhury.



Photograph credits: Department of Marine and Coastal Resources, Thailand (left); K. D. Karunaratne and M. D. S. T. de Croos (right).

Physical/morphological Characteristics	
Pneumatophore (Gas filled float) - Aboral (Upper)	
Shape	Disc-like chitinous float surrounded by soft living tissue, sail-shape absent. In live condition, the aboral direction of the organism floats on the surface of water and the lower side remains submersed
Colour	Blue turquoise to yellow (aboral), translucent white (oral)
Surface texture	Smooth and soft
Pattern mark	Concentric circles of air-filled tubes on the aboral (upper) surface
Bell top	Disc-shaped
Tentacles	
Number	Numerous
Shape	Digitiform; finger-like
Colour	Blue turquoise to yellow
Presence of tentacles	Capitate tentacles on the outer margin of the oral surface

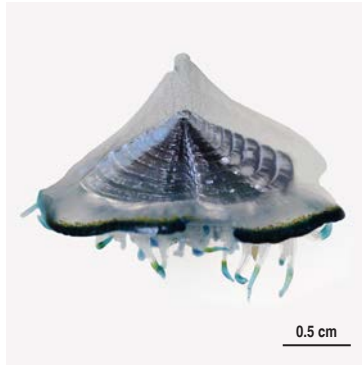
Class Hydrozoa

Order Anthoathecata

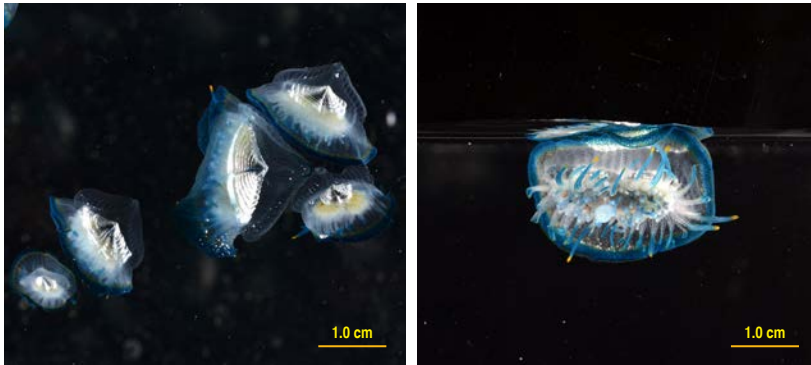
Family Porpitidae

Veleva veleva (Linnaeus, 1758)**Common Name** By-The-Wind Sailor**Distribution** Indonesia (Bali); Philippines; Sri Lanka and Thailand (Gulf of Thailand)

Veleva veleva is also known as the by-the-wind sailor, is a relative species to *Porpita porpita*, both from family Porpitidae. Genus *Veleva* is a monospecific taxon. *Veleva veleva* is distributed in both temperate and tropical waters of the world. Generally floats offshore but can be blown to onshore. Some of their striking features are blue pigmentation, chitinous semi-circular to triangular sail and small tentacles below gas-filled chambers.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.



Photograph credit: Iffah Iesa.

Physical/morphological Characteristics	
Pneumatophore (Gas filled float)- Aboral (Upper)	
Shape	Chitinous semi-circular to triangular sail; rigid and oval shape float; length to 4 cm; a sail on its upper side
Colour	Deeply blue or transparent with blue/green margin; sail shiny silver with transparent mantle
Surface texture	Smooth and soft
Tentacles	
Number	Numerous
Shape	Small tentacles below gas-filled chambers; several short tentacles arising from underneath the float
Colour	Whitish to bluish

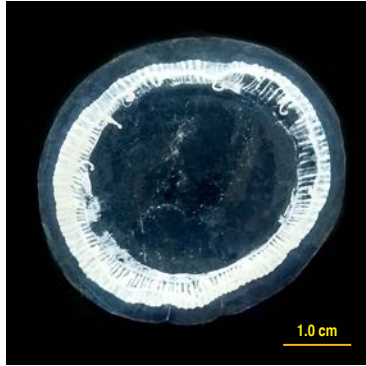
Class Hydrozoa

Order Leptothecata

Family Aequoreidae

Aequorea pensilis (Haeckel, 1879)**Common Name** Crystal Jellyfish**Distribution** Sri Lanka

About 24 species of crystal jellyfish are in the world, of them some are bioluminescent. *Aequorea pensilis* is one of the commonly reported species in the Atlantic, Indian and Pacific Oceans.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

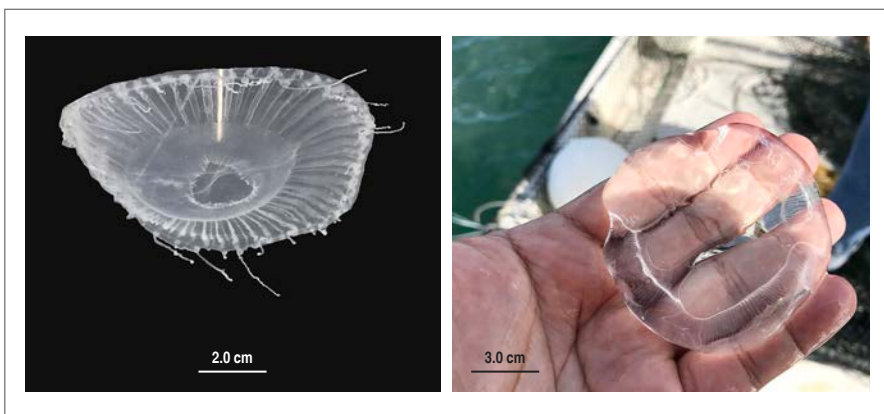
Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Lens-shaped; diameter to 7 cm
Marginal appendages	10–16 tentacles and 8–16 times as many small bulbs
Colour	Transparent
Gastrovascular system	
Stomach	Half to three-fourth as wide as the bell
Radial canals	100–250; gonads extending along almost entire length of radial canals

***Aequorea* sp.**

Common Name Crystal Jellyfish

Distribution Malaysia (Penang) and Thailand (Gulf of Thailand and Andaman Sea)

Aequorea is a genus of pelagic hydrozoans which encompasses several morphologically similar species. Their disc-like bodies are transparent with many unbranched radial canals and numerous marginal tentacles. They can be found both nearshore and offshore, usually in swarms.



Photograph credits: Department of Marine and Coastal Resources, Thailand (left); Sim Yee Kwang (right).

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flatten; disc-like; radially symmetrical
Colour	Transparent
Surface texture	Smooth
Pattern mark	Unbranched radial canals extended from the centre opening to bell margin
Tentacles	
Number	Numerous, increasing with the size
Shape	Thin; tube-like
Colour	Translucent white
Presence of tentacles	On outer bell margin

Class Hydrozoa

Order Leptothecata

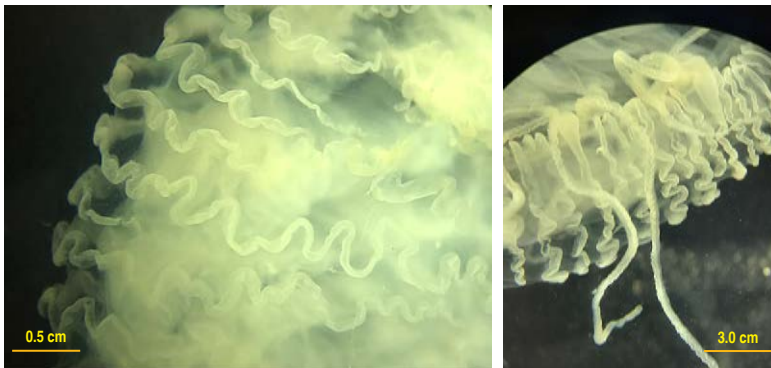
Family Aequoreidae

Zygocanna* sp.*Common Name** Crystal Jellyfish**Distribution** Thailand (Gulf of Thailand and Andaman Sea)

Zygocanna is a genus of pelagic hydrozoans which includes several near-identical species. Their disc-like bodies are transparent with many bifurcated radial canals and numerous marginal tentacles. They can be found both nearshore and offshore, mostly in swarms.



Photograph credits: Department of Marine and Coastal Resources, Thailand (left); Hiroshi Miyake (right).



Close up view of exumbrella (left); subumbrella view (right).

Photograph credit: Iffah Iesa.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flatten; disc-like; radially symmetrical
Colour	Transparent
Surface texture	Smooth with radial ridges
Pattern mark	Branched radial canals extended from centre opening to bell margin
Tentacles	
Number	Numerous, increasing with size
Shape	Thin; tube-like
Colour	Translucent white
Presence of tentacles	On outer bell margin

Class Hydrozoa

Order Leptothecata

Family Eirenidae

Eirene ceylonensis Browne, 1905**Common Name** NA**Distribution** Sri Lanka

This species has been originally described from Sri Lanka. Its distribution is within the Indian and Pacific Oceans.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical; diameter to about 1.5 cm
Marginal appendages	100 or more tentacles
Colour	Transparent
Gastrovascular system	
Stomach	With long, narrow and cylindrical peduncle
Radial canals	4; with gonads extending from the base of peduncle to near the bell margin

Class Hydrozoa

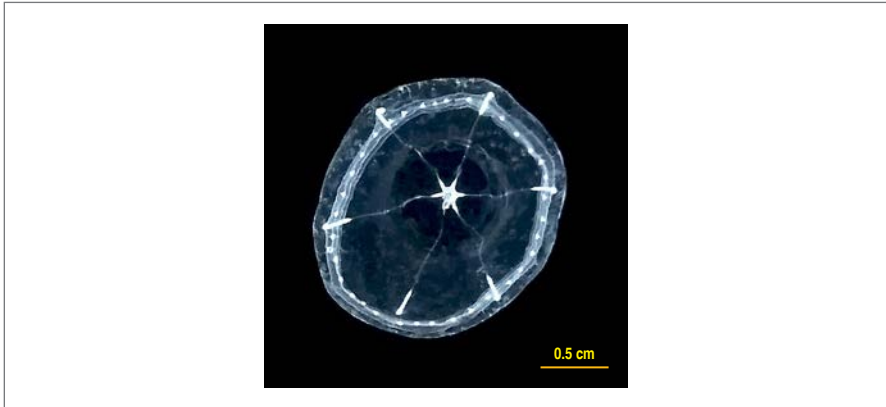
Order Leptothecata

Family Eirenidae

Eirene hexanemalis (Goette, 1886)

Common Name NA

Distribution Sri Lanka

Eirene hexanemalis is one of the most common hydromedusa reported in the Indian and Pacific Oceans.

Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flatter than a hemisphere; diameter to 2 cm
Marginal appendages	30–50 short and slender tapering tentacles, with large swollen bulbs
Colour	Nearly transparent
Gastrovascular system	
Stomach	Very small; with thick and conical peduncle
Radial canals	Usually 6 (4–8); gonads along the less than the distal half of radial canals

Class Hydrozoa

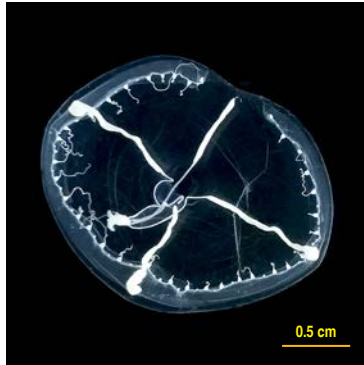
Order Leptothecata

Family Eirenidae

Eirene palkensis Browne, 1905

Common Name NA

Distribution Sri Lanka

Eirene palkensis has been originally described from Sri Lanka. Its distribution is within the Indo-Pacific region.

Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Diameter to about 2 cm
Marginal appendages	About 50 tentacles and about 3 times as many rudimentary bulbs
Colour	Transparent
Gastrovascular system	
Stomach	With a long, narrow and cylindrical peduncle
Radial canals	4; with gonads extending from base of peduncle to near margin

Class Hydrozoa

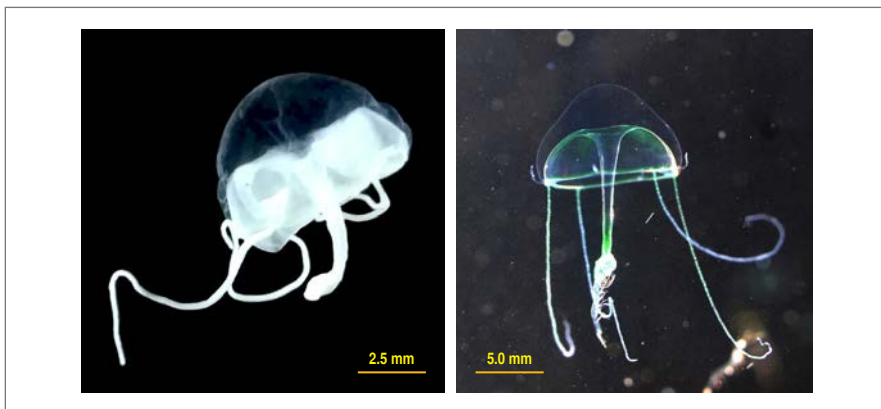
Order Limnomedusae

Family Geryoniidae

Liriope tetraphylla (Chamisso & Eysenhardt, 1821)

Common Name NA

Distribution Sri Lanka

The genus *Liriope* is a monospecific taxon. *Liriope tetraphylla* has been reported from the Atlantic, Indian and Pacific Oceans.

Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos (left); Hiroshi Miyake (right).

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical; diameter 1 cm
Marginal appendages	8 (4 long and 4 small) tentacles
Colour	Transparent to light greenish
Gastrovascular system	
Stomach	Small; peduncle of varying length
Radial canals	4; broad; 1–3 (or more) centripetal canals in each quadrant

Class Hydrozoa

Order Limnomedusae

Family Olindiidae

Olindias singularis Browne, 1905

Common Name NA

Distribution Sri Lanka

There are seven *Olindias* species over the world. *Olindias singularis* has been reported from the west Pacific and the Indian Ocean.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical; diameter 1.5–2.5 cm; height half of diameter
Marginal appendages	28–86 primary tentacles issuing above bell margin; 16–50 secondary tentacles on bell margin
Colour	Light greenish
Gastrovascular system	
Stomach	Small; short manubrium; no peduncle
Radial canals	4; each with 4–12 centripetal canals; gonads with papilliform processes

Class Hydrozoa

Order Narcomedusae

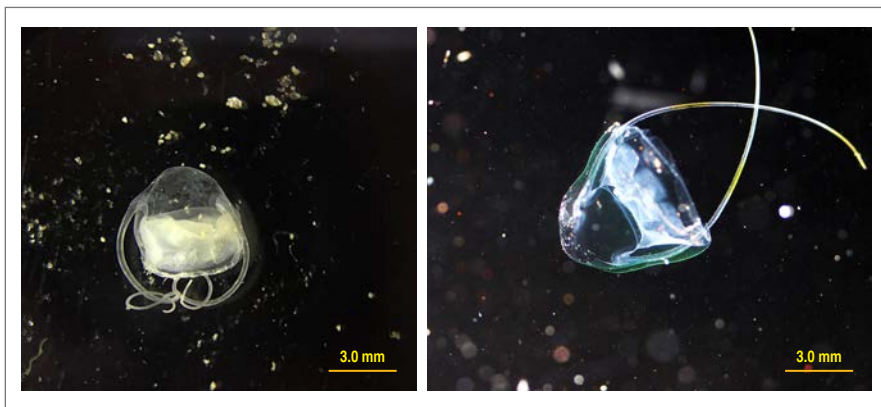
Family Solmundaeginidae

Solmundella bitentaculata (Quoy & Gaimard, 1833)

Common Name NA

Distribution Sri Lanka

The genus *Solmundella* is a monospecific taxon. *Solmundella bitentaculata* has been reported from the Atlantic, Indian and Pacific Oceans.



Photograph credits: Iffah Iesa (left); Hiroshi Miyake (right).

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Higher than wide; diameter to about 1 cm; epical jelly very thick
Marginal appendages	2 opposite very long tentacles issuing from umbrella near the apex
Colour	Transparent bell with greenish stomach and tentacles
Gastrovascular system	
Stomach	Broad and lenticular; no peduncle
Radial canals	Absent

Class Hydrozoa

Order Siphonophorae

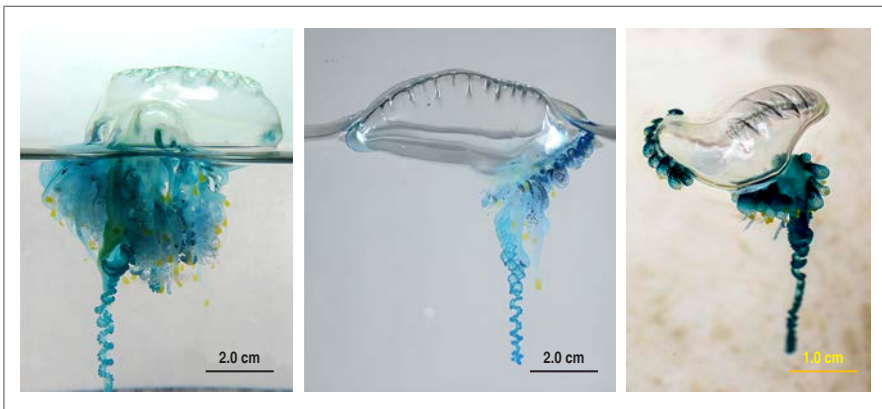
Family Physaliidae

Physalia physalis (Linnaeus, 1758)**Common Name** Portuguese Man O' War**Distribution** Indonesia (Bali and Java); Malaysia (Sabah); Sri Lanka and Philippines

Physalia physalis is a species of siphonophore jellyfish, also known as the Portuguese Man o' War, bluebottle (Australia), or obor-obor api (Indonesia). It can be found in tropical and subtropical waters worldwide. As a siphonophore, it differs from other types of jellyfish by being made up of individual many specialized, though genetically distinct, parts called zooids. These zooids are attached to one another and are physiologically integrated to such an extent that they cannot survive independently of one another, rather, combining together synergistically to function as an individual animal.



Photograph credit: Widiastuti.



Photograph credits: Cheong Kai Ching (left); Iffah Iesa (middle);
K. D. Karunaratne and M. D. S. T. de Croos (right).

Physical/morphological Characteristics	
Pneumatophore (Bell)	
Shape	Float with 3 lobes
Colour	Blue to purple
Surface texture	Smooth and soft; firm if inflated
Pattern mark	None
Bell top	Crest is present; similar to the keel of a ship
Bell edge	None
Presence of bell edge marginal tentacles	Bilaterally symmetrical; gas-filled sac
Bell section	Bilaterally symmetrical; gas-filled sac
Oral Arms & Tentacles	
Number of oral arms	None; has multiple tentacles up to 30 m in length
Layer of tentacles	3 types of zooids; Gastrozoid (digestive zooid), Tentacular palpon (stinging zooid) and Gonodendron (Reproductive zooid structure)
Shape of tentacles	Long and slender
Colour of tentacles	Blue with yellow tips
Presence of tentacles at the tip of oral arms	NA

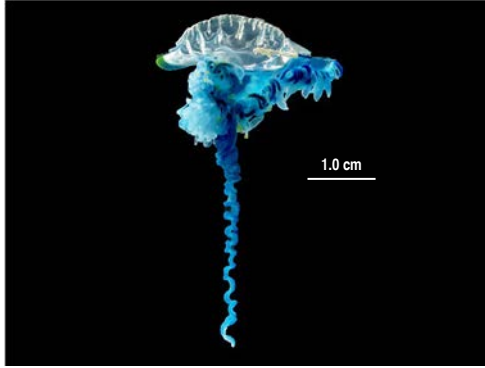
Class Hydrozoa

Order Siphonophorae

Family Physaliidae

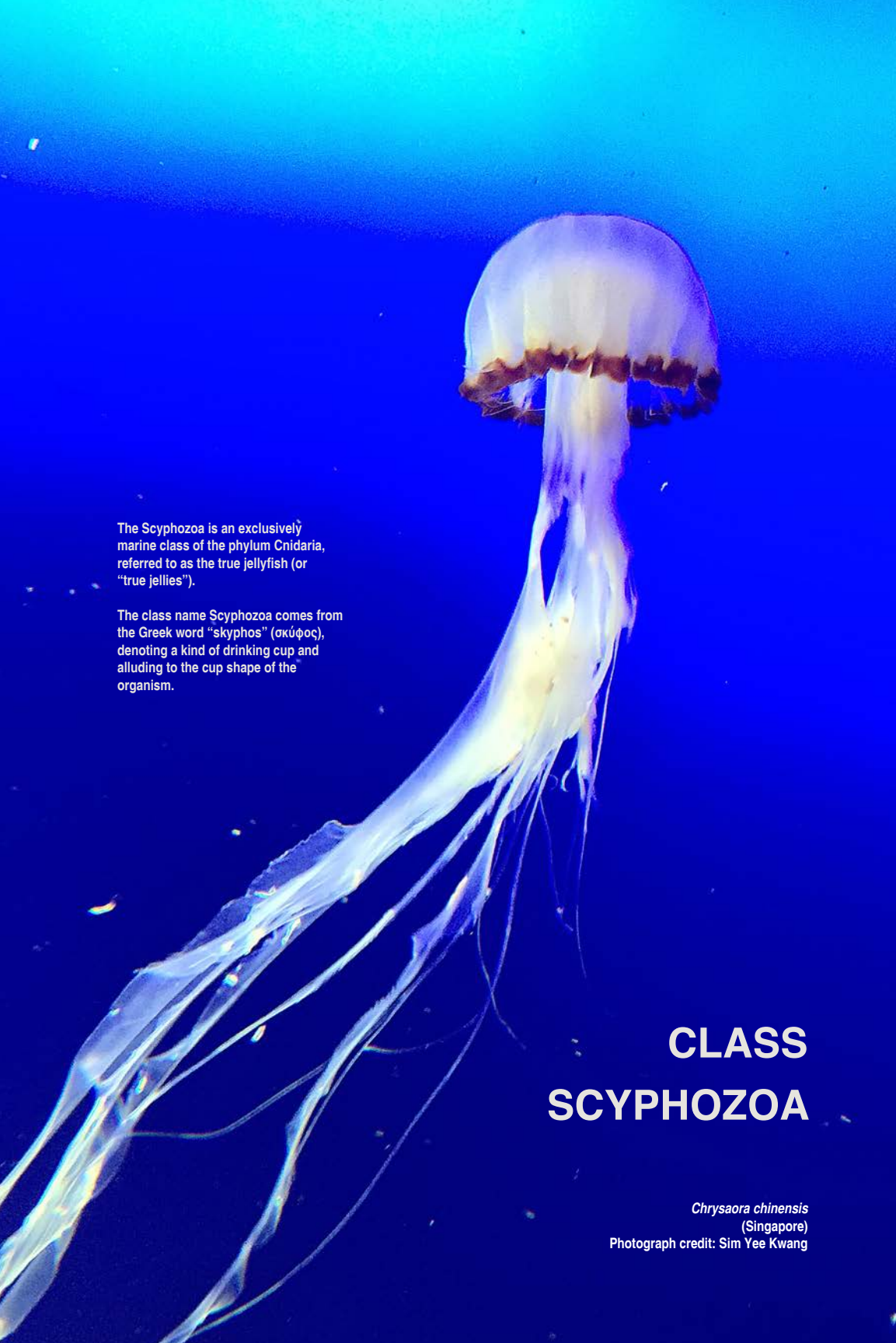
Physalia* sp.*Common Name** Portuguese Man O' War**Distribution** Thailand (Gulf of Thailand and Andaman Sea)

Physalia or the Portuguese Man O' War is a colony of individual organisms called Zooids, which functions as a single animal. The sail-shaped pneumatophore, a gas-filled bladder keeps the hydrozoa floating on the sea surface with the rest of the body submerged underwater.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Pneumatophore (Gas filled float)- Aboral (Upper)	
Shape	Sail-shaped gas-filled bladder
Colour	Blue turquoise
Surface texture	Smooth
Pattern mark	None
Tentacles	
Number	Differed between specimen
Shape	Spiral coil with a bead-like appearance
Colour	Blue turquoise
Presence of tentacles	Tentacle bearing zooids; attached to the underside of Pneumatophore



The Scyphozoa is an exclusively marine class of the phylum Cnidaria, referred to as the true jellyfish (or "true jellies").

The class name Scyphozoa comes from the Greek word "skyphos" (σκύφος), denoting a kind of drinking cup and alluding to the cup shape of the organism.

CLASS SCYPHOZOA

Chrysaora chinensis
(Singapore)

Photograph credit: Sim Yee Kwang

Introduction to Class Scyphozoa

The three major classes of medusozoan are Scyphozoa, Hydrozoa and Cubozoa. The class Scyphozoa comprises of two subclasses: Coronamedusae and Discomedusae. The Coronamedusae has an order Coronatae which is comprised of seven families, 14 genera including about 100 species. The other subclass Discomedusae is composed of two orders such as Rhizostomae and Semaestomeae. Rhizostomae has three families, six genera including about 50 species. The Semaestomeae has five families, eight genera including about 50 species (WoRMS, 2021).

The scyphozoans are exclusively marine; they can exist as planktonic, demersal or in attached form. Scyphozoan jellyfish predominates with medusoid stages. The polypoid individuals are small and inconspicuous but often long-lived, some groups are lacking polyps, but in some groups polyps produce medusae by asexual budding. The sense organs occur in notches and alternate with tentacles. Scyphozoan jellyfish mostly have tentacles at the outer margin of their bells, which are generally bowl-shaped. They also have oral arms at the centre of the sub-umbrella. The asexual form of scyphozoan cnidarians is a small polyp called the scyphistoma. It may produce new scyphistomae by budding from the column wall or from stolons. The medusae are produced by repeated transverse fission of the scyphistoma, the process called strobilation. Immature and newly released medusae are called ephyrae. A individual scyphistoma may survive only one strobilation event, or it may persist for several years, asexually giving rise to more scyphistomae and releasing ephyrae annually. The medusa phase clearly dominates the life cycles of the most scyphozoans.

The large scyphozoan jellyfish are considered a delicacy in several countries, especially in Chinese cuisine. Hitherto, there are about 10 edible species of Rhizostomeae. After being caught, the jellyfish are usually processed for consumption by salting or dried using the alum method, which utilises aluminium compounds that coagulate the protein content to ensure its insolubility in water. Southeast Asia was known for exporting jellyfish for major jellyfish consuming countries like Japan, China and Korea, about 200,000 tons were exported from the year 1988 to 1999 (Omori & Kitamura, 2011). They are most sought after in these counties due to traditional claims saying that consuming jellyfish can cure arthritis, hypertension, back pain and ulcers, aside from improving digestion, remedy fatigue and reduce skin swelling (Hsieh et al., 2001). However, the study for jellyfish biology is not stressed, and there is a lack of scientific evidence regarding the validity of these claims. Besides, the jellyfish in this region are only known by their local names. Hence, population fluctuations may decrease the rate of jellyfish exploitation in Southeast Asia.

In the past, the study for jellyfish diversity began with expeditions that were carried out throughout Southeast Asia, especially the Philippines and Indonesia. Even after the expeditions, there was still lack of studies regarding jellyfish diversity. This huge knowledge gap in ecological and taxonomical aspects regarding the invertebrates has been a big concern in Southeast Asia countries (Rizman-Idid et al., 2016).

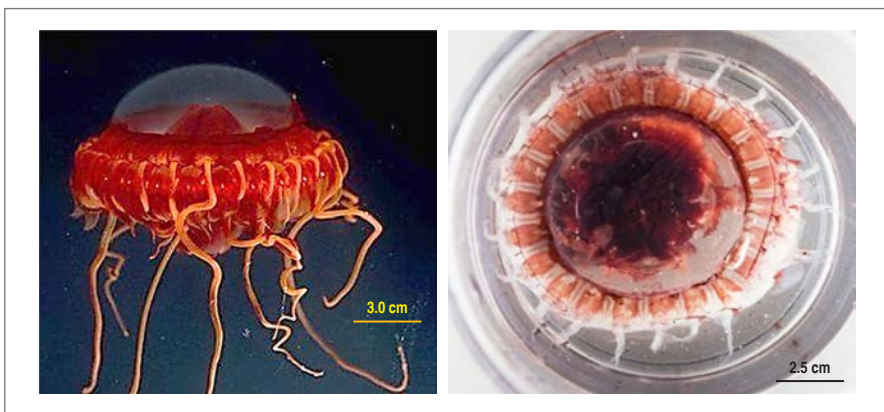
Class Scyphozoa

Order Coronatae

Family Atollidae

Atolla wyvillei Haeckel, 1880**Common Name** Crown Jellyfish; Alarm Jellyfish**Distribution** Philippines (Manila Bay)

Atolla wyvillei is a scyphozoan jellyfish species inhabiting cold, dark and deep midwater environments of up to 1000–4000 m in the Atlantic, Pacific, Indian, Arctic and Antarctic Oceans. Among past described specimens were from Philippines, Japan, Africa, Central and North America, and Tasmania.



Photograph credits: Michael Aw (left); Claude Nozères (right).

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Bell-shaped; nearly hemispherical; radially symmetrical
Colour	Red, reddish brown to orange; except translucent bell top
Surface texture	Smooth and soft on bell top; circular furrow on edge of dome, and coronal furrow
Pattern mark	No spots; umbrella with pigment pattern
Bell top	Dome-shaped
Bell edge	Edge folded inward and cleft into lappets; peripheral to this a zone of gelatinous thickenings (pedalia) divided by radiating clefts alternating in position with tentacles and rhopalia
Presence of bell edge marginal tentacles	22 (can reach to 32) solid and moderately long tentacles arising from cleft between lappets, with 1 hypertrophied for reproduction
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	Only thick mouth lips with 4 clefts
Layer of oral arms	NA
Shape of oral arms	Thick, extendable, clefted lips and tapering distally
Colour of oral arms (stalk) (lappet)	Red to maroon; magenta; same colour as the stomach
Presence of tentacles at the tip of oral arms	None, but distal edge slightly folded outward and slightly cleft

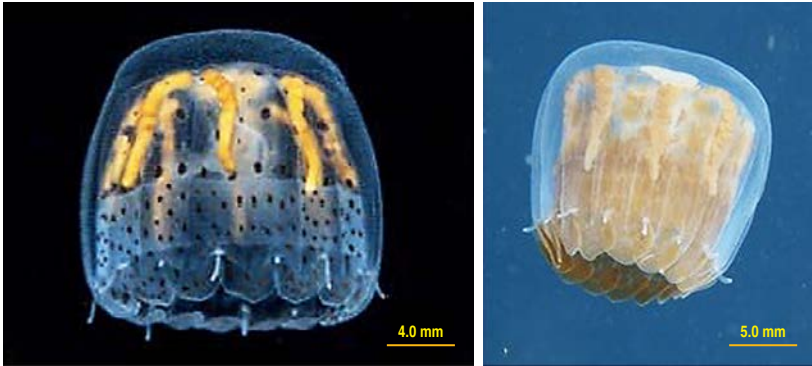
Class Scyphozoa

Order Coronatae

Family Linuchidae

Linuche aquila (Haeckel, 1880)**Common Name** Thimble Jellyfish**Distribution** Philippines (Davao, Mindanao)

Linuche aquila is a very small scyphozoan jellyfish species found in subtropical and tropical Pacific Ocean. Recent records show occurrence in Thailand, Malaysia, Philippines and the Indian Ocean including East Africa. Its ephyra (larval stage) can also cause severe itchiness (dermatitis) that can lead to seabather's eruption.



Photograph credits: Scott Tuason (left); krkzv (right).

Physical/morphological Characteristics

Exumbrella (Bell)

Shape	Bell-shaped but with a flat apex
Colour	Transparent
Surface texture	Smooth but subumbrella surface with 2 circular hollow protuberances
Pattern mark	Brown to black spots forming a band near bell edge; scattered on other areas of the bell
Bell top	Flat
Bell edge	With 16 bluntly oval marginal lappets and 8 rhopalia
Presence of bell edge marginal tentacles	With 16 very short tentacles
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of tentacles	8
Layer of tentacles	Single-layer projecting on bell edge in between inter-rhopalar lappet
Shape of tentacles	Very short and simple
Colour of tentacles (stalk) (lappet)	Whitish
Presence of appendages on tentacles	No appendages on tentacles

Nausithoe punctata Kölliker, 1853**Common Name** Crown Jellyfish**Distribution** Singapore; Sri Lanka and Thailand (Gulf of Thailand)

This worldwide distributed species is probably a species complex. Detailed studies on morphology, life cycle and genetics will provide further evidence to distinguish forms in this species complex. The life cycle is known for colonial specimens growing on sponges from the Mediterranean (Werner, 1973). A recent description of the medusa stage is provided by Jarms et al. (2002).



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Discoidal, with a crenate coronal groove; diameter to 1.5 cm
Surface texture	Finely warded
Marginal lappets	16; with numerous fine nematocyst warts; tentacle clefts and rhopalial clefts about equal in depth
Marginal tentacles	8
Colour	Jelly translucent-milky, greenish or light brownish; small crystalline spots on exumbrella
Oral Arms & Tentacles	
Number of oral arms	(lacking oral arms)
Shape	NA
Length	NA
Appendages	NA
Colour	NA

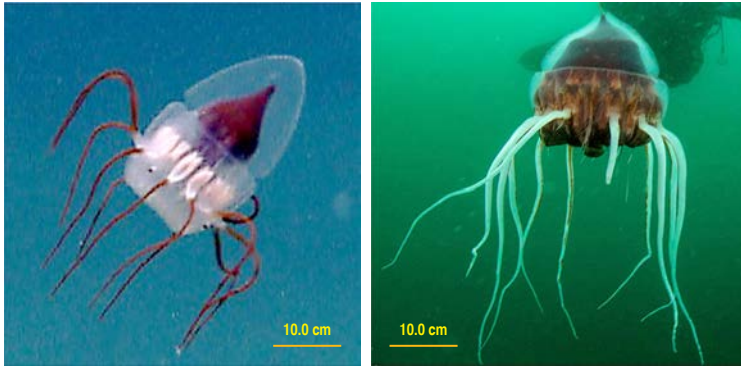
Class Scyphozoa

Order Coronatae

Family Periphyllidae

Periphylla periphylla (Péron & Lesueur, 1810)**Common Name** Crown Jellyfish; Helmet Jellyfish**Distribution** Philippines (Iligan Bay and Mindanao Sea)

Periphylla periphylla is a scyphozoan jellyfish species recorded from deep sea zones of tropical, subtropical, and temperate regions. The species is widely distributed in the world's oceans, seas and fjords. It vertically migrates from 1000 m to the surface at night and avoids light exposure. Tentacles of this bioluminescent species can be very lethal. Photos below are illustrative of the species.



Photograph credits: Jian Rzeszewicz (left); Poul Erik Rasmussen (right).

Physical/morphological Characteristics

Exumbrella (Bell)

Shape	Dome or helmet shaped; radially symmetrical; higher than wide
Colour	Purple, violet, red-brown due to stomach colour; mesoglea translucent to clear; subumbrella of same colour as stomach
Surface texture	Smooth
Pattern mark	Minute pigmentation in central dome, lappets and coronal groove
Bell top	Pointed; semi-spherical
Bell edge	Inward folded; with coronal groove containing pedalia and lappets
Presence of bell edge marginal tentacles	Above the margin are 12 stiff and thick tentacles and 16 lappets and 4 interradial rhopalia hanging downwards between clefts of lappets
Bell section	Octant (8 sections)

Oral Arms & Tentacles

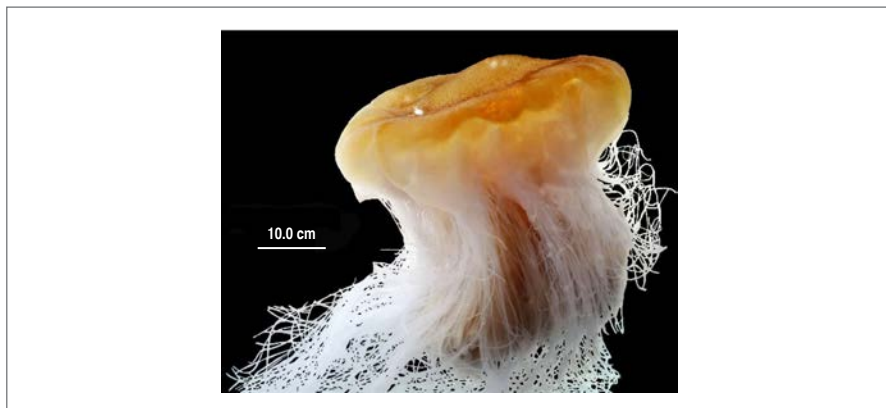
Number of oral arms	Only thickened mouth lips that are extendable downwards
Layer of oral arms	NA
Shape of oral arms	Reduced as thick lips
Colour of oral arms (stalk) (lappet)	Thickened lips purple or violet or red-brown
Presence of tentacles at the tip of oral arms	None

Cyanea buitendijki Stiasny, 1919

Common Name Elephant Placenta Jellyfish (Rok-Chang in Thai)

Distribution Thailand (Gulf of Thailand and Andaman Sea)

Cyanea buitendijki is a much smaller relative of lion's mane jellyfish. They also have numerous fine, hair-like tentacles extended from the umbrella, arranged in 8 horseshoeshaped clusters.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flatten; radially symmetrical
Colour	Light to dark orange
Surface texture	Finely granulated
Pattern mark	None
Bell top	Furnished with many granules
Bell edge	32 marginal lappets (4 per octant)
Presence of bell edge marginal tentacles	Numerous fine tentacles arising from the base of the 8 marginal lappets
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	4
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Long, frilly and tatter-like
Colour of oral arms (stalk) (lappet)	Light to dark orange
Presence of tentacles at the tip of oral arms	None

Class Scyphozoa

Order Semaestomeae

Family Cyneidae

Cyanea nozakii Kishinouye, 1891**Common Name** Lion's Mane Jellyfish**Distribution** Philippines (Leyte)

Cyanea nozakii is a large jellyfish species recorded from the Indo-West Pacific region. First described from Japanese specimens, the distribution of the species is also known in the Northwest Pacific, Indian Ocean, China and Indo-China waters.



Photograph credit: Ryan Yue Wah Chan.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flat-topped and saucer-shaped; radially symmetrical
Colour	Milky or creamy white to pale yellow; dark center and translucent rim
Surface texture	Smooth and soft
Pattern mark	Opaque white spots; distributed evenly
Bell top	Very flat
Bell edge	With large 8 marginal lobes or lappets; 8 rhopalia located near the clefts of the pair of smaller lappets or flaps
Presence of bell edge marginal tentacles	With 8 bundles or clusters of thread-like marginal tentacles; Each bundle can have 100 or more of these translucent or red tentacles arranged in 4 rows; some tentacles can reach a length of 10 m
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	4
Layer of oral arms	Block of highly folded arms; arise from underneath the bell and surround the mouth; distal ends become membranous
Shape of oral arms	Frilly and like folded curtains
Colour of oral arms (stalk) (lappet)	Creamy white or yellowish-brown
Presence of tentacles at the tip of oral arms	None

Class Scyphozoa

Order Semaestomeae

Family Cyneidae

***Cyanea* sp.**

Common Name Lion's Mane Jellyfish

Distribution Malaysia (Penang; Selangor; Kedah and Melaka) and Sri Lanka

Species from this genus can be found in Atlantic and Pacific and has a perceptible sting. This is one of the two largest jellyfish reported from Sri Lanka. Currently, 17 species of lion's mane jellyfish have been reported over the world.



Photograph credit: Mohammed Rizman-Iddid.



Dorsal view on exumbrella or bell (middle); ventral view (right).

Photograph credit: Sim Yee Kwang.



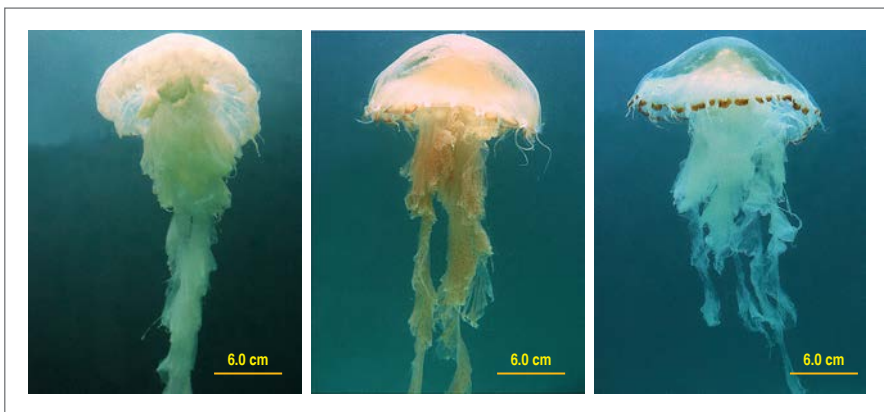
Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flattened hemispherical; mesoglea is rigid, thick in the centre and thin towards the bell margin
Colour	Yellowish-brown or reddish; and sometimes almost colourless
Surface texture	Smooth or finely granulated; numerous faint warts on exumbrella surface, denser at the centre of the bell and sparser towards the cleft of the lappet
Pattern mark	None
Bell top	Flattened
Bell edge	16 semi-square lappets overlapping each other along bell margin
Presence of bell edge marginal tentacles	No marginal tentacles; 8 whorls of tentacles originating from the coronal muscle at the subumbrella. Tentacles are soft, straight and string-like
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	4 oral arms, up to 4 times as long as the diameter of the bell
Layer of oral arms	Oral arms formed at the end of the oral pillar
Shape of oral arms	Oral arms are soft and curtain like
Colour of oral arms (stalk) (lappet)	Oral arms are transparent
Presence of tentacles at the tip of oral arms	Scapulae, terminal clubs and filaments were absent

Class Scyphozoa

Order Semaestomeae

Family Pelagiidae

Chrysaora chinensis Vanhöffen, 1888**Common Name** Sea Nettle; Ribbon Jellyfish**Distribution** Bangladesh (Northern Bay of Bengal); Indonesia (Jakarta Bay); Malaysia (Penang; Perak; Langkawi, Kedah; Selangor; Johor and Kelantan) and Singapore*Chrysaora chinensis* or the Indonesian sea nettle, is a species of jellyfish in the family Pelagiidae. It is native to the central Indo-Pacific region and its sting is considered dangerous.

Photograph credit: Sim Yee Kwang.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Saucer-shaped bell
Colour	Creamy white or reddish-brown
Surface texture	Smooth and soft
Pattern mark	Evenly distributed white or orangish red dots, the reddish-brown petaloid ring might present at bell edge
Bell top	Spherical
Bell edge	Slightly folded inward
Presence of bell edge marginal tentacles	Slightly folded inward
Bell section	Quadrant
Oral Arms & Tentacles	
Number of oral arms	4
Shape of oral arms	Long and ribbon-like, with ruffled edges
Colour of oral arms	Creamy white or orangish-brown, orangish red dots might present
Marginal tentacles	Long thin semi-transparent tentacles
Appendages at the tips of oral arms	None

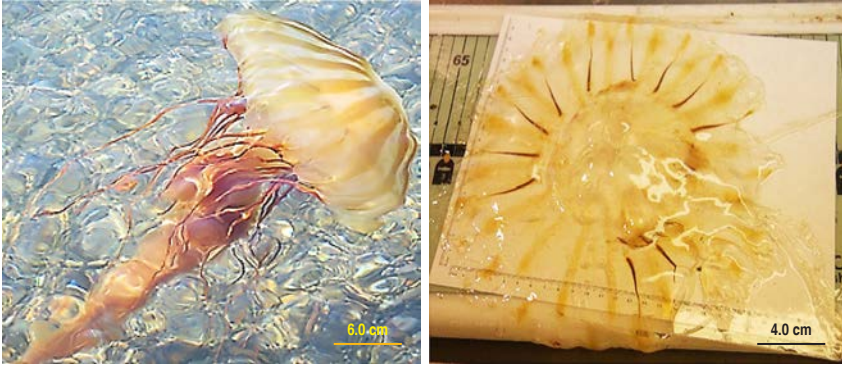
Class Scyphozoa

Order Semaestomeae

Family Pelagiidae

Chrysaora pacifica (Goette, 1886)**Common Name** Sea Nettle**Distribution** Philippines (Manila Bay and San Miguel Bay, Luzon)

Chrysaora pacifica is a scyphozoan jellyfish species that appears cosmopolitan having recorded in the tropics, subtropics, and temperate regions. Past described specimens were collected from Japan, Philippines, Alaska, Kamchatka, California, Trivandrum Coast (India) and Bay of Bengal.



Photograph credit: kilasiak.

Physical/morphological Characteristics

Exumbrella (Bell)

Shape	Hemispherical, but flatter in young; radially symmetrical
Colour	32 brownish streaks arising from apical brown ring on exumbrella; 16 radiating dark brown to black streaks on subumbrella
Surface texture	Smooth but very tiny nematocysts are scattered on surface
Pattern mark	Tiny brown spots
Bell top	Slightly flat
Bell edge	3 to 5 marginal non-overlapping lappets per octant
Presence of bell edge marginal tentacles	24 to 40 tentacles on edge with each pair of the 8 rhopalia, in deep rhopalar clefts; alternating successively between 3 to 5 lappets
Bell section	Octant (8 sections)

Oral Arms & Tentacles

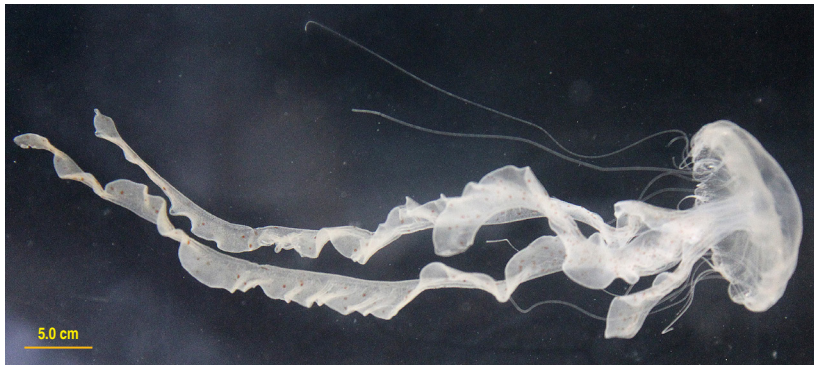
Number of oral arms	4
Layer of oral arms	1 layer, arising from outer edge of mouth on the subumbrella
Shape of oral arms	Oral arms linear and V-shaped in cross-section, with broad frilly margins, more or less coiled around central body down to distal part
Colour of oral arms (stalk) (lappet)	Brown to orange
Presence of tentacles at the tip of oral arms	None

Chrysaora* sp.*Common Name** Sea Nettle**Distribution** Sri Lanka and Thailand (Gulf of Thailand and Andaman Sea)

Chrysaora sp. is a true jellyfish with long, frilly mouth-arms and fiery stings, which may result in a burn-like wound on the skin. They are called "Fire Jellyfish" in Thai. Since sea nettles often come together in swarms, they might cause severe injuries to swimmers. Currently, the genus *Chrysaora* owns 16 valid species while *C. caliparea* which discovered in the Indian waters has been considered as the taxon inquirendum. Sri Lankan species owns some of the key characters of both the respective Indian species and *C. chinensis*.



Photograph credit: Department of Marine and Coastal Resources, Thailand.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Mushroom-shaped to hemispherical; radially symmetrical flatter than a hemisphere; diameter to 17 cm
Colour	Pinkish to milky translucent or translucent; whitish to brownish bell with usually reddish-brown marginal lappets, spots, and/or radiating stripes
Surface texture	Finely granulated
Pattern mark	NA
Bell top	Spherical
Bell edge	4–6 elongated marginal lappets per octant
Presence of bell edge marginal tentacles	24 long and thin marginal tentacles (3–5 per octant)
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	4
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Long, frilly, tatter-like and ribbon-like
Colour of oral arms (stalk) (lappet)	Transparent, whitish or brownish with reddish-brown spots
Appendages at the tips of oral arms	None

Class Scyphozoa

Order Semaestomeae

Family Pelagiidae

Pelagia noctiluca (Forsskål, 1775)**Common Name** Mauve Stinger**Distribution** Indonesia (Raja Ampat Island and Malang Beach, East Java) & Malaysia (Sabah)

Pelagia noctiluca is a strong stinging jellyfish from family Pelagidae, hence the well-known name mauve stinger. This species is also known as oceanic jelly from their holoplanktonic cycle, without polyp benthic stage in their life cycle.



Photograph credit: WoRMS.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Bell dome-shaped
Colour	Bell rich rose-purple; exumbrellar warts orange-brownish red
Surface texture	Numerous nematocyst warts; arranged in more or less irregular lines radiating from the apex
Pattern mark	None
Bell top	NA
Bell edge	NA
Presence of bell edge marginal tentacles	8 tentacles; 2–3 times as long as bell diameter; hollow and proximal base elliptical
Bell section	
Oral Arms & Tentacles	
Number of oral arms	4 oral arms; 1.5 times as long as bell diameter
Layer of oral arms	Numerous nematocyst warts on the distal part
Shape of oral arms	NA
Colour of oral arms (stalk) (lappet)	Oral arms mauve-pink to yellowish-brown
Presence of tentacles at the tip of oral arms	NA

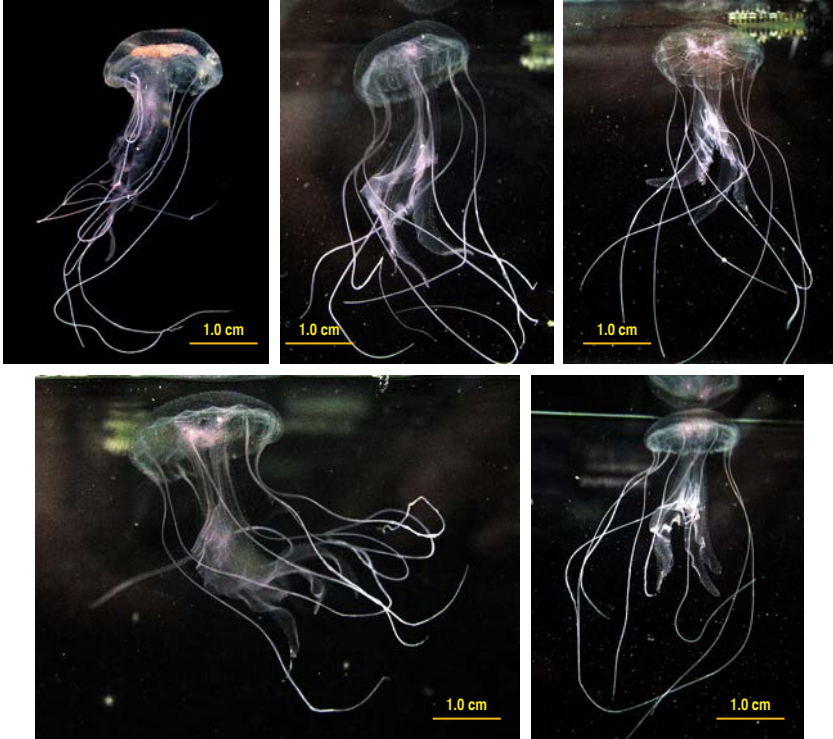
Class Scyphozoa

Order Semaestomeae

Family Pelagiidae

Pelagia panopyra Péron & Lesueur, 1810**Common Name** Sea Nettle**Distribution** Philippines (Jolo, Northern Visayan Sea and Samar)

Pelagia panopyra is a jellyfish species recorded from a range of tropical and subtropical localities in the Indo-West Pacific including Southern Japan and also recorded in Eastern Tropical Pacific waters of Peru, Chile and USA. Oldest specimens were recorded in Philippines and Indonesia.



Photograph credit: Department of Marine and Coastal Resources, Thailand.



Photograph credits: Serafin Geson III (left); blackdogto (right).

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical to somewhat flattened; radially symmetrical
Colour	Variable; transparent to translucent white
Surface texture	Nematocyst warts throughout the bell; small warts and number variable
Pattern mark	Warts magenta to brown giving colour to bell
Bell top	Flat
Bell edge	With 16 marginal lappets
Presence of bell edge marginal tentacles	With 8 marginal tentacles arising at some distance from the margin from clefts of the lappets and alternating with each of the 8 rhopalia
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	4
Layer of oral arms	Attached to long peduncle is a single layer of arms flanking the mouth
Shape of oral arms	Long, hollow, pointed and much folded and fringed; with conspicuous warts
Colour of oral arms (stalk) (lappet)	Translucent to creamy white
Presence of tentacles at the tip of oral arms	None

Class Scyphozoa

Order Semaestomeae

Family Pelagiidae

Pelagia* sp.*Common Name** Purple-striped Jellyfish, Mauve Stinger**Distribution** Sri Lanka and Thailand (Gulf of Thailand and Andaman Sea)

Pelagia is a genus of fairly small jellyfish with fiery stings. When the large number of these species are carried nearshore, they can cause health hazard to the swimmers. They are relatively easy to spot due to their usual bright pink or purple coloured bell and tentacles.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

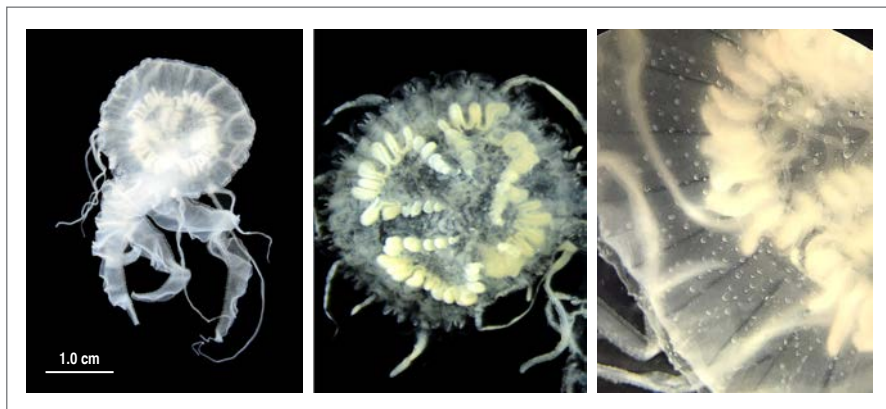
Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Mushroom-shaped; radially symmetrical; hemispherical; 4 cm in diameter
Colour	Colourless to purple; purplish exumbrella with dark spots
Surface texture	Finely granulated to strongly granulated
Pattern mark	NA
Bell top	Spherical
Bell edge	16 marginal lappets
Presence of bell edge marginal tentacles	8 long and thin marginal tentacles
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	4
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Long, pointed, many-folded and ribbon-like
Colour of oral arms (stalk) (lappet)	Colourless to speckled rose-red; purplish with darker patches
Presence of tentacles at the tip of oral arms	None

Sanderia malayensis Goette, 1886

Common Name NA

Distribution Indonesia (Java); Philippines and Singapore

Medium-sized semaestomeae with a transparent umbrella, covered with prominent nematocyst warts on its exumbrella surface. Four gastric pouches with its edge lined with distinct finger-like gonadal papillae.



Preserved example: scale = 1.0 cm [ZRC.CNI.1431] (left); subumbrella view with a close-up of fingerlike gonadal papillae, fringing along the edge of the gastric pouches [ZRC.CNI.1443] (middle); closeup of exumbrella surface covered with fine nematocyst warts (left).

Photograph credit: Iffah Iesa.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flat
Colour	Generally translucent with white or creamy gonadal papillae; can have violet colouration
Surface texture	Slightly 'grainy' outlook due to nematocyst warts
Pattern mark	More texture-based than colouration (see "Surface texture")
Bell top	Observable 4 interradial horseshoe to the heart-shaped gastric pouch with finger-like papillae. Variable shapes of gastric pouches
Bell edge	Slightly curved with 16 rhopalia
Presence of bell edge marginal tentacles	16 marginal tentacles
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	4
Layer of oral arms	Single manubrium extends to 4 oral arms with complex folds
Shape of oral arms	Tapering oral arms with complex folds
Colour of oral arms (stalk) (lappet)	May bear a violet cast on along its edges (live)
Presence of tentacles at the tip of oral arms	None

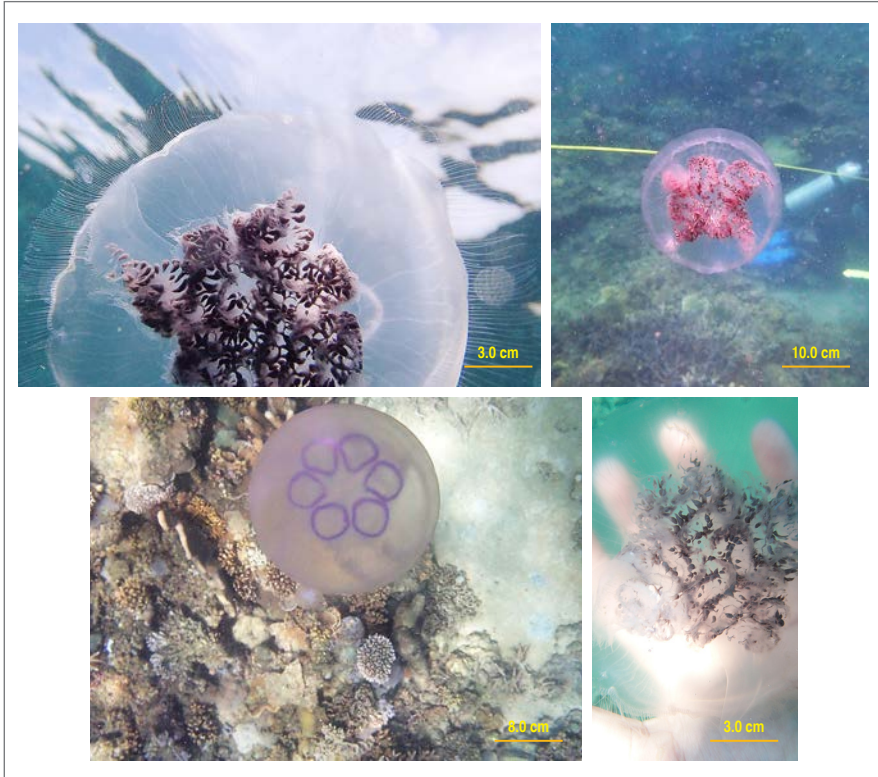
Class Scyphozoa

Order Semaestomeae

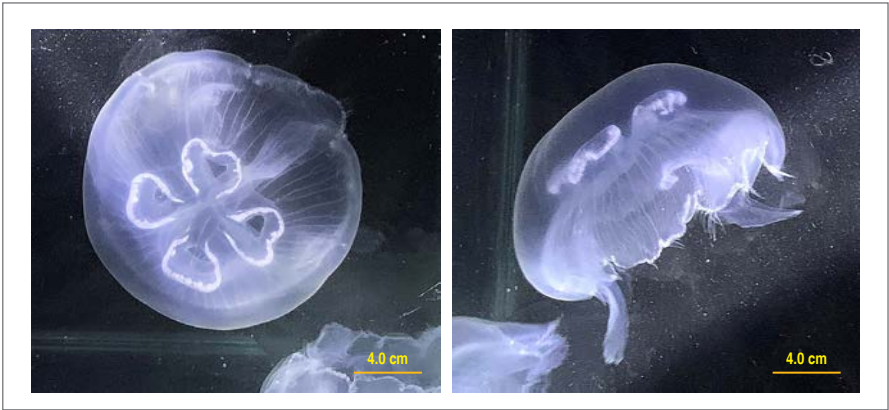
Family Ulmaridae

Aurelia* sp.*Common Name** Moon Jellyfish**Distribution** Indonesia (Java); Malaysia (Penang and East Coast, Sabah); Sri Lanka and Thailand (Eastern Gulf of Thailand and Andaman Sea)

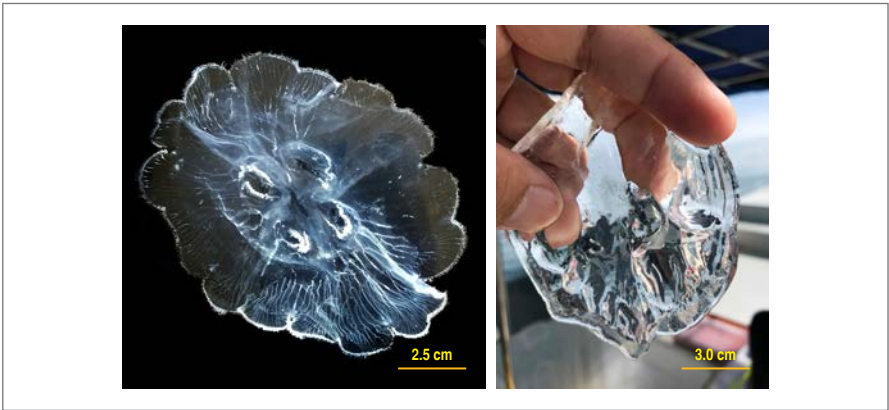
***Aurelia* sp.** is a species complex of jellyfish, commonly known as moon jellyfish. The species are closely related and difficult to identify without genetic analysis. The genus itself can easily be recognised by the four horseshoe-shaped gonads observed from the top of the umbrella. They are inshore species, which can be found throughout the world oceans, especially in estuaries and harbours.



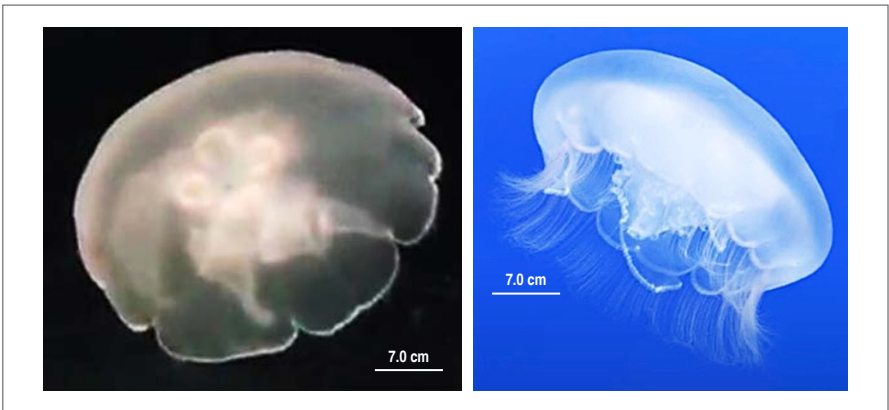
Photograph credit: Mohd. Ali Syed Hussein.



Photograph credit: Department of Marine and Coastal Resources, Thailand.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos (left); Sim Yee Kwang (right).

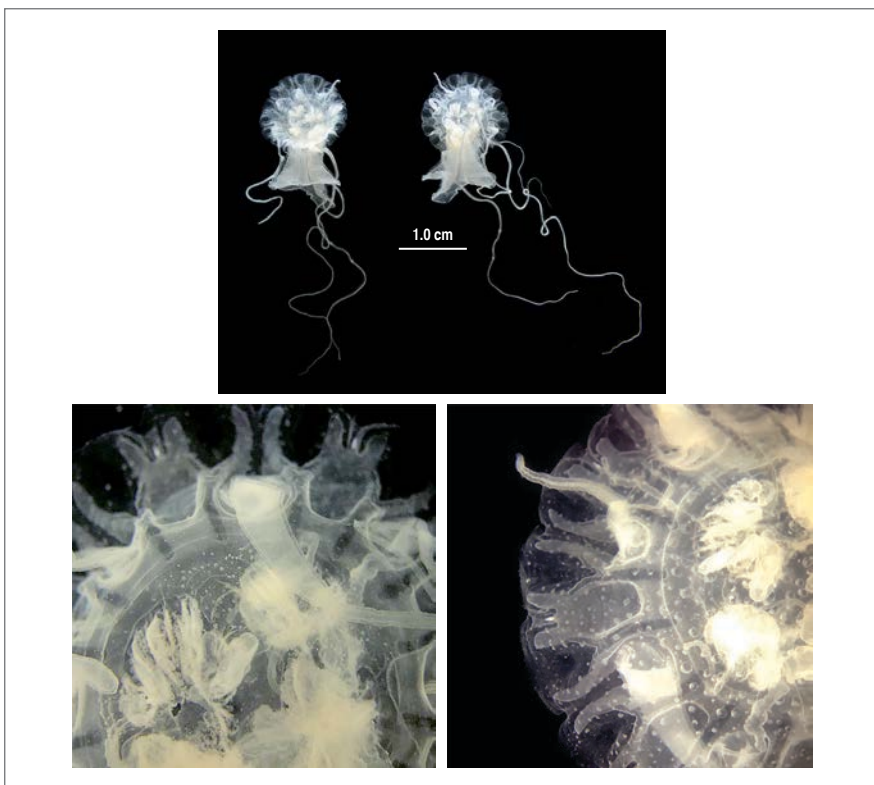


Photograph credits: Ephrime B. Metillo.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Saucer shaped bell; flattened dorsal-ventrally; radially symmetrical; flatter than hemispherical; radially symmetrical
Colour	Variation of bluish; fairly transparent, with visible gonads; nearly transparent
Surface texture	Smooth and soft
Pattern mark	None
Bell top	Flatten-spherical; smooth
Bell edge	Simple; broad lappets; scalloped edges; not folded in
Presence of bell edge marginal tentacles	Yes
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	4–8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Thick semi-transparent; stiff with crenulated margins; thin strap-like tentacles
Colour of oral arms (stalk) (lappet)	Translucent white
Presence of tentacles at the tip of oral arms	None

Ulmaris snelliusi Stiasny, 1935**Common Name** NA**Distribution** Singapore

Small-sized Semaestomeae medusa with broad rectangular lappets, tapering marginal tentacles around three times the length of bell diameter.



Two views of a preserved example: [ZRC.CNI.1442] (top); subumbrella view (bottom left); exumbrella view with nematocyst warts (bottom right).

Photograph credit: Iffah Iesa.

Physical/morphological Characteristic	
Exumbrella (Bell)	
Shape	Flat, shield-shaped
Colour	Translucent to milky
Surface texture	Slightly 'grainy' outlook due to nematocyst warts
Pattern mark	More texture-based than colouration (see "Surface texture")
Bell top	Speckled with nematocyst warts
Bell edge	8 rhopalia; 16 marginal broad lappets
Presence of bell edge marginal tentacles	8 marginal tentacles, gradually tapering; marginal tentacles a short distance from bell edge
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	Single manubrium
Layer of oral arms	Manubrium extends longer than bell radius
Shape of oral arms	Cruciform
Colour of oral arms (stalk) (lappet)	Translucent to milky
Presence of tentacles at the tip of oral arms	NA

Class Scyphozoa

Order Rhizostomeae

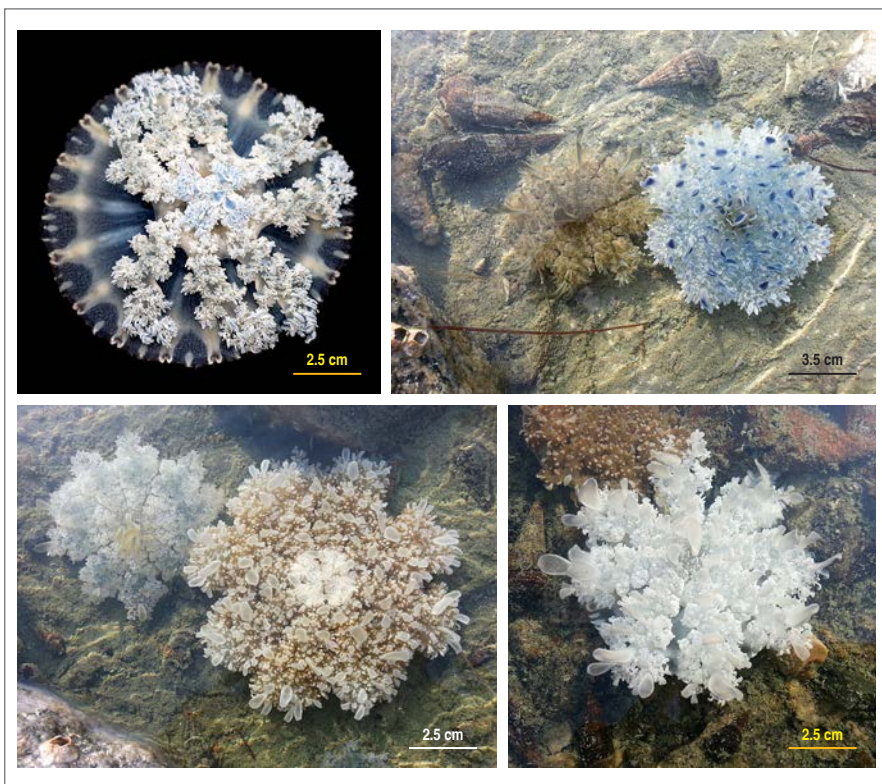
Family Cassiopeidae

Cassiopea andromeda (Forskål, 1775)

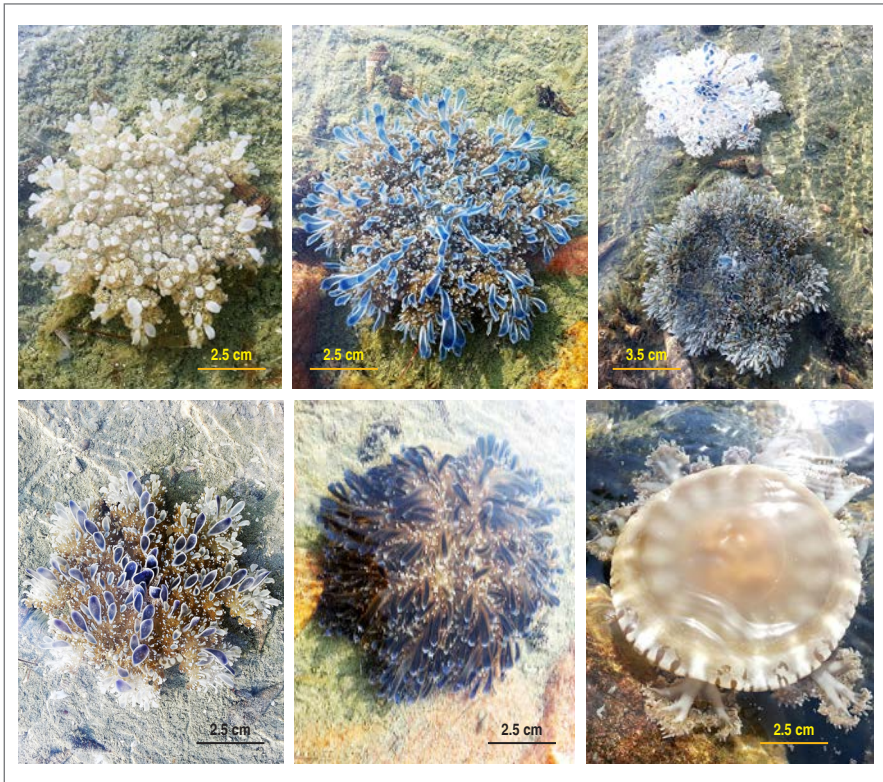
Common Name Upside Down Jellyfish

Distribution Indonesia (Lembah Strait and Bali) and Sri Lanka

There are 10 valid species of *Cassiopea*. *Cassiopea andromeda* is native to the Indian Ocean, but currently it has been reported to be invasive in several seas over the world.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

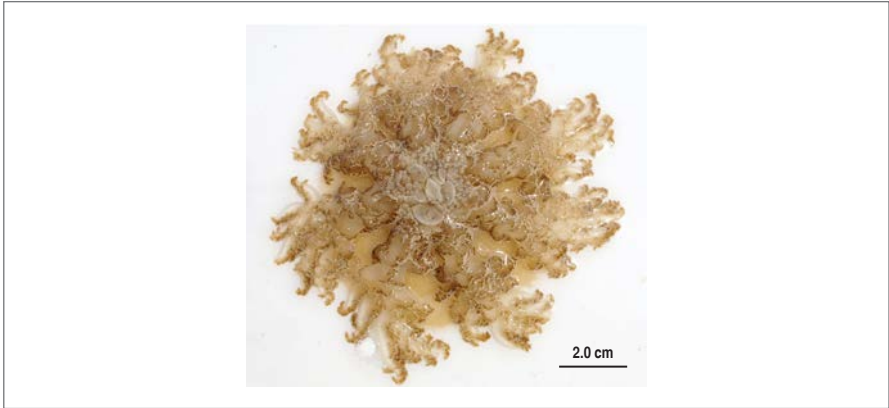


Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

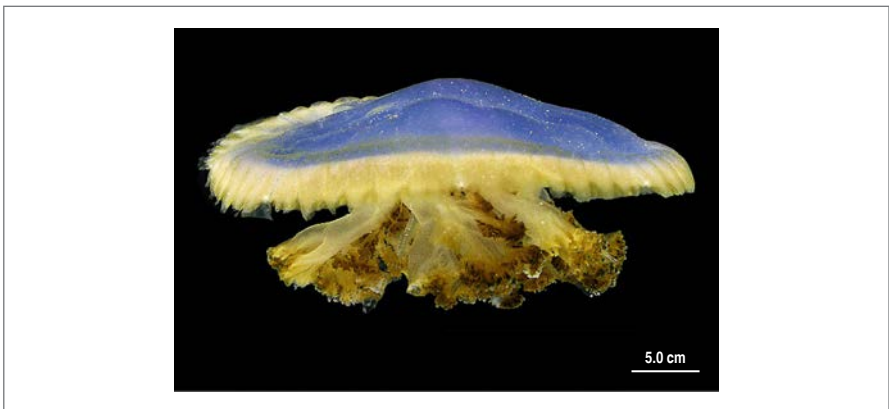
Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flat and disk-shaped; diameter to 21 cm
Surface texture	Center of exumbrella surface smooth; peripheral partially rough
Marginal lappets	Blunt; about 100 lappets per medusa
Marginal tentacles	Absent
Colour	Mostly brown with paler spots
Oral Arms & Tentacles	
Number of mouth-arms	8
Shape	Wide, flat and alternately arranged lateral branches (4–6 main branches)
Length	About as long as the bell radius
Appendages	Flat, leaf-shaped appendages (5 or more appendages arising from the middle; smaller appendages arranged along each oral arm)
Colour	Various (white, blue, brown, etc.)

Cassiopea ornata Haeckel, 1880**Common Name** Upside Down Jellyfish**Distribution** Indonesia (Misool Island); Philippines (Iligan Bay, Mindanao) and Thailand (Andaman Sea)

Cassiopea ornata is one of the upside down jellyfish species recorded from a range of tropical, subtropical, and mild temperate localities in the Pacific and Atlantic and Indian Ocean (west of Sumatra) localities. Earliest descriptions of specimens were from Palao Islands, Papua New Guinea, Australia, Saipan and Japan. They are found in warmer coastal regions around the world, including shallow mangrove swamps, mudflats, canals, and turtle grass flats.



Photograph credit: Ephrime B. Metillo.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flat and disk-shaped; Radially symmetrical
Colour	Golden to light brown; transparent white
Surface texture	Smooth and soft
Pattern mark	White polygonal marks near edge
Bell top	Flat
Bell edge	Thin and inward folded with 5 lappets per octant and 16 rhopalia equidistantly arranged throughout the distal edge
Presence of bell edge marginal tentacles	None
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Single layer of arms that surround the mouth; extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Cylindrical and slender arms with 5 main tree-like branches; only small and club-shaped vesicles between the mouth
Colour of oral arms (stalk) (lappet)	Translucent pale white
Presence of tentacles at the tip of oral arms	With terminal club

Class Scyphozoa

Order Rhizostomeae

Family Cassiopeidae

Cassiopea ndrosia Agassiz & Mayer, 1899

Common Name Upside Down Jellyfish

Distribution Philippines (Iligan Bay, Mindanao)

Cassiopea ndrosia or the upside down jellyfish species is recorded in shallow tropical waters, in coastal lakes and mangrove areas. Earliest described specimens are from Fiji Islands (type locality), New Caledonia and Australia.



Photograph credits: Ephrime B. Metillo (top); Dan Monceaux (bottom).

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flat and disk-shaped; radially symmetrical
Colour	Light brown to translucent
Surface texture	Smooth and soft
Pattern mark	None; but sometimes with white polygonal marks on the margin
Bell top	Shallow concavity at centre
Bell edge	Thin and inward folded with 4 lappets per octant; near the distal edge are 18–22 rhopalia equidistantly arranged throughout the distal edge
Presence of bell edge marginal tentacles	None
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Single layer surrounding the mouth
Shape of oral arms	Cylindrical with tree-like branches and numerous flattened, expanded and leaf-shaped vesicles between mouth; no ribbonlike filaments
Colour of oral arms (stalk) (lappet)	Light brown to yellowish-brown; translucent
Presence of tentacles at the tip of oral arms	None

Class Scyphozoa

Order Rhizostomeae

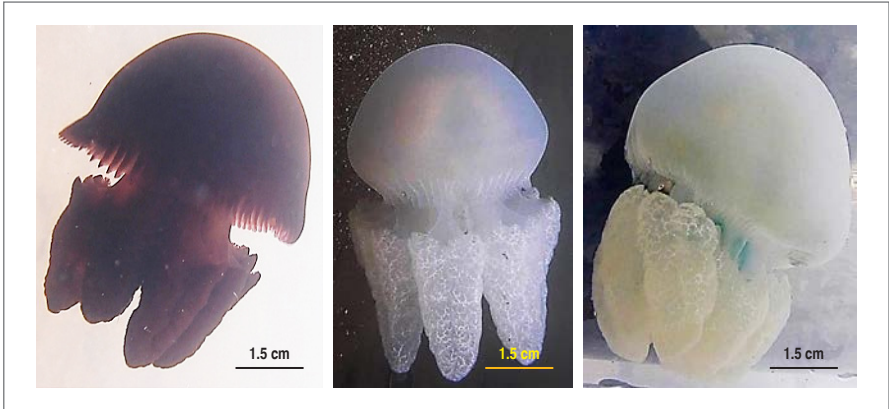
Family Catostylidae

Acromitoides purpurus (Mayer, 1910)

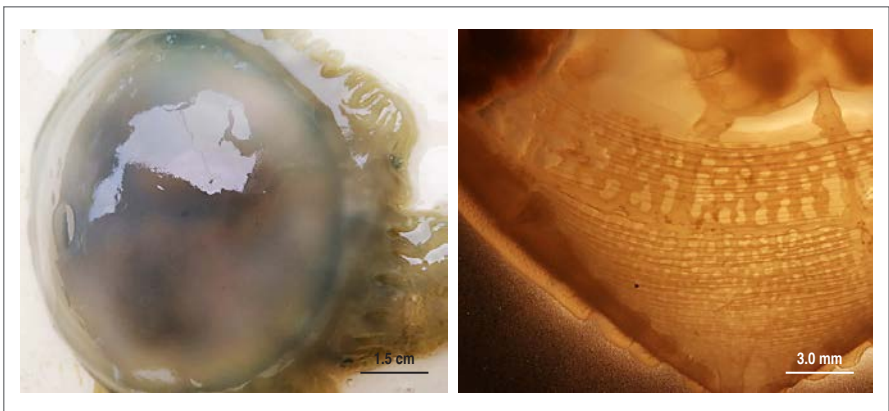
Common Name Dark Brown Jellyfish

Distribution Philippines (Panguil Bay; Carigara Bay; Manila Bay; Babatngon, Leyte; Capooacan, Leyte and Barugo, Leyte)

Acromitoides purpurus is a relatively small jellyfish species, with documented distribution in Philippine marine shallow coastal waters. In both Panguil Bay, Northern Mindanao and Carigara Bay, Western Leyte, the species shows colour polymorphism with creamy white, yellow, blue and orange oral arms. Documented occurrence is the Philippines.



Photograph credit: Ephrime B. Metillo.



Photograph credit: Libertine Agatha F. Densing.



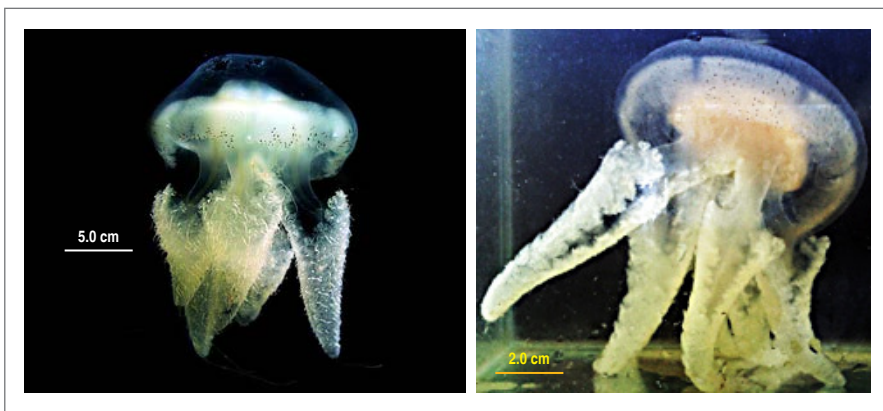
Photograph credit: Libertine Agatha F. Densing.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical; radially symmetrical
Colour	Variation of dark brown, creamy white, light orange, yellow and blue
Surface texture	Smooth
Pattern mark	No spots and markings
Bell top	Slightly pointed semi-spherical
Bell edge	Inward folded; each octant with 4 clefts and 2 simple velar lappets
Presence of bell edge marginal tentacles	None
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Single layer; projected under the bell and encircle mouth opening
Shape of oral arms	Short, straight and cylindrical with a 3-winged lower portion
Colour of oral arms (stalk) (lappet)	Dark brown; variation of creamy white, light blue, yellow and orange
Presence of tentacles at the tip of oral arms	No tentacles on oral arms

Class Scyphozoa

Order Rhizostomeae

Family Catostylidae

Acromitus flagellatus (Maas, 1903)**Common Name** River Jellyfish**Distribution** Indonesia (Jakarta; Surabaya; Serang; Cirebon and Probolinggo); Malaysia (Perak; Selangor; Penang and Sabah) and Thailand (Gulf of Thailand & Andaman Sea)*Acromitus flagellatus* is a species of jellyfish who share the same family with *Catostylus*, Catostylidae. Found in mangroves and estuaries. They are jellyfishes localized in coastal water in the intertropical of Indo-Pacific, present from India, Indonesia and Japan.

Photograph credits: Department of Marine and Coastal Resources, Thailand (left); Sim Yee Kwang (right).

Physical/morphological Characteristics**Exumbrella (Bell)**

Shape	Hemispherical bell; slightly pointed
Colour	Creamy white
Surface texture	Smooth and soft
Pattern mark	Evenly distributed dark brown spots
Bell top	Dome shape; flatter than hemisphere
Bell edge	Inwardly folded
Bell section	Octant

Oral Arms & Tentacles

Number of oral arms	8 (8 sections)
Shape of oral arms	Octopus-like oral arms with ruffled edges
Colour of oral arms	Creamy white
Marginal tentacles	None
Appendages at the tips of oral arms	1 whip-like tentacle on each oral arm

Class Scyphozoa

Order Rhizostomeae

Family Catostylidae

Acromitus hardenbergi Stiasny, 1934**Common Name** River Jellyfish; River Type (trade name)**Distribution** Malaysia (Perak) and Singapore

Acromitus hardenbergi can be found at mouths of rivers and even further inland, up to about 24 km upstream from the river mouth (Stiasny, 1934) and have been reported to be white or slightly brown and lightly pink or purple (Kitamura & Omori, 2010); but not light pastel blue or pale sky blue (exumbrella/bell) as in photographs below.



Photograph credit: Hiroshi Miyake.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Relatively flat; thin around the apex and toward margin; thick in middle portion
Colour	White or slightly brown; but faintly pink or orange in some live specimens
Surface texture	Smooth; finely granulated overall
Pattern mark	Unevenly distributed dark red spots; spotless in some live specimens
Bell top	Dome shape; flatter than hemisphere
Bell edge	Inwardly folded
Presence of bell edge marginal tentacles	None
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8; not coalesced with each other
Shape of oral arms	Extended straight beneath the bell and encircle mouth opening
Colour of oral arms	Orange
Appendages at the tips of oral arms	Whip-like appendages and thread-like transparent tentacle present at the end of each oral arms

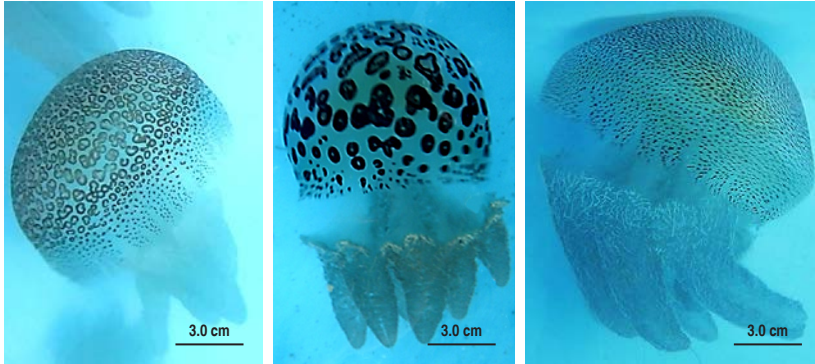
Class Scyphozoa

Order Rhizostomeae

Family Catostylidae

Acromitus maculosus Light, 1914**Common Name** Panther Jellyfish**Distribution** Philippines (Taytay Bay, Palawan)

Acromitus maculosus has been found in the tropical Western Central Pacific: the Malayan Archipelago including the Philippines, Myanmar, Malaysia, Vietnam, Thailand and Indonesia. Known occurrences in the Philippines are in Taytay Bay and Malampaya Sound, Northern Palawan and Carigara Bay, Western Leyte.



Photograph credit: Ephrime B. Metillo.

Physical/morphological Characteristics

Exumbrella (Bell)

Shape	Hemispherical; radially symmetrical
Colour	Pale blue, but deeper blue along radial canals
Surface texture	Covered with minute, blunt, cone-shaped projections
Pattern mark	With circular, ring-shaped, solid, elongated or irregular purplish black to dark brown spots
Bell top	Dome shape; flatter than hemisphere
Bell edge	With 80 marginal lappets folded inward
Presence of bell edge marginal tentacles	None
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Single layer straight beneath the bell and encircle mouth opening
Shape of oral arms	Thick and broad; not coalesced with each other
Colour of oral arms (stalk) (lappet)	More blue than bell
Presence of tentacles at the tip of oral arms	Each oral arm with a terminal whip-like filament, with long thread-like endings

Class Scyphozoa

Order Rhizostomeae

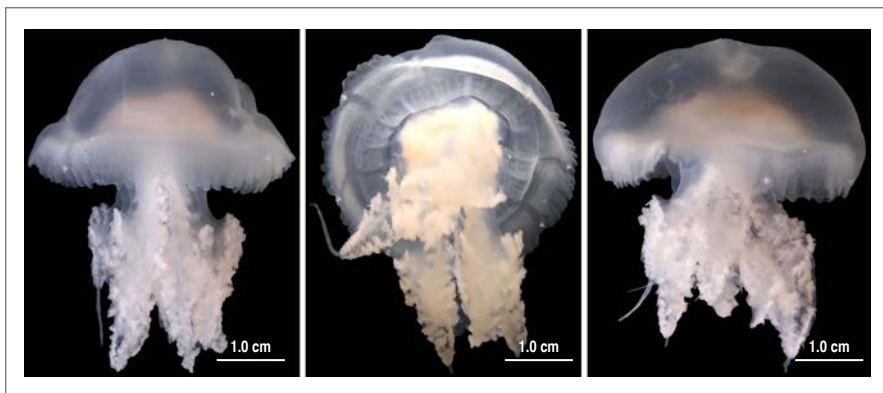
Family Catostylidae

***Acromitus* sp.**

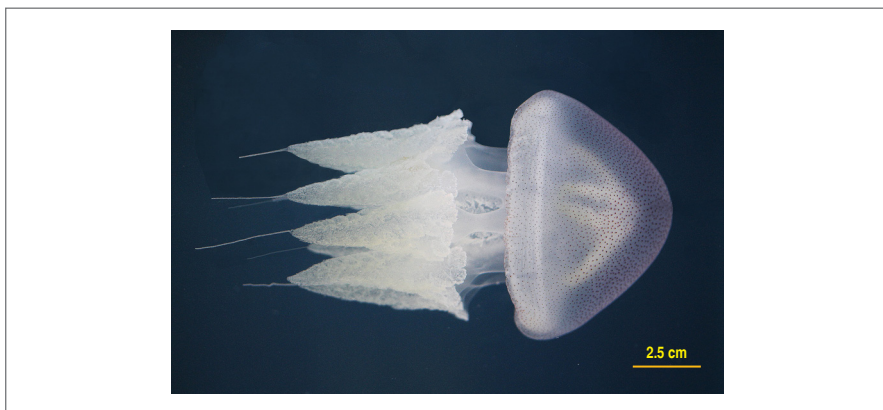
Common Name None

Distribution Bangladesh (Northern Bay of Bengal) and Sri Lanka

Species of *Acromitus* occur in brackish water and marine environments. There are 5 valid species of *Acromitus*, which are distributed in the Indo-Pacific region.



Photograph credits: S.M. Sharifuzzaman and Yean Das.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical
Colour	Whitish to grey; slightly translucent bell whitish, greenish, bluish, purplish or brownish with dark spots; rings and streaks on exumbrella
Surface texture	Smooth or finely granulated
Pattern mark	Typically with an unusual distribution of dark brown spots; rarely spotless
Bell top	Slightly pointed
Bell edge	Inward
Presence of bell edge marginal tentacles	None
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	NA
Shape of oral arms	Pyramidal and 3-winged oral arms as long as the bell diameter; with whip-like filaments
Colour of oral arms (stalk) (lappet)	Whitish, greenish, bluish or purplish but slightly translucent
Presence of tentacles at the tip of oral arms	Thread-like transparent appendage present at the end of each oral arms

Class Scyphozoa

Order Rhizostomeae

Family Catostylidae

Catostylus townsendi Mayer, 1915

Common Name Blubber Jellyfish

Distribution Indonesia (Jakarta); Malaysia (Kelantan and Sabah); Philippines and Thailand (Gulf of Thailand and Andaman Sea)

Catostylus townsendi is a species of jellyfish, also known as the blubber jellyfish, blackspotted jellyfish or obor-obor pasir (in Malay). It is native to the Southeast Asian region from Australia to Taiwan.



Photograph credit: Michael Yap Tzuen Kiat.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

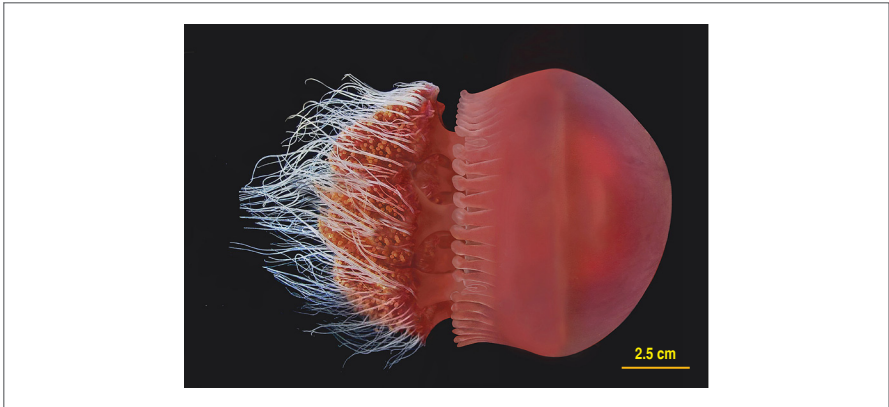
Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Mushroom-shaped bell; nearly hemispherical; radially symmetrical
Colour	Creamy white with spots
Surface texture	Smooth and soft
Pattern mark	Opaque spots; the colour of spots varies from brown to green to black
Bell top	Hemi-spherical
Bell edge	Inward folded
Presence of bell edge marginal tentacles	No
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Thick semi-transparent; highly dichotomous oral arms with a triangular cross-section
Colour of oral arms (stalk) (lappet)	White with brown patterning
Presence of tentacles at the tip of oral arms	None

Crambione mastigophora Maas, 1903

Common Name Prigi-Type Jellyfish

Distribution Indonesia (East Java and Sumbawa Island) and Sri Lanka

The genus *Crambione* owns three valid species and *C. mastigophora* is a commercially harvested in Southeast Asia.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical; diameter to 16 cm
Surface texture	Smooth
Marginal lappets	Elongate, with rounded outer edges; amongst deep furrows; usually 64 (7–11 per octant)
Marginal tentacles	Absent
Colour	Light red to dark brown
Oral Arms & Tentacles	
Number of oral arms	8
Shape	Pyramidal and 3-winged
Length	About as long as bell radius
Appendages	Many small club-shaped and some long filamentous appendages
Colour	Reddish or brownish

Class Scyphozoa

Order Rhizostomeae

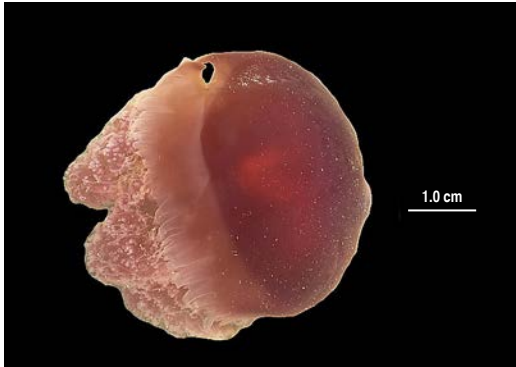
Family Catostylidae

***Crambione* sp.**

Common Name NA

Distribution Thailand (Andaman Sea)

Crambione sp. characterized by following features: exumbrella smooth; in each octant 8–10 velar lappets, elongate with rounded outer edges and deep clefts; arm-disk very wide; oral arms about as long as bell radius.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical; radially symmetrical
Colour	Reddish-brown
Surface texture	Smooth
Pattern mark	NA
Bell top	Highly arched
Bell edge	8–10 velar lappets per octant
Presence of bell edge marginal tentacles	None
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Long as bell radius; distal 3-winged portions as long as proximal simple portion; distal portion pyramidal, with many small clubshaped and some long filamentous appendages
Colour of oral arms (stalk) (lappet)	Reddish-brown
Presence of tentacles at the tip of oral arms	None

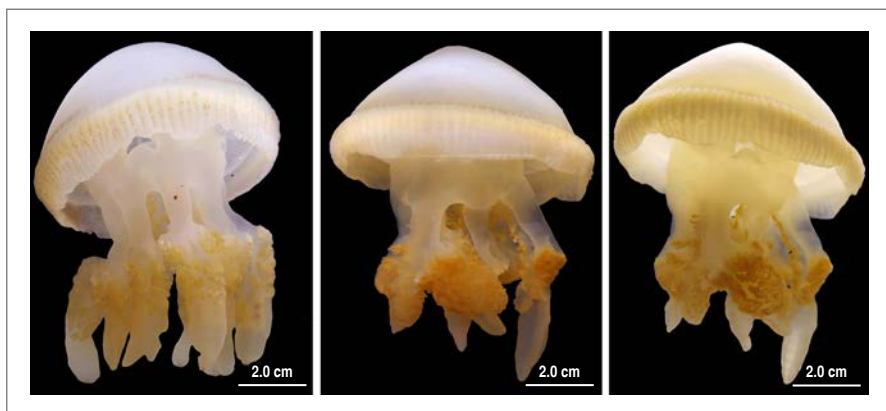
Class Scyphozoa

Order Rhizostomeae

Family Catostylidae

Crambionella annandalei Rao, 1931**Common Name** Ball Type Jellyfish**Distribution** Bangladesh (Northern Bay of Bengal)

Crambionella annandalei is a species of scyphozoan jellyfish, also known as the ball type or the sunflower type jellyfish. It blooms seasonally in the northwest Indian Ocean.



Photograph credits: S.M. Sharifuzzaman and Yean Das.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Dome-shaped bell; finely granular
Colour	Pale brown with brood dark brown in the margin
Surface texture	Smooth, plump
Pattern mark	No spot; no pattern
Bell top	Hemispherical
Bell edge	Inward, numerous conical projections present on exumbrella margin
Presence of bell edge marginal tentacles	None
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Naked proximal and 3-winged distal portions; furrows like appendages surrounded in the middle; taped 3-winged terminal club present at the end of the oral arm
Colour of oral arms (stalk) (lappet)	Transparent whitish to brown
Presence of tentacles at the tip of oral arms	No tentacles at the tip

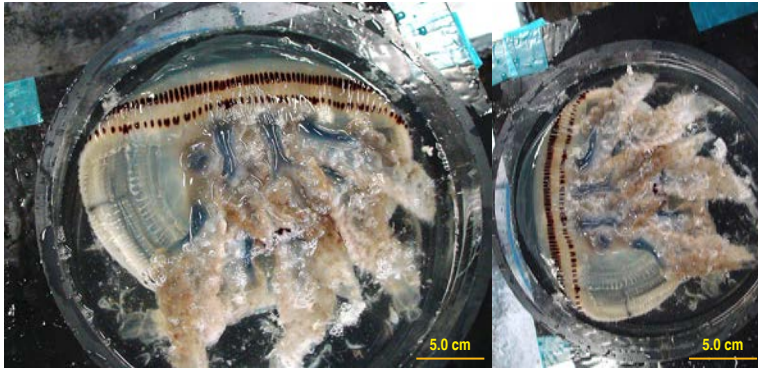
Class Scyphozoa

Order Rhizostomeae

Family Catostylidae

Crambionella helmbiru Nishikawa, Mulyadi & Ohtsuka, 2014**Common Name** Cilacap Type (trade name in Indonesia)**Distribution** Indonesia (Cilacap, Central Java)

Crambionella helmbiru is a new species that were found in Cilacap, Central Java, Indonesia. This species is an edible jellyfish species that were on trade for more than 40 years known as Cilacap type or locally called 'common jellyfish'. Until in 2014 it is finally identified as a new species.



Photograph credit: Hiroshi Miyake.

Physical/morphological Characteristics

Exumbrella (Bell)

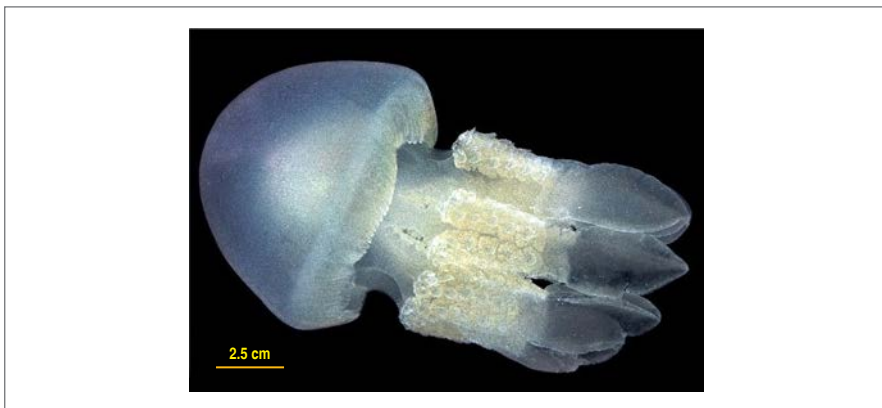
Shape	Hemispherical or dome-shaped with a diameter of 140–220 mm
Colour	Pale blue in apical part; cream in marginal part
Surface texture	Exumbrellar surface finely granulated but smooth
Pattern mark	None
Velar lappets	Columnar with rounded corner terminally, usually triangular or trapeziform proximally in cross-section; 14 lappets per octant (varying from 12–18)
Rhopalia	8 rhopalia on the margin of umbrella in moderately deep notches. Each rhopalium having 2 small rhopalal lappets with pointed tips
Presence of bell edge marginal tentacles	None
Bell section	NA
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	None
Shape of oral arms	Oral-arms are well developed, as long as umbrella height; the outer proximal margin of shaft cylindrical, without frills; middle part trifoliate-winged, bearing paired frills on the outer surface
Colour of oral arms (stalk) (lappet)	Whitish, reddish-purple on the end
Presence of tentacles at the tip of oral arms	None

***Crambionella* sp.**

Common Name Ball-Type Jellyfish

Distribution Sri Lanka

There are four valid species of *Crambionella*. All of these species are distributed in the Indian and Pacific Oceans. *Crambionella* species are harvested in Southeast Asia.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical; with a diameter up to 24 cm
Surface texture	Finely granulated
Marginal lappets	Sharp-pointed; usually 128 (16 per octant); amongst deep furrows
Marginal tentacles	Absent
Colour	Whitish, greenish, brownish
Oral Arms & Tentacles	
Number of oral arms	8
Shape	Pyramidal and 3-winged
Length	About as long as bell radius
Appendages	Lower arm with foliaceous appendages, and a gelatinous, pyramidal, bluntly pointed, 3 cornered terminal knob
Colour	Whitish, yellowish, greenish, brownish

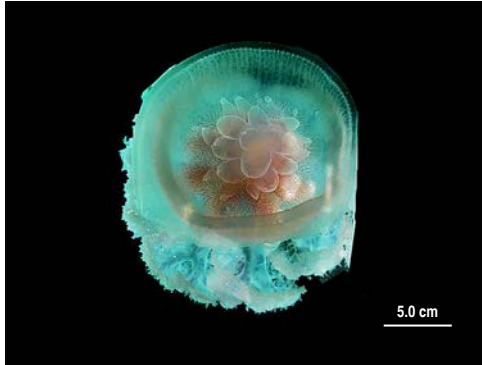
Class Scyphozoa

Order Rhizostomeae

Family Cepheidae

Cephea cephea (Forskål, 1775)**Common Name** Crown Jellyfish**Distribution** Malaysia (Terengganu); Philippines; Sri Lanka and Thailand (Gulf of Thailand and Andaman Sea)

There are four valid species of *Cephea* and all of these species have been reported in the Indian and Pacific Oceans. *Cephea cephea* is used as an ornamental marine species in aquariums.



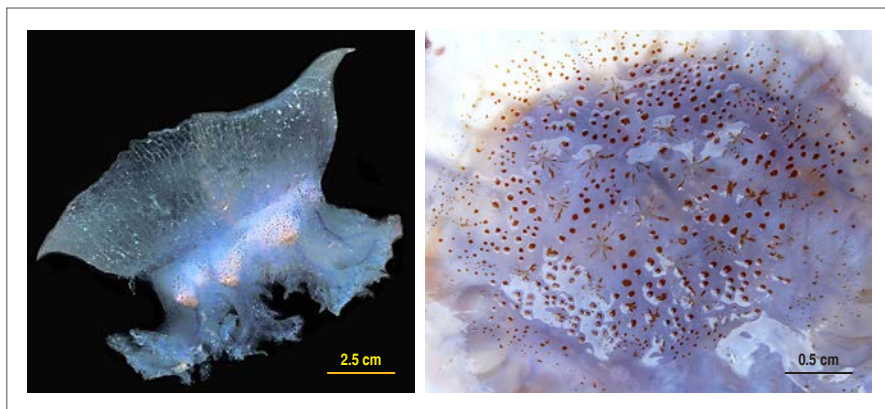
Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Inverted hat-shaped with a central dome; diameter 30 cm
Surface texture	Central dome bearing 30 difference sized; pointed to rounded and gelatinous protuberances
Marginal lappets	Round; 64 (8 per octant); united by a membrane
Marginal tentacles	Absent
Colour	Bluish, without colour patterns on exumbrella
Oral Arms & Tentacles	
Number of oral arms	8
Shape	Pyramidal and 3-winged
Length	About as long as bell radius
Appendages	Several short clubs and long, hollow, slender tapering filaments
Colour	Mouth-arms bluish-brown; short clubs whitish; filaments colourless

Marivagia stellata Galil & Gershwin, 2010

Common Name NA

Distribution Sri Lanka

Marivagia is a monotypic genus, which contains *M. stellata*. It has been reported to be invasive on Mediterranean waters.

Side view (left); exumbrellar view (right).

Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Inverted hat-shaped without a central dome; diameter to 20 cm
Surface texture	Lacking of conspicuous warts, papillae or knobs
Marginal lappets	Large, broad, distinct and tongue-shaped; 48 (6 per octant)
Marginal tentacles	Absent
Colour	Translucent, purplish or bluish-white jelly; with an obvious pattern of reddish stars, spots and streaks clustered in the center third of exumbrella
Oral Arms & Tentacles	
Number of oral arms	8
Shape	Triangular in cross-section, bifurcated distally, bearing numerous tiny and lateral branches
Length	Shorter than bell radius
Appendages	Numerous small and spindle-shaped appendages
Colour	Translucent, purplish or bluish-white jelly; sometimes distal ends of mouth-arms reddish-brown in colour

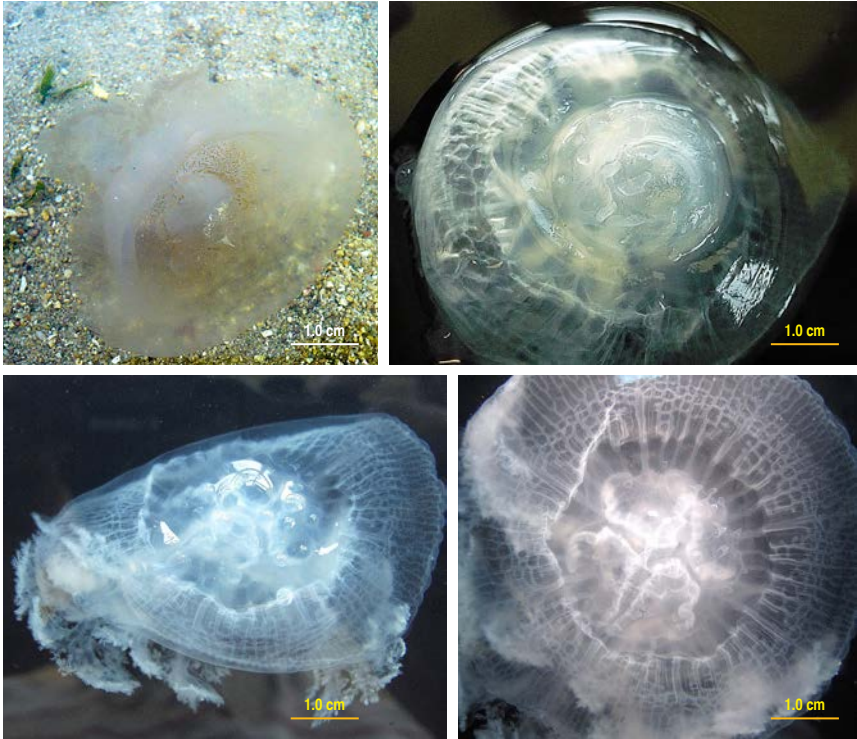
Class Scyphozoa

Order Rhizostomeae

Family Cepheidae

Netrostoma dumokuroa (Agassiz & Mayer, 1899)**Common Name** Crown Jellyfish**Distribution** Malaysia (Terengganu) and Singapore

Netrostoma is a genus of jellyfish, also known as the crown jellyfish and closely related to species from the genus *Cephea*. It has a bell with a dome bearing warts/protuberances or a large smooth central knob. Medium-sized individual, unmistakable due to a large central knob present at the center of its bell. Central knob is embellished with up to 20 papillae arranged in two whorls; knob in itself is surrounded by a shallow furrow. Bell is overall flattened and bumpy in texture. Oral arms are distinctly frilly. It is distributed in the Indo-Pacific and has a perceptible sting.



Lateral view with frilly oral arms visible (tip left and bottom left); exumbrella view (top right and bottom right). Photograph credit: Nicholas Yap Wei Liang.



Photograph credit: Mohammed Rizman-Idid.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Bell with a prominent dome, smooth, surrounded by 2 verticils of solid papillae and a wide; flattened and inverted disk with large central knob and shallow furrow
Colour	White, transparent, sometimes blue and milky white in fixative
Surface texture	Bumpy (see "Bell top"); smooth and soft
Pattern mark	More texture than colouration pattern (see "Bell top")
Bell top	2 whorls of papillae surround knob; up to 20 papillae may be present
Bell edge	Velar and ocular lappets appear to be flat and roundish; per octant, there are 7 velar and 2 ocular lappets
Presence of bell edge/marginal tentacles	No marginal tentacles; marginal lappets present and scarcely distinguishable
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	Manubrium thick, with 7–8 corners each corresponding to the oral arms
Layer of oral arms	Manubrium extends below the subumbrella, slightly concave in cross-section; mouth arms extending as long as bell radii
Shape of oral arms	Thick semi-transparent; highly dichotomous oral arms with a frilly end; each bears 14 lappets and become fused near their bases; branching and bifurcate, with 'feathery' on the edge or tips of the branches
Colour of oral arms (stalk) (lappet)	Same colour as exumbrella; variation of bluish to whitish-transparent
Presence of tentacles at the tip of oral arms	Branching and bifurcate oral arms, 'feathery' on the edge or tips of the branches; without filaments or club-shaped appendages

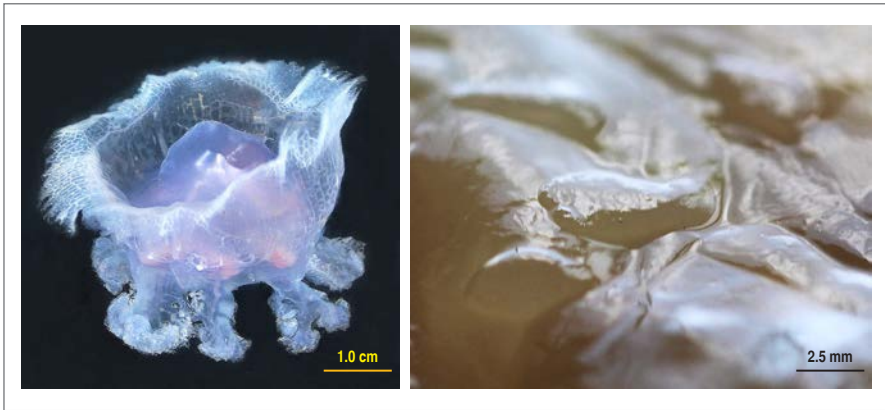
Class Scyphozoa

Order Rhizostomeae

Family Cepheidae

Netrostoma setouchianum (Kishinouye, 1902)**Common Name** Crown Jellyfish**Distribution** Sri Lanka

There are four valid species of *Netrostoma*. Of them, *N. coeruleascens* and *N. setouchianum* show a wide distribution within the Indian and Pacific Oceans respectively.



Side view (left); gelatinous protuberances of exumbrella (right).
Photograph credits: K. D. Karunaratne & M. D. S. T. de Croos.

Physical/morphological Characteristics

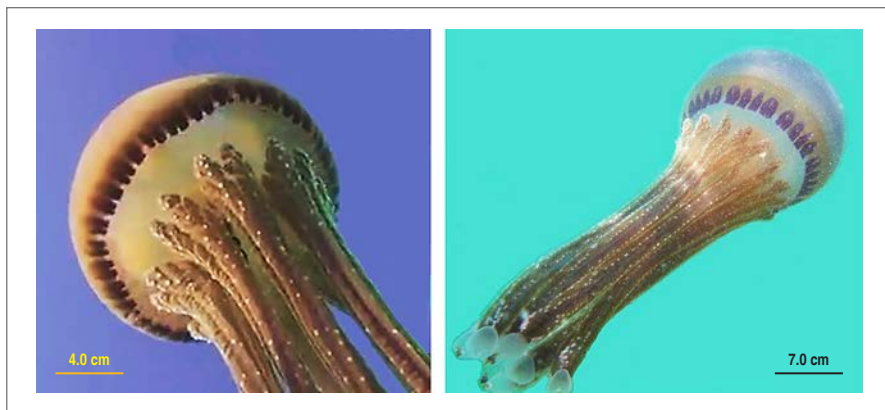
Exumbrella (Bell)

Shape	Inverted hat-shaped with a central dome; diameter 8 cm
Surface texture	Central dome bearing numerous, tiny and gelatinous protuberances
Marginal lappets	Round; 48 (6 per octant)
Marginal tentacles	Absent
Colour	translucent bluish-white jelly, without colour patterns on exumbrella
Oral Arms & Tentacles	
Number of oral arms	8
Shape	Triangular in cross section, bifurcated distally, bearing numerous tiny, lateral branches
Length	About as long as bell radius
Appendages	Numerous small, spindle-shaped appendages
Colour	Bluish-white

Class Scyphozoa

Order Rhizostomeae

Family Leptobrachidae

Thysanostoma loriferum (Ehrenberg, 1837)**Common Name** Purple Jellyfish**Distribution** Philippines (Off Cebu; Sarangani Bay and Honda Bay)*Thysanostoma loriferum* has Central and Indo-Pacific distribution. Earlier described specimens are from the Red Sea (type locality) and waters of the Philippines and Indo-Malay Archipelago.

Photograph credit: Jellywatch.org.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical; radially symmetrical
Colour	Light to pinkish-purple; light brown on the marginal edge area
Surface texture	Smooth or finely granulated
Pattern mark	No distinct markings; no spots
Bell top	Deep dome-shaped
Bell edge	6–8 purple velar lappets in each octant
Presence of bell edge/marginal tentacles	NA
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Single-layer hanging beneath the bell and encircle mouth opening
Shape of oral arms	Thick and broad; triangular (3-winged or tripterous) in crosssection; distal portion with conspicuous wings (with winglets) projecting towards subumbrella; oral arms often very long
Colour of oral arms (stalk) (lappet)	Light to dark brown
Presence of tentacles at the tip of oral arms	No tentacles, but oral arms terminate in a short, oval and naked knob

Class Scyphozoa

Order Rhizostomeae

Family Leptobrachidae

***Thysanostoma* sp.**

Common Name NA

Distribution Thailand (Andaman Sea)

Thysanostoma sp. is characterized by dome-shaped, exumbrella light brownish, surface rugged by granules; velar lappets well separated, without a connecting membrane; arm-disk with numerous short, slender filaments; oral arms without a naked terminal portion.



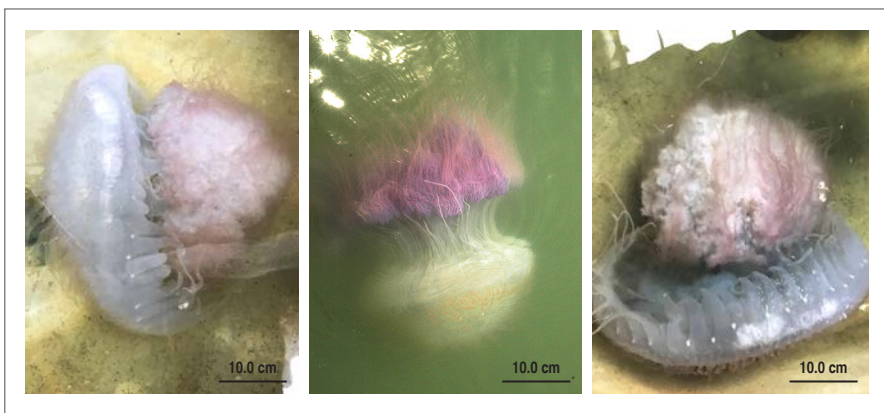
Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Dome-shaped; radially symmetrical
Colour	Light brownish
Surface texture	With a polygonal network of nematocysts
Pattern mark	NA
Bell top	Smooth, but furnished with many granules
Bell edge	Velar lappets well separated, without a connecting membrane; velar lappets are distinctly defined, but they are not prominently protruded out from the margin
Presence of bell edge/marginal tentacles	NA
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	With numerous short, slender filaments
Colour of oral arms (stalk) (lappet)	Milky white and translucent to slightly brownish
Presence of tentacles at the tip of oral arms	With terminal club

Class Scyphozoa

Order Rhizostomeae

Family Lobonemidae

Lobonemoides robustus Stiasny, 1920**Common Name** White Type (trade name)**Distribution** Indonesia (Kuala Tambangan, Borneo); Malaysia (Sabah; Penang; Perak; Selangor; Melaka and Langkawi, Kedah) and Philippines*Lobonemoides robustus* is an edible species, it is the most important commercial jellyfish in South-East Asia. Geographical and seasonal distribution at Central Indo Pacific.

Ventral view on oral arms and tentacles (right). Photograph credit: Sim Yee Kwang.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Wide; flatter than a hemisphere
Colour	Translucent white
Surface texture	Smooth; exumbrella with conspicuous and sharp papillae
Pattern mark	The papillae long in apical one-third of exumbrella, short in middle one-third and no papillae in marginal one-third
Bell top	With conspicuous and sharp papillae
Bell edge	Thin; velar lappets long with slender; thread-like extremities; 1–6 per octant
Presence of bell edge/marginal tentacles	There are 3 or 4 elongated, tentacle-like marginal lappets between neighbouring rhopalia; rhopalar lappet short with a rounded tip
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8; not coalesced with each other; window-like openings located in the membranes of mouth
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Broad; 3-winged, each with a window-like openings and with filaments
Colour of oral arms (stalk) (lappet)	Pinkish
Presence of tentacles at the tip of oral arms	Long spindle-shaped terminal appendage

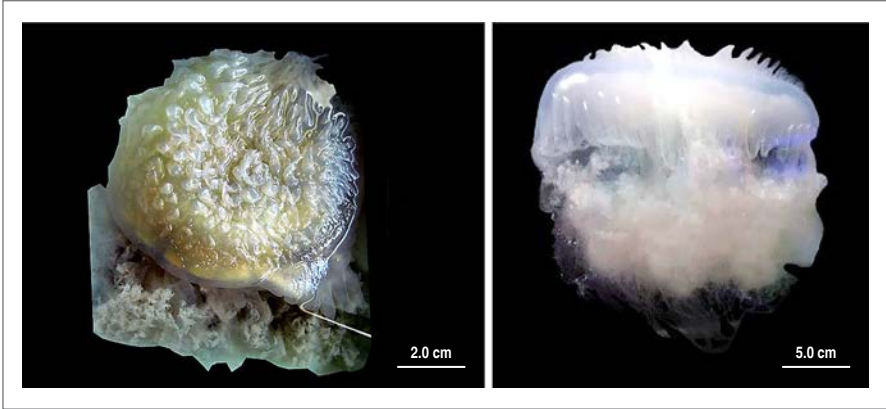
Class Scyphozoa

Order Rhizostomeae

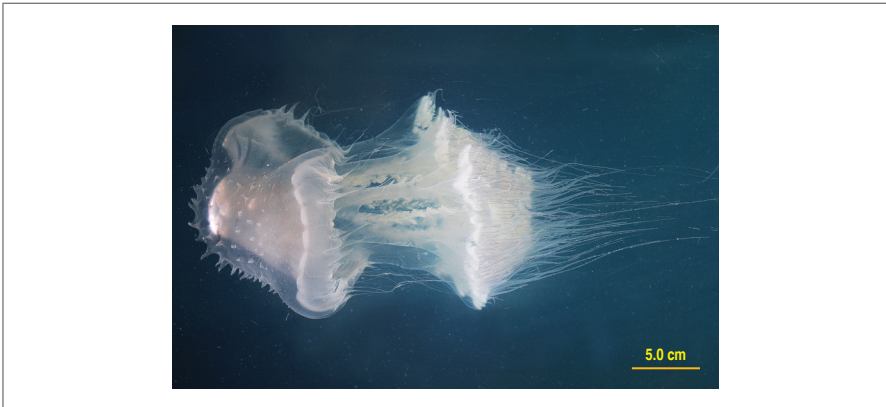
Family Lobonemidae

Lobonemoides* sp.*Common Name** Cendol Jellyfish (Lod-chong in Thai); White-Type Jellyfish**Distribution** Thailand (Gulf of Thailand and Andaman Sea) and Sri Lanka

Lobonemoides sp. is called lod-chong jellyfish in Thailand, thanks to numerous long pointed fleshy papillae on its bell top which resemble a type of Southeast Asian dessert. This jellyfish is considered commercial species and target species by fishermen when in season.



Photograph credit: Department of Marine and Coastal Resources, Thailand.



Photograph credit: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Faintly arched; radially symmetrical; hemispherical; diameter to 50 cm
Colour	Translucent white; whitish, pinkish or bluish bell; occasionally with dark purple marginal lappets
Surface texture	Very thick; with pointed, gelatinous papillae
Pattern mark	None
Bell top	With pointed papillae
Bell edge	Thin, velar lappets long with slender, thread-like extremities, 1–6 per octant
Presence of bell edge/marginal tentacles	None
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Broad, 3-winged, each with a window-like openings and with filaments
Colour of oral arms (stalk) (lappet)	Translucent white, whitish, pinkish or bluish
Presence of tentacles at the tip of oral arms	Long spindle-shaped terminal appendage

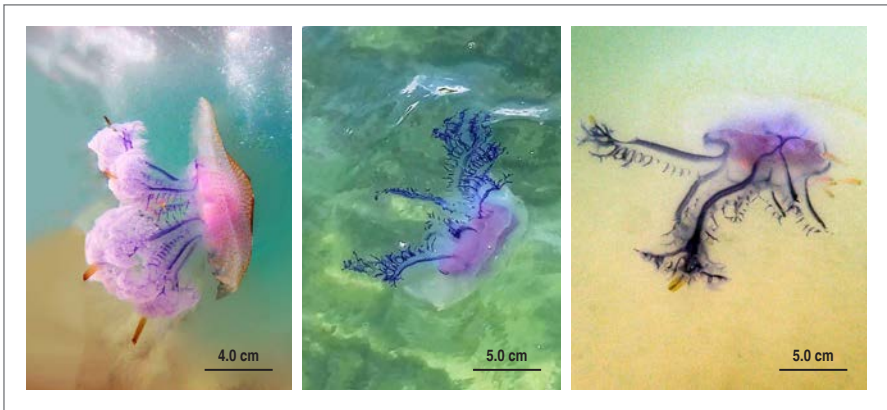
Class Scyphozoa

Order Rhizostomeae

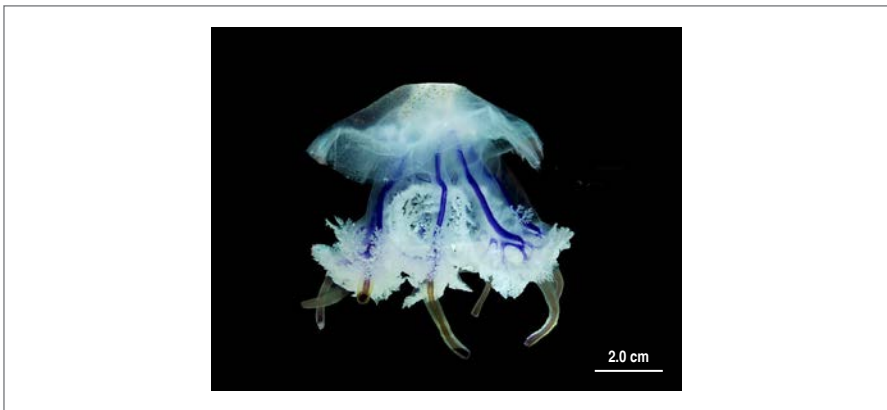
Family Lychnorhizidae

Anomalorhiza shawi Light, 1921**Common Name** None**Distribution** Malaysia (Sabah); Philippines; Singapore and Thailand (Gulf of Thailand)

Anomalorhiza shawi is a species of jellyfish, with very little information known on its biology and life cycle. It is native to the waters of the Philippines and the Southeast Asian region but has been introduced to Hawaii.



Photograph credits: Michael Yap Tzuen Kiat and Cheong Kai Ching.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Mushroom-shaped bell; flattened dorsal-ventrally; radially symmetrical
Colour	Creamy white
Surface texture	Extremely soft and bumpy
Pattern mark	Opaque brown bumps, denser at the center of the bell compared to margins
Bell top	Slightly pointed semi-spherical
Bell edge	Inward folded
Presence of bell edge/marginal tentacles	No
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Thick semi-transparent; branching only occurs on the last third of oral arms with a frilly end
Colour of oral arms (stalk) (lappet)	Transparent; canals are deep purple, with lilac frills
Presence of tentacles at the tip of oral arms	Extension of a longer club appendage ended with a dark brown club at each of the oral arms

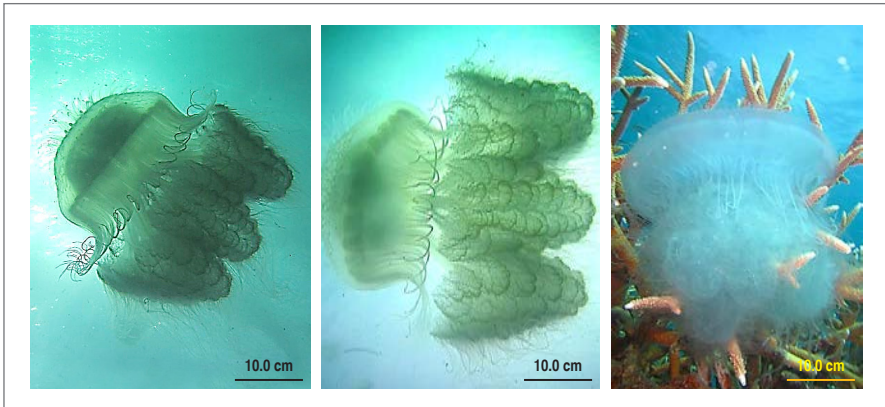
Class Scyphozoa

Order Rhizostomeae

Family Lychnorhizidae

Lobonema smithii Mayer, 1910**Common Name** White Jellyfish**Distribution** Philippines (Coron, Palawan)

Lobonema smithii is a tropical Indian Ocean, Indo-West Pacific species with a type locality in Manila Bay. Its recent distribution includes Verde Island Passage and off Coron Island in the Philippines; Bay of Bengal (Chennai), India; and Makassar Strait, Indonesia. The species is commonly identified as white jellyfish.



Photograph credits: Ephrime B. Metillo and Denmark Recamara.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Flatter than hemisphere; radially symmetrical
Colour	Milky grey with a shade of purplish light pink
Surface texture	With erect, gelatinous papillae largest and most abundant at the center; papillae pointed with nematocysts
Pattern mark	No spots and coloured markings
Bell top	Flat at the top of the bell
Bell edge	Margin inward folded fringed by tapering lappets with a tentacle-like distal portion that bifurcates in some
Presence of bell edge/marginal tentacles	No
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Suspended straight beneath the bell and encircle the mouth opening
Shape of oral arms	Long, slender and flexible
Colour of oral arms (stalk) (lappet)	Light shade of purplish-pink
Presence of tentacles at the tip of oral arms	Oral arms with long spindle-shaped appendages and threadlike filaments

Class Scyphozoa

Order Rhizostomeae

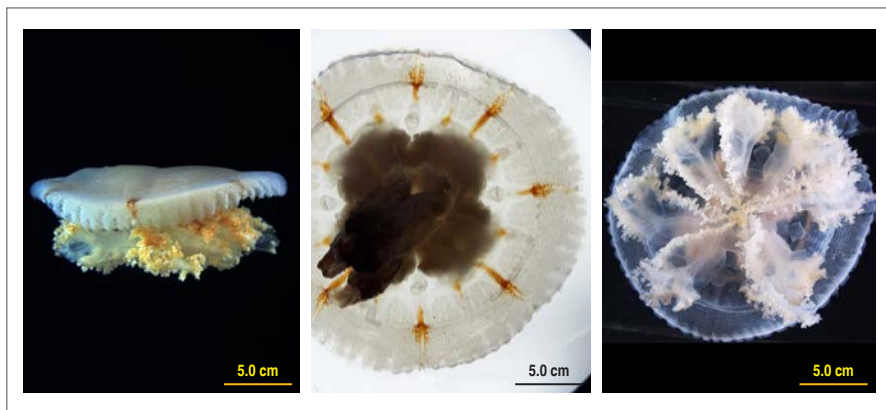
Family Lychnorhizidae

Lychnorhiza malayensis Stiasny, 1920

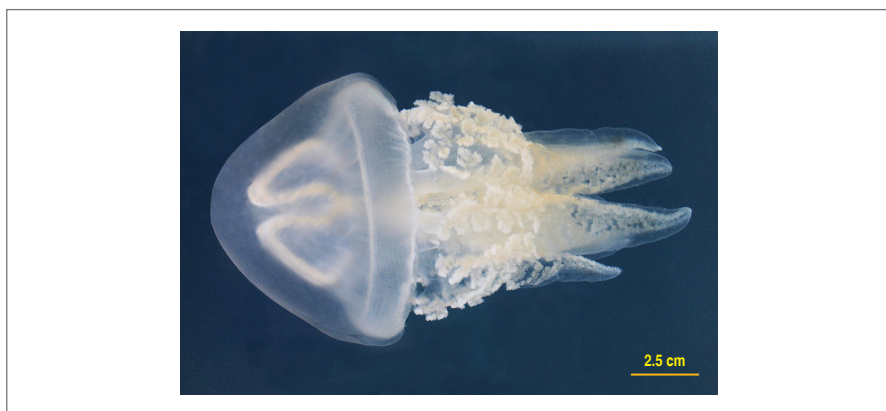
Common Name None

Distribution Malaysia and Sri Lanka

Lychnorhiza malayensis is a species of jellyfish discovered in the Malay Archipelago and is found as far as in the coasts of India. It is a seasonal and bloom-forming species. three valid species of Lychnorhiza, two are distributed in the Indo-Pacific region.



Photograph credits: Mohammed Rizman-Idid and Wan Mohd. Syazwan.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical in live specimens, more flattened in preserved ones
Colour	Bell whitish
Surface texture	Exumbrella surface with fine granules
Pattern mark	Reddish-brown spots or markings along the interradial and perradial axes that radiate from the apex towards bell margin
Bell top	Hemispherical
Bell edge	8 (4 pairs) of velar lappets per octant; 8 tear-drop shaped rhopalia
Presence of bell edge/marginal tentacles	No
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Adradial, not coalesced with each other; each slightly shorter than the radius of the bell
Shape of oral arms	Proximal portion half of the arm's total length, laterally flattened, outer margin without frills; remaining portion divided into 3 broad wings with frills
Colour of oral arms (stalk) (lappet)	Oral arms whitish, mouth frills whitish to faintly brown
Presence of tentacles at the tip of oral arms	No

***Lychnorhiza* sp.**

Common Name Bird jellyfish (Nok in Thai)

Distribution Thailand (Gulf of Thailand and Andaman Sea)

Lychnorhiza sp. is characterized by exumbrella partially smooth; with 8 oral arms 3-winged, lacking terminal clubs; 8 rhopalar canals extending to the bell margin.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristic	
Exumbrella (Bell)	
Shape	Faintly arched; radially symmetrical
Colour	Translucent white
Surface texture	Smooth and soft
Pattern mark	None
Bell top	Partly smooth, partly furnished with many granules
Bell edge	NA
Presence of bell edge/marginal tentacles	NA
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	3-winged; lacking terminal clubs, without club-shaped appendages between the mouths
Colour of oral arms (stalk) (lappet)	Translucent white
Presence of tentacles at the tip of oral arms	None

Class Scyphozoa

Order Rhizostomeae

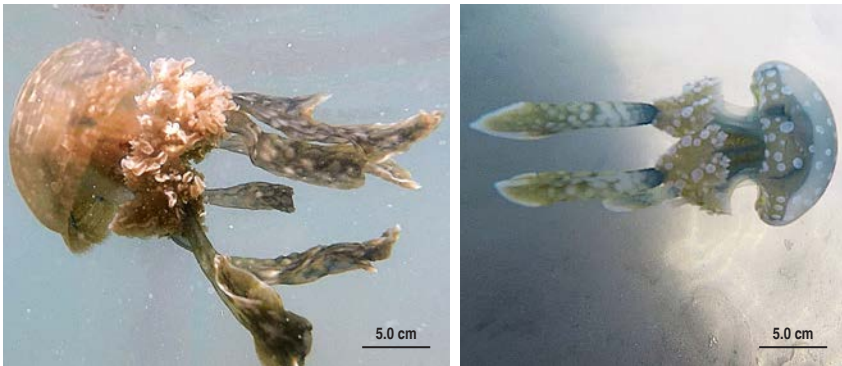
Family Mastigiidae

Mastigias papua (Lesson, 1830)**Common Name** Spotted Jellyfish; Golden Medusa; Lagoon Jelly; Papuan Jellyfish**Distribution** Indonesia (Papua and Kalimantan); Malaysia (Sabah) and Philippines (Barugo, Leyte; Babatngon, Leyte; Capoccan, Leyte and Subic Bay, Visayan Sea, Caramoan)

Mastigias papua is a widely distributed jellyfish species in the Indo-Pacific region and is in symbiosis with zooxanthellae that give its colour. The spotted jelly is so named because of the little dots that adorn its bell. It is native to the western Pacific from Australia to Japan but has been introduced widely elsewhere.



Photograph credits: Ephrime B. Metillo and Francis Xavier.



Photograph credit: Libertine Agatha F. Densing.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Mushroom-shaped bell; nearly hemispherical; radially symmetrical
Colour	Variation of bluish; brown, golden yellow
Surface texture	Smooth and soft
Pattern mark	Large opaque white spots; distributed evenly
Bell top	Semi-Spherical
Bell edge	Inward folded
Presence of bell edge/marginal tentacles	No
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Thick semi-transparent; highly dichotomous oral arms with a frilly end
Colour of oral arms (stalk) (lappet)	Translucent white; variation of bluish brown to creamy white
Presence of tentacles at the tip of oral arms	Extension of a longer triangular cross-sectioned club appendage ended with a green region at each of the oral arms

Class Scyphozoa

Order Rhizostomeae

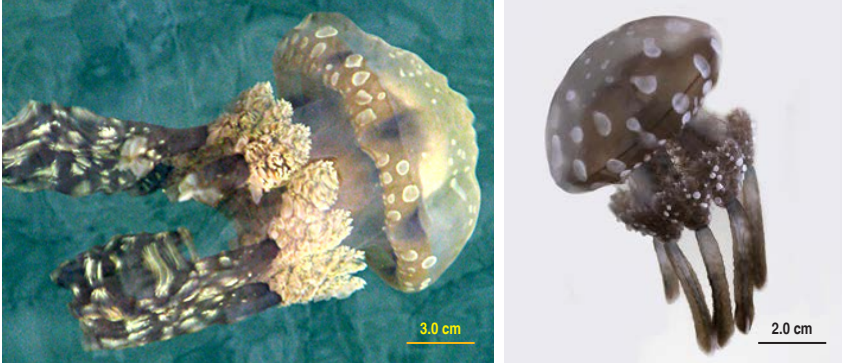
Family Mastigiidae

***Mastigias* sp.**

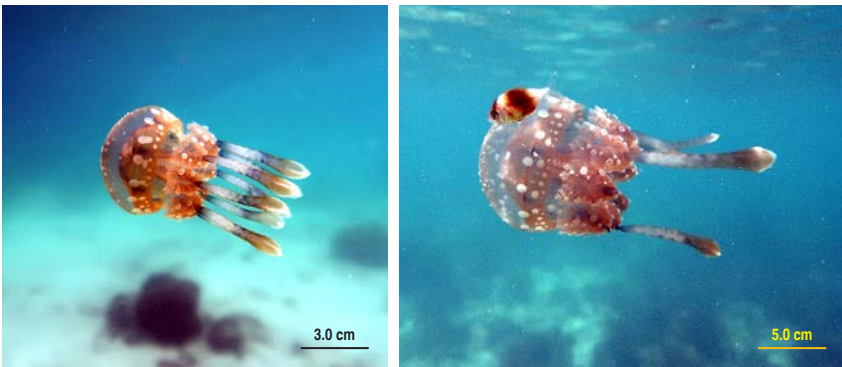
Common Name None

Distribution Malaysia (Sabah); Singapore and Sri Lanka

Mastigias* sp.** is a species of jellyfish, also known as the 'golden' or 'spotted' jellyfish. ***Mastigias species are widely used in the marine aquarium industry. It is widely distributed across the tropical and subtropical Indo-Pacific, from the Fijian Islands to the western Indian Ocean, and from Japan to Australia.



Photograph credits: Mohammed Rizman-Idid (left); K. D. Karunaratne and M. D. S. T. de Croos (right).



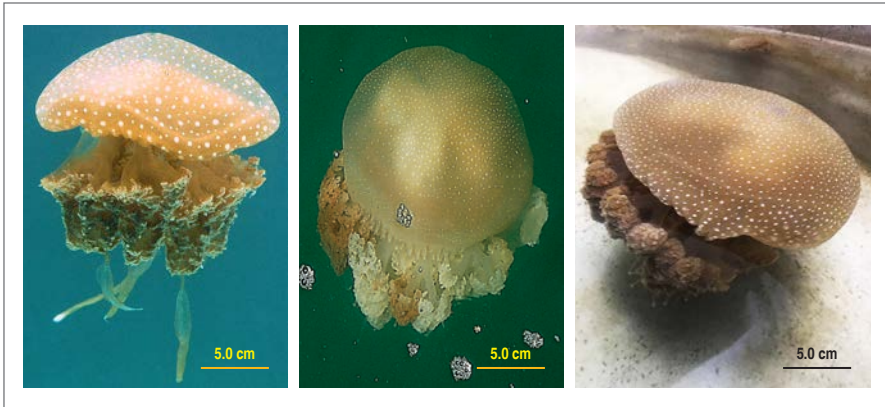
Photograph credit: Michael Yap Tzuen Kiat.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Bell is hemispherical
Colour	Yellow-brown with white spots
Surface texture	Exumbrella has very fine granulation
Pattern mark	White spots of various sizes on the exumbrella
Bell top	Mesoglea of the bell flexible, thicker around the center portion, thinning towards bell margin.
Bell edge	Velar lappets round with furrows often between adjacent pairs of lappets.
Presence of bell edge/marginal tentacles	No
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Brood filaments present (in females) at the base of the oral arms and oral disc
Shape of oral arms	Oral arm with winged and unwinged parts
Colour of oral arms (stalk) (lappet)	Yellow-brown with white spots
Presence of tentacles at the tip of oral arms	Each arm usually terminates in club-shaped vesicles between mouths

Class Scyphozoa

Order Rhizostomeae

Family Mastigiidae

Phyllorhiza punctata von Lendenfeld, 1884**Common Name** Spotted Jellyfish**Distribution** Indonesia (Jakarta); Malaysia (Penang; Perak; Langkawi; Selangor; Johor and Pahang); Philippines; Singapore and Thailand (Gulf of Thailand and Andaman Sea)*Phyllorhiza punctata* is a species of jellyfish, also known as the floating bell, Australian spotted jellyfish, brown jellyfish or the white-spotted jellyfish. It is native to the western Pacific from Australia to Japan but has been introduced widely elsewhere.

Photograph credit: Sim Yee Kwang.

Physical/morphological Characteristics

Exumbrella (Bell)

Shape	Mushroom-shaped bell; nearly hemispherical; radially symmetrical
Colour	Variation of bluish; brown to creamy white
Surface texture	Smooth and soft
Pattern mark	Opaque white spots; distributed evenly
Bell top	Slightly pointed semi-Spherical
Bell edge	Inward folded
Bell section	Octant (8 sections)

Oral Arms & Tentacles

Number of oral arms	8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Thick semi-transparent; highly dichotomous oral arms with a frilly end; each bears 14 lappets and become fused near their bases
Colour of oral arms (stalk) (lappet)	Translucent white; variation of bluish brown to creamy white
Presence of tentacles at the tip of oral arms	Extension of a longer ribbon-like transparent appendage ended with a bright blob at each of the oral arms

***Phyllorhiza* sp.**

Common Name Spotted Jellyfish

Distribution Sri Lanka

There are three valid species of *Phyllorhiza* and all of these species have been originally described from the Indo-Pacific region. Currently, *P. punctata* has become invasive in several regions of the world. *Phyllorhiza* species have an ornamental value.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical; diameter to about 38 cm
Surface texture	Finely granulated
Marginal lappets	Some broad and double, others simple; altogether up to 14 per octant
Marginal tentacles	Absent
Colour	Yellowish-brown, darkest peripherally, with many groups of minute conspicuous white spots
Oral Arms & Tentacles	
Number of oral arms	8
Shape	Bushy, pyramidal and 3-winged
Length	About as long as bell radius
Appendages	Many tapering, bluntly ending short filaments; distally bearing blunt, tapering, terminal filaments, sometimes end with a distal expansion
Colour	Lower arm dark brown; terminal filaments colourless in mature medusae, purplish-brown in juveniles

Class Scyphozoa

Order Rhizostomeae

Family Rhizostomatidae

***Rhizostoma* sp.**

Common Name NA

Distribution Thailand (Andaman Sea)

Specimens of *Rhizostoma* sp. were preserved in 3% formalin. Colour of bell edge was not noticed whereas *R. pulmo* has a violet border. Colour of the distal part of oral arms was not noticed whereas that of *R. luteum* has grey-black colouring.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispheric umbrella-shaped; radially symmetrical
Colour	Translucent white
Surface texture	Smooth, stiff over central, thinner and flexible in outer
Pattern mark	NA
Bell top	Stiff over central
Bell edge	Lappets ca. 8 per octant
Presence of bell edge marginal tentacles	None
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Extended straight beneath the bell and encircle mouth opening
Shape of oral arms	Inverted Y-shaped in section, bearing numerous mouthlets
Colour of oral arms (stalk) (lappet)	Translucent white
Presence of tentacles at the tip of oral arms	With terminal club

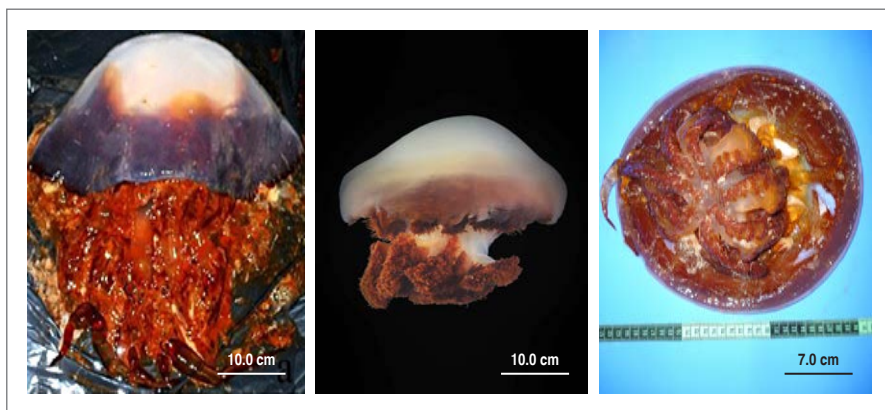
Class Scyphozoa

Order Rhizostomeae

Family Rhizostomatidae

Rhophilema esculentum Kishinouye, 1891**Common Name** Flame Jellyfish**Distribution** Malaysia (Selangor)

Rhophilema esculentum is a species of jellyfish, also known as the flame jellyfish. It is native to the warm tropical and temperate waters of the Pacific Ocean. It is an edible jellyfish with a perceptible sting.



Photograph credits: Mohammed Rizman-Idid and Wan Mohd. Syazwan.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Dome-shaped bell; nearly hemispherical; radially symmetrical
Colour	Reddish-brown bell
Surface texture	Smooth and rigid
Pattern mark	No distinct markings
Bell top	Thick in central part while thin in the margin
Bell edge	Long and short marginal grooves occurring alternately; marginal lappets rounded and 16–18 at each octant
Presence of bell edge marginal tentacles	No
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of oral arms	8
Layer of oral arms	Mouth-arms fused with each other from the base, where they connect with the subumbrella, to the distal level of the scapulets.
Shape of oral arms	Mouth-arms divided into 8 arms distally; each arm has 3 wings.
Colour of oral arms (stalk) (lappet)	Reddish brown oral arms
Presence of tentacles at the tip of oral arms	Numerous tentacles usually with a large terminal club.

Class Scyphozoa

Order Rhizostomeae

Family Rhizostomatidae

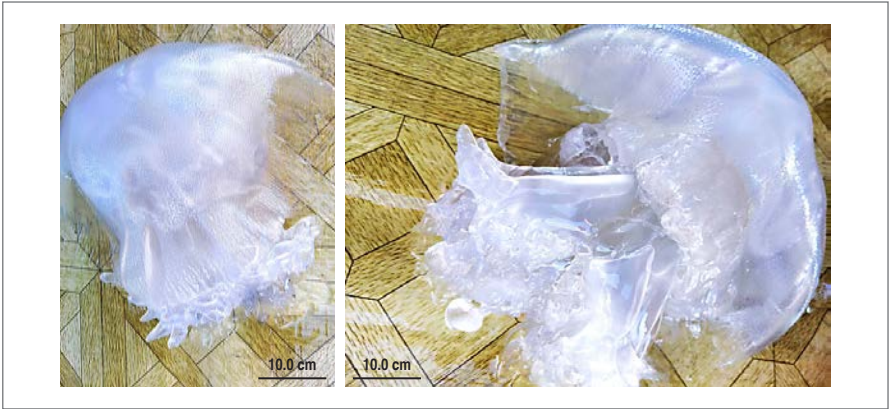
Rhopilema hispidum (Vanhöffen, 1888)**Common Name** Sand Type Jellyfish**Distribution** Indonesia (Kuala Tambangan, Borneo); Malaysia (Penang; Perak; Langkawi, Kedah and Selangor); Philippines (Canomantag, Leyte) and Thailand (Gulf of Thailand and Andaman Sea)

Rhizostomatidae medusae ranging in diameter from 120–650 mm. Exumbrella whitish in colour and rough; having minute, colourless, blunt warts giving the exumbrellar surface a granulated appearance and larger, brown, conical, pointed warts abundant near the margin and velar lappets; becoming gradually sparse and less pronounced in size towards the bell centre.



Close up views of rough/rigid exumbrella (bell) with papillae aggregate towards bell edge (top right & bottom left); ventral view with oral arms and tentacles (bottom right).

Photograph credit: Sim Yee Kwang.



Photograph credit: Libertine Agatha F. Densing.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical bell
Colour	Creamy white
Surface texture	Rough and rigid
Pattern mark	Colourless papillae aggregate towards bell edge
Bell top	Thick in central part while thin in margin
Bell edge	Inwardly folded
Bell section	Octant
Oral Arms & Tentacles	
Number of oral arms	8 with long manubrium and 16 medial arms
Shape of oral arms	Rigid, thick, with frilly ends
Colour of oral arms	Semi-transparent with creamy white ends
Marginal tentacles	None
Appendages at the tips of oral arms	Fine tentacles at the ends

Class Scyphozoa

Order Rhizostomeae

Family Rhizostomatidae

Rhopilema* sp.*Common Name** Sand-Type Jellyfish**Distribution** Sri LankaThere are six valid species of *Rhopilema*. Widely distributed species, *R. hispidum* is important as an edible jellyfish.

Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/morphological Characteristics

Exumbrella (Bell)

Shape	Flatter than a hemisphere; diameter to 60 cm
Surface texture	Numerous small, sharp-pointed, conical projections (sandpaper-like)
Marginal lappets	Round; 8 per octant
Marginal tentacles	Absent
Colour	Whitish, spotted in red colour (but not always)

Oral Arms & Tentacles

Number of oral arms	8
Shape	Proximally coalesced (forming a manubrium); distally separated
Length	About as long as bell radius
Appendages	8 pairs of large scapulets on upper arms; each mouth-arm terminates in a large club-shaped appendage with a faceted, swollen end, other club-shaped and filamentous appendages on the 3 wings
Colour	Whitish

Class Scyphozoa

Order Rhizostomeae

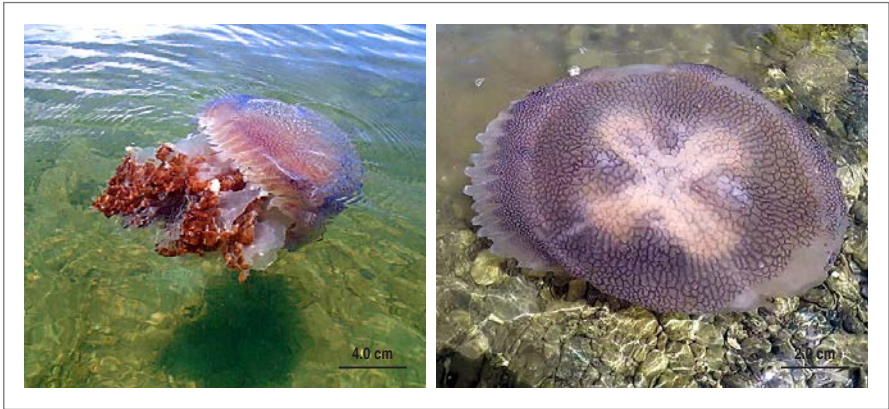
Family Versurigidae

Versuriga anadyomene (Maas, 1903)

Common Name NA

Distribution Indonesia (Seribu Island) and Philippines (Barugo, Leyte)

Versuriga anadyomene is one of the larger species of rhizostome jellyfish. They are commensal jellyfish species that serve as host to a fishes, crabs and copepods.



Photograph credit: Libertine Agatha F. Densing.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Hemispherical and quite flat on top; with purple "cobblestone" grooves terminating on the velar lappets
Colour	Purplish-white
Surface texture	Smooth with anastomosing furrows
Marginal lappets	8 rounded velar lappets with alternating flat and skin-like lappets per octant
Rhopalia	8 with grooved exumbrellar pits
Oral Arms & Tentacles	
Mouth Arms	Laterally flattened with numerous flat; V-shaped membranous branches bearing many clubs and filaments
Periradial canals	Broad; non-anastomosed with narrow interradial canals that are anastomosed



CLASS CUBOZOA

Morbakka sp.
(Penang National Park, Penang, Malaysia)
Photograph credit: Sim Yee Kwang

Box jellyfish (class Cubozoa) are Cnidarian invertebrates distinguished by their cubeshaped medusae.

Some species of box jellyfish produce extremely potent venom. Stings from these and a few other species in the class are extremely painful and can be fatal to humans.

Introduction to Class Cubozoa

The class Cubozoa contains two orders, which are Carybdeida and Chirodropida. The order Carybdeida comprises of five families, 11 genera and 35 species. Carybdeids generally have only one tentacle per pedalium, and nematocysts present both on their tentacles and bell. Meanwhile, Chirodropids have multiple tentacles per pedalium, each extending up to 3 m and nematocysts only found on their tentacles. The Chirodropida order comprises of three families, seven genera and 14 species (Kingsford & Mooney, 2014; WoRMS, 2021).

Cubozoans are known as box jellyfish, as in transverse section the bell appears box or cube-shaped. An adult box jellyfish can measure up to 20 cm along each side, about 30 cm in diameter, and the tentacles can grow up to 3 m in length. Tentacles are located at the corners of the square margins, and the base of each tentacle is distinctively flattened. The edge of the umbrella turns inward to form a rim called velarium that regulates the bell's aperture and generates a powerful jet when the bell pulsates. This makes cubozoans effective predators and strong swimmers, speeds up to 6 meters per minute. Differences in the movement are suggested to vary with body size, where larger individuals swim faster with lower pulse repetition than smaller individuals (Shorten et al., 2005).

Cubozoans are primarily belonged to tropical regions with a few species found outside of the tropical latitude. However, the highest diversity of species is found in the biodiversity hotspot of the Indo West Pacific and Coral Sea. Several species have been reported from the Philippine Sea, Caribbean Sea, Gulf of Mexico, and both east and west of Atlantic Ocean. Apart from mainly being near the coastline, cubozoans are also found in waters of islands, isolated oceanic waters, Hawaii, Samoa, etc. (Kingsford & Mooney, 2014).

Jellyfish from this class have a more developed nervous system compared to other jellyfish species. They own a nerve ring around the base of the bell that synchronizes their pulsing movement. Box jellyfish also has true eyes, with retinas, corneas and lenses. This allows them to see specific points of light and orientate (Garm et al., 2008). The diel movement was also observed in Cubozoan, where the medusae were spotted resting on the bottom during the daylight and surface at night (Matsumoto, 1995).

Cubozoans are voracious predators, preying on a variety of organisms, including both invertebrate and vertebrate prey. Studies have shown that the species-specific and toxins and injection mechanisms have developed to target specific types of prey (Underwood & Seymour, 2007). They predominantly prey on prawns and fish (e.g. juvenile trevally, *Caranx* sp.; pony fish, *Leiognathus* sp.; perchlets, *Ambassis* sp.; and mullet, *Mugil* sp.) (Hamner et al., 1995) by entangling predators and capture prey by envenomation through nematocysts on their tentacles (Buskey, 2003). Several fish species such as queen fish, parrotfish, bream, small Spanish mackerel, toadfish and green turtle, *Chelonia mydas* have been documented as a predator of cubomedusae, *Chironex fleckeri* (Hamner et al., 1995).

The toxin from some species is very potent, such as *Chironex fleckeri* or commonly known as sea wasp, *Chironex yamaguchii*, *Carukia barnesi* and *Malo kingi*. Stings from these jellyfish are extremely painful and can be fatal to swimmers and other users of marine environment (Gershwin et al., 2010). Cubozoans are considered one of the substantial threats to the tourism industry in the Great Barrier Reef, Australia and also in other parts of the world (Fenner & Lippmann, 2009). Physical influences are known to affect many marine organisms, similarly to cubozoans, especially those that are near shore are expected to be affected by riverine runoff, temperature and changing currents (Grimes & Kingsford, 1996).

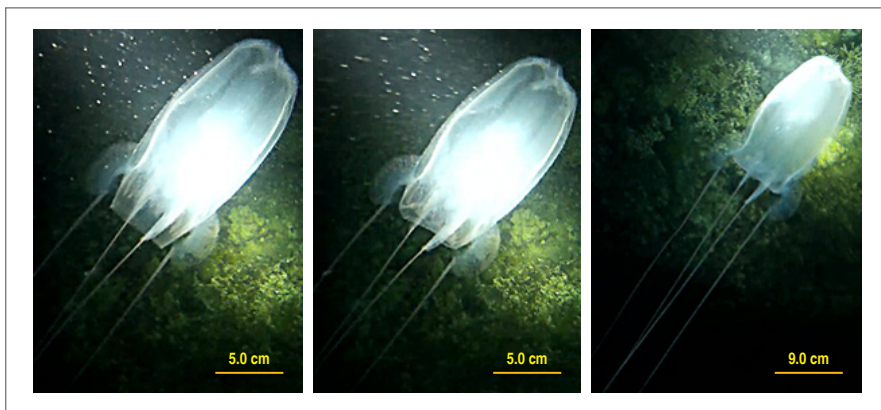
Class Cubozoa

Order Carybdeida

Family Alatinidae

Alatina alata (Reynaud, 1830)**Common Name** Winged Box Jellyfish**Distribution** Philippines (Moalboal Reef, Cebu) and Sri Lanka

Alatina alata is a box jellyfish, also known as the sea wasp and irukandji jellyfish, with a subtropical and pantropical distribution. With type locality in Bonaire, Caribbean Sea, it is now documented as in the tropical regions of the world with the human introduction as a reason for its widespread occurrence.



Photograph credits: Ephrime B. Metillo and Diva Licel Sipalay.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Tall and narrow bell (squarish in cross-section) and flared at the base; cuboidal; nearly round in cross-section; elongate; height 6–8 cm
Colour	Translucent and transparent
Surface texture	Smooth or finely granulated
Pattern mark	Opaque white spots; distributed evenly
Bell top	Tapering into the truncated pyramid at the apex
Bell edge	Bell aperture narrowed by a sheet-like velarium
Presence of bell edge marginal tentacles	Yes
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of tentacles	4 (1 per quadrant)
Layer of tentacles	4 simple tentacles each attached on the 4 corners of the bell aperture
Shape of tentacles	Wing-like pedalia with the distal end of each as the point of origin of a very long tentacle
Colour of tentacles	Pinkish to white tentacle with bands of nematocysts
Presence of tentacle structures	None, but entire tentacle is very long; 10–15 times the height of the bell

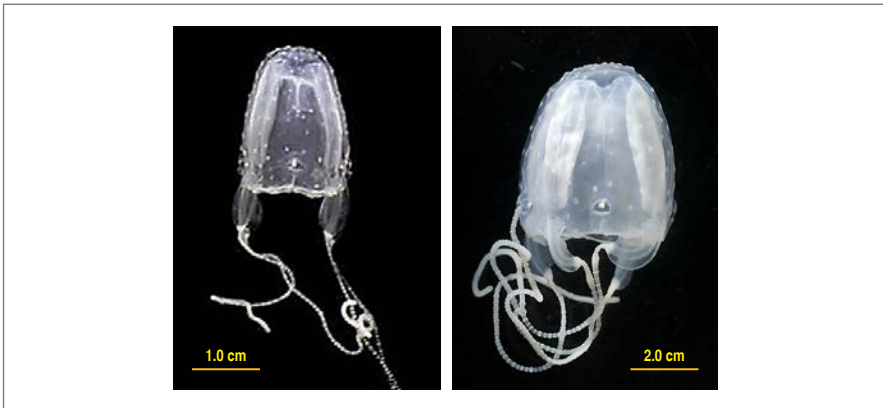
Class Cubozoa

Order Carybdeida

Family Carukiidae

Malo filipina Bentlage & Lewis, 2012**Common Name** Carukiid Box Jellyfish**Distribution** Philippines (TayTay Bay, Palawan)

Malo filipina is a small box jellyfish species recently described with type locality from Nasugbu, Batangas, Philippines. Specimens from Mindoro Island, Luzon Island, and Northern Palawan Island (TayTay Bay), Philippines have also been examined.



Photograph credits: Hiroshi Miyake (left); Sho Toshino (right).

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Small truncated pyramidal; bell taller than wide
Colour	Transparent; translucent
Surface texture	Warty; exumbrella with regularly spaced nematocyst warts
Pattern mark	No coloured marks or spots
Bell top	Flat or slightly convexed
Bell edge	Thin velarium
Presence of bell edge marginal tentacles	4 marginal tentacles
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of tentacles	4
Layer of tentacles	Only 4 tentacles; 1 in every corner of the pyramidal bell
Shape of tentacles	Simple and attached on winged pedaliium; longer than bell height
Colour of tentacles (stalk) (lappet)	Whitish; like a string of small white pearls (nematocyst battery)
Presence of appendages on tentacles	Tentacles no distinctive filaments or extensions

Class Cubozoa

Order Carybdeida

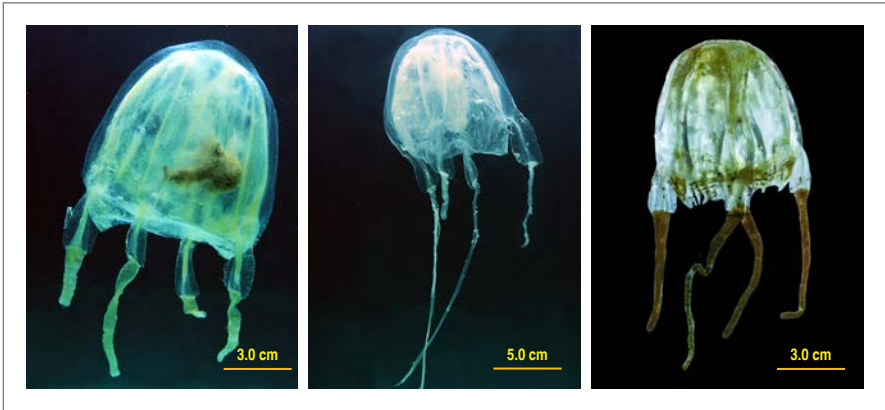
Family Carukiidae

***Morbakka* sp.**

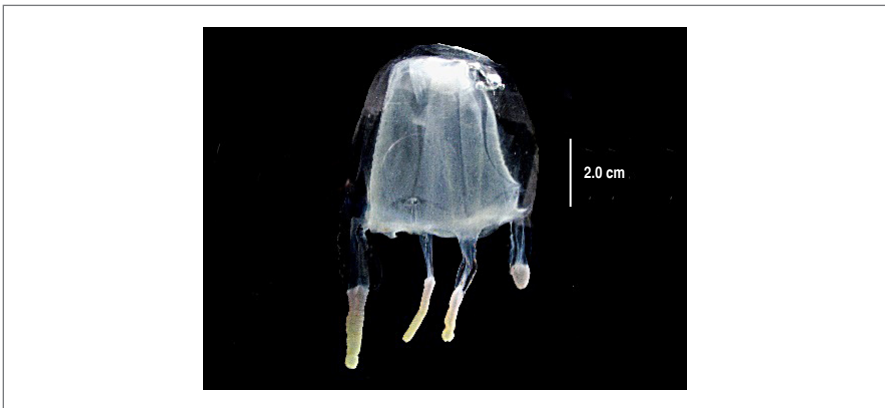
Common Name Box Jellyfish

Distribution Malaysia (Penang; Perak; Langkawi, Kedah and Selangor); Singapore and Thailand (Gulf of Thailand)

Morbakka sp. is a species of box jellyfish that has nematocysts that can cause painful fiery stings. Single-tentacled box jellyfish, whose stings are described as fiery or like an electric shock. The cubozoan are usually found offshore but occasionally driven shoreward by the current. It is distributed in Indo-Pacific including Japan, the Philippines and Australia.



Photograph credit: Sim Yee Kwang.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

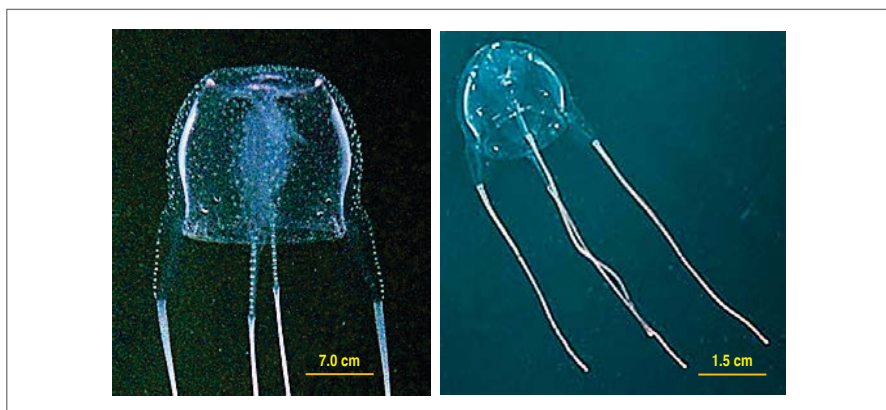
Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Oblong box-shaped; exumbrella is taller than it is wide, rectangular with a flat apex. Stomach lacking gastric phacellae
Colour	Transparent
Surface texture	Relatively smooth with nematocyst warts and soft
Pattern mark	None
Bell top	Flatten; slight granulation
Bell edge	Inward folded; rhopalial niche ostium frown-shaped with "rabbit-ear" like rhopalial horns; thorn-like extensions at the bases of their pedialial canals; numerous branching velarial canals with lateral diverticula
Presence of bell edge marginal tentacles	None
Bell section	Quadrant (4 sections)
Tentacles	
Number of tentacles on each pedalium	4 pedalium; single tentacle per pedalium
Shape of pedialial canal bend	Thorn
Shape of tentacles	Flat, wide, ribbon-like
Colour of nematocyst bands	Light brownish / bright pink

Carybdea rastonii Haacke, 1886

Common Name Box Jellyfish

Distribution Philippines (Mindanao, Philippines)

Carybdea rastonii is a small box jellyfish that are found in subtropical and tropical waters. The species has been reported in the Philippines, Japan and Marquesas Islands but latest records show a wide occurrence in the Pacific Ocean.



Photograph credit: David Muirhead.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Cuboidal, with a flat apex
Colour	Transparent; translucent; heart-shaped rhopalial niche ostia can easily be seen; diffuse gastric phacellae can be seen
Surface texture	Numerous nematocyst warts, mainly around interradial
Pattern mark	No coloured marks or spots
Bell top	Flat or slightly convexed when swimming
Bell edge	Thin velarium
Presence of bell edge marginal tentacles	4 marginal tentacles
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of tentacles	4
Layer of tentacles	Only 4 tentacles; 1 in every corner of the cuboidal bell
Shape of tentacles	Simple and each attached on simple pedalium; longer than bell height
Colour of tentacles (stalk) (lappet)	Whitish
Presence of appendages on tentacles	Tentacles have no distinctive filaments or extensions

Class Cubozoa

Order Carybdeida

Family Carybdeidae

Carybdea wayamba Karunaratne & de Croos, 2020**Common Name** Wayamba Box Jellyfish**Distribution** Sri Lanka

Nine species of *Carybdea* are distributed in distinct geographical areas of the world. So far, *C. wayamba* is known only from coastal waters of Sri Lanka.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

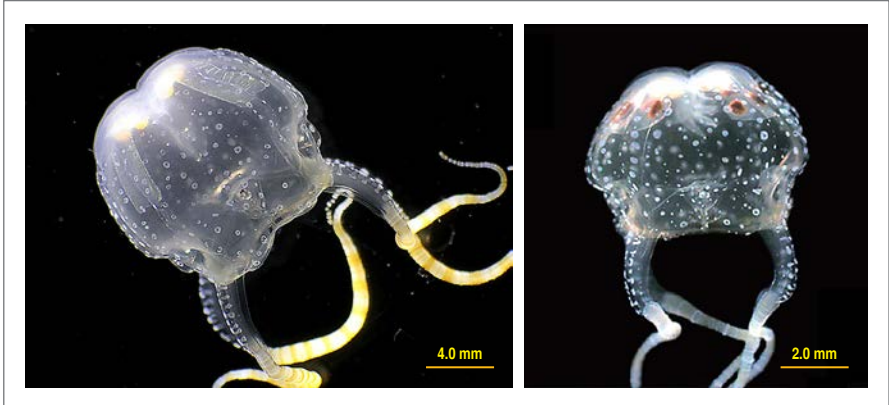
Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Cuboidal; height to about 3 cm
Surface texture	Apparently smooth
Rhopalial niche	Heart-shaped
Velarial canals	Biforked; 2 roots per octant
Colour	Slightly transparent to off-white
Oral Arms & Tentacles	
Number of pedalia	4 (1 per quadrant)
Shape and length of pedalia	Scalpel-shaped; about half as long as bell height
Pedialial knee-bend	Rounded, without appendage
Number of tentacles per pedalium	1
Colour of tentacles	Whitish

Copula sivickisi (Stiasny, 1926)

Common Name Sea Wasp, Marine Stinger, Box Jellyfish

Distribution Philippines (TayTay Bay, Palawan) and Thailand (Chang and Kood Island)

Copula sivickisi is a small box jellyfish species recorded from a range of tropical, subtropical, and mild temperate localities in the Pacific and Atlantic and Indian Ocean (west of Sumatra) localities. First described from Philippine specimens, the species is now known to be distributed in Japan and Taiwan to Vietnam and Thailand, Northern Australia, New Zealand, Micronesia and Hawaii.



Photograph credits: Hiroshi Miyake (left); Sho Toshino (right).



Photograph credit: Department of Marine and Coastal Resources, Thailand.

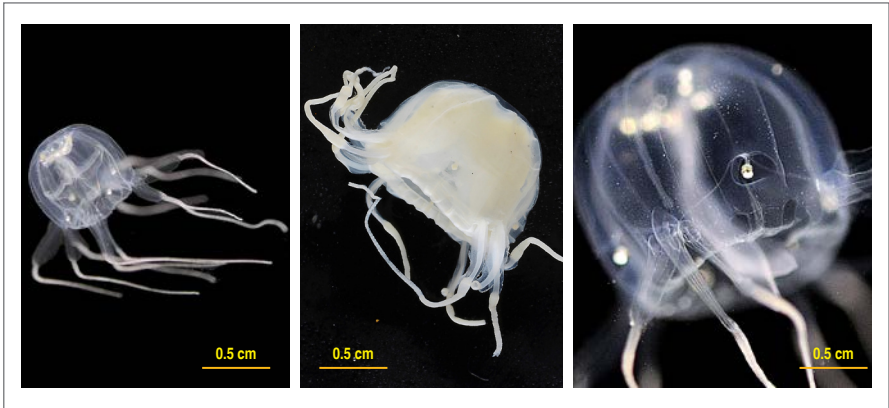
Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Small and almost spherical; oblong box-shaped with bell opening slightly wider than top
Colour	Translucent to Highly transparent
Surface texture	Covered with scattered nematocyst warts; relatively smooth with nematocyst warts
Pattern mark	Raised warts distributed unevenly
Bell top	Biconvex viewed from the side; apex has 4 distinctive adhesive pads; flatten with 4 adhesive pads
Bell edge	Very thin velarium folded inward; no marginal lobes Inward folded
Presence of bell edge marginal tentacles	4 marginal tentacles
Bell section	Quadrant (4 sections) or Octant (8 sections)
Oral Arms & Tentacles	
Number of tentacles	4 or 1 on each pedulum
Layer of tentacles	Only 4 tentacles; 1 in every corner of the pyramidal bell
Shape of tentacles	Attached on thickened and warty pedulum; Like a string of pearls; a 'pearl' is spherical nematocyst battery; slender, tube-like; rounded knee bend shape of pedalial canal bend
Colour of oral arms (stalk)	Has alternating colours of white and light brown cluster of nematocysts; white bands on orange/pink tentacles
Presence of tentacles at the tip of oral arms	Tentacles no distinctive filaments or extensions

Tripedalia cystophora Conant, 1897

Common Name Mangrove Box Jellyfish; Caribbean Box Jellyfish

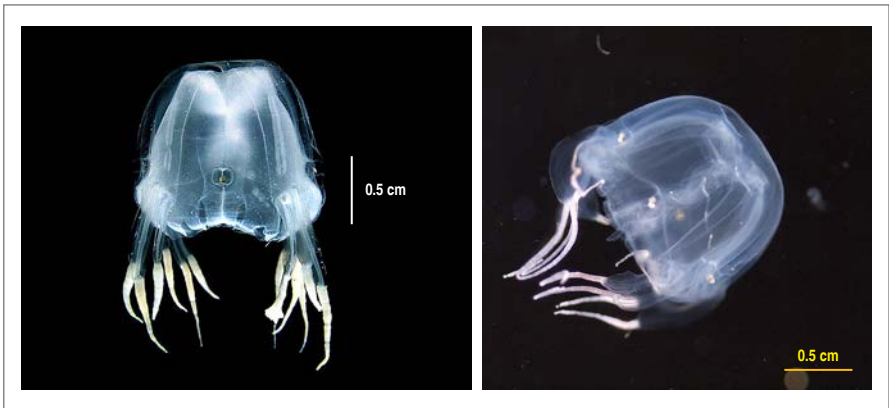
Distribution Indonesia (Cilacap and Kakaban Lake); Singapore and Thailand (Andaman Sea)

Small carybdeid cubozoan with 3 unbranched pedalia/tentacles per bell corner. With frown-shaped rhopalium niche ostium. Sexual dimorphism exists.



Live example from Singapore [ZRC.CNI.2820] (left); preserved example [ZRC.CNI.1329] (middle); close-up of bell corner and frown-shaped rhopalium niche (right).

Photograph credit: Iffah Iesa.



Photograph credits: Department of Marine and Coastal Resources, Thailand (left); Hiroshi Miyake (right).

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Cuboid
Colour	Generally transparent; milky to creamy in preservative; brown spermatophores, gametogenic tissues and tentacles in breeding males
Surface texture	Generally smooth
Pattern mark	Transparent
Bell top	Lightly ribbed outlook
Bell edge	Velarium present
Presence of bell edge/marginal tentacles	3 unbranched pedalia per bell corner
Bell section	Octant (8 sections)
Oral Arms & Tentacles	
Number of tentacles	Single manubrium
Layer of tentacles	NA
Shape of tentacles	Cruciform manubrium extends to bell height in live state
Colour of oral arms (stalk)	Generally transparent, milky or cream-coloured
Presence of tentacles at the tip of oral arms	NA

***Tripedalia* sp.**

Common Name Mangrove Box Jellyfish

Distribution Sri Lanka

There are two species in the genus *Tripedalia*. Both species are distributed especially in tropical waters.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

Physical/Morphological Characteristics	
Exumbrella (Bell)	
Shape	Cuboidal; height to 2 cm
Surface texture	Finely granulated
Rhopalial niche	Shallow frown-shaped
Velarial canals	Simple; 3 roots per octant
Colour	Translucent
Oral Arms & Tentacles	
Number of pedalia	12 (3 per quadrant)
Shape and length of pedalia	Lancet-shaped; about one-third to half as long as bell height
Pedialial knee-bend	With a small upward nub
Number of tentacles per pedalum	1
Colour of tentacles	Whitish

Class Cubozoa

Order Chirodropida

Family Chirodropidae

Chironex indrasaksajiae Sucharitakul, 2017**Common Name** Box Jellyfish**Distribution** Philippines (Babatngon, Leyte) and Thailand (Gulf of Thailand and Andaman Sea)

Chironex indrasaksajiae is a species of lethal box jellyfish with deadly venom. The species has been suspected of causing fatalities in many regions in the Gulf of Thailand. Newly discovered species of box jellyfish first discovered from the Gulf of Thailand in 2017. This is the first record of such species in the Philippines.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

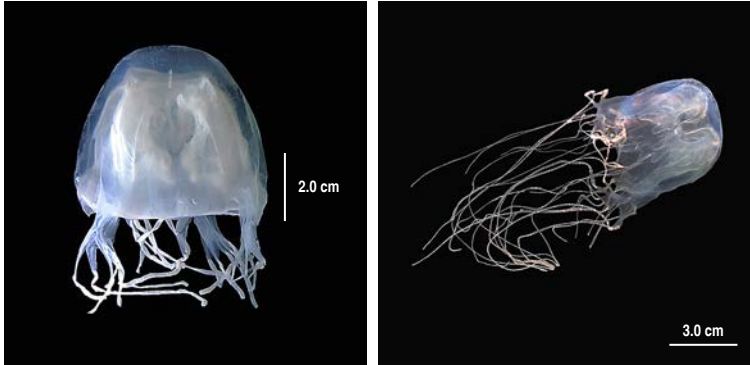
Physical/Morphological Characteristics	
Exumbrella (Bell)	
Shape	Cube-shaped
Colour	Transparent, white
Surface texture	Smooth
Pattern mark	None
Bell top	Flatten
Bell edge	Inward folded
Presence of bell edge marginal tentacles	None
Bell section	Quadrant (4 sections)
Oral Arms & Tentacles	
Number of tentacles on each pedalium	9–10 in each pedalia, filiform, rounded; up to 12
Shape of pedalial canal bend	Bulbous-shaped; 4 claw-like pedalia
Shape of tentacles	Flat
Colour of nematocyst bands	Pinkish

***Chironex* sp.**

Common Name Box Jellyfish; Sea Wasp

Distribution Sri Lanka and Thailand (Gulf of Thailand and Andaman Sea)

Chironex sp. is another species of box jellyfish with deadly venom. Their umbrellas are approximately half the size of *Chironex indrasaksajiae*, whose distribution areas overlap with theirs.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Box-shaped
Colour	Transparent
Surface texture	Smooth with no nematocyst warts
Pattern mark	None
Bell top	Flatten
Bell edge	Inward folded
Presence of bell edge marginal tentacles	None
Bell section	Quadrant (4 sections)
Tentacles	
Number of tentacles on each pedalum	Up to 7
Shape of pedalial canal bend	Volcano-like
Shape of tentacles	Flat
Colour of nematocyst bands	Pinkish

There are three species of *Chironex*, which are distributed in the Indo-Pacific region. Sri Lankan species morphologically close to *C. indrasaksajiae*.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos.

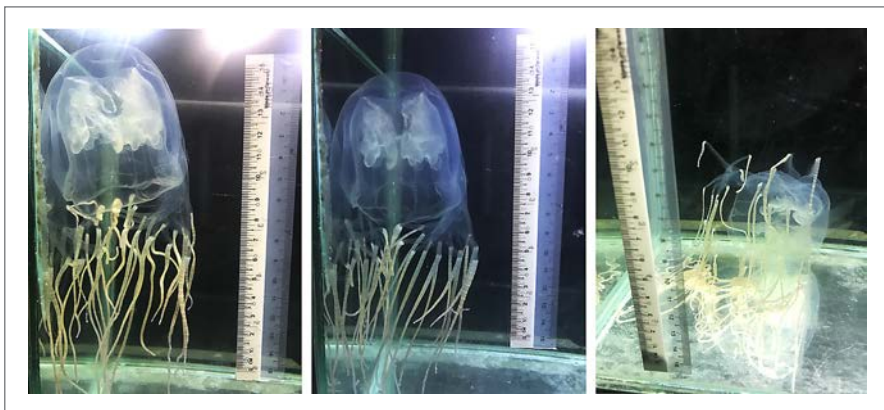
Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Cuboidal; height to 12 cm
Surface texture	Smooth
Rhopalial niche	Dome-shaped
Velarial canals	Extremely complex
Colour	Slightly transparent
Oral Arms & Tentacles	
Number of pedalia	4 (1 per quadrant)
Shape and length of pedalia	Doubly, uniserial alternate; about half as long as bell height
Pedialial knee-bend	Nearly 90° bend
Number of tentacles per pedalium	11–13
Colour of tentacles	Off-white

Chironex yamaguchii Lewis & Bentlage, 2009

Common Name Balung (in Malaysia); Salabay (in Philippines)

Distribution Malaysia (Sabah) and Philippines (Babatngon, Leyte)

Chironex yamaguchii is a species of chirodropid jellyfish, also known as the balung, ampieampie, and the habu kurage (in Japanese). It is native to the western Pacific from Malaysia to Japan, but due to improper identification as *Chiropsalmus quorigatus* in the past, its true extent of the range remains unknown.



Photograph credit: B. A. Venmathi Maran.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Cuboid shaped bell; distinctly 4 sided; radially symmetrical
Colour	Transparent; very faintly blueish white
Surface texture	Hard and firm
Pattern mark	None
Bell top	Flat top
Bell edge	Velarium is present
Presence of bell edge marginal tentacles	None
Bell section	Quadrant (four sections)
Oral Arms & Tentacles	
Number of tentacles on each pedaliium	7–9
Shape of pedialial canal bend	Volcanic shaped
Shape of tentacles	Flattened strap-like tentacles resembling fettucine
Colour of nematocyst bands	Lavender nematocyst bands

Class Cubozoa

Order Chiropoda

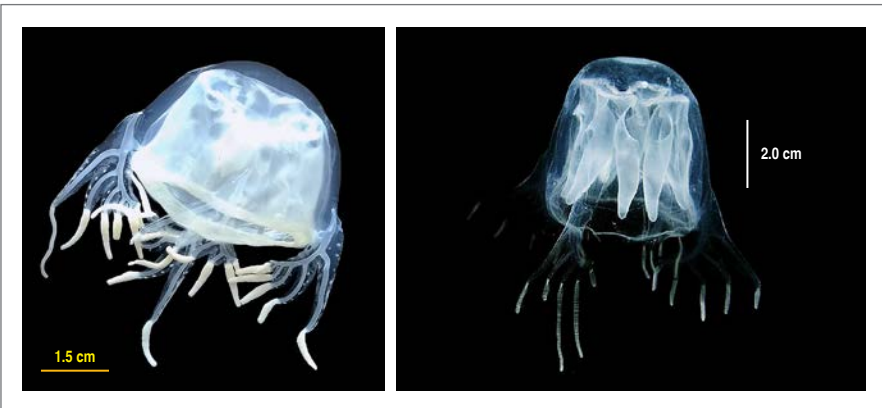
Family Chiropsalmidae

Chiropsoides buitendijki (van der Horst, 1907)**Common Name** Box Jellyfish**Distribution** Malaysia (Penang; Perak and Langkawi); Sri Lanka and Thailand (Gulf of Thailand and Andaman Sea)

The most distinct species characteristics are the shape of the gastric saccules, the pedial canals, and the unilateral pedial branching. *Chiropsoides buitendijki* has potent venom that can harm human skin. Several reported cases of human injury have been reported off the southern coast of Malaysia. The sting marks left by the species are very distinctive because of the unique shape of their nematocysts. Species identification is therefore important in treating jellyfish stings. *C. buitendijki* have been recorded in the Indo-Pacific, specifically sighted in India, Malaysia, and Indochina. They live in mangrove forests and other coastal ecosystems.



Photograph credit: Sim Yee Kwang.



Photograph credits: K. D. Karunaratne and M. D. S. T. de Croos (left); Department of Marine and Coastal Resources, Thailand (right).

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Cubical bell
Colour	Pale white; semi-transparent
Surface texture	Smooth and rigid
Pattern mark	Yellowish white quadralinga on top
Bell edge	Inwardly folded
Bell section	Quadrant (4 sections)
Oral Arms & Tentacles	
Number of oral arms	4 pedalia at the corners
Shape of oral arms	Unilateral branching of 5–9 tentacles on each pedalium
Colour of oral arms	Creamy white tentacles
Marginal tentacles	None
Appendages at the tips of oral arms	None

Class Cubozoa

Order Chirodropida

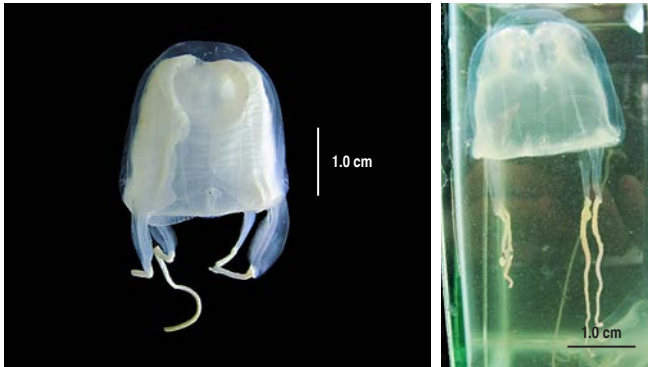
Family Chiropsellidae

***Meteorona* sp.**

Common Name Box Jellyfish

Distribution Thailand (Eastern Gulf of Thailand)

Meteorona sp. is a box jellyfish with single tentacle protruding from each bell corner. The genus was first described from eastern Japan. The genus name refers to the meteor-like appearance of jellyfish shooting through the sea.



Photograph credit: Department of Marine and Coastal Resources, Thailand.

Physical/morphological Characteristics	
Exumbrella (Bell)	
Shape	Box-shaped
Colour	Transparent
Surface texture	Smooth with no nematocyst warts
Pattern mark	NA
Bell top	Flatten
Bell edge	Inward folded
Presence of bell edge marginal tentacles	None
Bell section	Quadrant (4 sections)
Tentacles	
Number of tentacles on each pedalum	1
Shape of pedalia canal bend	Volcano-shaped or knee bend with a short rounded upward spike
Shape of tentacles	Flat
Colour of nematocyst bands	Light brownish

Glossary of Terms

Anthropogenic	(Chiefly of environmental pollution and pollutants) originating in human activity.
Appendages	A projecting part of an invertebrate or other living organism, with a distinct appearance or function.
Bell	The umbrella-shaped body of jellies.
Cnidaria	A phylum of aquatic invertebrate animals that comprises the coelenterates.
Cubozoa	Cnidarian invertebrates distinguished by their cube-shaped medusae.
Exumbrella	The top of the umbrella of a jellyfish. The aboral surface of the bell of a jelly. Literally, “outer umbrella”, or the outer/upper body wall of the jelly body (Gershwin, 2005).
Gastric saccules	Solid or hollow subumbrellar structures characteristic of the chirodropids, important in defining the genera. The saccules grow out of the subumbrellar wall and project into the subumbrellar cavity. They may be simple and finger-like, knob-like, cock’s-comb shaped, or highly branched resembling bunches of grapes (Gershwin, 2005).
Hydrozoa	A class of cnidaria in which most members have polyps arranged in colonies that are made up of different polyps with different functions.
Lappet	A fold or hanging piece of flesh in some animals. A loose or overlapping part of a garment.
Manubrium	An extension of the mouth in jellies that often is the place where the oral arms originate.
Marginal	Relating to or at the edge or margin.
Medusozoa	Medusozoa is a clade in the phylum Cnidaria and is often considered a subphylum. It includes the classes Hydrozoa, Scyphozoa, Staurozoa and Cubozoa, and possibly the parasitic Polypodiozoa.
Monophyletic	(Of a group of organisms) descended from a common evolutionary ancestor or ancestral group, especially one not shared with any other group.
Nematocysts/ Stinging cells	Specialized cells that when mechanically stimulated shoot a tiny harpoon-like dart into the tissue of prey or predators.
Oral	Pertaining to the mouth, generally used as a reference direction, with an oral orientation being towards the mouth and an aboral orientation being away from the mouth. Compare with Aboral (Gershwin, 2005).

- Paraphyletic** (Of a group of organisms) descended from a common evolutionary ancestor or ancestral group, but not including all the descendant groups.
- Pedalia** The blade-like or claw-like gelatinous extensions on the four corners of the body, forming the base for the tentacles. Carybdeid pedalia are simple (= unbranched), and each pedaliu gives rise to only a single tentacle. Chirodropid pedalia are complex (= branched), with each pedaliu branching into numerous finger-like extensions, and each finger giving rise to a single tentacle, but the entire pedial structure having multiple tentacles. The branching pattern (whether alternate or opposite) of the chirodropids and the shape of the pedial “keels” in the carybdeids are of taxonomic importance (Gershwin, 2005).
- Pedial canals** A single hollow canal runs through each of the pedalia, from the coelenteron of the body to the hollow tentacle. Many features of the pedial canals are important in species identification, including the shape of any diverticula that may occur near the base, the crosssection shape, and whether or not the end is flared where it meets the tentacle (Gershwin, 2005).
- Perradial lappets** Thickened regions on the perradial abaxial surface of the velarium of some species, appearing as a flap extending down from the outer body wall. The frenulum extends along the central axis of each of the four lappets on the subumbrellar side. The presence or absence of the lappets is important in species recognition, and in some cases the lappet shape can be useful as well. In a few taxa, the lappets give rise to lateral and distal canals (Gershwin, 2005).
- Pneumatophore** the gas-filled float of some colonial coelenterates, such as the Portuguese man-of-war.
- Radial canals** One of the canals extending through the substance of the umbrella from the gastric cavity to the marginal circular canal in jellyfishes
- Rhopalia** Found embedded in the lappets of the ephyrae and the rim of the bell in adult medusa. Contains two sense organs each (ocelli for light reception and statocyst for gravity reception).
- The sensory bodies that contain the eyes and balance organs (statoliths). An individual has 4 rhopalia, one inside each rhopaliar niche on the lower portion of the flat sides of the body wall. Each rhopalium typically has 6 eyes (2 median complex eyes and 2 pairs of lateral eye spots) plus a single statolith, however, some species are lacking the full complement of 6 eyes. The rhopalia are borne on the end of a stalk, such that they dangle inside the rhopaliar niche and can be rotated around by the animal at will. The stalk is connected to a nerve cord that encircles the body in a zig-zag fashion, alternating up to the rhopalia and down to the base of the pedalia (Gershwin, 2005).

Rhopalial niche	The cavity in the lower portion of the bell wall that protects the rhopalia. This has also been called the “sensory niche” or “sensory nitch” (Gershwin, 2005).
Rhopalial horns	Newly discovered structures issuing from the upper part of the rhopalial niche, as blind-ending canals that traject upward and sometimes outward from the rhopalial niche. The length, width and angle appear to be useful for identification. These structures are not mentioned in the older literature, being first described by Gershwin and Alderslade (in review) as “supra-rhopalial canals”. They have an appearance reminiscent of devil horns or Viking horns (Gershwin, 2005).
Stalk	A stem-like support for a sessile animal, or an organ in an animal.
Scyphomedusae	A class of cnidaria that tend to have medusa much larger than hydrozoan medusae and lack a velum at the rim of the bell.
Scyphozoa	Gelatinous animals that are at the mercy of ocean currents. Most have the ability to move on their own in a small space but are swept along with ocean currents.
Tentacles	The whip-like filaments on which the primary stinging cells occur, i.e., the business end of the jellyfish. In cubozoans, the tentacles are attached to the body by means of pedalia; the tentacles are properly defined as the flexible, opaque part, whereas the pedalia are the transparent, gelatinous, stiff part at the base (Gershwin, 2005).
Velarial canals	Blind-ending extensions of the gastric pouches down into the velarium. The number and form of the velarial canals can be highly diagnostic, primarily in the Carybdeidae (Gershwin, 2005).
Zooplankton	Animals that are generally at the mercy of ocean currents. Most have the ability to move on their own in a small space but are swept along with ocean currents.

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