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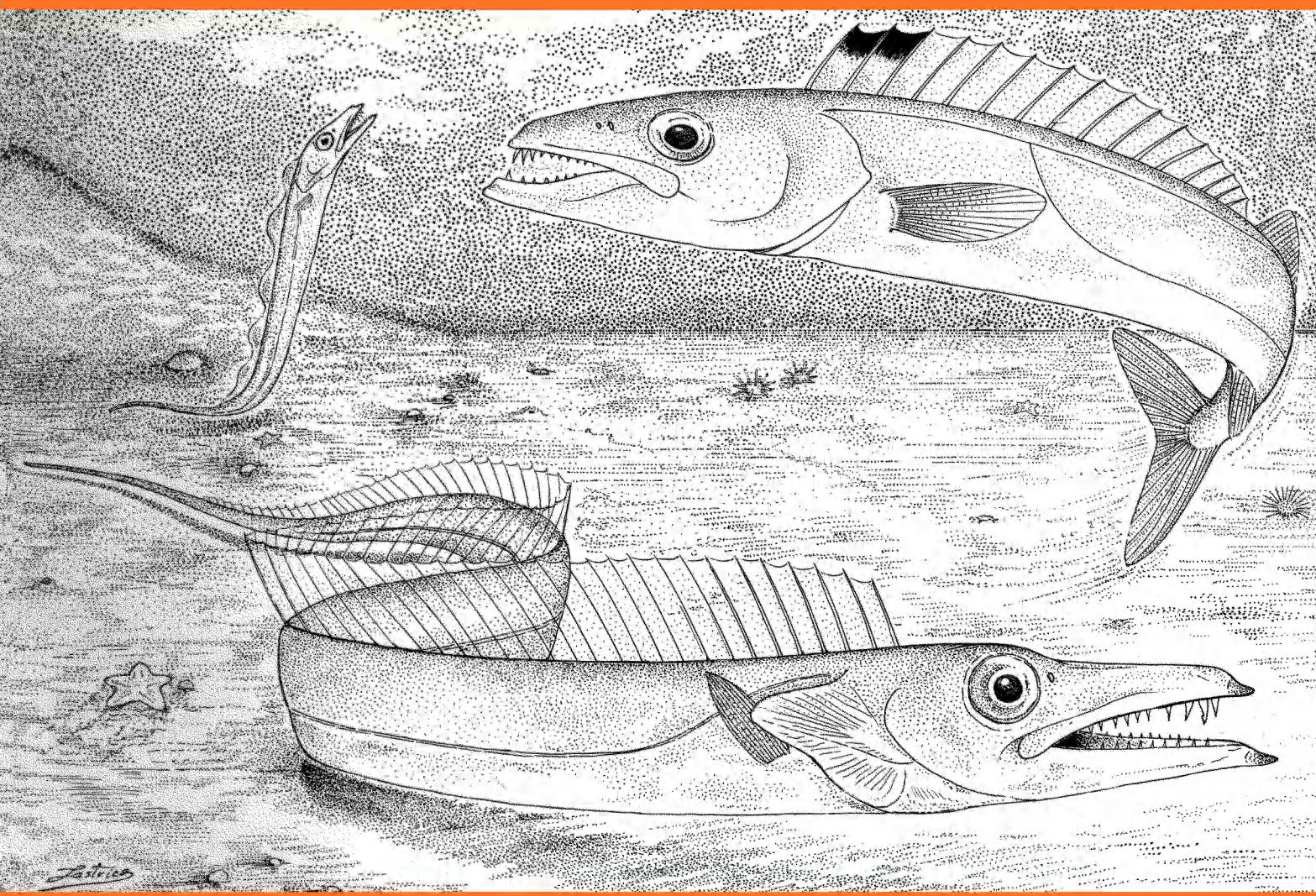
FAO SPECIES CATALOGUE

VOL. 15. SNAKE MACKERELS AND CUTLASSFISHES OF THE WORLD

(FAMILIES GEMPYLIDAE AND TRICHIURIDAE)

AN ANNOTATED AND ILLUSTRATED CATALOGUE OF THE SNAKE MACKERELS, SNOEKS, ESCOLARS, GEMFISHES, SACKFISHES, DOMINE, OILFISH, CUTLASSFISHES, SCABBARDFISHES, HAIRTAILS AND FROSTFISHES KNOWN TO DATE



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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VOL. 15. SNAKE MACKERELS AND CUTLASSFISHES OF THE WORLD

(Families Gempylidae and Trichiuridae)

An Annotated and Illustrated Catalogue of the Snake Mackerels, Snoeks, Escolars, Gemfishes, Sackfishes, Domine, Oilfish, Cutlassfishes, Scabbardfishes, Hairtails, and Frostfishes Known to Date

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PREPARATION OF THIS DOCUMENT

This document was prepared under the FAO Fisheries Department Regular Programme in the Marine Resources Service of the Fishery Resources and Environment Division. It is the fifteenth worldwide species catalogue in the FAO Fisheries Synopsis series.

The authors are two of the world's foremost authorities on the taxonomy of species of the Gempylidae and Trichiuridae. They have published numerous scientific articles on these fishes. This work is based on an extensive review of the literature and the authors have examined specimens, including most of the type material, from the major museums of the world. In addition, they have looked at fresh specimens during research cruises and from markets at localities around the world. Their work is part of an on-going revision of the systematics of these two closely related groups. They both have considerable taxonomic experience in each group and have worked nearly equally on each family depending on which genera they are most familiar with.

Commercial catch statistics are not extensive for these fishes, because their exploitation is mostly by small-scale fisheries and also because they are difficult to identify. Consequently, little is known about the biology of these fishes. This catalogue is timely therefore, as a compilation of what is known about these fishes, in order to serve as a stimulus for gathering more information and to improve the knowledge-base from which to manage them as a resource.

The illustrations were either supplied or drawn by the authors or were redrawn (and modified) at FAO from the literature or from the authors' sketches under the supervision of the editors.

English FAO fish names, were established in consultation with J.S. Nelson, University of Alberta, Edmonton (Chairman, Committee on Common Names of Fishes, American Fisheries Society and American Society of Ichthyologists and Herpetologists). Official French names were created in consultation with J.-C. Quero, Institut Français de Recherche pour l'Exploitation de la Mer, l'Houmeau. Spanish FAO names were adapted from the literature or translated from the English FAO names with the help of G. Burgos, Instituto Nacional de Investigación y Desarollo Pesquero, Argentina.

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Nakamura, I. and N. V. Parin

FAO species catalogue. Vol. 15. Snake mackerels and cutlassfishes of the world (Families Gempylidae and Trichiuridae). An annotated and illustrated catalogue of the snake mackerels, snoeks, escolars, gemfishes, sackfishes, domine, oilfish,cutlassfishes, scabbardfishes, hairtails, and frostfishes known to date.

FAO Fisheries Synopis. No. 125, Vol. 15. 1993. 136 p., 200 figs.

ABSTRACT

This is the fifteenth issue in the FAO series of world-wide annotated and illustrated catalogues of the groups of marine organisms that enter marine fisheries. This volume covers 23 species in 16 genera of gempylids (snake mackerels, snoeks, escolars, gemfishes, domine, oilfishes) and 32 species in 9 genera of trichiurids (cutlassfishes, scabbardfishes, hairtails, and frostfishes). It includes an introductory section with general remarks on habitat, biology, fisheries, systematics, zoogeography and problems of identification, a glossary of technical terms, illustrated keys to genera and species, including regional keys, detailed accounts of species, and a table of species by major fishing area. Species accounts include illustrations, scientific and vernacular names, references to scientific names, information on habitat, biology and fisheries, and a distribution map. The work is fully indexed and there is an extensive reference to pertinent literature.

Distribution

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I wish to express my deep gratitude to captains T. Omura, H. Gomyo and K. Yamanaka, and their crew of the R/V SHOYO MARU during several cruises which I joined. I thank the scientists and research institutions who provided useful information, accommodation, or the use of their facilities during visits, in particular: Prof. T. Iwai (Kyoto University, Kyoto); Drs M. Nishida and T. Yoshino (University of Ryukyus, Okinawa); Dr Y. Nishikawa (Far Seas Fisheries Research Laboratory, Shimizu); Dr K. Mochizuki (University of Tokyo, Tokyo); Prof. K. Amaoka and Dr K. Nakaya (Hokkaido University, Hakodate), Prof. O. Okamura (Kochi University, Kochi); Drs M.-L. Bauchot, M. Desoutter, J.-C. Hureau, G. Duhamel and B. Seret (Museum National d'Histoire Naturelle, Paris); Dr J.-C. Quero (Institut Français de Recherche pour l'Exploitation de la Mer, I' Houmeau); Dr M.-H. Du Buit (Laboratoire de Biologie Marine du College de France, Concarneau); Drs H. Nijssen and I.J.H. Isbrucker (Zoologisch Museum, Universiteit van Amsterdam, Amsterdam); Dr M.J.P. van Oijen (Rijksmuseum van Natuurlijke Historie, Leiden); Dr P. Pethon (Zoologisk Museum, Oslo); Drs S.O. Kullander and B. Fernholm (Naturhistoriska Riksmuseet, Stockholm); Dr J. Nielsen (Zoologisk Museum, Kebenhavns Universitet, Copenhagen); Dr W. Klausewitz (Natur Museum Senckenberg, Frankfurt); Drs M. Stehmann, C. Karrer and A. Post (Institut für Seefischerei, Universitat Hamburg, Hamburg); the late Dr P.J.P. Whitehead and Mr 0. Crimmen (The Natural History Museum, London); Dr H. Ahnelt (Naturhistorisches Museum, Wien);.Drs D. Lloris and J. Rucabado (Instituto de Ciencias del Mar, Barcelona); the late Dr R.H. Gibbs Jr., Dr B.B. Collette and Dr J. Russo (Smithsonian Institution, Washington, D.C.); Drs T. Iwamoto and W.N. Eschmeyer (California Academy of Sciences, San Francisco); Dr W. Klawe (Inter-American Tropical Tuna Commission, La Jolla); Dr J. Paxton (Australian Museum, Sydney); Dr J. Allen (Western Australian Museum, Perth); Dr B. Russell (Northern Territory Museum and Art Gallery, Darwin); Dr E.G. Silas (Central Marine Fisheries Research Institute, Cochin); Drs P.K. Talwar and K.C. Jayaram (Indian Museum, Calcutta); Dr O.K. Sumadhiharga (Lembaga Ilmu Pengetahuan Indonesia, Ambon).

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- Izumi Nakamura

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My study was greatly facilitated by the loan of specimens and radiographs, and access to collections, provided by curatorial staff of many museums in different countries, and I take this opportunity to thank these people: J. Paxton (Australian Museum, Sydney); A. Wheeler and N. Merrett (The Natural History Museum, London); J. Randall (Bernice P. Bishop Museum, Honolulu); 0. Okamura (Kochi University, Kochi); E. Anderson and T. Iwamoto (California Academy of Sciences, San Francisco); P. Last (Commonwealth Science and Industrial Research Organization, Hobart); K. Amaoka (Laboratory of Marine Zoology, Hokkaido University, Hakodate); M. Stehmann, C. Karrer and G. Schultze (Institut für Seefischerei, Universitat Hamburg, Hamburg); R. Lavenberg and J. Gago (Natural History Museum of Los Angeles County); M.-L. Bauchot, J.-C. Hureau and G. Duhamel (Museum National d'Histoire Naturelle, Paris); M. Gomon (Museum of Victoria, Melbourne); J. Garrick and C. Paulin (National Museum of New Zealand, Wellington); M. Van Oijen (Rijksmuseum van Natuurlijke Historie, Leiden); P. Heemstra (J.L.B. Smith Institute of Ichthyology, Grahamstown); R. Rosenblatt (Scripps Institution of Oceanography, La Jolla); T. Abe (University of Tokyo Museum, Tokyo): B. Collette, V. Springer and J. Russo (U.S. National Museum of Natural History, Washington, D.C.); A.P. Andriashev, V. Fedorov, A. Neelov and I.V. Paukova (Zoological Institute, Academy of Sciences, St. Petersburg); H. Nijssen (Zoologisch Museum, Universiteit van Amsterdam, Amsterdam): J. Nielsen (Zoologisk Museum, Kobenhavns Universitet, Copenhagen); I. Verigina and Y. Sazonov (Zoological Museum of Moscow University, Moscow); P.K. Talwar (Zoological Survey of India, Calcutta).

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- Nikolai V. Parin

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TABLE OF CONTENTS

1. INTRODUCTION

This catalogue covers all of the presently known species of trichiuroid fishes, which includes 23 species of snake mackerels, snoeks, gemfishes, sackfishes, escolars, the oilfish and the domine (Gempylidae) and 32 species of cutlassfishes, hairtails, scabbardiishes and frostfishes (Trichiuridae) (Fig. 1). It is not a definitive work on the classification, biology and exploitation of the trichiuroid fishes, since many taxonomic problems remain and much of their biology is still unknown. It is intended as a review of what is known, and as an illustrated guide that can serve as a basis for future work.

A comprehensive review specifically for trichiuroid fishes has never been attempted. There are a number of recent revisions at the regional or family level (e.g.,Matsubara and Iwai, 1952; Tucker, 1956; Parin and Becker, 1972) but none on a global basis. The present work is based on recent extensive examination of specimens in museums and in the field by both authors, and is part of an on-going effort to revise both groups.

To avoid excessive literature citations, we concentrate on publications of specific relevance to the biology and fisheries of the species in question. Other important papers on systematics, anatomy, and distribution, as well as more general aspects of biology and fisheries, though omitted in the text, have been included in the bibliography.

1.1 Habitat and Biology

Trichiuroid fishes are voracious carnivores distributed chiefly in tropical and temperate seas at 50 to 1 500 (rarely 2 000) m depth.

Species of the Gempylidae are adapted to mesopelagic, benthopelagic, or pelagic life and most of them typically swim fast in pursuit of prey, but some species of *Diplospinus* and *Paradiplospinus* move slowly or drift while waiting to ambush prey. Species of the Trichiuridae are well adapted to benthopelagic life and typically catch prey by waiting in ambush.

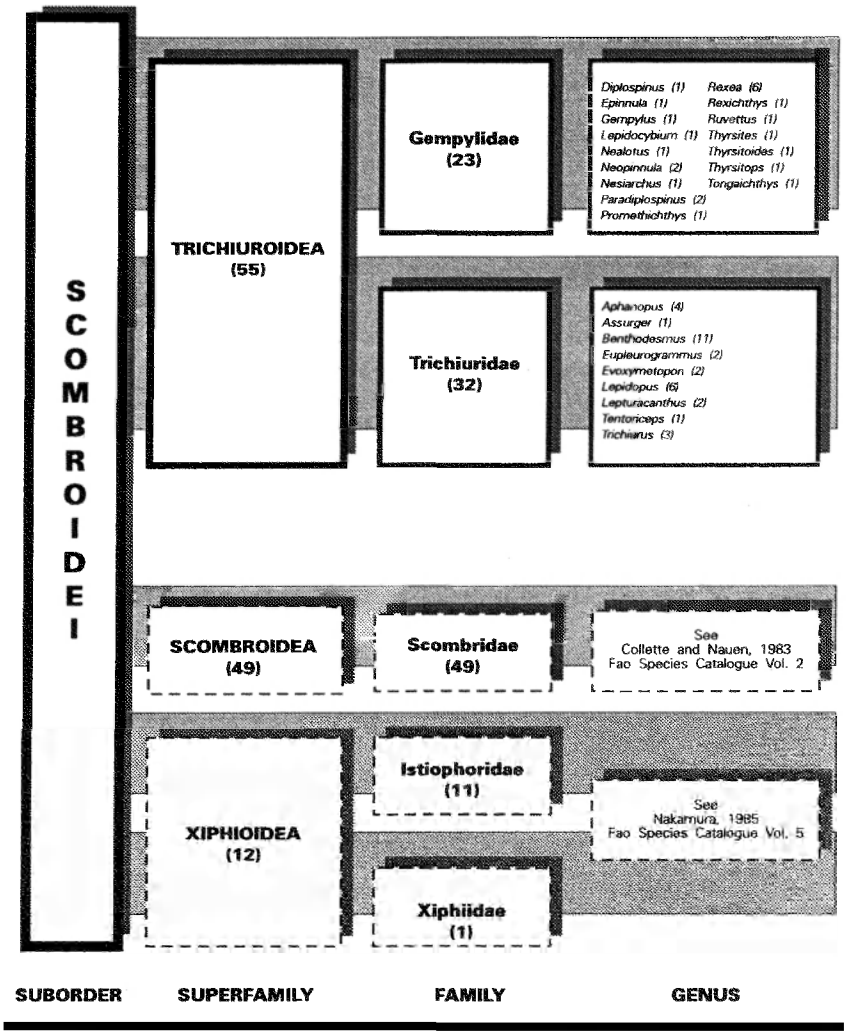


Fig. 1 Structure of the Linnean classification of the suborder Scombroidei (the families Sphyraenidae and Scombrolabracidae have also variously been included in the Scombroidei but are omitted here pending further clarification; see Collette et al., 1984, and Johnson, 1986). An alternative classification was given by Nakamura (1985) in which the billflshes (Istiophoridae and Xiphiidae) were placed in a separate suborder, the Xiphioidei

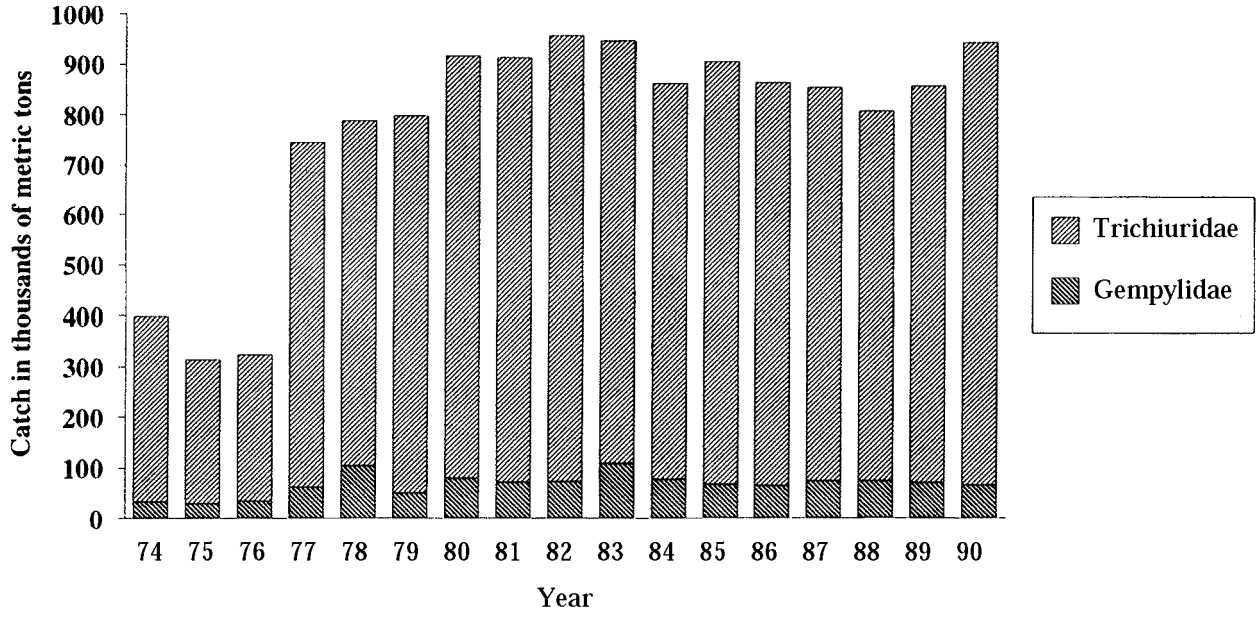


Fig. 2 Cumulative commercial landings of Gempylidae and Trichiuridae from 1974 to 1990 (from FAO, 1978,1980,1982,1992)

1.2 Fisheries

Landings of snake mackerels and cutlassfishes have contributed substantially to fisheries. In 1990, there was a total catch of 942 663 t reported globally and the catch appears to have been approximately stable for the last 10 years (Fig. 2) from a minimum of 805191 to a maximum of 956 640 t (FAO, 1992). This is likely to be an underestimate since many species are not reported, and much of the catch of trichiuroid fishes occurs in small scale fisheries and as bycatch that may go unreported. Trichiuridae contributed between 87 and 93% of the total catch of both trichiurid arid gempylid fishes in the period 1974 to 1990 (Fig. 2)

The exploitation of trichiuroid fishes varies widely among species and throughout their range (Fig. 3). They are caught by trawls, coastal set nets, shore seines and various types of angling gear. *Trichiurus lepturus* is the most important trichiuroid fish in fisheries (Table 1). *Thyrsites atun* is the second most important commercial species (Table 2), and also an important fish for sport fishing in South Africa. Other species such as *Lepidopus caudatus* and *Rexea solandri* are exploited on a smaller scale (Tables 3 and 4).

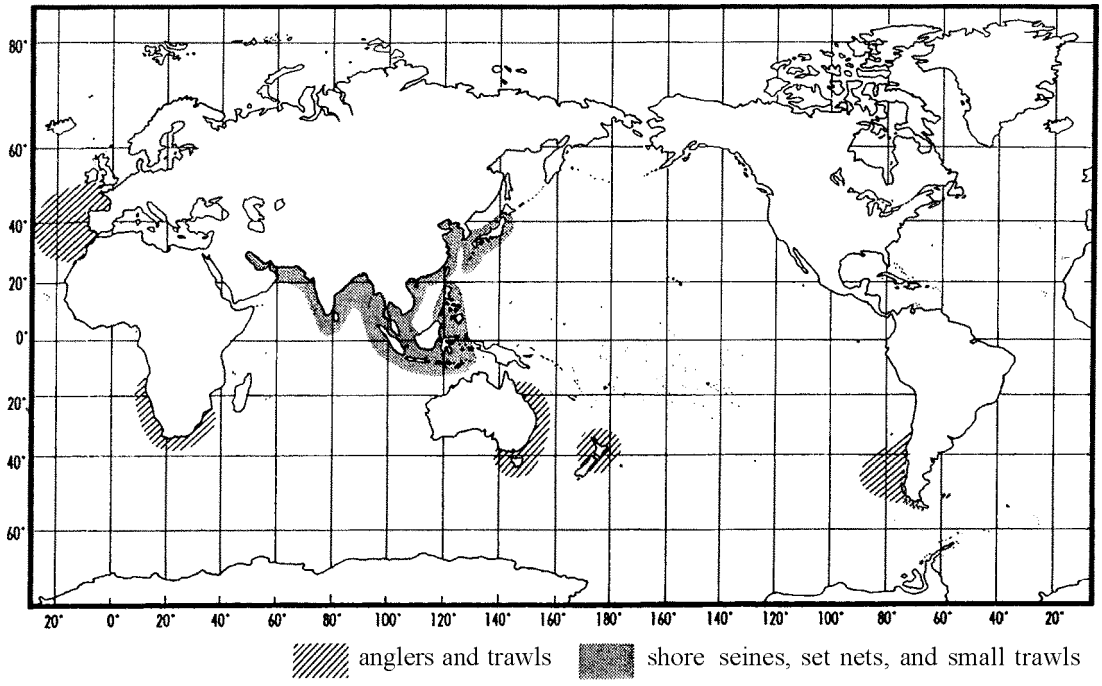


Fig. 3 Main fishing grounds for gempylids and trichiurids

Table 1
Catch in metric tons of *Trichiurus Lepturus* by country and year (from FAO, 1978,1980,1982,1992)

Year	China	Korean Republic	USSR	Japan	Total*
1973	?	124 200	24 500	41 600	251 307F
1974	?	66 391	40 710	39 262	292 296F
1975	?	120 078	22 152	32 423	214 375F
1976	?	75 555	33 414	30 563	188 237F
1977	392 515	72 032	42 530	28 035	596 733F
1978	387 164	86 065	24 090	28 085	574 470F
1979	437 206	120 723	21 174	30 518	647 815F
1980	473 315	119 980	54 467	37 805	748 716F
1981	499 012	147 677	9 415	35 097	751 486F
1982	493 373	121 960	66 838	35 948	785 643F
1983	451 772	152 633	54 494	34 851	735 415F
1984	450 030	145 413	24 570	33 602	693 448F
1985	458 723	127 608	48 190	32 037	710 344F
1986	406 403	107 561	85 261	30 195	673 920F
1987	393 606	113 446	72 339	31 883	650 222F
1988	365 730	104 392	68 376	30 912	617 616F
1989	416 202	102 399	68 114	29 806	682 818F
1990	497 733	99 460F	80 626	31 506	752 711F

*- all other countries also included; F - FAO estimate from available sources of information

Table 2
Catch in metric tons of *Thyrsites atun* by country and year (from FAO, 1978,1980,1982,1992)

Year	New Zealand	South Africa	USSR	Australia	Japan	Total*
1973	2 800	600	?	900	10 600	22 200
1974	3 375	9 721	?	708	18 252	32 324
1975	2 503	10 619	-	807	10 568	28 124
1976	3 673	16 273	-	183	10 344	33 050
1977	4 697	18 724	-	84	34 379	59 248
1978	5 197	17 162	67 568	299	10 227	100 996
1979	6 970	11 676	18 700	177	5 802	44 669
1980	8 803	17 832	34 510	121	9 463	74 725
1981	22 392	14 454	10 062	199	14 549	63 104
1982	20 290	13 077	21 951	151	7 834	64 510
1983	21 578	9 135	60 907	173	8 668	101 548
1984	21 996	10 220	27 192	375	8 763	68 978
1985	17 340	11 269	27 091	395F	-	57 699F
1986	18 019	11 281	22 299	556F	-	54 258F
1987	27 024	14 504	3 963	710F	9 002	64 334F
1988	23 691	21 225	8 948	745F	5 989	63 065F
1989	20 498	16 485	12 960	397F	5 707	61 497F
1990	24 470	20 844	1 341	792F	4 502	54 445F

* - all other countries also included; F - FAO estimate from available sources of information

Table 3
Catch in metric tons of *Lepidopus caudatus* by country and year (from FAO, 1978,1980,1982, 1992)

Year	South Africa	Portugal	New Zealand	Total*
1973	?	7 500	-	7 500
1974	?	5 025	-	5 379
1975	?	5 610	-	5 736
1976	?	5 739	-	6 149
1977	?	9 060	1	22 884
1978	?	7 467	6	9 152
1979	127	4 555	5	4 770
1980	154	5 938	2	6 095
1981	620	5 935	1	6 556
1982	400	5 495	3	6 021
1983	608	6 864	1 213	8 710
1984	943	7 369	669	9 029
1985	1 312	6 266	967	8 548
1986	1 839	4 537	1 322	7 839
1987	3 201	7 336	1 304	11 846
1988	3 700	5 339	2 816	11 928
1989	9 439	5 491	1 562	16 615
1990	14 610	4 569	2 406	21 748

* - all other countries also included

Table 4
Catch in metric tons of *Rexea solandri* by country and year (from FAO, 1978,1980,1982,1992)

Year	Australia	New Zealand	Total*
1974	496	-	496
1975	655	-	655
1976	747	-	747
1977	2112	-	2 112
1978	2383	-	2383
1979	4 542	423	4965
1960	3806	1035	4 841
1981	4750	3 006	7756
1982	3919	3822	7 741
1983	3046	3416	6462
1984	2796	5 336	8132
1985	2946	5429F	8375F
1986	4151	5208F	9359F
1987	5300	4099F	9399F
1988	5562	4935F	1097F
1989	4648	4035F	8691F
1990	5 912	4339F	10251F

* - all other countries also included
F - FAO estimate from available sources of information

1.3 Systematics and Zoogeography

Most authors (e.g., Nelson, 1984; Eschmeyer, 1990) recognize that the gempylids and trichiurids are closely related within the perciform suborder Scombroidei. They are here included in the superfamily Trichiuroidae which includes 25 genera and approximately 55 species (Table 5, Fig. 1). Also included in the suborder Scombroidei is the superfamily Scombroidea or tuna-like fishes (with one family, the Scombridae composed of 15 genera and 49 species, as reviewed in the FAO catalogue by Collette and Nauen, 1983) and the superfamily Xiphioidea or billfishes (with the families Xiphiidae and Istiophoridae as reviewed in the FAO Catalogue by Nakamura, 1985). However, Nakamura (1985) presented the billfishes as a separate suborder and offered evidence (Nakamura, 1989a,b) that they constitute a different "natural group" from scombroids and trichiuroids (Fig. 4). He hypothesized that the ancestors of trichiuroids were mesopelagic fishes that gave rise to mesopelagic gempylids which radiated into both benthic trichiurids and epipelagic tunas. An alternative view was presented by Parin (1988), who suggested that the common ancestors of trichiuroids were benthopelagic neritic forms that gave rise to both benthic trichiurids and mesopelagic gempylids. He considered that within the Gempylidae the benthopelagic species such as those in the genera

Table 5
Arrangement of the Trichiuroidea according to phylogenetic order (after Collette et al., 1984). Figures in brackets refer to the number of species

Phylum Chordata Superclass Gnathostomata Class Osteichthyes Subclass Actinopterygii Infraclass Teleostei Division Euteleostei Superorder Acanthopterygii Order Perciformes Suborder Scombroidei Superfamily Trichiuroidea	
Family Gempylidae (23)	**Family Trichiuridae (32)**
Genera *Lepidocybium (1)* *Ruvettus (1)* *Epinnula (1)* *Neoepinnula (2)* *Thyrsitops (1)* *Thyrsites (1)* *Rexea (6)* *Rexichthys (1)* *Promethichthys (1)* *Nealotus (1)* *Thyrsitoides (1)* *Nesiarchus (1)* *Tongaichthys (1)* *Gempylus (1)* *Diplospinus (1)* *Paradiplospinus (2)*	*Genera* *Aphanopus (4)* *Benthodesmus (11)* *Lepidopus (6)* *Eupleurogrammus (2)* *Evoxymetopon (2)* *Tentoriceps (1)* *Trichiurus (3)* *Lepturacanthus (2)* *Assurger (1)*

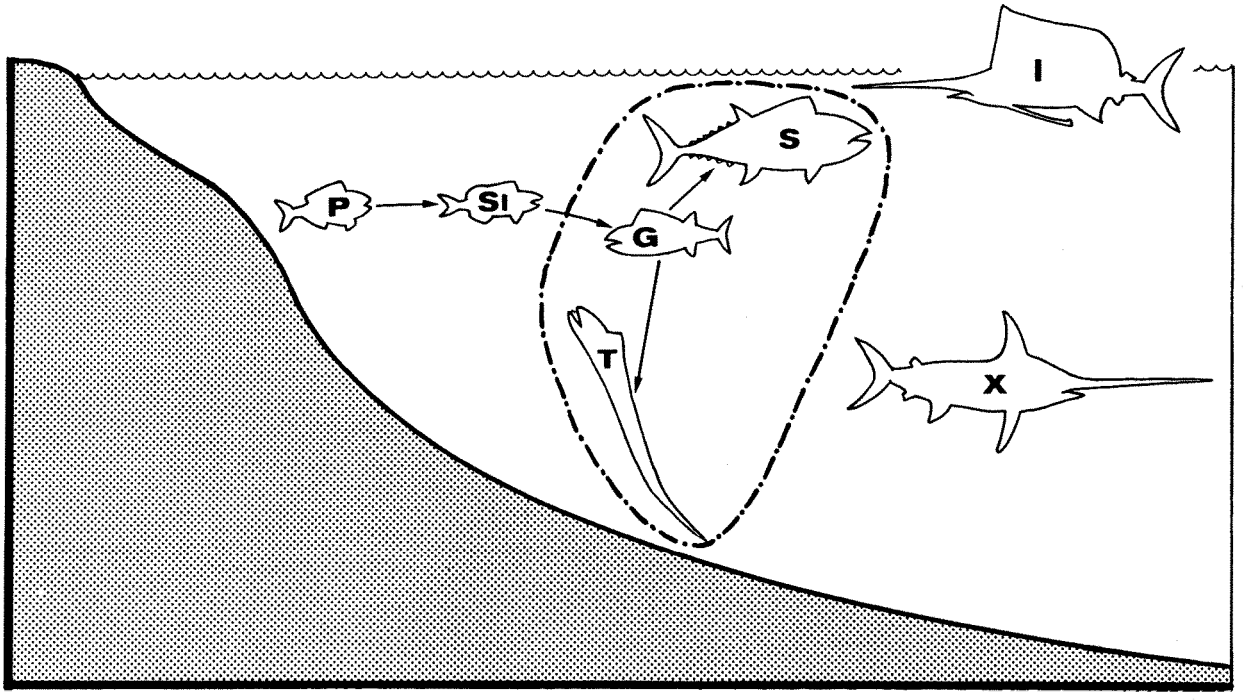


Fig. 4 Nakamura's (1989a,b) proposed phylogenetic relationships of certain scombroid fishes. The billfishes (I and X) are considered as an outgroup. P, hypothesized protopercoid; Si, scombrolabracids; S, scombrids; G, gempylids; T, trichiurids; I, istiophorids; X, xiphiids.

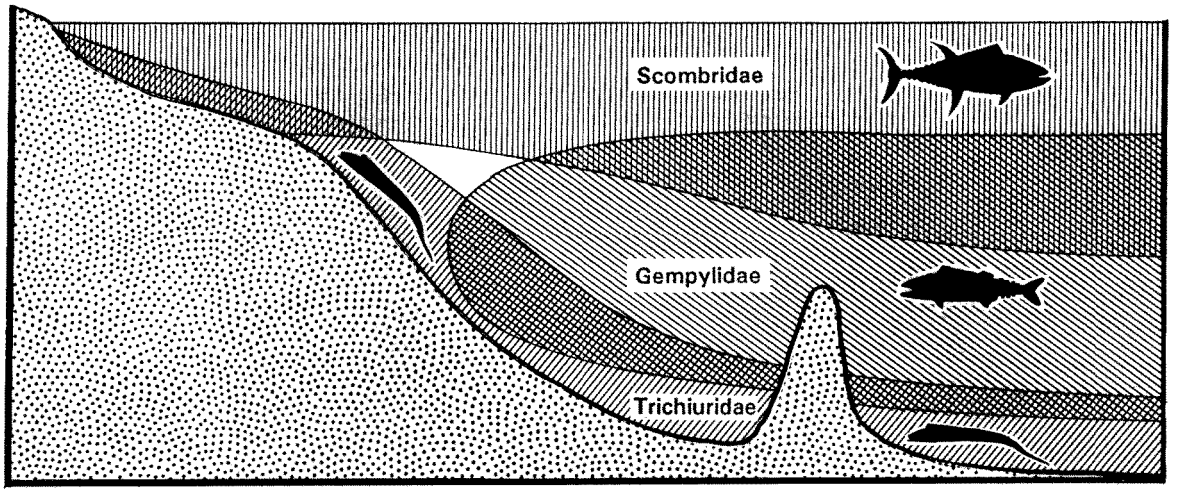


Fig. 5 Horizontal and vertical distribution of Scombridae (epipelagic), Gempylidae (mesopelagic and benthopelagic), and Trichiuridae (benthopelagic).

Lepidocybium, Ruvettus, and *Epinnula,* evolved first, followed by species of oceanic genera such as *Gempylus, Diplospinus,* and *Paradiplospinus.*

Nakamura (1989a,b,c; 1990c,d,e; 1991 a,b,c,d,e; 1992a,b,c) studied the correlation of certain morphological characteristics with habitat type of the Gempylidae, Trichiuridae and Scombridae. Scombrids are epipelagic (they inhabit the upper waters of the open ocean), trichiurids are benthopelagic (they inhabit the waters close to and some distance above the ocean bottom), and gempylids are either benthopelagic or mesopelagic (inhabiting the deeper waters of the open ocean) (Fig. 5). These habitat types are correlated with body form, body colour and markings, and shape of the lateral line, jaw teeth, tongue, nostrils, and, olfactory rosettes (Figs 6 to 11). There are 2 primary morphological and ecological forms in the 3 families of scombroid fishes studied by Nakamura (Fig. 6): 1) elongated body, slow-swimming and adapted to mesopelagic and benthopelagic habitats (Trichiuridae and trichiurid-like Gempylidae); and 2) fusiform body (streamlined), fast swimming and adapted to epipelagic life (Scombridae and scombrid-like Gempylidae). The cutlassfishes (Trichiuridae)

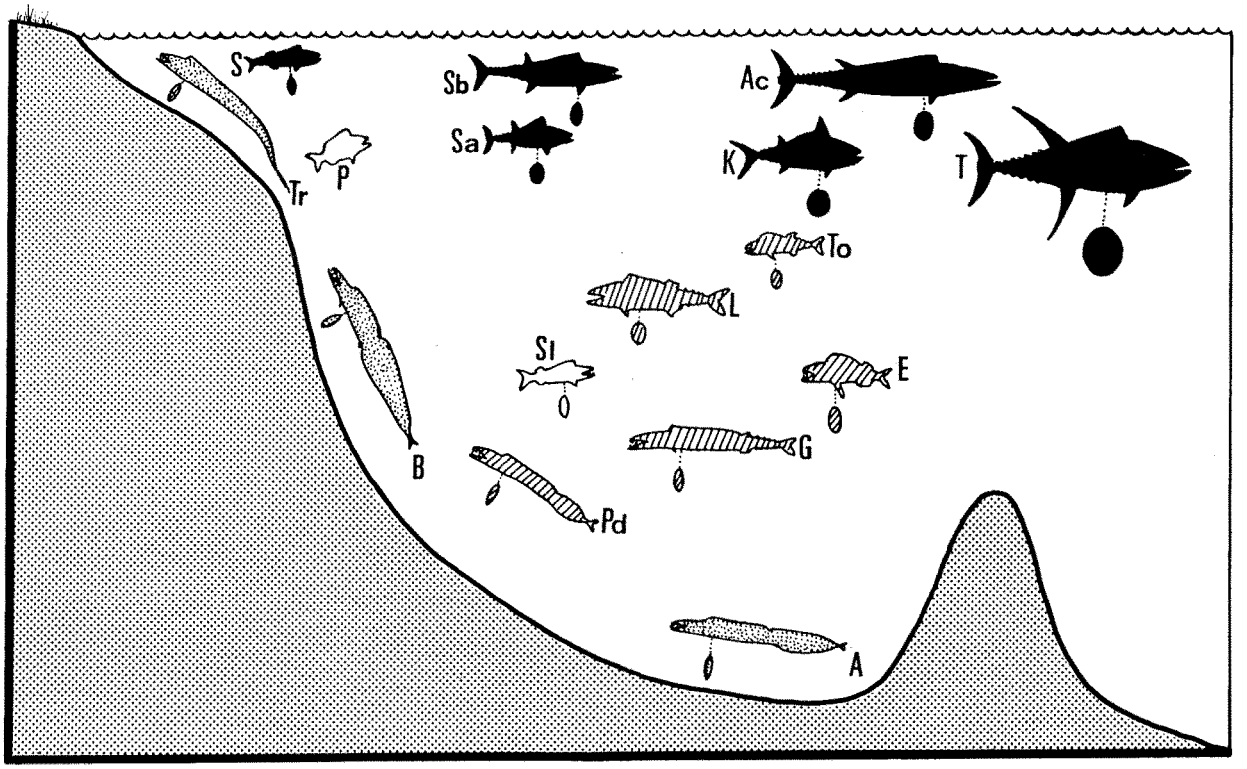


Fig. 6 Lateral and cross section body shape in relation to habitat type for certain scombroid fishes. Black figures represent scombrids, oblique lines gempylids, and stippled figures trichiurids. Genera are abbreviated as: A, ***Aphanopus;*** Ac, ***Acanthocybium;*** B, ***Benthodesmus;*** E, ***Epinnula; G, Gempylus;*** K, ***Katsuwonus;*** L, ***Lepidocybium;*** P, hypothesizcd protopercoid fish; Pd, ***Paradiplospinus; S, Scomber;*** Sa, ***Sarda,*** Sb, ***Scomberomorus;*** Sl, ***Scombrolabrax;*** T, ***Thunnus;*** To, ***Tongaichthys;*** Tr, ***Trichiurus.***

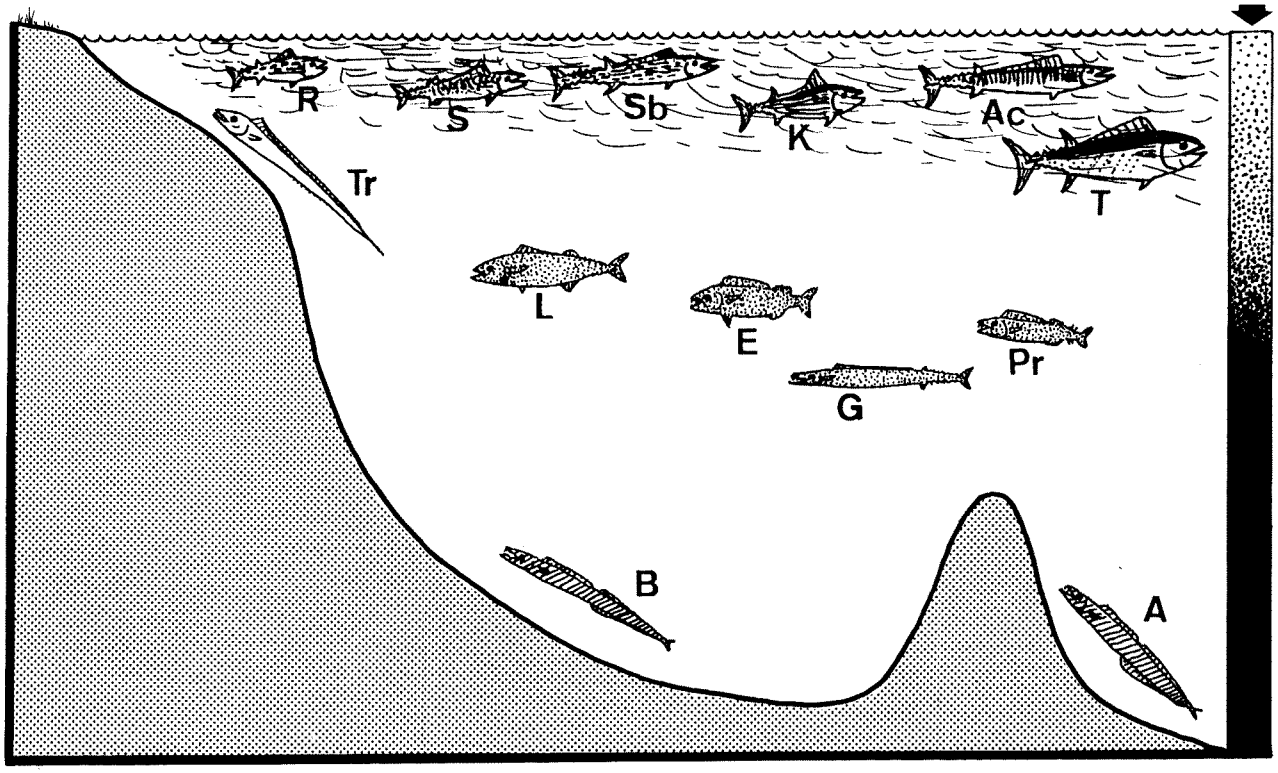


Fig. 7 Typical coloration with depth and decreasing light (direction of arrow). Stippling represents typically brownish gempylids, oblique lines represent dark coloration and tunas are counter shaded. Genus abbreviations as in Fig. 6 except: Pr, *Promethichthys;* R, *Rastrelliger*

represent one extreme of this ecological-morphological continuum in that they are elongate and exclusively benthic. At the other extreme, the tuna-like fishes (Scombridae) are fusiform and mostly epipelagic. The snake mackerels (Gempylidae) are intermediate with both elongate and fusiform body shapes and are both benthopelagic and mesopelagic. Body colour in these groups is also characteristic of their habitat type (Fig. 7). Tunas are counter-shaded (darker dorsally and silvery ventrally), gempylids are brownish or blackish consistent with their mesopelagic and benthopelagic existence, and trichiurids are dark coloured in deeper water and light coloured in shallow water. The pattern of the lateral line in the three families (Fig. 8) is also characteristic of the

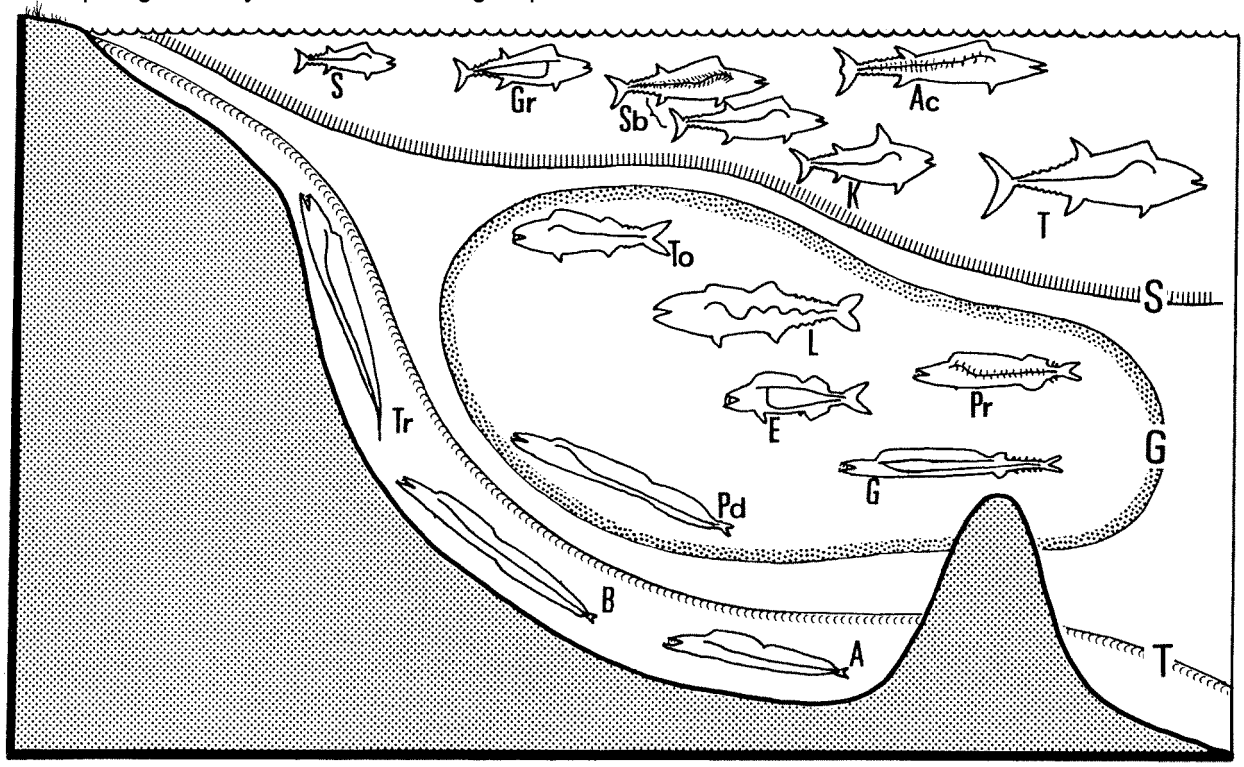


Fig. 8 Pattern of trunk lateral line in relation to habitat for Scombridae (S), Gempylidae (G), and Trichiuridae (T). Genus abbreviations the same as in Figs 6 and 7 except: Gr, *Grammatorcynus*

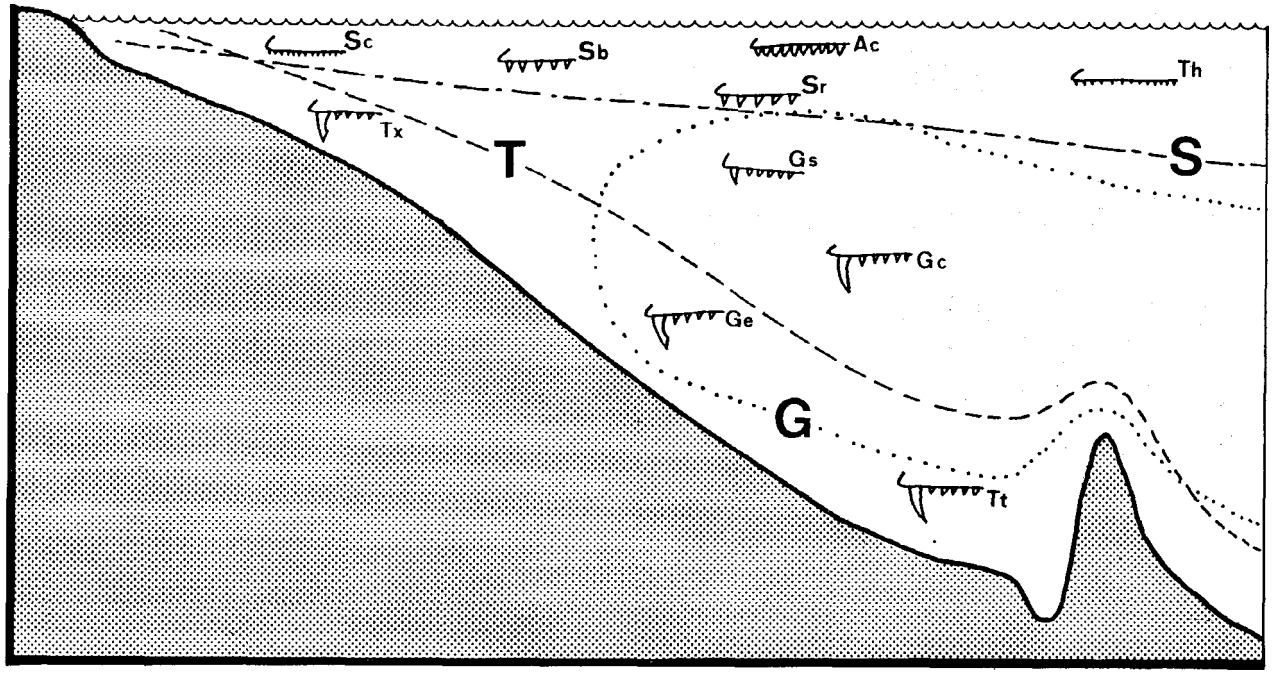


Fig. 9 Typical configuration of teeth in upper jaw in relation to habitat type for Scombridae (S), Gempylidae (G), and Trichiuridae (T). Abbreviations are the same as in Figs 6-9 except: Gc, compressed gempylids; Ge, elongate gempylids; Gs, semifusiform gempylids; Tt, trichiurids with tails; Tx, trichiurids without tails; Sc, Scombrini; Sr, Sardini; Th, Thunnini

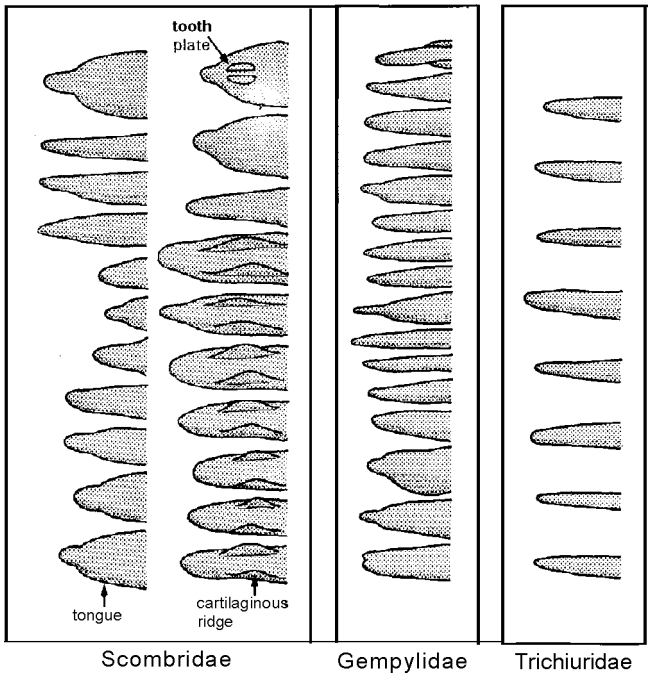


Fig. 10 Tongue shape for certain scombroid fishes. **Scombridae top to bottom on left:** ***Gasterochisma melampus, Scomber japonicus, S. australasicus, Rastrelliger kanagurta, Scomberomorus niphonius, S. koreanus, S. commerson, Acanthocybium solandri, Grammatorcynus bilineatus, G. bicarinatus, Sarda orientalis;*** **top to bottom on right:** ***Gymnosarda unicolor, Cybiosarda elegans, Allothunnus fallai, Auxis thazard, A. rochei, Euthynnus affinis, Katsuwonus pelamis, Thunnus albacares, T. tonggol, T. thynnus.*** Gempylidae top to bottom: ***Promethichthys Prometheus, Rexea solandri, R. prometheoides, Neoepinnula orientalis, Epinnula magistralis, Nealotus tripes, Nesiarchus nasutus, Thyrsitoides marleyi, Gempylus serpens, Paradiplospinus gracilis, Diplospinus multistriatus, Thyrsitops lepidopoides, Thyrsites atun, Lepidocybium flavobrunneum, Ruvettus pretiosus, Tongaichthys robustus.*** Trichiuridae top to bottom: ***Benthodesmus tenuis, Lepidopus caudatus, Evoxymetopon poeyi, Aphanopus carbo, Eupleurogrammus glossodon, Lepturacanthus savala, Tentoriceps cristatus, Trichiurus lepturus***

habitat type. The tunas have well developed lateral lines situated mostly on the upper sides which presumably is useful for detecting sensory stimuli in the upper waters of the open ocean. In contrast, trichiurids have their lateral line situated mostly on the lower sides which presumably is an adaptation to detecting sensory stimuli near the bottom of the ocean. Species of Gempylidae have lateral-line patterns similar to either trichiurids or scombrids depending on their habitat orientation. The swimming and feeding behaviour is also typical of these three families and their habitats. The tunas are fast-swimming predators with small, sharp teeth typidal for rapid grasping and ingestion of prey (Fig. 9). Their tongues are flat with cartilaginous ridges (Fig. 10) which serves to funnel water over the gills during their typically continuous, high-speed swimming. Nostril shape and shape of the olfactory rosette of tunas are also apparently adapted for their fast swimming mode (Fig. 11). Usually, the anterior nostril is small and round, the posterior nostril is a slit, and the rosette is rounded and often with an accessory sac. This 'design' decreases drag while water passes over the rosette and allows adequate olfactory function during continuous, fast swimming. Trichiurid fishes have dentition, tongues and nasal organs adapted to more sedentary benthic habits. Their teeth are long, sharp and often fang-like for seizing and holding prey during ambush predation. Their tongues are more slender and rounded and therefore not adapted to funnelling water over gills during swimming. They have a single, rounded nostril which serves as both incurrent and
rent pore and therefore passage of water over the

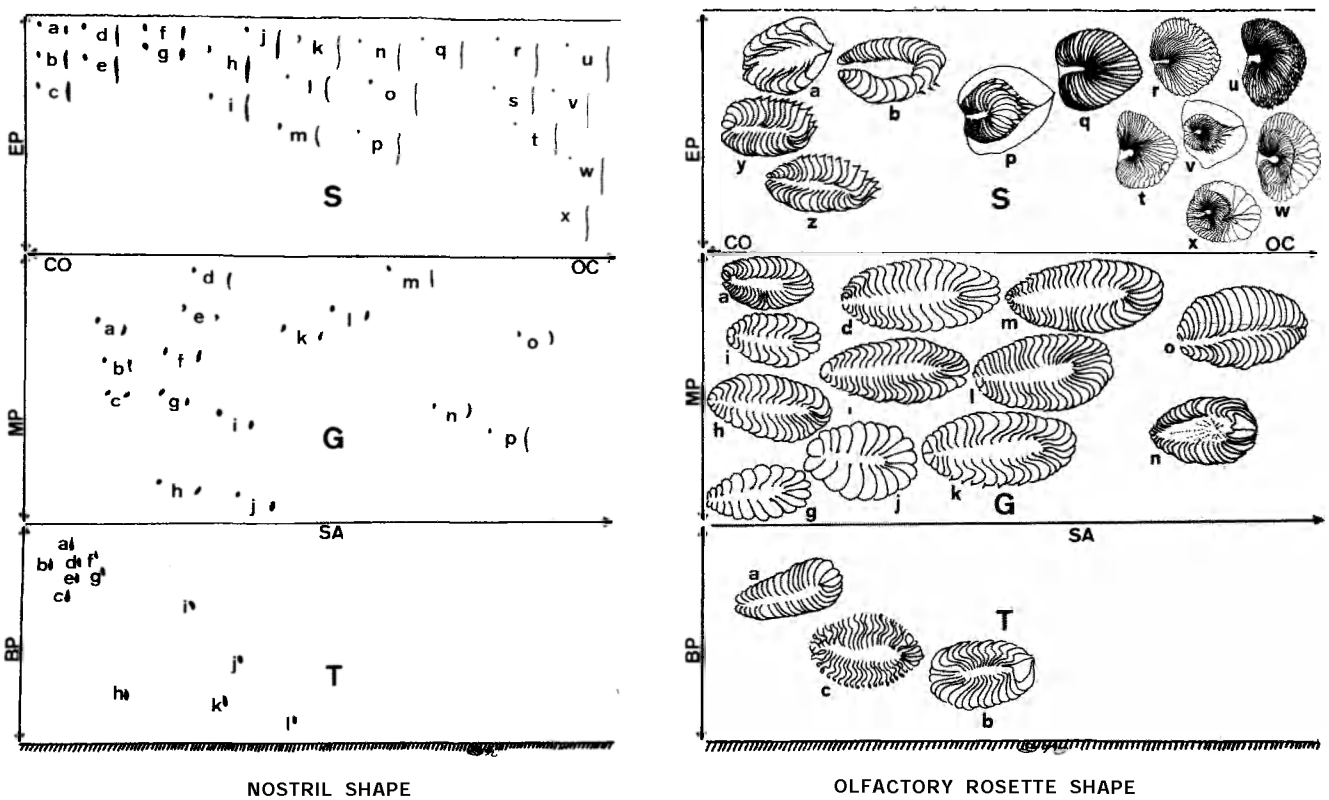


Fig. 11 Nostril and rosette shape arranged according to occurrence in epipelagic (EP), mesopelagic (MP), benthopelagic (BP), coastal (CO), and oceanic (OC) habitats and swimming ability (SA).
Scombridae (S): a, *Rastrelliger faughni*; b, *Scomber japonicus*; c, *S. australasicus*; d, *Grammatorcynus bilineatus*; e, *G. bicalinatus*; f, *Scomberomorus sinensis*; g, *S. queenslandicus*; h, *Cybiosarda elegans*; i, *Orcynopsis unicolor*; j, *Sarda orientalis*; k,*Auxis thazard*; l, *Gymnosarda unicolor*; m, *Gasterochisma melampus*; n, *Euthynnus affinis*; o, *Acanthocybium solandri*; p, *Allothunnus fallai*; q, *Katsuwonus pelamis*; r, *Thunnus tonggol*; s, *T. atlanticus*; t, *T. maccoyii*; u, *T. albacares*; v, *T. alalunga*; W, *T. thynnus*, x, *T. obesus*; y, *R. brachysoma*; z, *R. kanagurta*. Gempylidae (G): a, *Nealotus tripes*; b, *Rexea solandri*; c, *Rexichthys johnpaxtoni*; d, *Thyrsites atun*; e, *Thyrsitops lepidopoides*; f, *Promethichthys prometheus*; g, *Neoepinnula orientalis*; h, *Diplospinus multistriatus*; i, *Epinnula magistralis*; j, *Paradiplospinus gracilis*; k, *Nesiarchus nasutus*; l, *Thyrsitoides marleyi*; m, *Gempylus serpens*; n, *Ruvettus pretiosus*; o, *Tongaichthys robustus*; p, *Lepidocybium flavobrunneum*. Trichiuridae (T): a, *Trichiurus lepturus*; b, *T. gangeticus*; c, *Tentoriceps cristatus*; d, *Eupleurogrammus muticus*; e, *E. glossodon*; f, *Lepturacanthus pantului*; g, *L. savala*; h, *T. auriga*; i, *Lepidopus caudatus*; j, *Benthodesmus tenuis*; k, *Evoxymetopon taeniatus*; l, *Aphanopus carbo*

olfactory rosette is not strongly dependent on swimming movements. The olfactory rosette is more elongate in trichiurids than tunas but the relation of this shape with habitat type is not fully understood. Collectively, gempylids are intermediate between tunas and trichiurids in shape and configuration of teeth, tongue, nostrils and olfactory rosettes (Figs 9 to 11). Those that are fast swimming predators have short teeth, flat tongues and both rounded and slit-like nostrils. The more benthic-oriented gempylids have long, sharp teeth with fangs, relatively flat tongues and rounded nostrils.

Parin and Becker (1972) recognized three main ecological groups of trichiuroid fishes. The majority (33 species) are a group that are neritic or benthopelagic, dwelling above the bottom on continental shelves and slopes. The hairtails of the genera *Eupleurogrammus, Lepturacanthus* and *Tentoriceps* are usually found in shallow water from 20 to 200 m. Species belonging to *Lepidocybium, Neoepinnula, Rexea, Rexichthys, Ruvettus, Thyrsites, Thyrsitoides* and *Thyrsitops* of the Gempylidae, and *Assurger, Evoxymetopon, Lepidopus* and *Trichiurus* of the Trichiuridae are mostly confined to depths of 100 to 500 m at the continental shelf margin and at the upper part of the slope. Some are characteristically found on seamounts in the open sea, including the four commercially important species of trichiurids, *Trichiurus lepturus, Thyrsites atun, Lepidopus caudatus* and *Rexea solandri.*

The second group is comprised of 18 to 19 species found on the continental slope from 200 to 1500 m (rarely 2 000 m) and includes the gempylid genera *Nesiarchus, Paradiplospinus* and *Promethichthys,* and the trichiurid genera *Aphanopus* and *Benthodesmus. Aphanopus mik-. hailini* is found at depths deeper than all other trichiuroid fishes, having been reported from 1 350 to 2 000 m.

Most (perhaps all) of the benthopelagic trichiuroids of the continental slope develop in mesopelagic water masses. Postlarvae and juveniles of *Nesiarchus, Paradiplospinus, Promethichthys,*

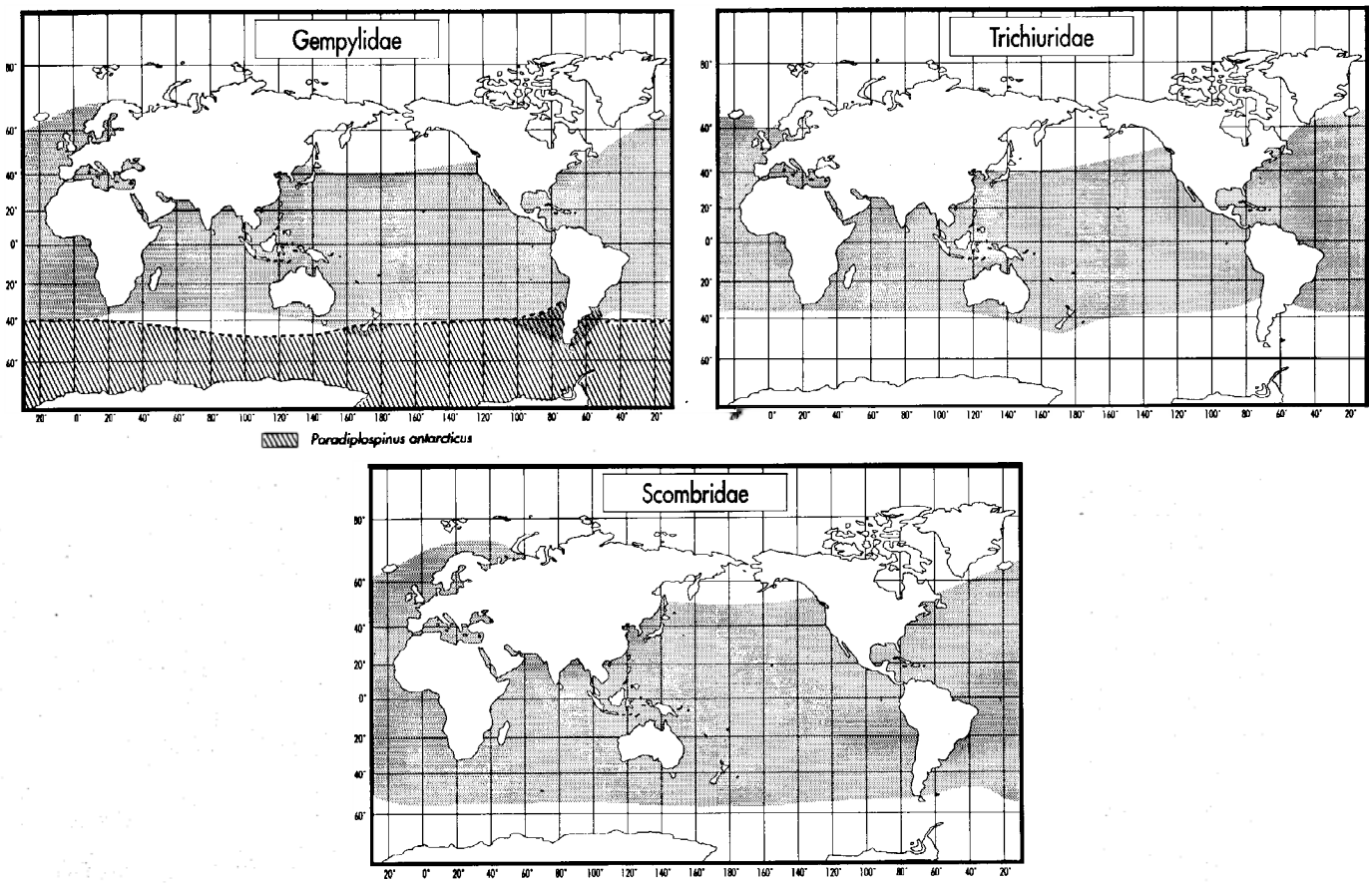


Fig. 12 Distribution limits for the Gempylidae, Trichiuridae and Scombridae

Aphanopus and *Benthodesmus* are common in midwater plankton and micronekton samples. In addition, adults of the benthopelagic gempylids *Lepidocybium flavobrunneum, Ruvettus pretiosus, Thyrsites atun,* and *Thyrsitoides marleyi* sometimes occur in epipelagic layers and are a normal bycatch of the tuna long-line fishery.

The least diverse is the third group of oceanic pelagic trichiuroids with 3 or 4 species, *Nealotus tripes* and *Gempylus serpens* are epi- to mesopelagic (both migrate to the surface at night), while *Diplospinus multistriatus* is mesopelagic (insufficiently known *Paradiplospinus antarcticus* might also be pelagic).

Trichiuroid and scombrid fishes are distributed throughout the world mainly in tropical, subtropical and warm temperate waters (Fig. 12). They tend to have different patterns of distribution in the northern and southern hemispheres. Scombrids are found further poleward in the northern hemisphere than in the southern hemisphere, especially in the eastern parts of oceans where warm currents extend further north into epipelagic layers. The significant poleward shift of the southern distributional boundary of the Gempylidae is because of the range of a single, ecologically aberrant species, *Paradiplospinus antarcticus.* Without this species, the distributional boundaries of the Gempylidae and the Trichiuridae are similar except off the southern tip of South America where the gempylid, *Thyrsites atun* occurs.

The scombrids are generally more widely distributed, especially during the warm season, than both families of the Trichiuroidea. Scombrids inhabit surface waters (Fig. 12) where they generally make long seasonal horizontal migrations. Gempylids and trichiurids are mesopelagic and benthopelagic and have much more limited horizontal migrations than scombrids. Trichiurids do however, have marked daily vertical migrations.

1.4 Problems of Identification

The tails of trichiurids are often damaged or cut off and certain standard measurements cannot be made accurately. Therefore, in this catalogue the overall length measurement for some trichiurids is taken as the preanal length, or the length from the tip of upper jaw to anus. In addition, when the tail is damaged the count of dorsal fin elements is taken from the fin's origin to above the anus.

The juvenile stages of trichiuroid fishes are largely unknown. Therefore, identification of juveniles is difficult and often not reliable.

1.5 Illustrated Glossary of Technical Terms and Measurements

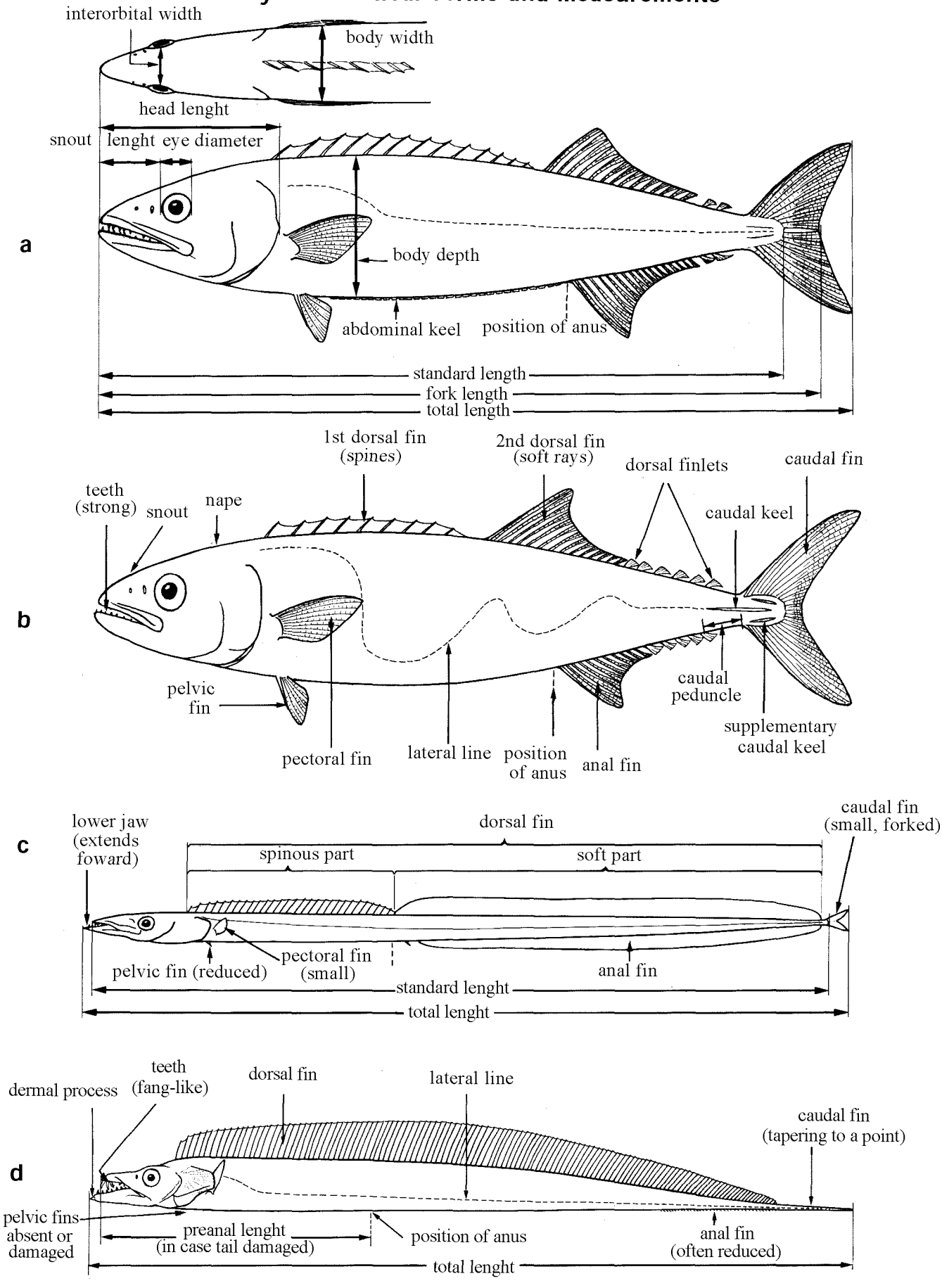


Fig. 13 External features and measurements for typical species of Gempylidae (a, b) and Trichiuridae (c, d)

Abdominal keel - Ossified dermal keel on ventral part of body between pelvic fins and anus, which is only present in *Ruvettus pretiosus* (Fig. 13a). Also called **mid-ventral keel.**

Anal fin - Unpaired fin located on the ventral median line of the body, behind the anus (Fig. 13), consisting of one to three free or comprised spines and a soft portion. Anterior soft rays underdeveloped or absent in many species of the Trichiuroidae; in this case number of anal-fin elements is counted from radio graphs interhaemal bones.

Anus - External opening of the intestine, situated on the ventral midline of the body (Fig. 13). Also known as vent. The position of the anus relative to the anal-fin and dorsal-fin origins is important in gempylid and trichiurid taxonomy.

Benthopelagic - Living near, or ecologically associated with the bottom but also often found a substantial distance above the benthos during part of the day.

Body depth - This measurement usually taken as the greatest distance from the dorsal midline to the ventral midline of the body (greatest depth of body) (Fig. 13a). However, in some works this depth is measured at the origin of pectoral fins, pelvic fins and first anal fin.

Body length - Several different measurements are used for body length. These are: the total length, standard length, fork length and preanal length (see definitions below).

Body width - **Usually measured as the greatest width** of the body (Fig. 13a). Sometimes, body width at origin of pectoral fins, pelvic fins and first anal fin is also used.

Branchial cavity - Cavity inside the mouth-enclosing the gills (Fig. 14). Also called **gill cavity.**

Branchiostegals - Ray-like bones attached to the hyoid arch, supporting the branchiostegal membrane on the underside of the head (Fig. 14).

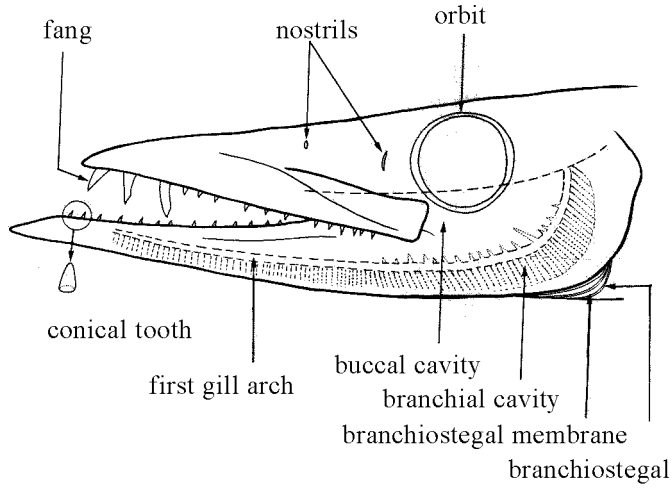


Fig. 14 Structures associated with the head

Branchiostegal membrane - The membrane connecting the branchiostegals and enclosing the gill chamber ventrally (Fig 14).

Buccal cavity - Cavity inside the mouth, above the gill arches (Fig. 14). Also called **mouth cavity.**

Conical tooth - **Cone-shaped** tooth (Fig. 14). Sharp, elongate conical teeth are sometimes called canine teeth.

Caudal fin - **Median** fin situated at the posterior end of the body, consisting of an upper and a lower lobe (Fig. 13).

Caudal keel - A lateral ridge posteriorly on the caudal peduncle or base of caudal fin. In trichiuroid fishes, only *Lepidocybium flavobrunneum* has a large median keel, and small accessory keels on the caudal fin (Fig. 13b).

Caudal peduncle -The narrow part of the body between the posterior ends of the dorsal and anal fins and the base of the caudal fin (Fig. 13b).

Caudal vertebrae - Vertebrae that bear a haemal spine ventral to the vertebral centrum (Fig. 15).

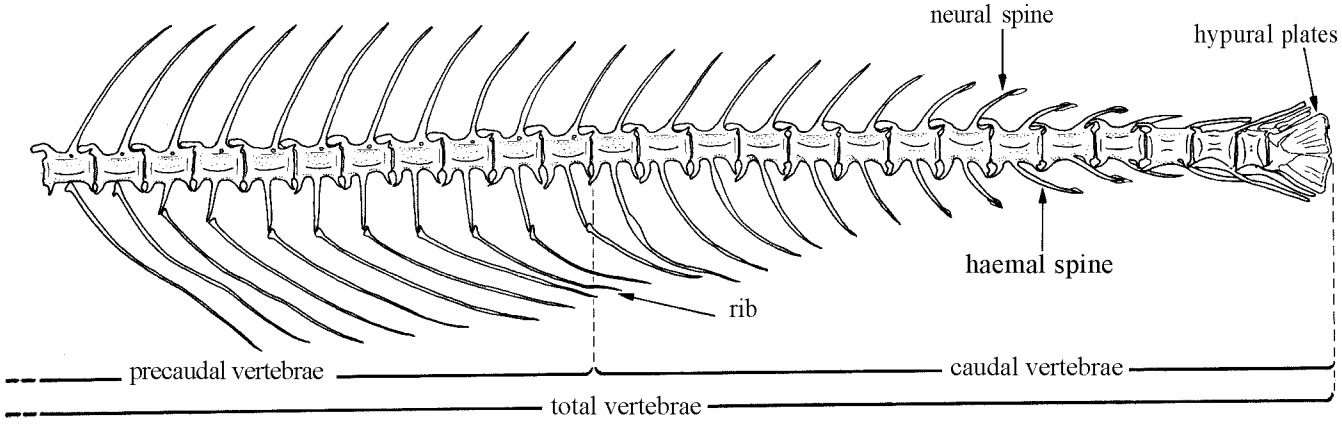


Fig. 15 Some bones associated with the axial skeleton

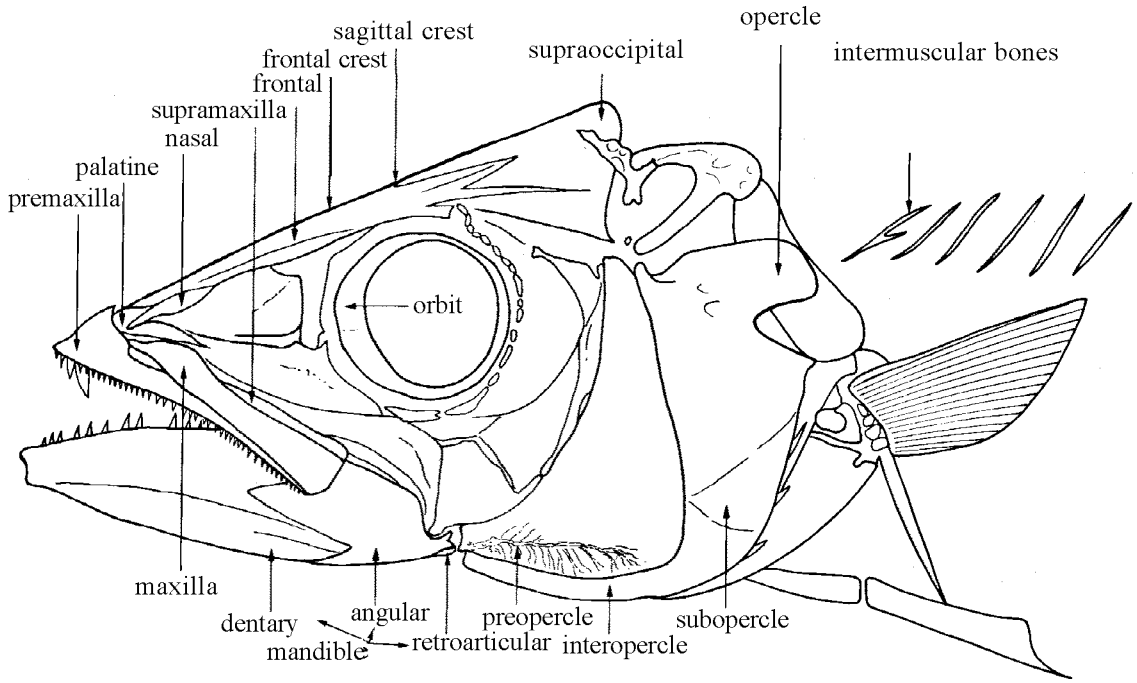


Fig. 16 Bones associated with the head

Dentary - Tooth-bearing bone of the lower jaw (Fig. 16).

Dermal processes - Conical process on tip of upper jaw or sometimes of lower jaw, found in some species of Gempylidae and Trichiuridae (Fig. 17).

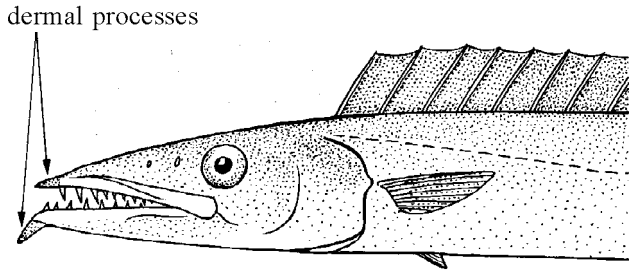


Fig. 17 Dermal processes

Dorsal fin - A median fin along the back of the fish, consisting of a spinous and a soft portion (Fig. 13).

Dorsum -The upper (dorsal) surface of the head or bqdy.

Epineurals - Bones that attach on outside of upper surface of neural spines (Fig. 18).

Epipelagic -The upper region of the open ocean extending from the surface to depths of around 200 m.

Epipleurals - Bones that attach on outside of upper surface of ribs (Fig. 18).

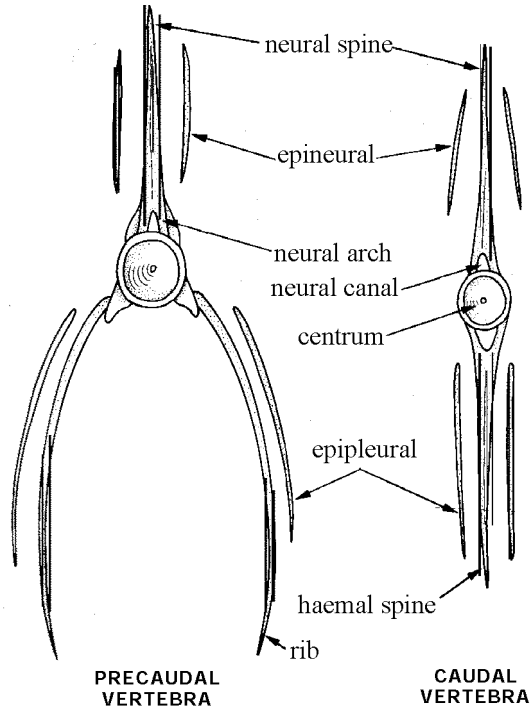


Fig.18 Bones and structures associated with vertebrae

Ethmoid - Unpaired skull bone on the anterior part of the neurocranium forming part of the nasal cavity and located above the vomer. **Lateral ethmoids** are paired bones on both sides of the nasal cavity (Fig. 19).

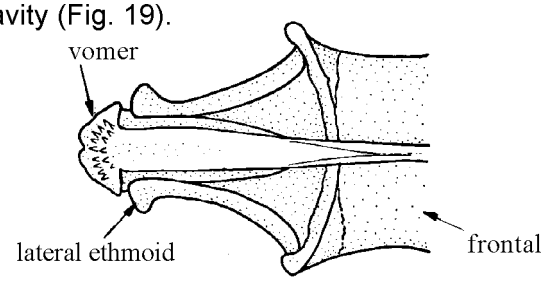


Fig. 19 Skull viewed from below

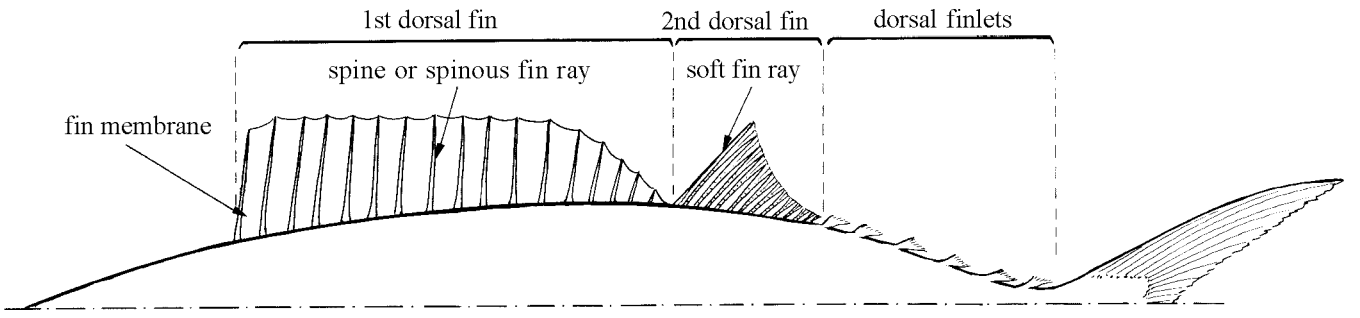


Fig. 20 Structures associated with fins

Eye **diameter** - The greatest distance between the margins of the orbit (Fig. 13a).

Fang - A long sharp tooth situated in the frontal part of the upper jaw, by which prey is seized (Fig. 14).

Finlets - Small individual fins posterior to second dorsal and anal fins (Figs 13b and 20).

Fin membranes - The thin membranes between the rays of the fins (Fig. 20).

Fin rays - General term for the soft rays and spines (spinous rays) that support the fins (Fig. 20).

Fork length -The straight line distance from the tip of upper jaw to the posterior margin of the middle caudal rays (Fig. 13a).

Frontal crest - An elevated bony ridge formed by paired frontal bones along the sagittal suture of the skull (Fig. 16).

Frontals - **Paired** skull bones in the middle dorsal part of the neurocranium (Figs 16,19).

Gill arch - The J-shaped bony or cartilaginous arches under the gill cover to which the gill filaments and gill rakers are attached (Fig. 21).

Gill filaments - The soft, red, fleshy part of the gills; organ for respiration **(Fig. 21).**

Gill rakers - Ossified stiff structures which extend from gill arches toward buccal cavity, usually from the first gill arch (the first or outermost gill arch visible when the gill cover is lifted) (Fig. 21).

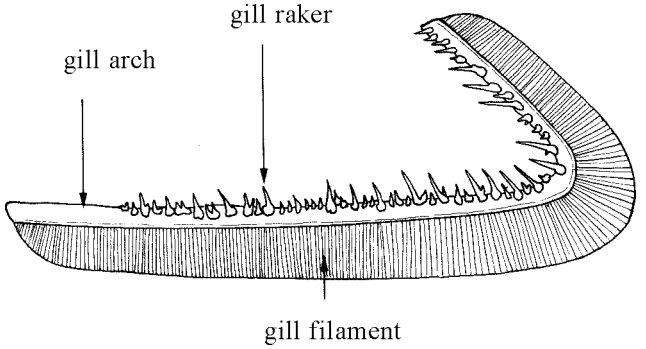


Fig. 21 The first gill arch

Haemal spines - The spines that extend ventrally from the centra of caudal vertebrae (Figs 15 and 18). The first vertebra with a haemal spine is the first caudal vertebra.

Head length - In this catalogue, the measurement is taken from the tip of the upper jaw to the most distant point on the opercular membrane (Fig. 13a). An alternative method used by fisheries biologists but not used in this catalogue, takes the anterior point of measurement from the tip of the lower jaw (mandible).

Hypurals - Terminal bones at posterior end of vertebral column (Fig. 15).

Hypural plate - The expanded ends of the hypurals that form a wide, fan-like plate onto which the caudal-fin rays are attached (Fig. 15).

Interhaemal bones - The bones situated between the haemal spines of the vertebrae and the spines or rays of the anal fin (Fig. 22).

Intermuscular bones - Long, ray-like free bone near skin, laterally in the body (Fig. 16).

Interneural bones - The bones situated between the neural spines of the vertebrae that are situated before the dorsal fin and do not support fin rays (called interneurals or pre-dorsal **bones),** or that support one or more dorsal-fin spine or ray (called **pterygiophores**) (Fig. 22).

Interorbital - The shortest distance between the fleshy margins of the orbits (Fig. 13a) is the **Interorbital width. The Interorbital space** is the area between the eyes.

Lateral line - A series of sense organs enclosed in tubular scales along the sides of the body (Fig. 13).

Mandible - Known as the lower jaw, consisting of dentary, angular and retroarticular bones (Fig. 16).

Maxilla - The bone in the upper jaw that lies behind the premaxilla (Fig. 16).

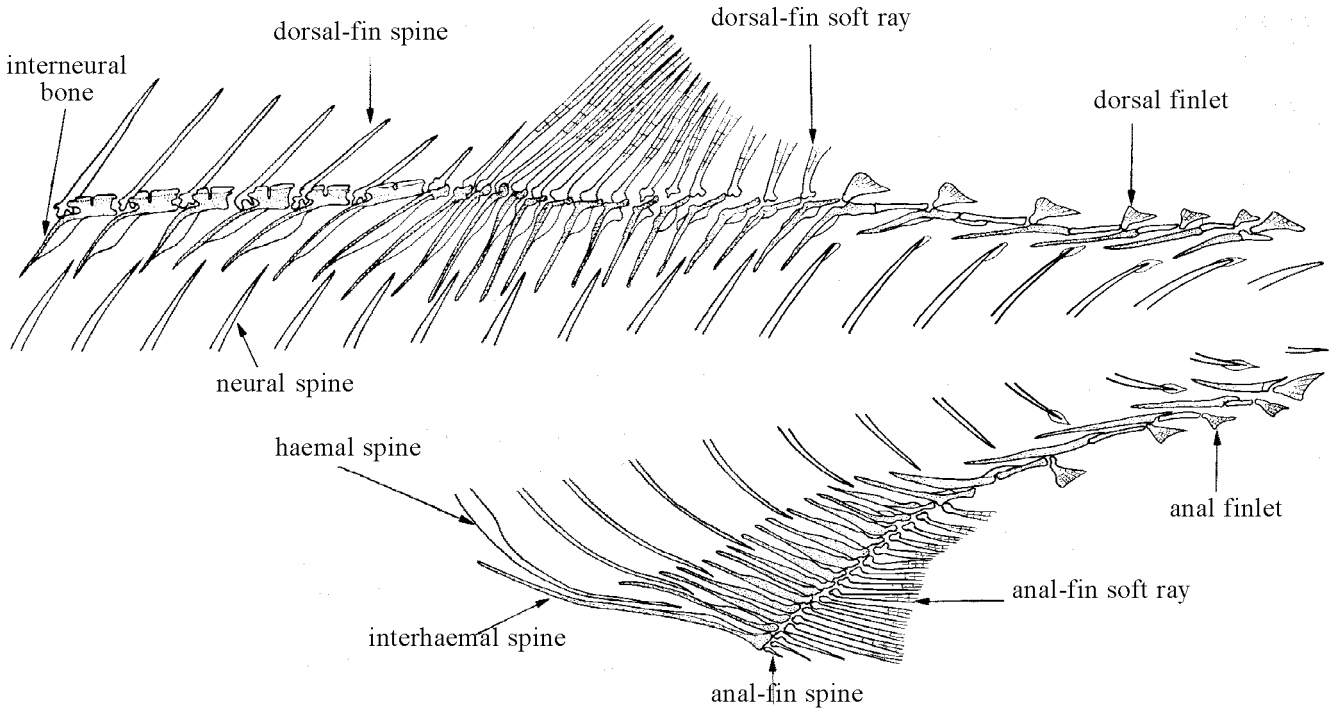


Fig. 22 Bones associated with fin structures

Mesopelagic - The region of the open ocean below the epipelagic zone, between the depths of around 200 m to 1 000 m.

Nape - The upper part of the head behind the eye (Fig. 13b).

Nasals - Paired bones in the ethmoid region of the neurocranium (Fig. 16).

Neural arch -The arch that is formed below the fused basal part of the neural spine of the vertebrae (Fig. 18).

Neural canal - The canal for the nerve cord formed by the neural arch (Fig. 18).

Neural spines - the spines that extend dorsally from the centra of vertebrae (Figs 15 and 18).

Nostrils - External openings of the nasal cavity (Fig. 14). There are a pair of nostrils (anterior and posterior) on each side of the snout in Gempylidae, and single nostril on each side in the Trichiuridae.

Operculum - Gill cover, supported by four bones: opercle, preopercle, interopercle and subopercle (Fig. 16).

Orbit - The bony border surrounding the eye (Figs 14 and 16).

Palatine - A **pair of bones on** each side of the roof of the mouth (Fig. 16).

Pectoral fins - Fin on each side of the body immediately behind the gill opening (Fig. 13).

Pelvic fins - Paired fins on the ventral edge of the anterior half of the body, usually below the pectoral fins (Fig. 13). Also known as ventral fins.

Preanal length - The straight distance from the upper jaw to the anus (Fig. 13).

Precaudal vertebrae - The anterior vertebrae without haemal spines (Fig. 15). Also known as abdominal vertebrae.

Premaxillae - Paired bones of the upper jaw, usually bearing teeth in higher teleosts and associated with the maxillae (Fig. 16).

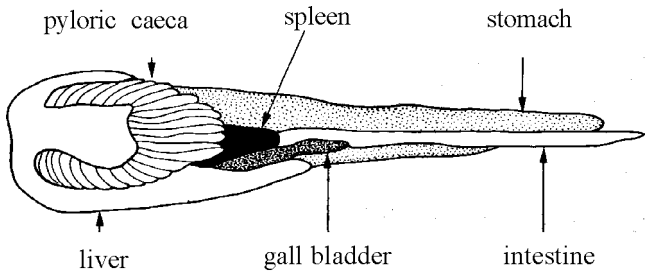


Fig. 23 Viscera of *Tongaichthys*

Pyloric caeca - Special organ of fish for secretion of digestive enzymes. It is a variously-shaped diverticulum originating at the junction of the stomach and the intestine (Fig. 23).

Rays - See definitions for soft rays and spinous rays.

Sagittal crest - An elevated bony ridge that develops along the sagittal suture of the skull (Fig. 16).

Snout - Anterior part of the head, anterior to the eyes and above the mouth (Fig. 13b).

Snout length - The distance from the tip of the upper jaw to anterior margin of the fleshy orbit (Fig. 13a).

Soft rays - A segmented fin ray that is usually flexible and branched.

Spines - Sharp, pungent and pointed structures.

Spinescent gill takers - Gill rakers formed as spines.

Spinous rays - An unsegmented fin ray that is usually rigid and sharply pointed and never branched (Fig. 20).

Standard length - The straight line distance from the tip of the upper jaw to the end of the last vertebra (easily bendable point of caudal fin) (Fig. 13).

Supraoccipital - Uppermost and posterior unpaired bone of skull (Fig. 16).

Total length - The distance from the anteriormost part of the jaw to posteriormost part of the tail (Fig. 13).

Upper jaw length - The length from the anteriormost point of the premaxilla to the posterior edge of the maxilla (Fig. 16).

Vertebrae - The bones of the axial skeleton; divided into 2 sections, precaudal and caudal vertebrae (Fig. 15).

Viscera - The internal soft organs of the body cavity (Fig. 23).

Vomer - A median bone which lies in the roof of the mouth, often bears teeth (Fig. 19).

1.6 Plan of the Systematic Catalogue

A superfamily diagnosis is given, followed by a key to the families Gempylidae and Trichiuridae. For each family, synonyms, FAO names and diagnostic features are presented as well as general information on biology, habitat and distribution, and interest to fisheries, followed by a key to genera. The generic accounts are arranged alphabetically. Genera are introduced with the type reference, synonyms, and diagnostic features (unless the genus contains only a single species and then diagnostic features are often included under the species), and a key to species is given for all non-monotypic genera.The species accounts are arranged alphabetically.The information pertaining to each species is arranged by paragraphs, in the order listed below:

(1) **Scientific Name:** The reference for the original description and the type locality is given.

(2) **Synonyms:** Only the often-used invalid names and combinations that have been applied are referenced; mis-identifications and incorrect applications of names are not referenced. A list of nominal species is given in Chapter 3 (p. 108).

(3) **FAO Names:** FAO-accepted English names and tentative French and Spanish names are given for each species. The FAO English name is considered the standard to be used for fishery purposes. This should avoid confusion which can be caused due to the existence of multiple names for the same species or because of the use of the same name for several species. The FAO name is not intended to supplant the use of local names but rather, to serve as a worldwide reference.

(4) **Field Characters:** Characters that are useful for identifying the species in the field are given.

(5) **Diagnostic Features:** Distinctive characters of the species, as an aid for identification. These diagnoses should be consulted to confirm species identified using the key.

(6) **Geographical Distribution:** The general geographic range is given in the text and illustrated on a map. The map shading includes known areas of occurrence and different types of shading are used for the known adult distribution (densely shaded) and larval distribution (lightly shaded). Limited locality records are indicated as a triangle and doubtful or probable presence indicated with a question mark.

(7) **Habitat and Biology:** Information on habitat, behaviour, food habitats and reproduction.

(8) **Size:** The approximate maximum total or standard length.

(9) **Interest to Fisheries:** General information on the extent, type of fisheries and utilization.

(10) **Local Names:** These are given where published names are available or left blank in case users wish to write in common names not listed but known from their own locality. Often, a single local name is applied to several species.

(11) **Literature:** References that are useful for identification and distributional data. It is stated if an incorrect name is given in the reference.

(12) **Remarks:** Useful information which is not appropriately covered in the previous paragraphs.

2. SYSTEMATIC CATALOGUE

2.1 The Superfamily Trichiuroidea

The superfamily Trichiuroidea as recognized here is made up of the families Gempylidae and Trichiuridae which together form a monophyletic group in the Scombroidei (Johnson, 1986). Some authors (e.g. Nelson, 1984) also include the Scombrolabracidae in this superfamily but their inclusion in the Scombroidei has been questioned (Johnson, 1986).

2.1.1 Diagnostic Features of the Superfamily Trichiuroidea

Diagnostic features: Body semifusiform to extremely elongate and compressed; no caudal keels (except ***Lepidocybium***). Mouth large, lower jaw protruding; one or two nostrils on each side of head: fang-like teeth usually present at front of jaws; gill rakers mostly spinescent.Dorsal fin along the entire dorsal surface of body; pectoral fins short, not inserted high on body; pelvic fins small or absent; caudal fin, if present, forked but not lunate, the rays attached to the distal edge of hypurals (except in ***Tongaichthys***). The first dorsal pterygiophore (an interneural-derived bone) inserts in second interneural space (between first and second neural spines) and does not share this space with other pterygiophores; vertebrae 32 to 170.

2.1.2 Illustrated Key to Families:

1a. Body elongate and moderately compressed, or semifusiform; caudal fin forked and rather large; nostrils double (Fig. 24); two clearly separated dorsal fins, the second dorsal fin (excluding finlets) shorter than the first (Fig. 24) **Gempylidae**

1b. Body very elongate and extremely compressed; caudal fin absent, or a small forked fin; nostrils single (Fig. 25); two continuous dorsal fins or separated by shallow notch, the second dorsal fin longer than the first (Fig. 25). **Trichiuridae**

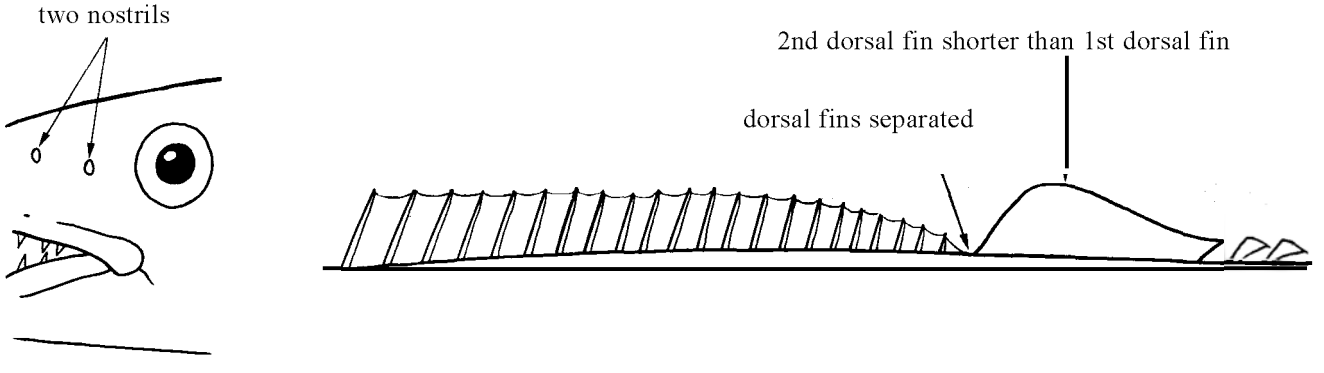


Fig. 24 Gempylidae

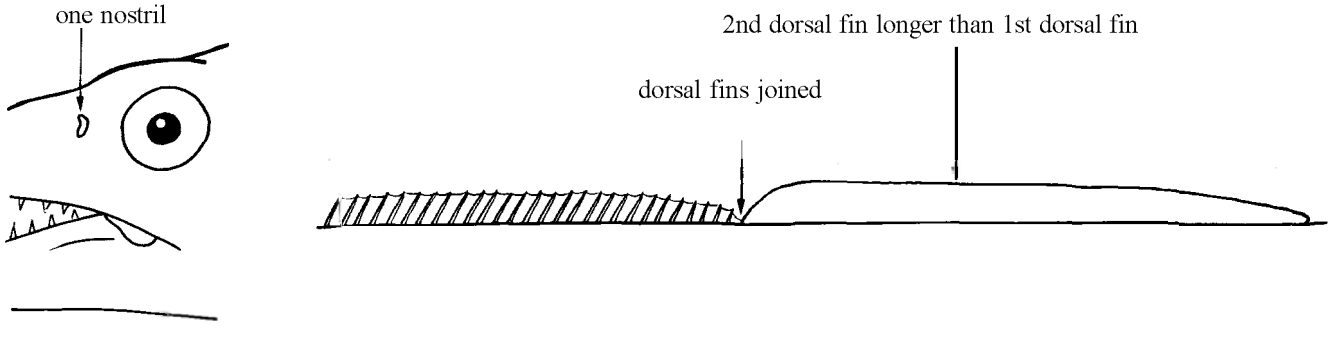


Fig. 25 Trichiuridae

2.1.3 Additional Aids to Identification of Genera and Species

The shape of gill rakers (Figs 26, 27) and jaw teeth (Figs 28, 29) show characteristic features of species and genera and can be used as an additional aid to identification.

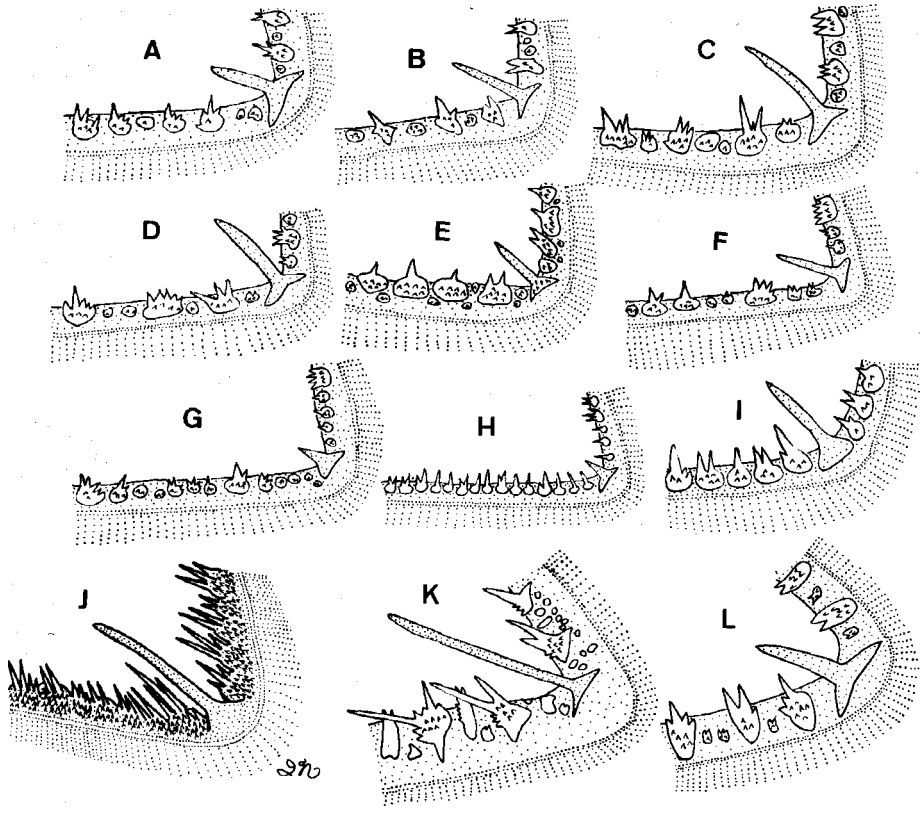


Fig. 26 First gill arch showing gill rakers of Gempylidae. A, *Epinnula magistralis*; B, *Neoepinnula orientalis*; C, *Rexea prometheoides*; D, *Nealotus tripes;* E, *Promethichthys prometheus;* F, *Thyrsitoides marleyi;* G, *Gempylus serpens;* H, *Paradiplospinus antarcticus;* I, *Thyrsitops lepidopoides;* J, *Thyrsites atun;* K, *Tongaichthys robustus;* L, *Ruvettus pretiosus*

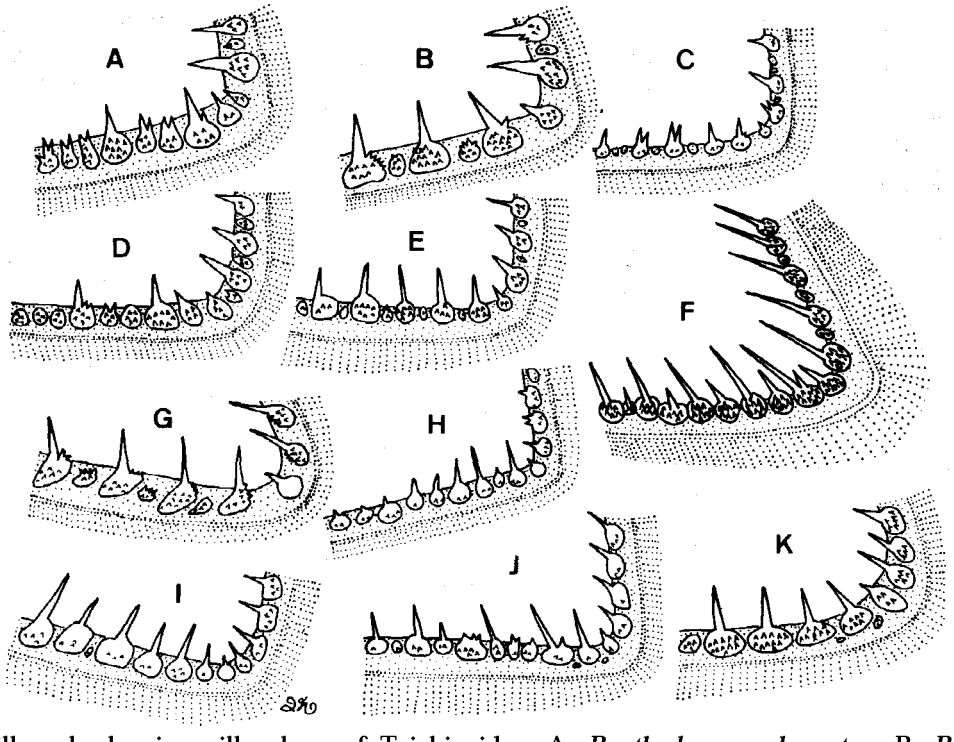


Fig. 27 First gill arch showing gill rakers of Trichiuridae. A, *Benthodesmus elongatus*; B, *B. tenuis*; *C, Assurger anzac*; D, *Aphanopus carbo*, E, *Evoxymetopon taeniatus*; F, *Lepidopus caudatus*; G: *Lepturacanthus savala;* H, *Eupleurogrammus glossodon;* I, *E. muticus;* J, *Trichiurus auriga;* K, *T. gangeticus*

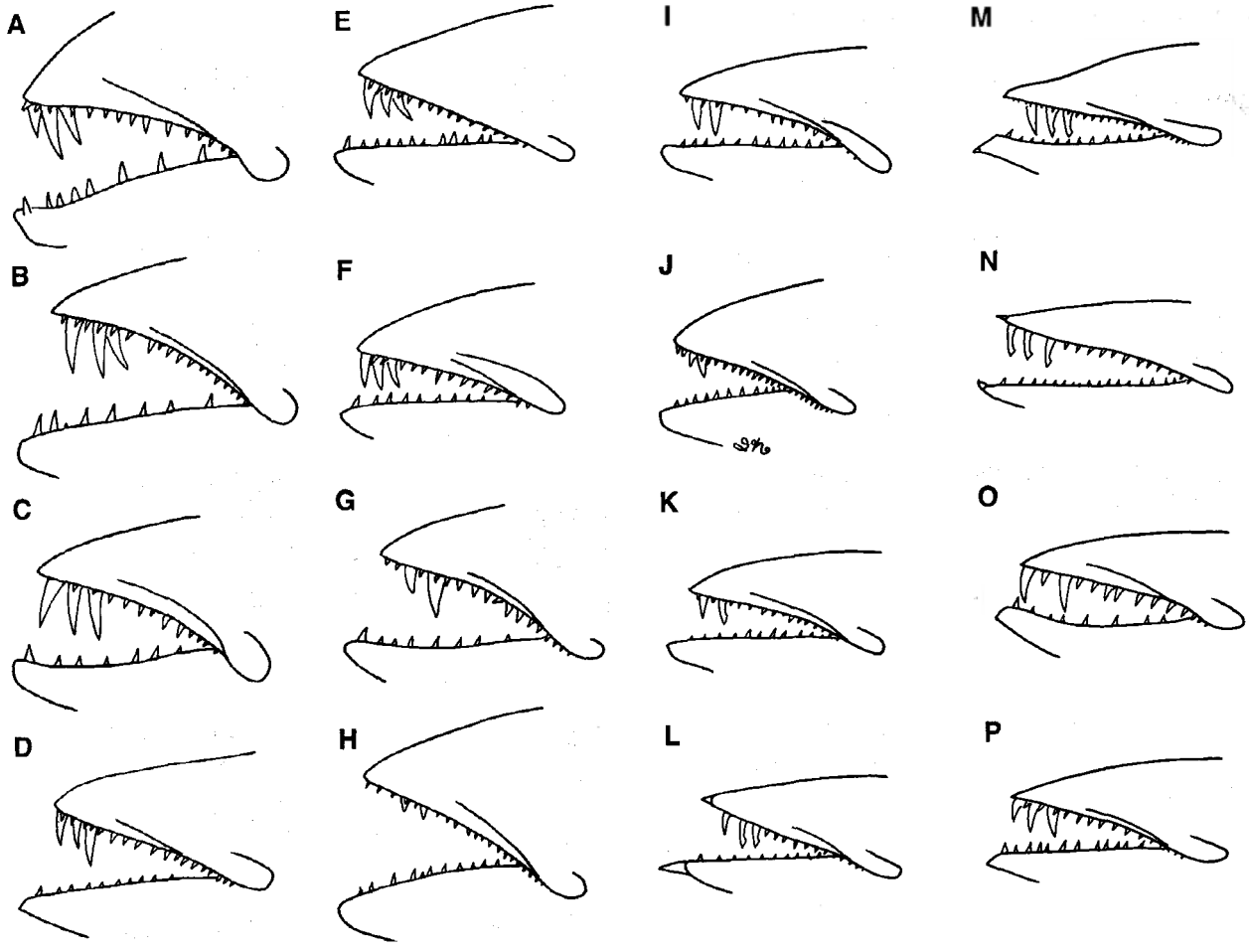


Fig. 28 Jaw teeth of Gempylidae (not drawn to scale). A, Epinnula magistralis; B, Neoepinnula orientalis; C, *Rexeaprometheoides;* D, *Rexichthys johnpaxtoni* (after Parin and Astakhov, 1987); E, *Nealotus tripes;* F, *Promethichthys Prometheus;* G, *Ruvettus pretiosus,* H, *Lepidocybium flavobrunneum;* I, *Thyrsitops lepidopides;* J, *Tongaichthys robustus;* K, *Thyrsites atun;* L, *Nesiarchus nasutus;* M, *Thyrsitoides marleyi;* N, *Gempylus serpens;* O, *Paradiplospinus antarcticus,* P, *Diplospinus multistriatus*

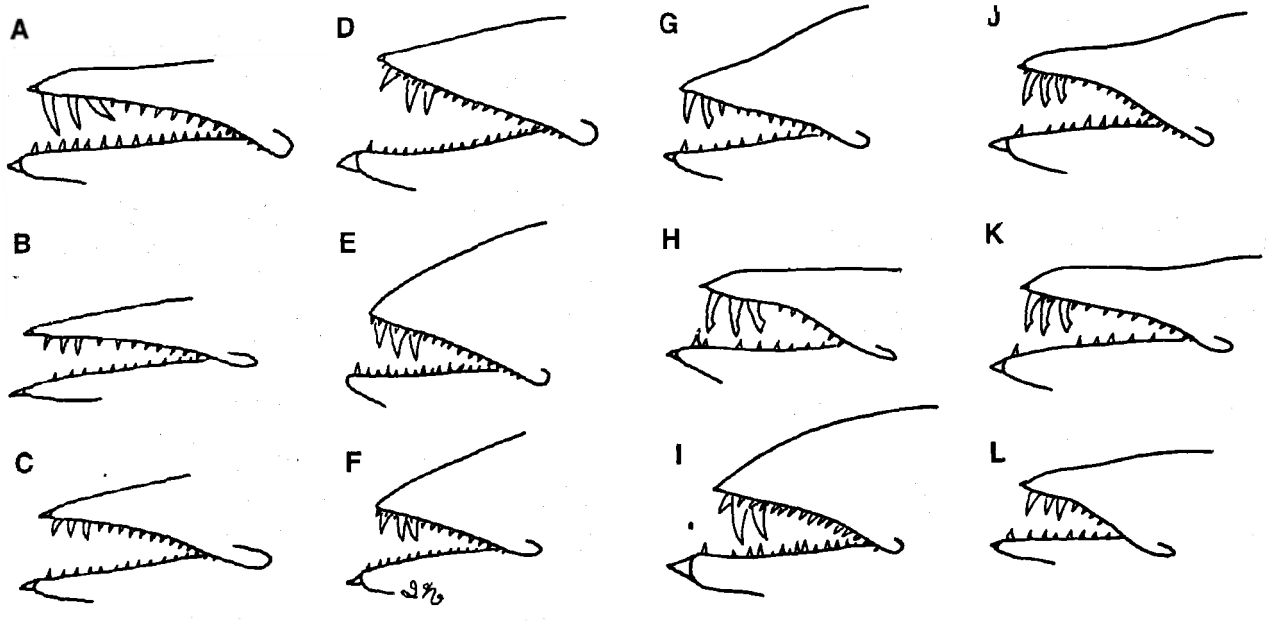


Fig. 29 Jaw teeth of Trichiuridae (not drawn to scale). A, *Aphanopus carbo*; B, *Bethodesmus tenuis*; C, *Lepidopus caudatus;* D, *Assurger anzac;* E, *Evoxymetopon taeniatus;* F, *Eupleurogrammus muticus;* G, *Eupleurogrammus glossodon;* H, *Lepturacanthus savala;* I, *Tentoriceps cristatus;* J, *Trichiurus lepturus;* K, *T. gangeticus;* L, *T. auriga*

2.2 GEMPLYDAE GEMP

2.2.1 Diagnostic Features of the Family Gempylidae

Synonyms: Acinaceidae, Lemnisomidae, Ruvettidae

FAO Names: En - Snake mackerels, Snoeks, Gemfishes, Sackfishes, Escolars, Oilfish, Domine; **Fr** - Escoliers, Rouvet; **Sp** - Escolars, Sierras, Dómine.

Field Characters: Strong teeth in jaws, those at front of upper jaw often fang-like. Two dorsal fins, base of the second (excluding finlets) shorter than the first. Pelvic fins usually small, often reduced to a single spine with only a few or no soft rays, or entirely absent in adults.

Diagnostic Features: Body elongate, compressed or semifusiform. Two nostrils on each side of snout; mouth large, not protractile; strong teeth, those at front of upper jaw often fang-like and sometimes also a pair of fangs at front of lower jaw. Two dorsal fins, followed by finlets in some species, second dorsal-fin base (excluding finlets) shorter than first dorsal-fin base; anal fin similar to second dorsal fin, with I to II free or comprised spines, in some species separate finlets present behind anal fin; pectoral-fin length shorter than head; pelvic fins small, rudimentary or absent in adults of some species; caudal fin forked, the rays attached only to distal edge of hypurals, except in ***Tongaichthys*** whose caudal-fin rays cover hypurals deeply but not completely. Lateral line single (sometimes further finely branched) or double. No caudal keels on caudal peduncle, except in ***Lepidocybium***.Scales small to minute, or variously modified in ***Lepidocybium*** and ***Ruvettus,*** or absent. Vertebrae generally total about 35, but more than 48 in ***Gempylus, Diplospinus*** and ***Paradiplospinus.***

Biology, Habitat and Distribution: Large, swift predators found in all oceans, usually in depths of 200 to 500 m, but some species migrate to the surface at night. Most species attain more than 1 m total length. There are 16 genera and 23 species known so far.

Interest to Fisheries: There appears to be no special fishery, except for ***Thyrsites atun,*** which is caught by hook-and-line and trawl in various waters of the Southern Hemisphere, and ***Rexea solandri,*** which is caught in trawls and by trolling off southeastern Australia and New Zealand. Some species are frequently taken as bycatch in the tuna longline fishery. The flesh is edible and tasty in ***Thyrsites*** and ***Rexea*** but oily with purgative properties in ***Lepidocybium*** and ***Ruvettus.***

2.2.2 Key to the Genera of Gempylidae:

1a. Dorsal-fin elements more than 60; distance from anus to anal-fin origin nearly equal to or greater than snout length (Fig. 30) ..... → *2*

1b. Dorsal-fin elements less than 56; distance from anus to anal-fin origin about equal to eye diameter (Fig. 31)..... → *3*

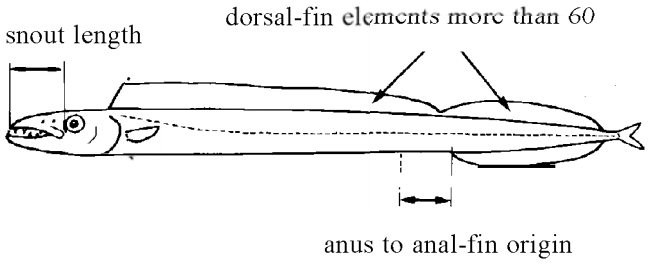


Fig. 30

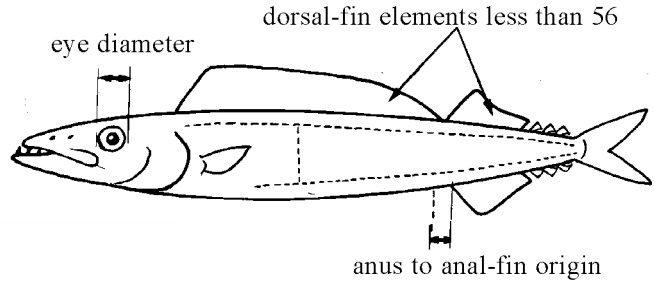


Fig. 31

2a. Anus situated midway between tip of snout and tip of caudal fin, in front of first anal-fin spine by distance equal to head length and much longer than snout length (Fig. 32); anterior part of anal fin with almost no fin membrane (Fig. 32)..... ***Diplospinus***

2b. Anus situated nearer tip of caudal fin than to tip of snout, in front of first anal-fin spine by distance much shorter than head length and nearly equal to snout length (Fig. 33); anterior part of anal fin with fin membrane (Fig. 33) ..... ***Paradiplospinus***

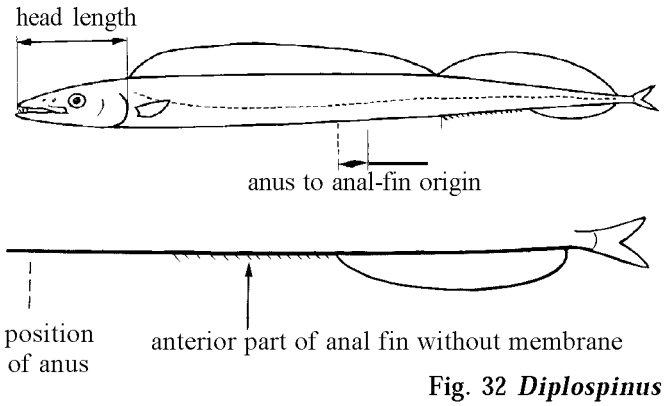


Fig. 32 ***Diplospinus***

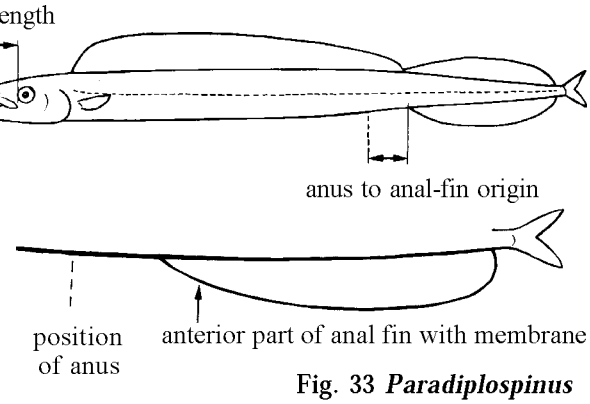


Fig. 33 ***Paradiplospinus***

3a. Caudal peduncle with a prominent keel and 2 small supplemental keels above and below (Fig. 34); dorsal-fin spines VIII or IX; lateral line single, extremely sinuous (Fig. 34)... ***Lepidocybium***

3b. Caudal peduncle without keels; dorsal-fin spines more than XII; lateral line single, or bifurcated, but not sinuous (Fig. 35) ..... → ***4***

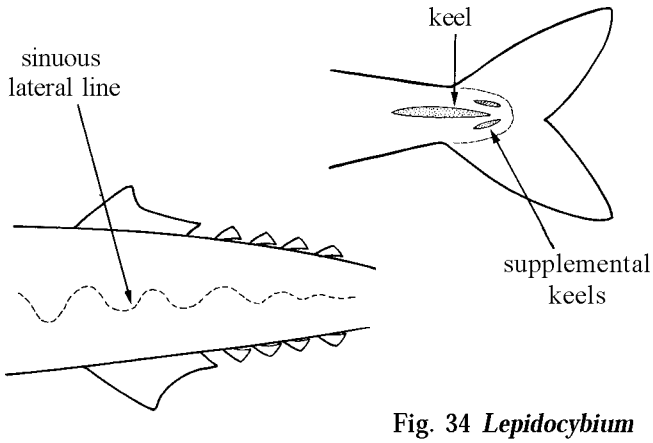


Fig. 34 ***Lepidocybium***

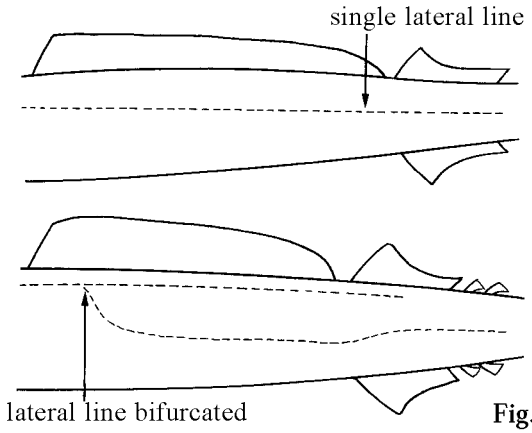


Fig. 35

4a. Skin very rough; scales medium-sized, interspersed with spinous bony tubercles (Fig. 36); mid-ventral (abdominal) keel on belly (Fig. 37); lateral line single, obscure ..... ***Ruvettus***

4b. Skin rather smooth, scales small, not interspersed with spinous bony tubercles; no mid-ventral (abdominal) keel on belly; lateral line single or double, always obvious ..... → ***5***

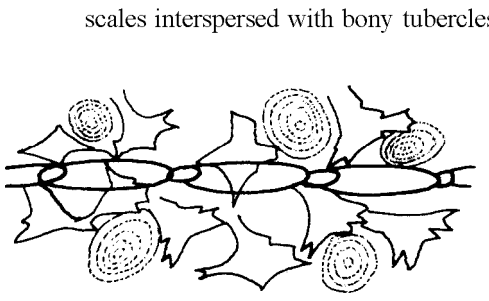


Fig. 36 Skin close up of ***Ruvettus***

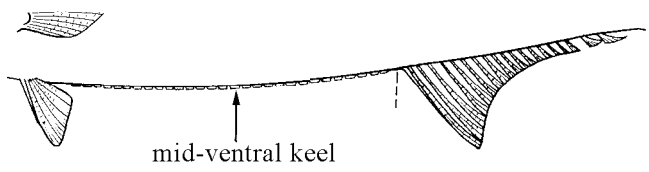


Fig. 37 Ventral part of ***Ruvettus***

5a. Pelvic fins rudimentary (with I spine and 0 to 4 rays) or absent ..... → *6*

5b. Pelvic fins well developed (with I spine and 5 rays) ..... → *10*

6a. Lateral line single ..... → *7*

6b. Lateral line double ..... → *8*

7a. Two free anal-fin spines behind anus, first of them large, dagger-shaped (Fig. 38); lateral line fairly strait (Fig. 38); dorsal-fin spines XX or XXI ***Nealotus***

7b. No free anal-fin spines behind anus; lateral line curved abruptly downward anteriorly (Fig. 39); dorsal-fin spines XVII or XVIII ***Promethichthys***

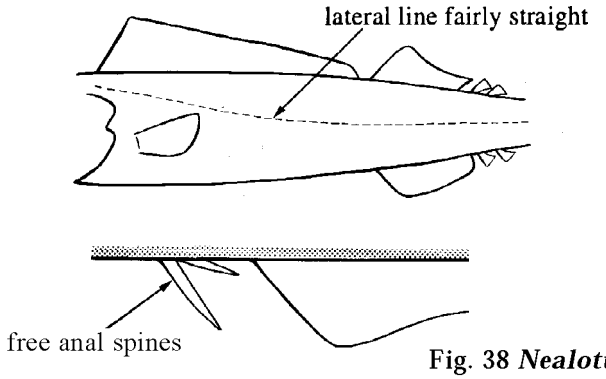


Fig. 38 ***Nealotus***

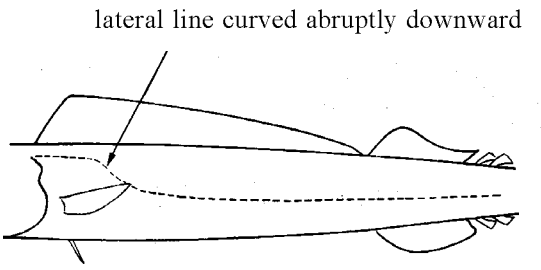


Fig. 39 ***Promethichthys***

8a. Body depth 14.5 to 19 times in standard length; head length 5.5 to 6 times in standard length; dorsal-fin spines XXVI to XXXII; dorsal and anal finlets 5 to 7; both lateral lines originating at one point at upper edge of opercle (Fig. 40) ..... ***Gempylus***

8b. Body depth 5 to 8 times in standard length; head length 2.7 to 3.9 times in standard. length; dorsal-fin spines XVII to XIX; dorsal and anal finlets 2 or 3; lower lateral line branching off below third to seventh dorsal-fin spines (Fig. 41) ..... → *9*

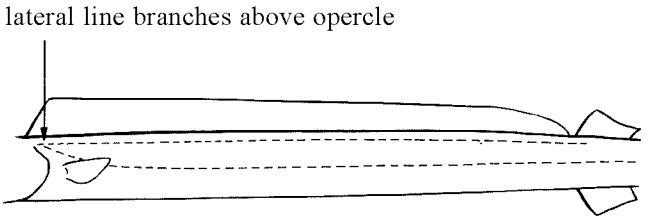


Fig. 40 ***Gempylus***

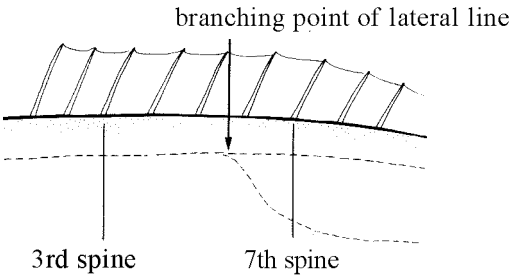


Fig. 41

9a. Lower lateral line very low, running along lower edge of body, anterior branch extends in front of oblique connecting lateral line (Fig. 42)..... ***Rexichthys***

9b. Lower lateral line not low, running nearly midbody, without anterior branch (Fig. 43) .... ***Rexea***

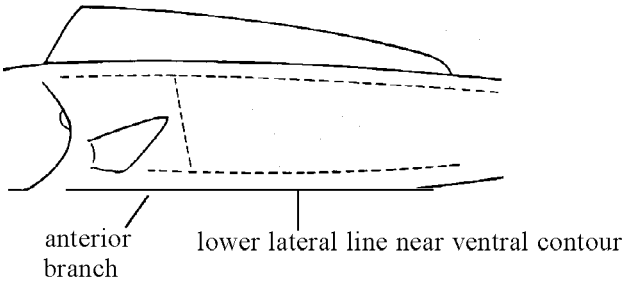


Fig. 42 ***Rexichthys***

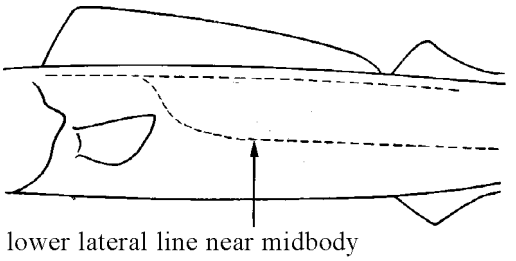


Fig. 43 ***Rexea***

10a. Lateral line double.....→ *11*

10b. Lateral line single .....→ *13*

11a. Dorsal-fin spines XVII to XIX; dermal processes on jaws (Fig. 44); lower lateral line running on midbody (Fig. 44)..... ***Thyrsitoides***

11b. Dorsal-fin spines less than XVI; no dermal processes on jaws; lower lateral line running near ventral contour **(Fig. 45)** .....→ *12*

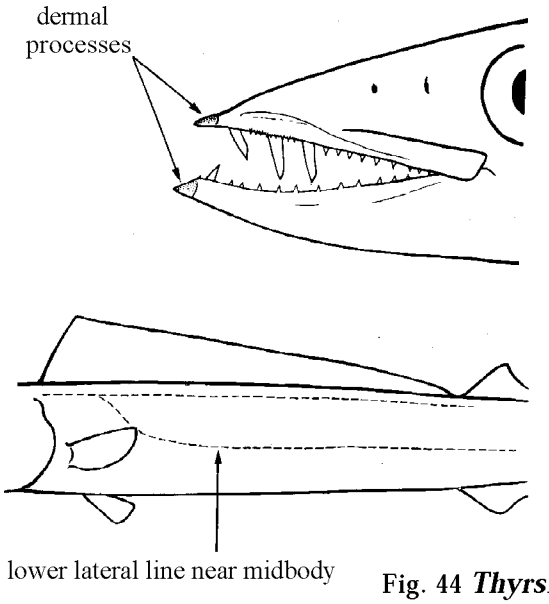


Fig. 44 ***Thyrsitoides***

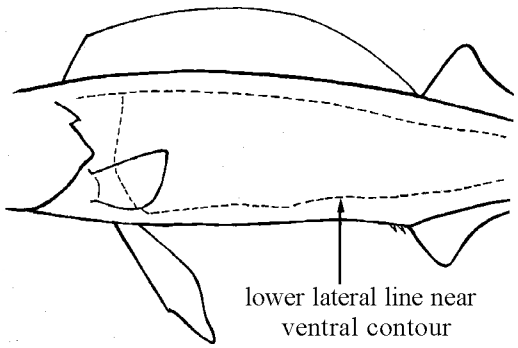


Fig. 45

12a. Lower lateral line branching off under fifth to sixth dorsal-fin spines; two small spines on lower angle of preopercle (Fig. 46).....***Epinnula***

12b. Both lateral lines originating at one point, at upper edge of opercle; no spines on preopercle (Fig. 47)..... ***Neoepinnula***

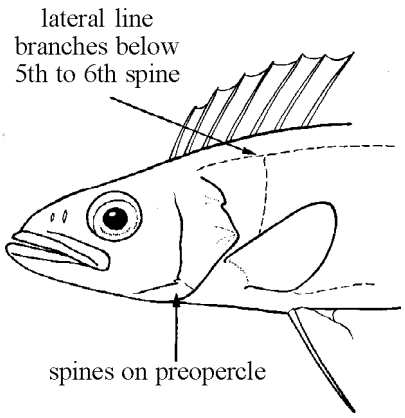


Fig. 46 ***Epinnula***

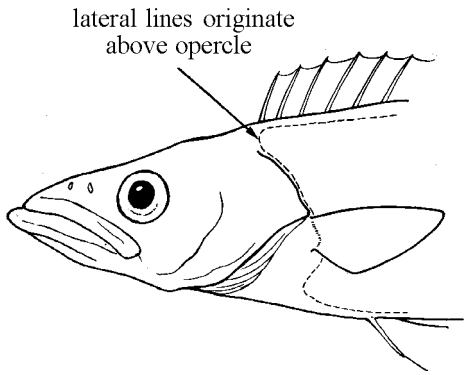


Fig. 47 ***Neoepinnula***

13a. Dorsal-fin spines XVI or XVII; body not elongate, its depth 4.2 to 6 times in standard length..... → *14*

13b. Dorsal-fin spines XVIII to XXI; body elongate, its depth 7.5 to 13 times in standard length ..... → *15*

14a. Head length about 3.2 times in standard length; body depth 4.2 to 4.5 times in standard length; pelvic fin length 1.3 to 1.4 times shorter than pectoral fin length..... ***Tongaichthys***

14b. Head length 3.4 to 3.8 times in standard length; body depth 5 to 6 times in standard length; pelvic fin length twice shorter than pectoral fin length..... ***Thyrsitops***

15a. Dermal processes on tip of jaws; lateral line fairly straight (Fig. 48); second dorsal-fin rays 19 to 24..... ***Nesiarchus***

15b. No dermal processes on tip of jaws; lateral line abruptly curved below posterior part of first dorsal fin (Fig. 49); second dorsal-fin rays 11 to 13..... ***Thyrsites***

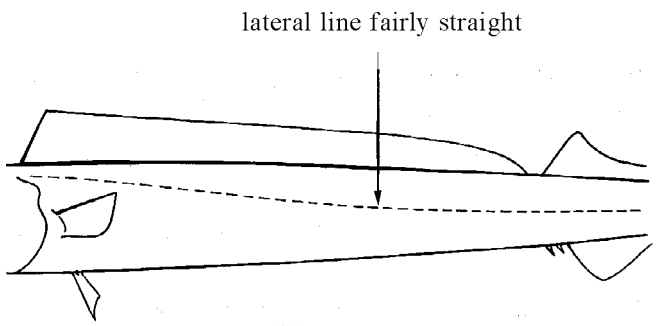


Fig. 48 *Nesiarchus*

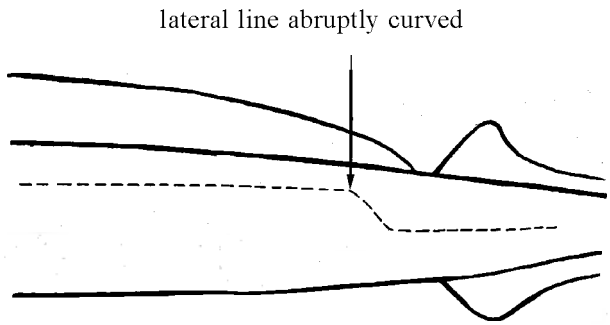


Fig. 49 *Thyrsites*

2.2.3 Information by species

Diplospinus Maul, 1948

GEMP Dipl

Diplospinus Maul, 1948:42. Type species, ***Diplospinus multistriatus*** Maul, 1948, by monotypy.

Synonyms: None.

Diagnostic Features: See species.

Species: A single species recognized so far, although some meristic characters vary geographically. For example, the total number of vertebrae are 57 to 62 in the North and Central Atlantic and 60 to 64 in the Southern Hemisphere (Mikhailin, 1983). Further taxonomic studies are necessary.

Diplospinus multistriatus Maul, 1948

Fig. 50

GEMP Dipl 1

Diplospinus multistriatus Maul, 1948:42-47, fig. 17 (Madeira, Portugal,from the stomach of *Alepisaurus ferox*).

Synonyms: None.

FAO Names: En - Striped escolar; **Fr** - Escolier rayé; **Sp** - Escolar rayado.

Field Characters: Anus situated midway between tip of snout and tip of caudal fin, distance to first anal-fin spine equal to head length. Anterior part of anal fin very low, nearly without fin membrane.

Diagnostic Features: Body extremely elongate and compressed; its body depth 13 to 18 times in standard length; anus situated midway between tip of snout and tip of caudal fin and in front of first anal-fin spine by a distance equal to head length.Head length contained 6 times in standard length; lower jaw extends anterior to upper jaw; tip of upper jaw with a small conical dermal process; 3 immovable and 3 or 4 movable fang-like teeth anteriorly in upper jaw; no teeth on vomer; no interorbital slits. Second

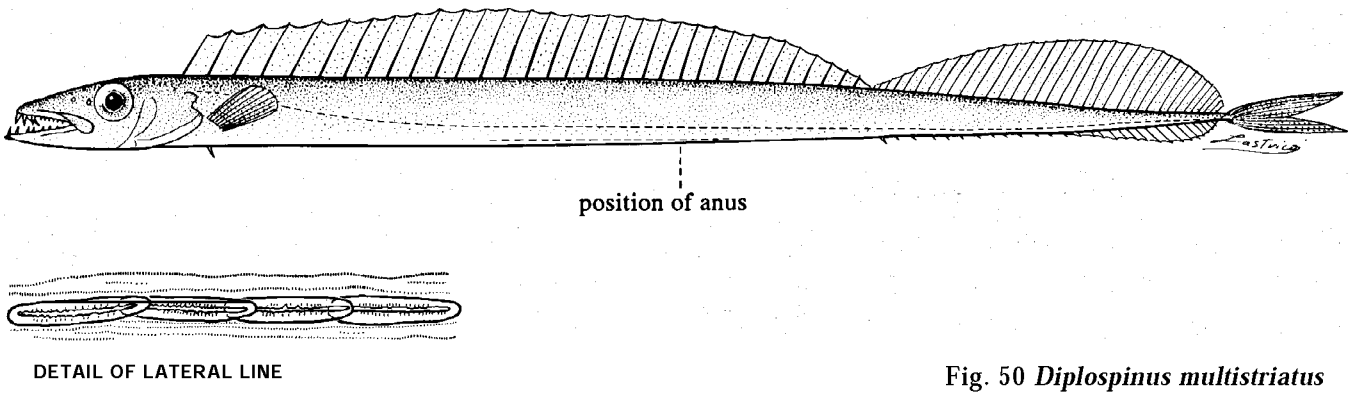


Fig. 50 *Diplospinus multistriatus*

dorsal-fin base about half the length of first dorsal-fin base, with XXX to XXXVI spines and 35 to 44 soft rays; anal fin with II small free spines in front of 28 to 35 soft rays, the anterior part short with greatly reduced fin membrane; pectoral fins with 11 to 13 soft rays, pelvic fins reduced to a minute spine in adults. A single lateral line, situated closer to ventral profile than dorsal profile posteriorly. Vertebrae total 57 to 64, including 32 to 36 precaudal and 24 to 28 caudal. **Colour**: Silvery with narrow dark dotted lines along body; gill membranes jet-black.

Geographical Distribution: Central water masses of the Atlantic, Indian and Pacific oceans. Rather rare, but relatively abundant in the northern West and southern East Atlantic, and southern East Pacific (Fig. 51).

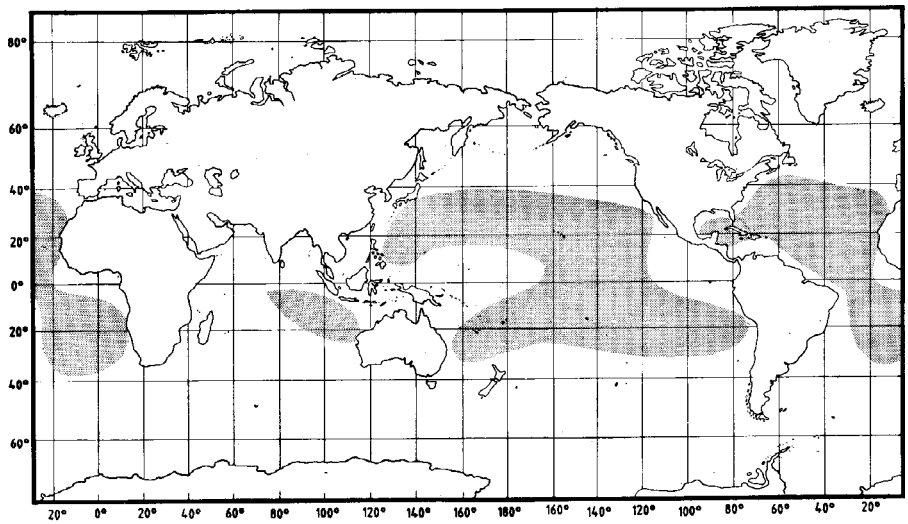


Fig. 51

Habitat and Biology: Mesopelagic, oceanic at depths to about 1 000 m. Migrates upward at night to 100 to 200 m, probably forming schools during daytime. Feeds on crustaceans and small fish. Females mature at about 16 cm. Reproductive throughout the year with fecundity of about 1 200 eggs.

Size: Maximum about 33 cm standard length (Boltachev, 1986), common to 20 cm.

Interest to Fishery: No special fishery for this species.

Local Names: JAPAN: Hoso-kurotachi.

Literature: Voss (1954); Tucker (1956); Haedrich (1964); Strasburg (1964); Haedrich and Nielsen (1966); Ahlstrom (1971); Fourmanoir (1969, 1971a); Fitch and Gotshall (1972); Legand et al. (1972); Parin and Becker (1972); Evseenko and Serebryakov (1974); Parin et al. (1974, 1977, 1978, 1990a); Karrer (1975); Clarke and Wagner (1976); Mikhailin (1976b, 1983); Gorbunova (1977, 1982); Nakamura (1982a,b, 1984b, 1986c); Boltachev (1986), Parin (1986, 1990c).

Epinnula Poey, 1854

GEMP Epin

Epinnula Poey, 1854:369. Type species, ***Epinnula magistralis*** Poey, 1854, by monotypy.

Synonyms: None.

Diagnostic Features: See species.

Species: A single species recognized so far, but Grey (1953, p. 140) proposed that Atlantic and Japanese specimens differing in number of soft dorsal- and anal- fin rays represent distinct species or subspecies.

Epinnula magistralis Poey, 1854

Fig. 52

GEMP Epin 1

Epinnula magistralis Poey, 1854:369, pl. 32, figs 3-4 (Habana, Cuba).

Synonyms: None.

FAO Names: En - Domine; **Fr** - Escolier maître.; **Sp** - Dómine.

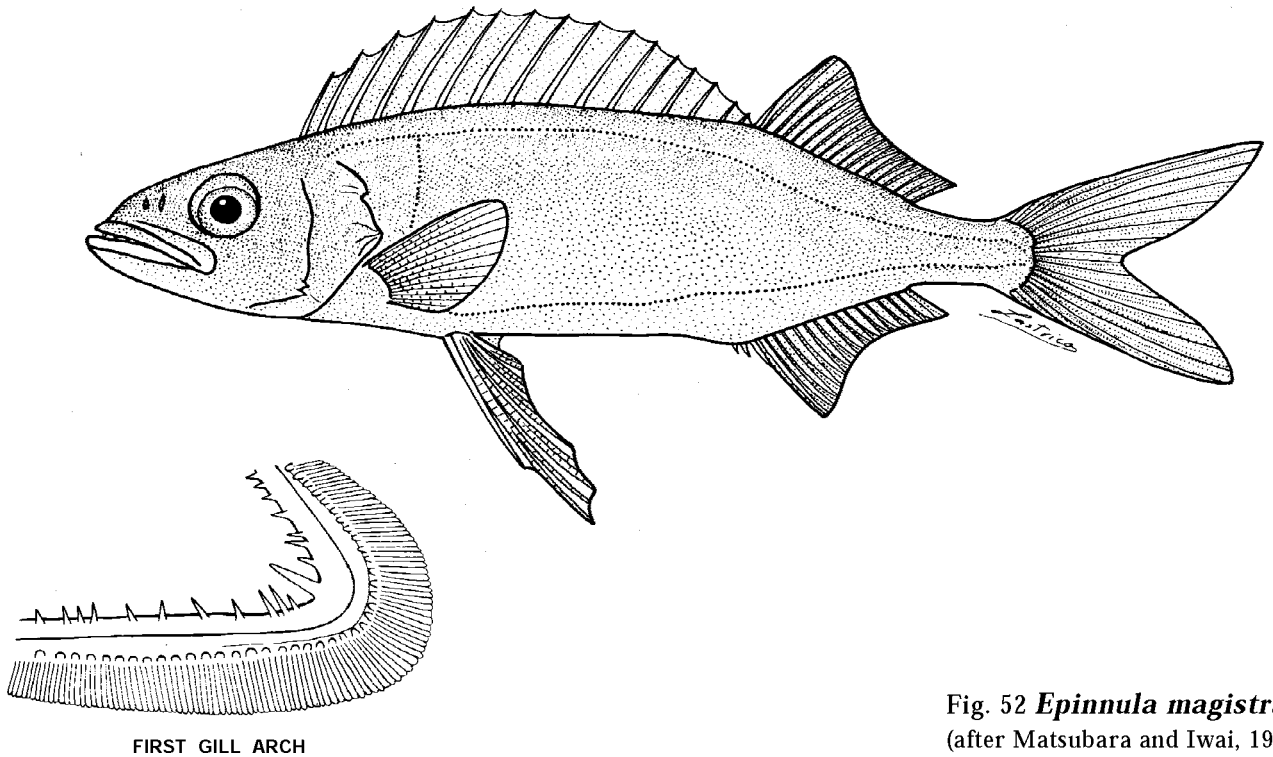


Fig. 52 ***Epinnula magistralis***
(after Matsubara and Iwai, 1952)

Field Characters: Lateral line double, the lower branching off under the fifth or sixth dorsal-fin spine. Two small sharp spines on lower angle of preopercle.

Diagnostic Features:Body fairly deep and compressed; its depth 4.1 to 5.6 times in standard length. Head length 3.0 to 4.1 times in standard length; dorsal profile of head slightly elevated in front of anterior nostril, then nearly straight to origin of dorsal fin; two small sharp spines on lower angle of preopercle; mouth large with several fangs, some depressible in upper jaw near tip of snout, and a pair of large canine teeth near tip of lower jaw, exposed outside when mouth closed; lower jaw extends anterior to upper jaw; lateral teeth on jaws conical and widely separated, those of lower jaw larger than those of upper jaw; vomer edentate; uniserial small conical teeth on palatines. First dorsal fin fairly high, with XV or XVI strong and pungent spines, second dorsal fin high anteriorly with 17 to 20 soft rays; anal fin a little smaller than second dorsal fin, with II free and I comprised and 13 to 17 soft rays; pectoral fins short and round in shape, with 15 soft rays; pelvic fins larger than pectoral fins, with I spine and 5 soft rays. Two lateral lines, both starting above upper end of gill opening; the lower branching off under the space between the fifth to sixth dorsal-fin spines, the lower running near ventral contour. Vertebrae total 32, including 16

precaudal and 16 caudal. **Colour:** Body light greyish blue, not paler below; head slightly darker than body: fin membranes of first dorsal and pelvic fins black; basal part of caudal fin dark blue, caudal fin jet-black except for whitish 8 shorter rays near axis of body; rays of pectoral and second dorsal fins spotted with black; anal fin pale black; buccal and branchial cavities pale brown; peritoneum black.

Geographical Distribution: Only known from the Caribbean Sea and southern Japan. One juvenile specimen recently collected in eastern North Indian Ocean (12°27'S, 116°16'E) (Fig. 53).

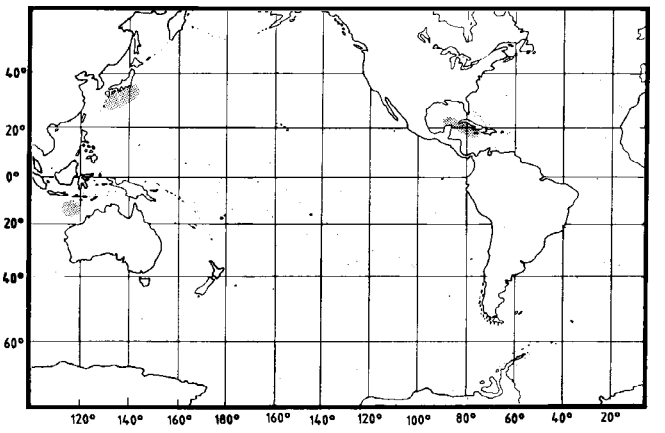


Fig. 53

Habitat and Biology: Probably mesobenthopelagic. Rare species, known from only a few specimens.

Size: The largest collected specimen is 1 m standard length, all others less than 45 cm standard length.

Interest to Fishery: No special fishery for this species.

Local Names: CUBA: Dómine; JAPAN: Aosumiyaki.

Literature: Kamohara (1938); Matsubara and Iwai (1952); Grey (1953); Duarte-Bello (1959); Nakamura (1984b); Parin and Kotlyar (1991).

Gempylus Cuvier, 1829

GEMP Gemp I

Gempylus Cuvier, 1829:200. Type species, ***Gempylus serpens*** Cuvier, 1829, by monotypy.

Synonyms: ***Acinacea*** Bory de Saint-Vincent, 1804 (nomen oblitum). ***Lemnisoma*** Lesson, 1831. ***Zyphothyca*** Swainson, 1839. ***Leucoscombrus*** Van der Hoeven, 1855.

Diagnostic Features: See species.

Species: A single species recognized so far, but populations in the Atlantic and the Indo-Pacific differ significantly in number of vertebrae and first dorsal-fin spines: vertebrae 51 to 55 versus 48 to 50, first dorsal fin with XXX to XXXII (rarely XXIX) versus XXVI to XXX spines, respectively (Parin and Becker, 1972; Parin et al., 1978; Collette et al., 1984). Therefore, these populations may represent distinct species.

Gempylus serpens Cuvier, 1829

Fig. 54

GEMP Gemp 1

Gempylus serpens Cuvier, 1829:200 (Tropic of Cancer).

Synonyms: ***Acinacea notha*** Bory de Saint-Vincent, 1804 (nomen oblitum). ***Lemnisoma thyrsitoides*** Lesson, 1831. ***Gempylus coluber*** Cuvier in Cuv. and Val., 1831. ***Gempylus ophidianus*** Poey, 1860.

FAO Names: En - Snake mackerel; **Fr** - Escolier serpent; **Sp** - Escolar de canal.

Field Characters: Two lateral lines, originating at one point, near upper edge of opercle. Dorsal and anal finlets 5 to 7.

Diagnostic Features: Body greatly elongate and strongly compressed, its depth 15 to 18 times in standard length. Head length 5.5 to 6 times in standard length; lower jaw extends anterior to upper jaw; tips of both jaws with dermal processes; 3 immovable and 0 to 3 movable fangs anteriorly in upper jaw; no fangs in lower jaw; vomer edentate. First dorsal-fin with XXVI to XXXII spines, its base very long, second dorsal fin with a minute spine and 11 to 14 soft rays followed by 5 or 6 finlets; anal fin with II free

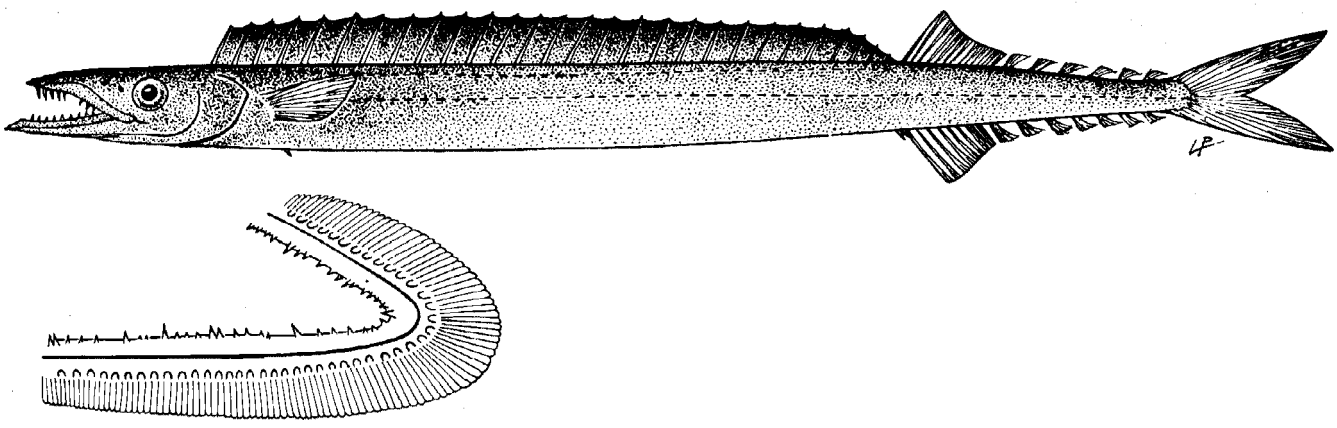


Fig. 54 *Gempylus serpens*

and I comprised spine and 10 to 12 soft rays followed by 6 or 7 finlets; pectoral fins with 12 to 15 soft rays; pelvic fins reduced to I spine and 3 or 4 soft rays. Two lateral lines, both originating below first spine of dorsal fin, the upper follows dorsal contour of body to end of first dorsal-fin base, the lower descends gradually posterior to about tip of pectoral fin and runs midlaterally. Scales absent except on posterior part of body. Vertebrae total 48 to 55, including 24 to 29 precaudal and 23 to 26 caudal. **Colour:** Body uniformly dark brown; all fins dark brown with somewhat darker margins.

Geographical Distribution: Worldwide in tropical and subtropical seas, adults also often caught in temperate waters. Specimens caught on the Atlantic side of South Africa (33°08'16° 47'E at 700 m) (Parin and Golovan, 1976) probably strayed from the Indian Ocean (Fig. 55).

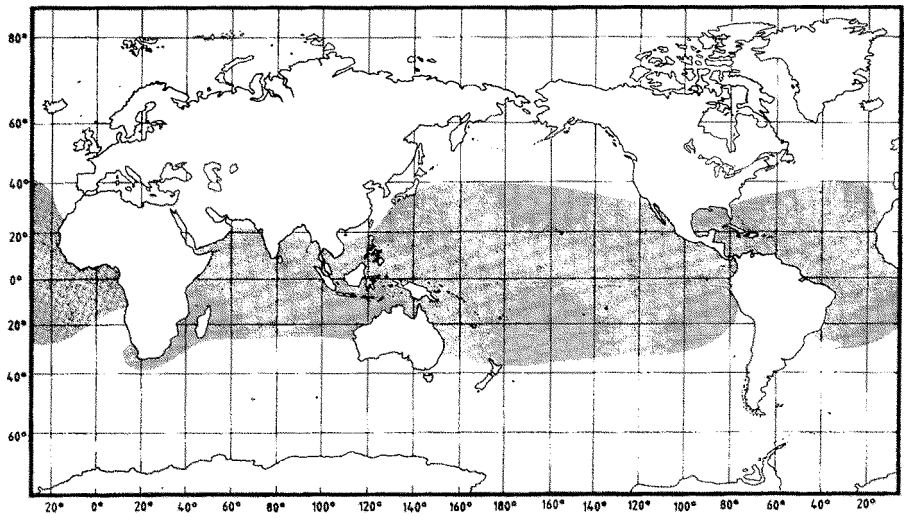


Fig. 55

Habitat and Biology: Strictly oceanic, epi- and mesopelagic from surface to depths of 200 m and perhaps deeper. Usually solitary. Rather common. Adults migrate to surface at night (nyctoepipelagic); larvae and juveniles stay near surface only during the day. Feeds on fishes (myctophids, exocoetids, sauries, scombrids), squid and crustaceans. Males mature at 43 cm standard length, females at 50 cm. Spawns in tropical. waters throughout the year, Fecundity of about 300 thousand to 1 million eggs.

Size: Maximum about 1 m standard length, common to 60 cm.

Interest to Fisheries: No special fishery for this species, but appears sometimes as bycatch in the tuna longline fishery.

Local Names: CANADA: Snake mackerel; FRANCE: Escolier serpent; JAPAN: Kurotachi-kamasu; RUSSIA: Zmeinaya makrel; SOUTH AFRICA: Slangmakriel; UK: Snake mackerel; USA: Snake mackerel: VIETNAM: Ca thu ran.

Literature: Matsubara and Iwai (1952); Grey (1953); Voss (1954); Jones (1960); Sebastian and Vedavyasa Rao (1963); Parin (1967, 1976b, 1986); Ahlstrom (1971); Fourmanoir (1969, 1971a); Legand et al.

(1972); Parin and Becker (1972); Parin et al. (1974, 1977, 1978, 1990a); Belyanina (1975, 1982); Clarke and Wagner (1976); Parin and Golovan (1976); Gorbunova (1977, 1982); Nakamura (1977, 1984a,b, 1986b,c); Kukuev (1982); Fujii (1983); Gloerfelt-Tarp and Kaiola (1984); Machida (1985); Parin (1986, 1990c).

Lepidocybium Gill, 1862

GEMP Lepid

Lepidocybium Gill, 1862:125. Type species, ***Cybium flavobrunneum*** Smith, 1849, by original designation (also monotypic).

Synonyms: ***Xenogramma*** Waite, 1904. ***Diplogonurus*** Noronha, 1926. ***Lepidosarda*** Kishinouye, 1926.

Diagnostic Features: See species.

Species: A single species recognized so far.

Lepidocybium flavobrunneum (Smith, 1849)

Fig. 56

GEMP Lepid 1

Cybium flavo-brunneum Smith 1849, pt. 20 (Cape of Good Hope, Africa).

Synonyms: ***Xenogramma carinatum*** Waite, 1904. ***Diplogonurus maderensis*** Noronha, 1926. ***Lepidosarda retigramma*** Kishinouye, 1926.

FAO Names: En - Escolar; **Fr** - Escolier noir; **Sp** - Escolar negro.

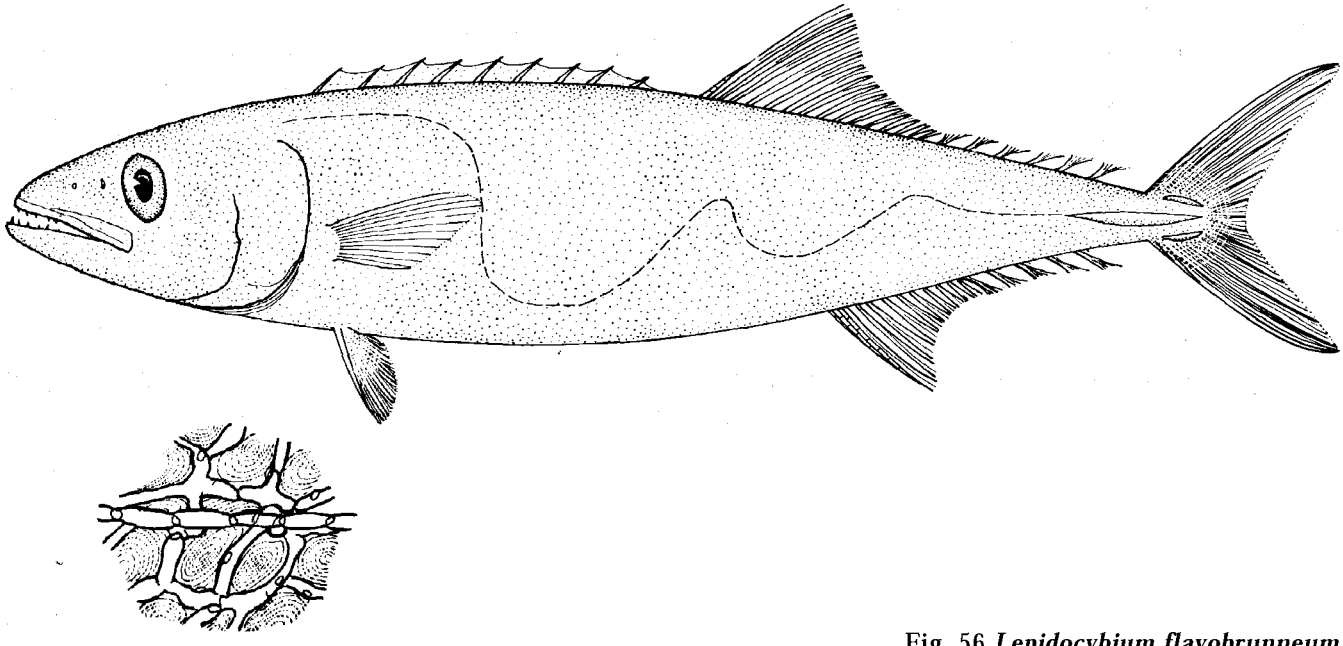


Fig. 56 ***Lepidocybium flavobrunneum***

Field Characters: First dorsal fin very low. Caudal peduncle with a prominent keel flanked with 2 small supplementary keels, one above and one below. A single, sinuous lateral line.

Diagnostid Features: Body semifusiform and slightly compressed; its depth about 4.1 to 4.3 times in standard length. Head length 3.6 to 3.7 times in standard length: lower jaw slightly extends anterior to upper jaw; tip of both jaws without dermal processes; two pairs of fangs anteriorly in upper jaw; vomer and palatines each with uniserial small teeth. First dorsal fin very low with VIII or IX spines, well separated from second dorsal fin which has 16 to 18 soft rays followed by 4 to 6 finlets; anal fin with I or II comprised spines and 12 to 14 soft rays; pectoral fins with 15 to 17 soft rays; pelvic fins well developed, with I spine and 5 soft rays; caudal fin wide but rather small, with a strong median keel flanked by 2 smaller supplementary keels, one on each side of the median keel. A single sinuous lateral line. Scales rather small, each surrounded by a network of tubules bearing pores. Vertebrae total 31, including 16 precaudal and 15 caudal. **Colour**: Body almost uniformly dark brown, becoming almost. black with age.

Geographical Distribution: Widely distributed in tropical and temperate seas of the world, but probably absent from the northern Indian Ocean (Fig. **57).**

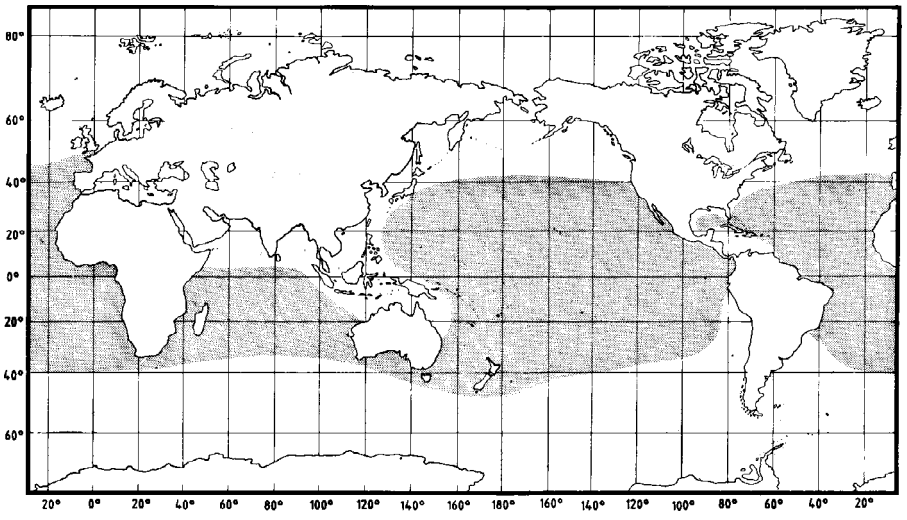


Fig. 57

Habitat and Biology: Mostly over the continental slope, down to 200 m and more. Often migrates upward at night. Feeds on squid, fishes (bramids, coryphaenids, scombrids, trachipterids, etc.) and crustaceans. Weighs 6.5 kg at 77 cm standard length (89 cm total length) and 13 kg at 91 cm standard length (105 cm total length).

Size: Maximum about 200 cm standard length, common to 150 cm.

Interest to Fisheries: No special fishery for this species, but appears as bycatch in the tuna longline fishery, caught usually at depths from 100 to 300 m. In eastern tropical Atlantic an average of 0.17 to 0.20 fish per 1 000 hooks (Maksimov, 1970).

Local Names: CANADA: Escolar; FRANCE: Escolier noir; JAPAN: Aburasoko-mutsu; SPAIN: Escolar negro, Escolar (Canary Islands); RUSSIA: Eskolar; USA: Escolar.

Literature: Munro (1949); Schultz and Springer (1956); Bartlett and Backus (1962); Merrett (1968); Fourmanoir (1969, 1970, 1971 b); Maksimov (1970); Legand et al. (1972); Belyanina (1975); Parin (1976b, 1986, 1990c); Gorbunova (1977); Nakamura (1977, 1981, 1984b, 1986b,c); Fitch and Schultz (1978); Paulin and Habib (1980); Kukuev (1982); Fujii (1983); Gloerfelt-Tarp and Kailola (1984); Machida (1985); Shcherbachev et al. (1986); Golovan and Pakhorukov (1988); Parin et al. (1990b).

Nealotus Johnson, 1865

GEMP Neal

Nealotus Johnson, 1865:434. Type species, ***Nealotus tripes*** Johnson, 1865, by monotypy.

Synonyms: ***Machaerope*** Ogilby, 1899.

Diagnostic: Features: See species.

Species: A single species recognized so far.

Nealotus tripes Johnson, 1865

Fig. 58

GEMP Neal 1

Nealotus tripes Johnson, 1865:434 (Madeira, Portugal).

Synonyms: ***Machaerope Latispinus*** Ogilby, 1899.

FAO Names: En - Black snake mackerel; **Fr** - Escolier reptile; **Sp** - Escolar oscuro.

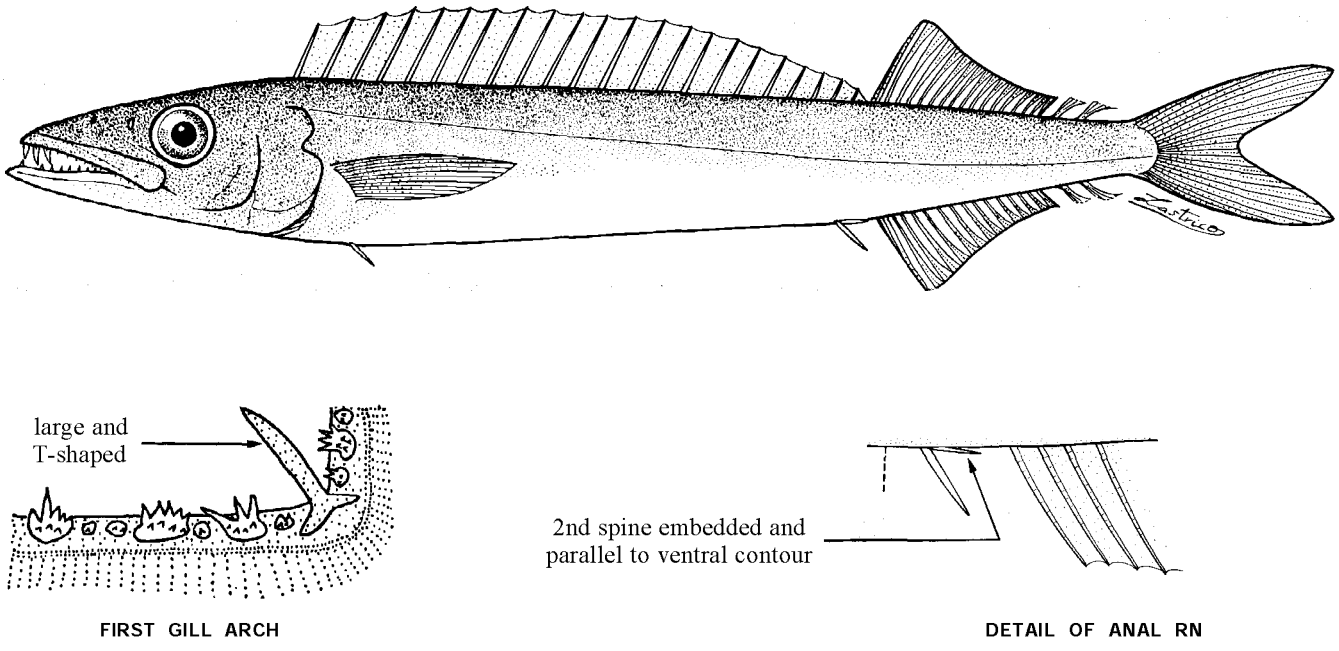


Fig. 58 *Nealotus tripes*

Field Characters: Anal fin with a large dagger-shaped first spine followed by a second smaller spine almost entirely embedded and parallel to ventral contour just in front of the soft rays. A single lateral line, fairly straight and oblique.

Diagnostic Features: Body elongate'and compressed; its body depth about 7 to 9 times in standard length. Head length 4 times in standard length; upper profile of head nearly straight from tip of snout to origin of dorsal fin; lower jaw extends anterior to upper jaw; tip of both jaws without dermal processes; 3 immovable and 0 to 3 movable fangs anteriorly in upper jaw; 1 fang anteriorly on each side of lower jaw; vomer edentate. Gill raker at angle of first arch T-shaped and larger than others. Dorsal fin with XX or XXI spines and 16 to 19 soft rays followed by 2 finlets; anal fin with I dagger-shaped spine and I smaller free spine parallel to ventral contour in front of 15 to 19 soft rays followed by 2 finlets; pectoral fins with 13 or 14 soft rays; pelvic fins reduced to I small spine. A single, fairly straight lateral line. Large scales, easily deciduous. Vertebrae total 36 to 38, including 21 or 22 precaudal and 15 or 16 caudal. **Colour:** Body blackish brown; dorsal and anal fins pale brown; buccal and branchial cavities and peritoneum black.

Geographical Distribution: Tropical and temperate waters of Atlantic, Indian and Pacific oceans. The southernmost Indian Ocean occurrence (28°08'S, 49°06'E) based on an unpublished record (R/V VITYAZ-II, station 2781) (Fig. 59).

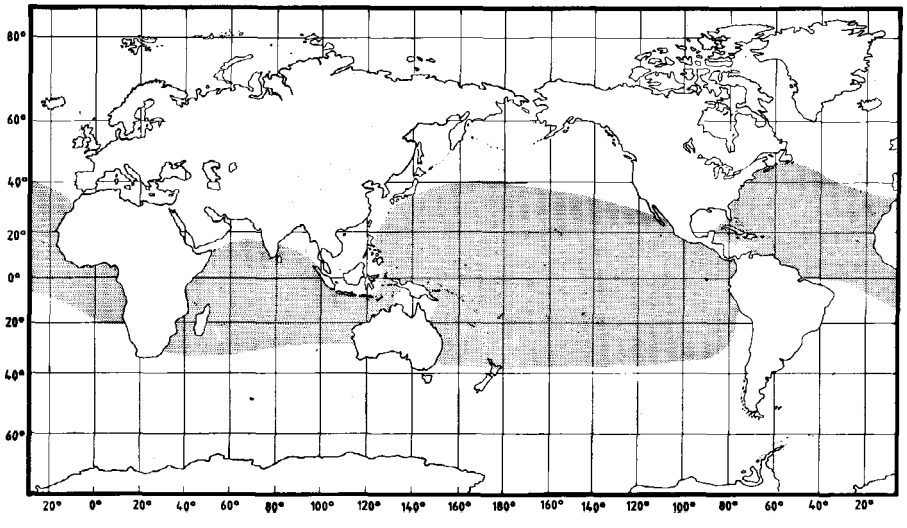


Fig. 59

Habitat and Biology: Oceanic, epi- to mesopelagic from surface to about 600 m depth. Migrates to surface at night (nyctoepipelagic). Feeds on myctophids and other small fishes, squid and crustaceans. Matures at about 15 cm standard length.

Size: Maximum about 25 cm standard length, common to 15 cm.

Interest to Fisheries: No special fishery for this species.

Local Names: CANADA: Black snake mackerel; JAPAN: Fuurai-kamasu; RUSSIA: Nealot; USA: Black snake mackerel.

Literature: Matsubara and Iwai (1952); Strasburg (1964); Backus et al. (1965); Haedrich and Nielsen (1966); Mago (1970); Ahlstrom (1971); Fourmanoir (1969, 1971a); Legand et al. (1972); Parin and Becker (1972); Belyanina (1975, 1982); Parin et al. (1973, 1977, 1978, 1981, 1990a); Clarke and Wagner (1976); Parin and Golovan (1976); Gorbunova (1977, 1982); Nakamura and Paxton (1977); Kukuev (1982); Nakamura (1982b, 1984b); Fujii (1983); Machida (1985); Shcherbachev et al. (1986); Parin (1986, 1990c); Paulin et al. (1989).

Neoepinnula Matsubara and Iwai, 1952

GEMP Neo

Neoepinnula Matusbara and Iwai, 1952:193-1 94. Type species, ***Epinnula orientalis*** Gilchrist and von Bonde, 1924, by original designation (also monotypic).

Synonyms: None.

Field Characters: Body moderately deep (depth less than 5 times in standard length). Two lateral lines, originating above upper angle of gill opening, the lower descends along margin of gill opening, then follows ventral contour of body. Pelvic fins normally developed, No dorsal or anal finlets.

Diagnostic Features: Body moderately deep and compressed. Lower jaw slightly extends anterior to upper jaw; tip of both jaws without dermal processes; no spines at angle of preopercle; jaw dentition includes anterior fangs and slightly compressed lateral teeth; one small tooth on each side of vomer; uniserial small teeth on palatines. Gill rakers on first arch with a single cusp and many small spines; angular raker long, with 2 longitudinal series of minute spines, triple-rooted. First dorsal fin with XVI spines, second dorsal fin with I spine and 16 to 20 soft rays; anal fin with II free and I comprised spine and 17 to 20 soft rays; pelvic fins well developed, its length about 3 times in head length, with I spine and 5 soft rays; pectoral fins with 13 to 16 soft rays. Two lateral lines, both originate above upper angle of gill opening, the upper follows dorsal contour of body to caudal peduncle, the lower descends downward along margin of gill opening, rounds pectoral base and follows ventral contour of body to end of anal-fin base and gradually ascends to middle of caudal-fin base. Body entirely covered with small deciduous scales. Vertebrae total 32, including 16 precaudal and 16 caudal; no epineurals or epipleurals. **Colour:** Body silvery or greenish brown; buccal and branchial cavities pale to black; first dorsal fin blackish.

Biology, Habitat and Distribution: Benthopelagic, dwelling at upper slope at 180 to 570 m depth. Known from tropical waters of the West Atlantic, Indian and West Pacific.

Interest to Fisheries: None.

Remarks: Two species are known.

Key to Species of *Neoepinnula:*

1a. Interorbital space narrower than diameter of eye; pectoral fins with 15 or 16 soft rays; dorsal fin inserted above upper angle of gill opening; buccal and branchial cavities pale or dusky..... ***N. americana***

1b. Interorbital space wider than diameter of eye; pectoral fins with 13 or 14 (rarely 15) soft rays; dorsal fin inserted behind upper angle of gill opening; buccal and branchial cavities usually black..... ***N. orientalis***

Neoepinnula americana (Grey, 1953) Fig. 60 **GEMP Neo 2**

Epinnula orientalis americanus Grey, 1953:137 (Gulf of Mexico: 29°20'N, 87°42'W).

Synonyms: None.

FAO Names: En - American sackfish; **Fr** - Escolier americain; **Sp** - Escolar americano.

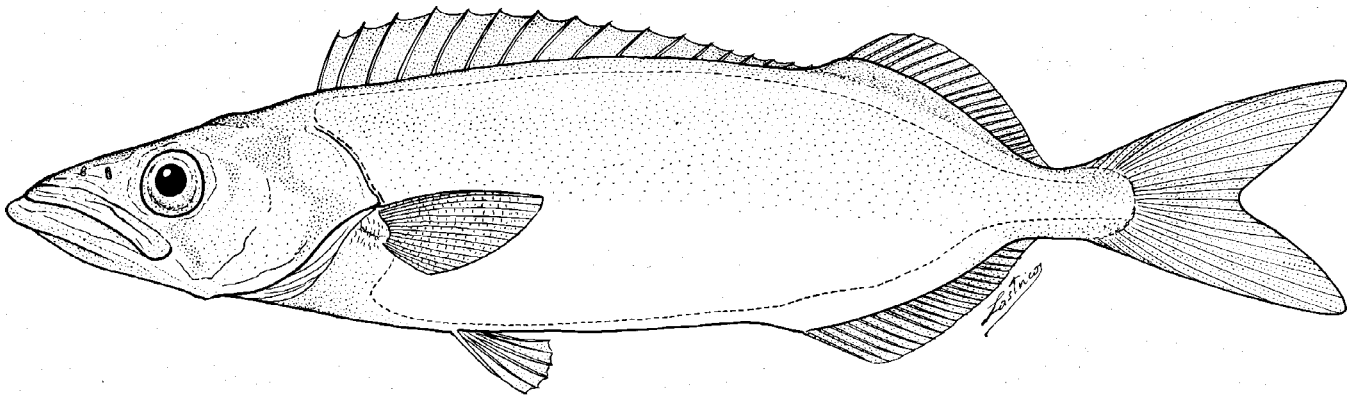


Fig. 60 ***Neoepinnula americana***
(after Grey, 1959)

Field Characters: Dorsal-fin insertion above angle of gill opening. Lining of buccal and branchial cavities pale.

Diagnostic Features: Body moderately deep, its depth 4.2 to 4.7 times in standard length. Head length 3.2 to 3.4 times in standard length; interorbital space 1.1 to 1.3 times in eye diameter; anteriorly in upper jaw 3 to 6 fangs and 1 fang anteriorly on each side of lower jaw. First dorsal fin inserted above or slightly behind margin of preopercle, with XVI spines and second dorsal fin with I spine and 17 to 20 soft rays; anal fin with II free and I comprised spine and 17 to 20 soft rays; pectoral fins with 15 or 16 soft rays: pelvic fins with I spine and 5 soft rays, inserted beneath middle of pectoral fin. Two lateral lines, both originate above upper angle of gill opening (sometimes the lower lateral line branches off from second or third tubular scale of the upper lateral line).

Colour: Sides of body silvery, back brown; first dorsal fin blackish, second dorsal fin black anteriorly; buccal cavity pale, and branchial cavity pale to dusky.

Geographical Distribution: Known only from the West Atlantic (Gulf of Mexico, Yucatan Channel, Caribbean Sea off Venezuela, and off Suriname) (Fig. 61).

Habitat and Biology: Benthopelagic, from depths of 184 to 457 m.

Size: Maximum 22 cm standard length.

Interest to Fisheries: No special fishery for this species.

Local Names: JAPAN: Tachikamasu.

Literature: Mead (1951); Grey (1959, 1960); Cervigón (1966); Gorbunova (1982); Fujii (1983).

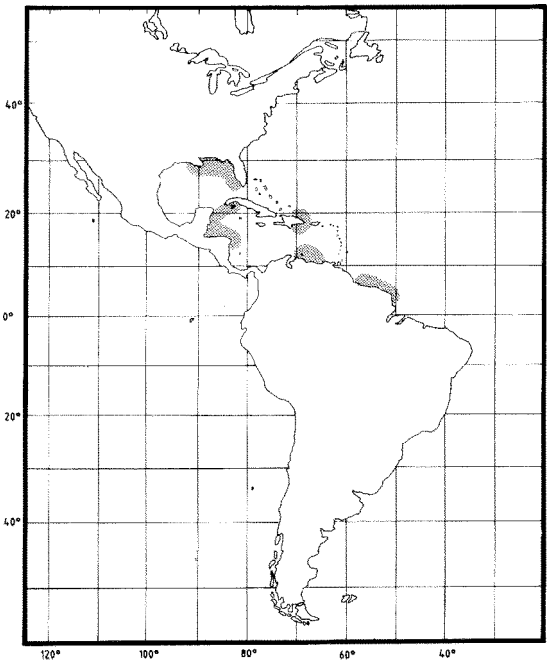


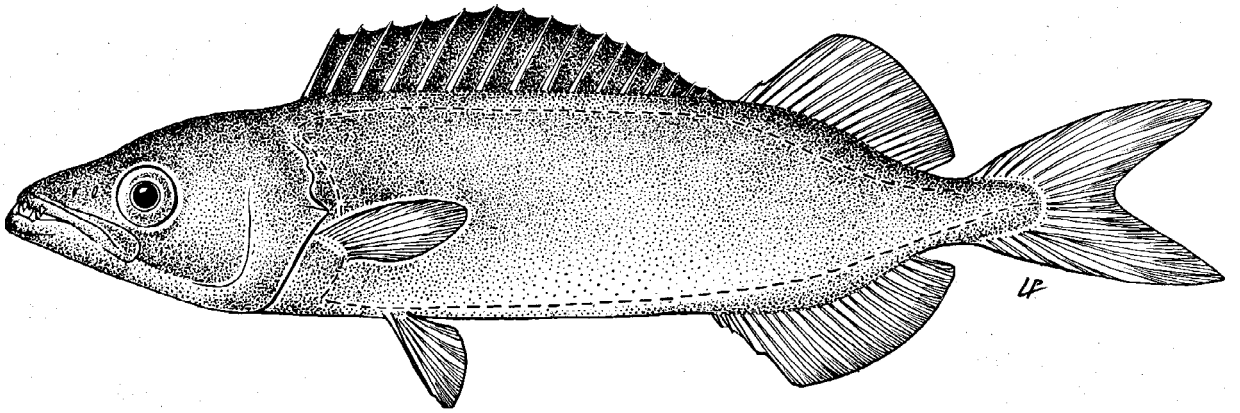
Fig. 61

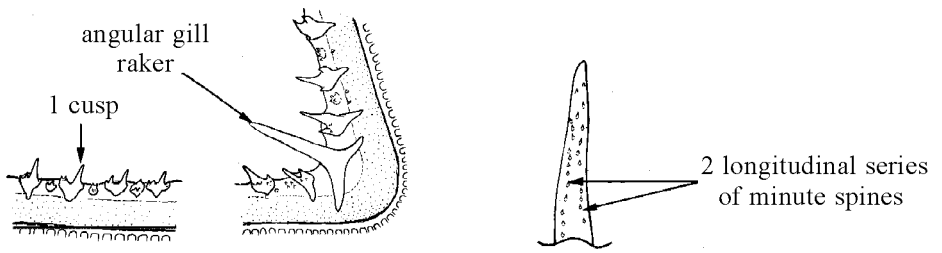
Neoepinnula orientalis (Gilchrist and von Bonde, 1924) Fig. 62 **GEMP Neo 1**

Epinnula orientalis Gilchrist and von Bonde, 1924:15, pl. 4, fig. 1 (southeast Africa).

Synonyms: ***Epinnula orientalis pacifica*** Grey, 1953.

FAO Names: En - Sackfish; **Fr** - Escolier oriental; **Sp** - Escolar oriental.





FIRST GILL ARCH ANGULAR GILL RAKER

Fig. 62 ***Neoepinnula orientalis***

Field Characters: Dorsal fin inserted behind angle of gill opening. Lining of buccal and branchial cavities usually black.

Diagnostic Features: Body moderately deep, its depth 3.9 to 4.2 times in standard length. Head length 3.1 to 3.5 times in standard length; interorbital space 0.7 to 0.9.times in eye diameter; anteriorly in upper jaw 3 immovable and 1 to 3 movable fangs and 1 fang anteriorly on each side of lower jaw. First dorsal fin inserted above insertion of pectoral-fin base with XVI spines, second dorsal fin with I spine and 17 to 20 soft rays; anal fin with II free and I comprised spine and 17 to 19 soft rays; pectoral fins with 13 or 14 (rarely 15) soft rays; pelvic fins with I spine and 5 soft rays, inserted beneath or behind middle of pectoral fin. Two lateral lines, both originate above upper angle of gill opening. Pyloric caeca usually 8. **Colour**: Body greenish brown to dark brown; first dorsal fin blackish, membranes between anterior 3 or 4 spines pigmented more intensively; buccal and branchial cavities usually black.

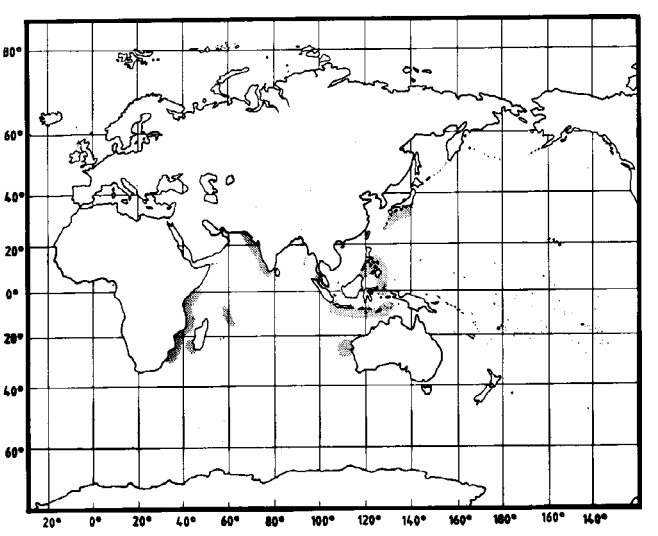


Fig. 63

Geographical Distribution: Indo-West Pacific species recorded from off East Africa (Natal to Kenya), Saya de Malha Bank, Arabian Sea; eastern North Indian Ocean, Flores, Banda, Arafura Sea, Sulawesi and Sulu Seas, off Riu-Kiu and southern Japan (Fig. 63).

Habitat and Biology: Benthopelagic on upper slope between 200 and 570 m. Matures at about 15 cm standard length, feeds on small fish, crustaceans and cephalopods.

Size: Maximum 30 cm standard length.

Interest to Fisheries: No special fishery for this species.

Local Names: JAPAN: Touyou-kamasu, Sokosumiyaki; RUSSIA: Vostochnaya epinula.

Literature: Barnard (1925, 1927); Kamohara (1938); Smith (1949); Matsubara and Iwai (1958); Narayana Rao (1965); Parin and Becker (1972); Parin (1976b); Gorbunova (1977, 1982); Parin et al. (1977); Nishikawa and Nakamura (1978); Fourmanoir (1981); Belyanina (1982); Gloerfelt-Tarp and Kailola (1984); Nakamura (1984a,b, 1986c); Machida (1985); Shcherbachev (1987).

Nesiarchus Johnson, 1862

GEMP Nes

Nesiarchus Johnson, 1862:173. Type species, ***Nesiarchus nasutus*** Johnson, 1862, by monotypy.

Synonyms: ***Escolar*** Jordan and Evermann in Goode and Bean, 1896. ***Bipinnula*** Jordan and Evermann, 1896.

Diagnostic Features: See species.

Species: A single species recognized so far.

Nesiarchus nasutus Johnson, 1862

Fig. 64

GEMP Nes 1

Nesiarchus nasutus Johnson, 1862:173 (Madeira, Portugal).

Synonyms: ***Prometheus paradoxus*** Capello, 1867. ***Thyrsitops violaceus*** Bean, 1887.

FAO Names: **En** - Black gemfish; **Fr** - Escolier long nez; **Sp** - Escolar narigudo.

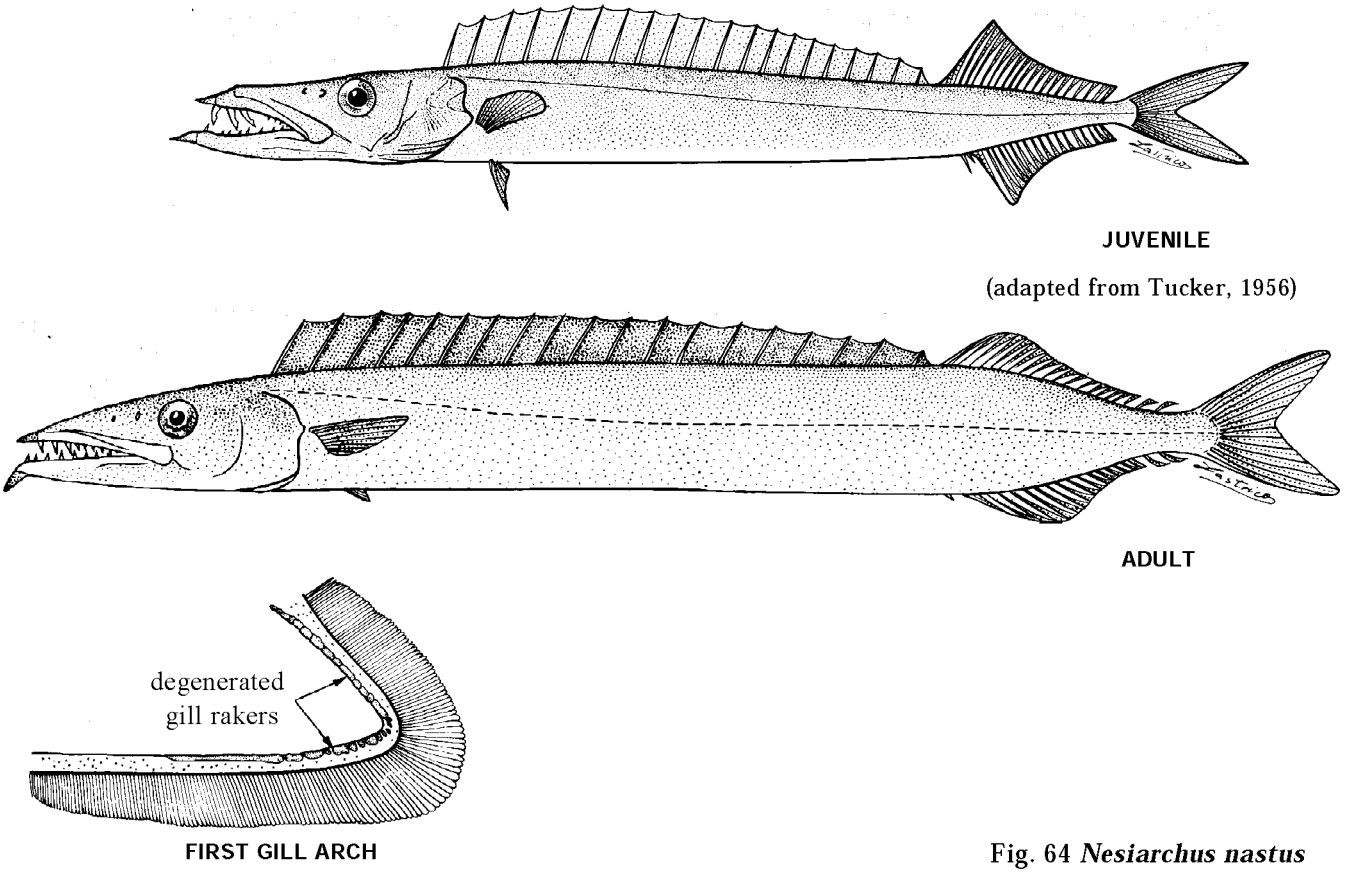


Fig. 64 ***Nesiarchus nastus***

Field Characters: Dermal processes on tips of both jaws well developed. A single and fairly straight lateral line. Snout fairly long. Gill rakers degenerated.

Diagnostic Features: Body fairly elongate and strongly compressed; its depth 10 to 13 times in standard length. Head length 4.2 to 4.6 times in standard length; lower jaw strongly extends anterior to upper jaw; a conical cartilaginous (or dermal) process at tip of each jaw, lower larger than upper; 3 immovable and 0 to 3 movable fangs anteriorly in upper jaw; 1 fang anteriorly on each side of lower jaw; vomer edentate. Gill rakers degenerated. First dorsal fin with XIX to XXI spines, its base long, second dorsal fin with I spine and 19 to 24 soft rays, its base short; anal fin a little smaller than second dorsal fin, with II comprised spines and 18 to 21 soft rays; pectoral fins short, with 12 to 14 soft rays; pelvic fins small, shorter than pectoral fins with I small spine and 5 soft rays. A single fairly straight lateral line, inserted above angle of opercle, gradually sloping posteriorly and runs midlateral above anal fin and caudal peduncle. Vertebrae total 34 to 36, including 20 to 22 precaudal and 14 caudal. **Colour:** Body dark brown with violet tint; fin membranes black; margin of anus black.

Geographical Distribution: Probably worldwide in tropical and subtropical seas except in eastern Pacific and northern Indian oceans. Large-sized strays in cold-temperate waters off Iceland, Norway, northern Japan and southern New Zealand (Fig. 65).

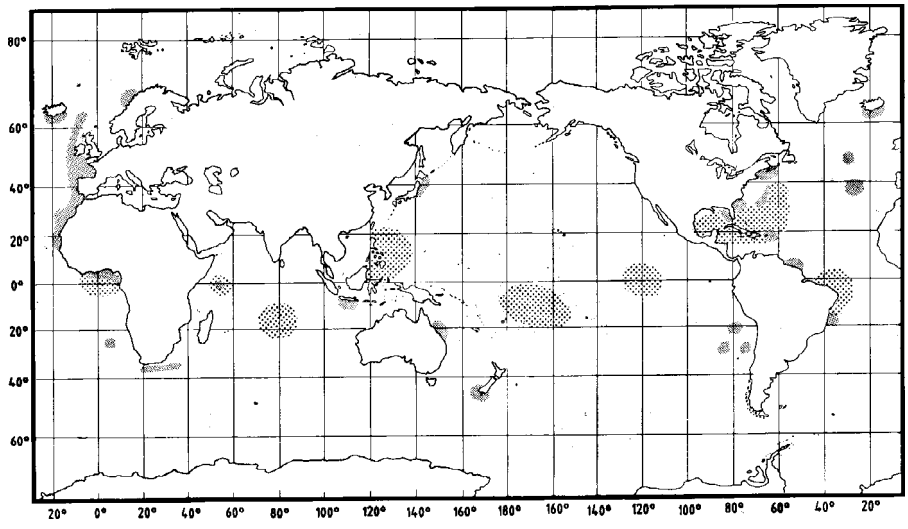


Fig. 65

Habitat and Biology: Adults bentho- to mesopelagic, dwelling on the continental slope or underwater rises at about 200 to 1 200 m, migrate to midwater at night. Larvae and juveniles epi- to mesopelagic, rather common in oceanic ichthyoplankton, only found in the tropics.Feeds on squid, fish and crustaceans. Reproductive throughout the year in warm waters.

Size: Maximum 130 cm standard length, common 30 to 80 cm.

Interest to Fisheries: No special fishery for this species.

Local Names: JAPAN: Hashinaga-kurotachi; PORTUGAL: Peixe espada preto, Peixe coelho de natura (Madeira); RUSSIA: Neziarkh; SPAIN: Pez espada picudo (Canary Islands).

Literature: Grey (1953); Tucker (1956); Fourmanoir (1969, 1979); Wheeler (1969); Legand et al. (1972); Parin and Becker (1972); Quero (1973); Parin (1976b, 1986, 1990c); Parin et al. (1974, 1976, 1978); Nakamura et al. (1981, 1983); Belyanina (1982); Gorbunova (1977, 1982); Fujii (1983); Nakamura (1984b); Konovalenko and Parin (1985); Parin and Prutko (1985); Becker and Evseenko (1986); Shcherbachev et al. (1986); Paulin et al. (1989).

Paradiplospinus Andriashev, 1960

GEMP Para

Paradiplospinus Andriashev, 1960:244, figs 1, 2. Type species, ***Paradiplospinus antarcticus*** Andriashev, 1960, by original designation (also monotypic).

Synonyms: None.

Field Characters: Body extremely elongate. Anus situated much nearer tip of caudal-fin origin than tip of snout, distance to first anal-fin spine much shorter than head length. Second dorsal-fin base less than half of first dorsal-fin base.

Diagnostic Features: Body extremely elongate and compressed; in adults, maximum body depth 12 to 17 times in standard length; body width 1.9 to 2.4 times in body depth: position of anus about twice nearer tip of caudal fin than to tip of snout and its distance to first anal-fin spine not more than snout length. Lower jaw extends anterior to upper jaw; tip of both jaws without dermal process; prominent interorbital slits developed between frontal and upper suborbital; several gently curved fangs on anterior part of upper jaw and a pair on tip of lower jaw, lateral teeth strongly compressed, pointed and irregularly spaced; vomer edentate, uniserial; minute teeth on palatines.Length of second dorsal-fin base less than half of first dorsal-fin base, first dorsal fin with XXXV to XXXIX spines, second dorsal fin with 26 to 34 soft rays; anal fin with II small free spines in front of 24 to 31 soft rays, anterior soft part of anal fin fairly high, with fin membrane; pectoral fins with 12 to 14 soft rays; pelvic fins with of I spine (in juveniles) or absent. A single midlateral lateral line.Vertebrae total 60 to 67, including 35 to 39 precaudal and 23 to 28 caudal. **Colour:** Body brownish black or silvery white; buccal and branchial cavities black.

Biology, Habitat and Distribution: Benthopelagic (***P. antarcticus*** may be pelagic) feeds on micronektonic fish and invertebrates. Known from southern East Atlantic and in the Southern Ocean.

Interest to Fisheries: No data available.

Species: Two species described, that are often considered synonymous, but they can be separated by the following key.

Remarks: Karrer (1975), Fitch and Gotshall (1972) and Russo (1983) considered ***Paradiplospinus*** as a synonym of ***Diplospinus.***

Key to Species of *Paradiplospinus:*

1a. Head length 4.9 to 5.4 times in standard length; distance from anus to first anal-fin spine equal to snout length; vertebrae total 64 to 67; body silvery . . . . . ***P. antarcticus***

1b. Head length 4.5 to 4.9 times in standard length; distance from anus to first anal-fin spine 1.1 to 1.4 times in snout length; vertebrae total 60 to 64; body in adults brownish black . . . . . ***P. gracilis***

Paradiplospinus antarcticus Andriashev, 1960

Fig. 66

GEMP Para 1

Paradiplospinus antarcticus Andriashev, 1960:245-248, figs 1, 2 (Antarctic Seas: 63º02'S, 121º08'E).

Synonyms: None, In the belief that there was only a single species of ***Paradiplospinus*** many authors used the name ***P. gracilis*** as including ***P. anturcticus.***

FAO Names: En - Antarctic escolar; **Fr** - Escolier antarctique; **Sp** - Escolar antartico.

Field Characters: Distance from anus to first anal-fin spine equal to snout length. Body silvery.

Diagnostic Features: Body extremely elongate, its depth 13 to 17 times in standard length; anus situated below the 32nd to 34th dorsal-fin spine; distance from anus to first anal-fin spine equal to snout length. Head length 4.9 to 5.4 times in standard length, in specimens more than 30 cm standard length; anteriorly in upper jaw 3 to 6 fangs and 1 fang anteriorly on each side of lower jaw. Second dorsal-fin base 2.1 to 2.6 times in length of first dorsal-fin base, first dorsal fin with XXXVI to XXXIX spines, second with 28 to 34 soft rays (total 66 to 71 fin elements); anal fin with II free spines and 25 to 31 soft rays. Pyloric caeca 6. Vertebrae total 64 to 67, including 37 to 39 precaudal and 26 to 28 caudal.

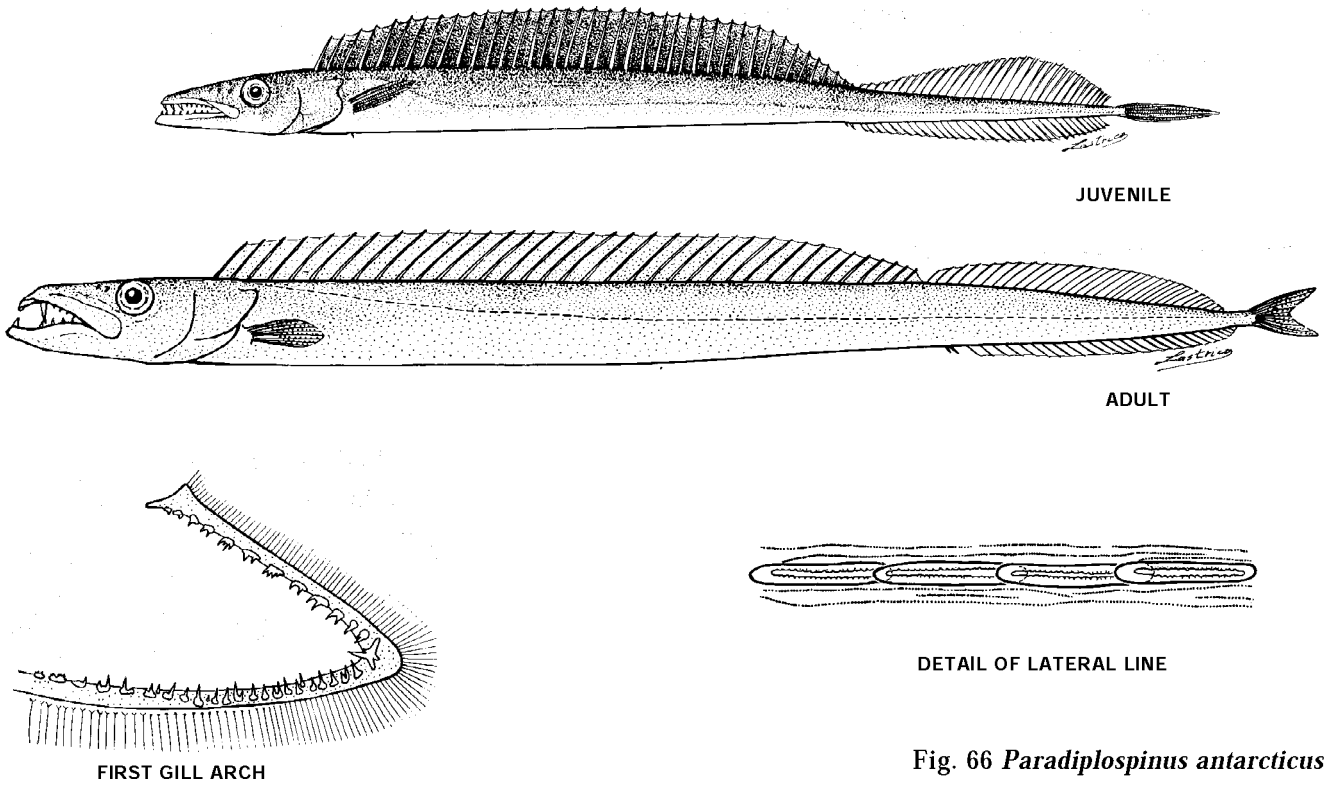


Fig. 66 *Paradiplospinus antarcticus*

Colour: Body silvery white without any conspicuous marks except 40 to 50 narrow longitudinal lines of pale melanophores; dorsal-fin base, opercular region and caudal-fin origin dark brownish.

Geographical Distribution: Circumpolar, in Antarctic and Subantarctic areas. Larval and juvenile specimens mostly obtained between southern land masses and the Antarctic Continent (Fig. 67).

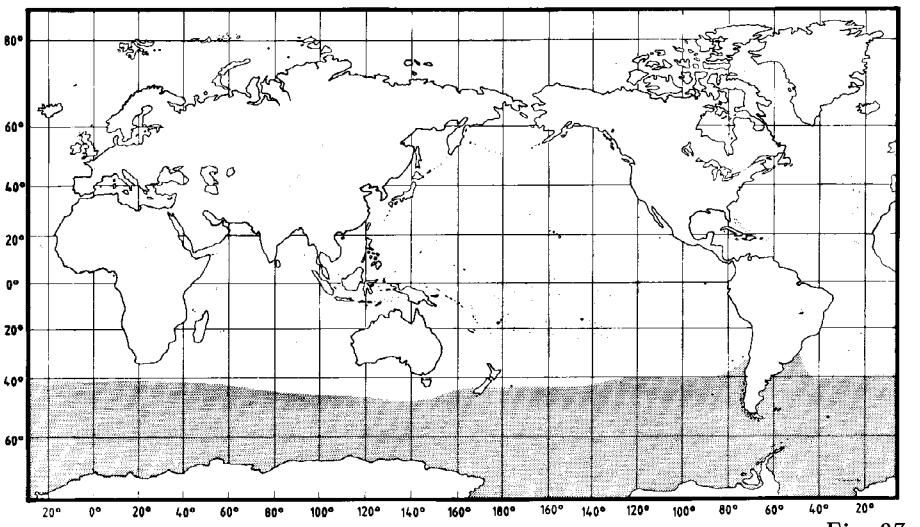


Fig. 67

Habitat and Biology: Adults and subadults epi- to mesopelagic, or mesobenthopelagic at shelves and slopes from surface to 830 m (temperature 0° to 4°C). Larvae and juveniles probably meso- to bathypelagic, down to 2 830 m (Bussing, 1965). Feeds on krill, squid and fishes (predominantly myctophids), weighs 165 g (average) at 41 to 46 cm standard length. No spawning or post-spawning fish found in Scotia Sea during late summer (February to March) in 1965 and 1967 (Permitin, 1969).

Size: Maximum 52 cm standard length, common to 30 to 40 cm.

Interest to Fisheries: No special fishery for this species.

Local Names:

Literature: Bussing (1965, as *P. gracilis)*; Permitin (1969, as *P. gracilis*); Parin and Becker (1972, as *P. gracilis*); Parin et al. (1974, 1990a, as *P. gracilis*); Karrer (1975); Nakamura (1982a, 1990b, as *P. gracilis*); Nishikawa (1984, as *P. gracilis*); Becker (1985, as *P. gracilis*); Becker and Evseenko (1986, as *P. gracilis*); Pavlov and Andrianov (1986, as *P. gracilis*).

Paradiplospinus gracilis (Brauer, 1906) Fig. 68 **GEMP Para 2**

Lepidopus gracilis Brauer, 1906:291, pl. 12, fig. 1 (off Walvis Bay, South Africa: 21°53'S, 6°58'E).

Synonyms: None.

FAO Names: En - Slender escolar; **Fr** - Escolier élégant; **Sp** - Escolar magro.

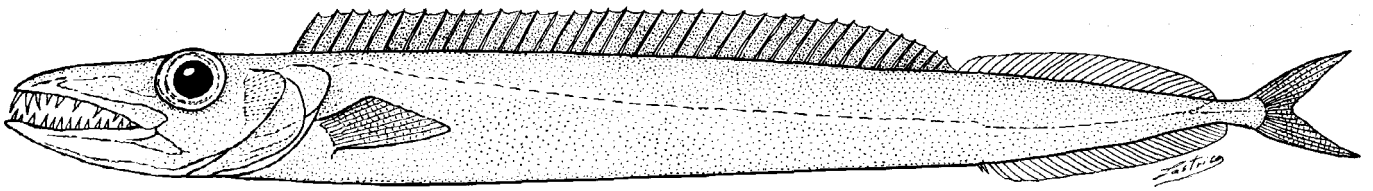


Fig. 68 *Paradiplospinus gracilis*
(adapted from Lloris, 1986)

Field Characters: Distance from anus to first anal-fin spine less than snout length. Body brownish black.

Diagnostic Features: Body depth contained 12 to 16 times in standard length; anus situated below 30th to 32nd dorsal-fin spine; distance from anus to first anal-fin spine 1.2 to 1.4 (rarely 1 .1) times in snout length. Head length 4.5 to 4.9 times in standard length, in specimens more than 35 cm standard length; anteriorly in upper jaw 3 immovable and 1 to 3 movable fangs and 1 fang anteriorly on each side of lower jaw, Length of second dorsal-fin base 2.8 to 3.0 times in length of base of first dorsal fin, dorsal fin with XXXV to XXXVIII spines and 26 to 30 soft rays (total 63 to 68 fin-elements); anal fin with II free spines and 24 to 29 rays. Pyloric caeca 6. Vertebrae total 60 to 64, including 35 to 38 precaudal and 23 to 26 caudal. **Colour:** Body and fins brownish black.

Geographical Distribution: Known only from off Namibia and western South Africa, from 17°30'S to 31°S (Fig. 69).

Habitat and Biology: Benthopelagic to upper continental slope (depth 368 to 626 m), juveniles pelagic (probably mesopelagic). Specimens 35 to 40 cm standard length collected with ripe gonads.

Size: Maximum 43 cm standard length (Mikhailin, 1986b).

Interest to Fisheries: No special fishery for this species.

Local Names: JAPAN: Minamihoso-kurotachi.

Literature: Karrer (1973, 1975); Mikhailin (1976b); Parin and Golovan (1976); Lloris (1986); Nakamura (1986a); Parin (1990c).

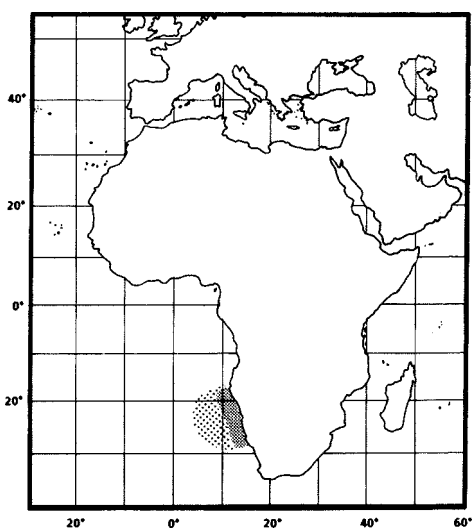


Fig. 69

Promethichthys Gill, 1893 **GEMP Prom**

Promethichthys Gill, 1893:115, 123. Type species, ***Prometheus atlanticus*** Lowe, 1838, by monotypy and subsequently by replacement name (replacement for ***Prometheus*** Lowe,1838, preoccupied by Hübner, 1824).

Synonyms: ***Prometheus*** Lowe, 1838 (preoccupied). ?***Dicrotus*** Günther,1860.

Diagnostic Features: See species.

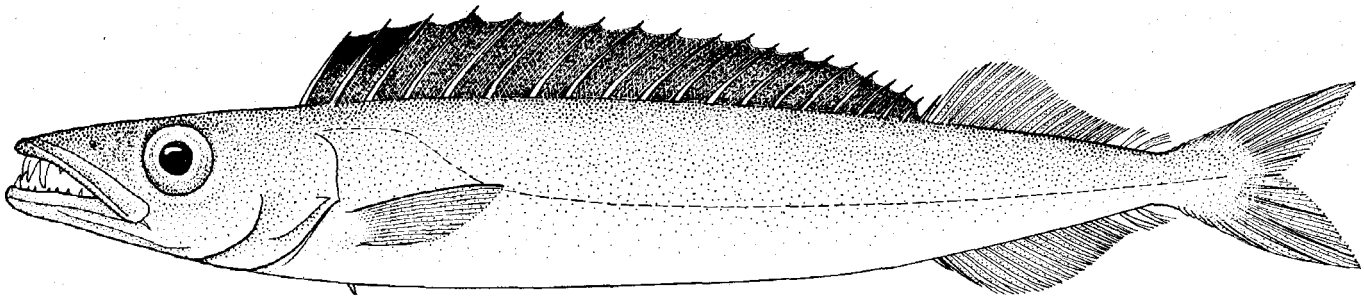
Species: One species recognized so far.

Promethichthys Prometheus (Cuvier, 1832) Fig: 70 **GEMP Prom 1**

Gempylus prometheus Cuvier in Cuv. and Val., 1832:213, pl. 222 (St. Helena Is.).

Synonyms: ***Prometheus atlanticus*** Lowe, 1838.?***Dicrotus armatus*** Günther, 1860. ***Thyrsites ballieui*** Sauvage, 1882. ?***Dicrotus parvipinnis*** Goode and Bean, 1896. ***Promethichthys pacificus*** Seale, 1906.

FAO Names: En - Roudi escolar; **Fr** - Escolier clair; **Sp** - Escolar prometeo.



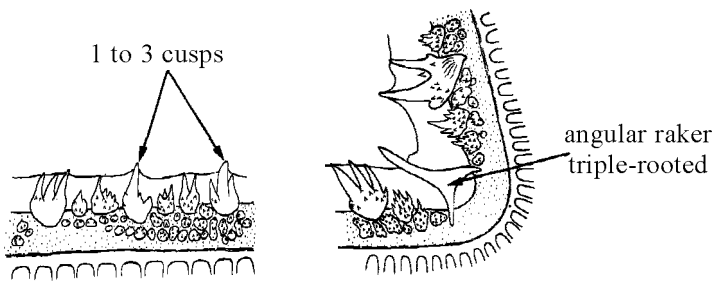


Fig. 70 ***Promethichthys Prometheus***

Field Characters: Body moderately elongate and compressed. A single lateral line, dorsolateral anteriorly, bending downward below fourth to sixth spines of first dorsal fin and becomes midlateral and horizontal for most of its length. Dorsal and anal finlets present.

Diagnostic Features: Body moderately elongate and compressed; its depth 6.5 to 7 times in standard length. Head length 3.5 to 3.7 times in standard length; lower jaw extends slightly anterior to upper jaw; tip of both jaws without dermal processes; strong jaw dentition including 3 or 4 immovable and 0-3 movable fangs anteriorly in upper jaw; 1 shorter fang anteriorly on each side of lower jaw and numerous lateral compressed teeth; no vomerine teeth; palatine teeth present. Spinescent gill rakers on first arch with 1 to 3 cusps and many small spines; the angular raker long and triple-rooted. First dorsal fin with XVII to XVIII (rarely XIX) spines, second dorsal fin with I spine and 17 to 20 soft rays followed by 2 finlets, base of first dorsal fin 2.5 times longer than base of second dorsal fin; anal fin with II (rarely III) comprised spines and 15 to 17 soft rays followed by 2 finlets; pectoral fins with 13 or 14 (rarely 15) soft rays, a little shorter to a little longer than half of head length; pelvic fins entirely absent at more than 40 cm standard length (in smaller specimens represented by I spine that reduces with growth), underskin articulation on pelvic girdle before pectoral-fin base. A single lateral line running subdorsally from above upper angle of

gill opening to under the fourth spine of the first dorsal fin, than abruptly curving down and, from under sixth spine, midlateral to caudal-fin origin, Body entirely scaled at more than 20 to 25 cm standard length. Pyloric caeca 7 or 8. Vertebrae total 33 to 35, including 18 to 20 precaudal and 14 to 16 caudal; epineurals from 2nd to 30th; epipleurals from 21st to 30th vertebra. **Colour:** Body greyish to copper brown; fins blackish at more than 40 cm standard length, yellowish with blackish tips in smaller specimens (first dorsal fin with a black blotch on two anteriormost membranes); buccal and branchial cavities black.

Geographical Distribution: Tropical and warm temperate waters of all oceans, but absent from East Pacific Ocean except at Sala y Gomez Ridge (Fig. 71).

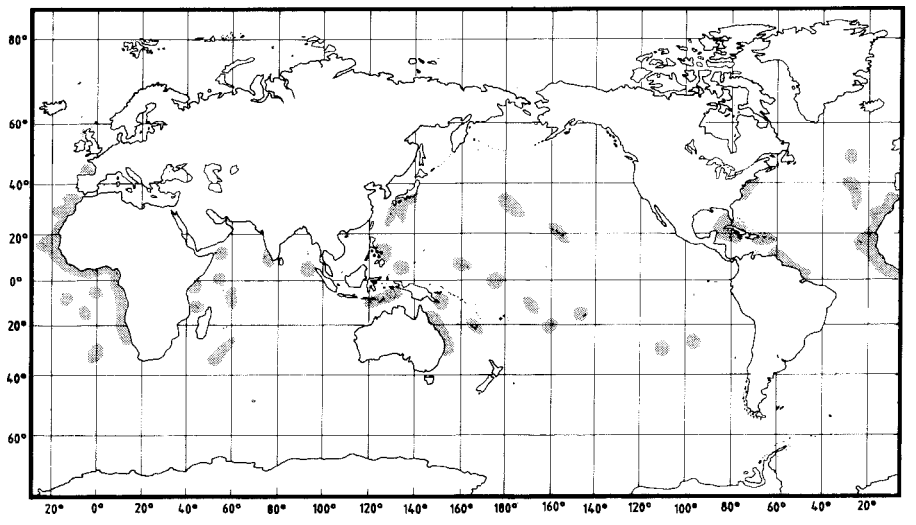


Fig. 71

Habitat and Biology: Benthopelagic at continental slopes, around oceanic islands and submarine rises at 100 to 750 m. Migrates to midwater at night, feeds on fish, cephalopods and crustaceans. Reproductive season from August to September near Madeira, probably throughout the year in warmer seas.

Size: Maximum 100 cm standard length, perhaps longer.

Interest to Fisheries: No special fishery for this species.

Local Names: AUSTRALIA: Single-line gemfish; JAPAN: Kuroshibi-kamasu; USSR: Prometikht.

Literature: Matsubara and Iwai (1952, 1958); Munro (1958); Grey (1960); Forster et al. (1970); Legand et al. (1972); Parin and Becker (1972); Quero (1973); Parin and Golovan (1976); Nakamura (1977, 1981, 1982b, 1984a,b); Parin et al. (1978); Golovan (1978); Gushchin and Kukuev (1981); Pakhorukov (1981); Fujii (1983); Gloerfelt-Tarp and Kailola (1984); Duhamel (1984); Randall and Egaña (1984); Wass (1984); Machida (1985); Parin and Prutko (1985); Parin (1986, 1990b,c); Shcherbachev et al. (1985, 1986); Borets (1986); Shcherbachev (1987); Golovan and Pakhorukov (1988); Parin and Paxton (1990).

Rexea Waite, 1911

GEMP Rexea

Rexea Waite, 1911 a:49. Type species, *Rexea furcifera* Waite, 1911 a, by original designation.

Synonyms: *Jordanidia* Snyder, 1911.

Field Characters: Body moderately elongated and compressed.Body depth 5 to 7 times in standard length. Two lateral lines, the lower originates below third to seventh spine of first dorsal fin and runs midlaterally or submidlaterally posteriorly. Dorsal and anal finlets present.

Diagnostic Features: Body moderately elongate and compressed; body depth 5 to 7 times in standard length, Lower jaw extends anterior to upper jaw; tip of both jaws without dermal processes; strong jaw dentition including anterior fangs and lateral compressed teeth; no vomerine teeth (present in juveniles): uniserial small teeth on palatines. Gill rakers on first arch tuberculous with a few cusps and many small

spines; the angular raker long and triple-rooted. First dorsal fin with XVII to XIX spines, second dorsal fin with I spine and 14 to 19 soft rays followed by 2 finlets; anal fin with I free and I comprised spine, and 11 to 16 soft rays followed by 2 finlets; pectoral fins with 12 to 15 soft rays; pelvic fins small, with I spine and 2 or 3 soft rays, or reduced. Two lateral lines, the upper follows dorsal contour of body, the lower originates below third to seventh spine of first dorsal fin, descends gradually backward and runs midlaterally or sublaterally; body entirely scaled or naked except a scaly part on caudal peduncle. Vertebrae total 33 to 36, including 19 or 20 precaudal and 14 to 16 caudal; epineurals from 2nd to 15th to 30th vertebrae; epipleurals from 19th or 20th to the 28th to 30th vertebrae, or absent. **Colour:** Body silvery to brown; black blotch at anterior part of first dorsal fin: buccal and branchial cavities black.

Biology, Habitat and Distribution: Benthopelagic, dwelling from lower shelves to middle slopes (also around islands and seamounts) at 100 to 800 m depth. Feeds on fish, squid and crustaceans. Known from tropical and temperate waters of the Indian and west to southern East Pacific Oceans.

Species: Six species are recognized following Parin's (1989) review.

Illustrated Key to Species of *Rexea:*

1a. Pelvic fins with I spine and 2 or 3 tiny soft rays, originate below the posterior margin of pectoral-fin base or further posteriorly; body entirely scaled at more than 20 cm standard length; epineurals present only at precaudal vertebrae, epipleurals absent; vertebrae total 34 to 36 ..... → *2*

1b. Pelvic fins with I spine at less than 20 to 25 cm standard length, reduced to a subdermal knob in larger specimens, originate below the middle of pectoral-fin base or further anteriorly; body naked or scales present only on caudal peduncle and along posterior part of lower lateral line; epineurals present at precaudal and caudal vertebrae (except 5 to 7 of the last), epipleurals present or absent; vertebrae total 34. ..... → *3*

2a. Upper lateral line extends beyond origin of second dorsal fin, usually terminates below 8th to 12th soft ray; dorsal-fin spines usually XVIII; vertebrae total 36 (rarely 35) of which 16 are caudal vertebrae; epineurals to 14 to 16th precaudal vertebrae (Fig. 72) ..... ***R. solandri***

2b. Upper lateral line not extending beyond origin of second dorsal fin, usually terminates below the 13th to 16th spine of first dorsal fin; dorsal-fin spines XVII; vertebrae total 34 of which 15 are caudal vertebrae; epineurals to the last precaudal vertebra (Fig. 73) ..... ***R. brevilineata***

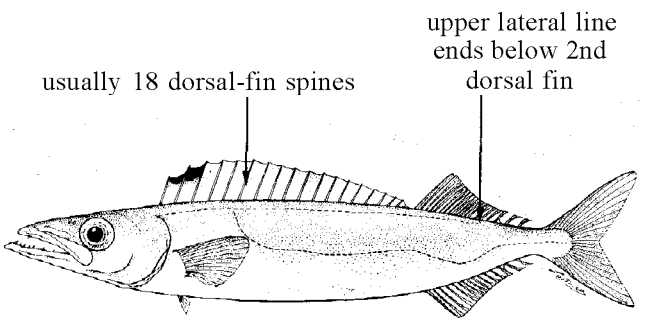


Fig. 72 *Rexea solandri*

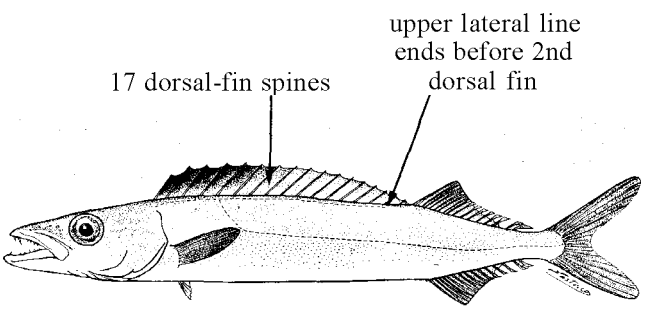


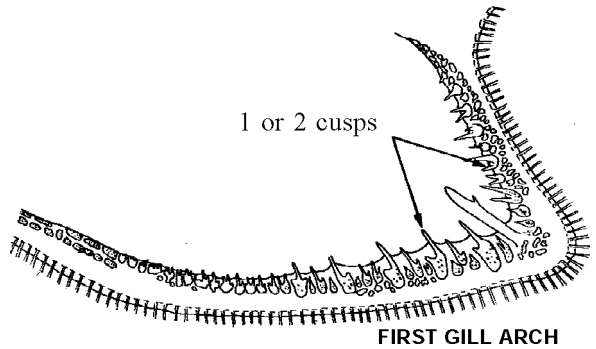
Fig. 73 *Rexea brevilineata*

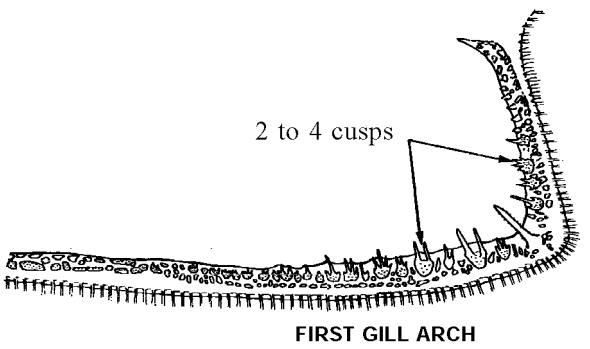
3a. Base of first dorsal fin 2.3 to 2.5 times longer than base of second dorsal fin (including finlets); pectoral fins usually with 13 soft rays, their length 2.2 to 2.4 times in head length; pelvic fins originates below pectoral-fin base; 15 caudal vertebrae; epipleurals present or absent ..... → *4*

3b. Base of first dorsal fin 2.7 to 3.4 times longer than base of second dorsal fin (including finlets); pectoral fins usually with 14 soft rays, their length 1.6 to 2.0 times in head length (in specimens longer than 12 cm standard length); pelvic fins originates before pectoral-fin base; 14 caudal vertebrae; epipleurals present ..... → *5*

4a. At greater than 30 cm standard length, lower lateral line sublateral, under the mid-part of first dorsal fin, it runs twice nearer ventral than dorsal contour of body; spinescent gill rakers with 1 or 2 cusps; epipleurals absent (Fig. 74) ..... *R. nakamurai*

4b. Lower lateral line running midlateral; spinescent gill rakers with 2 to 4 cusps; epipleurals present (Fig. 75) ..... *R. prometheoides*





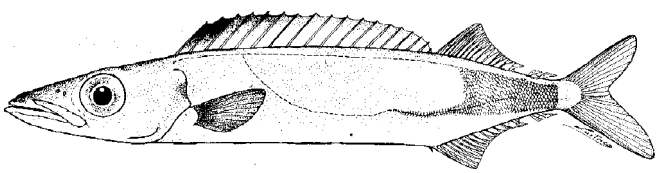


Fig. 74 *Rexea nakamurai*

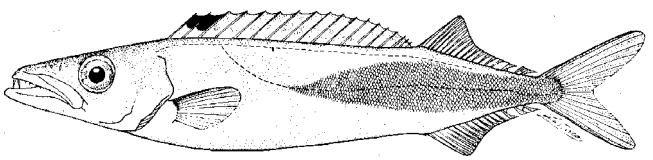


Fig. 75 *Rexea prometheoides*

5a. Lateral line bifurcating below the middle of interspace between the fourth and fifth spine of first dorsal fin or further anterior; pyloric caeca 8 or 9 (rarely 10); maximum size up to 72 cm standard length, matures at more than 25 cm standard length (Fig. 76). ..... *R. antefurcata*

5b. Lateral line bifurcating below the fifth spine of first dorsal fin or further posterior; pyloric caeca 7 (rarely 8); maximum size about 20 cm standard length, matures at about 10 cm standard length (Fig. 77) ..... *R. bengalensis*

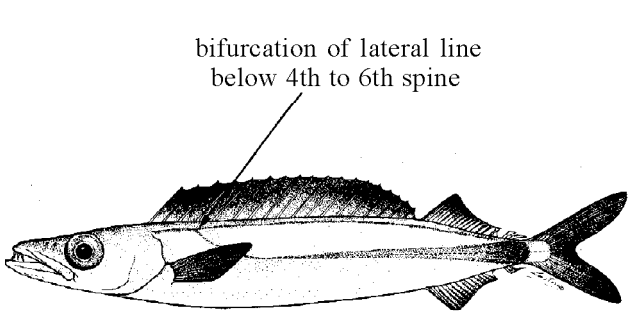


Fig. 76 *Rexea antefurcata*

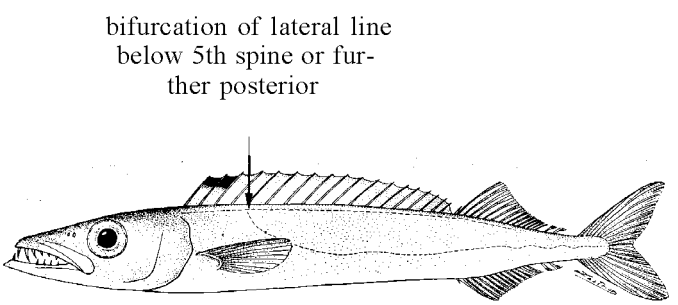


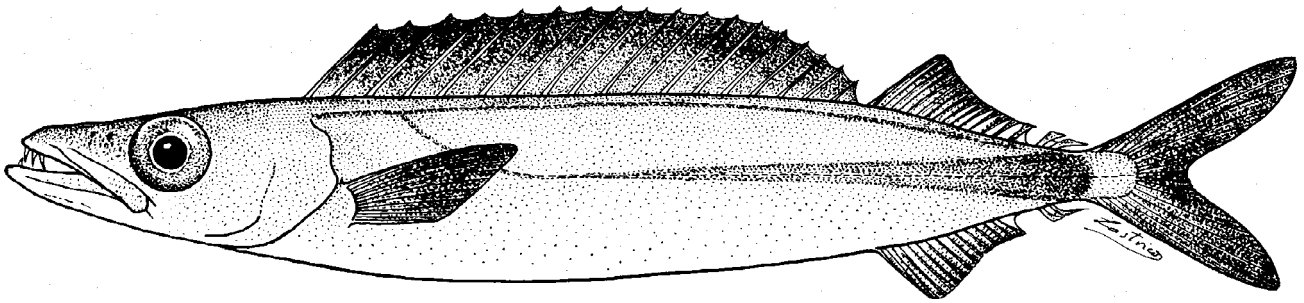
Fig. 77 *Rexea bengalensis*

Rexea antefurcala Parin, 1989 | Fig. 78 | **GEMP Rexea 2**

Rexea antefurcata Parin, 1989:19-21 , fig. 6 (Sala y Gomez Submarine Ridge: 25°34'S, 89°12'W).

Synonyms: None.

FAO Names: En - Long-finned escolar; **Fr** - Escolier longues ailes; **Sp** - Escolar de aleta larga.



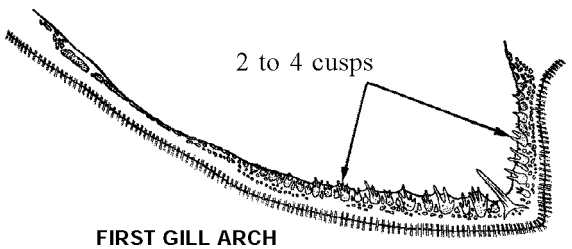


Fig. 78 *Rexea antefurcata* (after Parin, 1989)

Field Characters: Body naked except at caudal peduncle and along posterior part of lateral lines. Lower lateral line originates before fifth spine of first dorsal fin and runs midlaterally. Base of first dorsal fin about 3 times longer than base of second dorsal fin. Pectoral fins equal or longer than half of head length. Pelvic fins with I spine (in smaller specimens) or absent.

Diagnostic Features: Body depth 6 to 7 times in standard length; body width 2.1 to 2.6 times in body depth. Head length 3 to 3.5 times in standard length; anteriorly in upper jaw 3 to 5 immovable and 1 to 3 movable fangs and 1 fang anteriorly on each side of lower jaw; palatine teeth 9 to 16. Spinescent gill rakers with 2 to 4 cusps. First dorsal fin with XVIII (rarely XIX) spines, second dorsal fin with I spine and 15 to 17 soft rays followed by 2 finlets, base of first dorsal fin 2.8 to 3.1 times longer than base of second dorsal fin; anal fin with I free andI comprised spine and 12 to 34 soft rays followed by 2 finlets; pectoral fins with 14 (rarely 13) soft rays, their length equal or longer than half of head length; pelvic fins entirely absent at more than 25 cm standard length (represented by a single spine in smaller specimens), underskin articulation of pelvic girdle in front of or below anterior edge of pectoral-fin base. Lateral line bifurcating below third to fifth spine of first dorsal fin: upper lateral line reaches at least to end of soft dorsal-fin base; lower lateral line midlateral. Most of body naked except wedge-shaped stripe of squamation extending forward from caudal peduncle along horizontal part of lower lateral line and **a** few scales along posterior part of upper lateral line. Pyloric caeca 8 to 10. Vertebrae total 34, including 20 precaudal and 14 caudal; epineurals and epipleurals to 29th or 30th vertebra. **Colour:** Body greyish or brownish with metallic tint; anterior 3 membranes of first dorsal fin jet-black, rest of fin blackish; pectoral fins grey posteriorly.

Geographical Distribution: Known from the southern East Pacific (on seamounts of Nazca and Sala y Gomez Ridges and at Easter Island), from the Tasman Sea (from 23° to 37°S along east coast of Australia and on seamounts), and from southern Fiji (Fig. 79).

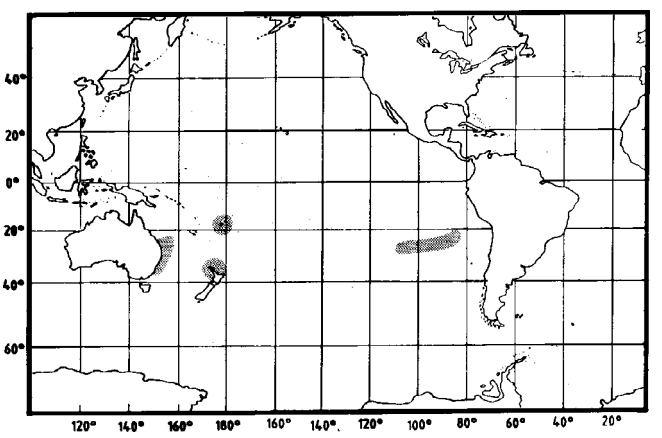


Fig. 79

Habitat and Biology: Benthopelagic from 126 to 770 m depth. Probably schooling, migrates to midwater at night. Feeds on fishes (myctophids, *Maurolicus*, eels, macrourids, carangids, emmelichthyids, etc.), prawn and squid; larger prey items are swallowed in parts (Parin et al., 1990b). Matures at about 25 cm standard length.

Size: Maximum 72.5 cm standard length.

Interest to Fisheries: No special fishery for this species, but appears as a bycatch of deep-water prawn trawl fishery in New South Wales, Australia.

Local Names: AUSTRALIA: Long-finned gemfish; RUSSIA: Dlinnokrylaya reksiya.

Literature: Parin and Paxton (1990); Parin (1990b).

Rexea bengalensis (Alcock, 1894) Fig. 80 **GEMP Rexea 3**

Thyrsites bengalensis Alcock, 1894:117-118, pl. VI, fig. 1 (Bay of Bengal off Madras).

Synonyms: None.

FAO Names: En - Bengal escolar; **Fr** - Escolier bengalais: **Sp** - Escolar bengali.

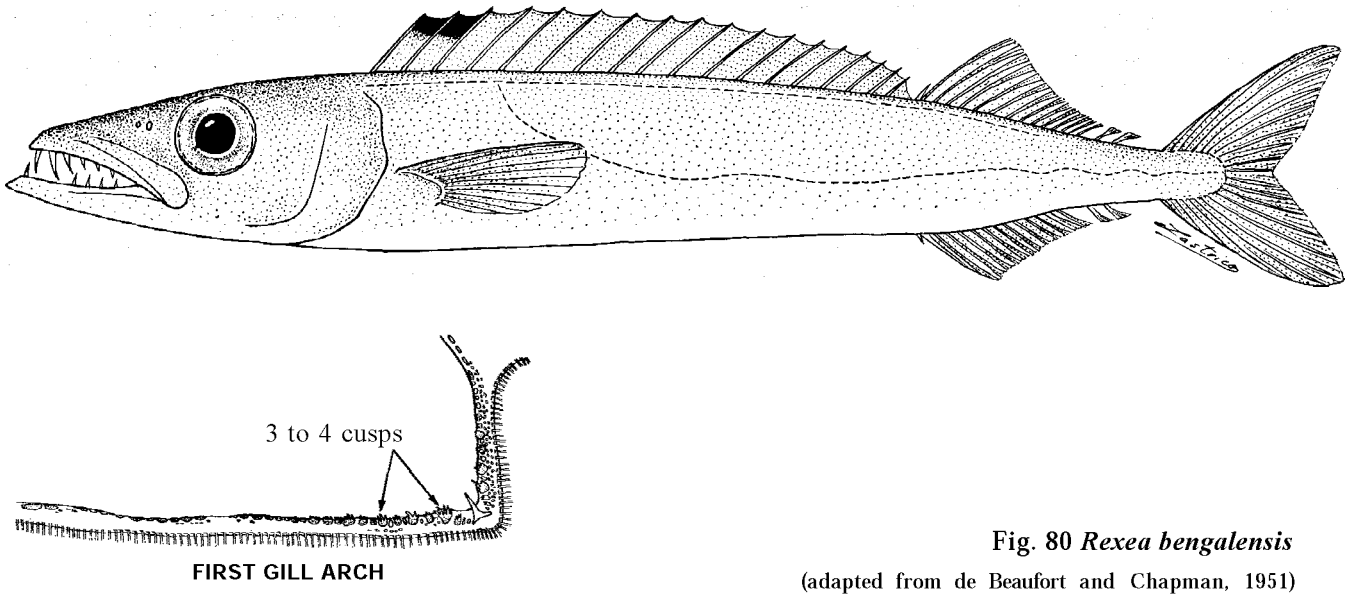


Fig. 80 *Rexea bengalensis*
(adapted from de Beaufort and Chapman, 1951)

Field Characters: Body naked. Lower lateral line originating under or a little behind fifth spine of first dorsal fin and runs midlaterally. Base of first dorsal fin about 3 times longer than base of second dorsal fin. Pectoral fin length equal to or longer than half of head length. Pelvic fins with I spine.

Diagnostic Features: Body depth 6 to 7 times in standard length; body width 2.3 to 2.6 times in body depth. Head length 2.9 to 3.4 times in standard length; anteriorly in upper jaw 6 fangs and 1 smaller fang anteriorly on each side of lower jaw; palatine teeth present. Spinescent gill rakers with 3 or 4 cusps. First dorsal fin with XVIII (rarely XIX) spines, second dorsal fin with I spine and 14 to 16 soft rays followed by 2 finlets, base of first dorsal fin 2.7 to 3.3 times longer than base of second dorsal fin; anal fin with I free and I comprised spine and 11 to 13 soft rays followed by 2 finlets; pectoral fins with 14 (rarely 13 or 15) soft rays, at more than 12 cm standard length their length equal to or longer than half of head length; pelvic fins represented by I spine, very short in larger specimens, originates before or below anterior edge of pectoral-fin base. Lateral line bifurcating from below fifth to before sixth spine of first dorsal fin; upper lateral line reaching at least to end of soft dorsal-fin base; lower lateral line midlateral. Entire body without scales. Pyloric caeca 7 or 8. Vertebrae total 34, including 20 precaudal and 14 caudal; epineurals and epipleurals to 29th or 30th vertebra. **Colour:** Body brownish with silvery tint; fins hyaline; anterior 3 membranes of first dorsal fin black, rest of fin black-edged; tips of caudal-fin lobes greyish.

Geographical Distribution: Indo-West Pacific species recorded from Mozambique Channel, Saya de Malha Bank, Maldives Islands, India, Sri Lanka, Arafura and Java Seas, Makassar Strait, northwestern and northeastern Australia and southern Japan (Fig. 81).

Habitat and Biology: Benthopelagic from 143 to 820 m depth. Matures at about 10 cm standard length. A squid was found in the stomach of one specimen.

Size: Maximum 20 cm standard length.

Interest to Fisheries: No special fishery for this species.

Local Names: AUSTRALIA: Small gemfish; RUSSIA: Malaya reksiya.

Literature: Alcock (1899); de Beaufort and. Chapman (1951, as *R. prometheoides*); Parin and Becker (1972, as *R. prometheoides,* in part); Parin (1989); Parin and Paxton (1990).

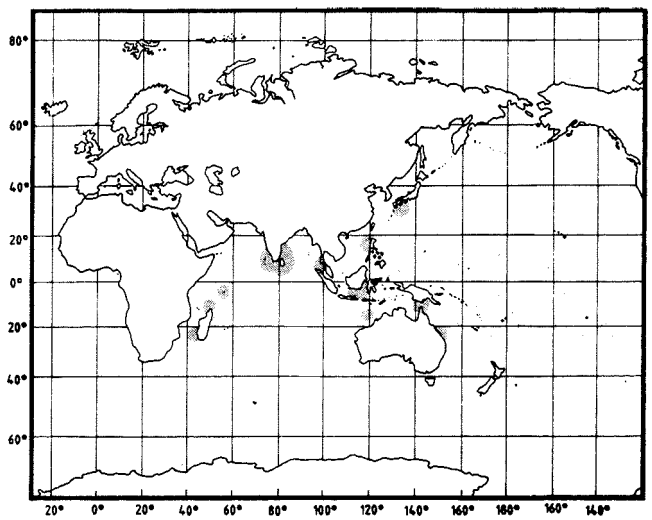


Fig. 81

Rexea brevilineata Parin, 1989

Fig. 82

GEMP Rexea 4

Rexea brevilineata Parin, 1989:13-1 4, fig. 3 (Nazca Submarine Ridge: 24°4 1'S, 85°29'W).

Synonyms: None.

FAO Names: En - Short-lined escolar; **Fr** - Escolier barracuda; **Sp** - Escolar de rayas cortas.

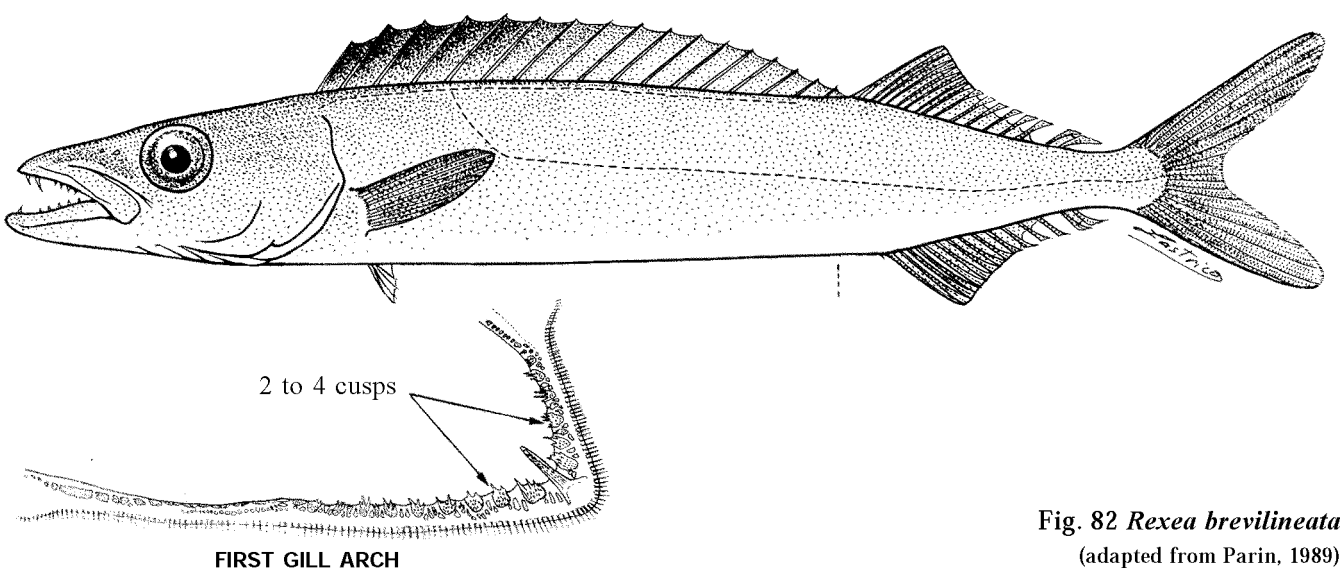


Fig. 82 *Rexea brevilineata*
(adapted from Parin, 1989)

Field Characters: Body entirely scaled at more than 20 cm standard length. Pelvic fins with I spine and 3 soft rays. Upper lateral line barely reaching origin of second dorsal fin.

Diagnostic Features: Body depth 6 to 7 times in standard length; body width 2.0 to 2.6 times in body depth. Head length 2.7 to 3.4 times in standard length; anteriorly in upper jaw 3 to 5 immovable and 1 to 3 movable fangs and 1 fang anteriorly on each side of lower jaw; palatine teeth 8 to 23. Spinescent gill rakers with 2 to 4 cusps. First dorsal fin with XVII spines, second dorsal fin with I spine and 15 to 18 soft rays followed by 2 finlets, base of first dorsal fin 2.3 to 2.7 times longer than base of second dorsal fin; anal fin with I free spine, I comprised spine and 12 to 14 soft rays followed by 2 finlets; pectoral fins with 14 (rarely 13) soft rays, shorter in length than half of head length; pelvic fins with I spine and 3 soft rays,

originating below or behind posterior edge of pectoral-fin base. Lateral line bifurcating below fifth to seventh spine of first dorsal fin, upper rarely reaching origin of second dorsal fin, usually terminating below third to last spine of first dorsal fin, lower midlateral, sometimes undulating on caudal peduncle. Body entirely scaled at more than 20 cm standard length. Pyloric caeca 7 or 8. Vertebrae total 34, including 19 precaudal and 15 caudal (very rarely total 33, 19 precaudal and 14 caudal); epineurals to 19th to 20th vertebra; no epipleurals. **Colour:** Body brown with silvery tint; anterior 2 membranes of first dorsal fin black, rest of fin black-edged; posterior part of pectoral fins black.

Geographical Distribution: Known only from seamounts of Nazca Submarine Ridge and adjacent parts of Sala y Gomez Ridge (Fig. 83).

Habitat and Biology: Benthopelagic from 180 to 400 m depth. Feeds on squid and fish. Matures at about 25 cm. Longevity up to 15 years (Kotlyar and Parin, 1990).

Size: Maximum 43 cm standard length.

Interest to Fisheries: No special fishery for this species.

Local Names: RUSSIA: Naskanskaya reksiya.

Literature: Parin (1990b).

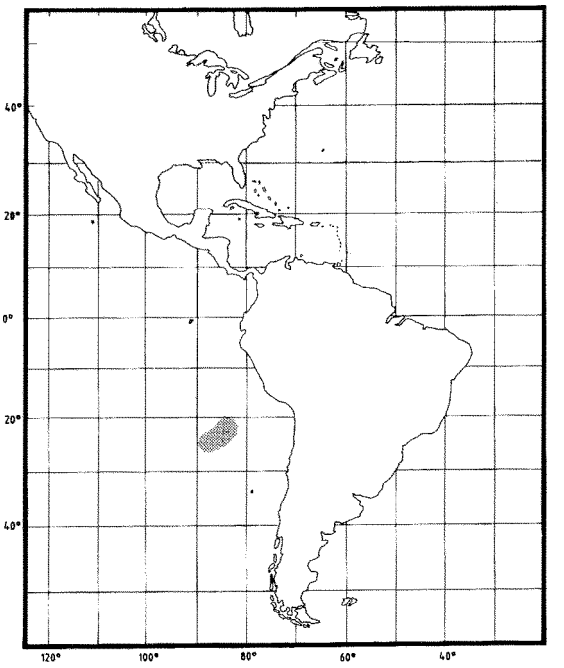


Fig. 83

Rexea nakamurai Parin, 1989

Fig. 84

GEMP Rexea 5

Rexea nakamurai Parin, 1989:14-16, fig. 4 (Kyushu-Palau Ridge: 26°11'N, 135°48'E).

Synonyms: None.

FAO Names: En - Nakamura's escolar; **Fr** - Escolier dentu; **Sp** - Escolar de Nakamura.

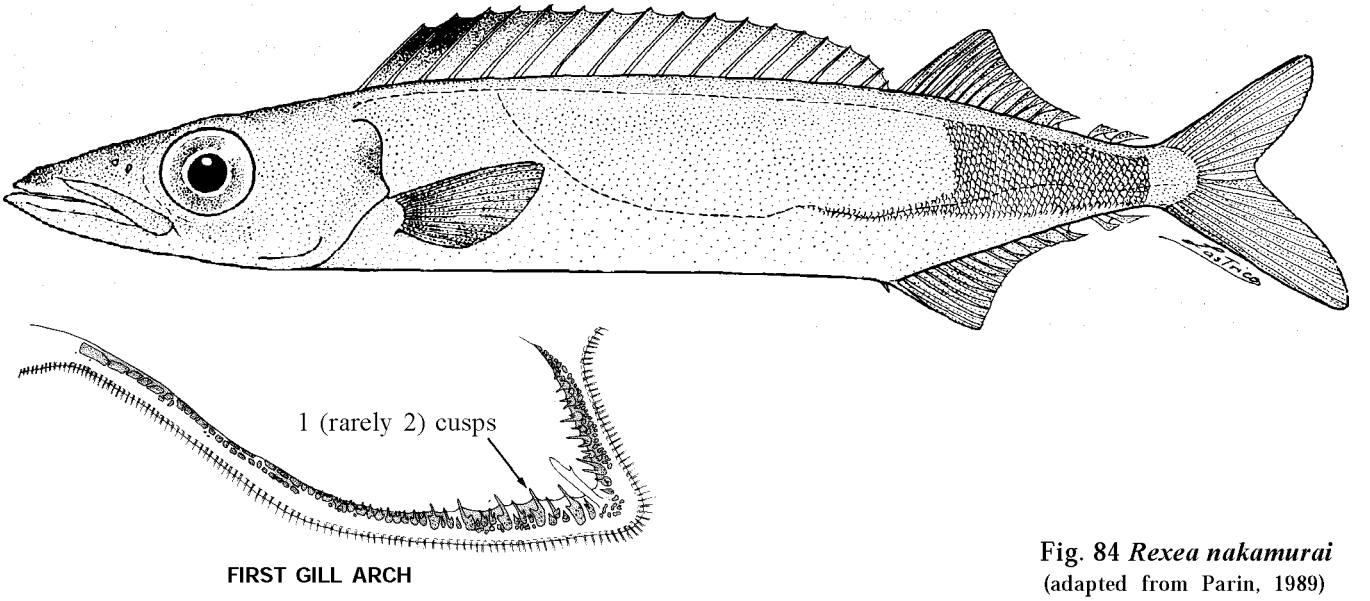


Fig. 84 *Rexea nakamurai*
(adapted from Parin, 1989)

Field Characters: Body naked except a limited scaly area between the second dorsal and anal fin. Lower lateral line originating between fifth and sixth spine of first dorsal fin, running sublaterally. Base of first dorsal fin about 2.5 times longer than base of second dorsal fin. Pectoral fin length shorter than half of head length. Pelvic fins with I spine (in smaller specimens) or absent.

Diagnostic Features: Body depth (in adults) about 6 times in standard length; body width 1.9 to 2.5 times in body depth. Head length 3.0 to 3.2 times in standard length; anteriorly in upper jaw 2 to 4 immovable and 1 to 3 movable fangs and I fang anteriorly on each side of lower jaw; palatine teeth 9 to 19. Spinescent gill rakers with 1, rarely 2 cusps. First dorsal fin with XVIII spines, second dorsal fin with I spine and 15 to 18 soft rays followed by 2 finlets, base of first dorsal fin 2.3 to 2.5 times longer than base of second dorsal fin; anal fin with I free and I comprised spine and 12 or 13 soft rays followed by 2 finlets; pectoral fins with 13 (very rarely 12) soft rays, shorter than half of head length; pelvic fins entirely absent at more than 25 cm standard length (represented by a single spine in smaller specimens, underskin articulation on pelvic girdle behind anterior edge of pectoral-fin base). Lateral line bifurcating below interspace between fifth to sixth spine of first dorsal fin; upper lateral line reaching base of first dorsal finlet; lower lateral line sublateral, running 1.5 to 2 times nearer ventral than dorsal profile of body. Most of body naked except almost rectangular stripe of squamation extending forward from caudal peduncle to behind the origins of second dorsal-fin base and anal-fin base. Pyloric caeca 8 or 9. Vertebrae total 34 (rarely 33), including 19 (rarely 18) precaudal and 15 caudal; epineurals to 27th to 29th vertebra; no epipleurals. **Colour:** Body greyish brown; anterior 2 membranes of fist dorsal fin black, rest of fin greyish, black-edged.

Geographical Distribution: Known from tropical Pacific (Kyushu-Palau Ridge and off Oahu) and Indian Ocean (Nazareth Bank and off Sumatra) (Fig. 85).

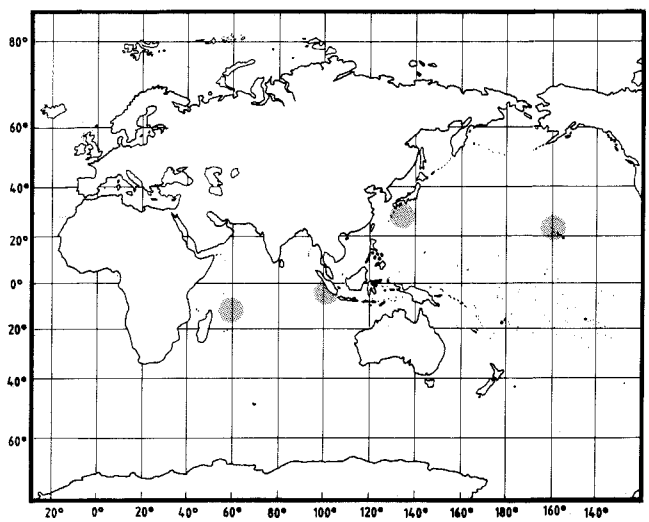


Fig. 85

Habitat and Biology: Benthopelagic from 340 to 370 m depth. Matures at about 25 cm standard length.

Size: Maximum 38 cm standard length.

Interest to Fisheries: No special fishery for this species.

Local Names: RUSSIA: Polucheshujnaya reksiya.

Literature: Nakamura (1982b, as ***R. prometheoides).***

Rexea prometheoides (Bleeker, 1856) Fig. 86 **GEMP Rexea 1**

Thyrsites prometheoides Bleeker, 1856:42 (Amboina Island, Indonesia).

Synonyms: ***Jordanidia raptoria*** Snyder, 1911.

FAO Names: En - Royal escolar; **Fr-** Escolier royal; **Sp** - Escolar real.

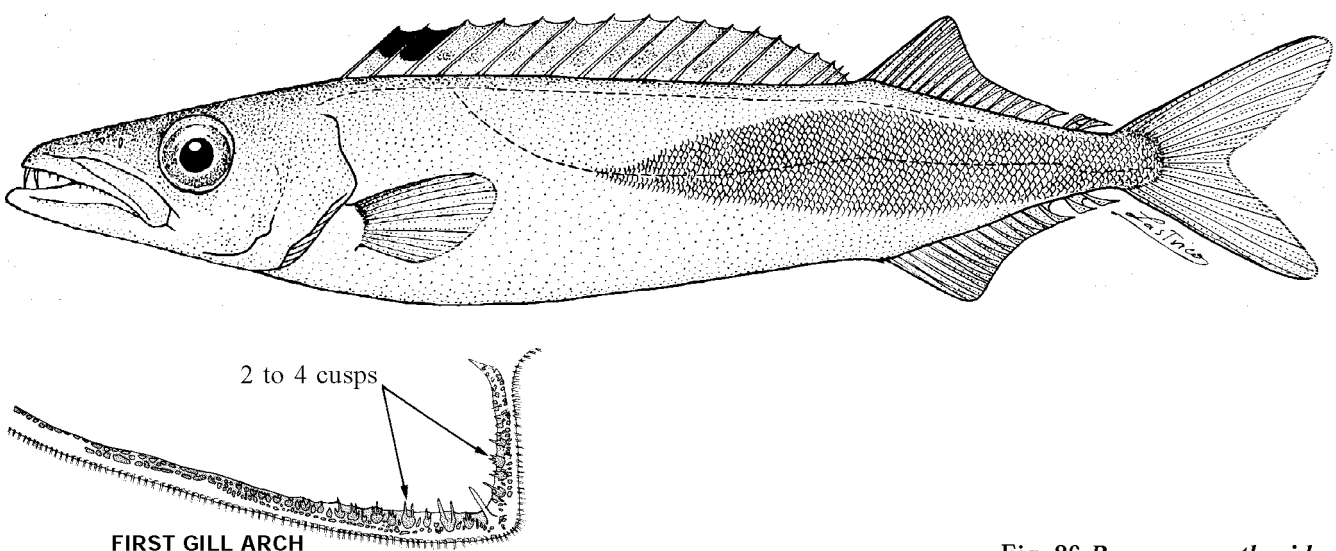


Fig. 86 *Rexea prometheoides*

Field Characters: Body naked except a large scaly area in its posterior part, extending around lower lateral line which originates between fourth to fifth spine of first dorsal fin and runs midlaterally. Base of first dorsal fin about 2.5 times longer than base of second dorsal fin.Pectoral fins shorter than half of head length. Pelvic fins with I spine (in juveniles and smaller specimens) or absent.

Diagnostic Features: Body depth 5 to 6 times in standard length; body width 1.8 to 2.8 times in body depth. Head length 3.1 to 3.4 times in standard length; anteriorly in upper jaw 5 or 6 fangs and 1 smaller fang anteriorly on each side of lower jaw; palatine teeth 11 to 16. Spinescent gill rakers with 2 to 4 cusps. First dorsal fin with XVIII (rarely XIX) spines, second dorsal fin with I spine and 14 to 17 soft rays followed by 2 finlets, base of first dorsal fin 2.2 to 2.5 times longer than base of second dorsal fin; anal fin with I free and I comprised spine and 12 to 15 soft rays followed by 2 finlets; pectoral fins with 13 (rarely 12 or 14) soft rays, its length shorter than half of head length; pelvic fins entirely absent at more than 18 to 20 cm standard length (represented by a single spine in smaller specimens), underskin articulation on pelvic girdle below pectoral base. Lateral line bifurcated below fourth to fifth spine of first dorsal fin, upper line reaches middle to end of second dorsal-fin base, lower line midlateral. Most of body naked except a large lancet-shaped stripe of squamation extending forward from caudal peduncle to below middle of first dorsal-fin base. Pyloric caeca 8 (rarely 7). Vertebrae total 34, including 19 precaudal and 15 caudal; epineurals and epipleurals to 28th to 30th vertebra. **Colour:** Body greyish with silvery tint; fins hyaline except a black blotch on membranes between first and second dorsal-fin spine, rest of second dorsal blackish or grey.

Geographical Distribution: Known in the Indo-West Pacific from off Mozambique, Kenya, Reunion Island, Saya de Malha Bank, North Australia, Indonesia, Vietnam, Philippines, Riu-Kiu Islands, and southern Japan (Fig. 87).

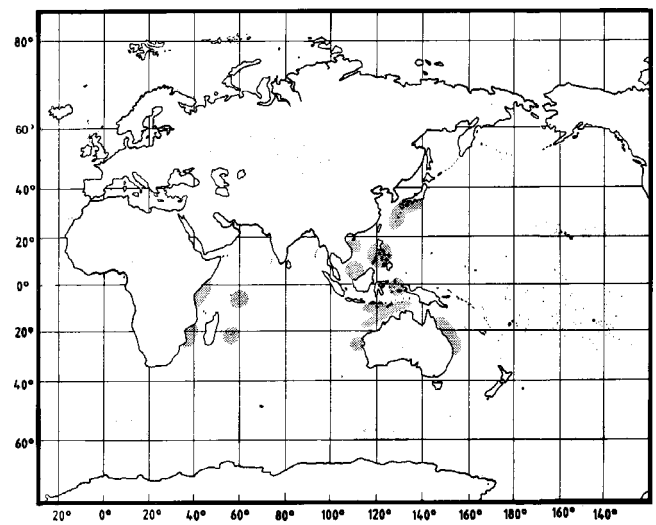


Fig. 87

Habitat and Biology: Benthopelagic from 135 to 540 m.

Size: Maximum 40 cm standard length.

interest to Fisheries: No special fishery for this species.

Local Names: AUSTRALIA: Prometheus gemfish; JAPAN: Kagokamasu; RUSSIA: Prometeeva reksiya.

Literature: Snyder (1912, as *Jordanidia raptoria*); Schmidt (1931); Kamohara (1938); Matsubara and Iwai (1952); Smith (1968); Parin and Becker (1972); Gloerfelt-Tarp and Kaiola (1984); Nakamura (1984a,b); Machida (1985); Parin and Paxton (1990).

Rexea solandri (Cuvier, 1832) Fig. 88 **GEMP Rexea 6**

Gempylus solandri Cuvier in Cuv. and Val., 1832:215 (Bay of Islands, New Zealand).

Synonyms: *Thyrsites micropus* McCoy, 1873. *Rexea furcifera* Waite, 1911 a.

FAO Names: En - Silver gemfish; **Fr** - Escolier tifiati; **Sp** - Escolar plateado.

Field Characters: Body entirely scaled at more than 25 cm standard length. Pelvic fins with I spine and 2 or 3 soft rays, Two lateral lines, the upper usually reaching middle to end of second dorsal-fin base.

Diagnostic Features: Body depth 5 to 6 times in standard length; body width 2.4 to 2.8 times in body depth. Head length 3.1 to 3.9 times in standard length; anteriorly in upper jaw 3 or 4 immovable and 0 to 3 movable fangs and 1 smaller fang anteriorly on each side of lower jaw; palatine teeth present. Spinescent gill rakers with 2 or 3 cusps. First dorsal fin with XVIII (rarely XVII) spines, second dorsal fin with I spine and 16 to 19 soft rays followed by 2 finlets, base of first dorsal fin 2.3 to 2.6 times longer than base of second dorsal fin; anal fin with I free and I comprised spine, very indistinct in larger specimens, and 13 to 16 soft rays followed by 2 finlets; pectoral fins with 14 (rarely 13 or 15) soft rays, their length

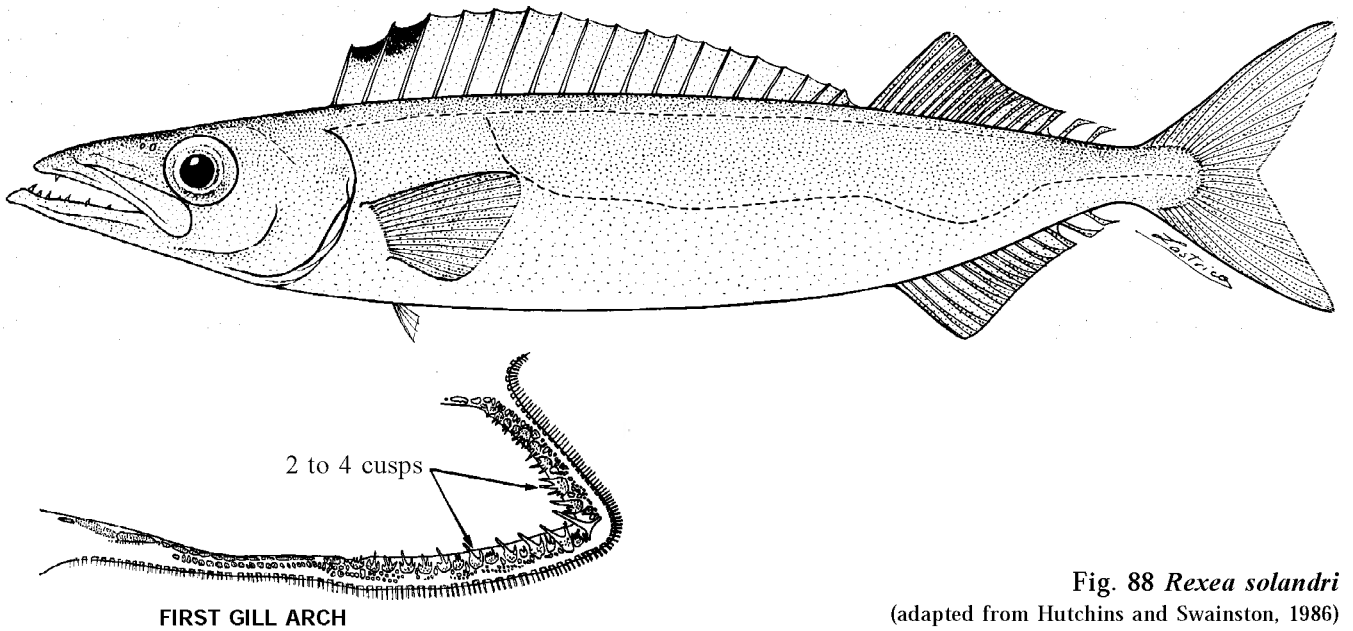


Fig. 88 *Rexea solandri*
(adapted from Hutchins and Swainston, 1986)

almost equal to half of head length; pelvic fins normally developed with I spine and 2 or 3 soft rays, originating behind posterior end of pectoral-fin base. Lateral line bifurcating below fifth to sixth spine of first dorsal fin, upper reaches beyond origin of second dorsal fin, usually terminating between 8th to 12th soft ray, lower line midlateral, undulating above anal-fin base. Body entirely scaled at more than 25 cm standard length. Pyloric caeca 7 or 8. Vertebrae total 36 (exceptionally 35), including 20 precaudal and 16 caudal; epineurals to 15th or 16th vertebra; no epipleurals. **Colour:** Body bluish above, silvery below; black blotch distally on two anterior membranes of first dorsal fin, rest of fin greyish; second dorsal, anal and caudal fins orange or greyish.

Geographical Distribution: Off southern, southwestern and southeastern Australia (occasionally as far north as 27°S), Tasmania and New Zealand (Fig. 89).

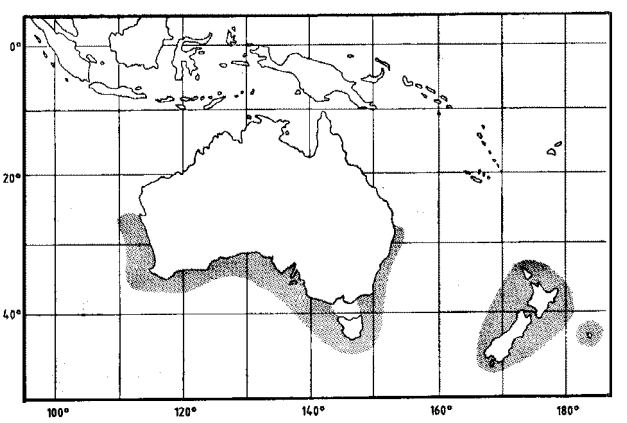


Fig. 89

Habitat and Biology: Benthopelagic on continental slope from 100 to 800 m; juveniles pelagic, adults also occur near surface off Tasmania and New Zealand. Schooling species. Feeds on fish and squid. Attains length of 104 cm after 13 years (Withell and Wankowsky, 1989). Maturesat 4 to 6 years at about 50 to 60 cm for males and 60 to 70 cm for females (Rowling, 1987). In southeastern Australia concentrated in spawning aggregations in winter (May to September) off New South Wales coast at 300 to 450 m, non-breeding fish found off Tasmania in summer.

Size: Maximum about 110 cm standard length, maximum weight about 8 kg.

Interest to Fisheries: One of the most important commercial fish species in southeastern Australia, also caught in New Zealand. Taken by trawls in New South Wales during summer months and in Tasmania at winter. Occasionally trolled near Tasmanian and New Zealand coasts. From 1983 to 1990, annual catches reported by Australia varied from 2 796 to 5 912 t and by New Zealand from 3 416 to 5 429 t (FAO, 1992). Flesh of good edible quality and especially tasty when smoked.

Local Names: AUSTRALIA: Common gemfish, Hake, (silver or southern) Kingfish, King barracuda; JAPAN: Ookagokamasu; NEW ZEALAND: Southern kingfish, Hake; RUSSIA: Bolshaya reksiya.

Literature: Waite (1911 b); Graham (1956); Scott (1962); Parin and Becker (1972); Scott et al. (1980); Last et al. (1983); Hutchins and Swainston (1986); Nakamura (1990a); Parin (1989); Parin and Paxton (1990).

Rexichthys Parin and Astakhov, 1987

GEMP Rexi

Rexichthys Parin and Astakhov, 1987:149. Type species, ***Rexichthys johnpaxtoni*** Parin and Astakhov, 1987, by original designation.

Synonyms: None.

Diagnostic Features: See species.

Species: A single species recognized so far.

Rexichthys johnpaxtoni Parin and Astakhov, 1987

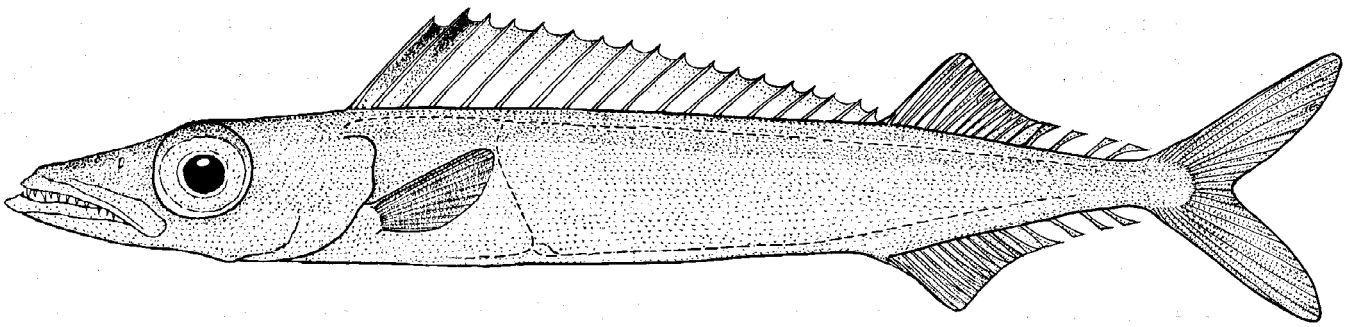
Fig. 90

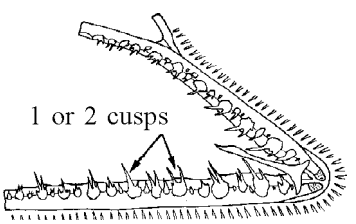
GEMP Rexi 1

Rexichthys johnpaxtoni Parin and Astakhov, 1987:149-1 52, figs 1, 2 (Tasman Sea: 32°18'S, 153°00'E).

Synonyms: None.

FAO Names: En - Paxton's escolar; **Fr** - Escolier becune; **Sp** - Escolar de Paxton.





FIRST GILL ARCH

Fig. 90 ***Rexichthys johnpaxtoni*** (after Parin, 1990)

Field Characters: Body moderately elongated and compressed; its depth 7 or 8 times in standard length. Two lateral lines, the lower originating below sixth to seventh spine of first dorsal fin, descending sharply to ventral contour of body, dividing into a short anterior branch and a much longer posterior branch. Dorsal and anal finlets present.

Diagnostic Features: Body moderately elongate and compressed; its depth 7 to 8 times in standard length; body width 1.8 to 2.1 times in body depth. Head length 3.2 to 3.3 times in standard length; lower jaw extends anterior to upper jaw; tip of both jaws without dermal processes; strong jaw dentition including 3 immovable and 1 to 3 movable fangs anteriorly in upper jaw, 1 shorter fang anteriorly on each side of lower jaw and numerous lateral compressed teeth; no vomerine teeth (present in juveniles); palatine with 20 to 25 teeth. Spinescent gill rakers on first arch with 1 or 2 cusps. First dorsal fin with XVIII spines, second dorsal fin with I spine and 14 or 15 soft rays followed by 3 finlets, base of first dorsal fin 2.3 to 2.4 times longer than base of second dorsal fin; anal fin with I free and I comprised spine and 12 or 13 soft rays followed by 3 finlets; pectoral fins with 13 soft rays, shorter than half of head length; pelvic fins entirely absent at more than 10 cm standard length (represented by I spine and 2 tiny soft rays in smaller specimens), underskin articulation on pelvic girdle below pectoral-fin base. Two lateral lines, the upper following dorsal contour of body and terminating below last dorsal finlet, the lower originating below sixth to seventh spine of first dorsal fin, sharply descending to supraventral position, dividing into a short anterior branch and a long posterior branch reaching origin of caudal fin.Body entirely naked. Pyloric caeca 9 or 10. Vertebrae total 34, including 19 precaudal and 15 caudal; epineurals to 27th or 28th vertebra; no epipleurals. **Colour:** Body brownish; fins hyaline except the first dorsal fin bearing a black blotch distally on two anterior membranes.

Geographical Distribution: Known from east coast of Australia between 17°31' and 32°34'S, and from New Caledonia (Fig. 91).

Habitat and Biology: Adults are probably benthopelagic from 400 to 470 m while juveniles are pelagic from 270 to 400 m.

Size: Maximum known standard length is 22 cm.

Interest to Fisheries: No special fisheries for this species.

Local Names: AUSTRALIA: Paxton's gemfish; RUSSIA: Reksikht.

Literature: Parin and Paxton (1990); Parin (1990a).

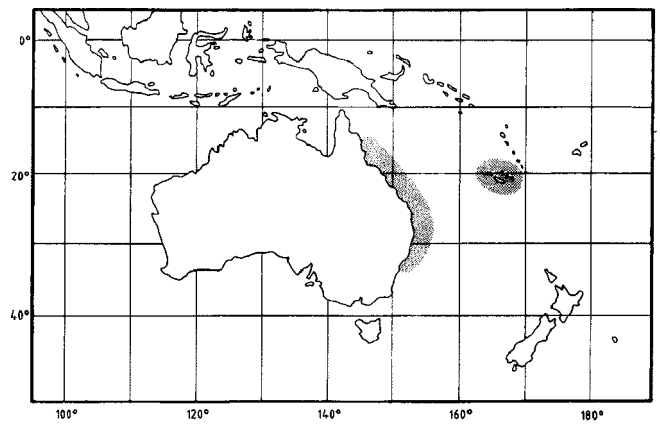


Fig. 91

Ruvettus Cocco, 1829

GEMP Ruv

Ruvettus Cocco, 1829:21. Type species, *Ruvettus pretiosus* Cocco, 1829, by monotypy.

Synonyms: *Rovetus* Cantraine, 1835. *Acanthoderma* Cantraine, 1835. *Aplurus* Lowe, 1838.

Diagnostic Features: See species.

Species: A single species recognized so far.

Ruvettus pretiosus Cocco, 1829

Fig. 92

GEMP Ruv 1

Ruvettus pretiosus Cocco, 1829:21 (Messina, Italy).

Synonyms: *Rovetus temminckii* Cantraine, 1833. *Tetragonurus simplex* Lowe, 1834. *Thyrsites acanthoderma* Lowe, 1839. *Thyrsites scholaris* Poey, 1854. *Ruvettus tydemani* Weber, 1913. *Ruvettus pacificus* Jordan and Jordan, 1922. *Ruvettus whakari* Griffin, 1927.

FAO Names: En - Oilfish; **Fr** - Rouvet; **Sp** - Escolar clavo (= Escolar).

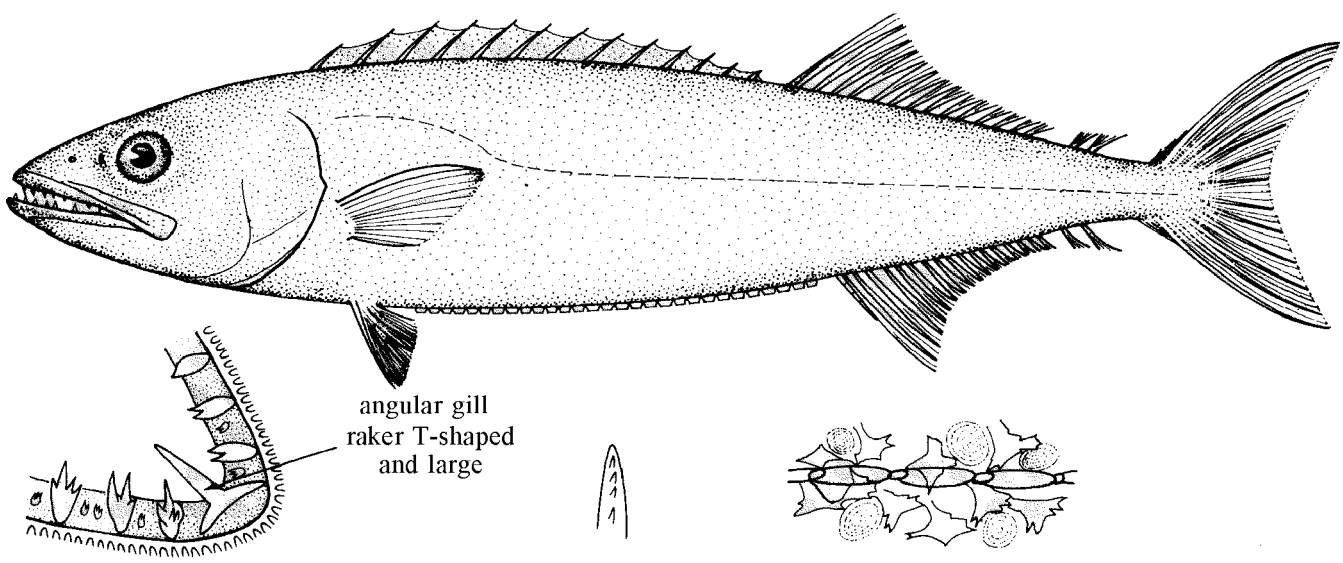


Fig. 92 *Ruvettus pretiosus*

Field Characters: Skin very rough, scales interspersed with spinous bony tubercles. Mid-ventral (abdominal) keel on ventral contour.

Diagnostic Features: Body semifusiform and slightly compressed; its depth 4.3 to 4.9 times in standard length. Head length 3.3 to 3.7 times in standard length; lower jaw extends slightly anterior to upper jaw; tip of both jaws without dermal processes; fang-like teeth in both jaws present in juveniles but indistinct in adults; uniserial small teeth on vomer and palatines. Gill raker at angle of first arch T-shaped and larger than other gill rakers. First dorsal fin low, with XIII to XV spines, second dorsal fin with 15 to 18 soft rays followed by 2 finlets; anal fin with 15 to 18 soft rays followed by 2 finlets; pectoral fins with about 15 soft rays; pelvic fin well developed, with I spine and 5 soft rays; caudal fin widely forked without caudal keels. Lateral line single, often obscure; belly keeled by bony scales between pelvic fins and anus. Small cycloid scales, interspersed with rows of sharp spiny tubercles. Vertebrae total 32, including 16 precaudal and 16 caudal. **Colour:** Body uniformly brown to dark brown, tip of pectoral and pelvic fins black, margins of second dorsal and anal fins white in young specimens.

Geographical Distribution: Widely distributed in tropical and temperate waters of the world (Fig 93).

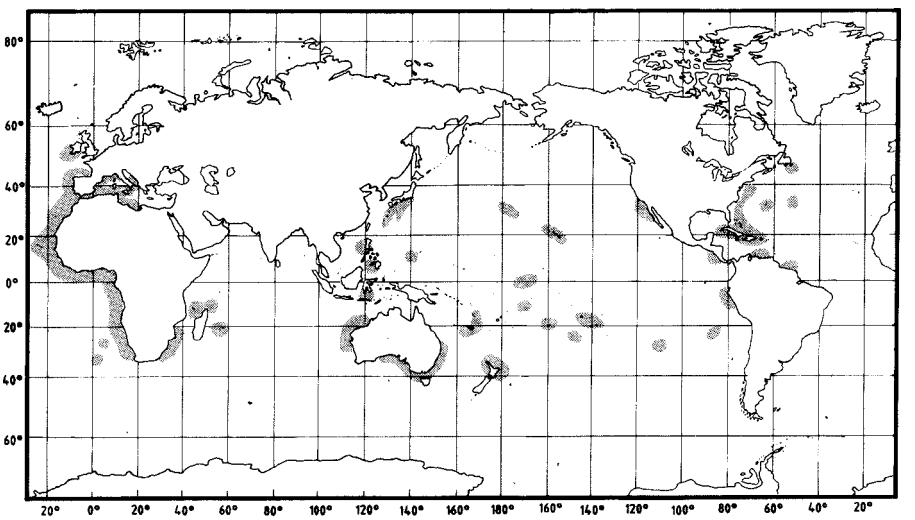


Fig. 93

Habitat and Biology: Oceanic, benthopelagic on continental slope and sea rises from about 100 to 700 m. Usually solitary or in pairs near sea bottom; feeds on fish, squid and crustaceans.

Size: Maximum 3 m total length, common to 150 cm standard length.

Interest to Fisheries: No special fishery for this species, but appears as bycatch in the tuna longline fishery, caught usually at depths from 200 to 400 m. The peculiar wooden "palu" or *Ruvettus* hook is used to catch this species in the southcentral Pacific, Flesh very oily, with purgative properties, if eaten much.

Local Names: CANADA: Oilfish; FRANCE: Rouvet; ITALY: Ruvetto; JAPAN: Bara-mutsu, Tama-kamasu; SPAIN: Escolar clavo; UK: Oilfish; USA: Oilfish; RUSSIA: Ruveta.

Literature: Bigelow and Schroeder (1953); Herre (1953); Wheeler (1969); Forster et al. (1970); Mago (1970); Fourmanoir and Griessinger (1971); Quero (1973); Chirichigno (1974); Parin and Golovan (1976); Parin (1976b, 1986, 1990c); Gorbunova (1977); Nakamura (1977, 1981, 1984b, 1986b,c); Fourmanoir (1979); Fourmanoir and Rivaton (1979); Pakhorukov (1981); Kukuev (1982); Fujii (1983); Randall and Egaña (1984); Wass (1984); Machida (1985); Parin and Prutko (1985); Borets (1986); Hutchins and Swainston'(l986); Lloris (1986); Paulin et al. (1989).

Thyrsires Cuvier, 1831

GEMP Thyrs

Thyrsites Cuvier in Cuv. and Val., 1832:196. Type species, ***Scomber atun*** Euphrasen, 1791, by subsequent designation by Gill, 1862.

Synonyms: *Leionura* Bleeker, 1860a.

Diagnostic Features: See species.

Species: A single species recognized so far.

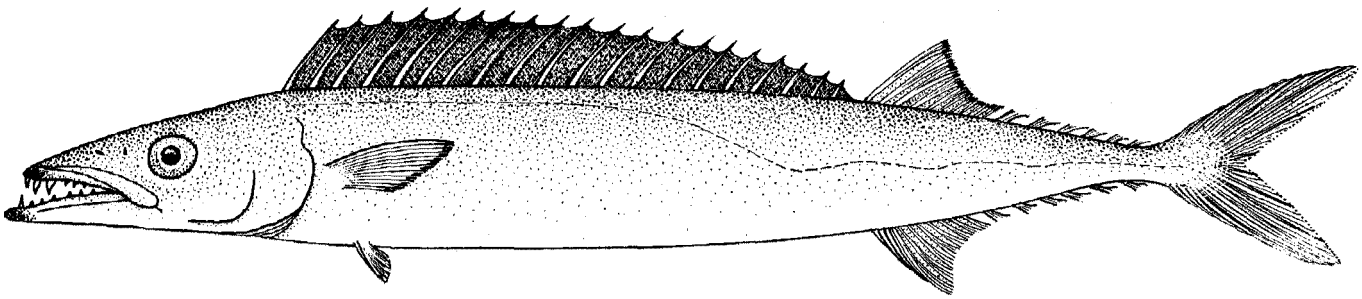
Thyrstes atun (Euphrasen, 1791) Fig. 94

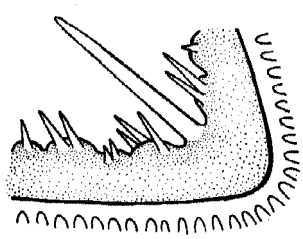
GEMP Thyrs 1

Scomber atun Euphrasen, 1791:315 (Cape of Good Hope, South Africa).

Synonyms: *Scomber dentatus* Bloch and Schneider, 1801, *Thyrsites chilensis* Cuvier in Cuv. and Val., 1832. *Scomber lanceolatus* Cuvier in Cuv. and Val., 1832. *Thyrsiles altivelis* Richardson, 1839. *Scomber splendens* Richardson, 1842. *Scomber dentex* Richardson, 1842.

FAO Names: En - Snoek; **Fr** - Escolier; **Sp** - Sierra.





FIRST GILL ARCH

Fig. 94 ***Thyrsites atun***

Field Characters: Second dorsal fin as large as anal fin, both followed by 6 or 7 finlets. Pelvic fins small, but well developed. Lateral line single, running close to upper contour of body, below most of first dorsal-fin base.

Diagnostic Features: Body fairly elongate and considerably compressed; its depth 7.5 to 9.2 times in standard length. Head length 3.8 to 4.2 times in standard length; two well separated nostrils, posterior nostril slit-like; mouth large, posterior end of upper jaw reaches to anterior margin of eye, lower jaw projects anterior to upper jaw; no dermal processes on tips of both jaws; several large fangs in anterior part of upper jaw; 2 minute teeth on vomer; fine uniserial teeth on palatines. Gill rakers on first arch short and spinescent, one raker at angle slightly larger than others. First dorsal fin high, and its base long, with XIX to XXI spines, second dorsal fin also high with 11 to 13 soft rays followed by 5 to 7 finlets; anal fin slightly smaller than second dorsal fin, with I spine and 10 to 12 soft rays followed by 5 to 7 finlets; pectoral fins slightly longer than snout, with 13 to 15 soft rays; pelvic fins small but well developed, with I spine and 5 soft rays. A single lateral line, running close to upper contour of body below most of first dorsal-fin base, then abruptly curving below. Vertebrae total 35, including 21 precaudal and 14 caudal.
Colour: Body dark blue, slightly paler on belly; first dorsal-fin membrane black.

Geographical Distribution: Distributed in the coastal regions from 35º to 55ºS latitude, penetrating north only in the waters of cold streams: Chile, southern Peru, Argentina, Uruguay, Tierra del Fuego, Tristan da Cunha, South Africa, Islands of St. Paul and Amsterdam, Tasmania, New Zealand, southern coast of Australia (Fig. 95).

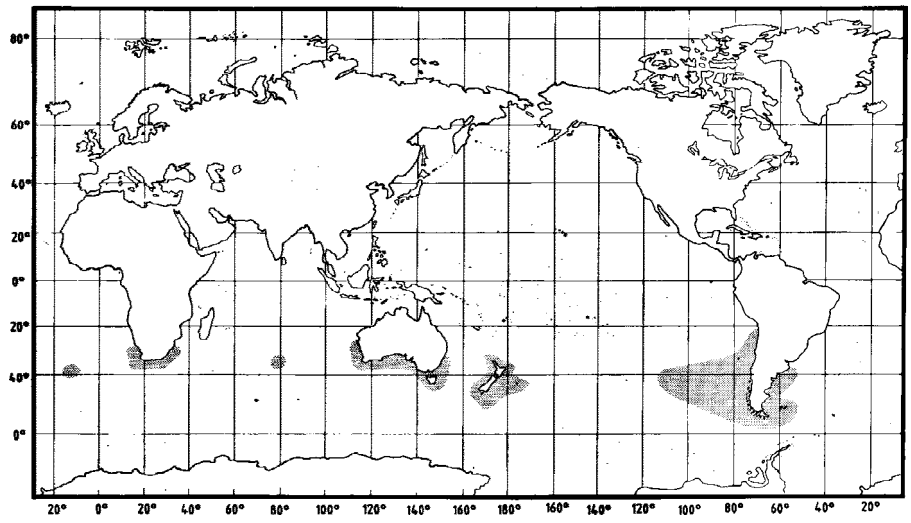


Fig. 95

Habitat and Biology: Neritic benthopelagic species, mostly inhabiting continental shelves or around islands. Preferred temperature range believed to be 13° to 18°C. Feeds on pelagic crustaceans (Euphausia, Nyctiphanes etc.), cephalopods, and fishes such as anchovies, sardines, herrings, carangids, and mugilids (Blackburn, 1957). Spawning occurs from late winter through autumn at Mernoo Bank, off the northwestern coast of the South Island and Chatham Island, New Zealand. Nursery grounds are located in the Hauraki Gulf, Tasman Bay and the Counterbury Bight, New Zealand. Schooling may occur either close to the sea bottom or midwater, and sometimes even at surface at night, Growth in the first 3 years is fast, reaching 29 cm fork length after the first year, 58 cm after the third years, and 90 cm after the tenth year (Hatanaka, 1990).

Size: Maximum 150 cm standard length and more than 6 kg weight, common from 50 to 100 cm.

Interest to Fisheries: Mostly caught by trolling lines and handlines, and sometimes by trawls in Australia, New Zealand, Chile, Argentina and South Africa. The fishing grounds in New Zealand are located around the South Island, especially off Stewart Island, Canterbury Bight and the northwest coast. The total world catch varied considerably from 1974 to 1990, from lowest catch in 1974 of 24 497 t to 101 548 t in 1983. The main fishing areas are off southwestern Africa (FAO Fishing Area 47) and around New Zealand (FAO Fishing Area 81). More than 90% of the 25 000 t to 35 000 t catches reported off South Africa and Namibia are taken by South Africa and Russia. The total catch by New Zealand, Japan and to a lesser extent Australia varies from 20 000 t to 30 000 t in the FAO Fishing Area 81 (FAO, 1992). Good for fish and chips or smoking. In Japan, made for fillet or fish cake.

Local Names: ARGENTINA: Pez sierra, Barracuda; CHILE: Sierra, Sierra comun; JAPAN: Ooshibi-kamasu; RUSSIA: Snek; SOUTH AFRICA: Snoek.

Literature: Angot (1951); Haedrich and Nielsen (1966); Movillo and Bahmonde (1971); Parin and Becker (1972); Robertson (1975); Chirichigno (1974); Shuntov (1979); Nakamura (1981, 1984a, 1986a, 1990a,b); Last et al. (1983); Hutchins and Swainston (1986); Lloris (1986); Parin (1990c).

Thyrsitoides Fowler, 1929

GEMP Thyrsd

Thyrsitoides Fowler, 1929:255-256. Type species, ***Thyrsitoides marleyi*** Fowler, 1929, by original designation (also monotypic).

Synonyms: ***Mimasea*** Kamohara, 1936.

Diagnostic Features: See species.

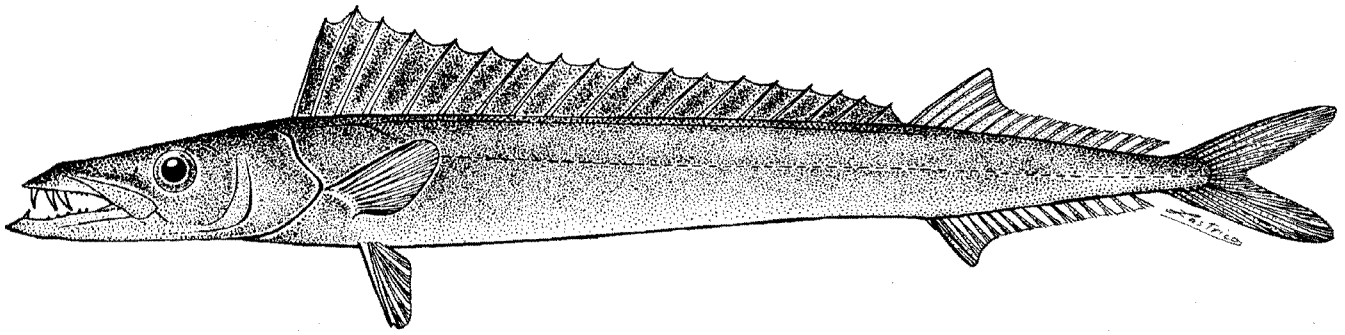
Species: A single species recognized so far.

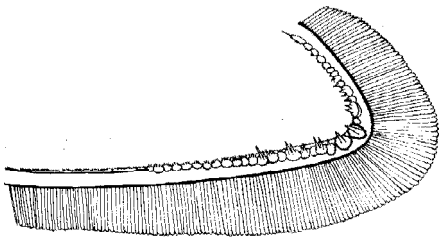
Thyrsitoides marleyi Fowler, 1929 | Fig. 96 | GEMP Thyrsd 1

Thyrsitoides marleyi Fowler

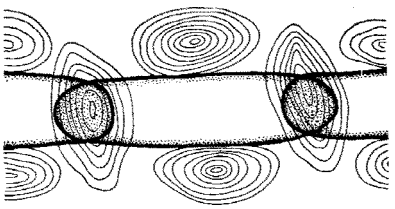
Synonyms: *Mimasea taeniosoma* Kamohara, 1936.

FAO Names: En - Black snoek; **Fr** - Escolier gracile; **Sp** - Sierra grácil.





FIRST GILL ARCH



SCALES AROUND LATERAL LINE

Fig. 96 *Thyrsitoides marleyi*

Field Characters: Pelvic fins well developed, about as long as pectoral fins. Two lateral lines, originating above upper angle of gill opening, bifurcating below fourth dorsal-fin spine or slightly behind it, upper line running along first dorsal-fin base and terminating below about end of first dorsal fin, lower line abruptly curved backward from bifurcation, running along middle of body to base of middle caudal-fin ray.

Diagnostic Features: Body greatly elongate and compressed; its depth 8.3 to 10.5 times in standard length. Head length 3.8 to 4.1 times in standard length; snout sharply conical, lower jaw sharply pointed and extends considerably beyond upper jaw; tip of both jaws with small conical dermal processes; 3 fangs anteriorly in each side of upper jaw, usually 3 fangs depressible and remaining ones immovable; 1 pair of slightly elongate tooth anteriorly on each side of lower jaw; lateral teeth in jaws conical, those in lower jaw much larger than those in upper jaw; vomer edentate; small teeth on palatines.First dorsal fin rather high and its base long with XVII to XIX spines, the second dorsal fin about as high as first dorsal fin, with I small spine and 16 or 17 soft rays; anal fin a little smaller than second dorsal fin, with I small spine and 16 or 17 soft rays; pectoral fin length a little shorter than snout length, with I small spine and 13 or 14 soft rays; pelvic fins well developed, about as long as pectoral fins with I spine and 5 soft rays. Two lateral lines, the upper following dorsal contour of body, the lower originating below fourth dorsal-fin spine or siightly behind it, running mid-laterally. Body covered with small, thin cycloid scales. Vertebrae total 34, including 20 precaudal and 14 caudal. **Colour:** Body dark brown with slightly metallic reflections, sometimes slightly paler on belly; black markings on first dorsal-fin membrane, other fins without any markings.

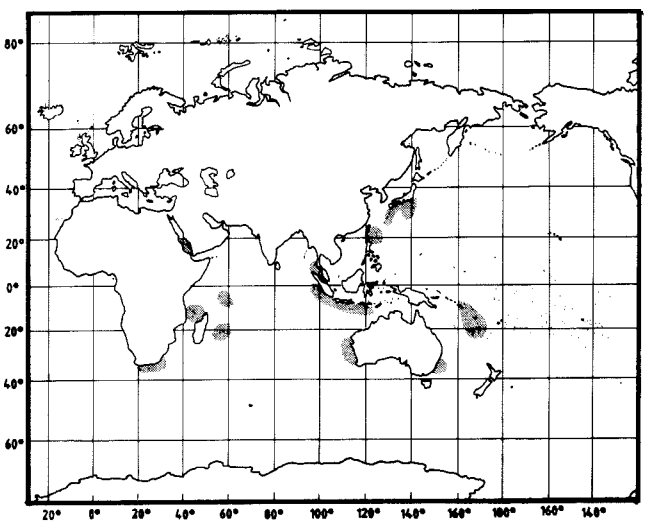


Fig. 97

Geographical Distribution: Distributed in the Indd-West Pacific: around Japan except Hokkaido (Northern Island), Kyusyu-Palau Ridge,

Taiwan, New Caledonia, New Hebrides, Malacca Straits, Andaman Sea, western Australia, around Madagascar, La Reunion, Saya de Malha Bank, east coast of South Africa and Red Sea (Fig. 97).

Habitat and Biology: Mesobenthopelagic, down to depths of 400 m or more, often at surface at night around Okinawa. The largest populations are probably on the slope of seamounts or ridges. Sporadically recorded. Feeds on a variety of mesopelagic fish, squid and crustaceans.

Size: Maximum 1.5 m standard length, common 50 to 100 cm.

Interest to Fisheries: No special fishery for this species. Marketed fresh in Okinawa, Japan, but rarely caught.

Local Names: JAPAN: Nagatachi-kamasu, Naganja; THAILAND: Pla Insee Saak.

Literature: Matsubaraand Iwai (1952); Forster et al. (1970); Fourmanoir and Rivaton (1979); Nakamura (1980, 1984a,b, 1986b and c); Wongratana (1980); Fourmanoir (1982); Gloerfelt-Tarp and Kailola (1984); Parin and Prutko (1985); Shcherbachev (1987); Parin and Paxton (1990).

Thyrsitops Gill, 1862

GEMP Thyrsi

Thyrsitops Gill, 1862:125. Type species, ***Thyrsites lepidopoides*** Cuvier in Cuv. and Val., 1831, by original designation (also monotypic).

Synonyms: None.

Diagnostic Features: See species.

Species: A single species recognized so far.

Thyrsitops lepidopoides Cuvier, 1831

Fig. 98

GEMP Thyrsi 1

Thyrsites Lepidopoides Cuvier in Cuv. and Val., 1831:205, pl. 220 (Atlantic Ocean).

Synonyms: None.

FAO Names: En - White snake mackerel; **Fr** - Escolier blanc; **Sp** - Escolar sierra.

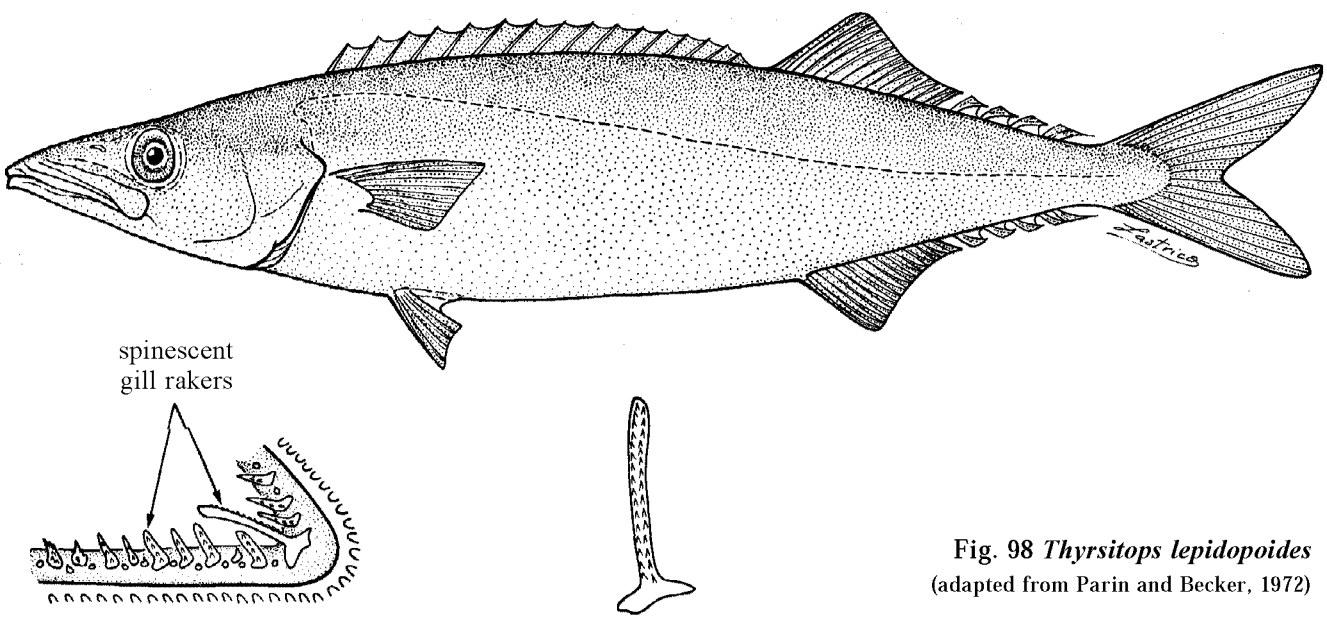


Fig. 98 *Thyrsitops lepidopoides*
(adapted from Parin and Becker, 1972)

Field Characters: Body semifusiform and slightly compressed. Head moderate in size, usually 3.4 to 3.8 times in standard length. Snout long and sharply pointed.

Diagnostic Features: Body semifusiform and slightly compressed; its depth 5 or 6 times in standard length. Head length 3.4 to 3.8 times in standard length; two small, fairly separated nostrils, the anterior nostril semicircular and the posterior nostril slit-like; mouth large, posterior end of upper jaw reaching below middle of eye, lower jaw extends anterior to upper jaw; several large fangs in anterior part of upper jaw, no fangs in lower jaw; small uniserial canine teeth about 15 in upper jaw, about 10 in lower jaw; teeth on lower jaw larger than those on upper jaw; minute teeth on vomer and palatines. Gill rakers on first arch short and spinescent, the raker at the angle much larger than others; pseudobranchiae well developed. First dorsal fin rather low, with XVI or XVII spines, second dorsal fin a little higher than first dorsal fin, with I small spine and 13 to 15 soft rays followed by 5 or 6 finlets; anal fin almost the same in size and shape as second dorsal fin, with I minute spine and 15 to 17 soft rays followed by 3 or 4 finlets; pectoral fins rather short and situated low, with 14 to 16 soft rays; length of pelvic fins half length of pectoral fins, with I spine and 5 soft rays. A single lateral line slightly curved anteriorly, then fairly straight and oblique. Vertebrae total 33, including 17 precaudal and 16 caudal. **Colour:** Body dark blue with metallic tint.

Geographical Distribution: Distributed on both sides of southern South America: off Chile, Argentina, Uruguay and southern Brazil (Fig. 99).

Habitat and Biology: Mesobenthopelagic on continental slope. Matures at about 25 cm, feeds on small fishes (myctophids, etc.).

Size: Maximum 40 cm standard length, common to 25 cm.

Interest to Fisheries: The world total catch decreased from 3 831 t in 1974 to 1 t in 1978. Since 1980, no catches have been reported, except for 21 t caught in 1990 by Argentina in southwest Atlantic (FAO Fishing Area 41). Of the total catch reported before 1980, Argentina accounted for only 1 to 4 t annually and the remainder was Chile (FAO, 1978, 1980, 1982, 1992). Good for smoked fish and fish and chips.

Local Names: ARGENTINA: Caballa blanca, Sierra; BRAZIL: Cavalinha; CHILE: Sierra del Sur, Sierra; JAPAN: Hirashibi-kamasu; RUSSIA: Tirzitop; UK: White snake mackerel.

Literature: Parin and Becker (1972); Nakamura (1986a); Nishikawa (1987).

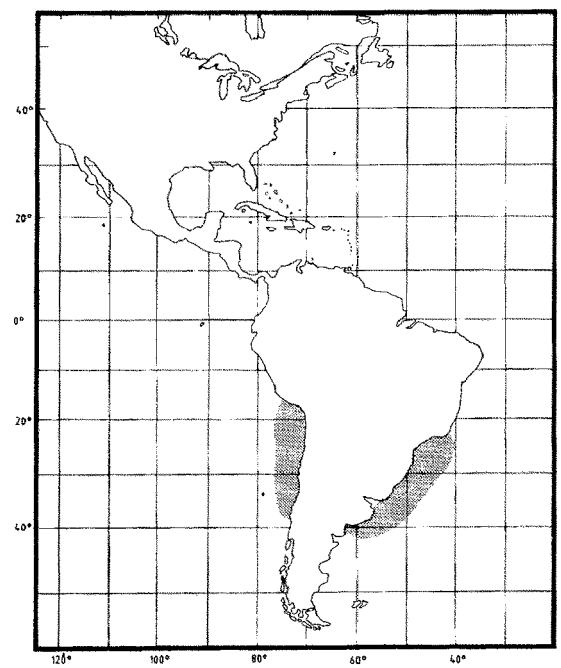


Fig. 99

Tongaichthys Nakamura and Fujii, 1983

GEMP Tong

Tongaichthys Nakamura and Fujii, 1983:174. Type species, *Tongaichthys robustus* Nakamura and Fujii, 1983, by original, designation (also monotypic).

Synonyms: None.

Diagnostic Features: See species.

Species: A single species recognized so far.

Tongaichthys robustus Nakamura and Fujii, 1983 | Fig. 100 | **GEMP Tong 1**

Tongaichthys robustus Nakamura and Fujii, 1983:173-179, figs 2-13 (Tonga Ridge, South Pacific: 22°11'S, 175°24'W).

Synonyms: None.

FAO Names: En - Tonga escolar; **Fr** - Escolier tonga; **Sp** - Escolar de Tonga.

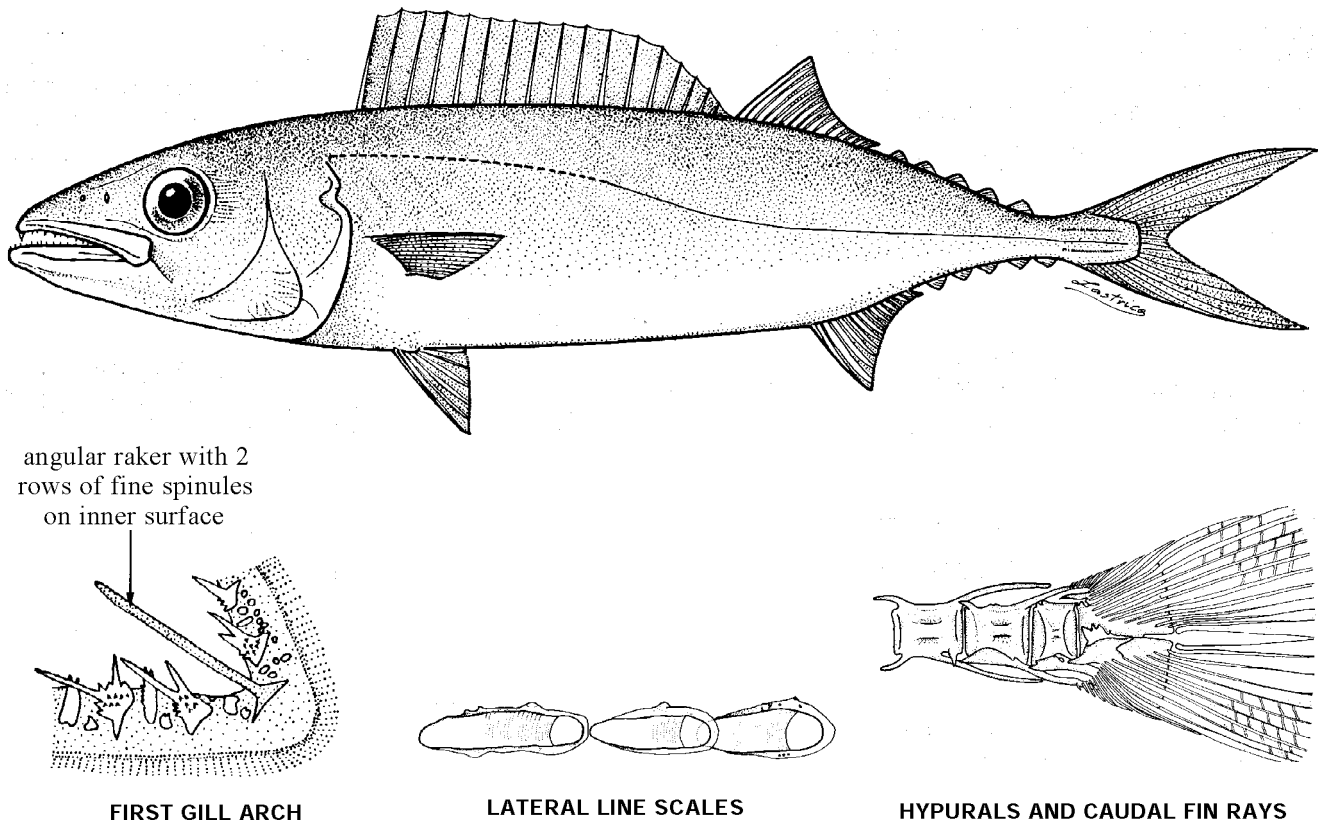


Fig. 100 ***Tongaichthys robustus***
(after Nakamura and Fujii, 1983)

Field Characters: Body semifusiform and slightly compressed. Head very large, its length about 3.1 to 3.2 times in standard length. Snout short and rather blunt.

Diagnostic Features: Body semifusiform and only slightly compressed; its depth 4.2 to 4.5 times in standard length. Head very large, about 3.2 times in standard length; snout short and rather blunt; anterior part of upper jaw with 1 or 2 (rarely 3) small fangs, no fangs in lower; lateral teeth in both jaws uniserial, compressed and caniniform, those of lower jaw (about 10) larger and more widely spaced than those of upper (about 40); middle teeth larger than anterior and posterior teeth, about 13 on vomer, about 30 on each palatine. Gill rakers spinescent with many spinules on their bases, numerous irregular fine bony plates on gill arches; longest raker with 2 rows of fine spinules on its inner surface, located at angle of first arc; pseudobranchiae well developed. First dorsal fin moderately high, with XVI to XVII soft and feeble spines, second dorsal fin rather low, with 14 to 17 soft rays followed by 5 or 6 finlets; anal fin also rather low, with I small spine, and 14 to 16 soft rays followed by 5 or 6 finlets; pectoral fins small and situated rather low, with I small spine and 16 to 18 soft rays; pelvic fins slightly shorter than pectoral fins, with I spine and 5 soft rays; caudal fin rays cover hypural complex deeply but not completely. A pair of faint keel-like processes on caudal base. A single lateral line, gradually descending from above upper margin of opercle to base of caudal fin with slight undulations. Scales on cheek enlarged, elongate and slightly overlapping. Vertebrae total 33, including 18 precaudal and 15 caudal. **Colour:** Body dark brown above, slightly paler below; dorsal part of head, hind part of end of upper jaw, upper margin of lower jaw, inner base of pectoral fins and base of caudal fin brown black; anterior 3 or 4 first dorsal fin membranes and proximal parts of other membranes black; upper margin of pectoral fins and anterior margin of second dorsal fin slightly darkened.

Geographical Distribution: 38 specimens of this species were reported only from the Tonga Ridge. Several specimens have recently been caught around Fiji (A.D. Lewis, comm.) and 1 specimen from off Flinders Reef, Queensland: 17°33'S, 149°46'E (CSIRO no. H1185-01) (Fig. 101).

Habitat and Biology: Probably mesopelagic or mesobenthopelagic, caught at about 300 m depth.

Size: Maximum 23 to 29 cm standard length known so far.

Interest to Fisheries: No special fishery for this species.

Local Names: JAPAN: Shibi-kamasu; RUSSIA: Tongaikht.

Literature: Nishikawa (1987).

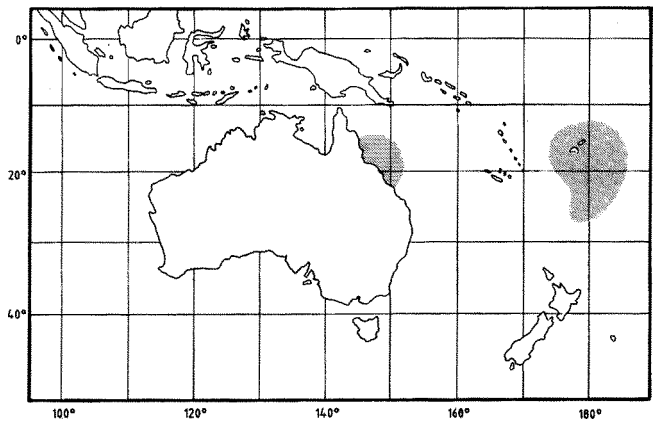


Fig. 101

2.3 TRICHIURIDAE

TRICH

2.3.1 Diagnostic Features of the Family Trichiuridae

Synonyms: Lepidopidae (in part).

FAO Names: En - Cutlassfishes, Hairtails, Scabbardfishes, Frostfishes; **Fr** - Sabres, Poissons sabres; **Sp** - Pez sable, Cintilla, Sable, Tajali.

Field Characters: Body exceptionally elongate and compressed, with a small forked. or hair-like caudal fin. One nostril on each side of snout. Strong teeth in jaws, those at front of upper jaw fang-like. Pelvic fins absent, or reduced to I scale-like spine and 0 to 2 rudimentary soft rays. A single lateral line usually situated closer to the ventral contour than the dorsal contour on posterior part of body.

Diagnostic Features: Body remarkably elongate and compressed, ribbon-like, with a tapered tail or small forked caudal fin. A single nostril on each side of head; mouth large, not protractile; lower jaw extends anterior to upper jaw; teeth extremely strong, fang-like in anterior part of upper jaw and sometimes in anterior part of lower jaw. Gill rakers spinescent. A single dorsal fin, running almost the entire length of the body, the spinous portion either short and continuous with a very short soft portion (in ***Assurger, Eupleurogrammus, Evoxymetopon, Lepidopus, Lepturacanthus, Tentoriceps*** and ***Trichiurus***), or the spinous part moderately long (slightly shorter than soft part in ***Aphanopus***) and separated from soft portion by a notch (***Benthodesmus***); anal fin preceded by II free spines behind anus (first inconspicuous and second variousy enlarged as a leaf-like or keeled scute, or as a stout spine), with absent or reduced soft rays (sometimes restricted to posterior part of the fin); pectoral fins rather small and situated mid-laterally or lower on sides; pelvic fins absent or reduced to I flattened spine and 0 to 2 tiny soft rays; caudal fin either small and forked or absent. Lateral line single. Scales absent. No keels or notch on caudal peduncle region. There are 9 genera and 32 species known so far.

Biology, Habitat and Distribution: Benthopelagic on continental shelves and slopes and underwater rises, from surface to about 2 000 m deep, found in tropical to warm temperate waters. Voracious predators feeding on fish, squid and crustaceans. Spawning throughout the year in warm waters. Eggs and larvae pelagic.

Interest to Fisheries: ***Trichiurus, Eupleurogrammus, Lepturacanthus, Lepidopus*** and ***Aphanopus*** exploited commercially.Though flesh scanty, meat excellent to eat. Marketed mostly fresh or salted, sometimes also frozen.The degree to which its flesh is esteemed varies locally.

2.3.2 Illustrated Key to the Genera of Trichiuridae:

1a. Caudal fin present, small and forked (Fig. 102); pelvic fins present, but strongly reduced or modified to a scale-like process (flattened spine) with 0 to 2 tiny soft rays (may be absent in some species) (Fig. 102). ..... → *2*

1b. Caudal fin absent, or tapering into a hair-like process (Fig. 103); pelvic fins absent or modified into a scale-like process (Fig. 103). ..... → *6*

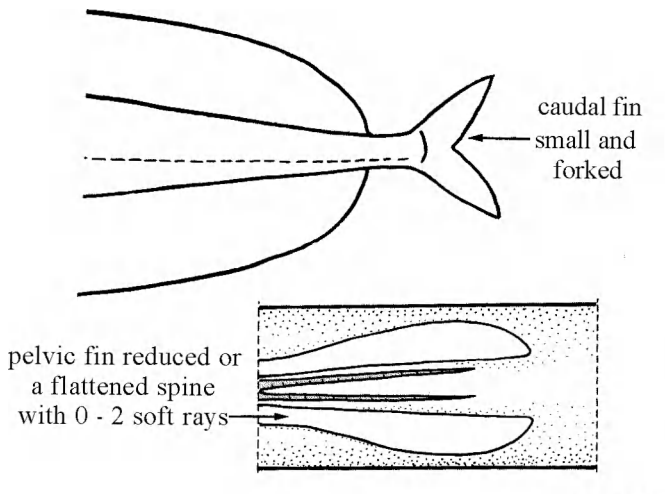


Fig. 102

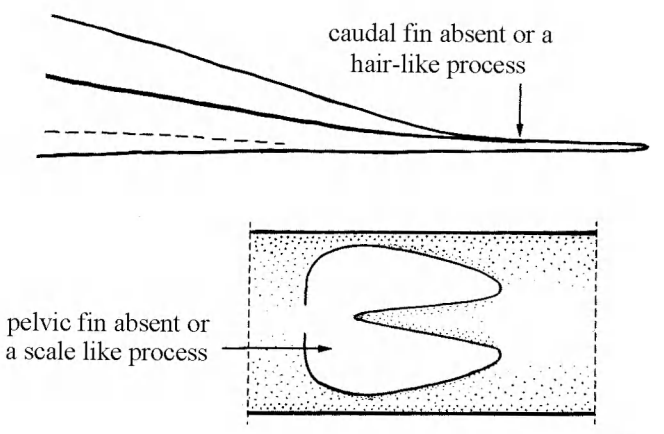


Fig. 103

2a. Head profile rising very gradually from tip of snout to origin of dorsal fin without forming a sagittal crest (Fig. 104); a notch between the spinous and soft part of dorsal fin (Fig. 104) → *3*

2b. Head profile with a prominent sagittal crest (Figs 105, 106, 107); no notch between the spinous and soft part of dorsal fin (Fig. 105) ..... → *4*

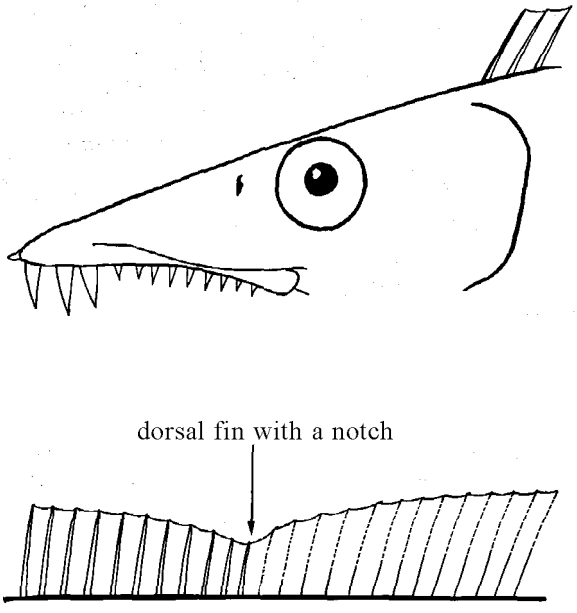


Fig. 104

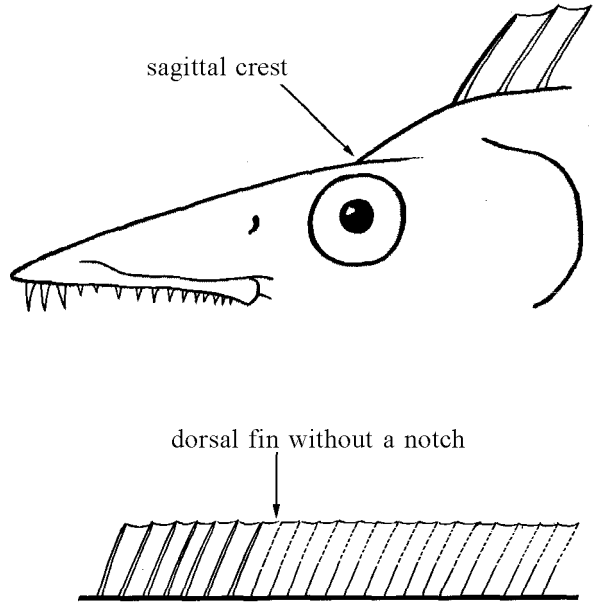


Fig. 105

3a. Spinous part of dorsal fin about half as long as the soft part; 102 to 155 dorsal-fin elements ..... *Benthodesmus*

3b. Spinous part of dorsal fin only slightly shorter than the soft part; 90 to 109 dorsal-fin elements ..... *Aphanopus*

4a. Head length 7 times in total length; eye fairly large, situated near dorsal contour (Fig.1 06) ..... *Lepidopus*

4b. Head length 8 times in total length; eye moderate in size, situated laterally (Fig. 107) ..... → *5*

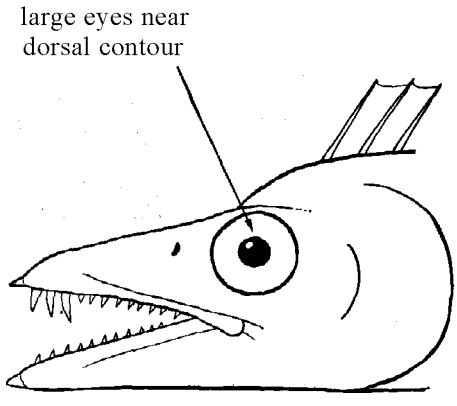


Fig. 106 *Lepidopus*

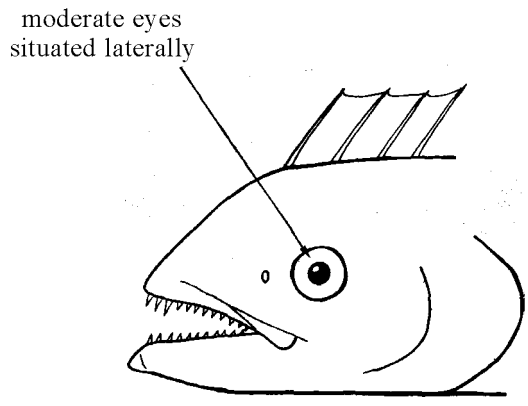


Fig. 107

5a. Dorsal-fin elements 116 to 123 ..... *Assurger*

5b. Dorsal-fin elements 81 to 93 ..... *Evoxymetopon*

6a. Pelvic fins absent; free margin of subopercle concave (Fig. 108) .....→ 7

6b. Pelvic fins scale-like; free margin of subopercle convex (Fig. 109) .....→ *8*

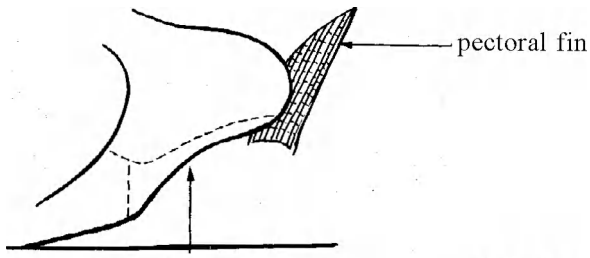


Fig. 108

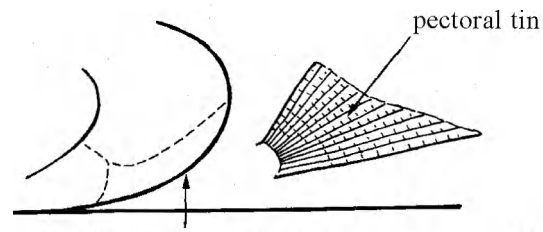


Fig. 109

7a. First anal-fin spine large, its length half of eye diameter; soft anal-fin rays pungent spinules breaking through ventral skin (Fig. 110); two small canine teeth on upper jaw projects forward (Fig. 110); a small slit present on ventral side of lower jaw for receiving anteriormost fang of upper jaw (Fig. 110) .....*Lepturacanthus*

7b. First anal-fin spine small, its length less than pupil of eye; soft anal-fin rays slightly breaking through ventral skin in smaller specimens (Fig, 111); no canine teeth on upper jaw projects forward (Fig. 111); no slit on ventral side of lower jaw (Fig. 111) .....*Trichiurus*

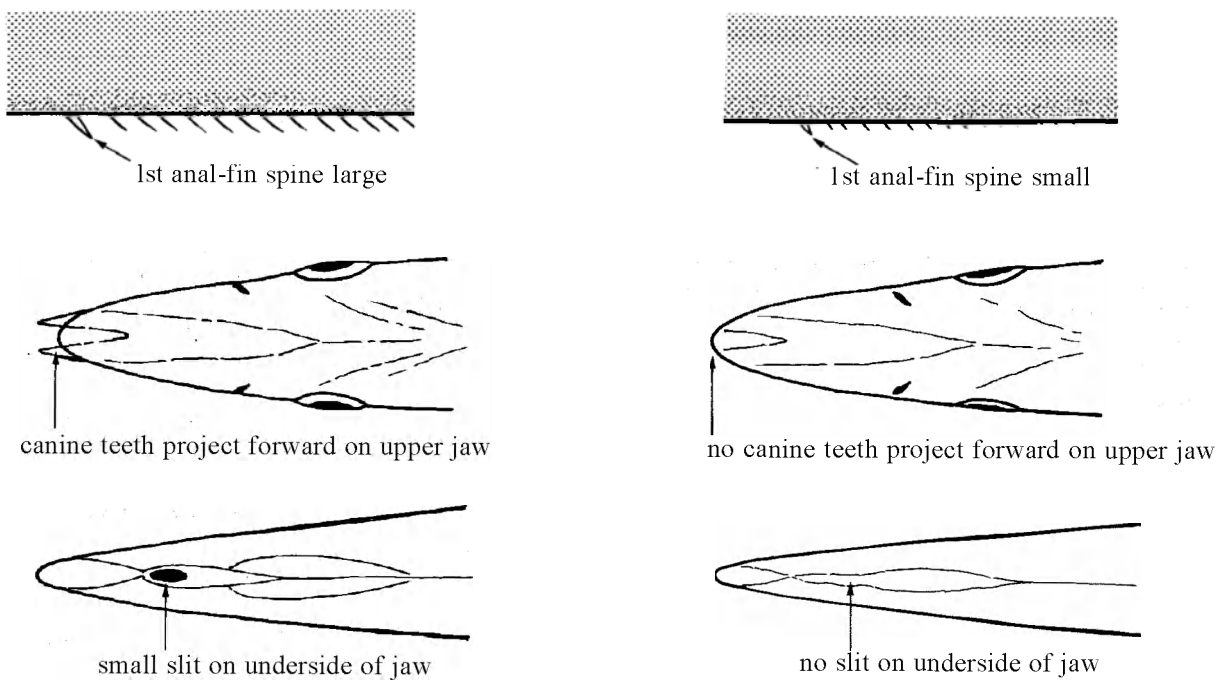


Fig. 110 ***Lepturacanthus***

Fig. 111 ***Trichiurus***

8a. Pectoral fins short, not reaching lateral line (Fig. 112); anal-fin origin below 47th to 50th soft dorsal-fin ray ..... *Tentoriceps*

8b. Pectoral fins long, extending beyond lateral line (Fig, 113); anal-fin origin below 31st to 35th or 41 st to 43rd soft dorsal-fin ray ..... *Eupleurogrammus*

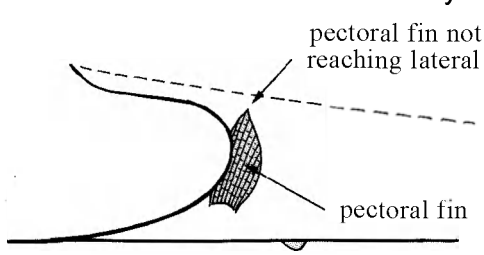


Fig. 112 ***Tentoriceps***

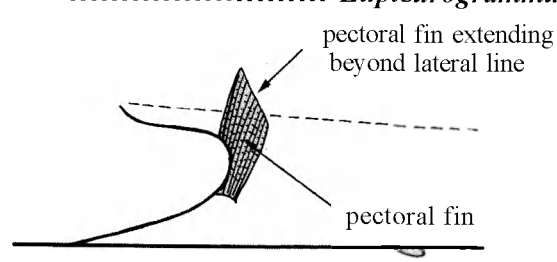


Fig. 113 ***Eupleurogrammus***

2.3.3 Information by species

Aphanopus Lowe, 1839 **TRICH Apha**

Aphanopus Lowe, 1839:79. Type species, ***Aphanopus carbo*** Lowe, 1839, by monotypy.

Synonyms: None.

Diagnostic Features: Body elongate and compressed. Head profile smooth, gently rising from tip of snout to dorsal-fin origin; frontal ridges not elevated, interorbital space and nape flattened, without sagittal crest; lower hind margin of gill cover convex; lower jaw extends anterior to upper jaw; tip of both jaws with a short dermal process; jaw dentition includes anterior fangs and compressed triangular teeth; no vomerine teeth; few uniserial teeth present on palatines. Gill rakers on first arch spinescent. Dorsal fin long, with XXXVIII to XLV spines and 52 to 65 soft rays (total 90 to 109 fin elements), partly divided by a deep notch, base of spinous part only slightly shorter than the soft part; anal fin with II close-set spines, well detached from the rest of fin, but the first diminutive, completely concealed in adults, the second very strong, dagger-like, and 43 to 54 soft rays, external rays developed throughout, but connected with membranes only in posterior portion of fin base; pectoral fins with 12 rays; pelvic fins absent in adults but present in juveniles as a single spine inserted before base of pectoral fins; a small forked caudal fin present. **Colour:** Body coppery black with iridescent tint. Inside of mouth and gill cavities black.

Biology, Habitat and Distribution: Benthopelagic on continental slope, mostly from 400 to 1 600 m, juveniles mesopelagic. Feeds on cephalopods, crustaceans and a variety of fish. Distributed throughout temperate and tropical oceans.

Interest to Fisheries: Of the four species in this genus, commercial catches are only reported for ***Aphanopus carbo.***

Species: Four species recognized (Parin, 1983) but the systematic status of the Pacific form is uncertain.

Key to Species of *Aphanopus:*

1a. Total dorsal-fin elements 104 to 109; vertebrae total 111 to 115 ..... ***A. mikhailini***

2b. Total dorsal-fin elements 90 to102; vertebrae total 97 to 108 .....→ *2*

2a. Total dorsal-fin elements 95 to102; vertebrae total 102 to 108 ..... ***A. intermedius***

2b. Total dorsal-fin elements 90 to97; vertebrae total 97 to 102 ..... → *3*

3a. Dorsal-fin spines 38 to 41; precaudal vertebrae 40 to 44 ..... ***A. carbo***

3b. Dorsal-fin spines 41 to 43; precaudal vertebrae 44 to 47 .....***A. microphthalmus***

Aphanopus carbo Lowe, 1839 | Fig. 114 | **TRICH Apha 1**

Aphanopus carbo Lowe, 1839:79 (Madeira).

Synonyms: ***Aphanopus minor*** Collett, 1887. ***Aphanopus schmidti*** Saemundsson, 1907. ***Aphanopus acus*** Maul, 1948.

FAO Names: En - Black scabbardfish; **Fr** - Sabre noir; **Sp** - Sable negro.

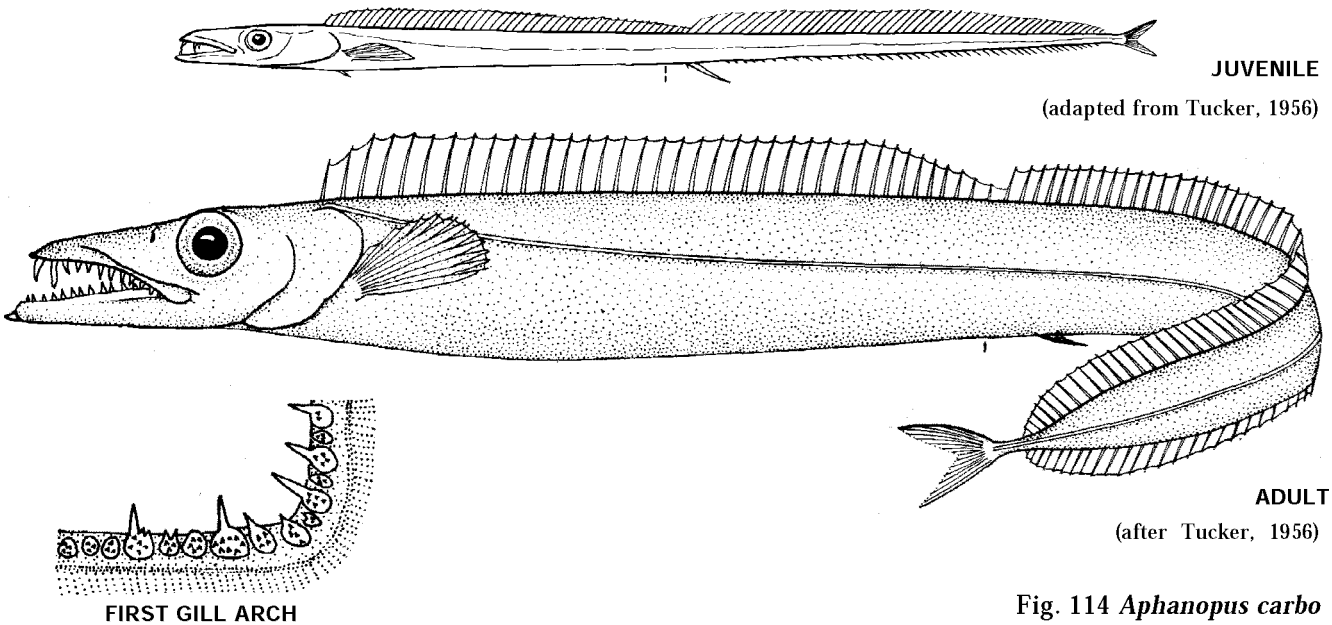


Fig. 114 ***Aphanopus carbo***

Diagnostic Features: Body depth 10.8 to 13.4 times in standard length; anus situated below the last 3 dorsal-fin spines; distance from snout to anus 1.7 to 1.8 times in standard length. Head length 4.7 to 5.2 times in standard length; snout length 2.3 to 2.5 times in head length; eye diameter 4.9 to 5.8 times in head length; interorbital width 1.1 to 1.4 times in eye diameter; maxillary length 2.1 to 2.2 times in head length. Dorsal fin with XXXVIII to XL (rarely XLI) spines, and 52 to 56 soft rays (total 90 to 96 fin elements); anal fin with II spines, situated below second to fifth dorsal-fin soft ray, and 44 to 48 (rarely 43) soft rays. Vertebrae total 97 to 100, including 40 to 44 precaudal and 55 to 60 caudal.

Geographical Distribution: On both sides and at underwater rises of North Atlantic from Denmark Strait to about 30°N (Fig. 115).

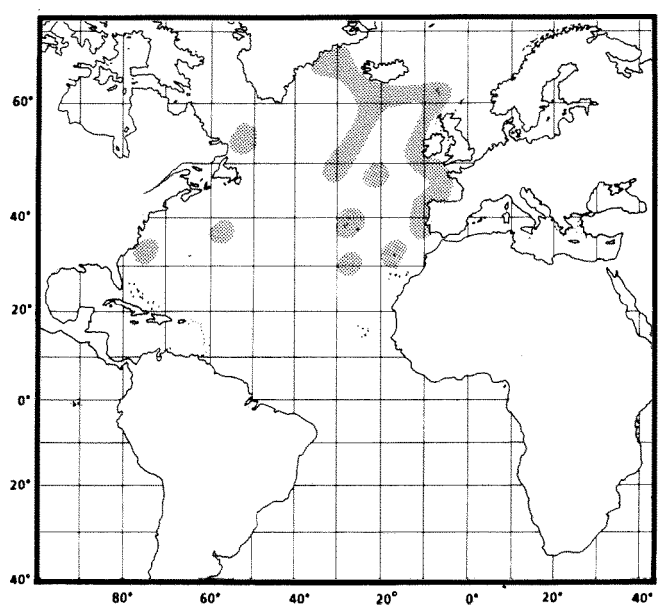


Fig. 115

Habitat and Biology: Benthopelagic from 200 to 1 600 m, juveniles mesopelagic. Migrates to midwater at night and feeds on crustaceans, cephalopods and fishes (mostly macrourids, morids and alepocephalids). Matures at 80 to 85 cm. Spawns west of the British Isles from November to April at depths from 700 to 900 m.

Size: Maximum 110 cm standard length.

Interest to Fisheries: Commercial catch reported entirely from Portugal with total annual landings (probably including *A. intermedius* off Madeira) from 4 613 to 6 865 t (1985 to 1990) (FAO, 1992), including up to 1 000 t which is caught off Madeira with a specialized commercial deep water longline (Maul, 1950). Appears as bycatch in the trawl fishery west of the British Isles, along the Middle-Atlantic Ridge and at Corner Rise.

Local Names: FRANCE: Ophanope carbon, Sabre noir; GERMANY: Schwarzer Degenfisch; JAPAN: Kurotachi-modoki; PORTUGAL: Espada preta (incl. Madeira); RUSSIA: Ugolnaya ryba-sablya; SPAIN: Sable negro; UK, USA: Black scabbard fish.

Literature: Tucker and Palmer (1949); Tucker (1950); Templeman and Squires (1963, in part); Wheeler (1969); Zilanov and Shepel (1975); Kukuev (1982, in part); Parin (1983, 1986); Nakamura (1984b).

Aphanopus intermedius Parin, 1983	Fig. 116	TRICH Apha 2

Aphanopus intermedius Parin, 1983:358 (off Congo and Angola, eastern Atlantic Ocean).

Synonyms: None.

FAO Names: En - Intermediate scabbardfish; **Fr** - Poisson sabre tachuo; **Sp** - Sable intermedio.

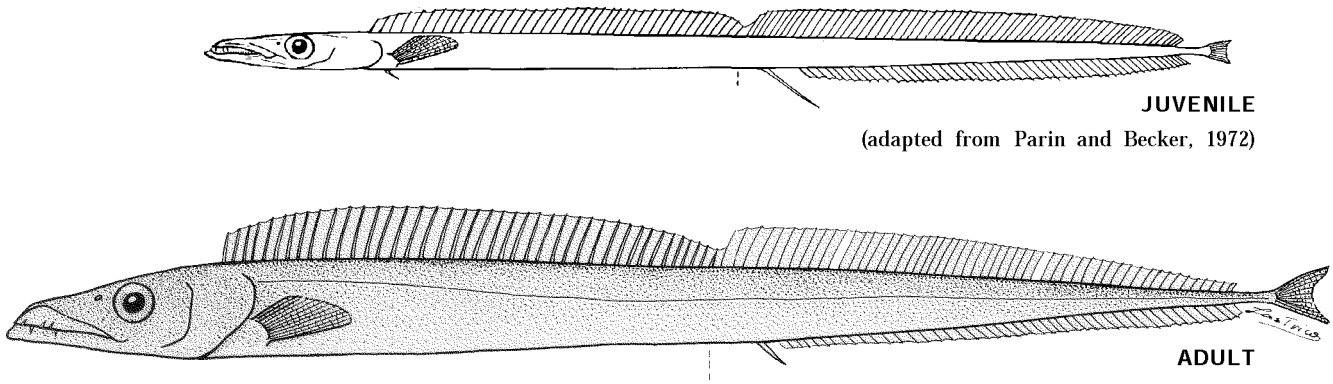


Fig. 116 *Aphanopus intermedius*

Diagnostic Features: Body depth 12.0 to 16.4 times in standard length; anus situated below the third from the last dorsal-fin spine, to the first dorsal-fin soft ray; distance from snout to anus 1.8 to 1.9 times in standard length. Head length 4.9 to 5.5 times in standard length; snout length 2.3 to 2.6 times in head length; eye diameter 5.0 to 6.0 times in head length; interorbital width 1.2 to 1.4 times in eye diameter; maxillary length 2.0 to 2.2 times in head length. Dorsal fin with XL to XLIV (rarely XXXIX) spines and with 54 to 59 soft rays (total 96 to 102 (rarely 95) fin elements); anal fin with II spines situated below the third to sixth dorsal-fin soft rays, and 46 to 50 soft rays. Vertebrae total 102 to 108, including 43 to 47 precaudal and 57 to 61 caudal.

Geographical Distribution: Tropical and subtropical Atlantic Ocean; in the North Pacific off Japan, Kuril Islands, Hawaii, and British Columbia to California; and in the South Pacific off Australia and Peru (Fig. 117).

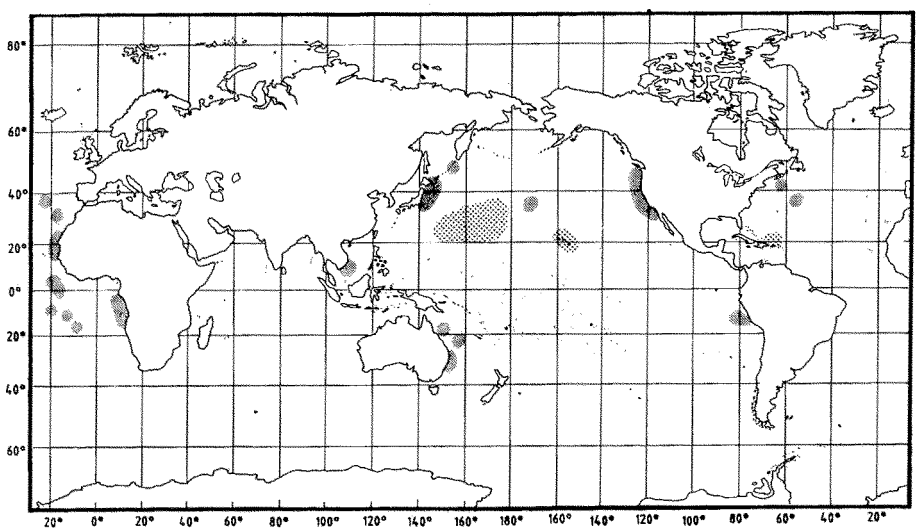


Fig. 117

Habitat and Biology: Benthopelagic from 800 to 1 350 m juveniles mesopelagic from 300 to 500 m (1000 m).

Size: Maximum 100 cm standard length.

Interest to Fisheries: No special fishery for this species.

Local Names: JAPAN: Kurotachi-modoki; USA: Black scabbard fish.

Literature: (as *A. carbo* or *Aphanopus* sp.) Templeman and Squires (1963, in part); Parin and Becker (1972); Fitch and Gotshall (1972); Peden (1974); Clarke and Wagner (1976); Parin and Golovan (1976); Parin et al. (1978); Howe et al. (1980); Mikhailin (1982); Parin and Sazonov (1982); Kukuev (1982, in part); Parin (1983, 1990b,c); Nakamura (1984b); Borets (1986).

Aphanopus microphthalmus Norman, 1939 Fig. 118 **TRICH Apha 3**

Aphanopus microphthalmus Norman, 1939:71, fig. 25 (Gulf of Aden).

Synonyms: None.

FAO Names: En - Smalleye scabbardfish; **Fr** - Poisson sabre petits yeux; **Sp** - Sable ojito.

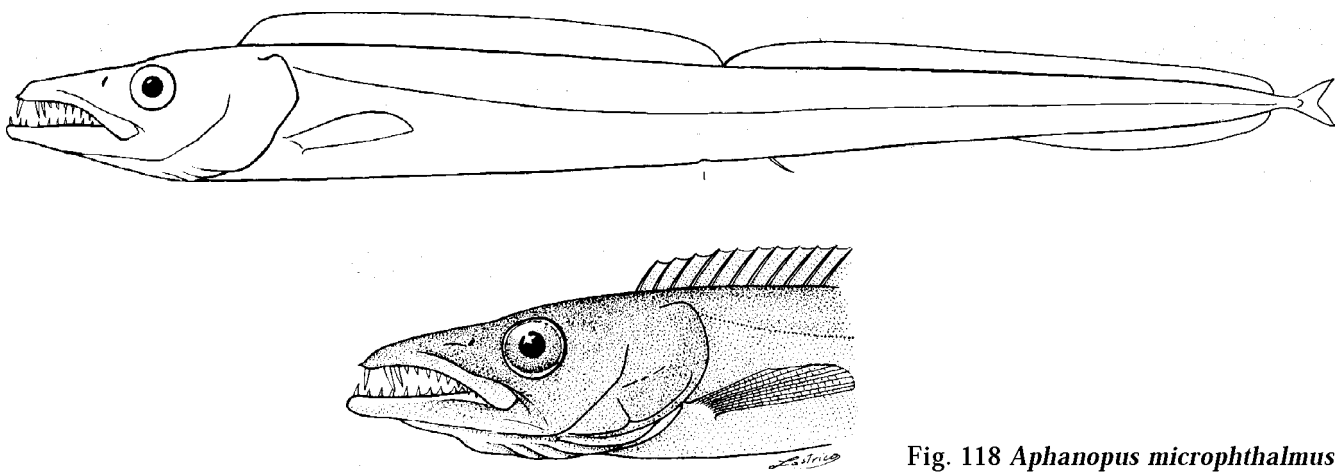


Fig. 118 *Aphanopus microphthalmus*
(adapted from Norman, 1939)

Diagnostic Features: Body depth 9.5 to 12.2 times in standard length; anus situated below penultimate dorsal-fin spine to first dorsal-fin soft ray; distance from snout to anus 1.8 times in standard length. Head length 4.3 to 5.0 times in standard length; snout length 2.2 to 2.5 times in head length; eye-diameter 5.4 to 6.2 times in head length; interorbital width 1 .1 to 1.4 times in eye diameter; maxillary length 2.0 to 2.1 times in head length. Dorsal fin with XLI to XLIII spines and 53 to 55 soft rays (total 94 to 97 fin elements); anal fin with II spines, its origin situated below third to sixth dorsal-fin soft rays, and 43 to 46 soft rays. Vertebrae total 99 to 102, including 44 to 47 precaudal and 54 to 56 caudal.

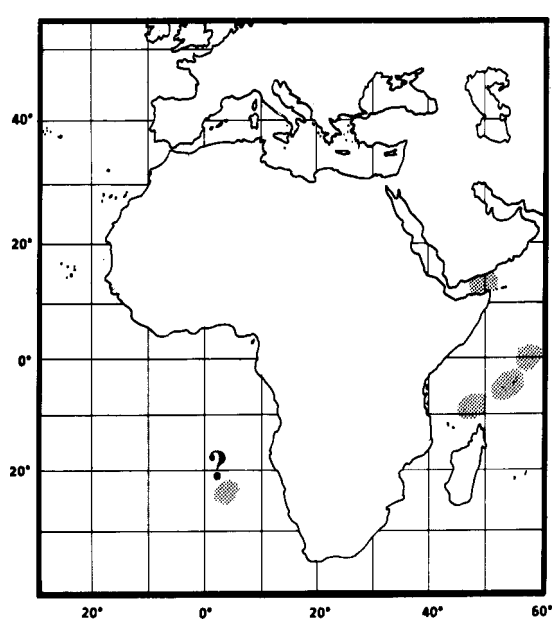


Fig. 119

Geographical Distribution: Western Indian Ocean; one specimen collected at Walvis Ridge in the eastern South Atlantic (Fig. 119).

Habitat and Biology: Benthopelagic from 810 to 1 020 m.

Size: Maximum 94 cm.

Interest to Fisheries: None.

Local Names:

Literature: Forster et al. (1970, as A. carbo); Piotrovsky (1979, as *A. carbo,* in part); Pakhorukov (1981, as *A. carbo,* in part); Parin (1983); Nakamura (1986c); Shcherbachev et al. (1986).

Aphanopus mikhailini Parin, 1983 | Fig. 120 | **TRICH Apha 4**

Aphanopus mikhailini Parin, 1983:356 (Walters Shoals, western South Indian Ocean).

Synonyms: None.

FAO Names: En - Mikhailin's scabbardfish; **Fr** - Poisson sabre jarretière; **Sp** - Sable de Mikhailin.

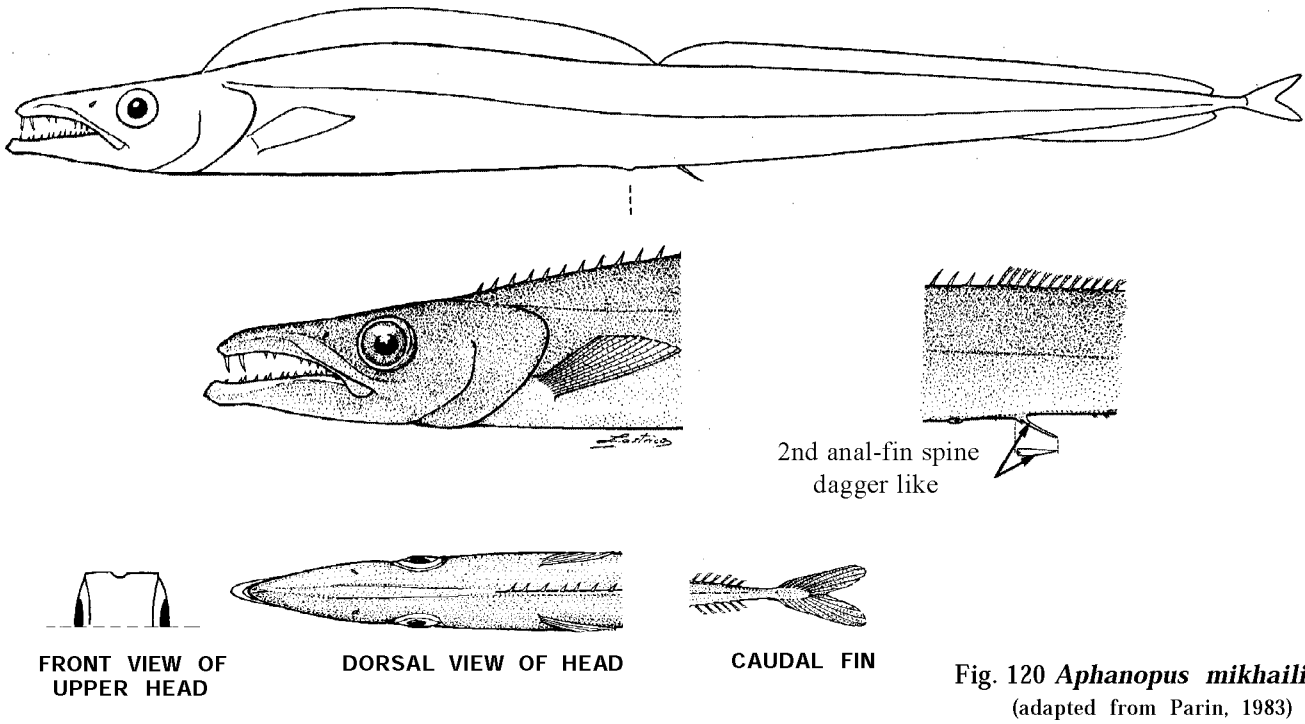


Fig. 120 ***Aphanopus mikhailini*** (adapted from Parin, 1983)

Diagnostic Features: Body depth 11.4 to 15.1 times in standard length; anus situated below penultimate or last dorsal-fin spine; distance from snout to anus 1.8 to 1.9 times in standard length. Head length 5.1 to 6.0 times in standard length; snout length 2.2 to 2.4 times in head length; eye diameter 4.8 to 5.6 times in head length; interorbital width 1.3 to 1.7 times in eye diameter; maxillary length 2.0 to 2.2 times in head length. Dorsal fin with XLIII to XLV spines and 61 to 65 soft rays (total 104 to 109 fin elements); anal fin with II spines, its origin situated below third to fourth dorsal-fin soft ray, and 51 to 54 soft rays. Vertebrae total 111 to 115, including 48 to 51 precaudal and 63 to 65 caudal.

Geographical Distribution: In the South Atlantic Ocean off Argentina, Namibia and at Walvis Ridge, and in the South Indian Ocean on seamounts off Mozambique and the West Australian Ridges (Fig. 121).

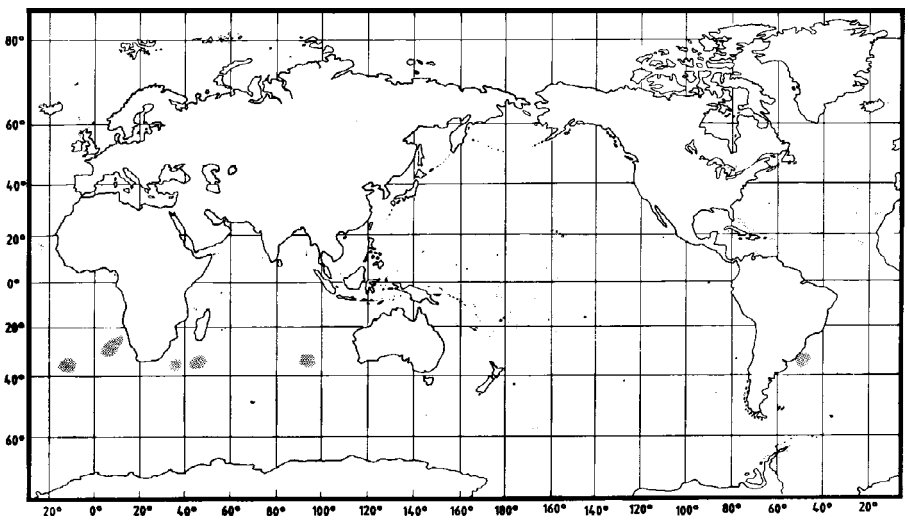


Fig. 121

Habitat and Biology: Benthopelagic from 1 035 to 2000 m.

Size: Maximum 82 cm.

Interest to Fisheries: None.

Local Names:

Literature: Piotrovsky (1979, as *A. carbo,* in part); Mikhailin (1982, as *Aphanopus* sp.); Nakamura (1986c); Parin (1990c).

Assurger Whitley, 1933

TRICH Assur

Assurger Whitley, 1933:84. Type species, ***Evoxymetopon anzac*** Alexander, 1916, by original designation (also monotypic).

Synonyms: None.

Diagnostic Features: See species.

Biology, Habitat and Distribution: Rare benthopelagic fish, probably widely distributed in all warm oceans.

Interest to Fisheries: No special fishery.

Species: A single species.

Assurger anzac (Alexander, 1916)

Fig. 122

TRICH Assur 1

Evoxymetopon anzac Alexander, 1916:104, pl. 7 (Freemantle, Western Australia).

Synonyms: ***Assurger alexanderi*** Whitley, 1933 .

FAO Names: En - Razorback scabbardfish; **Fr** - Poisson sabre rasoir; **Sp** - Sable aserrado.

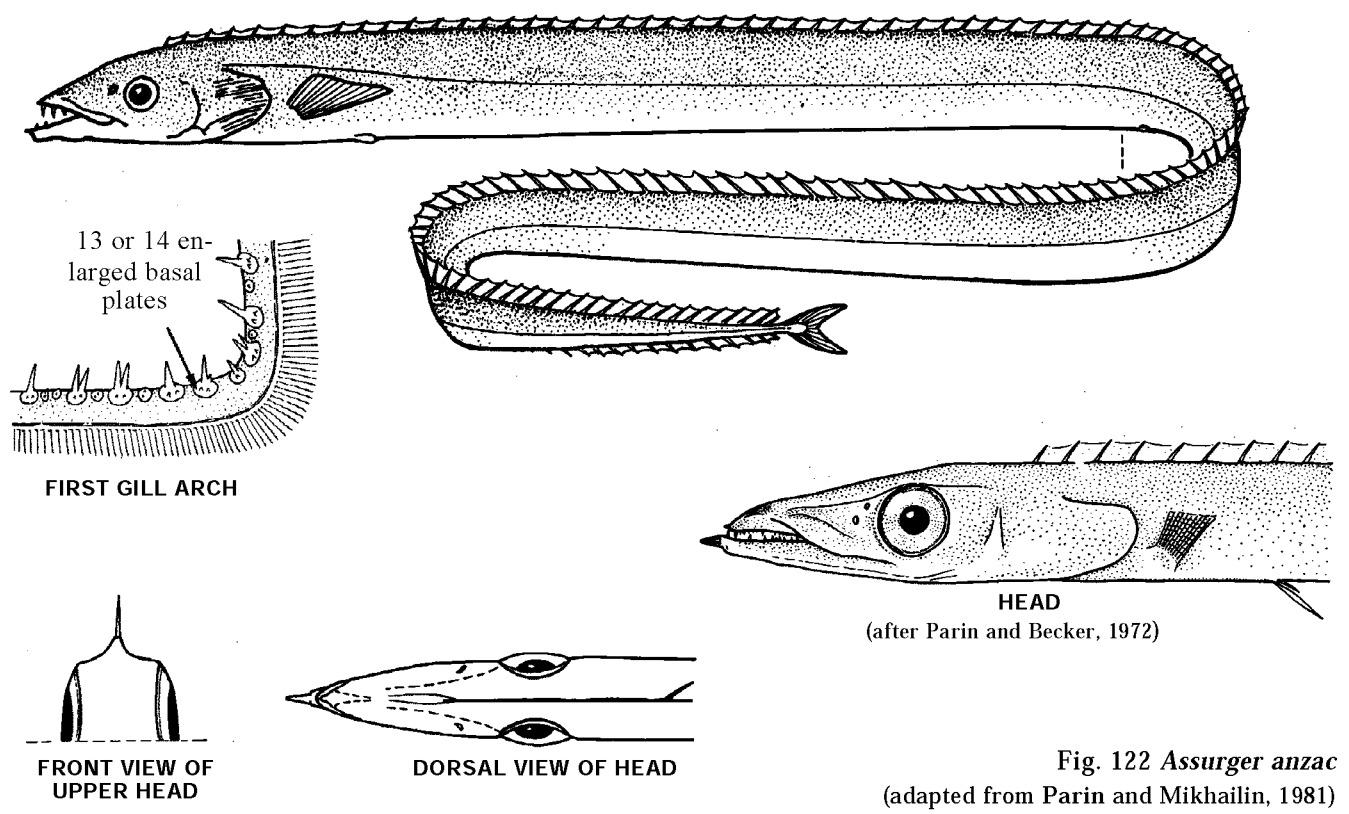


Fig. 122 *Assurger anzac*
(adapted from Parin and Mikhailin, 1981)

Field Characters: Caudal fin present. Sagittal crest developed on interorbital space and nape. Upper head profile gentle. Body depth 25 to 28 times in standard length.

Diagnostic Features: Body very elongate and remarkably compressed; maximum depth 25.1 to 28.0 times in standard length; anus situated below the 40th to 42nd dorsal-fin soft ray. Head length 12.1 to 13.5 times in standard length; snout length 2.5 to 2.6 times in head length; upper head profile straight or scarcely convex, gently rising from tip of snout to dorsal-fin origin; frontal crests confluence at nares level; interorbital space and nape convex, with sagittal crest strongly elevated; lower hind margin of gill cover convex; eye diameter 7.4 to 8.0 times in head length; interorbital width 1.1 to 1.2 times in eye diameter; maxillary length 3.1 to 3.3 times in head length; lower jaw extends anterior to upper jaw; tip of both jaws with a short dermal process; anteriorly in lower jaw, 3 pairs of fangs; a single pair of smaller fangs at tip of lower jaw. Gill rakers spinescent, enlarged basal plates 13 or 14. Dorsal fin with a few weak anterior spines hardly differing from the soft rays, dorsal-fin elements 116 to 123; first anal-fin spine rudimentary, second spine scale-like, anal-fin spines inserted below 42nd to 44th soft dorsal-fin ray, total 74 to 87 anal-fin elements, with only 14 to 17 external soft rays, confined to posterior portion of the fin; pectoral fins with 12 soft rays, triangular, with anterior rays much shorter than posterior rays; pelvic fins of I scale-like spine and 1 tiny soft ray, inserted below eighth or ninth dorsal-fin soft ray and with a distance of 1.5 to 1.6 eye diameters behind the posterior part of pectoral-fin base; small forked caudal fin present. Lateral line fairly straight. Vertebrae total 125 to 129, including 42 to 43 precaudal and 83 to 86 caudal. **Colour:** Body silvery, dorsal-fin membrane black before third to fourth soft ray.

Geographical Distribution: Known from off Puerto Rico and Uruguay (specimens at Institut für Seefischerei, Universität Hamburg (ISH) were collected from 32°44'S, 48°43'W) and at Walvis Ridge in the Atlantic, off western Australia in the Indian Ocean, and in the Pacific off New Guinea, southern. Japan, Midway Island, California, Nazca and Sala y Gomez Ridges (Fig. 123).

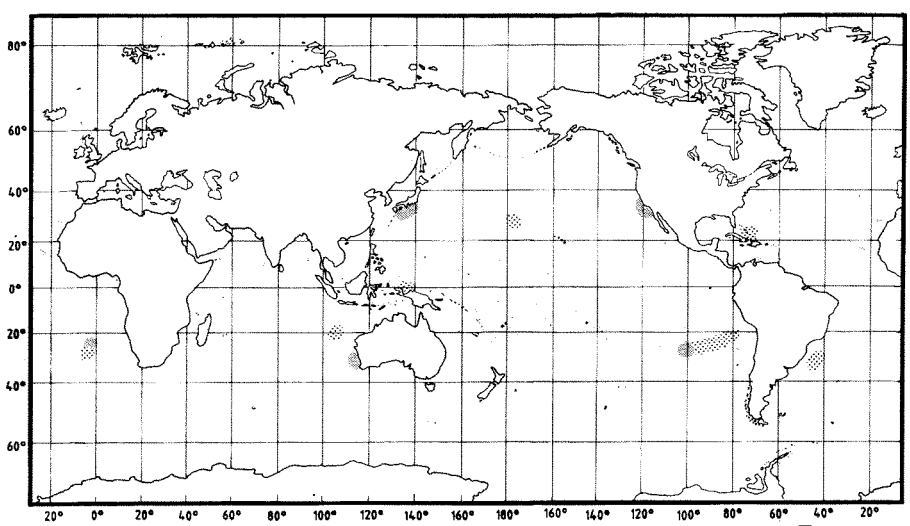


Fig. 123

Habitat and Biology: Probably benthopelagic from 150 to 400 m, juveniles epi- or mesopelagic. Feeds on fishes (including *Englauris mordax* and *Merluccius productus* off California) and squid

Size: Maximum 225 cm standard length.

Interest to Fisheries: No special fishery for this species.

Local Names: JAPAN: Nagayume-tachimodoki.

Literature: Kamohara (1952); Tucker (1956); Backus et al. (1969); Parin and Becker (1972); Fitch and Gotshall (1972); Abe et al. (1974); Parin and Mikhailin (1981); Nakamura (1984b); Parin (1990b).

Benthodesmus Goode and Bean, 1882

TRICH Benth

Benthodesmus Goode and Bean, 1882:380. Type species, ***Lepidopus elongatus*** Clarke, 1879, by original designation (also monotypic).

Synonyms: None.

Diagnostic Features: Body extremely elongate and compressed. Head profile smooth, gently rising from tip of snout to origin of dorsal fin; frontal ridges not elevated, nape flattened without sagittal crest; lower hind margin of gill cover convex; lower jaw extends anterior to upper jaw; tips of both jaws with a short dermal process in larger specimens; jaw dentition includes anterior fangs and slightly compressed lateral teeth; no vomerine teeth; uniserial teeth present on palatines. Gill rakers on first arch spinescent. Dorsal fin long, with XXXI to XLVI spines and 68 to 112 soft rays (total 102 to 155 fin elements), partially divided by a shallow notch, base of spinous part about half as long as base of soft part; anal fin with II spines closely drawn together, the first rudimentary, completely concealed in adults, the second with a delicate cardiform shape, well detached from the rest of the fin, and 64 to 102 soft rays, external rays developed throughout or confined to posterior portion of the fin; pectoral fins with 12 soft rays; pelvic fins diminutive, composed of a scale-like spine and a rudimentary soft ray, inserted before, below or behind base of pectoral fins; small forked caudal fin present. **Colour:** Body silvery, jaws and opercle blackish. Inside of mouth and gill cavities black.

Biology, Habitat and Distribution: Benthopelagic, mostly at upper to middle continental slope (200 to 960 m), juveniles epi- to mesopelagic. Feeds on a variety of fish, squid and crustaceans. Distributed in all temperate and tropical oceans.

Interest to Fisheries: None.

Species: Eleven species, eight of which were recognized in recent revision (Parin and Becker, 1972). In addition, at least two undescribed species are known from juvenile specimens in the eastern tropical Pacific and off Ryukyu Islands. The possibility that ***B. tenuis*** represents a complex of different species is currently being studied by N. Parin.

Illustrated Key to Species of *Benthodesmus:*

1a. Pelvic fins inserted before or below pectoral-fin base (Fig. 124) ..... → *2*

1b. Pelvic fins inserted behind pectoral-fin base (Fig. 124) ..... → *8*

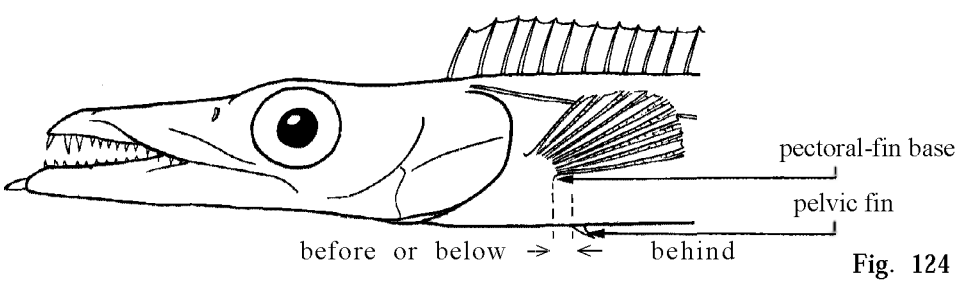


Fig. 124 Pelvic-fin position

2a. Dorsal-fin spines XXXI to XXXIV, total dorsal-fin elements 102 to 105; vertebrae total 105 to 109 ..... ***B. oligoradiatus***

2b. Dorsal-fin spines XXXIV to XLIV, total dorsal-fin elements 113 to 150; vertebrae total 119 to I55 (Fig.125) ..... → *3*

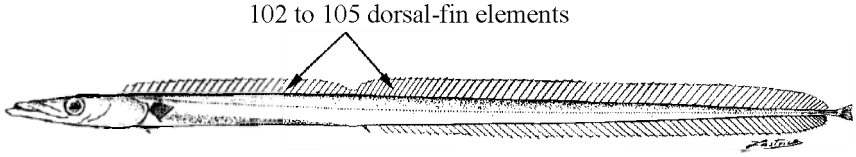


Fig. 125 *B. oligoradiatus*

3a. Total dorsal-fin elements 150; anal fin with 102 soft rays; vertebrae total 155 (Fig. 126) ..... ***B. papua***

3b. Total dorsal-fin elements 113 to 137; anal fin with 69 to 92 soft rays; vertebrae total 119 to142 ..... → ***4***

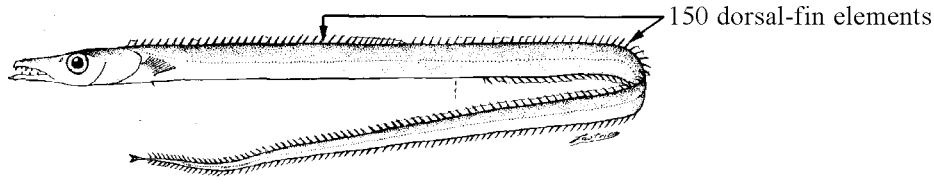


Fig. 126 ***B. papua***

4a. Total dorsal-fin elements 113 to 129; vertebrae total 119 to 132 .....→ ***5***

4b. Total dorsal-fin elements 129 to 137; vertebrae total 133 to 142 ..... → ***7***

5a. Dorsal-fin spines XXXVIII to XLII (Fig. 127) .....***B. tenuis***

5b. Dorsal-fin spines XXXIV to XXXVII .....→ ***6***

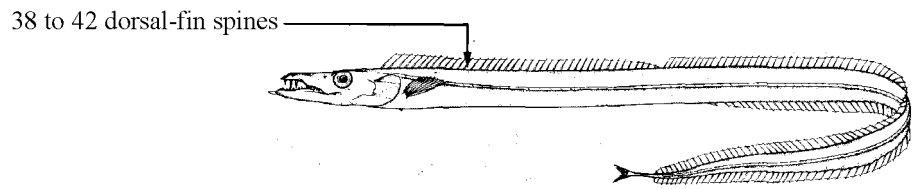


Fig. 127 ***B. tenuis***

6a. Anal fin with 70 to 76 soft rays; vertebrae total 119 to 124 (Fig. 128) .....***B. macrophthalmus***

6b. Anal fin with 80 to 84 soft rays; vertebrae total 126 to 129 (Fig. 129) ..... ***B. neglectus***

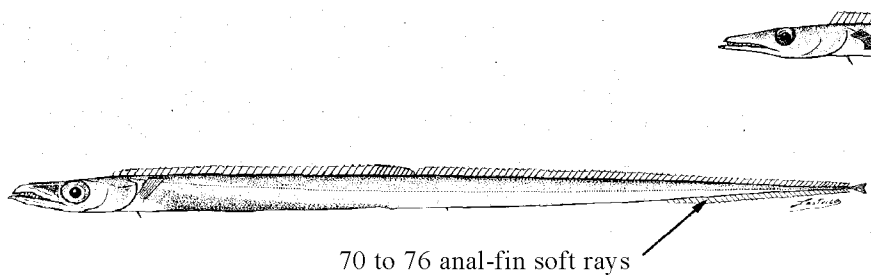


Fig. 128 ***B. macrophthalmus***

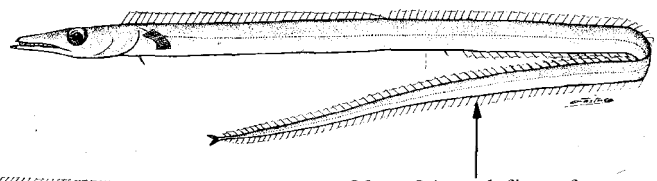


Fig. 129 ***B. neglectus***

7a. Dorsal-fin spines XXXIX-XLIV, anal fin with 73 to 83 soft rays; anal-fin spines situated below the 8th to 11 th dorsal-fin soft ray (Fig. 130) .....***B. tuckeri***

7b. Dorsal-fin spines XXXVI-XXXIX, anal fin with 86 to 92 soft rays; anal-fin spines situated below the second to sixth dorsal-fin soft ray (Fig. 131) ..... ***B. Suluensis***

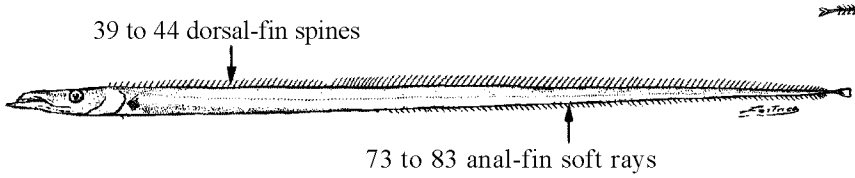


Fig. 130 ***B. tuckeri***

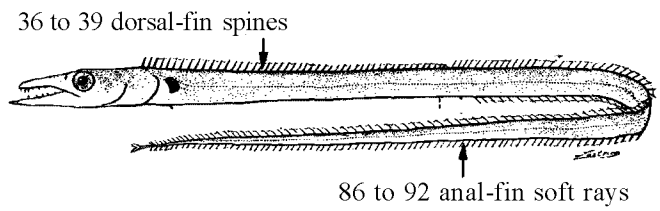


Fig. 131 ***B. suluensis***

8a. Total dorsal-fin elements 131 to 136; anal fin with 80 to 85 soft rays; vertebrae total 137 to 142 (Fig. 132) ..... ***B. vityazi***

8b. Total dorsal-fin elements 140 to 155; anal fin with 89 to 101 soft rays; vertebrae total 149 to159 ..... → ***9***

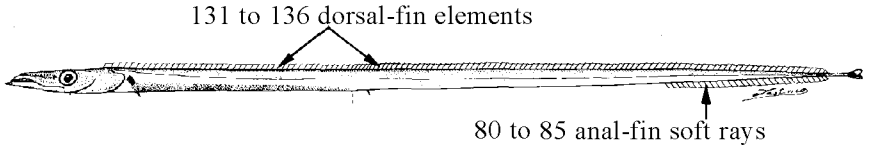


Fig. 132 ***B. vityazi***

9a. Head length in juveniles and adults (standard length >20 cm) 8.5 to 9.5 times in standard length: body depth in adults (standard length >60 cm) 30 to 46 times in standard length (Fig.133) ..... ***B. elongatus***

9b. Head length in juveniles and adults (standard length >20 cm) 7.0 to 8.0 times in standard length; body depth in adults (standard length >60 cm) 22 to 27 times in standard length ..... → ***10***

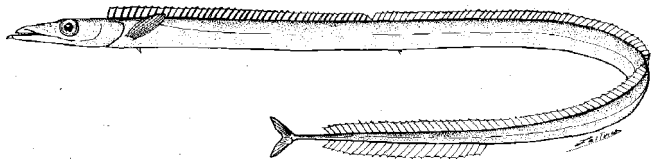


Fig. 133 ***B. elongatus***

10a. Total dorsal-fin elements 142 to 148; vertebrae total 149 to 153 (Fig. 134) ..... ***B. pacificus***

10b Total dorsal-fin elements 148 to 155; vertebrae total 153 to 158 (Fig. 135) ..... ***B. simonyi***

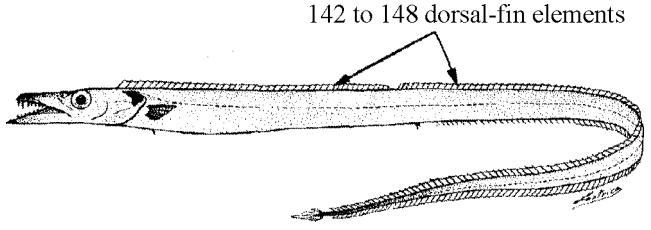


Fig. 134 ***B. pacifcus***

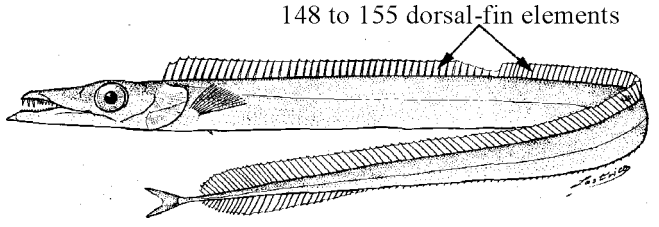


Fig. 135 ***B. simonyi***

Benthodesmus elongatus (Clarke, 1879) Fig. 136 **TRICH Benth 2**

Lepidopus elongatus Clarke, 1879:294, pl. 14 (New Zealand, Hokitika, South Island).

Synonyms: None.

FAO Names: En - Elongate frostfish; **Fr** - Poisson sabre long; **Sp** - Cintilla elongada.

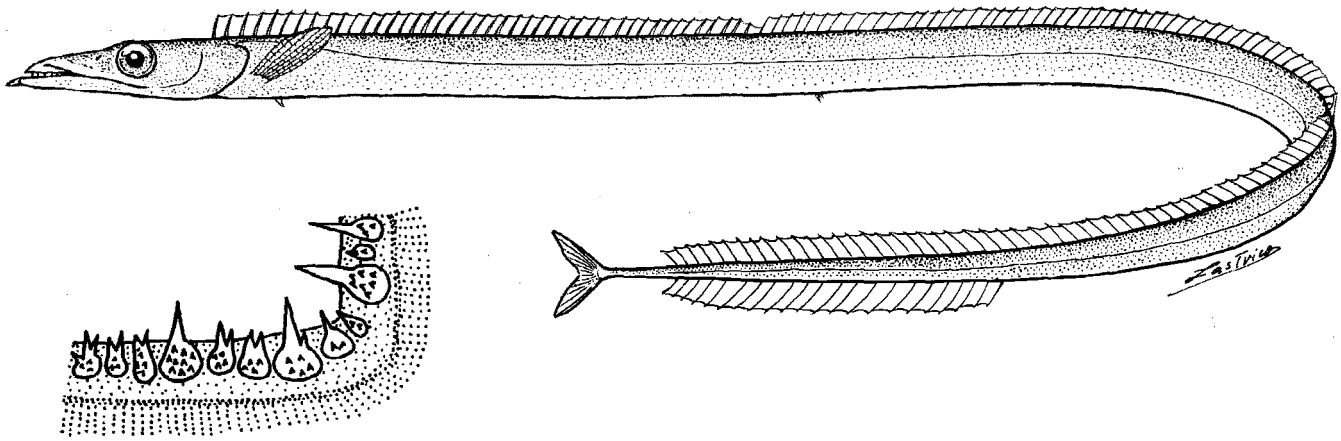


Fig. 136 *Benthodesmus elongatus*
(adapted from Tucker, 1953)

Diagnostic Features: Body depth 30.6 to 46.3 times in standard length; anus under first to fourth soft dorsal-fin soft ray; distance from snout to anus 2.6 to 2.8 times in standard length. Head length 8.6 to 9.3 times in standard length; snout length 2.2 to 2.5 times in head length; eye diameter 4.7 to 6.2 times in head length; interorbital width 2.8 to 3.9 times in eye diameter; maxillary length 2.6 to 3.1 times in head length. Dorsal fin with XLII to XLVI spines and 99 to 108 soft rays (total 143 to 152 fin elements); anal fin with II spines, its origin situated below fourth to eighth soft dorsal-fin ray, and 91 to 98 soft rays, external soft rays developed only in the last third of its base; pelvic fins inserted behind pectoral-fin base. Vertebrae total 151 to 159.

Geographical Distribution: Subtropical and temperate waters of Southern Hemisphere: off south Brazil and Argentina, Rio Grande Rise, southeastern Africa, Madagascar Ridge, southeastern Australia, New Zealand, Sala y Gomez Ridge (Fig. 137).

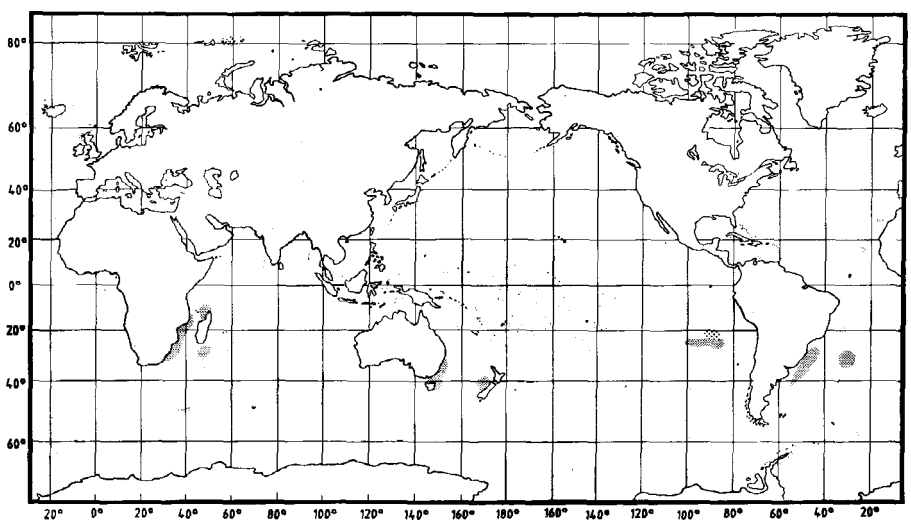


Fig. 137

Habitat and Biology: Benthopelagic from 260 to 575 m at Sala y Gomez Ridge, 380 to 950 m elsewhere, juveniles mesopelagic. Feeds on crustaceans (mainly prawns and euphausiids), small fishes (e.g. *Maurolicus*) and squid (Parin et al., 1990b). Attains a length of 88 cm at age of 9 years (Kotlyar and Parin, 1990).

Females mature at 57 cm and males at 71 cm, 5 to 6 years old. Batch spawners with 5 000 to 16 000 eggs per spawn (Andrianov et al., 1990).

Size: Maximum 93 cm standard length.

Interest to Fisheries: No data available.

Local Names: AUSTRALIA: Slender frostfish; NEW ZEALAND: Bigeyed scabbardfish; SOUTH AFRICA: Slank kalkvis, Slender frostfish.

Literature: Tucker (1953); Parin et al. (1981); May and Maxwell (1986); Nakamura (1984b, 1986a); Paulin et al. (1989); Parin (1990b).

Benthodesmus macrophthalmus Parin and Becker, 1970 | Fig. 138 | **TRICH Benth 3**

Benthodesmus macrophthalmus Parin and Becker, 1970:356, fig. 2 (Arafura Sea).

Synonyms: None.

FAO Names: En - Bigeye frostfish; **Fr** - Poisson sabre gros yeux; **Sp** - Cintilla ojogrande.

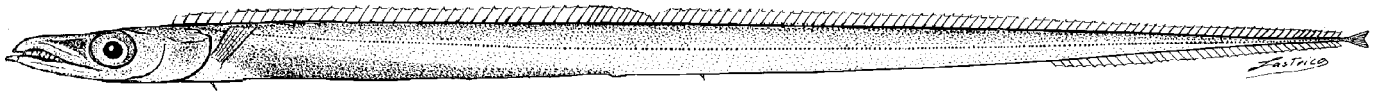


Fig. 138 *Benthodesmus macrophthalmus*
(adapted from Parin and Becker, 1970 and 1972)

Diagnostic Features: Body depth 20.8 to 30.2 times in standard length; anus situated below third to fifth dorsal-fin soft ray; distance from snout to anus 2.2 to 2.3 times in standard length. Head length 7.0 to 7.8 times in standard length; snout length 2.2 to 2.6 times in head length; eye diameter 4.4 to 5.0 times in head length; interorbital width 2.5 to 3.5 times in eye diameter: maxillary length 2.3 to 2.8 times in head length. Dorsal fin with XXXIV to XXXVII spines and 78 to 85 soft rays, (total 113 to 120 fin elements); anal fin with II spines, inserted below fifth to eighth dorsal-fin soft ray, and 70 to 76 fin elements, external soft rays developed only in posterior half of its base; pelvic fins inserted below pectoral-fin base. Vertebrae total 119 to 124.

Geographical Distribution: Arafura Sea and Indian Ocean off Java (Fig. 139).

Habitat and Biology: Benthopelagic from 320 to 600 m.

Size: Maximum 50 cm standard length.

Interest to Fisheries: No data available.

Local Names:

Literature: Parin and Becker (1972).

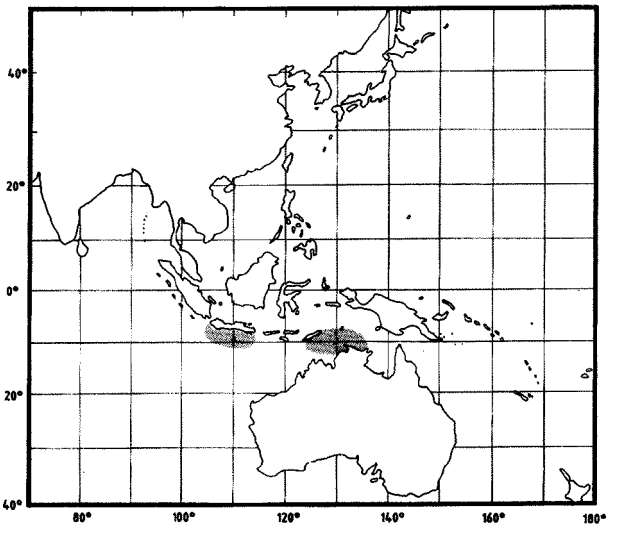


Fig. 139

Benthodesmus neglectus Parin, 1976 | Fig. 140 | **TRICH Benth 4**

Benthodesmus neglectus Parin, 1976a:192 (Halmahera Sea).

Synonyms: None.

FAO Names: En - Neglected frostfish; **Fr** - Poisson sabre négligé; **Sp** - Cintilla descuido.

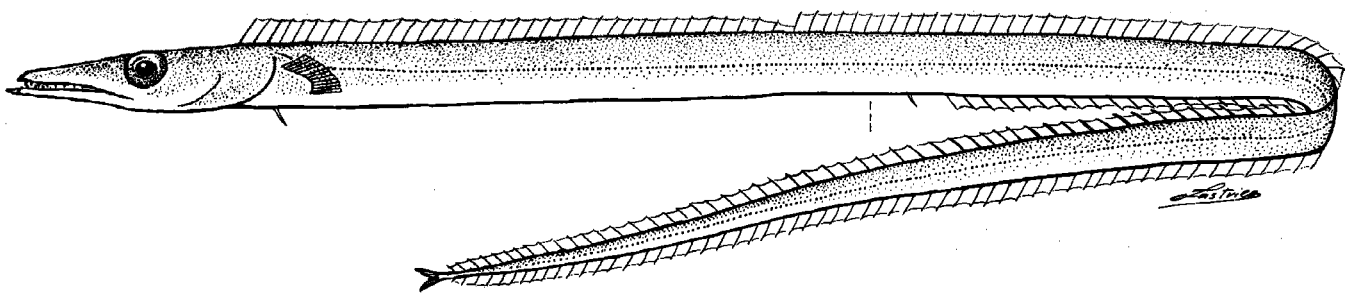


Fig. 140 *Benthodesmus neglectus*

Diagnostic Features: Body depth 37.0 times in standard length; anus situated below third to seventh soft dorsal-fin soft ray; distance from snout to anus 2.6 times in standard length. Head length 8.0 times in standard length; snout length 2.2 times in head length; eye diameter 5.9 times in head length; interorbital width 4.3 times in eye diameter; lower jaw (mandible) length 3.1 times in head length (proportions of holotype 227 mm standard length). Dorsal fin with XXXIV to XXXV spines and 85 to 90 soft rays, (total 118 to 126 fin elements); anal fin with II spines, situated below fifth to ninth soft dorsal-fin ray, and 80 to 84 soft rays, external soft rays developed throughout its base; pelvic fins inserted below pectoral-fin base. Vertebrae total 126 to 129.

Geographical Distribution: Halmahera and Flores Sea, Pacific Ocean, north of New Guinea (Fig. 141). 401)

Habitat and Biology: Probably benthopelagic, juveniles mesopelgic from 200 to 800 (1 000) m.

Size: Maximum 23 cm standard length (known from 5 juvenile specimens).

Interest to Fisheries: No data available.

Local Names:

Literature: Parin et al. (1977); Parin (1978).

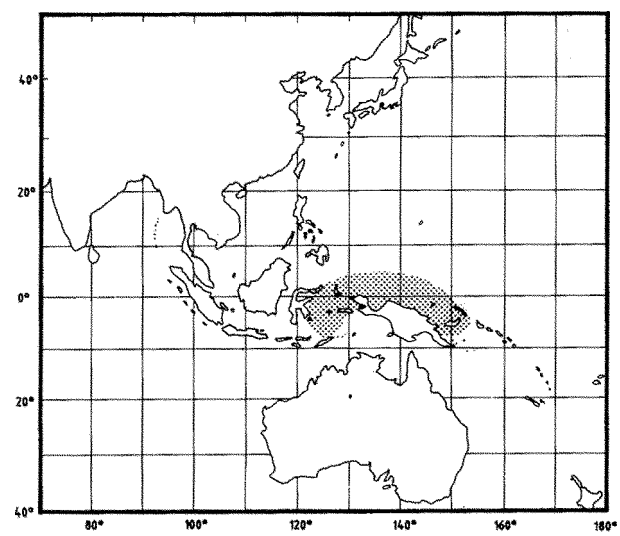


Fig. 141

Benthodesmus oligoradiatus Parin and Becker, 1970 | Fig. 142 | **TRICH Benth 5**

Benthodesmus oligoradiatus Parin and Becker, 1970:355, fig. 2 (Arabian Sea).

Synonyms: None.

FAO Names: En - Sparse-rayed frostfish; **Fr** - Poisson sabre chauve; **Sp** - Cintilla rastrillo.

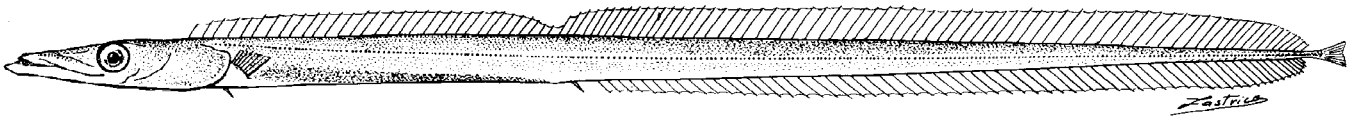


Fig. 142 ***Benthodesmus oligoradiatus***
(adapted from Parin and Becker, 1970 and 1972)

Diagnostic Features: Body depth 16.7 to 25.6 times in standard length; anus situated below penultimate dorsal-fin spine to first soft ray; distance from snout to anus 2.2 to 2.4 times in standard length. Head length 5.8 to 6.6 times in standard length; eye diameter 4.9 to 5.6 times in head length; interorbital width 2.7 to 3.7 times in eye diameter; maxillary length 2.9 to 3.1 times in head length. Dorsal fin with XXXI to XXXIV spines and 68 to 74 soft rays (total 102 to 105 fin elements); anal fin with II spines, situated below first to third dorsal-fin soft ray, and 64 to 67 soft rays, external soft rays developed only in posterior half of its base; pelvic fins inserted before or below pectoral-fin base. Vertebrae total 105 to 109.

Geographical Distribution: Arabian Sea and Bay of Bengal (Fig. 143).

Habitat and Biology: Benthopelagic on seamounts and the continental slope from 375 to 600 m, juveniles mesopelagic from 100 to 300 (1 000) m.

Size: Maximum 51 cm standard length.

Interest to Fisheries: No data available.

Local Names:

Literature: Brauer (1906, as *Lepidopus argenteus*); Parin and Becker (1972); Shcherbachev et al. (1986); Shcherbachev (1987).

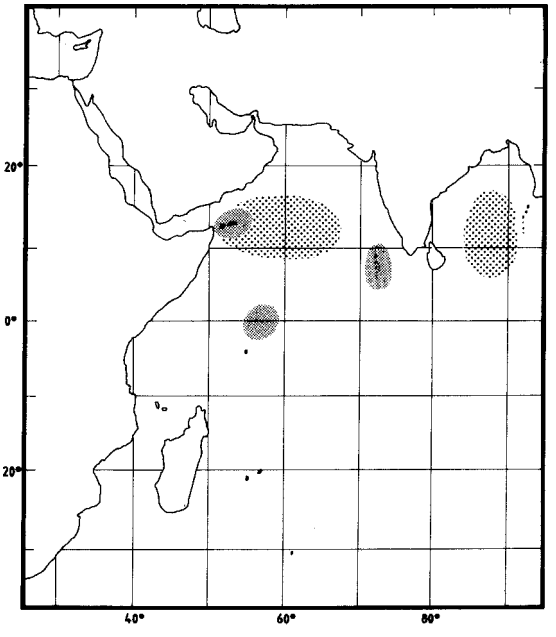


Fig. 143

Benthodesmus pacificus Parin and Becker, 1970 | Fig. 144 | **TRICH Benth 6**

Benthodesmus elongatus pacificus Parin and Becker, 1970:355, fig. 2 (off northern Honshu, Japan).

Synonyms: None.

FAO Names: En - North-Pacific frostfish; **Fr** - Poisson sabre nord-pacifique; **Sp** - Cintilla del Pacifico.

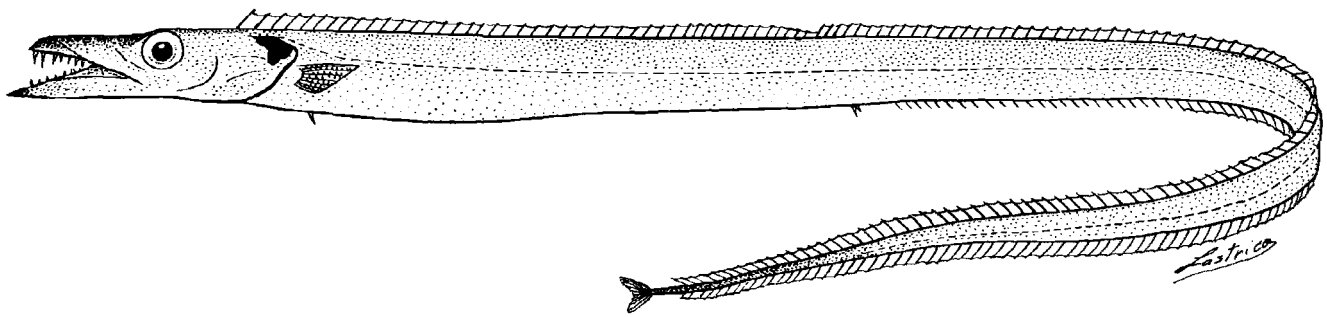


Fig. 144 ***Benthodesmus pacificus***

Diagnostic Features: Body depth 22.0 to 26.5 times in standard length; anus situated below penultimate dorsal-fin spine to second dorsal-fin soft ray; distance from snout to anus 2.5 times in standard length. Head length 7.2 to 7.5 times in standard length; snout length 2.1 to 2.5 times in head length; eye diameter 5.1 to 6.5 times in head length; interorbital width 2.8 to 3.1 times in eye diameter; maxillary length 2.6 to 2.9 times in head length. Dorsal fin with XLIV to XLVI spines and 99 to 104 soft rays (total 142 to 148 fin elements); anal fin with II spines, situated below third to sixth dprsal-fin soft ray, and 90 to 94 soft rays, external soft rays developed only in the last third of its base; pelvic fins inserted behind pectoral-fin base. Vertebrae total 149 to 153.

Geographical Distribution: North Pacific Ocean (known from off Japan, Ryukyu Islands, Kyushu-Palau Ridge, British Columbia, and California) (Fig. 145).

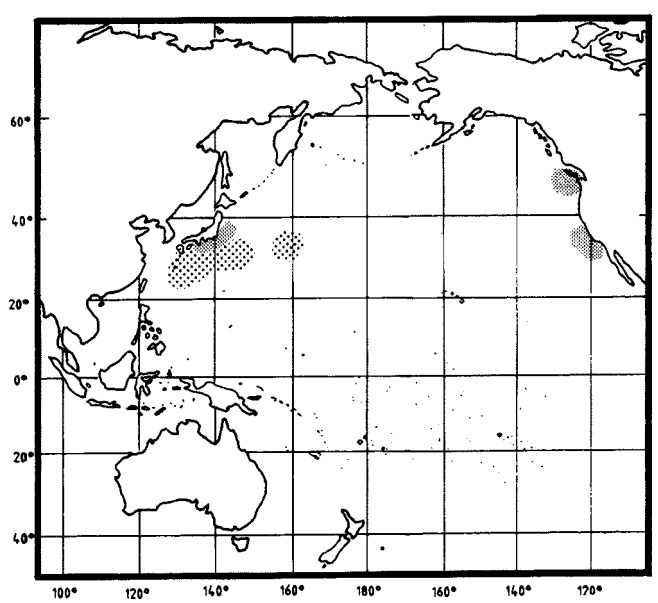


Fig. 145

Habitat and Biology: Benthopelagic from 305 m (depth of specimens hooked off Manazuru, Japan) and deeper, sometimes migrates to surface, juveniles mesopelagic from 100 to 500 (1 000) m.

Size: Maximum 112 cm standard length.

Interest to Fisheries: No data available.

Local Names: CANADA: North Pacific frostfish; JAPAN: Yamamoto-tachimodoki, Hoso-tachimodoki; USA: North Pacific frostfish.

Literature: Franz (1910, as ***Lepidopus tenuis***); Gilbert (1817, as ***B. atlanticus);*** Parin and Becker (1972); Abe and Kobata (1974); Anderson and Cailliet (1975); Parin et al. (1977); Peden (1974, 1980); Belyanina (1982); Nakamura (1982b, 1984b).

Benthodesmus papua Parin,1978 | Fig. 146 | **TRICH Benth 7**

Benthodesmus papua Parin, 1978:164 (Coral Sea).

Synonyms: None.

FAO Names: En - Papuan frostfish; **Fr** - Poisson sabre papou; **Sp** - Cintilla Papua.

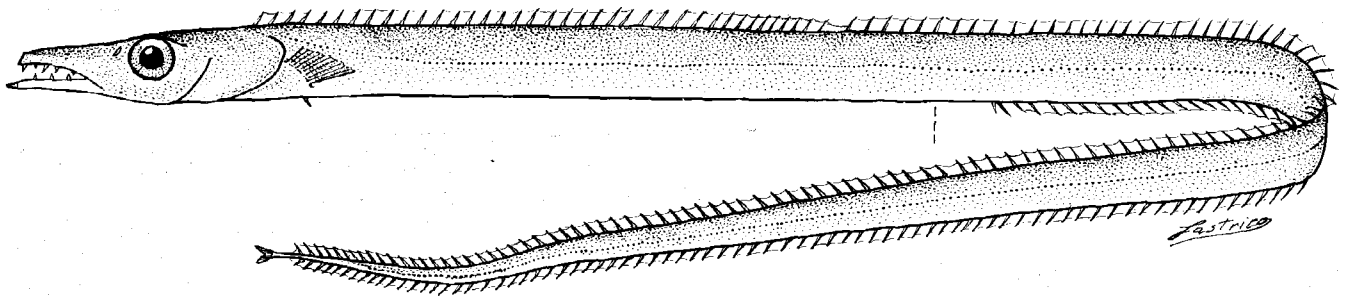


Fig. 146 ***Benthodesmus papua***

Diagnostic Features: Body depth 33.3 times in standard length; anus situated below sixth dorsal-fin soft ray; distance from snout to anus 2.7 times in standard length. Head length 8.8 times in.standard length; snout length 2.5 times in head length; eye diameter 5.9 times in head length; interorbital width 3.5 times in eye diameter; maxillary length 2.9 times in head length (proportions of holotype 243 mm standard length). Dorsal fin with XXXVIII spines and 112 soft rays (total 150 fin elements); anal fin with II spines, situated below ninth soft dorsal-fin ray, and 102 soft rays, external soft rays developed throughout its base; pelvic fins inserted below posterior edge of pectoral-fin base. Vertebrae total 155.

Geographical Distribution: Coral Sea, southeast of Gulf of Papua (Fig. 147).

Habitat and Biology: Probably benthopelagic, juveniles mesopelagic at 200 m.

Size: Maximum 24 cm standard length (species known from a single pelagic juvenile).

Interest to Fisheries: No data available.

Local Names:

Literature: None.

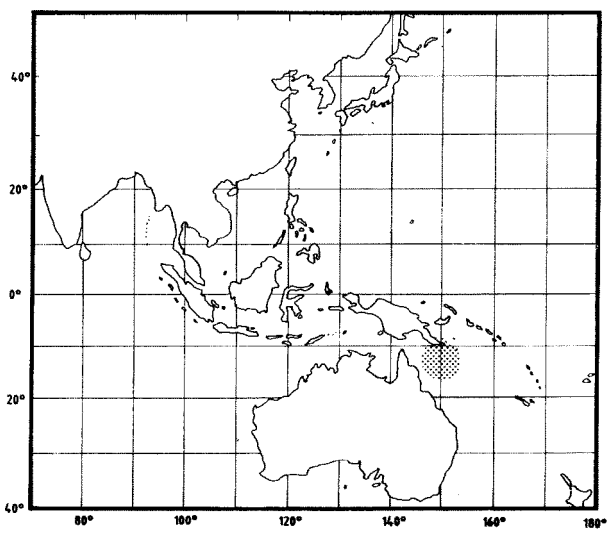


Fig. 147

Benthodesmus simonyi (Steindachner, 1891) Fig. 148 **TRICH Benth 8**

Aphanopus simonyi Steindachner, 1891:356 (Santa Cruz de Tenerife, Canary Islands).

Synonyms: ***Benthodesmus atlanticus*** Goode and Bean, 1896.

FAO Names: En - Simony's frostfish; **Fr** - Poisson sabre ganse; **Sp** - Cintilla de Simony.

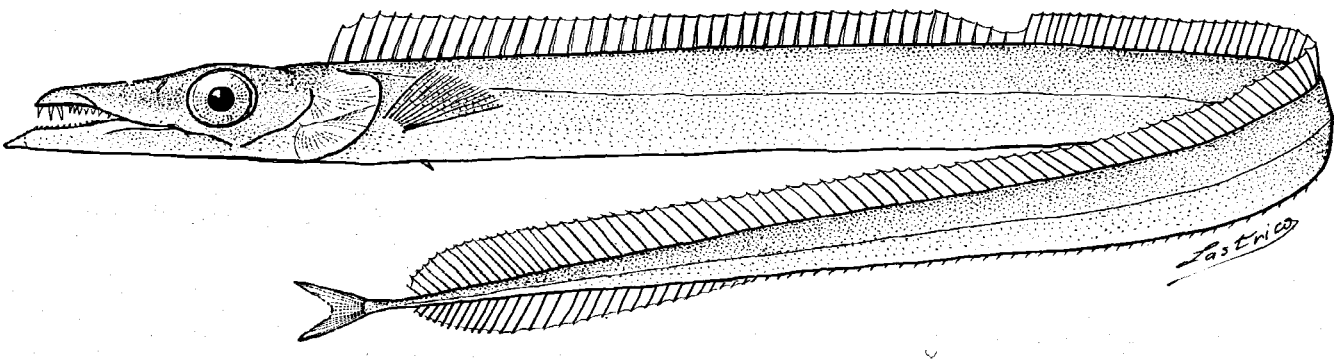


Fig. 148 ***Benthodesmus simonyi***
(adapted from Tucker, 1956)

Diagnostic Features: Body depth 22.0 to 27.1 times in standard length; anus situated below last dorsal-fin spine to second dorsal-fin soft ray; distance from snout to anus 2.4 to 2.5 times in standard length. Head length 7.0 to 8.0 times in standard length; snout length 2.2 to 2.6 times in head length; eye diameter 5.1 to 5.8 times in head length; interorbital width 2.6 to 3.0 times in eye diameter; maxillary length 2.5 to 2.6 times in head length. Dorsal fin with XLIV to XLVI spines and 104 to 109 soft rays (total 148 to 155 fin elements); anal fin with II spines, situated below fifth to seventh soft dorsal-fin ray, and 93 to 102 soft rays; external soft rays developed only in the last third of its base; pelvic fins inserted behind pectoral-fin base. Vertebrae total 153 to 158.

Geographical Distribution: North Atlantic Ocean (known from off Newfoundland, Bermuda, New England and Middle Atlantic Ridges, Iceland, Norway, Portugal, Madeira and Canary Islands) (Fig. 149).

Habitat and Biology: Benthopelagic from 200 to 900 m on continental slope and underwater rises, juveniles mesopelgic.

Size: Maximum 130 cm standard length.

Interest to Fisheries: No data available

Local Names: FRANCE: Sabre d'argent; RUSSIA: Benthodema; UK: Frostfish.

Literature: Maul (1953); Tucker (1953, 1955, 1956); Grey (1955); Leim and Scott (1966); Wheeler (1969); Parin and Becker (1972); Gushchin and Kukuev (1981); Kukuev (1982); Parin (1986).

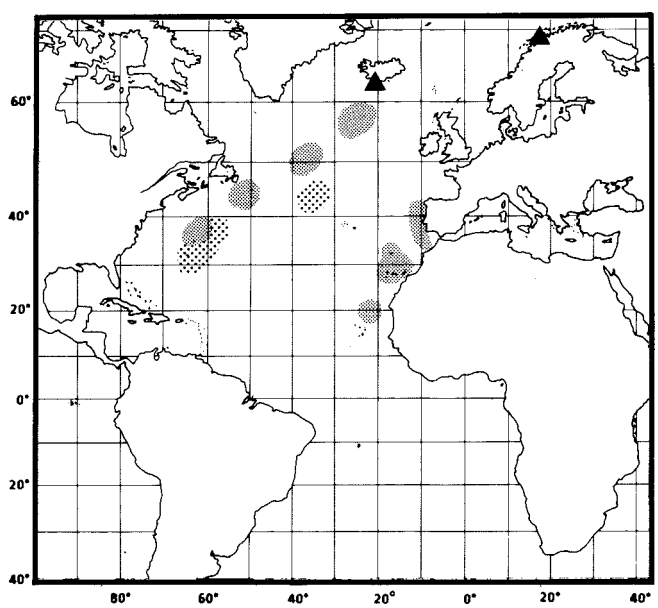


Fig. 149

Benthodesmus suluensis Parin, 1976 | Fig. 150 | **TRICH Benth 9**

Benthodesmus suluensis Parin, 1976a:191 (Sulu Sea).

Synonyms: None.

FAO Names: En - Philippine frostfish; **Fr** - Poisson sabre philippin; **Sp** - Cintilla filipina.

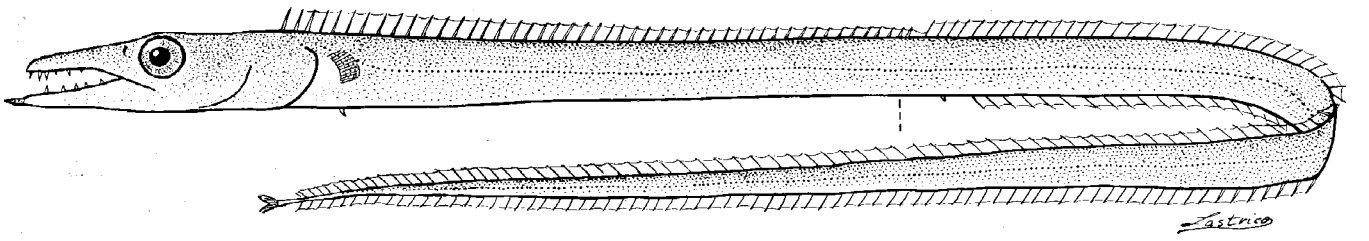


Fig. 150 ***Benthodesmus suluensis***

Diagnostic Features: Body depth 32.2 times in standard length; anus situated below last dorsal-fin spine to behind third dorsal-fin soft ray; distance from snout to anus 2.7 times in standard length. Head length 7.9 times in standard length; snout length 2.6 times in head length; eye diameter 6.4 times in head length; interorbital width 2.9 times in eye diameter; maxillary length 3.4 times in head length (proportions of holotype 181 mm standard length). Dorsal fin with XXXVI to XXXIX spines and 92 to 99 soft rays (total 129 to 137 fin elements); anal fin with II spines, situated below second to sixth soft dorsal-fin ray, and 86 to 92 soft rays, external soft rays developed only in posterior half of its base; pelvic fins inserted below posterior part of pectoral-fin base. Vertebrae total 133 to 137.

Geographical Distribution: Sulu Sea (Fig. 151).

Habitat and Biology: Probably benthopelagic, juve niles mesopelagic from 200 to 500 m.

Size: Maximum 18 cm standard length (species known from 9 juvenile specimens).

Interest to Fisheries: No data available.

Local Names:

Literature: Parin (1976b); Parin et al. (1977).

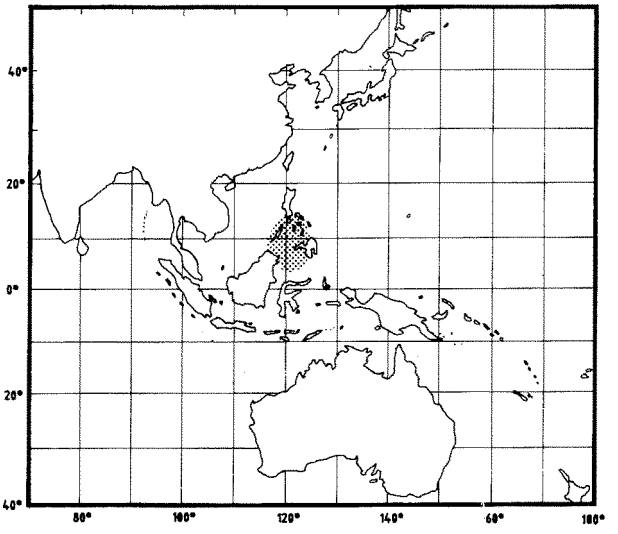


Fig. 151

Benthodesmus tenuis (Günther, 1877) Fig. 152 **TRICH Benth 1**

Lepidopus tenuis Günther, 1877:437 (Sagami Bay, Japan).

Synonyms: ***Lepidopus aomori*** (Jordan and Snyder, 1901). ***Benthodesmus benjamini*** Fowler, 1938.

FAO Names: En - Slender frostfish; **Fr** - Sabre fleuret; **Sp** - Cintilla.

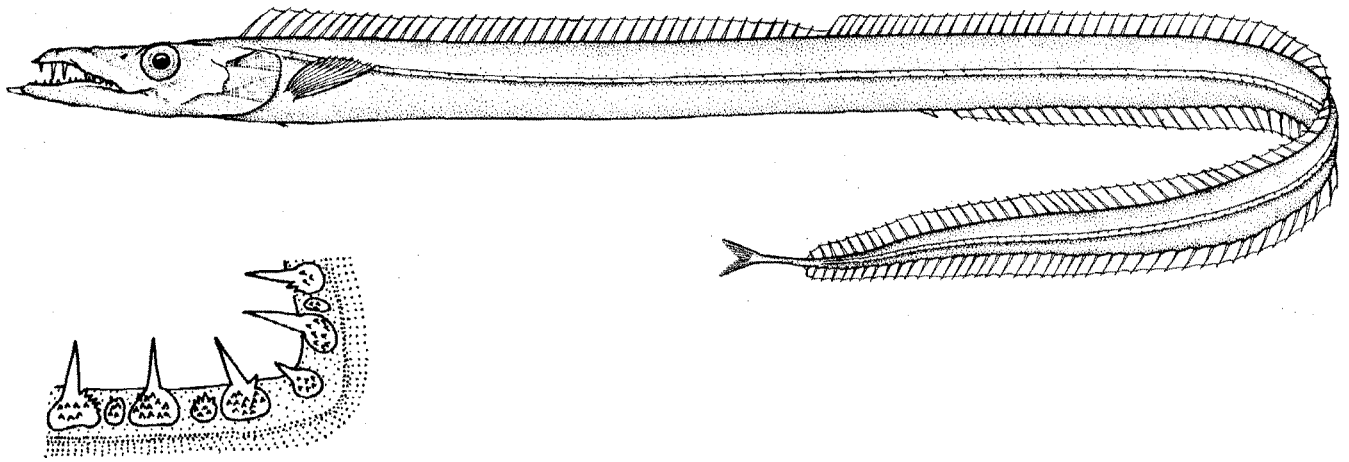


Fig. 152 ***Benthodesmus tenuis***
(adapted from Tucker, 1956)

Diagnostic Features: Body depth 18.3 to 35.2 times in standar length; anus situated below fourth to seventh dorsal-fin soft ray; distance from snout to anus 2.2 to 2.4 times in standard length. Head length 7.1 to 8.7 times in standard length; snout length 2.3 to 2.8 times in head length; eye diameter 5.9 to 7.5 times in head lenth; interorbital width 1.3 to 2.0 times in eye diameter; maxillary length 2.3 to 2.8 times in head length. Dorsal fin with XXXVIII to XLII spinesand 78 to 87 soft rays (total 118 to 128 fin elements); anal fin with II spines, situated below 6th to 11th soft dorsal-fin ray, and 69 to 76 soft rays, external soft rays developed throughout its base; pelvic fins inserted before or below pectoral-fin base. Vertebrae total 122 to 132.

Geographical Distribution: In the western Atlantic off Cape Hatteras, Gulf of Mexico, Surinam and southern Brazil; in the eastern Atlantic from Gulf of Guinea to Angola; in the western Pacific from the Emperor Seamounts, Japan, Ryukyu Islands, Vietnam, and the Sulu Sea; and in the Indian Ocean from south of Java (Fig. 153).

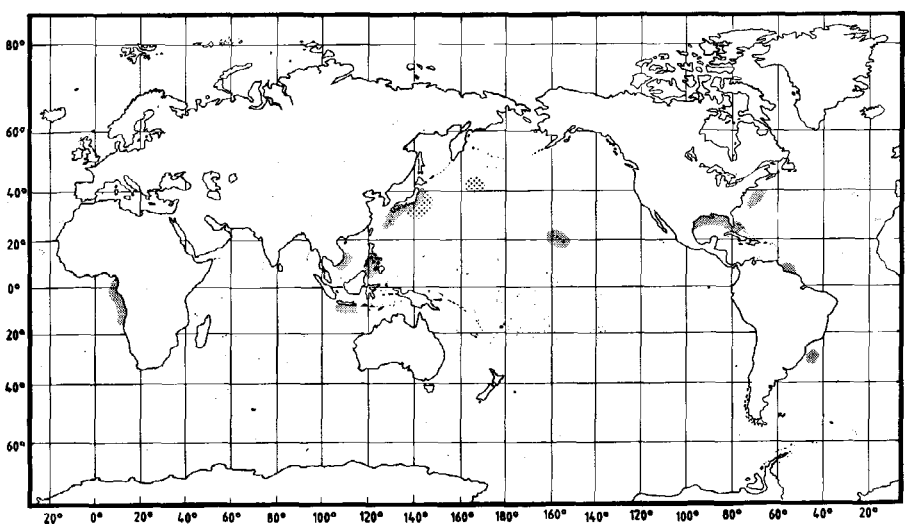


Fig. 153

Habitat and Biology: Benthopelagic from 200 to 850 m, juveniles mesopelagic.

Size: Maximum 72 cm standard length, maybe more.

Interest to Fisheries: No data available.

Local Names: JAPAN: Tachimodoki.

Literature: Tucker (1953, 1955, 1957); Parin and Becker (1972); Parin et al. (1977); Fujii in Uyeno et al. (1983); Nakamura (1984b); Machida (1985); Parin (1990c).

Remarks: Tucker (1955) showed that the two Atlantic populations of ***B. tenuis*** differ significantly in number of vertebrae and total dorsal-fin spinous and soft ray elements: in Gulf of Guinea specimens, the number of vertebrae total 123 to 128 and dorsal-fin elements total 125 to 129, and in the Gulf of Mexico specimens, vertebrae total 129 to 131 and dorsal-fin elements total 125 to 129. The Indo-West Pacific populations overlap in these characters with both Atlantic populations with number of vertebrae total 122 to 132 and dorsal-fin elements 118 to 128. The eastern tropical Pacific ***"B. tenuis"*** appears to be a separate species (Clemens and Nowell, 1963). Differences among populations of ***B. tenuis*** are currently being studied by N. Parin.

Benthodesmus tuckeri Parin and Becker, 1970 | Fig. 154 | **TRICH Benth 10**

Benthodesmus tuckeri Parin and Becker, 1970:359, fig. 2 (off Sombrero Island, Philippines).

Synonyms: None.

FAO Names: En - Tucker's frostfish; **Fr** - Poisson sabre ruban; **Sp** - Cintilla de Tucker.

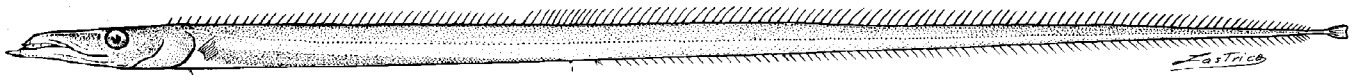


Fig. 154 ***Benthodesmus tuckeri***
(adapted from Parin and Becker, 1970 and 1972)

Diagnostic Features: Body depth 20.2 to 30.0 times in standard length; anus situated below fifth or seventh dorsal-fin soft ray; distance from snout to anus 2.4 to 2.5 times in standard length. Head length 7.2 to 8.3 times in standard length; snout length 2.0 to 2.5 times in head length; eye diameter 7.2 to 8.2 times in head length; interorbital width 1.2 to 2.2 times in eye diameter; maxillary length 2.4 to 2.8 times in head length. Dorsal fin with XXXIX to XLIV spines and 88 to 96 soft rays (total 130 to 137 fin elements); anal fin with II spines, situated below 8th to 11 th dorsal-fin soft ray, and 76 to 83 soft rays, external rays developed throughout its base; pelvic fins inserted before or below anterior edge of pectoral-fin base. Vertebrae total 133 to 142.

Geographical Distribution: In the western Pacific Ocean known from the Philippines, Vietnam, Molucca Islands and southeastern Australia and in the Indian Ocean from Socotra Island, Saya de Malha Bank, Mozambique Channel and south of Java (Fig. 155).

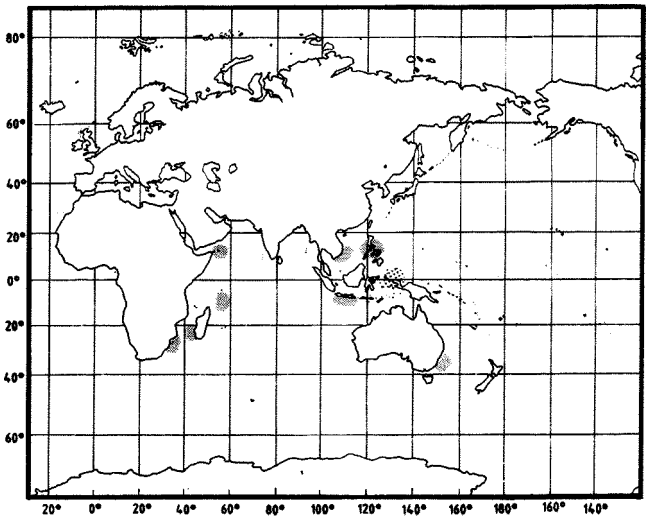


Fig. 155

Habitat and Biology: Benthopelagic from 550 to 790 m, juveniles mesopelagic at 500 m.

Size: Maximum 77 cm standard length.

Interest to Fisheries: No data available.

Local Names:

Literature: Parin and Becker (1972); Parin et al. (1977).

Benthodesmus vityazi Parin and Becker, 1970 | Fig. 156 | **TRICH Benth 11**

Benthodesmus vityazi Parin and Becker, 1970:360, fig. 2 (Central Equatorial Pacific).

Synonyms: None.

FAO Names: En - Vityaz' frostfish; **Fr** - Poisson sabre galon; **Sp** - Cintilla de Vityaz.

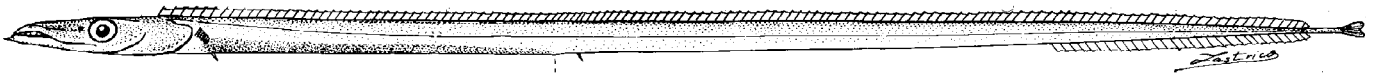


Fig. 156 ***Benthodesmus vityazi***
(adapted from Parin and Becker, 1970 and 1972)

Diagnostic Features: Body depth 30.5 to 40.0 times in standard length; anus situated below first to fourth dorsal-fin soft ray; distance from snout to anus 2.3 to 2.6 times in standard length. Head length 7.0 to 7.9 times in standard length; snout length 2.4 to 2.7 times in head length; eye diameter 5.2 to 5.9 times in head length; interorbital width 2.5 to 3.1 times in eye diameter; maxillary length 2.7 to 3.3 times in head length. Dorsal fin with XLI to XLIV spines and 88 to 93 soft rays (total 131 to 136 fin elements); anal fin with II spines, situated below fourth to seventh dorsal-fin soft ray, and 80 to 85 soft rays, external rays developed only in the last third of its base; pelvic fins inserted behind pectoral-fin base. Vertebrae total 137 to 142.

Geographical Distribution: Central and western Pacific, seas of Indo-Australian Archipelago, north-eastern and northwestern Indian Ocean (Fig. 157).

Habitat and Biology: Benthopelagic from 640 to 820, juveniles mesopelagic from 170 to 900 m.

Size: Maximum 77 cm standard length.

Interest to Fisheries: No data available.

Local Names:

Literature: Fourmanoir (1971 b, as ***B. elongatus***); Parin and Becker (1972); Parin (1975, 1978); Parin et al. (1977); Belyanina (1982); Gloer-felt-Tarp and Kailola (1984); Shcherbachev et al. (1986); Scherbachev (1987).

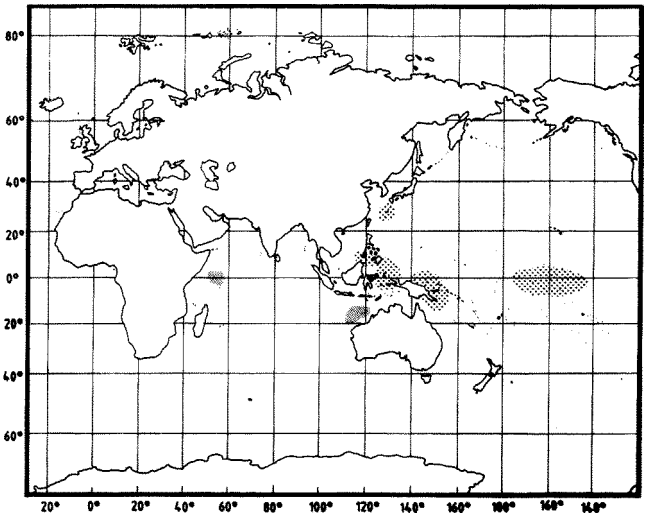


Fig. 157

Eupleurogrammus Gill, 1862 | **TRICH Eupl**

Eupleurogrammus Gill, 1862:126. Type species, ***Trichiurus muticus*** Gray, 1831, by original designation (also monotypic).

Synonyms: None

Diagnostic Features: Body elongate and remarkably compressed. Lower hind margin of gill cover convex. Pectoral fins fairly long, extending beyond lateral line; pelvic fins small, reduced to a scale-like process; caudal fin absent, posterior part of body tapering to a point.

Biology, Habitat and Distribution: Benthopelagic, mostly on continental shelf, but often comes near surface at night. Feeds on a wide variety of small coastal fishes, squids and crustaceans. Shows a typical Indo-West Pacific distribution.

Interest to Fisheries: Caught commercially with shore seines, bag nets and coastal bottom trawls around Indian coastal waters.

Species: Two species are recognized (Nakamura, 1984a).

Key to Species of *Eupleurogrammus:*

1a. A pair of fangs on tip of lower jaw; dorsal-fin membrane slightly tinged with black along spines; dorsal side of posterior part of body slightly black; a black spot just behind dermal process of lower jaw; pelvic fins situated below 11 th to 14th dorsal-fin soft ray . *E. glossodon*

1b. No fangs on tip of lower jaw: dorsal-fin membrane pale; both dorsal and ventral sides of posterior part of body black; no black spot behind dermal process on ventral side of lower jaw; pelvic fins situated below 15th to 18th dorsal-fin soft ray ..... *E. muticus*

Eupleurogrammus glossodon (Bleeker, 1860) Fig. 158 **TRICH Eupl 1**

Trichiurus glossodon Bleeker, 1860b:38 (Borneo).

Synonyms: ***Eupleurogrammus intermedius*** (Gray, 1831). ***Trichiurus intermedius*** Gray, 1831.

FAO Names: En - Longtooth hairtail; **Fr** - Poisson sabre dentu; **Sp** - Pez sable dentón.

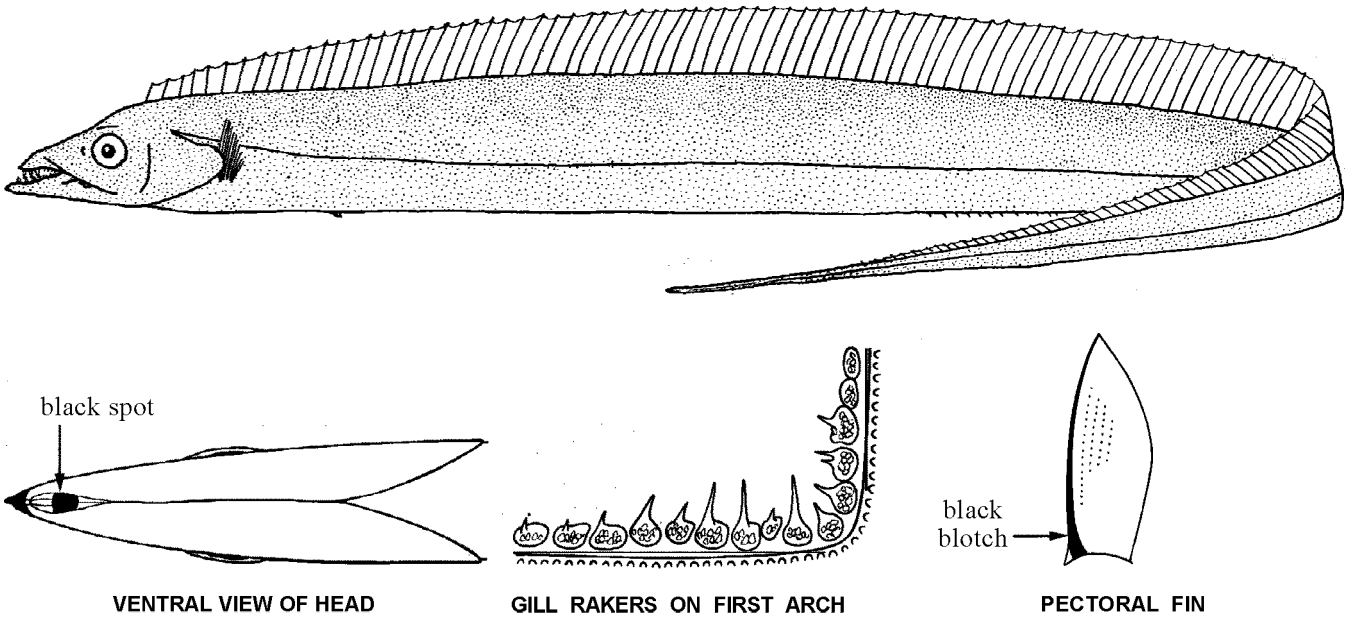


Fig. 158 *Eupleurogrammus glossodon*

Field Characters: A pair of fangs on tip of lower jaw. Eye small, ifs diameter about 7 or 8 times in head length, located close to dorsal profile of head. A black spot just behind dermal process on bottom of lower jaw. A fairly noticeable black blotch on base of anterior margin of pectoral fins.

Diagnostic Features: Body extremely elongate and compressed, ribbon-like, tapering to a point; anus elongate and fairly large. Mouth large with a dermal process on tip of each jaw; lower hind margin of gill cover convex; eye small, its diameter about 7 or 8 times in head length, located close to dorsal profile of head; 2 or 3 fangs (usually without barbs) in upper jaw, a pair of fangs on tip of lower jaw; a single series of sharp compressed lateral teeth in both jaws. Dorsal-fin elements 118 to 132; anal fin reduced to minute spinules buried in skin, its origin situated below 31 st to 35th dorsal-fin soft ray; pectoral fins slightly shorter than snout, with I spine and 13 soft rays; pelvic fins reduced to scale-like spines, situated below 11 th to 14th dorsal-fin soft ray; caudal fin absent, posterior part of body tapering to a point. Lateral line running almost straight, closer to ventral contour.**Colour:** In fresh specimens, body steely blue with metallic reflections, becoming silvery grey after death; dorsal-fin membrane slightly tinged with black along spines, dorsal side of posterior part slightly tinged with black; dermal processes at tip of each jaw black, a black

spot present just behind dermal process on bottom of lower jaw, a fairly noticeable black blotch on base of anterior margin of pectoral fins.

Geographical Distribution: Indo-West Pacific including The Gulf, India, Sri Lanka, Malaysia, Singapore, Indonesia and Thailand (Fig. 159).

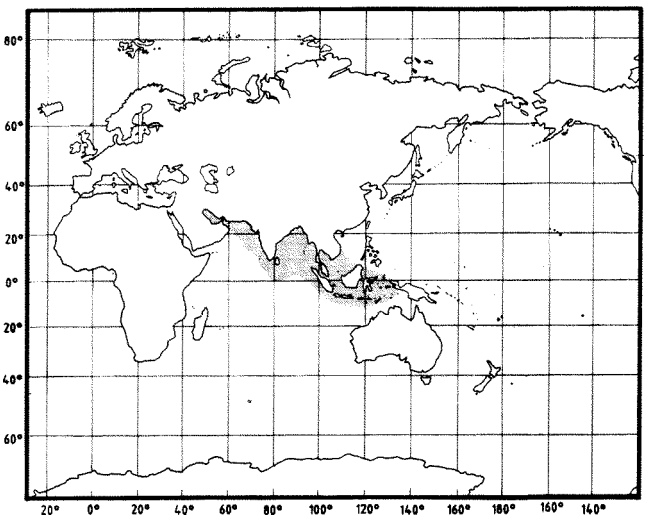


Fig. 159

Habitat and Biology: Benthopelagic, in coastal waters down to about 80 m depth, often comes near surface at night. Feeds on crustaceans, squid and fishes (species of *Atherina, Stolephorus, Escualosa, Sardinella, Dussurneria, Thryssa, Sphyraena, Hemiramphus, Leiognathus,* ***Eupleurogrammus,*** etc., in Palk Bay, India).

Size: Maximum 50 cm total length, common 15 to 40 cm.

Interest to Fisheries: Caught mainly with shore seines, bag nets and bottom trawls in coastal waters down to 50 m depth in West Bengal to Madras, Palk Bay and Gulf of Mannar. Marketed mostly dried, mixed with other trichiurids, also salted or fresh.

Local Names:

Literature: Tucker (1956); James (1961, 1967); Nakamura (1984a).

Eupleurogrammus muticus (Gray, 1831) Fig. 160 **TRICH Eupl 2**

Trichiurus muticus Gray, 1831:10 (India).

Synonyms: None.

FAO Names: En - Smallhead hairtail; **Fr** - Poisson sabre asbas; **Sp** - Pez sable asbas.

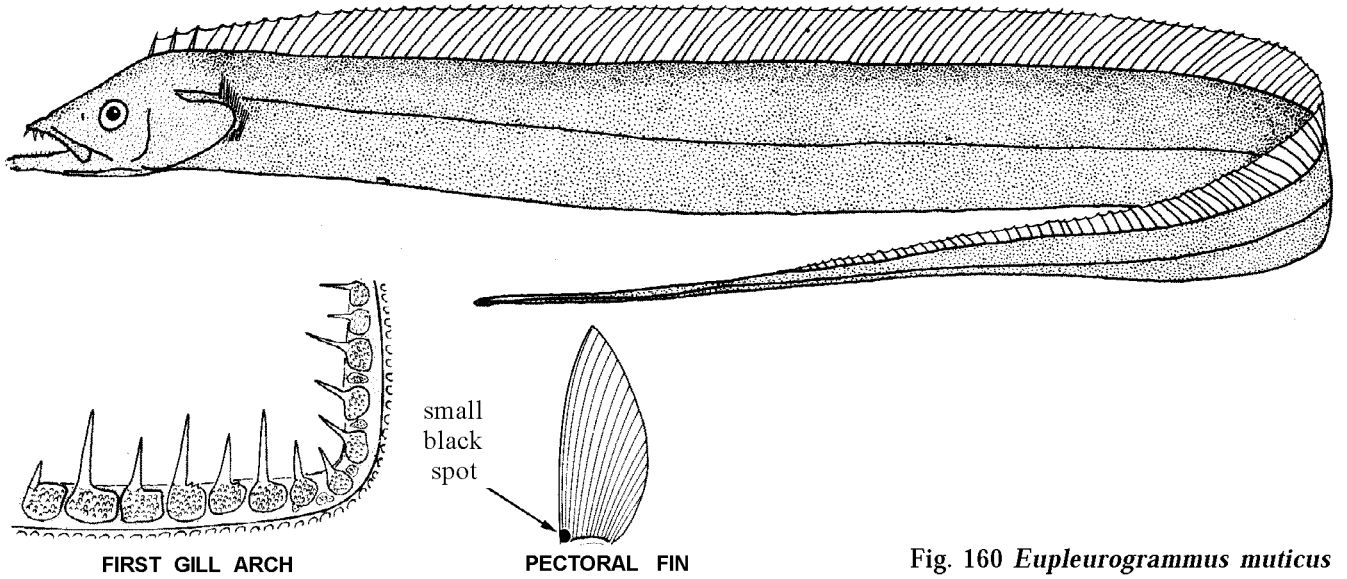


Fig. 160 *Eupleurogrammus muticus*

Field Characters: No fangs on tip of lower jaw. Eye small, its diameter 6 to 8 times in head length, located far from dorsal profile of head. A small pale black spot on base of anterior margin of pectoral fins.

Diagnostic Features: Body extremely elongate and compressed, ribbon-like, tapering to a point; anus small. Mouth large with a dermal process at tip of each jaw; lower hind margin of gill cover convex; eye small, its diameter 6 to 8 times in head length, located far from dorsal profile of head; 2 or 3 (usually 3) fangs (usually

click for next page

without barbs) in upper jaw; no fangs on tip of lower jaw; a series of sharp compressed lateral teeth in both jaws. A single, long-based dorsal fin with III spines and about 140 soft rays; anal fin reduced to minute spinules buried in skin, situated below 41st to 43rd dorsal-fin soft ray; pectoral fins about as large as snout, with Ispine and 12 soft rays; pelvic fins present, but reduced to a small scale-like process; caudal fin absent, posterior part of body tapering to a point.Lateral line running almost straight along mibdody or slightly nearer ventral contour than dorsal contour. **Colour:** In fresh specimens, body steely blue with metallic reflections, becoming silvery grey after death; dorsal-fin membrane semi-transparent, both dorsal and ventral sides of posterior part of fin black; dermal process on upper jaw black, dermal process of lower jaw black adove and grey below; a small pale black spot on base of anterior margin of pectoral fins.

Geographical Distribution: Indo-West Pacific including The Gulf, India, Sri Lanka, Malaysia, Indonesia, Gulf of Thailand, China and southern Korean Peninsula (Fig. 161).

Habitat and Biology: Benthopelagic, in coastal waters down to about 80 m depth, often comes near surface at night. Feeds on a wide variety of small fish, squid and crustaceans.

Size: Maximum 70 cm total length, common 20 to 50 cm.

Interest to Fisheries: Caught mainly with shore seines, bag nets and coastal bottom trawls in coastal waters down to about 50 m in West Bengal to Madras in the east coast of India and around Bombay in the west coast of India. Marketed mostly dried and salted, mixed with other trichiurids, sometimes fresh.

Local Names: JAPAN: Oshiroidachi; MALAYSIA: Seleyur, Timah-timah; THAILAND: Smallhead rib-bonfish.

Literature: Tucker (1956); James (1961, 1967); Nakamura (1984a,b).

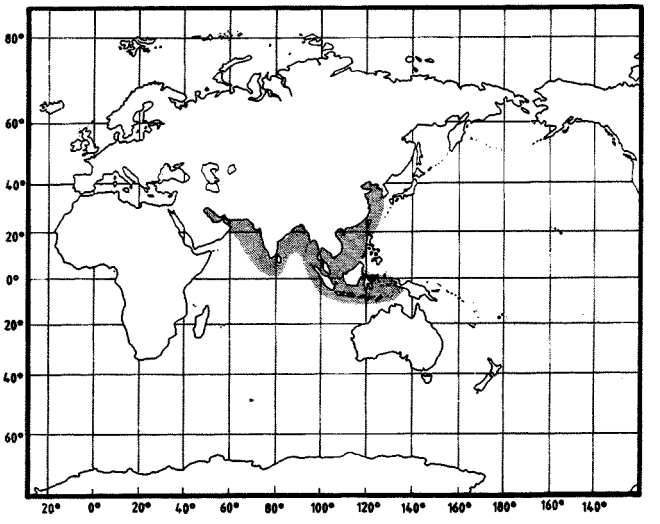


Fig. 161

Evoxymetopon Gill, 1863

TRICH Evox

Evoxymetopon Gill, 1863:227. Type species, ***Evoxymetopon taeniatus*** Gill, 1863, by monotypy.

Synonyms: None

Diagnostic Features: Body elongate, deep and remarkably compressed. Upper profile of head convex steeply rising from tip of snout to dorsal-fin origin forming a prominent sagittal crest. Posterior end of gill cover broadly rounded. First anal-fin spine scale-like in shape; pelvic fins present, scale-like; small caudal fin present.

Biology, Habitat and Distribution: Little information is known about the biology of this genus. Benthopelagic on continental shelf and slope, seems to be abundant in sea mountain areas.

Interest to Fisheries: No special fishery for species of this genus.

Species: Two species recognized thus far.

Key to Species of *Evoxymetopon:*

1a. First dorsal-fin spine elongated; nostril slit-like; body depth 12.5 to 13.5 times in standard length ..... ***Evoxymetopon poeyi***

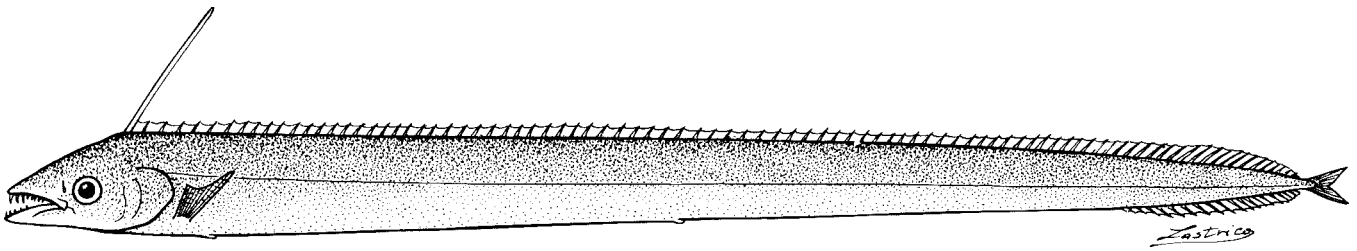
1b. First dorsal-fin spine not elongated; nostril crescent; body depth 11.5 to 12.5 times in standard length ..... ***Evoxymetopon taeniatus***

Evoxymetopon poeyi Günther, 1887 | Fig. 162 | **TRICH Evox 1**

Evoxymetopon poeyi Günther, 1887:39, pl. 43 (Mauritius, Indian Ocean).

Synonyms: None

FAO Names: En - Poey's scabbardfish; **Fr** - Poisson sabre latte; **Sp** - Tajali de Poey.



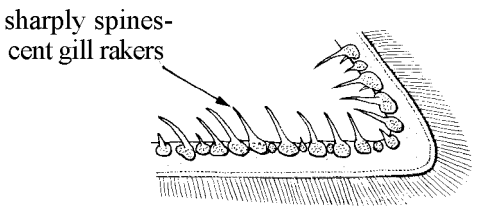


Fig. 162 ***Evoxymetopon poeyi***

Field Characters: First spine of dorsal fin elongate. Pectoral fins triangular in shape.

Diagnostic Features: Body elongate and compressed; body depth 12.5 to 13.5 times in standard length. Head length 7.5 to 8.5 times in standard length; upper profile of head rather straight; a slit-like nostril present; mouth large, not protractile; 3 pairs of large fangs in anterior end of upper jaw (3 of them often lost), 1 pair of small fangs in lower jaw; sharp conical teeth in both jaws, upper (about 30) larger and more sparsely arranged than lower (about 40); tongue slender with many irregular villiform tooth patches; vomer edentate, fine uniserial canine teeth on palatine. Gill rakers sharply spinescent. Dorsal-fin elements 91 to 93, first dorsal-fin spine elongate; first anal-fin ray scale-like, other rays embedded; pectoral fins situated low, rather small and acute triangular in shape with shorter anterior rays and longer posterior rays; pelvic fins reduced to scale-like spines. Lateral line fairly straight, situated mid-laterally or slightly nearer ventral contour than dorsal contour. No scales. **Colour:** Body silvery white, all fins pale brown; opercle lining blackish.

Geographical Distribution: In the Indian Ocean reported from Mauritius, and in the West Pacific Ocean, reported from Okinawa and Kyushu-Palau Ridge (Fig. 163).

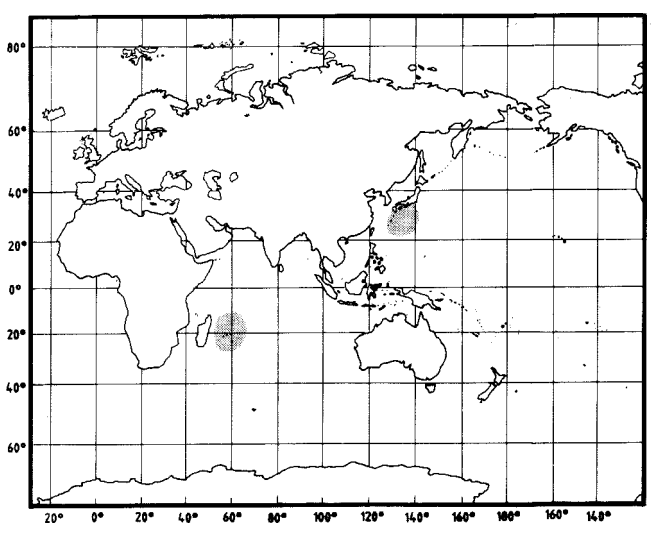


Fig. 163

Habitat and Biology: Benthopelagic, seems to be abundant in sea mountain areas, sometimes near shore. Feeds on rather large fishes (species of *Priacanthus, Decapterus, Emmelichthys* etc.) in Kyushu Palau-Ridge.

Size: Maximum 200 cm standard length, common 130 to 180 cm.

Interest to Fisheries: No special fishery for this species. Sometimes marketed fresh in Okinawa when caught.

Local Names: JAPAN: Hatatateyume-tachimodoki, Hirenaga-yumetachi.

Literature: Tucker (1956); Abe and Asai (1975); Nakamura (1982b, 1984b).

Remarks: Tucker (1956) reported that differences between ***E. poeyi*** and ***E. taeniatus*** are probably due to sex, growth stages or damage of the specimens described. Nakamura (1982b) recognized both species to be valid.

Evoxymetopon taeniatus Gill, 1863 Fig. 164 **TRICH Evox 2**

Evoxymetopon taeniatus Gill, 1863:228 (Havana, Cuba).

Synonyms: None

FAO Names: En - Channel scabbardfish; **Fr** - Poisson sabre canal; **Sp** - Tajali de canal.

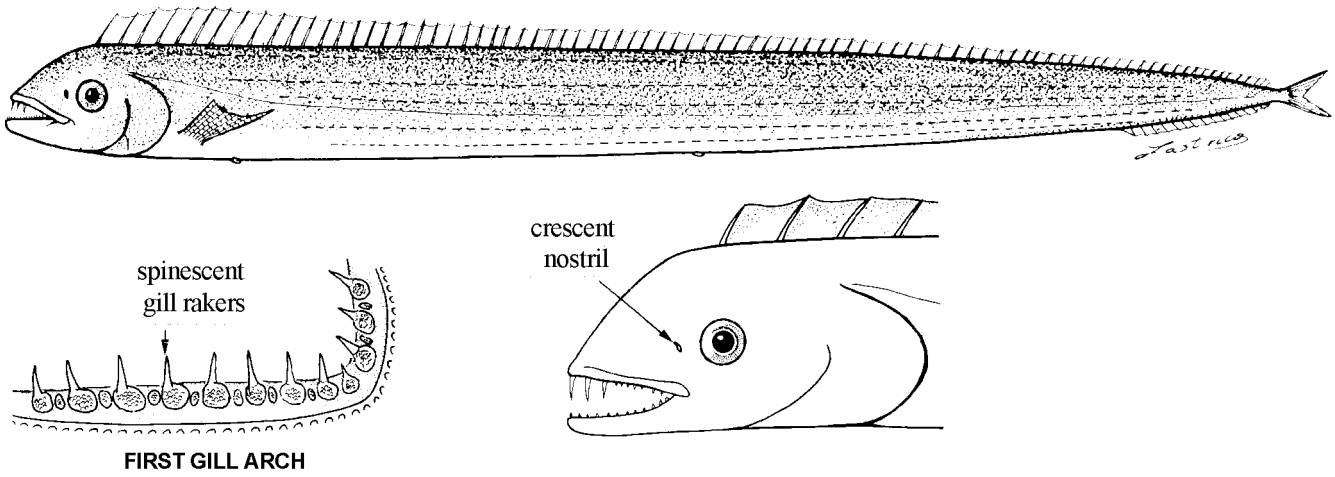


Fig. 164 ***Evoxymetopon taeniatus***

Field Characters: First spine of dorsal fin not elongate. Pectoral fins triangular in shape.

Diagnostic Features: Body elongate and compressed; body depth 11.5 to 12.5 times in standard length. Head length 7.5 to 8.0 times in standard length; upper profile of head convex; a crescent nostril in front of eye; mouth large, not protractile; lower jaw slightly anterior to upper jaw; several fangs in anterior end of upper jaw and a pair of fangs in lower jaw; lateral teeth in both jaws sharp and conical; vomer edentate and fine uniserial canine teeth on palatine. Gill rakers spinescent. Dorsal-fin elements 81 to 88, first dorsal-fin spine not elongate; first anal-fin ray scale-like, other rays ordinal and short; pectoral fins situated low, rather small and triangular in shape with shorter anterior rays and slightly longer posterior rays; pelvic fins reduced to a scale-like spine. Lateral line fairly straight, situated mid-laterally or slightly nearer ventral contour than dorsal contour. No scales. **Colour:** Body silvery white with slight red-brownish on dorsal part; several longitudinal pale yellow stripes on body; fin membrane of anterior part blackish and posterior part semitransparent in first dorsal fin.

Geographical Distribution: In the Atlantic Ocean from the Bahamas, Caribbean Sea and off southern Brazil (specimens at Institut für Seefischerei, Universitat Hamburg (ISH) were collected from 24°40'S, 44°35'W) and in the Pacific Ocean from Cheju Do Island (south of Korean Peninsula) (Fig. 165).

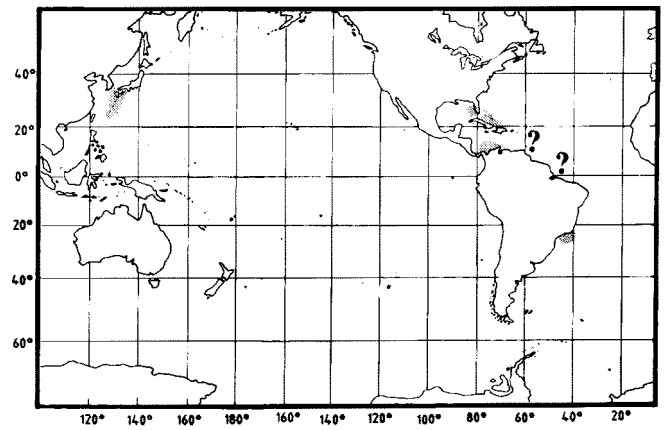


Fig. 165

Habitat and Biology: Benthopelagic on the continental slope, and sometimes the continental shelf.

Size: Maximum 200 cm standard lenght, common 130 to 180 cm.

Interest to Fisheries: No special fishery for this species.

Local Names: CUBA: Triante, Tyrant fish; JAPAN: Yumetachimodoki; KOREA: Dong-dong-gal-chi.

Literature: Uchida (1940); Tucker (1956); Duarte-Bello (1959); Parin and Mikhailin (1981); Nakamura (1984b).

Remarks: See ***E. poeyi.***

Lepidopus Goüan, 1770

TRICH Lepid

Lepidopus Goüan, 1770:107, 185. Type species, ***Lepidopus gouanianus*** Lacepede, 1800 = ***Trichiurus caudatus*** Euphrasen, 1788, by subsequent monotypy or subsequent designation (see Eschmeyer, 1990).

Synonyms: ***Vandellius*** Shaw, 1803. ***Scarcina*** Rafinesque, 1810. ***Ziphoteca*** Montague, 1811.

Diagnostic Features: Body elongate and compressed. Head length 4.2 to 6.8 times in standard length; upper head profile slightly concave to slightly convex, gently rising from tip of snout to dorsal-fin origin; frontal crests converging from before middle of orbits to behind their rear margins; sagittal crest, if present, confined to nape (beginning between orbits in ***Lepidopus*** sp.); lower jaw projects anterior to upper jaw; lower hind margin of gill cover convex; eyes fairly large, situated near dorsal contour; interorbital space concave to convex; tips of both jaws usually with a short dermal process; jaw dentition including anterior fangs (3 to 6 in upper jaw and a pair in lower jaw) and smaller lateral teeth. Dorsal fin with VII to X weak anterior spines hardly differing from subsequent soft rays; first anal-fin spine rudimentary, second spine moderate to strong; pectoral fins with 12 soft rays, subtriangular, anterior rays shorter than posterior soft rays; pelvic fins with I small scale-like spine and 1 to 2 tiny soft rays, inserted behind end of pectoral-fin base; small forked caudal fin present. Lateral line slowly descending from above gill opening to mid-lateral position.

Biology, Habitat and Distribution: Benthopelagic at shelf and upper slope. Distributed throughout all oceans.

Interest to Fisheries: See species.

Species: Six species recognized (Parin and Collette, 1992).

Illustrated Key to Species of *Lepidopus:*

1a. Posterior confluence of frontal crests before middle of orbits; sagittal crest begins in interorbital region; interorbital space strongly convex; orbits relatively far from dorsal profile (Fig. 168) ..... ***Lepidopus*** sp.

1b. Posterior confluence of frontal crests behind middle of orbits; sagittal crest, if present, confined to nape; interorbital space usually concave or flat (convex only in ***L. dubius);*** orbits nearly touching dorsal profile (Fig. 166 and 167) ..... → **2**

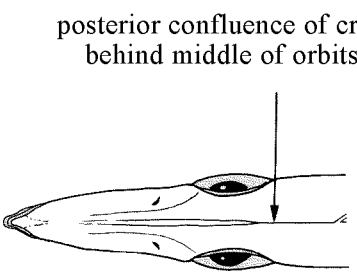


Fig. 166 Dorsal view of head

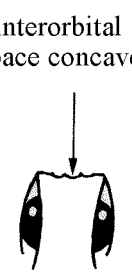


Fig. 167 Front view of upper head

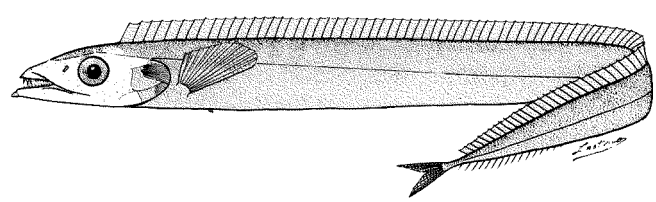


Fig. 168 ***Lepidopus*** **sp.**

2a. Upper head profile concave; dorsal-fin elements 91 to 110; vertebrae total 98 to 114 ..... → **3**

2b. Upper head profile slightly convex; dorsal-fin elements 78 to 89; vertebrae total 82 to 96 ..... → **4**

3a. Second anal-fin spine spur-like, longer than pupil; dorsal-fin elements 91 to 93, anal-fin soft elements 44 to 47; vertebrae total 98 to 100 (Fig. 169) ..... ***L. calcar***

3b. Second anal-fin spine plate-like, twice or more shorter than pupil; dorsal-fin elements 98 to 110, anal-fin soft elements 59 to 66; vertebrae total 105 to 114 (Fig. 170) ..... ***L. caudatus***

Fig. 169 *L. calcar*

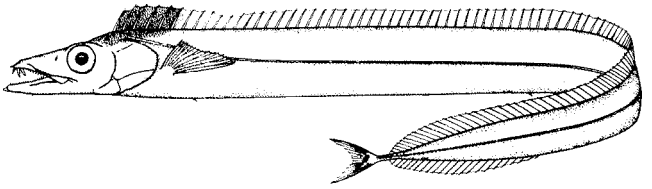
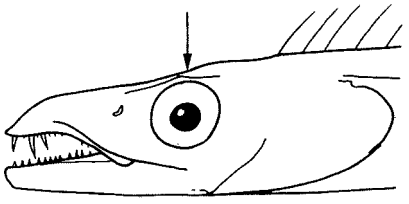


Fig. 170 *L. caudatus*

4a. Interorbital space convex, sagittal crest confined to nape; head length 6.4 to 6.8 times in standard length; body depth 16 to 18 times in standard length; second anal-fin spine cardiform, equal to length of pupil ..... ***L. dubius***

4b. Interorbital space concave, no sagittal crest; head length 4.2 to 5.5 times in standard length; body depth 9 to 13 times in standard length; second anal-fin spine plate-like, shorter than length of pupil .....→ **5**

sagittal crest confined to nape



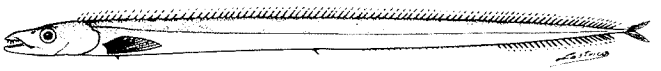


Fig. 171 *L. dubius*

5a. Eye diameter 4.9 to 6.2 times in head length; caudal-fin span less than length of upper caudal-fin lobe; dorsal-fin elements 78 to 87; vertebrae total 82 to 93 ..... ***L.fitchi***

5b. Eye diameter about 4.0 times in head length; caudal-fin span greater than length of upper caudal-fin lobe; dorsal-fin elements 89; vertebrae total 94 ..... ***L. manis***

78 to 87 dorsal fin elements

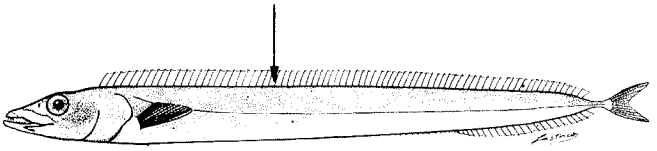


Fig. 172 *L. fitchi*

89 dorsal fin elements

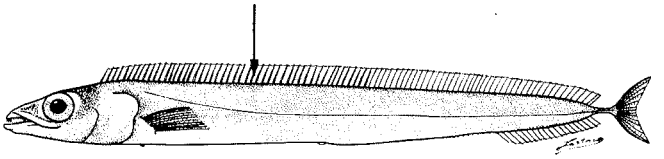


Fig. 173 *L. manis*

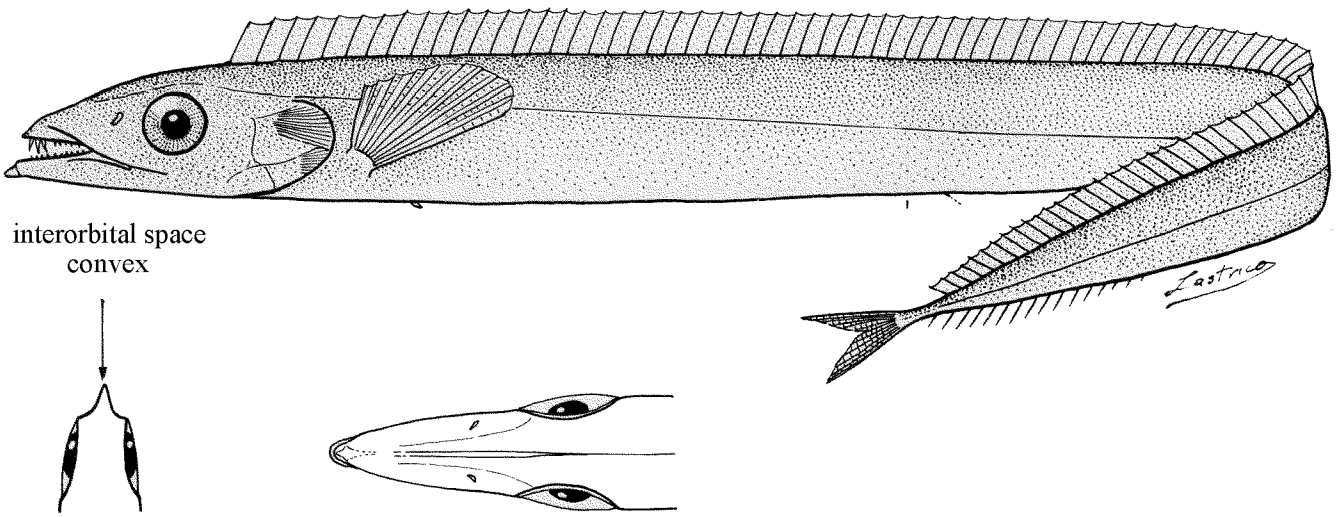
Lepidopus sp.

TRICH Lepid 6

(to be described by Parin and Collette, 1993 in Archiv. Fischereiwiss.)

Synonyms: None.

FAO Names: **En** - Crested scabbardfish; **Fr** - Poisson sabre crénelé; **Sp** - Pez cinto encrestado.



* (after Parin and Mikhailin, 1981)

Fig. 174 *Lepidopus* **sp.**
(adapted from Tucker, 1957)

Field Characters: Body silvery to brownish, darker along lateral line. Interorbital space strongly convex.

Diagnostic Features: Body elongate and compressed; body depth 10.9 to 13.0 times in standard length; anus situated below 36th to 40th soft dorsal-fin ray. Head length 5.9 to 6.5 times in standard length; snout length 2.5 to 2.7 times in head length; upper head profile almost straight, gently rising from snout to dorsal-fin origin; posterior confluence of frontal crests before middle of orbits; sagittal crest prominent, extending through nape; orbits far, not reaching upper profile, interorbital space strongly convex; eye diameter 4.9 to 5.1 times in head length; interorbital width 1.6 to 1.8 times in eye diameter; upper jaw length 2.8 to 3.0 times in head length; lateral teeth 15 to 20 in maxillary, 15 to 21 in dentary; a few teeth on palatines. Gill rakers 17 or 18. Dorsal-fin elements 90 to 96; anal fin with II spines, the second spine flat, triangular, twice shorter than the distance from its origin to anus inserted below 37th to 40th dorsal-fin soft ray, and 52 to 58 soft rays, posterior 19 to 23 connected by membrane; pelvic fins inserted below 9th to 10th dorsal-fin soft ray, about half eye diameter behind posterior end of pectoral-fin base. Pyloric caeca about 20. Vertebrae total 98 to 107, including 37 to 40 precaudal and 61 to 67 caudal. **Colour:** Body silvery to brownish, darker along lateral line; inside of gill cavity black.

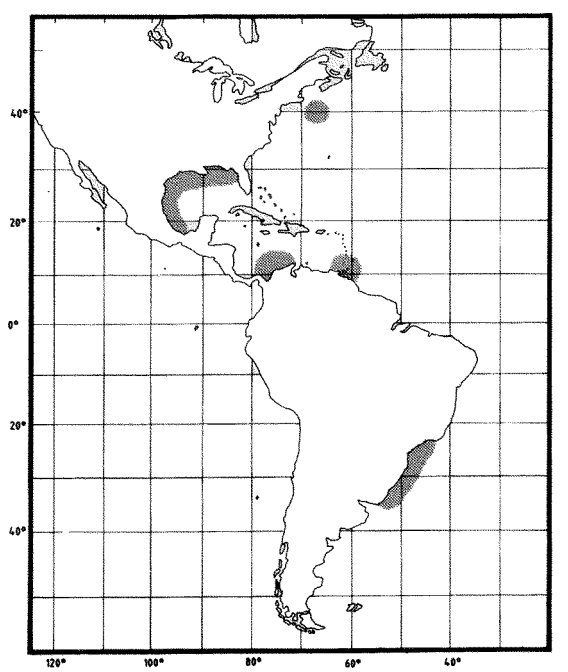


Fig. 175

Geographical Distribution: Western Atlantic Ocean from 43°N off the Scotian Shelf to 35°S off southern Brazil (Fig. 175).

Habitat and Biology: Benthopelagic from 200 to 500 m, juveniles pelagic.

Size: Maximum 66 cm standard length.

Interest to Fisheries: No data available. **Local Names:**

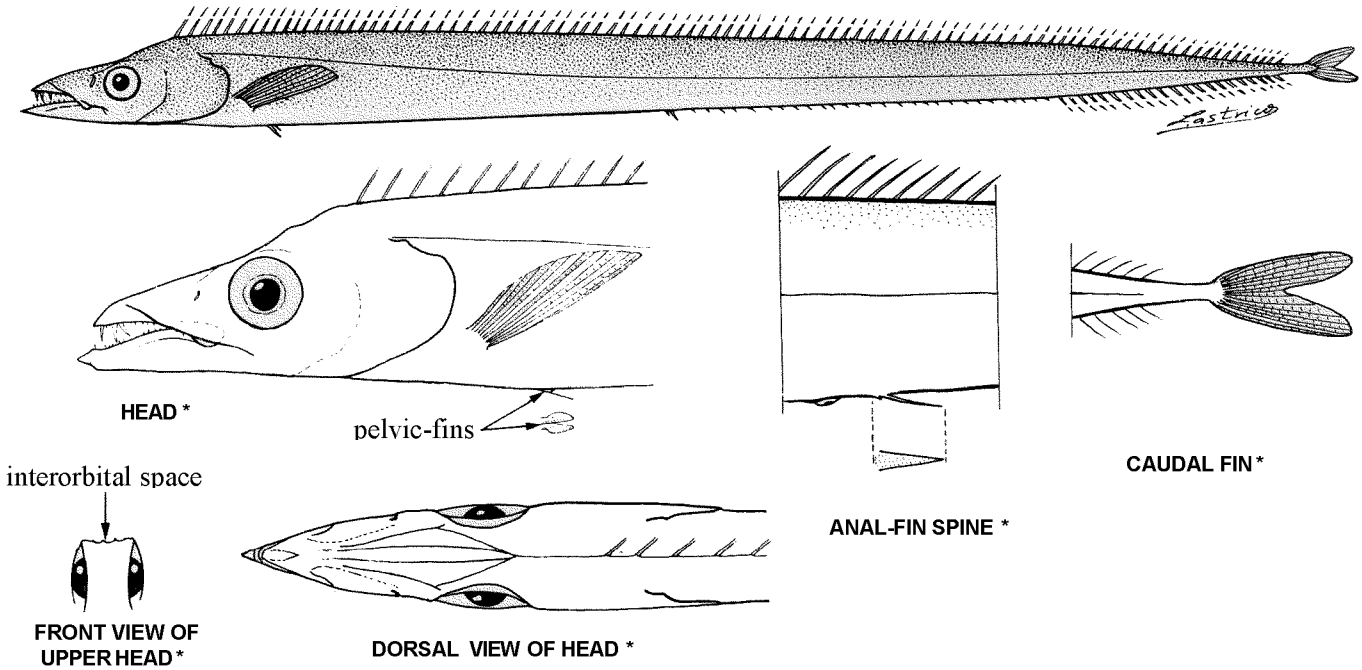
Literature: Tucker (1957, as *Evoxymetopon taeniatus);* Parin and Mikhailin (1981, as *Lepidopus* sp.).

Lepidopus calcar Parin and Mikhailin, 1982	Fig. 176	TRICH Lepid 2

Lepidopus calcar Parin and Mikhailin, 1982a:27 (Colahan Seamount, Hawaiian Ridge).

Synonyms: None.

FAO Names: En - Hawaiian ridge scabbardfish; **Fr** - Poisson sabre hawaiien; **Sp** - Pez cinto expolín.



* (after Parin and Mikhailin, 1982)

Fig. 176 *Lepidopus calcar*

Field Characters: Body dark brown. Second anal-fin spine stout, spur-like, longer than pupil of eye.

Diagnostic Features: Body elongate and compressed; body depth 10.5 to 13.9 times in standard length; anus situated below 40th to 43th dorsal-fin ray. Head length 5.9 to 6.4 times in standard length; snout length 2.5 to 2.6 times in head length; upper head profile oblique-concave, rising gently from tip of snout to middle of orbits and more steeply to dorsal origin; posterior confluence of frontal ridges before rear margin of orbits; sagittal crest confined to nape; orbits nearely touching upper profile, interorbital space slightly concave; eye diameter 4.7 to 5.1 times in head length; interorbital width 1.7 to 1.8 times in eye diameter; upper jaw length 2.8 times in head length; lateral teeth 15 to 17 in maxillary, 15 to 19 in dentary; teeth present on palatines. Gill rakers 13 to 16. Dorsal-fin elements 91 to 93; anal fin with II spines, second spur-like, very stout, 1.7 to 1.8 times longer than distance from its origin to anus, (inserted below 44th to 45th dorsal-fin soft ray), 44 to 47 soft rays, posterior 10 to 20 soft rays connected by membrane; pelvic fins inserted below seventh to eighth dorsal-fin soft ray with a distance of 0.6 to 0.7 times eye diameter behind posterior end of pectoral base. Pyloric caeca 18. Vertebrae total 98 to 100, including 43 to 44 precaudal and 54 to 57 caudal. **Colour:** Body dark brown, much paler below (might be silvery iridescent in life); opercle black, inside of mouth and gill cavities black.

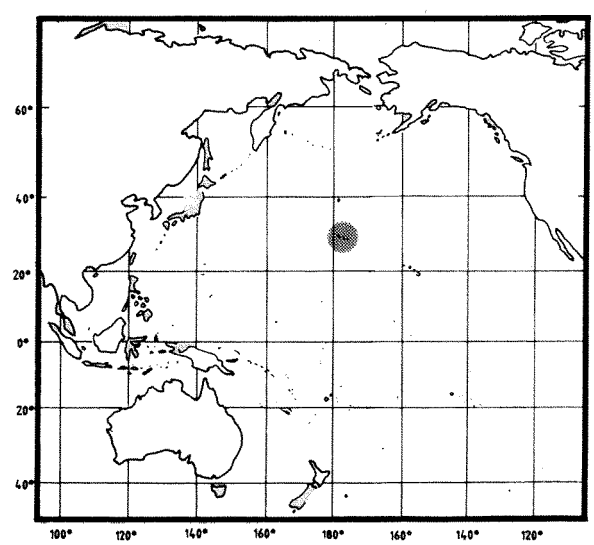


Fig. 177

Geographical Distribution: So far recorded only from type locality at Colahan Seamount of Hawaiian Submarine Ridge (31°01'N, 175°53'W) (Fig. 177).

Habitat and Biology: Benthopelagic from 270 to 350 m.

Size: Maximum 79 cm standard length (known from 3 specimens).

Interest to Fisheries: No data available.

Local Names:

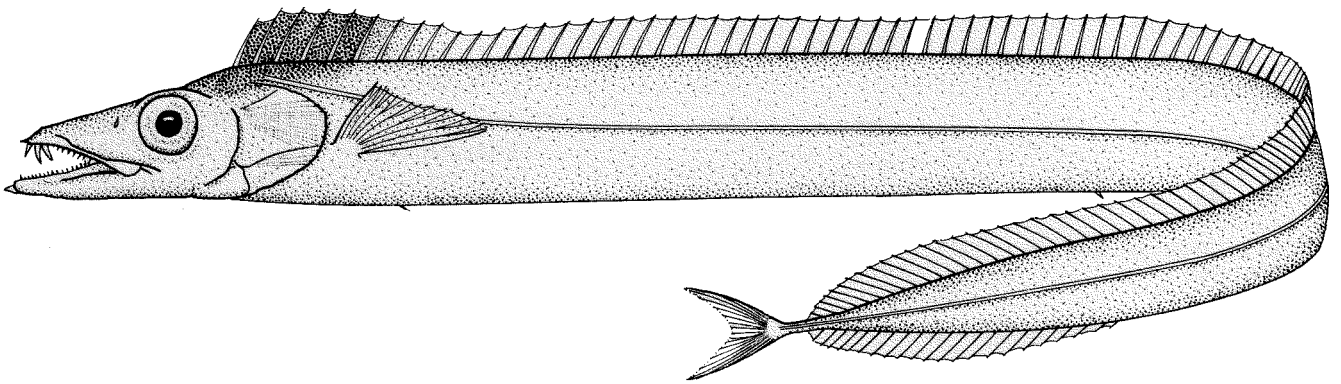
Literature: Borets (1986).

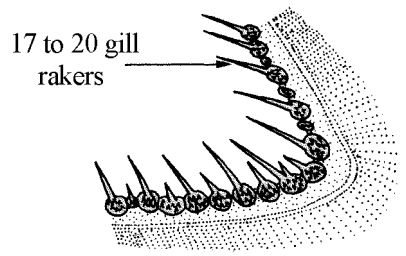
Lepidopus caudatus (Euphrasen, 1788)	Fig. 178	**TRICH Lepid 1**

Trichiurus caudatus Euphrasen, 1788:52, pl. 9 (Cape of Good Hope).

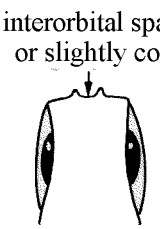
Synonyms: ***Lepidopus argenteus*** Bonnaterre, 1788. ***Trichiurus ensiformis*** Vandelli, 1797. ***Lepidopus gouanianus*** Lacepède, 1800. ***Trichiurus gladius*** Holten, 1802. ***Vandellius lusitanicus*** Shaw, 1803. ***Lepidopus peronii*** Risso, 1810. ***Scarcina argyrea*** Rafinesque, 1810. ***Ziphotheca tetradens*** Montague, 1811. ***Lepidopus xantusi*** Goode and Bean, 1895. ***Lepidopus lex*** Phillips, 1932.

FAO Names: En - Silver scabbardfish; **Fr** - Sabre argenté (Sabre in Area 37); **Sp** - Pez cinto.

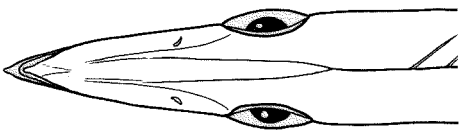




FIRST GILL ARCH



FRONT VIEW OF UPPER HEAD*



DORSAL VIEW OF HEAD*
* (after Parin and Mikhailin, 1981)

Fig. 178 ***Lepidopus caudatus***
(adapted from Tucker, 1956)

Field Characters: Body uniformly silvery. Second anal-fin spine plate-like, twice or more shorter than pupil.

Diagnostic Features: Body elongate and compressed; body depth 10.9 to 15.4 times in standard length; anus situated below 36th to 40th dorsal-fin soft ray. Head length 5.7 to 6.8 times in standard length; snout length 2.4 to 2.7 times in head length; upper head profile oblique concave, rising gently from tip of snout to middle of orbits and more steeply to dorsal origin; posterior confluence of frontal ridges behind rear margin of orbits; sagittal crest confined to nape; orbits nearely touching dorsal profile, interorbital space flat or slightly concave; eye diameter 4.9 to 6.1 times in head length; interorbital width 1.3 to 1.6 times in eye diameter; upper jaw length 2.7 to 3.0 times in head length; palatine teeth present. Gill rakers 17 to 20. Dorsal-fin elements 98 to 110; anal fin with II spines, second plate-like or triangular, shorter than pupil, (inserted below 38th to 42nd dorsal-fin soft ray), 59 to 66 soft rays, posterior 15 to 24 soft rays connected by membrane; pelvic fins inserted below eighth to ninth dorsal-fin soft ray, about 1 eye diameter behind posterior end of pectoral-fin base. Pyloric caeca 20 to 29. Vertebrae total 105 to 114, including 38 to 44 precaudal and 65 to 72 caudal. **Colour:** Body uniformly silvery; dorsal fin blackish grey (in North Atlantic populations) or with black margin of membrane between first 3 soft dorsal-fin rays and seventh to ninth soft rays (in South Hemisphere populations).

Geographical Distribution: Eastern North Atlantic from France to Senegal, including Azores, Madeira, Canaries and offshore seamounts, western Mediterranean (individual stragglers as far north as Iceland and east to Black Sea), off South Africa from Cape Frio to Agulhas Bank, including northern Walvis Ridge, seamounts in southern Indian Ocean along 30 to 35°S, Australia from New South Wales to southern West Australia, and New Zealand (Fig. 179). A doubtful record from Cape San Lucas, Mexico (Rosenblatt and Wilson, 1987).

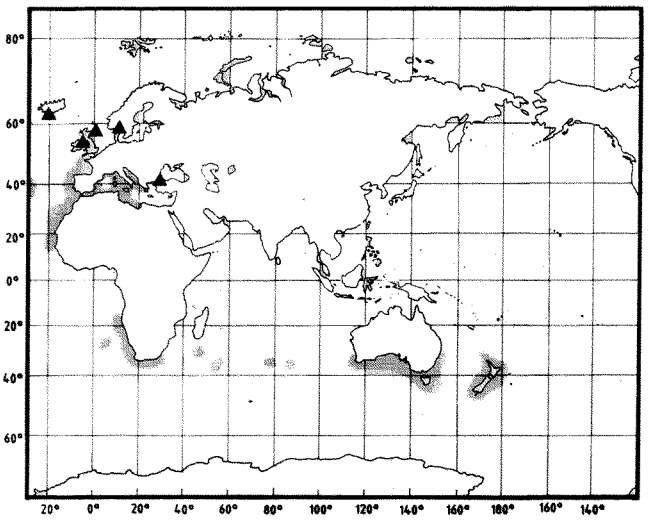


Fig. 179

Habitat and Biology: Benthopelagic on continental shelf, along its edge and upper slope down to 400 m (600 m in Australia), usually over sandy and muddy bottoms from 100 to 250 m (over 300 m in Australia). Migrates into midwater at night. Occasionally found inshore in upwelling of deep water when it appears at surface. Schooling species. Feeds on crustaceans, small squid and fish. In the southern East Atlantic the most important forage items are *Euphausia hanseni, E. luceus, Pasiphaea semispinosa, Sergesthes* spp., *Todaropsis eblanae, Engraulis capensis, Etrumeus terres, Sardinops ocellata, Maurolicus muelleri, Symbolophorus humbolti, Diaphus dumerili, Lampanyctodes hectoris, Chlorophthalmus* sp. and *Scomber japonicus* (Mikhailin, 1978). Attains length of 125 cm at 9 years of age in southern East Atlantic and 160 cm at age of 13 years in northern East Atlantic (Mikhailin, 1976a). Spawns from end of winter to early spring off North African coast (Wheeler, 1969) and spring to autumn in New Zealand waters (Robertson, 1980).

Size: Maximum 205 cm standard length and about 8 kg weight in eastern North Atlantic, usually 100 to 135 cm and 1.0 to 2.3 kg.

Interest to Fisheries: Important commercial fish species in the eastern North Atlantic, mainly off Portugal and Morocco. Also caught by trawls off Namibia and New Zealand. World annual catches varied in 1985 to 1990 from 7 839 to 21 748 t (FAO, 1992). Flesh excellent.

Local Names: AUSTRALIA: Southern frostfish; FRANCE: Sabre; GERMANY: Degenfisch; GREECE: Spadopsaro; ITALY: Pesce sciabola; MALTA: Fjamma; NEW ZEALAND: Scabbard fish, Frostfish; PORTUGAL: Espada branca; RUSSIA: Lepidop; SPAIN: Espadiella; SOUTH AFRICA: Bottersnoek, Buttersnoek; UK: Frostfish, Scabbard fish; YUGOSLAVIA: Zmijicnjak repas.

Literature: Tucker (1956); Wheeler (1969); Mikhailin (1977); Scott et al. (1980); Last et al. (1983); Duhamel (1984); Portsev and Nikolaev (1-984); Nakamura (1986c, 1990a); May and Maxwell (1986); Parin (1986, 1990c); Rosenblatt and Wilson (1987); Shcherbachev et al. (1989).

Remarks: Comparisons of populations of the main distributional areas, that is, the eastern North Atlantic- Mediterranean, South Africa, southern Indian Ocean and Australia- New Zealand, have never been based on adequate material. However, samples from southwest Africa (304 specimens) and the Azores (102 specimens) differ significantly in dorsal-fin pigmentation (see above) and meristic characters (Mikhailin, 1977). Surprisingly, Mikhailin's samples (if they were not mislabelled) from Gettysburg Seamount (36°22'N, 11°37'W) agree with the southern population in vertebral and dorsal counts. Morphometric studies of ***L. caudatus*** require further elaboration.

Lepidopus dubius Parin and Mikhailin, 1981 | Fig. 180 | **TRICH Lepid 3**

Lepidopus dubius Parin and Mikhailin, 1981:403, fig. 1 (off Angola, East Atlantic Ocean).

Synonyms: None.

FAO Names: **En** - Doubtful scabbardfish; **Fr** - Poisson sabre énigme; **Sp** - Pez cinto enigma.

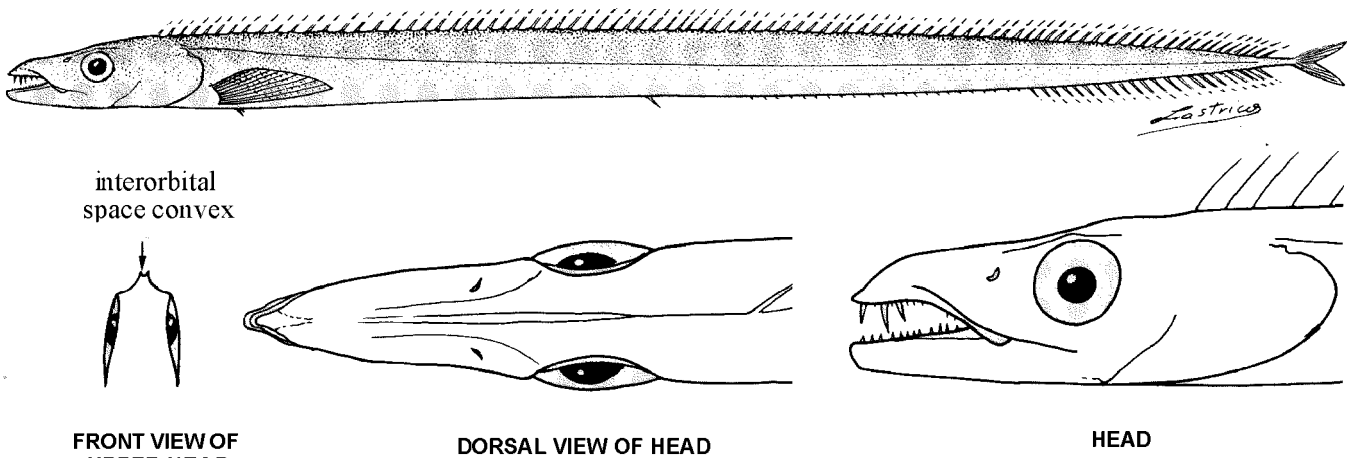


Fig. 180 ***Lepidopus dubius***
(adapted from Parin and Mikhailin, 1981)

Field Characters: Body silvery, edges of jaws and opercle blackish. Interorbital space convex. Sagittal crest confined to nape.

Diagnostic Features: Body elongate and compressed; body depth 16.4 to 18.5 times in standard length; anus situated below 33th to 35th soft dorsal-fin ray. Head length 6.4 to 6.8 times in standard length; snout length 2.6 to 2.8 times in head length; upper head profile slightly convex, rising very gently from snout to nape; posterior confluence of frontal ridges before rear margin of orbits, sagittal crest confined to nape; orbits nearely touching upper profile, interorbital space strongly convex; eye diameter 5.3 to 5.6 times in head length; interorbital width 1.7 to 1.9 times in eye diameter; upper jaw length 2.8 to 3.2 times in head length; lateral teeth 15 to 20 in maxillary, 11 to 17 in dentary; a few teeth on palatines. Dorsal-fin elements 85 to 89 (rarely 83); anal fin with II spines, second spine weak, cardiform and a little longer than the distance from its origin to anus (inserted below 35th to 37th dorsal-fin soft ray), 48 to 53 soft rays, posterior 20 to 25 soft rays connected by membrane; pelvic fins inserted below seventh to ninth dorsal-fin soft ray, about an eye diameter behind posterior end of pectoral-fin base. Pyloric caeca 13. Vertebrae total 91 to 96, including 33 to 37 precaudal and 55 to 61 caudal. **Colour:** Body silvery; edges of jaws and opercle blackish.

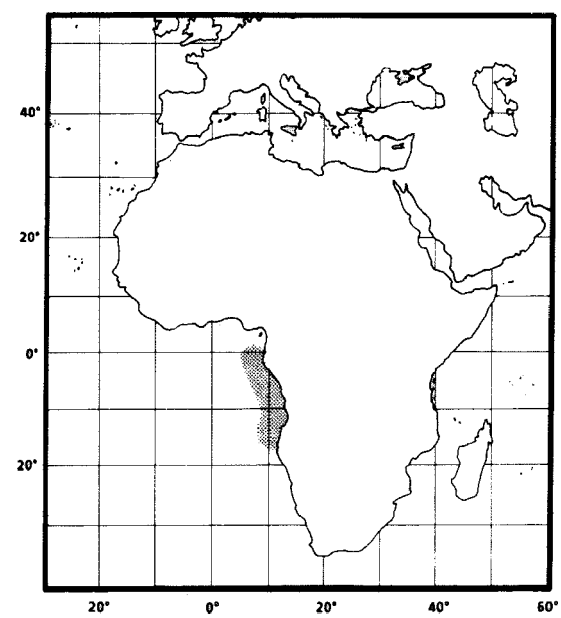


Fig. 181

Geographical Distribution: Along shores of West Africa from Equator to 14°30'S (Fig. 181).

Habitat and Biology: Benthopelagic from 320 to 495 m, juveniles epi- to mesopelgic from 20 to 220 m.

Size: Maximum known standard length is 43 cm.

Interest to Fisheries: No data available.

Local Names:

Literature: Parin et al. (1978, as ***Evoxymetopon taeniatus*** **?**); Parin (1990c).

Lepidopus fitchi Rosenblatt and Wilson, 1987 | Fig. 182 | **TRICH Lepid 4**

Lepidopus fitchi Rosenblatt and Wilson, 1987:348, fig. 6 (North Coronado Island, Baja California Norte, Mexico).

Synonyms: None.

FAO Names: **En** - Fitch's scabbardfish; **Fr** - Poisson sabre yatagan; **Sp** - Fez cinto de Fitch.

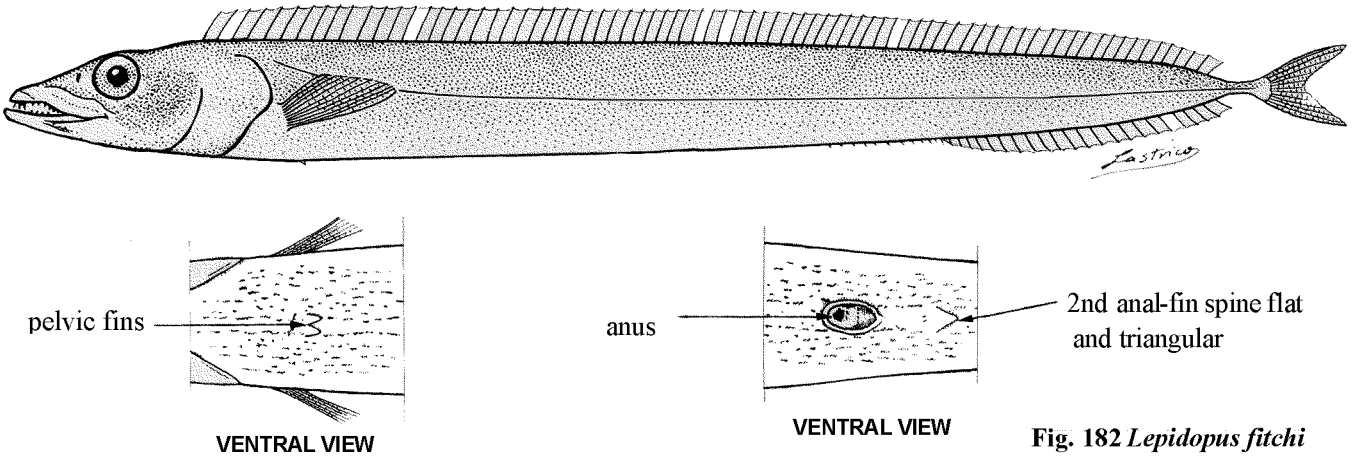


Fig. 182 ***Lepidopus fitchi***
(adapted from Rosenblatt and Wilson, 1987)

Field Characters: Body black or brown with a silvery sheen along abdomen. Caudal span less than length of upper caudal-fin lobe.

Diagnostic Features: Body moderately elongate and compressed; body depth 9.2 to 13.3 times in standard length; anus situated below 35th or 36th dorsal-fin ray. Head length 4.2 to 5.5 times in standard length; snout length 2.7 to 3.1 times in head length; upper head profile slightly convex, rising gently from snout to dorsal-fin origin; posterior confluence of frontal crests just behind rear margin of orbits; sagittal crest absent; orbit touching dorsal profile; interorbital space slightly concave; eye diameter 4.9 to 6.0 times in head length; interorbital width 1.3to 1.8 times in eye diameter; upper jaw length 2.7to 3.4 times in head length; lateral teeth 20 to 27 in maxillary, 18 to 30 indentary; a few teeth on palatines. Gill rakers 12 to 17. Dorsal-fin elements 78 to 87; anal fin with II spines, second spine flat, triangular, much shorter than distance from its origin to anus, inserted below 37th to 38th dorsal-fin soft ray, 41 to 50 soft rays, posterior 23 to 27 connected by membrane; pelvic fins inserted below eighth to ninth dorsal-fin soft ray, less than eye diameter behind posterior end of pectoral-fin base; caudal fin lunate, its span less than length of upper caudal-fin lobe. Pyloric. caeca 16 to 18. Vertebrae total 84 to 93, including 32 to 37 precaudal and 48 to 57 caudal. **Colour:** Body black or brown with a silvery shine along abdomen.

Geographical Distribution: Eastern Pacific Ocean from Cape Kiwanda, Oregon (45°N) to Gulf of California and from 5°N to southern Peru (Fig. 183).

Habitat and Biology: Benthopelagic from 175 to 500 m, juveniles epipelagic at upper 150 m. Apparently schooling species. Feeds on euphausiids and small fishes, including *Engraulis mordax* and juvenile *Merluccius productus*. Attains a length of 80 to 90 cm at 11 to 18 years (Fitch and Gotshall, 1972).

Size: Maximum 102 cm standard length and 1.4 kg.

Interest to Fisheries: No special fishery for this species, but a catch of 1 360 kg was once taken by otter trawl at 250 m off Newport Beach, California.

Local Names: USA: Black scabbardfish.

Literature: Fitch and Lavenberg (1968, as ***L. xantusi***); Fitch and Gotshall (1972, as ***L. xantusi***); Chirichigno (1974, as ***L. xantusi***); Hubbs et al. (1979, as ***L. xantusi***); Mikhailin (1982, as ***L. xantusi***).

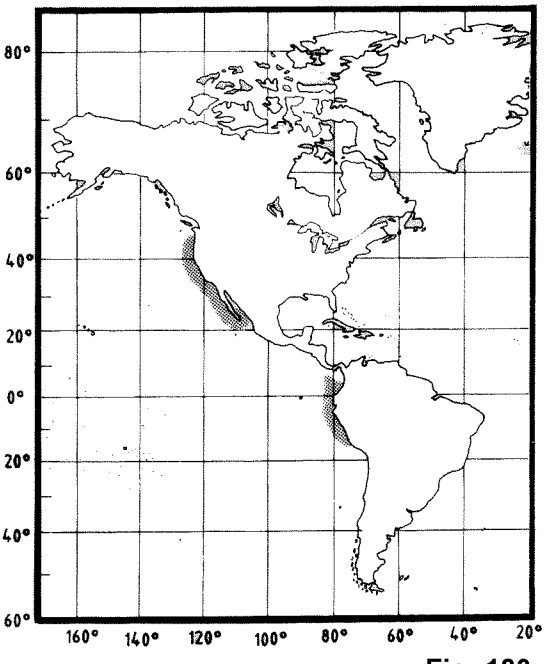


Fig. 183

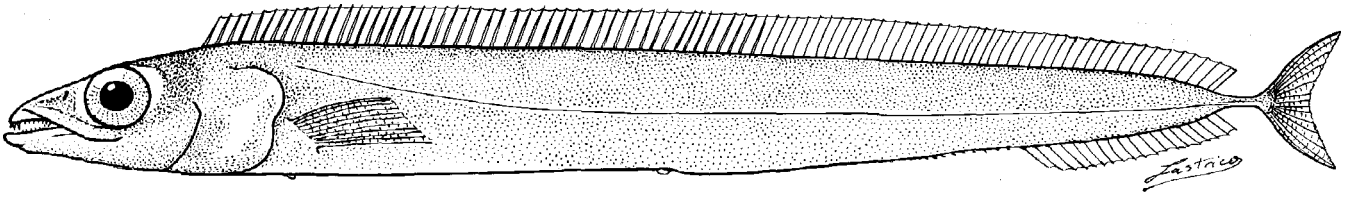
Remarks: Northern and southern populations of *L.fitchi* differ in number of vertebrae, dorsal- and anal-fin soft rays (see Mikhailin, 1982; Rosenblatt and Wilson, 1987) and may warrant taxonomic recognition.

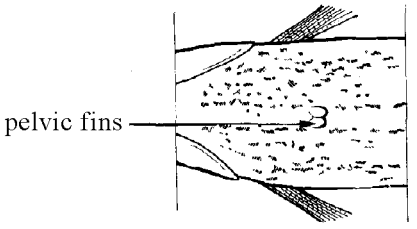
Lepidopus manis Rosenblatt and Wilson, 1987 Fig. 184 **TRICH Lepid 5**

Lepidopus manis Rosenblatt and Wilson, 1987:344, fig. 5 (Isla Isabela, Galapagos Islands).

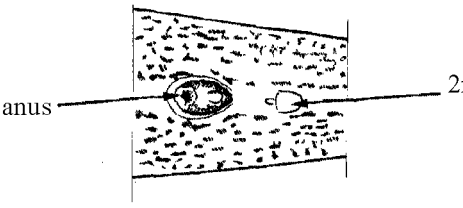
Synonyms: None.

FAO Names: En - Ghost scabbardfish; **Fr** - Poisson sabre fantôme; **Sp** - Pez cinto fantasma.





VENTRAL VIEW



VENTRAL VIEW

Fig. 184 ***Lepidopus manis*** (adapted from Rosenblatt and Wilson, 1987)

Field Characters: Body light tan, head uniformly brown.Caudal-fin span greater than length of upper caudal-fin lobe.

Diagnostic Features: Body moderately elongate and strongly compressed; body depth 9.1 times in standard length. Head length 4.2 times in standard length; snout length 3.0 times in head length; upper head profile slightly convex, rising gently from tip of snout to dorsal-fin origin; posterior confluence of frontal ridges just behind rear margin of orbits; sagittal crest absent; orbits entering dorsal profile; interorbital space slightly concave; eye diameter 3.9 times in head length; interorbital width 1.8 times in eye diameter; upper jaw length 2.7 times in head length; lateral teeth 29 in maxillary, 26 in dentary; no palatine teeth. Gill rakers 24. Dorsal-fin elements 89; anal fin with II spines, second spine flat, plate-like, much shorter than the distance between its origin to anus, 50 soft rays, posterior 24 connected by membrane; pelvic fins inserted with a distance less than eye diameter behind posterior end of pectoral-fin base; caudal fin lunate, its span greater than length of upper caudal-fin lobe. Vertebrae total 94, including 37 precaudal and 57 caudal. **Colour:** Body light tan, head uniformly brown.

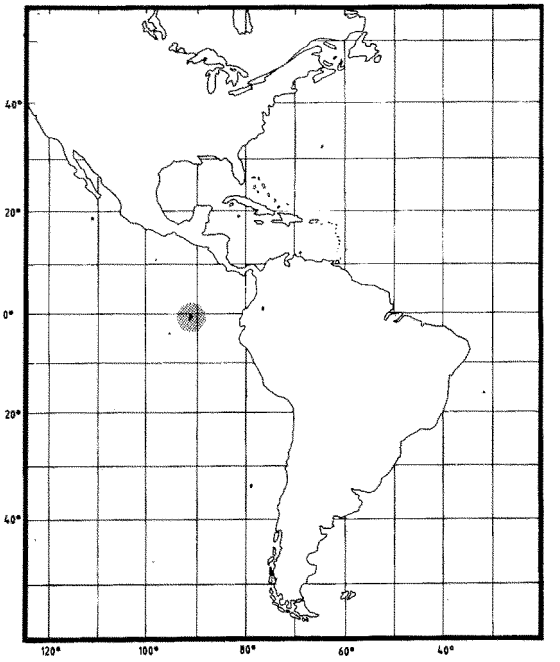


Fig. 185

Geographical Distribution: Isla Isabela, Galapagos Islands (Fig. 185).

Habitat and Biology: Unknown (holotype found dead in a cove).

Size: 69 cm standard length (species known only from holotype).

Interest to Fisheries: No data available.

Local Names:

Lepturacanthus Fowler, 1905

TRICH Lept

Lepturacanthus (subgenus of ***Trichiurus)*** Fowler, 1905:770. Type species, ***Trichiurus savala*** Cuvier, 1829, by original designation (also monotypic).

Synonyms: None.

Diagnostic Features: Body elongate and remarkably compressed. Anteriormost fang of upper jaw very long, coming out through a small slit on ventral side of lower jaw; lower hind margin of gill cover concave. Anal-fin soft rays pungent spinules; pectoral fins fairly long, extending above lateral line; pelvic fins completely absent; caudal fin absent, posterior part of body tapering to a point.

Biology, Habitat and Distribution: Benthopelagic mostly on continental shelf, comes often close to surface at night. Feeds on a wide variety of small coastal fishes, squid and crustaceans. Known from Indo-West Pacific waters.

Interest to Fisheries: Caught with shore seines, bag nets and small bottom trawls in many Asian countries, mainly mixed with other coastal fish.

Species: Two species recognized so far.

Key to Species of *Lepturacanthus*:

1a. Snout rather short, its length about 3 times in head length; eye large, its diameter 5 to 7 times in head length; distance between eye and upper jaw (suborbital length) about half of eye diameter; dorsal-fin elements 123 to 133 ..... ***L. pantului***

1b. Snout long, its length about 2 to 2.5 times in head length; eye small, its diameter 7 to 9 times in head length; distance between eye and upper jaw (suborbital length) slightly smaller than eye diameter; dorsal-fin elements 113 to 123 ..... ***L. savala***

Lepturacanthus pantului (Gupta, 1966)

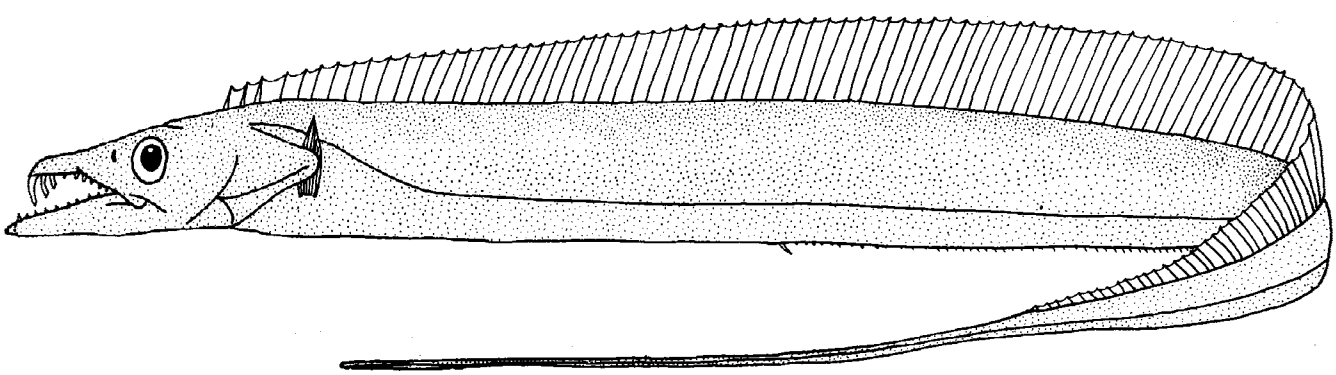
Fig. 186

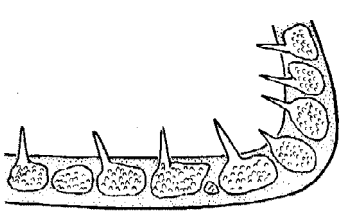
TRICH Lept 1

Trichiurus pantului Gupta, 1966:170-171 (Parganas District, west Bengal, India).

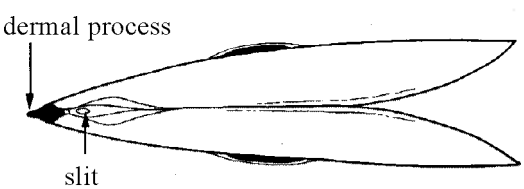
Synonyms: None.

FAO Names: En - Coromandel hairtail; **Fr** - Poisson sabre bécune; **Sp** - Pez sable coromandélico.





FIRST GILL ARCH



VENTRAL VIEW OF HEAD

Fig. 186 ***Lepturacanthus pantului***

Field Characters: Snout short, its length about 3 times in head length. Eye large, its diameter about 5 to 7 times in head length. Suborbital space about half as large as eye diameter.

Diagnostic Features: Body extremely elongate and strongly compressed, ribbon-like, gradually tapering to a point. Snout short, its length about 3 times in head length; mouth large with a dermal process at tip of each jaw; lower hind margin of gill cover concave; eye large, its diameter about 5 to 7 times in head length, suborbital space about half as large as eye; 3 (sometimes 4) fangs with barbs and 2 smaller forward directed canine teeth present in upper jaw; anteriormost fang very long, coming out through a small slit on ventral side of lower jaw. A single, long-based, dorsal fin with III spines and 120 to 131 soft rays; anal fin reduced to a long spine and 74 to 84 smaller spinules, breaking through the skin, the anteriormost fairly long, situated below 36th to 40th dorsal-fin soft ray; pectoral fins slightly shorter than snout, with I spine and 10 or 11 soft rays; pelvic and caudal fins absent. Lateral line nearer ventral contour than dorsal contour of body. **Colour:** In fresh specimens, body steely blue with metallic reflections, becoming silvery grey after death; tapering part black; margin of anus black; usually margin of dorsal fin, inside of opercle and anterior part of shoulder girdle, jet black.

Geographical Distribution: Known from Hooghly estuaries to Gulf of Mannar in the east coast of India (Fig. 187).

Habitat and Biology: Benthopelagic (or pelagic), estuaries and coastal waters from surface to the depths of about 80 m. Feeds on a wide variety of small fishes and crustaceans (chiefly on prawns, young clupeoids, *Harpodon nehereus* and *Trichiurus* spp. in Hooghly estuaries, India).

Size: Maximum 92 cm total length, common 20 to 60 cm.

Interest to Fisheries: In the east coast of India, caught mainly with bag nets in estuaries, with shore seines and boat seines in inshore waters, and with trawls in off-shore waters. Marketed fresh as well as dried salted.

Local Names:

Literature: Gupta (1966, 1967, 1968); Nakamura (1984a).

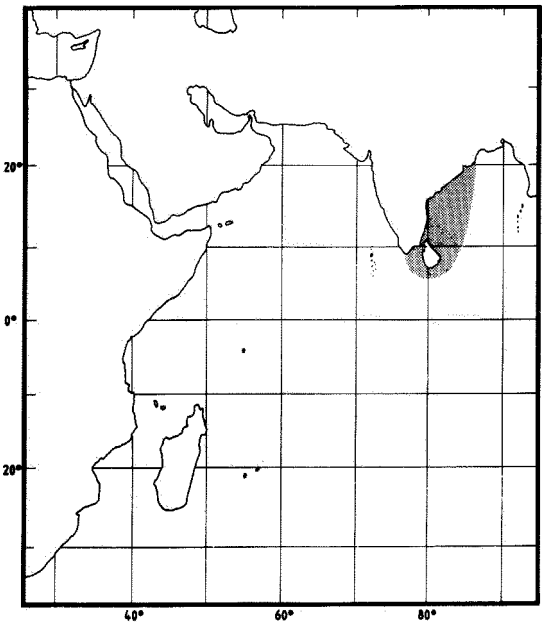


Fig. 187

Lepturacanthus savala (Cuvier, 1829) Fig. 188 **TRICH Lept 2**

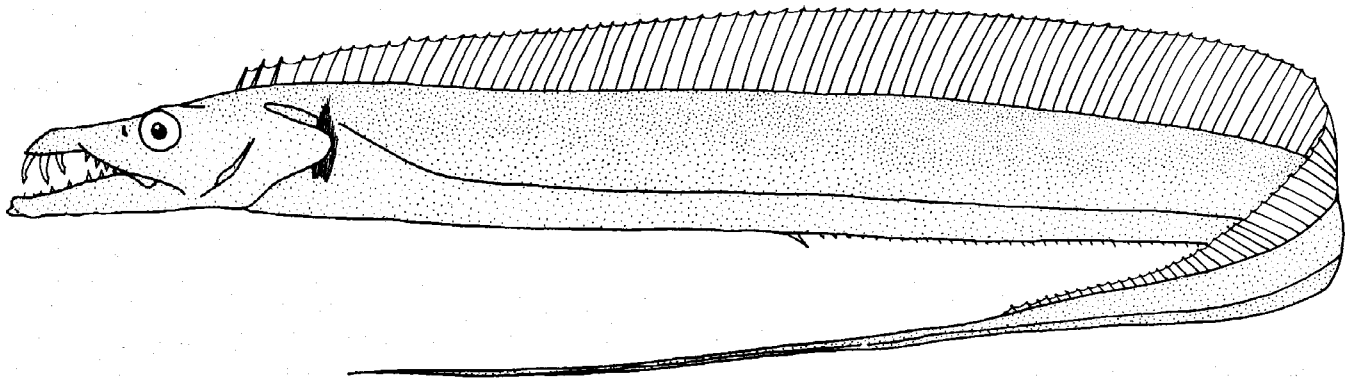
Trichiurus savala Cuvier, 1829:219 ("Mer des Indes"= Bombay and Malabar district, India).

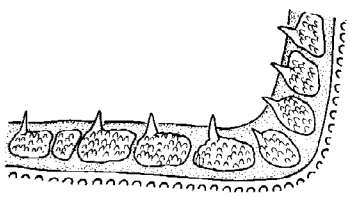
Synonyms: ***Trichiurus armatus*** Gray, 1831. ***Trichiurus roelandti*** Bleeker, 1860.

FAO Names: En - Savalani hairtail; **Fr** - Poisson sabre cimeterre; **Sp** - Pez sable savalai.

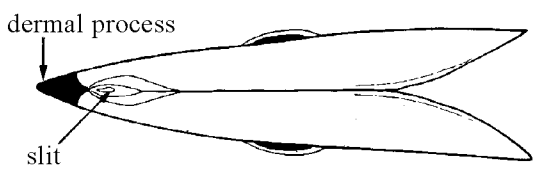
Field Characters: Snout long, its length 2 to 2.5 times in head length. Eye small, its diameter about 7 to 9 times in head length and slightly longer than suborbital space.

Diagnostic Features: Body extremely elongate and strongly compressed, ribbon-like, tapering to a point (caudal tapering part very long). Snout long about 2 to 2.5 times in head length; eye small, its diameter about 7 to 9 times in head length and slightly longer than suborbital space; mouth very large with a dermal process at tip of each jaw; 2 or 3 (mostly 3) fangs with barbs and 2 small forward directed canine teeth present in upper jaw, anteriormost fangs (usually without barbs) present at tip of lower jaw. Lower hind margin of gill cover concave. A single, long-based, dorsal fin with III or IV spines and 110 to 120 soft rays; anal fin reduced to small spinules (about 75) breaking through skin, the anteriormost fairly long, its origin situated below 36th to 39th soft dorsal-fin ray: pectoral fins slightly shorter than snout, with I spine and 10 soft rays; pelvic and caudal fins absent. Lateral line nearer ventral than dorsal contour of body. **Colour:** In fresh specimens, body steely blue, with metallic reflections, tapering part white; margin of anus pale; usually margin of caudal-fin membrane white; tip of both jaws black; inside of opercle and anterior part of shoulder girdle, pale black.





FIRST GILL ARCH



VENTRAL VIEW OF HEAD

Fig.188 *Lepturacanthus savala*

Geographical Distribution: Indo-West Pacific: from India and Sri Lanka to Malaysia,Singapore, Indonesia, Philippines, Thailand, China, New Guinea, and northern Australia (Fig. 189).

Habitat and Biology: Benthopelagic, in coastal waters down to about 100 m depth, often comes near surface at night. Feeds on a wide variety of small fishes and crustaceans (chiefly on prawns and species of *Setipinna, Anchoviella, Harpodon, Trichiurus* etc. in Hooghly estuaries, India).

Size: Maximum 100 cm, common 30 to 70 cm total length.

Interest to Fisheries: Caught mainly with shore seines, bag nets and coastal bottom trawls in Asian countries. Marketed fresh as well as dried salted.

Local Names: AUSTRALIA: Spiny hairtail; MALAYSIA: Selayur, Timah; SRI LANKA: Smallheaded ribbonfish, Savalai.

Literature: Tucker (1956); James (1961, 1967); Gupta (1967, 1968); Nakamura (1984a).

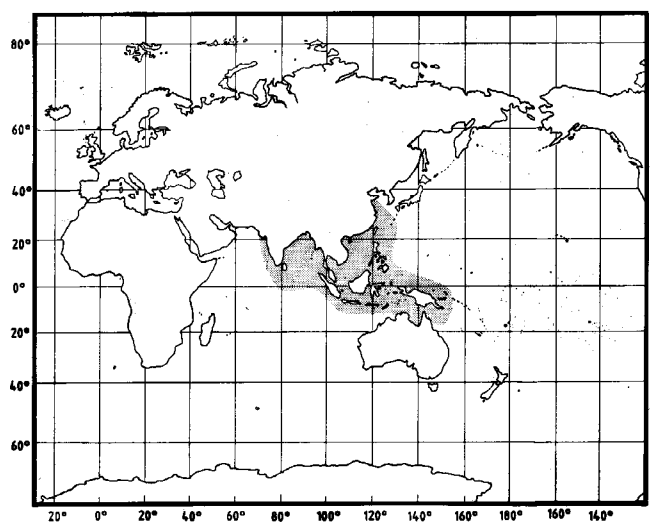


Fig. 189

Tentoriceps Whitley, 1948

TRICH Tent

Tentoriceps Whitley, 1948:94. Type species, ***Trichiurus cristatus*** Klunzinger, 1884, by original designation (also monotypic).

Synonyms: ***Pseudoxymetopon*** Chu and Wu, 1962.

Diagnostic Features: See species.

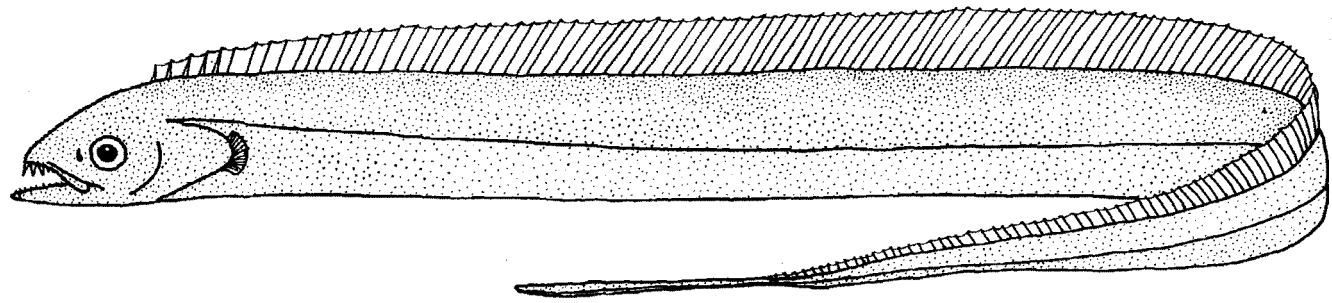
Species: Only one species recognized so far.

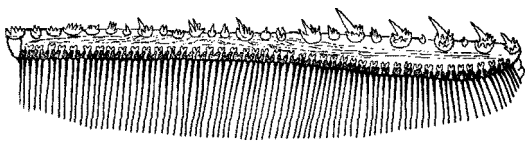
Tentoriceps cristatus (Klunzinger, 1884) Fig. 190 **TRICH Tent 1**

Trichiurus cristatus Klunzinger, 1884:120, pl. 13, fig. 5a (Kosseir, Red Sea coast of Egypt).

Synonyms: ***Pseudoxymetopon sinensis*** Chu and Wu, 1962.

FAO Names: En - Crested hairtail; **Fr** - Poisson sabre manchot; **Sp** - Pez sable cuchilla.





FIRST GILL ARCH

pelvic fins reduced to scale-like processes

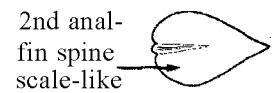


Fig. 190 ***Tentoriceps cristatus***

Field Characters: Pectoral fins short, not reaching lateral line. Pelvic fins reduced to scale-like process.

Diagnostic Features: Body extremely elongate and strongly compressed, ribbon-like, tapering to a point. Dorsal profile of head evenly convex; mouth large with a dermal process at tip of each jaw; lower hind margin of gill cover convex; eye very large situated laterally, its diameter 5 or 6 times in head length; 2 or 3 fangs in upper and 2 fangs in lower jaw, a single series of sharp compressed lateral teeth in both jaws. A single, long-based, dorsal fin with V spines and 126 to 144 soft rays; anal fin represented by I minute first spine and I scale-like second spine, situated below 47th to 50th soft dorsal-fin ray, reduced to minute spinules buried in skin thereafter; pectoral fins short, not reaching lateral line; pelvic fins present but reduced to scale-like processes; caudal fin absent, posterior part of body tapering to a point. Lateral line running almost straight mid-lateral, or slightly nearer ventral than dorsal contour. **Colour:** In fresh specimens, body silvery white becoming silvery grey with dark cloud-like patches after death; each jaw, dorsal and anal-fin bases sooty.

Geographical Distribution: Indo-West Pacific: Red Sea, Mozambique channel, Saya- de Malha Bank, Chagos Islands, Andaman Sea, Northwest and North Australia, South China Sea, East China Sea, Tasman Sea, Philippines and southern Japan (Fig. 191).

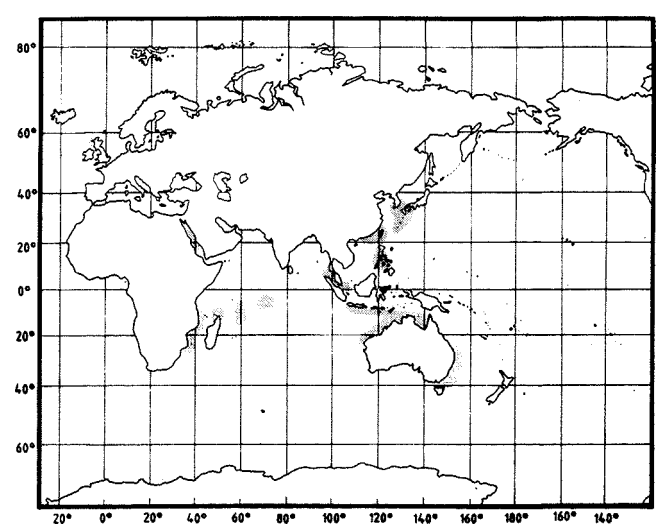


Fig. 191

Habitat and Biology: Benthopelagic or pelagic, lives in coastal waters from 30 to 110 m depth, not found in low salinity waters. Feeds mainly on small fish, squid and crustaceans.

Size: Maximum 90 cm total length, common 30 to 70 cm.

Interest to Fisheries: Caught mainly with bottom trawls and sometimes with bag nets, mixed with other trichiurids in southeast Asian countries. Marketed fresh and dried salted in the Philippines.

Local Names: JAPAN: Kanmuri-dachi; PHILIPPINES: Crested hairtail.

Literature: Tucker (1956); Senta (1975, 1977); Parin and Mikhailin (1982b); Nakamura (1984a,b); Gloerfelt-Tarp and Kailola (1984); Sainsbury et al. (1985).

Trichiurus Linnaeus, 1758

TRICH Trich

Trichiurus Linnaeus, 1758:246. Type species, *Trichiurus Lepturus* Linnaeus, 1758, by monotypy

Synonyms: *Enchelyopus* Bleeker, 1862. *Lepturus* Gill, 1863.

Diagnostic Features: Body elongate and remarkably compressed. Lower hind margin of gill cover concave. Anal-fin soft rays mostly buried in skin; pectoral fins fairly long, extending above lateral line; pelvic fins absent; caudal fin absent, posterior part of body tapering to a point.

Biology,Habitat and Biology: Benthopelagic, on continental shelf and slope. Feeds on fish, squid and crustaceans. Generic distribution being tropical and temperate waters worldwide for *T. Lepturus* and off Indian Ocean for the other two species.

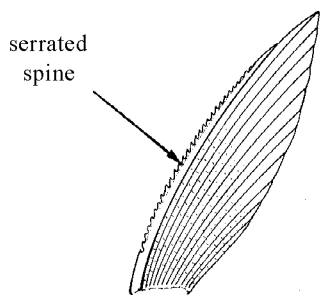
Interest to Fisheries: *T. Lepturus* is a commercially important species worldwide, and the other two species are occasionally caught in local fisheries in India.

Species: Three species recognized so far (Nakamura, 1984a). *T. Lepturus* seems to be composed of various local populations which have been evaluated by some author as species or subspecies. We follow Tucker (1956) who recognized only one single species for *T Lepturus.*

Illustrated Key to Species of *Trichiurus*:

1a. Pectoral-fin spine serrated: first anal-fin spine situated below about 36th soft dorsal-fin soft ray (Fig. 192) ..... *T. gangeticus*

1b. Pectoral-fin spinenot serrate; first anal-fin spine situated below 39th to 41st soft dorsal-fin soft ray ..... → *2*



PECTORAL FIN

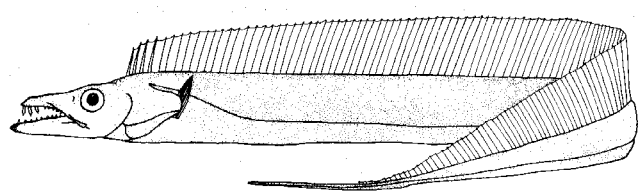


Fig. 192 *Trichiurus gangeticus*

2a. Fangs on jaws with barbs; dorsal-fin elements more than 130 (Fig. 193) ..... *T. Lepturus*

2b. Fangs on jaws without barbs; dorsal-fin elements less than 120 (Fig. 194) ..... *T. auriga*

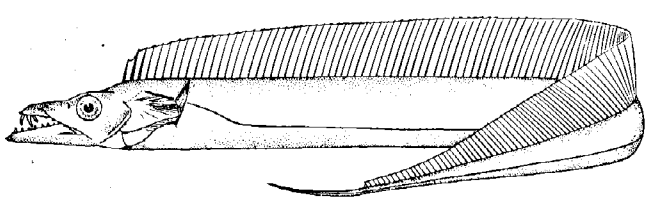


Fig. 193 *Trichiurus lepturus*

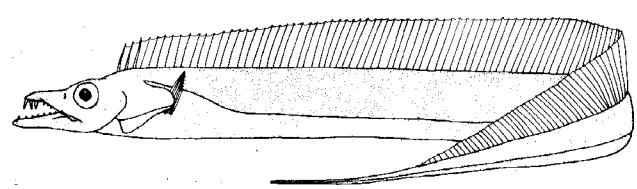


Fig. 194 *Trichiums auriga*

Trichiurus auriga Klunzinger, 1884 | Fig. 195 | **TRICH Trich 2**

Trichiurus auriga Klunzinger, 1884:120, pl. 12, fig. 1 (Kossier, Red Sea coast of Egypt).

Synonyms: None.

FAO Names: En - Pearly hairtail; **Fr** - Poisson sabre brochet; **Sp** - Pez sable perla.

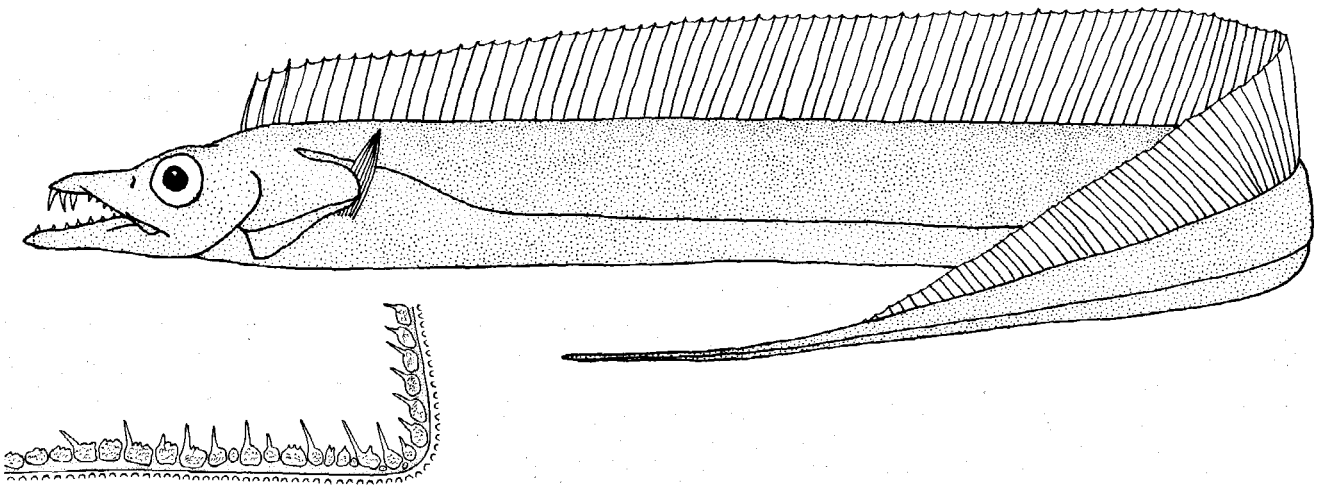


Fig. 195 *Trichiurus auriga*

Field Characters: Anterior margin of pectoral-fin spine not serrated. Anal-fin origin situated below 40th or 41st dorsal-fin soft ray. Fangs on both jaws without barbs.

Diagnostic Features: Body extremely elongate and strongly compressed, ribbon-like, tapering to a point; distance from snout to anus about 2/5 of standard length. Mouth very large, with a small dermal process at tip of each jaw; lower hind margin of gill cover concave; eye very large, its diameter 5.5 to 7 times in head length; 2 or 3 pairs and one pair of fangs without barbs in upper and lower jaws, respectively; a single series of sharp, compressed lateral teeth in both jaws; minute teeth on palatines. Dorsal-fin base long and fin rather low, without a notch between the spinous and soft parts, with III spines and 106 to 113 soft rays; anal fin reduced to about 80 spinules slightly breaking skin (its origin situated below 40th or 41st dorsal-fin soft ray); pectoral fins about as long as snout, with I spine and 9 soft rays; pelvic and caudal fins absent. Lateral line originating at upper margin of gill cover, running obliquely to behind tip of pectoral fins, then straight to ventral contour of body. **Colour:** Fresh specimens are pearl white and slightly dusky dorsally; margins of dorsal and anal fins dusky in formalin.

Geographical Distribution: Indian Ocean: Red Sea, off west coast of India and Timor Sea (Fig. 196).

Habitat and Biology: Benthopelagic, in deep waters ranging from 250 to 350 m depth off Kerala and Tamil Nadu, India. Feeds on deep water shrimps and small fishes like myctophids.

Size: Maximum 35 cm total length, common 15 to 30 cm.

Interest to Fisheries: No special fishery for this species. Caught with deep water trawls mixed together with other commercially important fish as by-catch.

Local Names:

Literature: Silas and Rajagopalan (1974); Nakamura (1984a).

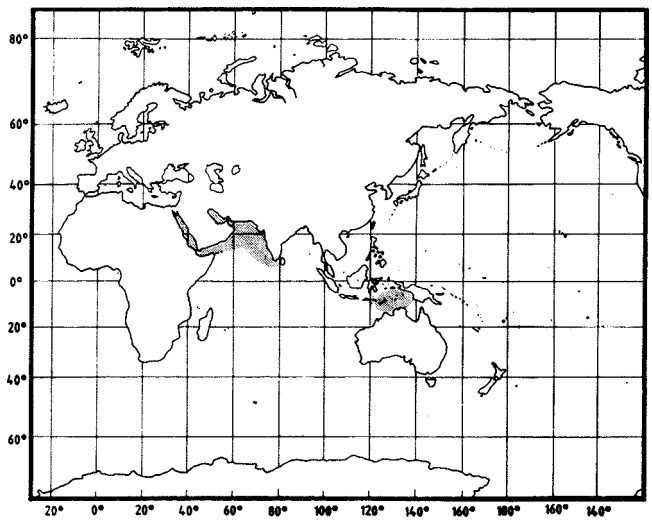


Fig. 196

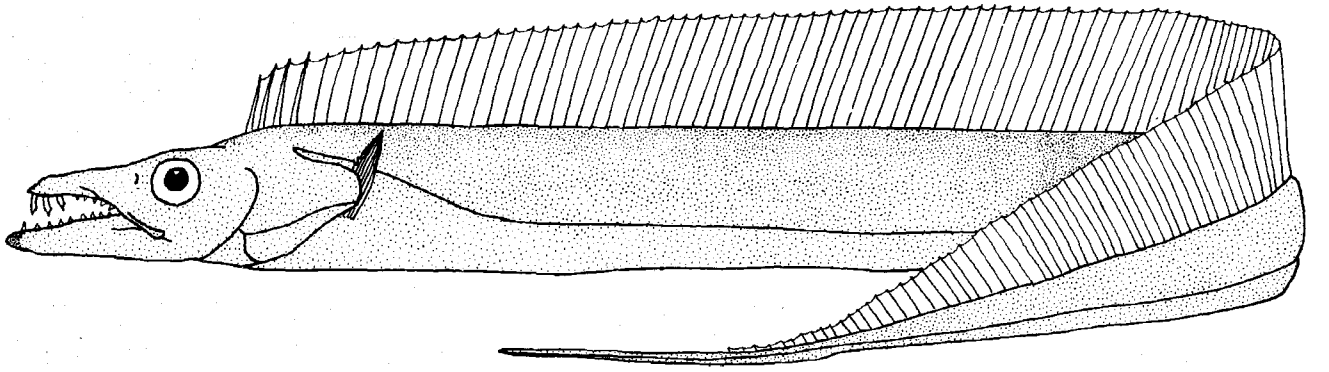
Remarks: This species has long been synonymized with *Trichiurus Lepturus.* Silas and Rajagopalan (1974) recognized this species as distinct.

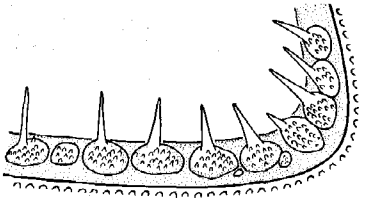
Trichiurus gangeticus Gupta, 1966 | Fig. 197 | **TRICH Trich 3**

Trichiurus gangeticus Gupta, 1966:169-170 (Parganas District, West Bengal, India).

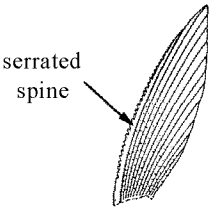
Synonyms: ***Lepturacanthus serratus*** Dutt and Thankam, 1966.

FAO Names: En - Ganges hairtail; **Fr** - Poisson sabre du Gange; **Sp** - Pez sable del Ganges.





FIRST GILL ARCH



PECTORAL FIN

Fig. 197 *Trichiurus gangeticus*

Fields Characters: Anterior margin of pectoral-fin spine serrated. Anal-fin origin situated below about 36th dorsal-fin soft ray. Fangs on both jaws with barbs.

Diagnostic Features: Body extremely elongate and strongly compressed, ribbon-like, tapering to a point. Mouth very large, with a dermal process at tip of each jaw; lower hind margin of gill cover concave; eye very large, situated dorsally, its diameter 6 or 7 times in head length; 2 or 3 pairs and one pair of fangs with barbs near tip of upper and lower jaws, respectively; a single series of sharp, compressed lateral teeth in both jaws. A single long-based dorsal fin, with IV spines and 116 to 129 soft rays; anal fin reduced to about 85 minute spinules, slightly breaking through skin, its origin situated below about 36th dorsal-fin soft ray; pectoral fins about as long as snout with I serrated spine and 10 or 11 soft rays; pelvic and caudal fins absent. Lateral line nearer ventral Contour than dorsal contour of body, rising toward dorsal profile only anteriorly. **Colour:** Fresh specimens bright silvery white with semi-transparent dorsal- and anal-fin membranes; body becomes darker in formalin.

Geographical Distribution: Distributed in east coast of India from Hooghly estuaries to Gulf of Mannar (Fig. 198).

Habitat and Biology: Benthopelagic to pelagic, in coastal waters and estuaries, comes often near surface at night. Feeds on a wide variety of small fish and crustaceans.

Size: Maximum 50 cm as far as known total length, common 20 to 40 cm.

Interest to Fisheries: Caught mainly with shore seines, bag nets and coastal bottom trawls, mixed with other trichiurids in catches on the east coast of India. Marketed fresh as well as dried salted, mixed with other trichiurids.

Local Names:

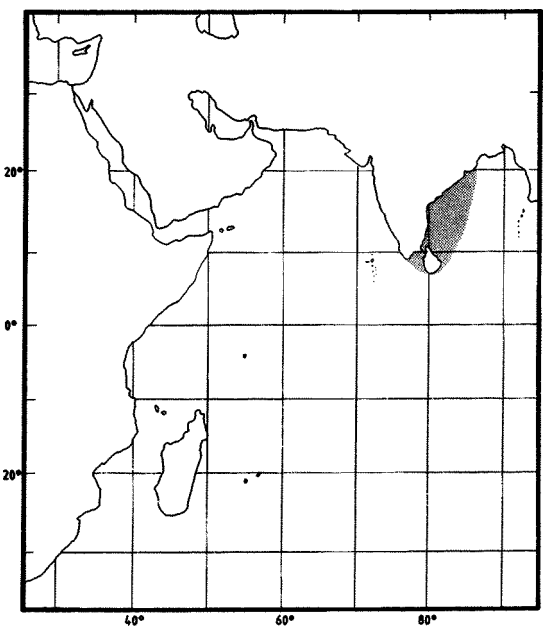


Fig. 198

Literature: Gupta (1967); Nakamura (1984a).

Trichiurus lepturus Linnaeus , 1758	Fig. 199	TRICH Trich 1

Trichiurus Lepturus Linnaeus, 1758:246 (South Carolina, North America).

Synonyms: *Clupea haumela* Forsskål, 1775. *Trichiurus lepturus japonicus* Temminck and Schlegel, 1844. *Trichiurus coxii* Ramsay and Ogilby, 1887. *Trichiurus nitens* Garman, 1899.

FAO Names: En - Largehead hairtail; **Fr** - Poisson sabre commun, **Sp** - Pez sable.

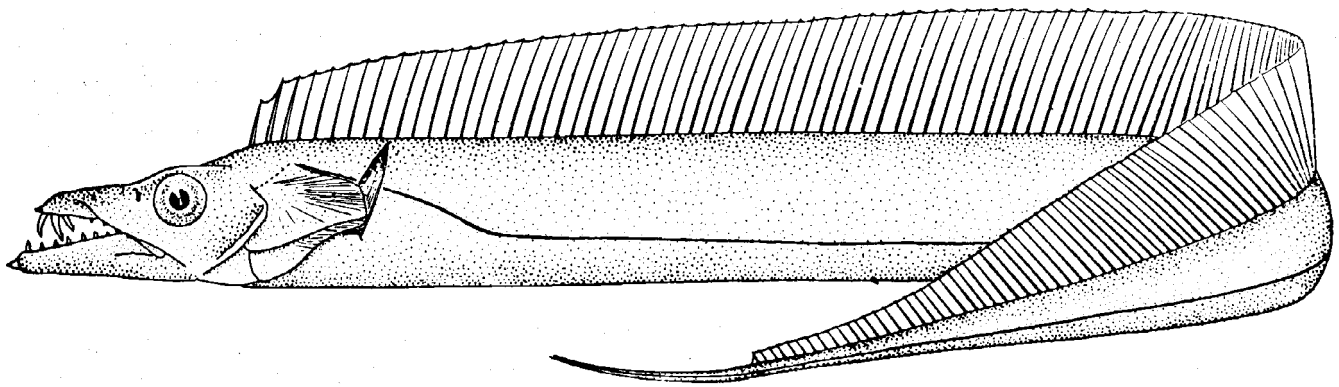


Fig. 199 *Trichiurus lepturus*

Field Characters: Anterior margin of pectoral-fin spine not serrated. Anal-fin origin situated below 39th to 41st dorsal-fin soft ray. Fangs in both jaws with barbs.

Diagnostic Features: Body extremely elongate and strongly compressed, ribbon-like, tapering to a point (tip often broken); position of anus nearer snout than posterior tip of body (preanal length about 2/5 of standard length). Mouth large, with a dermal process at tip of each jaw; lower hind margin of gill cover, concave; eye large, its diameter 5 to 7 times in head length; 2 or 3 pairs of enlarged fangs with barbs nearer tip of upper jaw and another pair near tip of lower jaw; a single series of sharp, compressed lateral teeth (often also fang-like in larger specimens) in both jaws; minute teeth on palatines. Dorsal fin rather high and long, without a notch between the spinous and soft parts, with III spines and 130 to 135 soft rays; anal fin reduced to about 100 to 105 minute spinules, usually embedded in the skin or slightly breaking through, its origin situated below 39th to 41st dorsal-fin soft ray; pectoral fins medium-sized, about as long as snout, with I spine and 11 to 13 soft rays; pelvic and caudal fins absent. Lateral line beginning at upper margin of gill cover, running oblique to behind tip of pectoral fins, then straight close to ventral contour. Scales absent on body. Excess ossification of supraoccipital, interhaemal and interneural bones often seen in specimens from Indian waters. **Colour:** Fresh specimens steel blue with silvery reflection, pectoral fins semi-transparent, other fins sometimes tinged with pale yellow; the colour becomes uniform silvery grey sometime after death.

Geographical Distribution: Throughout tropical and temperate waters of the world (Fig. 200).

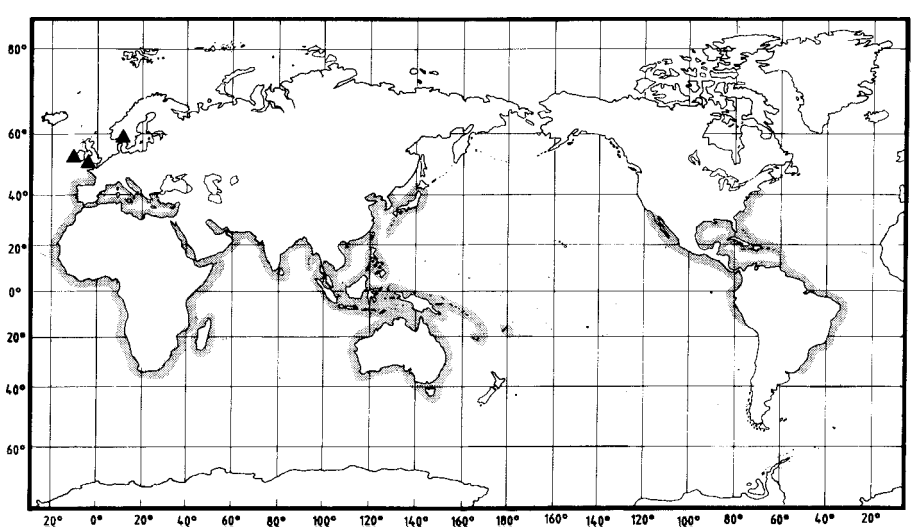


Fig. 200

Habitat and Biology: Benthopelagic, continental shelf to 350 m depth (from 55 to 385 m in the eastern Pacific), occasionally in shallow waters and at surface at night. Young and immature fish feed mostly on euphausiids, small pelagic planktonic crustaceans, such as *Paracalanus, Acartia, Oncaea* etc., and small fishes (anchovies, bregmacerotids etc.). Adults become more piscivorous and feed on anchovies, sardines, myctophiids, bregmacerotids, carangoids, sphyraenids, atherinids, sciaenids, *Scomber, Trichiurus* etc. and occasionally on squid and crustaceans. Adults and juveniles have. opposing complementary vertical diurnal feeding migration. Juveniles and small adults form schools about 100 m above the bottom during daytime and form loose feeding aggregations at night-time near the surface where they prey on planktonic organisms. Large adults feed on pelagic prey near the surface during daytime and migrate to the bottom at night.

In the Sea of Japan, this species matures at 2 years old at a size of about 30 cm preanal length in females and 28 cm in males. Some individuals of both sexes also mature at age 1 (Shiokawa, 1988). Egg production at 45 cm preanal length is estimated at about 130 000 over the entire spawning season around the central part of the Sea of Japan. Eggs are pelagic, have a diameter of 1.59 to 1.88 mm, and hatch after 3 to 6 days at a size of 5.5 to 6.5 mm total length. The spawning season is from April to August with a peak in June in the East China Sea, from July to October with a peak of September in Suruga Bay, from April to October with a peak in June in the Kii Channel, from May to November off the Kii Peninsula, and from June to October with a peak in July and August in the central part of the Sea of Japan (Shiokawa, 1988).

Shiokawa (1988) estimated the age at preanal length of this species in the Sea of Japan based on otolith readings. Females: 1 year at 24 cm, 2 years at 30 cm, 3 years at 34 cm, 4 years at 37 cm, 5 years at 40 cm, 6 years at 41 cm. Males: 1 year at 23 cm, 2 year at 28 cm, 3 year at 31 cm, 4 year at 33 cm, 5 year at 34 cm, 6 year at 35 cm. For the Californian population Fitch and Gotshall (1972) estimated the age of a 83 cm total length male as 4 years and the age of a 112 cm total length female as 7 years. Migration of this species is considered to be carried out between the wintering grounds in the East China Sea and the spawning grounds in the Yellow Sea (Misu, 1961). In the Sea of Japan, the wintering grounds is situated in the coastal waters, mostly on the continental shelf (Shiokawa, 1988).

Size: Maximum 120 cm total length, common from 50 to 100 cm.

Interest to Fisheries: Caught mainly with bag nets in estuaries, with trolling, shore seines, boat seines, set nets and bottom or midwater longlines in inshore waters, and with bottom trawls in offshore waters throughout the world. The most important commercially caught trichiurid or gempylid with an annual catch of 752 711 t in 1990. About 85% of the catches reported are taken from FAO Fishing Area 61, and around 60% of the total yield is taken by China. For more information about fisheries statistics see section 1.2. Excellent taste for fish fry and various kinds of grills and for sashimi (sliced raw meat prepared with soysauce and horse raddish) when fresh.

Local Names: AUSTRALIA: Australian hair-tail; CANADA: Cutlassfish; FRANCE: Sabre; JAPAN: Hakuio, Hakuuo, Hakunagi, Hakuyo, Hiragatana, Katana, Saabera, Sawaberu, Shiraga, Tabinohimo, Tachiuo, Tachi, Tachio, Tachuo, Tachiio, Tachinoiyu, Tachinuiyu, Tachinja, Tachinouo, Tachinoyo; MALAYSIA: Selayar, Timah; RUSSIA: Sablja ryba; SPAIN: Espada, Sable, Savola; SRI LANKA: Largeheaded ribbonfish; KOREA: Mae-dom-gwa; UK: Cutlassfish, Hairtail; USA: Cutlassfish.

Literature: Tucker (1956); James (1961); Gupta (1967); Franca (1969); Fitch and Gotshall (1972); Nakamura (1981, 1984a,b); Mikhailin (1982); Gloerfelt-Tarp and Kaiola (1984); Sainsbury et al. (1985); Parin (1986, 1990c); Shiokawa (1988); Ochiai and Tanaka (1988).

Remarks: ***Trichiurus japonicus*** was originally described by Temminck and Schlegel (1844) from Japan as ***Trichiurus lepturus japonicus,*** and synonymized with ***Trichiurus lepturus*** Linnaeus by Tucker (1956). Two forms referable to the genus ***Trichiurus*** are recently recognized in Okinawa, Japan, and Dr. Tetsuo Yoshino of the University of the Ryukyus and I. Nakamura are currently studying these forms with respect to the validity of ***Trichiurus japonicus.*** Another nominal species synonymized with ***T. lepturus*** is ***Trichiurus nitens*** Garman, 1899 from the eastern Pacific Ocean (California to Peru) (Tucker, 1956). This form differs from all other populations of ***T. lepturus*** in having fewer numbers of dorsal-fin soft rays (116 to 128 versus 136 to 142) and vertebrae (141 to 158 versus 162 to 170), and is considered as a valid species by Hubbs and Hubbs (1941) and many subsequent authors, including most recently by Mikhailin (1982).

3. LIST OF NOMINAL SPECIES OF TRICHIUROIDEA

The following list gives information (horizontally) in the order (i) the scientific name as it originally appeared, in alphabetical order according to the specific name; (ii) the author or author(s) - Cuvier (1829) = in Cuvier and Valenciennes is abbreviated in Cuv. and Val.; (iii) date of publication; and (iv) present identification.

NOMINAL SPECIES	CORRECT NAME

3.1 NOMINAL SPECIES OF GEMPYLIDAE

Thyrsites acanthoderma Lowe, 1839	*Ruvettus pretiosus*
Thyrsites altivelis Richardson, 1839	*Thyrsites atun*
Paradiplospinus antarcticus Andriashev, 1960	*Paradiplospinus antarcticus*
Rexea antefurcata Parin, 1989	*Rexea antefurcata*
Dicrotus armatus Günther, 1860	*Promethichthys prometheus*
Prometheus atlanticus Lowe, 1838	*Promethichthys prometheus*
Scomber atun Euphrasen, 1791	*Thyrsites atun*
Thyrsites ballieui Sauvage, 1882	*Promethichthys prometheus*
Thyrsites bengalensis Alcock, 1894	*Rexea bengalensis*
Rexea brevilineata Parin, 1989	*Rexea brevilineata*
Xenogramma carinatum Waite, 1904	*Lepidocybium flavobrunneum*
Thyrsites chilensis Cuvier in Cuv. and Val., 1832	*Thyrsites atun*
Gempylus coluber Cuvier in Cuv. and Val., 1831	*Gempylus serpens*
Scomber dentatus Bloch and Schneider, 1801	*Thyrsites atun*
Scomber dentex Richardson, 1842	*Thyrsites atun*
Cybium flavo-brunneum Smith, 1849	*Lepidocybium flavobrunneum*
Rexea furcifera Waite, 1911	*Rexea solandri*
Lepidopus gracilis Brauer, 1906	*Paradiplospinus gracilis*
Rexichthys johnpaxtoni Parin and Astakhov, 1987	*Rexichthys johnpaxtoni*
Scomber lanceolatus Cuvier in Cuv. and Val., 1832	*Thyrsites atun*
Machaerope latispinus Ogilby, 1899	*Nealotus tripes*
Thyrsites lepidopoides Cuvier in Cuv. and Val., 1831	*Thyrsitops lepidopoides*
Diplogonurus maderensis Noronha, 1926	*Lepidocybium flavobrunneum*
Epinnula magistralis Poey, 1854	*Epinnula magistralis*
Thyrsitoides marleyi Fowler, 1929	*Thyrsitoides marleyi*
Thyrsites micropus McCoy, 1873	*Rexea solandri*
Diplospinus multistriatus Maul, 1948	*Diplospinus multistriatus*
Rexea nakamurai Parin, 1989	*Rexea nakamurai*
Nesiarchus nasutus Johnson, 1862	*Nesiarchus nasutus*
Acinacea notha Bory de Saint-Vincent, 1804	*Gempylus serpens*
Gempylus ophidianus Poey, 1860	*Gempylus serpens*
Epinnula orientalis Gilchrist and von Bonde, 1924	*Neoepinnula orientalis*
Epinnula orientalis americana Grey, 1953	*Neoepinnula americana*
Epinnula orientalis pacifica Grey, 1953	*Neoepinnula orientalis*
Promethichthys pacificus Seale, 1906	*Promethichthys prometheus*
Ruvettus pacificus Jordan and Jordan, 1922	*Ruvettus pretiosus*
Prometheus paradoxus Capello, 1867	*Nesiarchus nasutus*
Dicrotus parvipinnis Goode and Bean, 1896	*Promethichthys prometheus*
Ruvettus pretiosus Coco, 1829	*Ruvettus pretiosus*

Thyrsites prometheoides Bleeker, 1856	*Rexea prometheoides*
Gempylus prometheus Cuvier(in Cuv. and Val., 1832	*Promethichthys prometheus*
Jordanidia raptoria Snyder, 1911	*Rexea prometheoides*
Lepidosarda retigramma Kishinouye, 1926	*Lepidocybium flavobrunneum*
Tongaichthys robustus Nakamura and Fujii, 1983	*Tongaichthys robustus*
Thyrsites scholaris Poey, 1854	*Ruvettus pretiosus*
Gempylus serpens Cuvier, 1829	*Gempylus serpens*
Tetragonurus simplex Lowe, 1834	*Ruvettus pretiosus*
Gempylus solandri Cuvier in Cuv. and Val., 1832	*Rexea solandri*
Scomber splendens Richardson, 1842	*Thyrsites atun*
Mimasea taeniosoma Kamohara, 1936	*Thyrsitoides marleyi*
Rovetus temmincki Cantraine, 1833	*Ruvettus pretiosus*
Lemnisoma thyrsitoides Lesson, 1831	*Gempylus serpens*
Nealotus tripes Johnson, 1865	*Nealotus tripes*
Ruvettus tydemani Weber, 1913	*Ruvettus pretiosus*
Thyrsitops violaceus Bean, 1887	*Nesiarchus nasutus*
Ruvettus whakari Griffin, 1927	*Ruvettus pretiosus*

3.2 NOMINAL SPECIES OF TRICHIURIDAE

Aphanopus acus Maul, 1948	*Aphanopus carbo*
Assurger alexanderi Whitley, 1933	*Assurger anzac*
Evoxymetopon anzac Alexander, 1916	*Assurger anzac*
Lepidopus aomori Jordan and Snyder, 1901	*Benthodesmus tenuis*
Lepidopus argenteus Bonnaterre, 1788	*Lepidopus caudatus*
Scarcina argyrea Rafinesque, 1810	*Lepidopus caudatus*
Benthodesmus atlanticus Goode and Bean , 1896	*Benthodesmus simonyi*
Trichiurus auriga Klunzinger, 1884	*Trichiurus auriga*
Benthodesmus benjamini Fowler, 1938	*Benthodesmus tenuis*
Lepidopus calcar Parin and Mikhailin,1982	*Lepidopus calcar*
Aphanopus carbo Lowe, 1839	*Aphanopus carbo*
Trichiurus caudatus Euphrasen, 1788	*Lepidopus caudatus*
Trichiurus coxii Ramsay and Ogilby, 1887	*Trichiurus lepturus*
Trichiurus cristatus Klunzinger, 1884	*Tentoriceps cristatus*
Lepidopus dubius Parin and Mikhailin, 1981	*Lepidopus dubius*
Lepidopus elongatus Clarke, 1879	*Benthodesmus elongatus*
Benthodesmus elongatus pacificus Parin and Becker, 1970	*Benthodesmus pacificus*
Trichiurus ensiformis Vandelli, 1797	*Lepidopus caudatus*
Lepidopus fitchi Rosenblatt and Wilson, 1987	*Lepidopus fitchi*
Trichiurus gangeticus Gupta, 1966	*Trichiurus gangeticus*
Trichiurus gladius Holten, 1802	*Lepidopus caudatus*
Trichiurus glossodon Bleeker, 1860	*Eupleurogrammus glossodon*
Lepidopus gouanianus Lacepède, 1800	*Lepidopus caudatus*
Clupea haumela Forsskål, 1775	*Trichiurus lepturus*
Eupleurogrammus intermedius Gray, 1831	*Eupleurogramrnus glossodon*
Trichiurus intermedius Gray, 1831	*Eupleurogrammus glossodon*
Aphanopus intermedius Parin, 1983	*Aphanopus intermedius*
Trichiurus lepturus Linnaeus, 1758	*Trichiurus lepturus*

Trichiurus lepturus japonicus Temminck and Schlegel, 1844	*Trichiurus lepturus*
Lepidopus lex Phillips, 1932	*Lepidopus caudatus*
Vandellius lusitanicus Shaw, 1803	*Lepidopus caudatus*
Benthodesmus macrophthalmus Parin and Becker, 1970	*Benthodesmus macrophthalmus*
Trichiurus malabaricus Day, 1865	*Trichiurus lepturus*
Lepidopus manis Rosenblatt and Wilson, 1987	*Lepidopus manis*
Aphanopus microphthalmus Norman, 1939	*Aphanopus microphthalmus*
Aphanopus mikhailini Parin, 1983	*Aphanopus mikhailini*
Aphanopus minor Collett, 1887	*Aphanopus carbo*
Trichiurus muticus Gray, 1831	*Eupleurogrammus muticus*
Benthodesmus neglectus Parin 1976	*Benthodesmus neglectus*
Trichiurus nitens Garman, 1899	*Trichiurus lepturus*
Benthodesmus oligoradiatus Parin and Becker, 1970	*Benthodesmus oligoradiatus*
Trichiurus pantului Gupta, 1966	*Lepturacanthus pantului*
Benthodesmus Papua Parin, 1978	*Benthodesmus papua*
Lepidopus peronii Risso, 1810	*Lepidopus caudatus*
Evoxymetopon poeyi Günther, 1887	*Evoxymetopon poeyi*
Trichiurus savala Cuviei, 1829	*Lepturacanthus savala*
Aphanopus schmidti Saemundsson, 1907	*Aphanopus carbo*
Lepturacanthus serratus Dutt and Thankam, 1966	*Trichiurus gangeticus*
Aphanopus simonyi Steindachner, 1891	*Benthodesmus simonyi*
Pseudoxymetopon sinensis Chu and Wu, 1962	*Tentoriceps cristatus*
Benthodesmus suluensis Parin, 1976	*Benthodesmus suluensis*
Evoxymetopon taeniutus Gill, 1863	*Evoxymetopon taeniatus*
Lepidopus tenuis Günther, 1877	*Benthodesmus tenuis*
Ziphotheca tetradens Montague, 1811	*Lepidopus caudatus*
Benthodesmus tuckeri Parin and Becker, 1970	*Benthodesmus tuckeri*
Benthodesmus vityazi Parin and Becker, 1970	*Benthodesmus vityazi*
Lepidopus xantusi Goode and Bean, 1895	*Lepidopus caudatus*

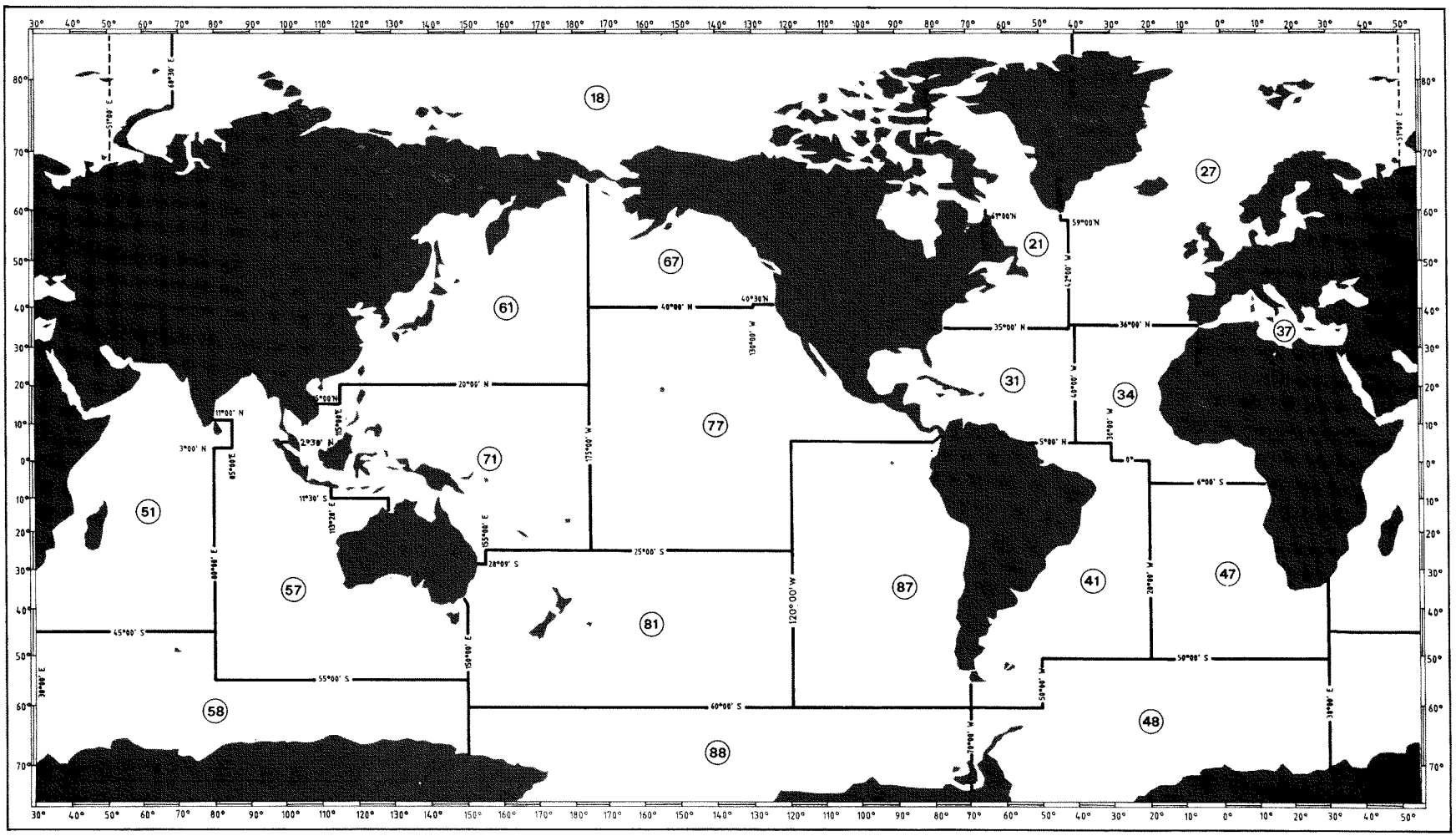
4. LIST OF SPECIES BY MAJOR MARINE FISHING AREAS

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
		21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
GEMPYLIDAE																			
Diplospinus multistriatus	24	●	●	●	●		●	●		●	●		●		●	●	●	●	
Epinnula magistralis	26			●							●		●						
Gempylus serpens	27		●	●	●		●	●		●	●		●		●	●	●	●	
Lepidocybium flavobrunneum	29		●	●	●		●	●		●	●		●	●	●	●	●	●	
Nealotus tripes	30	●	●	●	●		●	●		●	●		●		●	●	●	●	
Neoepinnula americana	33			●															
Neoepinnula orientalis	34									●	●		●		●				
Nesiarchus nasutus	35	●	●	●	●		●	●		●	●		●		●	●	●	●	
Paradiplospinus antarcticus	37						●	●	●	●	●	●					●	●	●
Paradiplospinus gracilis	39							●											
Promethichthys prometheus	40	●	●	●	●		●	●		●	●		●		●	●	●	●	
Rexea antefurcata	44														●		●	●	
Rexea bengalensis	45									●	●		●		●				
Rexea brevilineata	46																	●	
Rexea nakamurai	47									●	●		●			●			
Rexea prometheoides	48									●	●		●		●				
Rexea solandri	49										●						●		
Rexichthys johnpaxtoni	51														●		●		
Ruvettus pretiosus	52	●	●	●	●	●		●		●	●		●		●	●	●	●	
Thyrsites atun	54						●	●		●	●						●	●	

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
		21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Thyrsitoides marleyi	56							●		●	●		●		●		●		
Thyrsitops lepidopoides	57						●											●	
Tongaichthys robustus	59														●	●	●		
TRICHIURIDAE																			
Aphanopus carbo	65	●	●	●	●														
Aphanopus intermedius	66	●	●	●	●			●					●	●	●	●	●	●	
Aphanopus microphthalmus	67							?		●									
Aphanopus mikhailini	68						●	●		●	●								
Assurger anzac	69			●			●	●			●		●		●	●		●	
Benthodesmus elongatus	74						●			●	●						●	●	
Benthodesmus macrophthalmus	75										●				●				
Benthodesmus neglectus	76														●				
Benthodesmus oligoradiatus	77									●	●								
Benthodesmus pacificus	78												●	●		●			
Benthodesmus papua	79														●				
Benthodesmus simonyi	80	●	●	●	●														
Benthodesmus suluensis	81														●				
Benthodesmus tenuis	82		●	●	●		●	●			●		●		●	●			
Benthodesmus tuckeri	83									●	●				●		●		
Benthodesmus vityazi	84									●	●		●		●	●			
Eupleurogrammus glossodon	85									●	●				●				

SPECIES	PAGE	GEOGRAPHICAL DISTRIBUTION MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES																	
		21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Eupleurogrammus muticus	86									●	●		●		●				
Evoxymetopon poeyi	88									●			●						
Evoxymetopon taeniatus	89			●			●						●						
Lepidopus sp.	92	●		●			●												
Lepidopus calcar	93												●			●			
Lepidopus caudatus	94		●		●	●		●		●	●						●		
Lepidopus dubius	96				●			●											
Lepidopus fitchi	97													●		●		●	
Lepidopus manis	98															●			
Lepturacanthus pantului	99									●	●								
Lepturacanthus savala	100									●	●		●		●				
Tentoriceps cristatus	102									●	●		●		●		●		
Trichiurus auriga	104									●					●				
Trichiurus gangeticus	105									●	●								
Trichiurus lepturus	106	●	●	●	●	●	●	●		●	●		●		●	●	●	●	

MAJOR MARINE FISHING AREAS FOR STATISTICAL PURPOSES



5. BIBLIOGRAPHY

Abe, T., and M. Asai. 1975. Records of *Evoxymetopon poeyi* from Japan. *Uo*, 25:1-3.

Abe, T., and T. Kobata. 1974. Observations on some fishes of Sagami Bay. Part II. *Uo*, 21:1-3.

Abe, T., K. Minoshima, and T. Kobata. 1974. Observations on some fishes of Sagami Bay. Part III. *Uo*, 22:1-3.

Ahlstrom, E.H. 1971. Kinds and abundance of fish larvae in the eastern tropical Pacific, based on collection made on EASTROPAC I. *Fish. Bull.*, 69(1):3-78.

Alexander, W.B. 1916. History of zoology in western Australia. Part II. *J. Roy. Soc. W Austr.*, 1:83-1 49.

Alexander, W.B. 1917. Description of new species of fish of the genus *Evoxymetopon poeyi*. *J. Roy.Soc. W. Austr.*, 2:104-1 05.

Alcock, A.W. 1894. An account of a recent collection of bathybial fishes from Bay of Bengal and from the Laccadive Sea. *Asiatic Soc. Bengal.*, 63(2):115-I 37.

Alcock, A.W.1899. *A descriptive catalogue of the Indian deep-seafishes in the Indian Museum.* Being a revised account of the dep-sea fishes collected by the Royal Indian marine Survey Ship "Investigator". Calcutta. 211 p.

Anderson, M.E., and G.M. Cailliet. 1975. Occurrence of the rare North Pacific frostfish, *Benthodesmus elongatus pacificus* Parin and Becker, 1970, in Monterey Bay, California. *Calif Fish Game*, 61(3):149-152.

Andrianov, D.P., L.A. Lisovenko, A.N. Kotlyar, and A.A. Abramov. 1990. Data on reproduction of some near-bottom fishes of the Nazca and Sala y Gomez Submarine Ridges. *Trudy Inst. Okeanol.*, 125:58-96 (in Russian).

Andriashev, A.P. 1960. Families of fishes new to the Atlantic. I. *Paradiplospinus antarcticus*, gen. et sp. n. (Pisces, Trichiuridae). *Zool. Zhurn.*, 39(2):244-249 (in Russian).

Angot, M. 1951. Observations sur la faune marine et la pêche aux iles Saint-Paul et Amsterdam. *Mém Inst. Sci. Madagascar*, Ser. A, 6(1):1 -51.

Aoyama, T. 1960. Studies on the structure of fish shoals by means of fish finder.I. Echo patches of hair-tail observed at the middle area of the East China Sea, in February 1959.*Bull. Jap. Soc. Sci. Fish.*, 26(12):1162-1166 (in Japanese).

Backus, R.H., J.E. Craddock, R.L. Haedrich'; and D.L. Shores. 1969. Mesopelagicfishes and thermal fronts in the western Sargasso Sea. *Mar. Biol.*, 3(2):87-106.

Backus, R.H., G.W. Mead, R.L. Headrich, and A.W. Ebeling. 1965. The mesopelagic fishes collected during cruise 17 of the R/V "Chain", with a method for analyzing faunal transects. *Bull. Mus. Comp. Zool. Harv.*, 134(5):139-158.

Baird, G.G., and J.L. McKoy. 1988. *Papers from the workshop to review fish stock assessments for the 1987-88 New Zealand fishing year.* Fish. Res. Center, Wellington. 300 p.

Barnard, K.H. 1925. A monograph of the marine fishes of South Africa. Part I. *Ann. S. Afr: Mus.*, 21(1):1-417.

Barnard, K.H. 1927. A monograph of the marine fishes of South Africa. Part II. *Ann. S. Afr Mus.*, 21(2):417-I 065.

Bartlett, M.R., and R.H. Backus. 1962. A catch of the rare gempylid *Lepidocybium flavobrunneum* (Smith) in the Bahamas. *Copeia*, 4:845-847.

Bean, T.H. 1887. Description of a new species of *Thyrsitops (T.violaceus)* from the fishing banks off the New England coast. *Proc. U.S. Nat. Mus.*, 10:51 3-514.

Beaufort, L.E. de, and W.M. Chapman. 1951. *The fishes of the Indo-Australian Archipelago.* Vol. 9. E.J. Brill, Leiden. 484 p.

Becker, V.E. 1985. Distribution of the Myctophidae and biogeographical boundary in between the Saint Paul and Amsterdam Islands. *Vopr. Ikhtiol.,* 25(2):348-351 (in Russian).

Becker, V.E., and S.A. Evseenko. 1986. Distribution of the mesopelagic fishes and biogeographical boundaries in South Pacific. *Vopr Ikhtiol.,* 26(6):890-901 (in Russian).

Belyanina, T.N. 1975. Preliminary results of the study of ichthyoplankton of the Caribbean Sea and Gulf of Mexico. *Trudy Inst. Okeanol.,* 100:127-I 46 (in Russian).

Belyanina, T.N. 1982. Larvae of midwater fishes in the western tropical Pacific Ocean and the seas of the Indo-Australian Archipelago. *Trudy Inst. Okeanol.,* 118:5-42 (in Russian).

Bigelow, H.B., and W.C. Schroeder, 1953. Fishes of the Gulf of Maine. *Fish. Bull. Fish Wild. Serv.,* 53: I-577.

Blackburn, M. 1957. The relation between the food of the Australian barracuda, *Thyrsites atun* (Euphrasen), and recent fluctuations in the fisheries. *Austr. J. Mar. Freshwat. Res.,* 8(1):29-54.

Bleeker, P. 1856. Beschrijvingen van nieuwe ein weinig bekende vischsoorten van Amboina, verzameld op eene reis door den Molukschen Archipel gedaan in het gevolg van Gouverneur-Generaal Duymaer van Twist. *Act. Soc. Sci. Indo-Neerl.,* 1: I-80.

Bleeker, P. 1860a. Over eenige vischsoorten van de Kaap de Goode Hoop. *Nat. Tijdschr: -Ned. Indië,* 21:49-80.

Bleeker, P. 1860b. Dertiende bijdrage tot de kennis der vischrfauna van Borneo. *Act. Soc. Sci. Indo-Neerl.,* 8(4): I-64.

Bleeker, P. 1862. Sixiéme mémoire sur la fauna ichthyologigue de l'île Batjan. *Versl. Akad. Amsterdam* 14:99-112.

Bloch, M.E., and J.G. Schneider. 1801. *M.E. Blochii Systema Zchthyologiae iconibus CX illustratum. Post obitum auctoris opus inchoatum absolvit, correxit, interpolavit.* J.G. Schneider, Saxo Berolini. 584 p. and 110 pls.

Boltachev, A.P. 1986. Some peculiarities of the distribution and behaviour of *Diplospinus multistriatus* Maul (Gempylidae) in the Southeast Atlantic. *Vopr Ikhtiol.,* 26(5):715-719 (in Russian).

Bonnaterre, J.P. 1788. *Ichthyologie. Tableau encyclopédique et méthodique des trois régnes de la nature.* Paris. 215 p.

Borets, L.A. 1986. Ichthyofauna of Northwest and Hawaiian ridges. *Vopr Ikhtiol.,* 26(2):208-220 (in Russian).

Bory de Saint-Vincent, G.J.B.M. 1804. *Voyages dans les quatre princiales îles des mers d'Afrique.* Paris, 3 vols. + atlas.

Brauer, A. 1906. Die Tiefseefische. 1. Systematisther Teil. *Wiss. Ergebn. Deutsch. Tiefsee-Exped. Valdivia. Bd.,* 15(1):1-432.

Briggs, J.C. 1974. *Marine zoogeography.* New York. 475 p.

Bussing, W.A. 1965. Studies of the midwater fishes of the Peru-Chile Trench. In: G.A. Llano (ed.), Biology of Antarctic Seas II. *Antarct. Res. Ser,* 5:185-227.

Cantraine, F.J. 1835. Sur un Poisson nouveau trouvé dans le canal de Messine en janvier 1833. *Bull. Acad. R. Belg. Cl, Sci.,* 2(1):23-24; 2(4):207-209.

Capello, F. de B. 1867. Catàlogo dos peixes de Portugal queexisten no Museu de Lisbona. *J. Sci. Math. Phys. Nat.,* 1(3):233-264, 307-313.

Capello, F. de B. 1867. Peixes novos de Portugal e da Africa occidental, e caracteres distinctivos d'outras especies já conhecidas. *J. Sci. Math. Phys. Nat.,* 1(2):154-169.

Cervigón, F.M. 1966. *Los peces marinos de Venezuela.* Vol. 2 (Mon. 12), p. 449-951. Fundación La Salle, Caracas. 951 p.

Chirichigno, N.F. 1974. Clave para identificar los peces marinos del Perú, *Inf: Inst. Mar Peru',* 44:1-387.

Chu, Y.T., and H. Wu.1962. Description of a new genus and new species of a trichiurid fish off China. *Acta Zool. Sinica,* 14(2):219-223.

Clark, M.R. 1988. Records of fish from the West Norfolk Ridge, north-west of New Zealand. *N.Z.J. Zool.,* 15(3):415-421.

Clarke, F.E. 1879. On some new fishes. *Trans. Proc. N.Z. Inst.,* 11:291-295.

Clarke, T.A., and P.J. Wagner. 1976. Vertical distribution and other aspects of the ecology of certain mesopelagic fishes taken near Hawaii. *Fish. Bull.*, 74(3):635-645.

Clemens, H.B., and J.C. Nowell. 1963. Fishes collected in the eastern Pacific during tuna cruises 1952 through 1959. *Calif Fish Game,* 49(4):240-264.

Cocco, A. 1829. Su di alcuni nuovi pesci del mar di Messina. *G. Sci. Lett. Art. Sicilia,* 26(77):138-l 47.

Collett, R. 1887. *Aphanopus minor;* en ny dybvandsfisk af Trichiuridernes familie fra Grønland. *Forh. VidenskSelsk. Krist.,* 1886, 19:1-7.

Collette, B.B., and C.E. Nauen. 1983. FAO species catalogue. Vol. 2. Scombrids of the world. An annotated and illustrated catalogue of tunas, mackerels, bonitos and related species known to date. *FAO Fish. Synop.,* 125, Vol. 2, 137 p.

Collette, B.B., T. Potthoff, W.J. Richards, S. Ueyanagi, J.L. Russo, and Y. Nishikawa. 1984. Scombroidei: Development and relationships. In: Ontogeny and systematics of fishes. *ASIH Spec. Publ.,* 1:591-620.

Cuvier, G. 1829. *Le règne animal distribué d'après son organisation, pour servir de base à d'histoire naturelle des animaux et l'introduction à l'anatomie comparée.* Vol. 2. Paris. 532 p. Second Edition.

Cuvier, G., and A. Valenciennes, 1831. *Histoire naturelle des poissons.* Vol. 7. F.G. Levrault, Paris-Strasbourg. 531 p.

Cuvier, G., and A. Valenciennes, 1832. *Histoire naturelle des poissons.* Vol. 8. F.G. Levrault, Paris-Strasbourg. 509 p.

Duarte-Bello, P.P. 1959. Catalogo de peces cubanos. *Monographia Villanueva,* 6:1-208.

Duhamel, G. 1984.Ichtyofaune d'un haut-fond (34º54'S, 53º14'E) de l'Ocean Indien sud-ouest. *Cybium,* 8(4):91-94.

Dutt, S., and V. Thankam. 1966. Two new species of trichiurid fish from Waltair. *J. Bombay Nat. Hist. Soc.,* 63(3):755-758.

Eschmeyer, W.N. 1990. *Catalog of the genera of recent fishes* California Academy of Sciences, San Francisco. 697 p.

Euphrasen, B.A. 1788. Beskrifning på trenne fiskar. *K. Svenska Vetensk Akad. Handl. Stockholm,* 9:51-55.

Euphrasen, B.A. 1791. *Scomber atun och Echeneis tropica. K. Svenska Vetensk. Akad. Handl.,* 15:223-227.

Evseenko, S.A., and V.P. Serebryakov. 1974. The larvae of *Diplospinus multistriatus* Maul (Pisces, Gempylidae) from the Northwest Atlantic. *Vopr.Ikhtiol.,* 14(1):111-116 (in Russian).

FAO. 1978. Yearbook of Fishery Statistics, 1976. Catches and Landings (Vol. 46). *FAO Statistics Series,* No. 25.

FAO. 1980: Yearbook of Fishery Statistics, 1978. Catches and Landings (Vol. 50). *FAO Statistics Series,* No. 38.

FAO. 1982. Yearbook of Fishery Statistics, 1980. Catches and Landings (Vol. 54). *FAO Statistics Series,* No. 52.

FAO. 1992. Yearbook of Fishery Statistics, 1990. Catches and Landings (Vol. 70). *FAO Statistics Series,* No. 105.

Fitch, J. E., and D. W. Gotshall. 1972. First record of the black scabbardfish, *Aphanopus carbo*, from the Pacific Ocean with notes on other Californian trichiurid fishes. *Bull. South. Calif Acad. Sci.*, 72 [71?]:12-18.

Fitch, J.E., and R.J. Lavenberg. 1968. *Deep-water teleostean fishes of California.* University of California Press, Berkley. 155 p.

Fitch, J. E., and S. A. Schultz. 1978. Some rare and unusual occurrences of fishes off California and Baja California. *Calif Fish. Game,* 64(2):74-92.

Forsskål, P. 1775. *Descriptions animalium, avium, amphibiorum, piscium, insectorum, vermium; quae in itinere orientali observuvit.* Hauniae. 164 p,

Forster, G. R., J. R. Badcock, M. R. Longbottom, N. R. Merrett, and K. S. Thomson. 1970. Results of the Royal Society Indian Ocean Deep Slope Fishing Expedition. *Proc. Roy. Soc. Lond.,* 175:364-404.

Fourmanoir, P. 1969. Contenus stomacaux d'Alepisaurus (Poissons) dans le sud-ouest Pacifique. *Cah. ORSTOM, Sér.Océanogr* , 7(4):51-59.

Fourmanoir, P. 1970. Notes ichtyologiques (III). *Cah. ORSTOM, Sér Océanogr,* 8(3):35-46.

Fourmanoir, P. 1971 a. Liste des espèces de poissons contenus dans les estomacs de thons jaunes, *Thunnus albacares* (Bonnaterre, 1788) et de thons blancs, *Thunnus alalunga* (Bonnaterre, 1788). *Cah. ORSTOM, Sér Océanogr,* 9(2):109-118.

Fourmanoir, P. 1971 b. Notes ichtyologiques (III). *Cah. ORSTOM, Sér. Océanogr.,* 9(2):267-278.

Fourmanoir, P. 1979. Decouverte de très jeunes *Ruvettus pretiosus* Cocco dans un estomac de "Poissons lancette", *Alepisaurus ferox* et de "Maquereau-frégate", *Auxis thazard* presence d'Antopterus en eau tropicale. *Cah. Indo-Pac.,* 1(4):445-446.

Fourmanoir, P. 1981. Poissons (premiere liste). Results des campagnes MUSORSTOM. I. Philippinos (18-28 Mars 1976). *Coll. Mém. ORSTOM,* 91:86-102.

Fourmanoir. P. 1982. Repartition geographique de quelques poissons de la pente recifale externe des îles Indo-Pacifiques. *Cybium,* 6(3):91-96.

Fourmanoir, P., and M. Griessinger. 1971. Poissons de Rangiroa. *Cah. ORSTOM, Sér Océanogr.,* 9(4):425-489.

Fourmanoir, P., and J. Rivaton. 1979. Poissons de la pente récifale externe de Nouvelle-Calédonie et des Nouvelles-Hebrides. *Cah. Indo-Pac.,* 1(4):405-443.

Fowler, H. W. 1905. New, rare, or little known scombroids, 1. *Proc. Acad. Nat. Sci. Philad.,* 56:757-771.

Fowler, H. W. 1929. New and little known fishes from the Natal coast. *Ann. Natal. Mus.*,6(2):245-264.

Fowler, H. W. 1938. Descriptions of new fishes obtained by the U. S. Bureau of Fisheries Steamer "Albatross", chiefly in the Philippine seas and adjacent waters.*Proc. U.S. Nat. Mus.,* 85(3032):31-135.

Franca, P. da. 1969. Sobre a distibuçião dos Trichiuridae (Pisces, Perciformes) que ocorrem na costa de Angola. *Notas Cent. Biol. Aquut. Trop.,* 16:1-I 9.

Franz, V. 1910. Die japanischen Knochenfische der Sammlungen Haberer und Doflein. *Abh. Bayer Akad. Wiss., Suppl.,* 4(1):1-135.

Fujii, E. 1.983. Scombrolabracidae, Gempylidae, Trichiuridae, p. 407-416. In: *Fishes trawled off Surinam and French Guiana.* Japan Marine Fishery Resource Research Center, Tokyo. 519 p.

Garman, S. 1899. The fishes. In: Reports on an exploration off the west coast of Mexico, Central and South America, and off the Galapagos Islands in charge of Alexander Agassiz, by the U.S. Fish Commission Steamer "Albatross" during 1891, Lieut.-Commander Z.L. Tanner, U.S.A. commanding. No. XXVI. *Mem. Mus. Comp. Zool. Harv.,* 24:1-431.

Gilbert, C.H. 1917. On the occurrence of *Benthodesmus altanticus* Goode and Bean on the coast of British Columbia. *Smithson. Misc. Coll.,* 66(18):1-2.

Gilchrist, J.D.F., and C. von Bonde. 1924. Deep-sea fishes procured by the S.S. "Pickle" (Part II). Rep. *Fish. Mar Biol. Surv. Un. S. Afr.* (1922), 3(Spec. Rep. 7):1-24.

Gill, T.N. 1862. On the limits and arrangements of the family of scombroids. *Proc. Acad. Nat. Sci. Philad.,* 1862, 14:124-127.

Gill, T.N. 1863. Synopsis of the family of Lepturoids, and description of a remarkable new generic type. *Proc. Acad. Nat. Sci. Philad.,* 1863:224-229.

Gill, T.N. 1893. A comparison of antipoddl faunas. *Mem. Nat. Acad. Sci.*, 6:91-124.

Gloerfelt-Tarp T., and P.L. Kailola.1984. *Trawled fishes of southern Indonesia and northwestern Australia.* Tien Wah Press, Singapore. 406 p.

Golovan, G.A. 1978. Composition and distribution of the ichthyofauna of the continental slope of northwestern Africa. *Trudy Inst. Okeanol.*, 111:195-258 (in Russian).

Golovan, G. A., and N. P. Pakhorukov. 1988. Species composition, distribution'and behaviour of fishes in the areas of Vavilov Ridge and Equator Seamount.In: *Biogeographical Structure in the ureas of Underwater Rises.* Naukova Dumka, Kiev (in Russian).

Goode, G.B., and T.H. Bean. 1882. *Benthodesmus*, a new genus of deep-sea fishes allied to *Lepidopus. Proc. U.S. Natn. Mus.*, 4:379-383.

Goode, G.B., and T.H.. Bean. 1896. Oceanic ichthyology. *Mem. Mus. Comp. Zool. Harvard,* 22:1-553.

Goode, G.B., and T.H. Bean. 1896. Oceanic ichthyology, a treatise on the deep-sea and pelagic fishes of the world, based chiefly upon the collectins made by steamers "Blake", "Albatross" and "Fish Hawk" in the northwestern Atlantic. *Spec. Bull. U.S. Nat. Mus.,* 1895:1-553.

Gorbunova, N.N. 1977. Larvae of some trichiuroid fishes (Osteichthyes: Gempylidae, Trichiuridae). *Trudy Inst. Okeanol.,* 109:133-148 (in Russian).

Gorbunova, N.N. 1982. Larvae of trichiuroid fishes from collection of the International Mexican Biological Centre (Pisces: Gempylidae, Trichiuridae). *Trudy Inst. Okeanol.,* 118:85-1 06 (in Russian).

Goüan, A. 1770. *Historia piscium, sisteas ipsorum anatomen externam, internam, atque genera in classes et ordines redacta.* Strasbourg, 228 p.

Graham, D. H. 1956. *A treasure of New Zealand fishes.* A.H. and A.W. Reed, Wellington. 424 p.

Gray, J.E. 1831. Description of twelve new genera of fish, discovered by Gen. Hardwicke, in India, the greater part in the British Museum. *Zool. Misc.,* 1831:7-10.

Grey, M. 1953. Fishes of the family Gempylidae, with records of *Nesiarchus and Epinnula* from the western Atlantic and description of two new subspecies of *Epinnula orientalis. Copeia,* 3:135-141.

Grey, M. 1955. Notes on a collection of Bermuda deep-sea fishes. *Fieldiana Zool.*, 37:265-302.

Grey, M. 1959. Deep sea fishes from the Gulf of Mexico with the description of a new species *Squalogadus intermedius* (Macrouridae). *Fieldiana Zool.,* 39(29);323-346.

Grey, M. 1960. Description of a western Atlantic specimen of *Scomberolabrax heterolepis* and notes on fishes of the family Gempylidae. *Copeia,* 3:210-215.

Griffin, L.T. 1927. Studies in New Zealand fishes. *Trans. N.Z. Inst.,* 58:136-150.

Günther, A.1860. *Catalogue of the Acanthopterygian fishes in the collection of the British Museum. 2. Squamipinnes, Cirrhitidae, Triglidae, Trachinidae, Polynemidae, Sphyraenidae, Trichiuridae, Scombridae, Carangidae, Xiphiidae.* London. 548 p.

Günther, A. 1877. Preliminary notes on new fishes collected in Japan during the expedition of H.M.S. "Challenger". *Ann. Mag. Nat. Hist.,* Ser 4, 20:433-446.

Günther, A. 1887. Report of the deep-sea fishes collected by H.M.S. "Challenger" during the years 1873-76. *Rep. Scient. Results. Voyage Challenger Zool.,* 22:1-268.

Gupta, M.V. 1966. Two new species of ribbon fishes of the genus *Trichiurus* Linnaeus (Pisces: Trichiuridae) from the Hooghly estuarine system. *Proc. Zool. Soc. Calcutta,* 19:169-171.

Gupta, M.V. 1967. Studies on the taxonomy, biology and fishery of ribbon fishes (Trichiuridae) of the Hooghly estuarine system. 2. Biology of *Trichiurus savala* Cuvier. *Proc. Zool. Soc. Calcutta,* 20:153-170.

Gupta, M.V., 1968. Studies on the taxonomy, biology and fishery of ribbon fishes (Trichiuridae) of the Hooghly estuarine system. *Proc. Zool. Soc. Calcutta,* 21:35-50.

Gushchin, A.V., and E.I. Kukuev, 1981. On composition of ichthyofauna of the northern part of the Middle-Atlantic Ridge, p. 36-40. In: N.V. Parin (ed.), *Fishes of the open ocean.* Inst. Okeanol., Moscow. 119 p. (in Russian).

Haedrich, R.L. 1964. Food habits and young stages of North Atlantic *Alepisaurus* (Pisces, Iniomi). Breviora, 201 :1-15.

Haedrich R.L., and J.G. Nielsen. 1966. Fishes eaten by *Alepisaurus* (Pisces, Iniomi) in the southeastern Pacific Ocean. *Deep-Sea Res.,* 13:909-919.

Hatanaka, H. 1990. *Thyrsites atun.*Fishery and biology, p. 306-307. In: *Fishes collected by the R/V Shinkai Maru around New Zealand.* Japan Marine Fishery Resource Research Center, Tokyo. 410 p.

Herre, A.W. 1953. Check list of Philippine fishes. *Res. Rep. U.S. Fish. Wildl. Serv.*, 20:1-977.

Holten, H.S. 1802. *Trichiurus gladius,* en ny fisk fra Portugal. *Skrivter Naturh. Selsk. Kjøbenhavn,* 5: 19-26.

Howe, K.M., D.L. Stein, and C.E. Bond. 1980. First records off Oregon of the pelagic fishes *Paralepis atlantica, Gonostoma atlanticus* and *Aphanopus carbo,* with notes on the anatomy of *Aphanopus carbo. Fish. Bull.,* 77(3):700-703.

Hubbs, C.L., W.I. Follett, and L.J. Dempster. 1979. List of the fishes of California. *Occ. Pap. Calif Acad.* Sci., 133:1-51.

Hubbs, C.L., and C. Hubbs. 1941. Pacific cutlassfish, *Trichiurus nitens* Garman. *Calf Fish Game,* 27(1):29-30.

Hutchins, B., and R. Swainston. 1986. *Sea fishes of southern Australia.* Swainston Publ., Perth. 180 p.

James, P.S.B.R. 1961, Comparative osteology of the ribbon-fishes of the family Trichiuridae from Indian waters with remarks on their phylogeny. *.J. Mar Biol. Ass. India,* 3: 215-248.

James, P.S.B.R. 1967. *The ribbon-Fishes of the family Trichiuridae of India.* Marine Biological Association of India, Mandapam Camp. 288 p.

Johnson. G. D. 1986. Scombroid phylogeny: An alternative hypothosis. *Bull. Mar Sci.,* 39(1):1-41.

Johnson, J.Y. 1862. Descriptions of some new genera and species of fishes obtained at Maderia. *Proc. Zool. Soc. Lond.,* 1862(2):167-180.

Johnson, J.Y. 1865. Descriptions of a new genus of trichiuroid fishes obtained at Madeira (*Nealotus tripes*), with remarks on the genus *Dicrotus* Günther, and on some allied genera of Trichiuridae. *Proc. Zool. Soc. Lond.,* 1865(2):434-437.

Jones, S. 1960. On the snake mackerel, *Gempylus serpens* Cuvier from the Laccadive Sea. *J. Mar. Biol. Assoc. India,* 2(1):85-88.

Jordan, D.S., and B.W. Evermann. 1896, The fishes on North and Middle America, a descriptive catalogue of the species of fish-like vertebrates found in the waters of North America, north of isthmus of Panama. *Bull. U.S. Nat. Mus.*, 47(Part I):1 -1240

Jordan, D.S., and E.K. Jordan. 1922. A list of the fishes of Hawaii, with notes and descriptions of new species. *Mem. Carneg. Mus.,* 10(1):1 -92.

Jordan, D.S., and J-O. Snyder. 1901'. Descriptions of nine new species of fishes contained in museums of Japan. *J. Coll. Soc. Imp. Univ. Tokyo,* 15:301-311.

Kamohara, T. 1936. Supplementary note on the fishes collected in the vicinity of Koci-shi (x). *Zool. Mag. (Japan)*, 48(11):929-935 (in Japanese).

Kamohara, T. 1938. Gempylidae of Japan. *Annot. Zool. Jap.,* 17(1):45-50.

Kamohara, T. 1940. *Scombroidei, exclusive of carangiformes.* Fauna Nipponica, Sanseido, Tokyo. 255 p. (in Japanese).

Kamohara, T. 1952. Revised descriptions of the offshore bottom fishes of Prov. Tosa, Shikoku, Japan. *Rep. Kochi. Univ. (Nat. Sci.),* 3:1-122.

Kamohara, T. 1967. *Fishes of Japan in color.* Osaka. 135 p.

Karrer, C. 1973. Über Fische aus dem Südostatlantik. *Mit. Zool. Mus. Berlin,* 49(1):191-251.

Karrer, C. 1975. Über Fische aus dem Südostatlantik (Teil 2). *Mit. Zool. Mus. Berlin,* 51(1):63-82.

Kishinouye, K. 1926. A new aberrant form of the Cybiidae from Japan. *J. Coll. Agric. Imp. Univ. Tokyo,* 7(4):377-382.

Klunzinger, C.B.1884. *Die Fische des Rothen Meeres. Eine Kritische Revision mit Bestimmungstabellen.* Teil. I. Acanthopteri veri Owen, Stuttgart. 133 p.

Konovalenko, I.I., and N.V. Parin. 1985. The first record of *Nesiarchus nasutus* Johnson (Gempylidae) in the southeast Pacific, *Vopr Ikhtiol.,* 25(3):513-515 (in Russian).

Kotlyar, A.N., and N.V. Parin. 1990. Otoliths and age of bottom and near-bottom fishes from the Nazca and Sala y Gomez Submarine Ridges. *Trudy Inst. Okeanol.*, 125:97-1 26 (in Russian).

Kukuev, E.I. 1982. Fish fauna of the Corner Mountains and New England Submarine Ridge in the western North Atlantic, p. 92-I 09. In: N.V. Parin (ed.), *Poorly known fishes of the open ocean.* Inst. Okeanol, Moscow. 140 p. (in Russian).

Kyushin K., K. Amaoka, K. Nakaya, H. Ida, Y. Tanino, and T. Senta. 1982. *Fishes of the south China Sea,* Japan Marine Fishery Resource Research Center, Tokyo. 333 p.

Lacepede, B. 1800. *Histoire naturelle des poissons.* Vol. 2, Paris. 632 p.

Last, P.R., E.O.G. Scott, and F.H. Talbot. 1983. *Fishes of Tasmania.* Tasm. Fish. Dev. Auth., Hobart. 563 p.

Legand, M., P. Bourret, P. Fourmanoir, R. Grandperrin, A. Michel, P. Rancurel, R. Repelin, and C. Roger. 1972. Relations trophiques et distributions verticales en milieu pelagique dans l'Océan Pacifique intertropical. *Cah. ORSTOM, Sér Océanogr.*, 10(4):301-393.

Leim, A.H., and W.B. Scott, 1966. Fishes of the Atlantic coast of Canada. *Bull. Fish. Res. Board Canada,* 155:1- 485.

Lesson, R.P. 1831. Poissons, p. 66-238, and pl. I-38 in Atlas. In: L.I. Duperrey, *Voyage autourdu monde sur la Coguille pendant les années 1822, 1823, 1824 et 1825....,Zoologie.* Vol. 2, pt. 1. Paris. 471 p.

Linnaeus, C. 1758. *Systema Naturae.* 10th Edition, Vol. 1. Holmiae. 824 p.

Lloris, D. 1986. Ictiofauna demersal y aspectos biogeograficos de la costa sudoccidental de Africa (SWA/Namibia). *Monogr Zool. Mar:,* 1:9-432.

Lopez, M.I., and W.A. Bussing. 1982. Lista provisional de los peces marinos de la Costa Pacifica de Costa Rica. *Rev. Biol. Trop.*, 30(1):5-26.

Lowe, R.T. 1834. Characters of a new genus *Leirus*, and of several new species of fishes from Madeira. *Proc. Zool. Sac. Lond.,* 1:142-144.

Lowe, R.T. 1838. A synopsis of the fishes of Madeira; with the principal synonyms, Portugese names, and characters of the new genera and species. *Trans. Zool. Soc. Lond.*, 2(3):173-200.

Lowe, R.T. 1839. A supplement to a synopsis of the fishes of Madeira. *Proc. Zool. Soc. London,* 7:76-92.

Machida, Y. 1985. Scombrolabracidae,'Gempylidae, Trichiuridae, p. 532-541. In: *Fishes of the Okinawa trough and the adjacent waters.* Japan Fisheries Resource Conservation Association, Tokyo. Vol. II:41 8-781 p.

Mago, F.L.1970. *Lista de los Peces de Venezuela, incluendo un estudio preliminar sobre la ictiogeograja del pais.* Ministr. Agricult. Cria., Caracas. 283 p.

Maksimov, V.P. 1970. Data on the biology of *Lepidocybium flavobrunneum* Smith in the Eastern Atlantic. *Vopr Ikhtiol.,* 10(1):50-57 (in Russian).

Masuda, H., K. Amaoka, C. Araga, T. Uyeno, and T. Yoshino (eds). 1984. *The fishes of the Japanese Archipelago.* Tokai University Press, Tokyo. Vol. 1, 376 p. and Vol. 2, 460 p.

Matsubara, K., and T. Iwai. 1952. Studies on some Japanese fishes of the family Gempylidae. *Pacific Sci.*, 6(3):193-212.

Matsubara, K., and T. Iwai. 1958. Anatomy and relationships of the Japanese fishes of the family Gempylidae. *Mem. Coll. Agric. Kyoto Univ.,* Spec. No.:23-54.

Maul, G.E. 1948. Quatro peixes novos dos mares da Madeira. *Bolm Mus. Munic. Funchal,* 3(6):41-55.

Maul, G.E. 1950. A espada preta. *Pub. Liga Protec. Natur, Lisboa.* 4:1-10.

Maul, G.E. 1953. Rediscovery of the trichiuroid fish *Benthodesmus simonyi* (Steindachner) off Madeira. Proc. Zool. Soc. Lond., 123:167-I 70.

May, J.L., and J.G.H. Maxwell.1986. *Trawl fish from temperate waters of Australia.* CSIRO, Hobart. 492 p.

McCoy, F. 1873. On a new Australian species of *Thyrsites. Ann. Mag. Nat. Hist.*, Ser. 4., 11 (65):338-339.

McCoy, F. 1874. Note of *Thyrsites microps* (McCoy). *Monthly Notice Pap. Proc. Roy. Soc. Tasm.*, Sept., 1873:50.

Mead, G.W. 1951. First record of the gempylid fish *Epinnula orientalis* from American waters. *Copeia,* 4:301.

Mead, G.W., and F.H. Taylor. 1953. A collection of oceanic fishes from off northeastern Japan. *J. Fish. Res. Board Canada,* 10(8):560-582.

Merrett, N. R. 1968. *Lepidocybium flavobrunneum* (Smith, 1849) from the western Indian Ocean. *J. Nat. Hist.*, 2:201-204.

Mikhailin, S.V. 1976a. On the methods of age determination of the frostfish of the south-eastern Atlantic. *Trudy AtlantNiRO,* Kaliningrad, 69:51-58 (in Russian).

Mikhailin, S.V. 1976b. Characters of distribution of some members of the families Gempylidae and Trichiuridae in the south-western African waters. *Vopr Ikhtiol.*, 16(2):362-365 (in Russian).

Mikhailin, S.V. 1977. The intraspecific variability of the frostfish, *Lepidopus caudatus. Vopr Ikhtiol.,* 17(2):226-236 (in Russian).

Mikhailin, S.V. 1978. Feeding of frostfish, *Lepidopus caudatus* (Euphr.) in the south-eastern Atlantic Ocean. *Trudy AtlantNIRO,* Kaliningrad, 74:49-57 (in Russian).

Mikhailin, S.V. 1982. Materials on the distribution and biology of *Lepidopus xantusi* Goode et Bean and *Trichiurus nitens* Garman (Trichiuridae) in the Southeast Pacific, *Vopr Ikhtiol.,* 22(5):730-737 (in Russian).

Mikhailin, S.V. 1983. On intraspecific variations of the principal meristic characters in *Diplospinus* multistriatus Maul (Gempylidae, Perciformes). *Vopr Ikhtiol.,* 23(3):366-372 (in Russian).

Misu, H. 1961. Studies on the fisheries biology of the ribbon fish (Trichiurus lepturus Linné) in the East China and Yellow Seas. 3. Distribution, Migration and Consideration of Population. *Contr. Seikai Reg. Fish. Res. Lab.,* 141:115-131 (in Japanese).

Montague; G. 1811. An account of five rare species of British fishes. *Mem. Wern. Nut. Hist. Soc. Edinb.,* 1808-1810, 1:79-101.

Movillo, J., and N. Bahmonde. 1971. Contenido gástrico y relaciones troficas de *Thyrsites atun* (Euphrasen) en San Antonio, Chile. *Bol. Mus. Nat. Hist. Nat.,* 29:289-338.

Munro, I.S.R. 1949. The rare gempylid fish, *Lepidocybium flavobrunneum* (Smith). *Proc. R. Soc, Queensland,* 60(3):31-41.

Munro, I.S.R. 1958. The fishes of the New Guinea Region. *Papua New Guinea Agric. J.*, 10(4):97-369.

Nakamura, I. 1977. Gempylidae, Istiophoridae, Trichiuridae. In: W. Fischer (ed.), *FAO Species Identification Sheets for Fishery Purposes. Western Central Atlantic, fishing area 31.* Vols. 1-7, (pag.var.).

Nakamura, I. 1980. New record of a rare gempylid, *Thyrsitoides marleyi,* from the Sea of Japan. Jap. J. Ichthyol., 26(4):357-360.

Nakamura, I. 1981. Gempylidae, Istiophoridae, Trichiuridae.In: W. Fischer, G. Bianchi, and W.B. Scott (eds), *FAO Species Identification Sheets for Fishery Purposes.Eastern Central Atlantic, fishing area 34,47 (inpart).* Food and Agriculture Organization of the United Nations, Roma. Vols 1-7, (pag.var.).

Nakamura, I. 1982a. Lateral line of *Diplospinus multistriatus* (Teleostei:Gempylidae). *Biol. Soc. Washington,* 95(2):408-411.

Nakamura, I. 1982b. Scombrolabracidae, Gempylidae, Trichiuridae, p. 260-267. In: *Fishes of the Kyushu-Palau Ridge and Tosa Bay.* Japan Fisheries Resource Conservations Associaton, Tokyo. 435 p.

Nakamura, I. 1984a. Gempylidae, Istiophoridae, Trichiuridae, Xiphiidae. In: W. Fischer, and G. Bianchi (eds), *FAO Species Identification Sheets for Fishery Purposes. Western Indian Ocean,fishing area 51.* Food and Agricultural Organization of the United Nations, Rome. Vols 1-6, (pag.var.).

Nakamura, I. 1984b. Scombrolabracidei, Scombroidei, p. 224-228. In: Masuda, H., K. Amaoka, C. Araga, T. Uyeno, and T. Yoshino (eds), *The fishes of the Japanese Archipelago.* Tokai University Press, Tokyo. 437 p.

Nakamura, I., 1985. FAO Species Catalogue. Vol. 5. *Billfishes of the world. An annotated and illustrated catalogue of marlins, sailfishes, spearfishes and swordfishes known to date.* FAO Fish. Synop., No. 125:1-65.

Nakamura, I. (ed.). 1986a. *Important fishes trawled off Patagonia.* Japan Marine Fishery Resource Research Center, Tokyo. 369 p.

Nakamura, I. 1986b. Scombroidei, Xiphioidei, p. 296-305. In: *Fishes. Illustrated books for organisms.* Sekaibukasha, Tokyo. 431 p. (in Japanese).

Nakamura, I. 1986c. Scombrolabracidae, Gempylidae, Trichiuridae, p. 825-830. In: M.M. Smith, and P.C. Heemstra (eds), *Smith's Sea Fishes.* Macmillan South Africa, Johannesburg. 1047 p.

Nakamura, I. 1989a. Introduction to Scombriform fishes. 1. Concept of Scombriform fishes. *Aquabiology,* 61:96-101 (in Japanese).

Nakamura, I. 1989b. Introduction to Scombriform fishes. 2. Systematics of Scombriform fishes. *Aquabiology,* 62:185-190 (in Japanese).

Nakamura, I. 1989c. Introduction to Scombriform fishes. 3. Methods of measuring and counting, and external features of Scombriform fishes. *Aquabiology,* 63:272-277 (in Japanese).

Nakamura, I. 1990a. Gempylidae, Trichiuridae, Scombrolabracidae, Scombridae, p. 304-311. In: *Fishes collected by the R/V Shinkai Maru around New Zealand.* Japan Marine Fishery Resources Research Center, Tokyo. 410 p.

Nakamura, I. 1990b. Gempylidae, Scombridae, p. 402-405. In: *Fishes of the southern Ocean.* J.L.B. Smith Institute of Ichthyology, Grahamstown. 462 p.

Nakamura, I. 1990c. Introduction to Scombriform fishes. 4. Body form with gross external morphology. *Aquabiology,* 69:276-281 (in Japanese).

Nakamura; I. 1990d. Introduction to Scombriform fishes. 5. Gross morphology of lateral line system. *Aquabiology,* 70:364-371 (in Japanese).

Nakamura, I. 1990e. Introduction to Scombriform fishes. 6. Body color and makings. *Aquabiology,* 71:448-456 (in Japanese).

Nakamura, I. 1991a. Introduction to Scombriform fishes. 7. Nostril and olfactory organ. *Aquabiology,* 73:90-97 (in Japanese).

Nakamura, I. 1991 b. Introduction to Scombriform fishes. 8. Mouth and snout region. *Aquabiology,* 74:168-173 (in Japanese).

Nakamura, I. 1991c. Introduction to Scombriform fishes. 9. Teeth. *Aquabiology*, 75:249-225 (in Japanese).

Nakamura, I. 1991d. Introduction to Scombriform fishes. 10. Gill. *Aquabiology,* 76:330-337 (in Japanese).

Nakamura, I. 1991e. Introduction to Scombriform fishes. 11. Neumerical characters on opercular region. *Aquabiology,* 77:460-464 (in Japanese).

Nakamura, I. 1992a. Introduction to Scombriform fishes. 12. Fins. *Aquabiology,* 78:7-11 (in Japanese).

Nakamura, I. 1992b. Introduction to Scombriform fishes. 13. Dorsal fin and anal fin. *Aquabiology,* 79:94-99 (in Japanese).

Nakamura, I. 1992c. Introduction to Scombriform fishes.14. Pelvic fins. *Aquabiology,* 81 :in press (in Japanese).

Nakamura, I., and J. R. Paxton. 1977. A juvenile gempylid fish, *Neulotus tripes,* from eastern Australia. *Aust. Zool.,* 19(2):178-184.

Nakamura, I., and E. Fujii. 1983. A new genus and species of Gempylidae (Pisces: Perciformes) from Tonga Ridge. *Seto Mar. Biol. Lab.,* 27(4/6):173-191.

Nakamura, I., E. Fujii, and T. Arai.1983. First record of the gempylid, *Nesiarchus nasutus* from Japan and the Sulu Sea. . *Jap. J, Ichthyol.*, 29(7):337-344.

Nakamura, I., B.F. Webb, and G.A. Tunnicliffe. 1981. First record of a rare gempylid fish, *Nesiarchus nasutus,* (Teleostei; Gempylidae) from New Zealand. *Rec. Canterbury Mus.*, 9(7):337-344.

Narayano Rao, K.V. 1965. On a record of *Epinnula orientalis* Gilchrist and Von Bonde, a bathypelagic fish, from the Konkan coast. *J. Mar: Biol. Ass, India,* 7(1):217-218.

Nelson, J.S. 1984. *Fishes of the world.* Second edition, John Wiley and Sons, New York. 523 p.

Nishikawa, Y. 1987. Studies on the early life history of gempylid fishes. *Bull. Far Seas Fish. Res. Lab.,* 24:1-1 54 (in Japanese).

Nishikawa, Y., and I. Nakamura. 1978. Postlarvae and juveniles of the gempylid fish, *Neoepinnula orientalis* (Gilchrist and von Bonde) from the North Arabia Sea. *Bull. Far Seas Fish. Res. Lab.,* 16:75-91.

Noronha, A.C. 1926. Description of a new genus and species of deep water gempyloid fish, *Diplogonurus maderensis. Ann. Curneg. Mus.,* 16(3-4):381-383.

Norman, J.R. 1939. Fishes. *Sci. Rep. John Murray Exped., Lond.*, 7(1):1-116.

Norman, J.R. 1966. *A draft synopsis of the orders, families and genera of recent fishes and fish-like vertebrates.* British Museum (Natural History), London. 649 p. (Unpubl. photo offset copy).

Ochiai, A., and M. Tanaka. 1988. *Ichthyololgy* Vol. 2 (New edition). Koseisha-Koseikaku, Tokyo. 1140 p. (in Japanese).

Ogilby, J.D. 1899. Additions to the fauna of Lord Howe Island. *Proc. Linn. Soc. New South Wales,* 23:730-745.

Okamura, O. (ed.). 1985. *Fishes of the Okinawa Trough and the adjacent waters.* Vol. II. Japan Fishery Resource Conservation Association, Tokyo. 780 p.

Okamura, 'O., K. Amaoka, and F. Mitani (eds). 1982. *Fishes of the Kyushu-Palau Ridge and Tosa Bay.* Japan Fishery Resource Conservation Association, Tokyo. 435 p.

Pakhorukov, N.P. 1981. Deep-sea bottom fishes of the Whale Ridge and adjacent area, p. 19-31. In: N.V. Parin (ed.), *Fishes of the open ocean.* Inst. Okeanol, Moscow. 119 p. (in Russian).

Parin, N.V. 1967. On the distribution and biology of *Gempylus serpens* Cuv. (Pisces, Gempylidae) in the Pacific and Indian Oceans. *Vopr Ikhtiol.*, 7(6):990-1000 (in Russian).

Parin, N.V. 1975. Changes of pelagic ichthyocoenes along the Equator in the Pacific Ocean between 96° and 155°W. *Trudy Inst. Okeanol.*, 102:313-334 (in Russian).

Parin, N.V. 1976a. Two new species of the genus *Benthodesmus* (Trichiuridae, Osteichthyes) from the western tropical Pacific Ocean. *Trudy Inst. Okeanol.,* 104:191-194 (in Russian).

Parin, N.V. 1976b. Comparative analysis of mesopelagic ichthyocoenes on four polygones in the western tropical Pacific. *Trudy Inst. Okeanol.,* 104:195-205.

Parin, N.V. 1978. New records of midwater fishes from off New Guinea and Tonga Islands with descriptions of two new species of *Eustomias* (family Melanostomiatidae) and *Benthodesmus* (family Trichiuridae). *Trudy Inst. Okeanol.,* 111:156-168.

Parin, N.V. 1983. *Aphanopus mikhailini* sp.n. and A. *intermedius* sp.n. (Trichiuridae, Perciformes) - two new species of scabbardfishes from the temperate waters of Southern Hemisphere and Tropical Atlantic. *Vopr. Ikhtyol.,* 23(3):355-366 (in Russian).

Parin, N.V. 1986. Gempylidae, Trichiuridae, p. 967-973, 976-980, Vol. II. In: P.J.P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen, and E. Tortonese (eds), *Fishes of the North-eastern Atlantic and the Mediterranean.* UNESCO, Paris. 490 p.

Parin, N.V. 1988. *Fishes of the open ocean.* Nauka, Moscow. 272 p. (in Russian).

Parin, N.V. 1989. A review of the genus *Rexea* (Gempylidae) with descriptions of three new species. *Vopr. Ikhtiol.,* 29(1):3-23 (in Russian).

Parin, N.V. 1990a. Improved diagnosis of the genus *Rexichthys* and its place in the system of the family Gempylidae. *Vopr. Ikhtiol.,* 30(4):531-536 (in Russian).

Parin, N.V., 1990b. Preliminary review of fish fauna of the Nazca and Sala y Gomez Submarine Ridges (southeastern Pacific Ocean). *Trudy Inst. Okenol.,* 125:6-36 (in Russian).

Parin, N.V. 1990c. Gempylidae. Trichiuridae, p. 965-977. In: J.C. Quéro, J.C. Hureau, C. Karrer, A. Post, and L. Saldanha (eds), *Check-list of the fishes of the eastern tropical Atlantic.* JNICT, Lisbon. Vol. II. 560 p.

Parin, N.V., A.P. Andriashev, O.D. Borodulina, and V.M. Tchuvasov. 1974. Midwater fishes of the south-western Atlantic Ocean. *Trudy Inst. Okeanol.,* 98:76-140 (in Russian).

Parin, N.V., and D.A. Astakhov. 1987. *Rexichthys johnpaxtoni* - a new fish of the family Gempylidae from the Tasman Sea. *Vopr. Ikhtiol.,* 27(1):149-I 51 (in Russian).

Parin, N.V., and V.E. Becker. 1970. Materials for a revision of the trichiuroid fishes of the genus *Benthodesmus,* with the description of four new species and one new subspecies. *Proc. Biol. Soc. Washington,* 83(33):351-364.

Parin, N.V., and V.E. Becker. 1972. Materials on taxonomy and distribution of some trichiuroid fishes (Pisces: Trichiuroidei: Scombrolabracidae, Gemylidae and Trichiuridae). *Trudy Inst. Okeanol.,* 93:110-204 (in Russian).

Parin, N.V., V.E. Becker, O.D. Borodulina, and V.M. Tchuvasov. 1973. Deep-sea pelagic fishes of the south-eastern Pacific Ocean. *Trudy Inst. Okeanol.,* 94:71-1 72 (in Russian).

Parin, N.V., V.E., Becker, O.D., Borodulina, E.S. Karmovskaya, B.I. Fedoryako, Y.N. Shcherbachev, G.N. Pokhilskaya, and V.M. Tchuvasov. 1977. Midwater fishes in the western tropical Pacific Ocean and the seas of Indo-Australian Archipelago. *Trudy Inst. Okeanol.,* 107:68-188 (in Russian).

Parin, N.V., O.D. Borodulina, I.I. Konovalenko, and A.N. Kotlyar. 1990a. Oceanic pelagic fishes of the south-eastern Pacific (composition of fauna and geographical distribution). *Trudy Inst. Okeanol.,* 125:192-222 (in Russian).

Parin, N.V., and B.B. Collette. 1993. Results of the research cruises of FRV "Walther Herwig" to South America. LXIX. *Lepidopus altifrons,* a new species of cuttlassfish (Scombroidei:Trichiuridae) from the western Atlantic Ocean. *Archiv. Fischereiwiss.,* 41(3):(in press).

Parin, N.V., and G.A. Golovan. 1976. Pelagic deep-sea fishes of the families characteristic of the open ocean collected over the continental slope off west Africa. *Trudy Inst. Okeanol.,* 104:250-276 (in Russian).

Parin, N.V., G.A. Golovan, N.P. Pakhorukov, Y.I. Sazonov, and Y.N. Shcherbachev. 1981. Fishes from the Nazca and Sala y Gomez Submarine Ridges collected in cruise of R/V "Ikhtiandr", p. 5-18. In: N.V. Parin (ed.), Fishes *of the open ocean.* Inst. Okeanol, Moscow. 119p. (in Russian).

Parin, N.V., T.A. Gorelova, and O.D. Borodulina. 1990b. Feeding, and trophic relationships of fishes inhabiting the Nazca and Sala y Gomez Submarine Ridges. *Trudy Inst. Okenol.,* 125:37-57 (in Russian).

Parin, N.V., and A.N. Kotlyar. 1991. Record of *Epinnula magistralis* in the Indian Ocean. *Vopr. Ikhtiol.,* 31(6):1004-1005 (in Russian).

Parin, N.V., and S.V. Mikhailin. 1981. A new cutlassfish, *Lepidopus dubius* Parin, and Mikhailin (Trichiuridae), from the eastern tropical Atlantic. *Vopr. Ikhtiol.,* 21(3):403-410 (in Russian).

Parin, N.V., and S.V. Mikhailin. 1982a. *Lepidopus calcar,* a new trichiurid fish from the Hawaiian underwater ridge. *Jap. J. Ichthyol.,* 29(1):27-29.

Parin, N.V., and S.V. Mikhailin. 1982b. *Tentoriceps cristatus* (Klunzinger) (Trichiuridae) in the Indian Ocean, p. 48-54. In: N.V. Parin (ed.), *Poorly known fishes of the open ocean.* Inst. Okeanol, Moscow. 140 p. (in Russian).

Parin,.N.V., and J.R. Paxton. 1990. Australia's East Coast gemfish. *Aust. Fish.,* 49(5):115.

Parin, N.V, G.N. Pokhilskaya, Y.I. Sazonov, and B.I. Fedoryako. 1976. Rare and poorly known midwater fishes from the Central and Eastern Equatorial Pacific Ocean. *Trudy Inst. Okeanol.,* 104:206-236 (in Russian).

Parin, N.V., and V.G. Prutko. 1985. Thalassal mesobenthopelagic ichthyocoen over the equator submarine rise in the western tropical Indian Ocean. *Okeanologiya,* 25(6):1017-I 020 (in Russian).

Parin, N.V., and Y.I. Sazonov. 1982. Deepsea fishes collected during the cruise of R/V "Professor Mesyatsev" off Peru in 1972, p. 79-91. In: N.V. Parin (ed.), *Poorly known fishes of the open sea.* Inst. Okeanol, Moscow. 140 p. (in Russian).

Parin, N.V., Y.I. Sazonov, and S.V. Mikhailin. 1978. Deep-sea pelagic fishes in the collection of R/V "Fiolent" in the Gulf of Guinea and adjacent areas, *Trudy Inst. Okeanol.,* 111:169-184 (in Russian).

Paulin, C.D., and G. Habib. 1980. First record of *Lepidocybium flavobrunneum* (Pisces: Gempylidae) from New Zealand. *N.Z.J. Mar. Freshwat. Res.,* 14(4):405-407.

Paulin, C.D., A.L. Stewart, C.D. Roberts, and P.J. McMillan. 1989. New Zealand fish. A complete guide. *Nat. Mus. N.Z. Misc. Ser,* 19:1-279.

Pavlov, Y.P., and D.P. Andrianov. 1986. A preliminary list of the fishes from the Mill Rise. *Vopr. Ikhtiol.,* 26(4):552-559 (in Russian).

Peden, A. 1974. Rare fishes, including first records of thirteen species, from British Columbia. *Syesis,* 7:47-62.

Peden, A. 1980. Rare captures of two fishes, *Benthodesmus* and *Paralepis,* off British Columbia. *Syesis,* 12:179-180.

Permitin, Y.I., 1969. New data on the specific composition and distribution of fish fauna in the Scotia Sea. *Vopr. Ikhtiol.,* 9(2):221-239 (in Russian).

Poey, F. 1854. Nuevo género de peces escobrideos, *Epinnula magistralis* Poey, fasc 1 p. 281-463. In: *Memorias sobre la historia natural de la isla de Cuba, acompañadas de sumarios latinos y extractos en frances.* Habana. Vol. 1. 441 p.

Poey, F. 1860. XLIX Poissons de Cuba, espèces nouvelles, p. 115-356. In: *Memorias sobre la historia natural de la isla de Cuba, acompañadas de sumarios latinos y extractos en frances* Habana. Vol. 2.

Phillipps, W.J. 1932. Notes on new fishes from New Zealand. *N.Z.J. Sci. Technol.,* 13(4):226-234.

Piotrovsky, A.S., 1979. On the range of the black scabbardfish *Aphanopus carbo* Lowe (Trichiuridae) in the Indian Ocean. *Vopr. Ikhtiol.,* 19(5):931-932 (in Russian).

Portsev, P.I., and Y.K. Nikolaev. 1984. The first record of *Lepidopus caudatus* (Euphrasen) (Trichiuridae) in the Black Sea. *Vopr. Ikhtiol.*, 24(2):328-329 (in Russian).

Quero, J.-C. 1973. Sur la capture de trois espèces de Gempylides (Pisces, Percomorphi, Trichiuroidea) par les chalutiers de la Rochelle. *Ann. Soc. Sci. Nat. Charente-Marit,* 5(5-9):337-343.

Rafinesque, C.S. 1810. *Caratteri di alcuni nuovi generi e nuove specie di animali (principalmente di pesci).* Palermo. 105 p.

Ramsay, E.P., and J.D. Ogilby. 1887. Notes on the genera of Australian fishes. *Proc. Linn. Soc. N.S.W.,* 2(2):181-184, 561-564.

Randall, J.E., and A.C. Egaña. 1984. Native names of Easter Island fishes, with comments on the origin of the Rapanui people. *Oceas. Pap. B.P. Bishop Mus.,* 25(12):1-16.

Richardson, J. 1839. Description of fishes collected at Port Arthurin Van Diemen's Land. *Proc. Zool. Soc. Lond.,* 7:95-100.

Richardson, J. 1842. Report on the present state of ichthyology of New Zealand. *Rep. Br. Ass. Advmt. Sci.* (12th meet.), 1842:12-30.

Risso, A. 1810. *Ichthyologie de Nice, ou histoire naturelle des poissons du département des Alpes Maritimes F. Schoell.* Paris. 388 p.

Robertson, D.A. 1975; A key to the planktonic eggs of some New Zealand marine teleosts. *Fish. Res. Div. Occas. Pubb.,* 9:1-19.

Robertson, D.A. 1980. Spawning of the frostfish, *Lepidopus caudatus* (Pisces: Trichiuridae), in New Zealand waters. *N.Z.J. Mar. Freshwat. Res.,* 14(2):129-136.

Rosenblatt, R.H., and R.R. Wilson. 1987. Cutlassfishes of the genus *Lepidopus* (Trichiuridae), with two new eastern Pacific species. *Jap. J. Ichthyol.,* 33(4):342-351.

Rowling, K.R. 1987. The need for catch controls in the gemfish industry. NSW Department of Agriculture, Fisheries, *Fisheries Res. Inst. Intern. Rep.,* 26:1-8.

Russo, J.L.. 1983. *Interrelationships of the gempylid fishes (Teleostei, Scombroidei).* Unpubl Ph.D. Dissertation, George Washington Univ., Washington, D.C., 248 p.

Saemundsson, B. 1907. Zoologiske Meddelelser fra Island. X. *Vidensk. Meddr. dansk. naturh. Foren.,* 59:19-27.

Sainsbury, K.J., P.J. Kailola, and G.G. Leyland.1985. *Continental Shelf fishes of northern and north-western Australia.* Clouston & Hall and Peter Powhall Fisheries Information Service. Canberra, 375 p.

Sauvage, H.E. 1882. Description de quelques poissons de la collection du Muséum d'histoire naturelle. *Bull. Soc. Philomath., Paris,* 6(Ser. 7):168-176.

Schmidt, P.J. 1931. Fishes of Japan, collected in 1901. *Trudy Tikhook. Komisi. Akad. Nauk SSSR.,* 2:1-176.

Schultz, L.P., and S. Springer. 1956. *Lepidocybium flavobrunneum,* a rare gempylid fish new to the fauna of the Gulf of Mexico. *Copeia,* 1:65.

Scott, T.D. 1962. *The marine and fresh water fishes of South Australia.* Adelaide. 338 p.

Scott, T.D., C.J.M. Glover, and R.V. Southcott. 1980. *The marine and freshwater fishes of South Australia.* Adelaide. 392 p.

Sebastian, M.J., and Rao P. Vedavyasa.1963. On the feeding habits of the snake mackerel *Gempylus serpens* (Cuvier), with some remarks on the specimens collected off the Indian coast. *J. Mar. Biol. Ass. India,* 5(2):322.

Seale, A.F. 1906. Fishes of the South Pacific. *Occ. Pap. Bernice P. Bishop Mus.,* 4(1):1-89, figs 1-23.

Senta, T. 1975. Redescription of trichiurid fish *Tentoriceps cristatus* and its occurrence in the south China Sea and the Straits of Malacca. *Jap. J. Ichthyol.,* 21(4):175-182.

Senta, T. 1977. Records of the crested hairtail, *Tentoriceps cristatus* from the Philippine waters. *Bull. Fac. Fish. Nagasaki Univ.,* 42:21-23.

Shaw, G. 1803. *General zoology or systematic natural history.* Vol. 4, London. 632 p.

Shcherbachev, Y.N. 1987. A preliminary list of thalassobathial fishes from the tropical and subtropical Indian Ocean. *Vopr. Ikhtiol.,* 27(1):3-11 (in Russian).

Shcherbachev, Y.N., A.N. Kotlyar, and A.A. Abramov. 1989. Fish fauna and fish resources of submarine rises in the Indian Ocean, p. 159-I 85. In: *Biological resources of the Indian Ocean.* Nauka, Moscow. (in Russian).

Shcherbachev, Y.N., E.I. Kukuev, and V.I. Shlibanov. 1985. Fishes of bottom and near bottom ichthyocenes of seamounts in the southern Mid-Atlantic Ridge. *Vopr. Ikhtiol.,* 25(1):35-50 (in Russian).

Shcherbachev, Y.N., N.V. Parin, N.P. Pakhorukov, and A.S. Piotrovsky. 1986. Mesobenthic and mesobenthopelagic fishes from submarine rises in the western Indian Ocean. *Trudy Inst. Okeanol.,* 121:195-214 (in Russian).

Shiokawa, T. (ed.). 1988. *Managements of ribbon fish resources in the Central Japan Sea.* Japan Fisheries Resource Conservation Association, Tokyo. *102* p. (in Japanese).

Shuntov, V.P. 1979. *Ichthyofauna of Southwest Pacific Ocean.* Pishchevaya Prom., Moscow. 193 p. (in Russian).

Silas, E.G., and M. Rajagopolan. 1974. Studies on demersal fishes of the deep neritic waters and the continental slope 2 on *Trichiurus auriga* Klunzinger, with notes on its biology. *J. Mar Biol. Ass. India,* 16(1):253-274.

Sloane, H. 1707. A voyage to Jamaica. In: *A voyage to the islands Madeira, Barbados, Nieves, S. Chriostphers and Jamaica, with the natural history of the herbs and trees, ... fishes, birds, . . . of the last of those islands.* 2 vol., London,1:1-256.

Smith, A.1849. *Illustrations of the zoology of South Africa, consisting chiefly of figures and descriptions of the objects of natural history collected during an expedition into the interior of South Africa in 1834-1836.* London. Vol. 4. 77 p.

Smith, J.L.B. 1949. *The sea fishes of southern Africa.* Central News Agency, Johannesburg. 580 p.

Smith, J.L.B. 1968. New and interesting fishes from deepish water off Durban, natal and southern Mozambique. *Invest. Rep. Oceanogr. Res. Inst.,* 19:1-30.

Snyder, J.O. 1911, Description of new genera and species of fishes from Japan and the Riukiu Islands. *Proc. U.S. .Nat. Mus.,* 40(1836):525-549

Snyder, J 0. 1912. Japanese shore fishes collected by the United States Bureau of Fisheries steamer "Albatross" expedition of 1906. *Proc. U.S. Nat. Mus.,* 42(1909):395-450.

Steindachner, F. 1891. Ichthyologische Beiträge. XV. Über einige seltene und neue Fischarten aus dem canarischen Archipel. *Sitzber. K. Akad. Wiss. Wien,* 10(1):343-374.

Strasburg, D.W. 1964. Postlarval scombroid fishes of the genera *Acanthocybium, Nealotus* and *Diplospinus* from the central Pacific Ocean. *Pacific Sci.,* 18(2):174-185.

Swainson, W. 1839. *The natural history and classification ofjishes, amphibians and reptiles, or monocardian animals.* London. Vol. 2. 448 p.

Temminck, C.J., and H. Schlegel. 1844. Pisces. In: P.F. Siebold, *Fauna Japonica, sive descriptio animalium, quae in itinere per Japoniam suscepto, annis 1823-30 collegit, notis, observationbus et adunbrationibus illustravit P.F. Siebold.* Lugduni Vatavorum, Lugduni Batavorum. 325 p.

Templeman, W., and H.J. Squires.1963. Three records of the black scabbard fish, *Aphanopous carbo* Lowe, from the Canadian region of the western Atlantic. *J. Fish. Res. Board Canada,* 20(3):273-278.

Tucker, D. W. 1950. The biology of *Aphanopus carbo* Lowe. *Rep. Challenger Soc., Lond.,* 3(2):26.

Tucker, D.W. 1953. The fishes of the genus *Benthodesmus* (family Trichiuridae). *Proc. Zool. Soc. Lond.,* 123: 171-197.

Tucker, D.W. 1955. Studies on trichiuroid fishes 2. *Benthodesmus tenuis* (Günther) collected by the "Expedition Oceanographique Belge dans les eaux côtières de l'Atlantique Sud (1948-1949)", with additional notes on the genus *Benthodesmus. Bull. Inst. Roy. Sci. Natur: Belg.,* 31(64):1-26.

Tucker, D.W. 1956. Studies on the trichiuroid fishes. 3. A preliminary revision of the family Trichiuridae. *Bull. Brit. Mus. Nat. Hist., Zool.,* 4(3):73-130.

Tucker, D.W. 1957. Studies on the trichiuroid fishes. 4. A specimen of *Evoxymetopon taeniatus* (Poey) Gill, from the Gulf of Mexico. *Ann. Mug. Nut. Hist., Ser.* 12, 10(144):425-428.

Tucker, D.W., and C. Palmer. 1949. New British records of two rare deep-sea fishes: *Oxynotus paradoxus* Frade and *Aphanopus carbo* Lowe. *Nature, Lond.,* 146(4178):930-931.

Uchida, K. 1940. Note on a rare fish *Evoxymetopon taeniatus* from Korea. *Zool. Mag.,* 52(7):260-262 (in Japanese).

Uchida, R.N., and D.T. Tagami. 1984. Groundfish fisheries and research in the vicinity of seamounts in the North Pacific Ocean. *Mar. Fish. Rev.,* 46(2):1-17.

Uyeno, T., K. Matsuura, and E. Fujii. 1983. *Fishes trawled off Suriname and French Guiana.* Japan Marine Fisheries Resource Research Center, Tokyo. 519 p.

Van del Hoeven, J. 1855. *Handbook der dierkunde; tweede verbeterde uitgave met bijroegsels en aanmerkingen door Leuckart.* Amsterdam, 3. vol. 1849-1856, 1855:188-419.

Vandelli, D. 1797. Florae et faunae Lusitanicae specimen. *Mem. R. Acad. Sci. Lisbon,* 1:37-79.

Voss, N.A.1954. The postlarval development of the fishes of the family Gempylidae from the Florida Current: *I. Nesiarchus* Johnson and *Gempylus* Cuv. and Val. *Bull. Mar Sci. Gulf Caribb.,* 4(2):120-159.

Waite, E.R. 1904. Additions to the fish fauna of Lord Howe Island, No. 4. *Rec. Aust. Mus.,* 5(3):135-186, 3 pls.

Waite, E.R. 1911a. Additions of the fauna of New Zealand. No. II. *Proc. N.Z. Inst.,* 43(2):9-51.

Waite, E.R. 1911 b. Scientific results of the New Zealand Government Trawling Expedition, 1907. Pisces. Part. II. *Rec. Canterbury Mus.,* 1(3):157-272.

Wass, R.C. 1984. An annotated checklist of the fishes of Samoa. *NOAA Techn. Rep. NMFS SSRF,* 781:1-43.

Weber, M. 1913. Die Fische der Siboga-Expedition. *Siboga Exped.,* 57:1-710.

Wheeler, A.1969. *The fishes of the British Isles and North-West Europe. Macmillan,* London, Melbourne and Toronto. 613 p.

Whitley, G.P. 1933. Studies in ichthyology. No. 7. *Rec. Aust. Mus.,* 19(1):60-112.

Whitley, G.P. 1948. Studies in ichthyology. No. 13. *Rec. Aust. Mus.,* 22(1):70-94.

Withell, A.F., and J.W.J. Wankowsky. 1989. Age and growth estimates for pinkling, *Genypterus blacodes* (Schneider), and gemfish, *Rexea solandri* (Cuvier), from eastern Bass Strait, Australia. *Aust. J. Mar Freshwater Res.,* 49:215-226.

Wongratana, T. 1980. An occurrence of *Thyrsitoides marleyi* Fowler in the Andaman Sea (Pisces: Gempylidae). *Nat. Hist. Bull. Siam Soc.,* 28:137-146.

Zilanov, V.K., and L.I. Shepel. 1975. A contribution to the ecology of black scabbardfish *Aphanopus carbo* Lowe in the North Atlantic. *Vopr. Ikhtiol.,* 15(4):737-739 (in Russian).

6. INDEX OF SCIENTIFIC AND VERNACULAR NAMES

EXPLANATION OF THE SYSTEM

Type faces used:

Italics	(bold)	:	Valid scientific names (double entry by genera and species)
Italics			Synonyms (double entry by genera and species)
Roman	(bold)	:	International (FAO) species names
Roman		:	Local species names

A

B

C

D

E

F

G

H

J

K

L

M

N

O

P

R

S

T

U

V

W

X

Y

Z