1. INTRODUCTION

This catalogue is intended as an identification guide to the threadfin breams (genus ***Nemipterus***),whiptail breams (genus ***Pentapodus***), monocle breams (genus ***Scolopsis***), dwarf monocle breams (genus ***Parascolopsis***) and coral breams (genus ***Scaevius)*** of the world, primarily for use in fisheries and fisheries-related studies. Information useful for identification, as well as details on biology, ecology and catch statistics, where known, are presented for all of the 62 presently recognized species of nemipterid fishes, regardless of their importance to fisheries.

The nemipterids are one of the most important economic groups of marine fishes in the tropical Indo-West Pacific region, but they are also one of the most taxonomically difficult families to deal with. The group has been previously reviewed by Fowler (1931 b, 1933), Weber & de Beaufort (1936) and Akazaki (1959, 1962), but there is little agreement in the nomenclature of these authors, and classification at the species level has been greatly confused. Recent reviews of the ***Nemipterus*** species of Thailand (Wongratana, 1972, 1974) and of the western Indian Ocean species of ***Nemipterus*** (Russell, 1986a), as well as re-examination of nemipterid type specimens in the Muséum National d'Histoire Naturelle, Paris, (Bauchot et al., 1983) have resolved some taxonomic problems. However, many species continue to be confused or incorrectly identified in the literature.

A major problem in resolving the taxonomy of the nemipterids is that many species are similar in morphology, and separation of taxa has been mainly on the basis of fresh coloration. Identification from preserved specimens often is difficult, and this has frequently led to misidentification. Except in the case of a few well-known species, much of our biological knowledge is tied to names which may not be correct, thus rendering the associated biological information of doubtful value. Other factors contributing to past confusion have been the failure of some taxonomists to re-examine type specimens, and also a lack of fresh material. In the course of the present work, the author has examined a wide range of museum specimens, including all extant types (the majority of which are in European museums), and has undertaken extensive field collecting of fresh specimens, mainly from fish markets throughout the Southeast Asian region. In some cases correct species determination was possible only by visiting the original type localities to obtain fresh material.

The taxonomic information provided in this catalogue is based on an on-going revision of the family Nemipteridae by the author. As such, the catalogue is not intended as a final, definitive work on the classification of the Nemipteridae, but rather as a state-of-the-art guide which summarizes taxonomic information to date, and which hopefully will serve as a foundation for further work.

Consistent with the format and style of the "FAO Species Catalogue" series, this catalogue is intended to be as self-contained as possible, and a glossary of technical terms and illustrations is provided to minimize the necessity to refer to related literature. Literature citations in the text have been kept to a minimum, and the literature that has been consulted is listed in the bibliography.

Acknowledgements

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Finally, I thank FAO staff for making the final editing session both successful and enjoyable.

1.1 Plan of the Catalogue

A family description is given, followed by a key to genera. The species accounts are arranged alphabetically by genera and species. Each genus is introduced with its type reference and synonyms. Descriptions of genera with more than one species also list diagnostic features and comments on general biology, habitat, distribution, and interest to fisheries. The genus descriptions are followed by a key to the species and species accounts in alphabetical order. 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 type locality is given.

(2) Synonyms: All invalid names that have been applied are referenced.

(3) FAO Name: The FAO English name is considered the standard to be used by fishery purposes. This should avoid confusion which can be caused by the existence of multiple names for the same species or 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. FAO French and Spanish names are not yet available for most species.

(4) Diagnostic Features: Distinctive characters of the species are given as an aid for identification, accompanied by useful diagrams. These diagnoses should be consulted to confirm species identified using the illustrated key.

(5) 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 intermediate areas between locality records where a species is expected to be found.

(6) Habitat and Biology: Information on habitat, behaviour, food habits and reproduction is given, where known.

(7) Size: Because many nemipterid fishes have filamentous extensions to the caudal fin, the usual measurement of size as total length can be misleading. For this reason, the measurement of size used throughout this Catalogue is standard length (SL) (see Fig. 5). The approximate maximum size, and the size commonly attained are given throughout in SL.

(8) Interest to Fisheries: General information on the extent, type of fisheries, and utilization are given. Detailed fisheries data are unavailable for all species, and therefore only a qualitative assessment is usually possible.

(9) Local Names: These are given where published names are available. Often, a single local name is applied to several species.

(10) Literature: Only more recent references which contain illustrations that could be useful for identification are given. It is indicated if an incorrect name is given in the reference.

(11) Remarks: Useful information which is not appropriately covered in the previous paragraphs is included here. Frequently used incorrect scientific names are mentioned here.

1.2 General Remarks on Nemipterids

The Nemipteridae are marine perciformes that occur in the tropical-subtropical Indo-West Pacific. They belong to the superfamily Sparoidea, a monophyletic group that also contains the families Sparidae (porgies), Lethrinidae (emperor fishes and large eye breams - see FAO Species Catalogue, Vol. 9) and Centracanthidae (picarels).

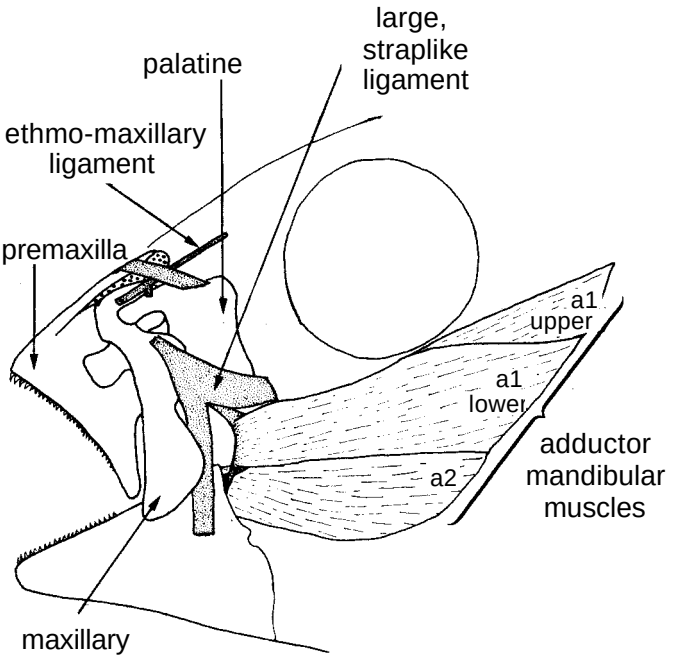


Fig. 1 Ligaments and muscles associated with jaw bones in ***Nemipterus*** (from Johnson, 1980)

Phylogenetic relationships and classification: The limits and relationships of the sparoid fishes have been discussed by Akazaki (1962) and Johnson (1980). Within the Sparoidea, the Nemipteridae are characterized by the presence of a well-developed, Y-shaped ethmo-maxillary ligament, with a branch inserting on the palatine (Fig. 1). In all other sparoids this ligament is reduced or absent. In addition, nemipterids have a large, strap-like ligament running forward from the ectopterygoid to insert by two separate branches on the maxillary and articular; the adductor mandibulae section A_1 is completely or partially divided into two separate sections, the lower of which lies lateral to A_2 (in contrast to lethrinids, in which A_1 lies medial to A_2); and the ramus mandibular passes lateral to A_2. Nemipterids also have a well-developed opisthotic (lost or fused in all other sparoids); an accessory subpelvic keel; a post pelvic process; and a subocular shelf. The posterior predorsal bone (predorsal configuration 0/0/2 + 1/1/) and the second epibranchial tooth plate also are lost in nemipterids.

The phylogenetic position of the Nemipteridae is still uncertain, but Johnson (1980) considers the nemipterids to be more closely related to the lethrinids than to other sparoids.

The Nemipteridae are recognized here as comprising five genera: ***Nemipterus***, ***Parascolopsis***, ***Pentapodus***, ***Scaevius***, and ***Scolopsis*** (Fig. 2). The taxonomic integrity of These genera has been widely accepted, although the validity of ***Parascolopsis*** has been challenged by some authors, who have included this genus within ***Scolopsis***. Preliminary osteological study, however, indicates a number of significant differences between ***Parascolopsis*** and ***Scolopsis.*** These include differences in jaw structure, development of the infraorbital bones, number of epipleural ribs and degree of development of the second anal spine. In addition, species of ***Parascolopsis*** generally occur in deeper offshore waters and differ in habitat from ***Scolopsis***, which typically inhabit shallow reef areas. Pending further analysis of relationships, ***Parascolopsis*** and ***Scolopsis*** are therefore retained here as separate genera.

Taxonomic work on the Nemipteridae is still on-going. Among problems that remain to be resolved are the taxonomy of the species of the mainly deeper-water genus ***Parascolopsis***. Specimens of this group are comparatively rare in museums, and additional material is needed for identification of a number of apparently undescribed species which, because of their uncertain taxonomic status, are not included here. A revision of the genus ***Parascolopsis*** is planned, and separate papers revising the other nemipterid genera are presently being prepared. The reader is alerted particularly to forthcoming papers by the author in which the undescribed species of ***Nemipterus*** and ***Pentapodus*** included here, will be formally described and named.

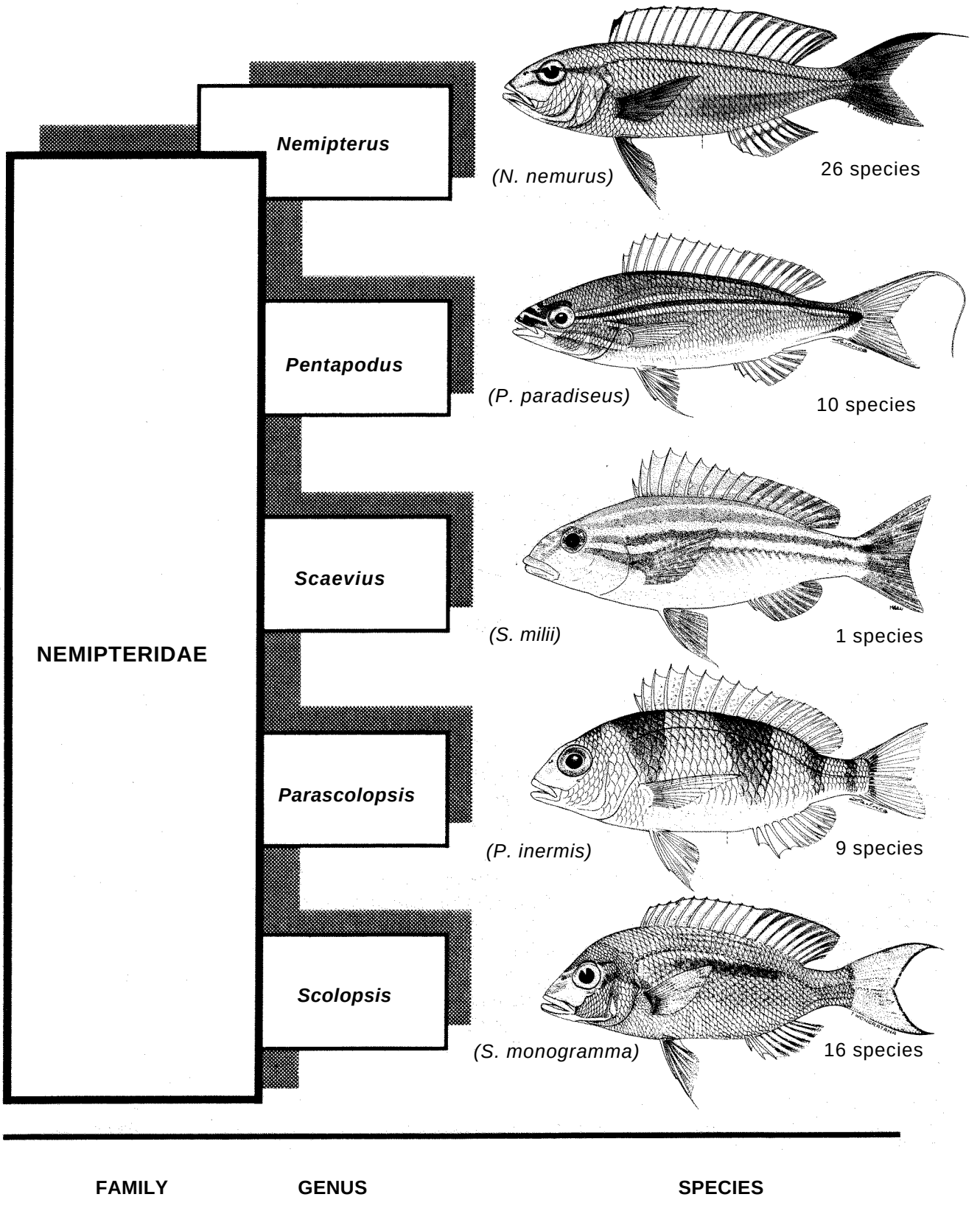


Fig. 2 A provisional classification of the genera of the Family Nemipteridae

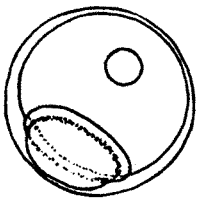
Distribution, Habitat and Biology: The family Nemipteridae is confined to the tropical and subtropical Indo-West Pacific, and no species occur in the eastern Pacific, Atlantic (the type-locality of 'Surinam' for ***Dentex filamentosus*** Valenciennes [= ***Nemipterus nematophorus***] appears to be an error for Sumatra), or Mediterranean Sea (a report of ***N. japonicus*** as a Red Sea immigrant into the Mediterranean [Fischer & Whitehead, 1974] has yet to be confirmed). Three genera, ***Nemipterus***, ***Scolopsis*** and ***Parascolopsis***, are distributed widely throughout the Indo-West Pacific region; the genus ***Pentapodus*** is restricted to the West Pacific (including north-western Australia and western Indonesia); and the monotypic genus ***Scaevius*** is endemic to northern Australia. Nemipterids are marine, bottom-living fishes (records of ***N. balinensoides*** and ***N. oveniides*** Popta [= ***N. peronii***] from 'Süsswasser' [fresh water] are very doubtful). Species of the genus ***Nemipterus*** occur on mud and sand bottoms in coastal inshore as well as offshore shelf waters and range in depth down to about 300 m, although most species occur in much shallower water. Species of the genus ***Parascolopsis*** occur on mud or sand bottoms mainly in offshore shelf waters in depths down to about 400 m. Species of the genus ***Pentapodus*** are benthic or free-swimming near the bottom, and usually occur on or close to coral reefs in depths down to 100 m. The monotypic ***Scaevius milii*** occurs on reef and shallow muddy or sand bottoms in inshore areas. Species of the genus ***Scolopsis*** occur usually on coral reefs, or on sand or mud bottoms close to reefs, in depths down to about 60 m. Nemipterids can be solitary or schooling and do not appear to be territorial.

Nemipterids are entirely carnivorous fishes and feed mainly on other small fishes, cephalopods, crustaceans, and polychaetes. Feeding in most species appears to be done during the day.

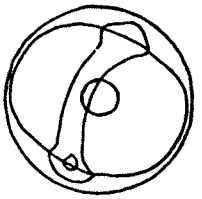
Many nemipterid fishes show size-related differences in sex ratios, with small fishes being mainly females and larger fishes males. In some species this size-related skew in sex ratios appears to be due to higher growth rates in males. However, histological examination of gonads indicates that protogynous hermaphroditism may also explain the size-related differences in sex ratios in some species. Protogynous hermaphroditism is reported for some species of ***Scolopsis***. There is evidence of hermaphroditism also in species of ***Pentapodus*** and ***Nemipterus*** (Young & Martin, 1985), although species of Nemipterus appear to be non-functional rudimentary hermaphrodites in which the males have functional testes, but retain rudimentary ovarian tissue throughout their life (Takahashi et al., 1989).

There are no reports of courtship or spawning behaviour among nemipterid fishes. Spawning seasonality varies widely among different species and appears to vary also between localities. Mature ova are present in species of ***Nemipterus*** over a prolonged period, inferring a protracted spawning season, with usually one or two periods of increased fecundity.

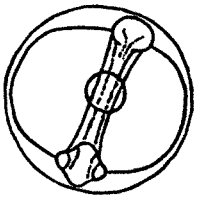
The eggs and newly-hatched larvae of ***N. virgatus*** (Fig. 3) have been described by Aoyama & Sotogaki (1955), Renzhai & Suifen (1980) and Renzhai (1986). Leis & Rennis (1983) have described and illustrated larvae of an unidentified nemipterid, probably ***Pentapodus*** (Fig. 4). Eggs of ***N. virgatus*** are colourless, buoyant and spherical, measuring 0.71 to 0.79 mm in diameter (Fig. 3 a-f). The yolk mass measures 0.58 to 0.60 mm in diameter, with an oil globule of 0.15 to 0.16 mm. Eggs take about 24 hours to hatch. The larvae hatch at 1.5 to 1.8 mm and newly hatched larvae have an elongate body, a small yolk sac, a single oil globule, unformed mouth, and unpigmented eyes (Fig.3 g). The lower finfold is transparent and only a few stellate melanophores are present along the ventral margin of the tail region. The body pigment changes during yolk absorption with branching melanophores appearing on the snout and front of the yolk mass. At 1.95 mm, the stellate melanophores along the ventral tail region are increased. By 7 mm spines are not yet present on the head and operculum but the stellate melanophores remain on the margin of the base of the anal fin and peduncle (Fig. 3 m). Distinguishing characteristics of nemipterid larvae include 22-24 myomeres, tightly coiled gut, large head lacking any spines, large eye, and ventral midline pigment (Fig. 4).



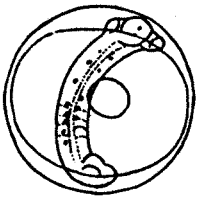
a) 8 hours, 35 min.



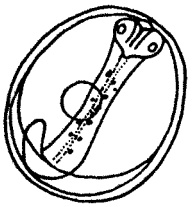
b) 16 hours, 50 min.



c) 20 hours, 10 min.

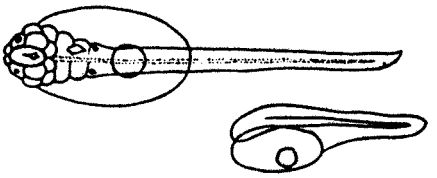


d) 20 hours, 30 min.

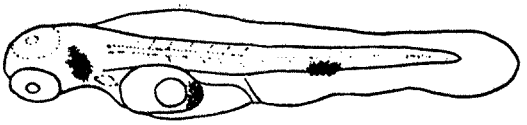


e) 26 hours

f) 27 hours

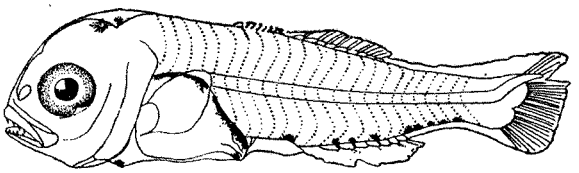


g) larvae just hatched, 1.7 mm TL

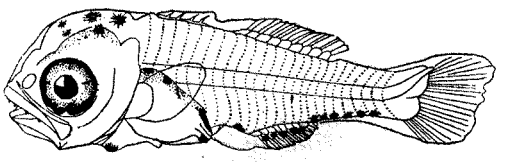


h) 24 hours after hatching, 2.3 mm TL

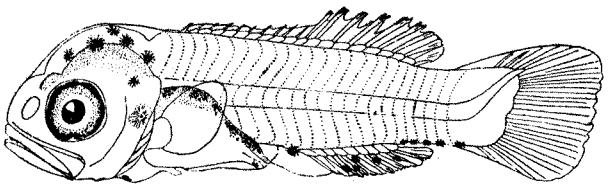
i) 48 hours after hatching, 2.5 mm TL



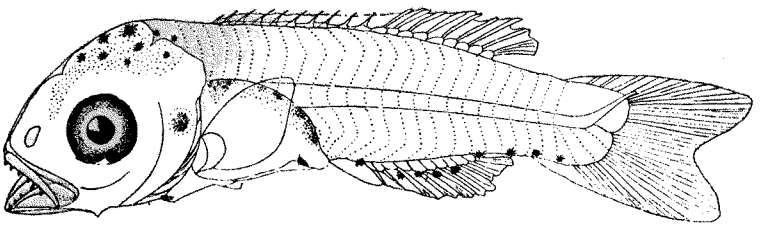
j) prelarva, 4.16 mm SL



k) prelarva, 4.6 mm SL



l) late postlarva, 5.9 mm SL



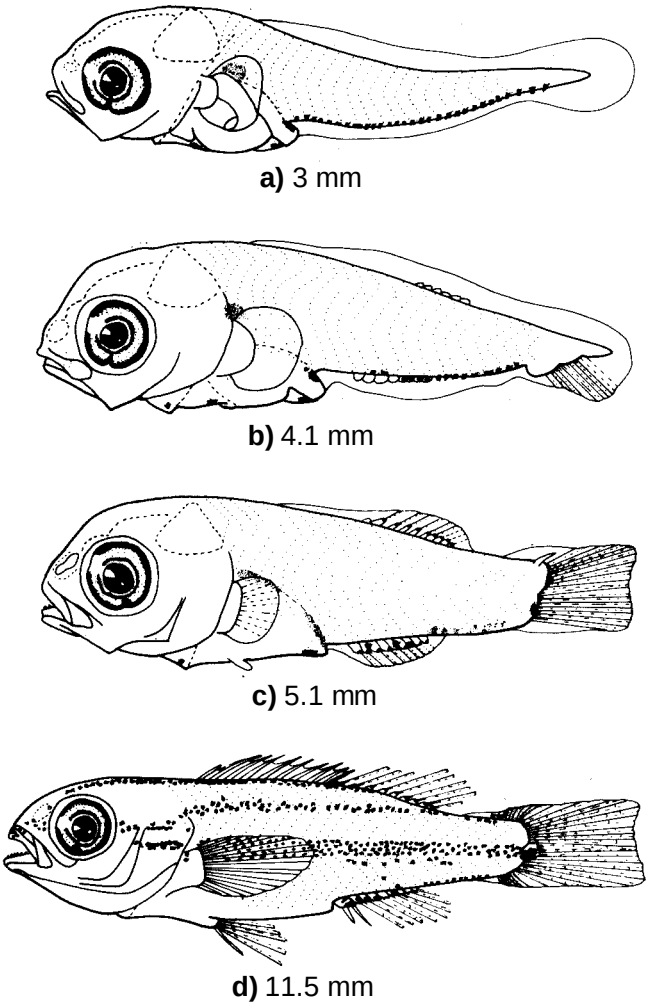
m) late postlarva, 7 mm SL

Fig. 3 Early development stages of ***Nemipterus virgatus***
(from Aoyama & Sotogaki, 1955: a to i; Renzhai, 1986: j to m)

Juveniles of ***Scolopsis*** species often are strikingly different in colour pattern to adults, and the juveniles of at least two species (***S. bilineatus*** and ***S. margaritifer***) appear to be Batesian mimics (Allen et al., 1975; Russell et al., 1976; Smith-Vaniz, 1976). The juvenile coloration of these scolopsids closely resembles poisonous or noxious blenniid species, and in the case of ***S. bilineatus*** this resemblance even extends to geographic subspecies of the blenniid (Russell et al.,1976).

Population dynamics of nemipterids have been studied only for species of ***Nemipterus*** and ***Scolopsis***, and the von Bertalanffy growth parameters, asymptotic length (L_{∞}) and the coefficient of growth (K) are known for populations of a few commercially important species (for details of growth parameters see individual species accounts).

Fisheries: Threadfin breams, and to a much lesser extent monocle breams, are an important component of commercial and artisanal fisheries of the Indo-West Pacific region. Whiptail breams are of artisanal fisheries importance in some areas and are also taken occasionally by recreational fishermen. Dwarf monocle breams, because of their usually small size and deeper-water habits are of little fisheries importance.



a) 3 mm

b) 4.1 mm

c) 5.1 mm

d) 11.5 mm

Fig. 4 Larvae of an unidentified nemipterid, possibly ***Pentapodus* sp**. (from Leis & Rennis, 1983)

Nemipterids are caught mainly by bottom trawl or by handline. Other methods include longline, gill nets, lift nets, surrounding nets, drive-in nets, fish stakes and traps. Some species of ***Scolopsis*** also are captured live by hand net for the aquarium trade. Nemipterids are popular eating fishes and are marketed fresh, dry-salted, dry-smoked, fermented and steamed. Trash fish are made into fish balls, fish cakes, fish meal and surimi, or used as animal feed.

Threadfin breams are usually taken in multispecies catches, and often three or more species of ***Nemipterus*** occur in the same trawl. Because of problems of identification, they are rarely reported as separate species, separate landing statistics are available only for one species (***Nemipterus virgatus***), while the remaining catch data are reported under unidentified ***Nemipterus*** species, ***Scolopsis*** species, or ***Nemipteridae*** (see Table 1). In many areas, species of ***Nemipterus*** are the second or third-most important catch species by weight. The total catch of nemipterids reported to FAO for 1987 amounted to 128 491 m. tons (FAO Yearbook of Fishery Statistics, Vol. 64, 1987). However, because of the largely artisanal nature of the fisheries of some areas and the paucity of landing statistics, the available figures probably grossly underestimate the actual catch of nemipterids taken in the Indo-West Pacific region.

Table 1

Reported Catch in Metric Tons of Nemipterids by Fishing Areas for 1987

	Fishing areas				
	51	57	61	71	Total
Nemipterus virgatus	-	-	6 220	-	6 200
***Nemipterus* spp.**	906	10 086	23 232	86 175	120 400
***Scolopsis* spp.**	-	521		353	874
Nemipteridae	997	-	-	-	997
Total	1 903	10 607	29 452	86 529	128 491

1.3 Illustrated Glossary of Technical Terms and Measurements

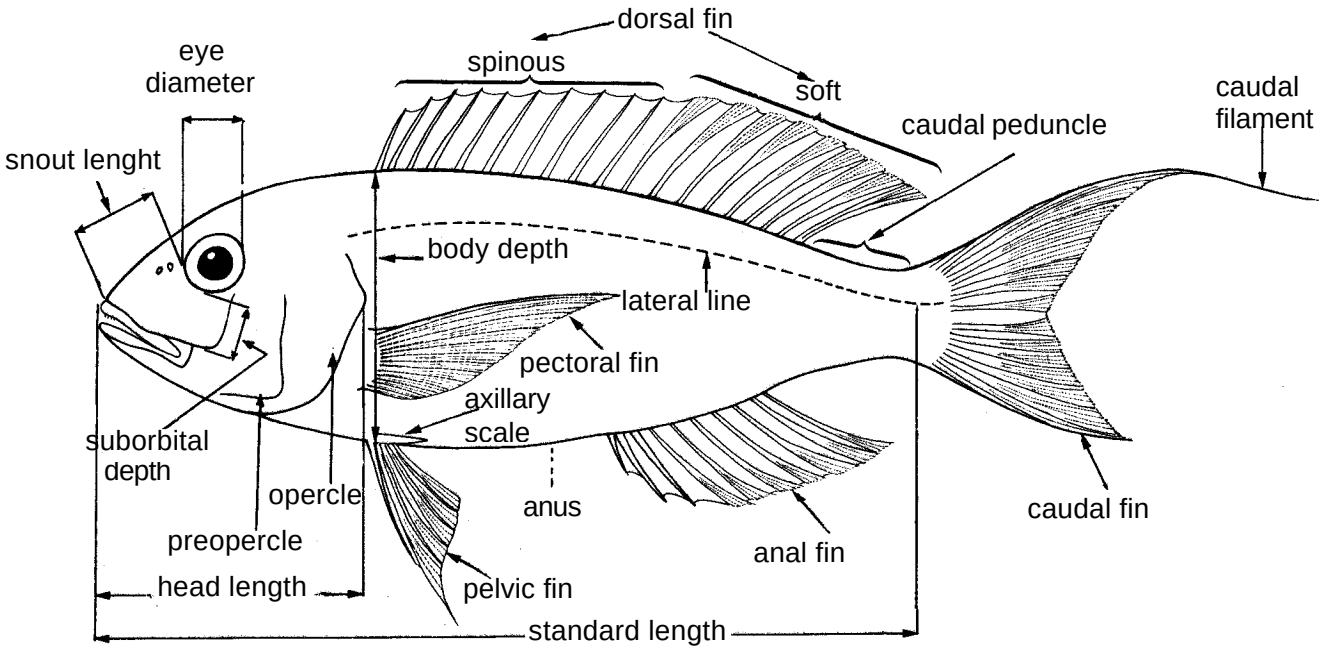


Fig. 5 External morphology and measurements

Anterior - Relating to the front portion.

Anus - The external opening of the intestine (Fig. 5).

Axillary scales - The pair of elongate, pointed, scales at the base of the pelvic fins (Fig. 5).

Bar - An elongate colour marking with vertical orientation, the sides of which are more or less straight.

Canine - A prominent elongate, curved, sharp tooth. In nemipterids, canines are usually restricted to the front part of the jaws (Fig. 6).

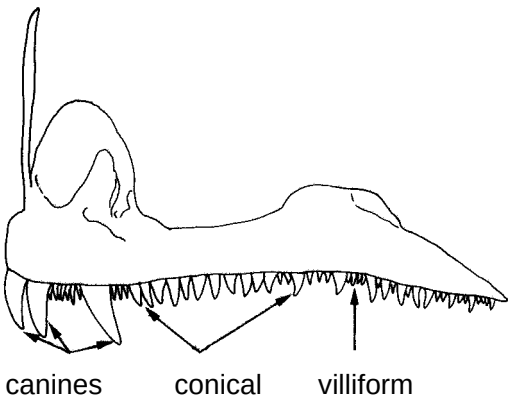


Fig. 6 Premaxilla of a nemipterid showing types of teeth

Caudal fin - The tail fin (Fig. 5).

Caudal peduncle - The narrow end of the body between the posterior basal ends of the dorsal and anal fins and the base of the caudal fin (Fig. 5)

Cheek, cheek scales - The area between the lower part of the eye and the lower limb of the preopercle. Species of the genus ***Nemipterus*** have 3 transverse rows of cheek scales, while other nemipterid species possess 4 to 6 transverse rows of scales (Fig. 7).

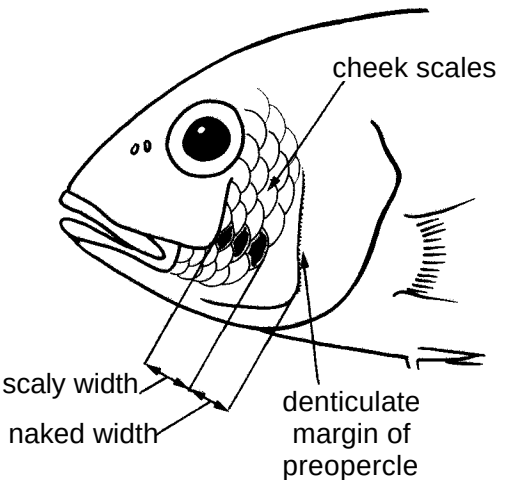


Fig. 7 Cheek scales and preopercle measurements

Compressed - Flattened from side to side; refers to relative body width.

Conical - Cone-shaped; refers to teeth (Fig. 6).

Continuous - In actual contact or closely adjoining.

Dentary - The lower jaw bone.

Denticulate - Having the appearance of teeth or teeth-like structures (Fig. 7)

Dorsal - Toward the back or upper part of the body.

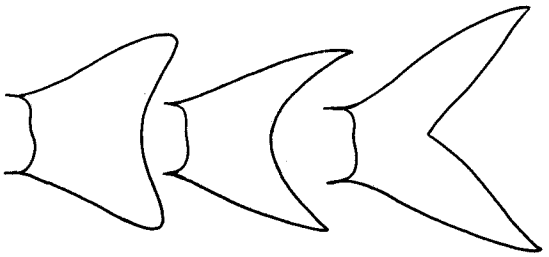
Dorsal fin - A median fin along the back. In nemipterids, the fin is supported by spinous rays anteriorly and soft rays posteriorly (Fig. 5).

Dorsal profile - Refers to the upper edge of the body in lateral view.

Dorsal midline - The longitudinal axis along the dorsal surface of the body.

Elongate - Extended; drawn out.

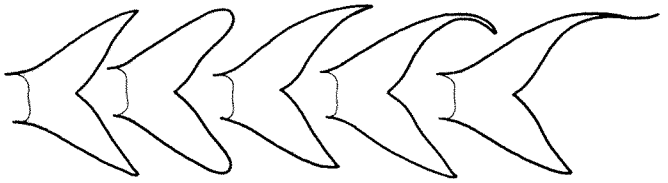
Emarginate - With the margin slightly hollowed, concave; used to describe the shape of the posterior margin of the caudal fin (Fig. 8).



emarginate lunate forked

Fig. 8 Types of caudal fins

Falcate - Scythe-like; long, narrow and curved; used to describe the shape usually of the upper lobe of the caudal fin (Fig. 9).



pointed rounded elongate falcate filamentous point

Fig. 9 Shapes of upper caudal fin lobe

Filament, filamentous - Used to describe the elongation of the anterior rays of the dorsal fin or the upper and/or lower lobe of the caudal fin (Fig. 9).

Forked - Used to describe a caudal fin shape with angular lobes (Fig. 8).

Gills, gill rakers - Bony arches, covered by the operculum, which bear the gill filaments posteriorly and the gill rakers anteriorly. In nemipterids, the gill rakers are short and sparsely covered with tiny spines. Gill raker counts are made on the first arch and include small rudiments.

Interobital width - The least distance between the orbits (Fig. 10).

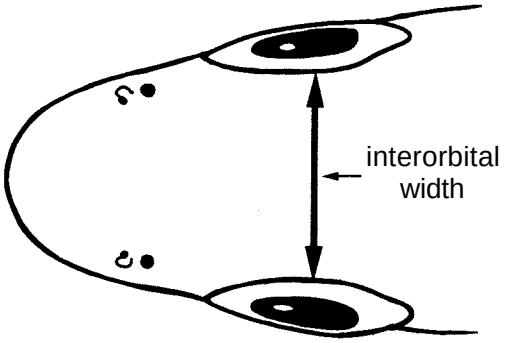


Fig. 10 Top of head

Isthmus - The area of the ventral surface where the gill membranes meet.

Lateral - At or towards the side.

Lateral fine - A series of pored or tubed scales forming a fine along the side of the body (Fig. 5). The lateral-fine scales are counted from the most anterior pored scale near the upper end of the operculum to the base of the caudal fin which is detected by the crease which results from folding the fin forward.

Lunate - Shaped like a crescent moon; used to describe the shape of the caudal fin Fig. 8).

Maxilla, maxillary - The bone of the upper jaw lying above the premaxilla (Fig. 11). The outside surface of the maxilla in nemipterids can be either relatively smooth (Fig. 11 a), or have a denticulate ridge (Fig. 11 b).

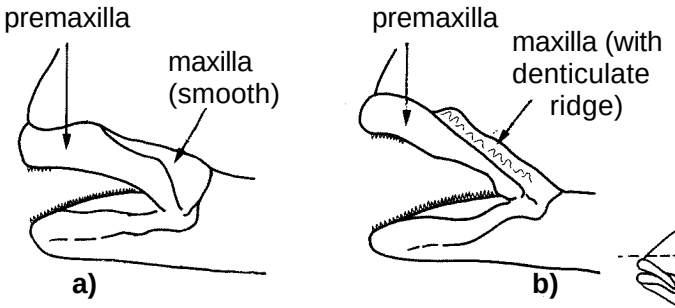


Fig. 11 Jaw bones

Median - Pertaining to the middle.

Meristic - Divided into parts or discrete units; pertaining to the number of parts as in scales or fin rays. Meristic characters include scale counts and fin ray counts.

Midlateral - The longitudinal axis along the side of the body.

Naked - Without scales.

Nomen nudum - A species name proposed without any acceptable description and having no taxonomic validity.

Opercle, operculum - The large bone forming the upper posterior of the gill cover (Fig. 5).

Pectoral fins - The anterior or uppermost of the paired fins (Fig. 5).

Pelvic fins - Paired fins behind or below the pectoral fins (Fig. 5).

Posterior - The rear or hind portion.

Position of eye relative to a line drawn from tip of snout to upper base of pectoral fin - The lower margin of the eye may be below (Fig. 12a), tangent to (Fig. 12b) or above (Fig. 12c) a line drawn from the tip of the snout to the upper base of the pectoral fin.

Premaxilla, premaxillary - The anterior bone of the upper jaw (Fig. 11).

Preopercle - Bone on check in front of opercle and forming front of gill cover (Fig. 5).

Rays - The rigid structures that support the fin; spinous rays are stiff, unsegmented, and support the anterior portion of the dorsal and anal fin; soft rays are segmented, and flexible and support the posterior portion of the dorsal and anal fin in nemipterids (Fig. 5).

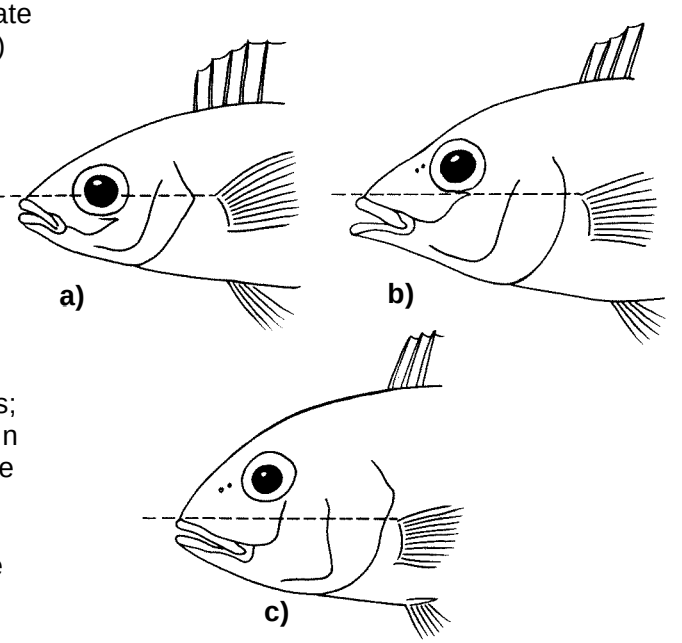


Fig. 12 Position of eye relative to a line between tip of snout to upper pectoral fin base

Scales above and below lateral line - A transverse series of scale rows; scales below the lateral line are counted from the origin of the anal fin, not including the median scale row, along a forward diagonal to the lateral line, but not including the lateral-fine scale; scales above the lateral fine are counted from the origin of the spinous portion of the dorsal fin, including the row of small scales at the base of the dorsal fin (this is usually listed as half a scale), on a diagonal backward to the lateral line, and not including the lateral-fine row (Fig. 13).

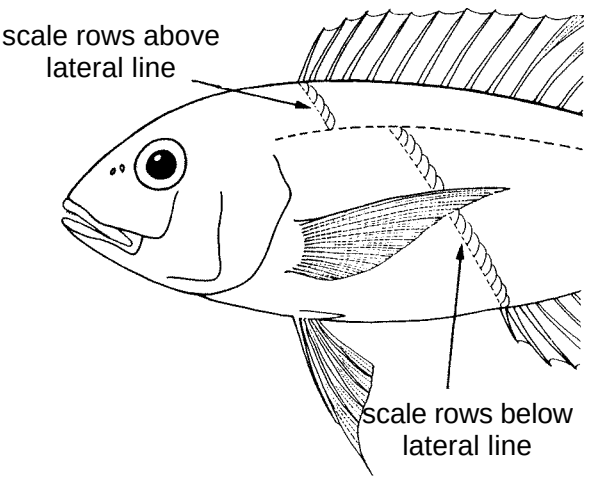


Fig. 13 Scale counts above and below lateral line

Snout - The area between the tip of the upper lip and the anterior margin of the eye. In nemipterids the snout is measured without the lip (Fig. 5).

Soft dorsal - The posterior part of the dorsal fin which is composed of jointed or soft rays.

Spinous dorsal - The anterior part of the dorsal fin supported by spines.

Spot - A more or less circular colour marking.

Standard length - The straight line distance from the tip of the snout, excluding the upper lip, to a vertical line passing through the base of the caudal fin (taken to be the point of flexure of the caudal fin) (Fig. 5).

Stripe - An elongate colour marking with a horizontal or length wise orientation, the sides of which are more or less straight.

Suborbital, suborbital width - The bone beneath the eye. In nemipterids this bone has a free posterior margin that is smooth, denticulate or bears one or more spines (see Fig. 20). Its lower margin is straight or emarginate. It may be scaly or naked. A line drawn up from the posterior margin may reach the dorsal profile before, at or behind the origin of the dorsal fin (Fig. 14). The suborbital depth is the distance between the anterior edge of preorbital bone (can be felt at about mid-point of upper jaw, behind lip) to the lower edge of orbit (Fig. 5).

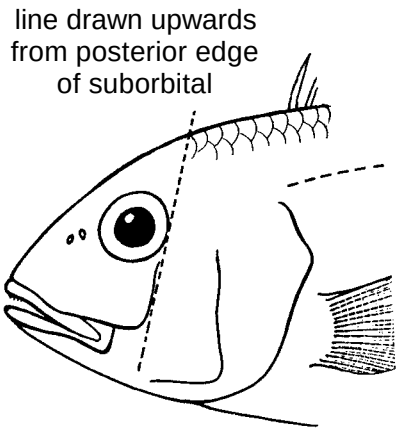


Fig. 14 Slope of posterior margin of suborbital bone

Synonym - One or more scientific names used to denote the same taxon. The first established scientific name is usually that which is the accepted name; all other later established names are junior synonyms.

Transverse - Crosswise.

Undulated - Waved.

Uniform - As applied to coloration, of one colour.

Ventral - Pertaining to the abdomen or lower surface

Ventral midline - The longitudinal axis along the ventral surface of the body

Vertical fins - Fins on the median line of the body; the dorsal, anal and caudal fins.

Villiform - Small, close-set teeth, usually in bands.

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