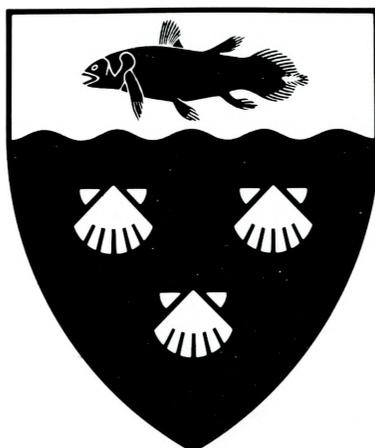


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ADDITIONS TO THE FISH FAUNA OF THE MALDIVE ISLANDS

**PART 1: AN ANNOTATED CHECKLIST OF THE DEEP DEMERSAL FISHES
OF THE MALDIVE ISLANDS**

by

M. Shiham Adam, Nigel R. Merrett and R. Charles Anderson

**PART 2: NEW RECORDS OF FISHES FROM THE MALDIVE ISLANDS,
WITH NOTES ON OTHER SPECIES**

by

R. Charles Anderson, John E. Randall and Rudie H. Kuitert

ABSTRACT (Part 1)

Adam, M. Shiham, Nigel R. Merrett & R. Charles Anderson (1998). An annotated checklist of the deep demersal fishes of the Maldivian Islands. *Ichthyological Bulletin of the J.L.B. Smith Institute of Ichthyology*, 67, Part 1: 1-19.

We report here information on the occurrence of the deep demersal fish species known to date from the Maldivian Exclusive Economic Zone below a depth of 180 m. Collections of Maldivian deep demersal fishes are held by The Natural History Museum, London (BMNH); the Bernice P. Bishop Museum, Honolulu; the Field Museum of Natural History, Chicago; the Marine Research Section, Ministry of Fisheries and Agriculture, Malé, Republic of Maldives; the South African Museum, Cape Town; and the Zoological Survey of India, at the Indian Museum, Calcutta. Specimens from all of these institutions have been studied by the authors. In addition, the authors carried out sampling of the slope shark fishery during March - April 1996, which resulted in a significant new collection of shark material. A total of 99 deep demersal species are reported here which includes 36 new records for the Maldives. The six most speciose families are the Macrouridae (7 species), Congridae (5), Lutjanidae (5), Squalidae (4), Ogocephalidae (4) and Halosauridae (4).

ABSTRACT (Part 2)

Anderson, R. Charles, John E. Randall and Rudie H. Kuitert (1998). New records of fishes from the Maldivian Islands, with notes on other species. *Ichthyological Bulletin of the J.L.B. Smith Institute of Ichthyology*, No. 67, Part 2: 20-32.

Seventy-eight fish species are recorded from the Maldives for the first time. A further 30, which have been recorded in the literature but not included in previous reviews of Maldivian fishes, are listed. The total known shore and epipelagic fish fauna of the Maldives now stands at 1007 species. The total known demersal and epipelagic fish fauna is raised to 1090.

AN ANNOTATED CHECKLIST OF THE DEEP DEMERSAL FISHES OF THE MALDIVE ISLANDS

by

M. Shiham Adam¹, Nigel R. Merrett² & R. Charles Anderson¹

INTRODUCTION

The Republic of Maldives consists of 26 atolls located in the central Indian Ocean, southwest of the southern tip of India (Figure 1). The Maldivian atolls lie in a north-south chain forming the middle, and largest, part of the Laccadives-Chagos Ridge. In the central part of the Maldives itself the atolls lie in a double chain, partially enclosing an "inner sea". In this area there is an inter-atoll shelf with an average depth of about 350 m, although it ranges in depth from about 180-500 m. Elsewhere the outer atoll slopes drop steeply to the ocean floor, which has an average depth of about 2500 m immediately to the east and about 3500 m to the west.

Randall and Anderson (1993) produced an annotated checklist of the 899 species of epipelagic and shore fishes then known from the Maldives, to a depth of 200 m. Mesopelagic and bathypelagic fishes, as well as deep demersal fishes of the inter-atoll shelf, the deeper parts of the outer atoll slopes and bathyal regions were excluded from the review of Randall and Anderson (1993). The aim of this report is to present information on the occurrence of the deep (below 180 m) demersal fish species known from the Maldivian Exclusive Economic Zone (EEZ).

During the years 1884-1926, the Royal Indian Marine Survey Ship (RIMSS) Investigator carried out extensive marine biological surveys in Indian Seas, including some deep-sea trawling in waters now included within the Maldivian EEZ (Alcock, 1899 & 1902; Talwar, 1994). The *Investigator* collections are housed at the Zoological Survey of India, Calcutta. Many specimens are in poor state of preservation and some appear to have been lost at the end of the Second World War.

The John Murray Anglo-Egyptian Indian Ocean Expedition visited the Maldives in 1934 aboard the HEMS *Mahabiss* (Rice, 1986). From 30 stations in the "Maldivian area", a total of 12 bottom samples were obtained using dredges, grabs and trawls from depths of 229-2249 m within the present Maldivian EEZ (Sewell, 1935). The entire *Mahabiss* fish collection was deposited at the British Museum of Natural History (now The Natural History Museum) and was reported on by Norman (1939). Unfortunately, Maldivian specimens of species represented by specimens caught by the *Mahabiss* elsewhere in the Indian Ocean, notably near Zanzibar, appear to have been discarded (probably at the time) as they can not now be located in the Museum collection.

Norman (1939) included *Mahabiss* station no. 143

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(from 05°15'48"S, 73°22'48"E to 05°13'42"S, 73°23'36"E) in the "Maldives area", although it is outside the boundaries of the present Maldivian Exclusive Economic Zone (EEZ). Four species recorded from that station have not been reported from within Maldivian EEZ. They are therefore not included in this report, although it is likely that they do occur there. The species involved are:

Lamprogrammus niger Alcock, 1891, Ophidiidae
Mataeocephalus microstomus (Regan, 1908),
Macrouridae
Hoplostethus (Leiogaster) melanopus (Weber, 1913),
Trachichthyidae
Gavialeceps arabicus (D'Ancona, 1928),
Muraenesocidae.

During the International Indian Ocean Expedition of 1963-64 major collections of shore and mesopelagic fishes were made in the Maldives. Shelf and slope fishes do not appear to have been specifically collected. However, some slope specimens were collected by the R.V. *Te Vega* in April 1964 (station 131, lot number LW-64-36) when a mid-water Tucker trawl dragged bottom for one hour (M.A. Rogers, Field Museum of Natural History, pers. comm., August 1995). These specimens are in the collection of the Field Museum of Natural History, Chicago.

A large unlabelled jar containing a mixed lot of deepwater fishes has been housed at the Ministry of Fisheries and Agriculture in Malé since the late 1970s. These fishes are believed (M.H. Maniku, pers. comm., 1995) to have been collected during a short trawl survey carried out around the southern atolls of the Maldives in 1977 by a German consultancy company (GOPA, 1977). No details of the trawl survey are available, and no other specimens can be located (E. Drewes, GOPA Consultants, pers. comm., September 1995).

During a visit to the Maldives by the Norwegian R.V. *Dr Fridtjof Nansen* in 1983 (Stromme, 1983) a small collection of mostly deep shelf species was made by Ahmed Hafiz of the then Maldivian Ministry of Fisheries. This collection is maintained at the Marine Research Section (MRS) in Malé; some duplicate specimens have been transferred to the Natural History Museum, London. With the exception of a single lot of *Symphysanodon* sp., no fishes were collected by Norwegian scientists on board, and the Institute of Marine Research, Bergen holds no Maldivian material (G. Bianchi, pers. comm., March 1994). However, some additional information on catches is provided in the unpublished fishing logs of the R.V. *Dr Fridtjof Nansen* cruise (Anon, 1983). Some records based on these fishing logs are included below, when there is little chance of misidentification.

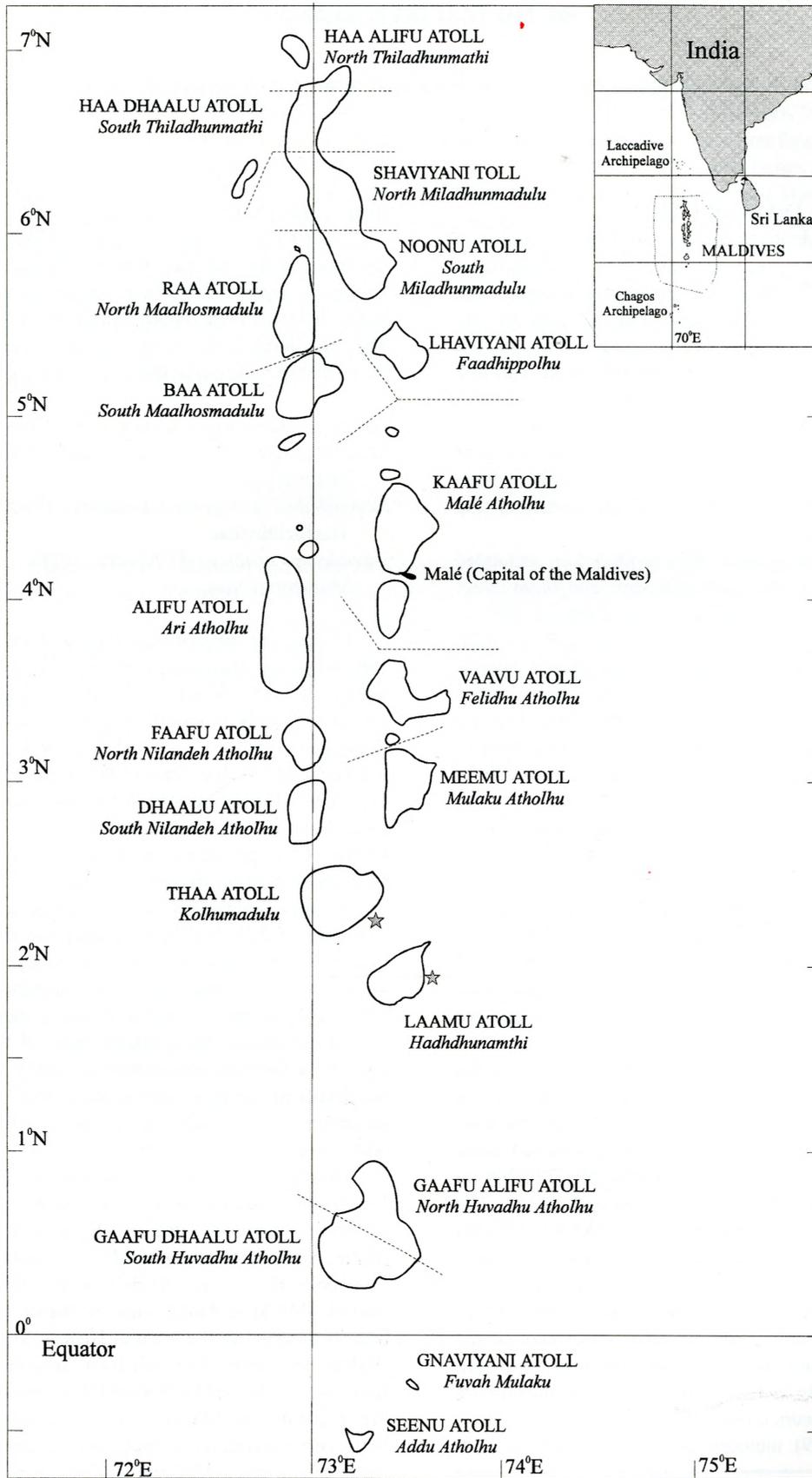


Figure 1. Location map of the Maldives, giving modern and traditional (italicised) atoll names. Dotted lines show the boundaries demarcating the administrative units and the Exclusive Economic Zone of the Maldives (inset). Asterisks indicate places where shark fishing was carried out.

A reef fish resources survey was carried out by the Marine Research Section of the Maldivian Ministry of Fisheries and Agriculture during 1986-1991 aboard the R.V. *Farumas* (Van der Knaap et al., 1991; Anderson et al., 1992). The major aim of that survey was to assess the abundance of commercial reef fishes on the shallow reef and atoll basin areas of the Maldives. However, some fishing using bottom-set longlines was carried out on the outer slopes of four atolls (Shaviyani, North Malé, Ari and Laamu) within the range 150-210 m. This resulted in several new records of fishes for the Maldives, most of which were reported by Randall and Anderson (1993), and a small collection of upper slope fishes for the Bernice P. Bishop Museum, Hawaii. During the survey it was difficult to estimate the true fishing depth of the longline on the steep outer atoll slopes. A number of fish species were caught within the recorded depth range 140-170 m, but no deeper. They are therefore not reported in this checklist. However, they may actually have been caught at depths of 180 m or greater, and in almost all cases have been recorded from at least 180 m from other localities. These fishes include the serranids *Epinephelus chlorostigma*, *Epinephelus morrhua* and *Epinephelus poecilonotus*, the carangid *Caranx lugubris*, the lethrinid *Wattsia mossambica*, and the lutjanids *Aprion virescens*, *Lutjanus bohar*, *Paracaesio sordidus*, *Pristipomoides multidentis* and *Pristipomoides zonatus*.

There has been a minor fishery for gulper sharks (*Centrophorus* spp.) on the outer atoll slopes in depths of about 250-800 m using multi-hook vertical longline since 1980 (Anderson and Ahmed, 1993). The fishery was carried out in calmer periods of the year, during the northeast monsoon season. The sharks were caught exclusively for their liver, which forms about 25% of their body weight. The liver oil is rich in squalene and was exported to Japan (Anderson and Ahmed, 1993). In addition to gulper sharks, this fishery takes several other species of slope sharks and teleosts. Anderson and Ahmed (1993) reviewed this fishery, and provided the first records of several species of upper slope sharks. Gulper sharks are known in *Dhivehi* (Maldivian language) as *kashimiyaru* (spine shark) in reference to the spines on the anterior margin of the dorsal fins.

MATERIALS AND METHODS

Collections of Maldivian deep demersal fishes are held by the Natural History Museum, London (BMNH), the Bernice P. Bishop Museum, Honolulu (BPBM); the Field Museum of Natural History, Chicago (FMNH); the Marine Research Section, Ministry of Fisheries and Agriculture, Malé (MRS); the South African Museum, Cape Town (SAM); and the Zoological Survey of India, at the Indian Museum, Calcutta (ZSI). Specimens from all of these institutions have been studied by the authors.

In addition the authors sampled catches from the slope shark fishery during March - April 1996, which resulted in a significant new collection of shark material now housed at the NHM. Gulper shark fishing is conducted in small open boats (5-6 m LOA) using multi-hook vertical longlines on the outer slopes of the atolls. In most

cases the outer slopes are only few hundred yards from edge of the reef. The fishing boats are locally built with small inboard diesel engines. The main line is usually 4 mm polypropylene which is available locally in 220 m rolls; 2-4 rolls are used. Typically, 6-8 circle hooks (no. 6 or 7) are used, attached by 20-40 cm wire leaders to the mainline. The hooks are baited with cut pieces of reef fish. Small luminous beads are sometimes threaded on the leaders. Fishing is usually carried out at night, the fishermen leaving their islands in the afternoon and returning the following morning. The lines are set in 250-800 m depth, being sent to bottom with coral boulders. These coral boulders (weighing 20-30 kg each), collected from the shallow reef en route to the fishing, are tied to the end of the fishing lines with coconut rope or bark fibre and are released with a sharp tug during hauling. 2-4 lines may be set at one time. The line at the bow is generally thicker than the others and has a larger coral boulder; this line is used as an anchor whilst fishing and is the last to be hauled. Lines are hauled when fish are felt or within 2-5 hours. Hauling is by hand.

Records of deep demersal fish species are included in this checklist without reservation if the authors have seen specimens. Deep demersal fish species are included with reservations if: (a) they were recorded from the Maldives by Norman (1939) even if specimens cannot now be located at the NHM; (b) they were recorded by Anon (1983) and/or Stromme (1983) and are not represented in the MRS collection but are so distinctive that they are unlikely to have been misidentified; or (c) they are distinctive species and are described consistently by several experienced Maldivian fishermen. Some species have been recorded in Maldivian waters from deeper than 180 m, but are only represented in collections by specimens collected from shallower than 180 m; in such cases specimen numbers are not normally listed here, but may be found in Randall and Anderson (1993). Some large specimens are represented in the MRS collection only by photographs; such specimens are identified by the prefix "P" added to the specimen number. Species not previously recorded from the Maldives are marked with an asterisk (*).

The standard length (SL) of most specimens was measured from the tip of the snout to the base of the caudal fin. Some fishes were recorded by total length (TL) or fork length (FL), the latter from the tip of the snout to the end of the shortest median caudal ray. Some sharks were recorded by precaudal length (PCL). The halosaurs were recorded by gnathoproctal length (GnPL), from chin tip to the anus and the macrourids by head length (HL).

The order of presentation of families follows Nelson (1994). English and *Dhivehi* common names are noted whenever available, in order to make this work more accessible to fisheries workers.

STATION DATA

Investigator (Alcock, 1899 & 1902):

Station 150: 07°05'45"N, 75°20'54"E; 1315 m; northeast of Haa Alifu Atoll; 29 November 1893.

Station 216: 06°55'56"N, 72°51'30"E; 1403-1737 m; west of Haa Alifu Atoll; 19 October 1896.

Station 217: 06°56'56"N, 72°53'30"E; 839 m; west of Haa Alifu Atoll; 21 October 1896.

John Murray Expedition (Norman, 1939):

JM 143: 05°15'48"S, 73°22'48"E to 05°13'42"S, 73°23'36"E; 797 m; 30 March 1934.

JM 145: 04°58'42"N, 73°16'24"E; 494 m; southeast of Baa Atoll; 31 March - 2 April 1934.

JM 153: 04°45'36"N, 72°52'12"E to 04°42'36"N, 72°50'24"E; 256-293 m; southwest of Baa Atoll; 4 April 1934.

JM 156: 04°44'30"N, 72°46'00"E to 04°41'12"N, 72°42'48"E; (depth not known as the trawl was never on the bottom); northwest of Alifu Atoll; 6 April 1934.

JM 157: 04°43'48"N, 72°55'24"E to 04°44'00"N, 72°54'18"E; 229 m; north of Ari Atoll; 6 April 1934.

JM 158: 04°42'30"N, 72°42'30"E to 04°36'48"N, 72°48'54"E; 786-1000 m; northwest of Alifu Atoll; 7 April 1934.

JM 159: 04°47'30"N, 72°45'18"E to 04°48'00"N, 72°46'42"E; 914-1463 m; southwest of Baa Atoll; 7 April 1934.

TeVega:

Station 131: 03°21'N, 72°37'E; about 15 nm west of Faafu Atoll; 22 April 1964.

GOPA:

Fishes believed to have been trawled around the southern atolls of the Maldives in 1977 by the German consultancy company GOPA.

Dr Fridtjof Nansen (Stromme, 1983):

Station 01: 04°05'N, 73°20'E; 354 m; between Kaafu and Alifu Atolls; 17 August 1983.

Station 13: 04°11'N, 72°55'E; 218 m; east of Alifu Atoll; 21 August 1983.

Station 16: 04°25'N, 72°51'E; 202 m; Alifu Atoll, northwest of Rasdhoo Island; 22 August 1983.

Station 17: 04°25'N, 73°00'E; 248 m; northeast of Rasdhoo Island in Alifu Atoll; 22 August 1983.

Station 27: 06°58'N, 73°14'E; 223 m; Gallandhoo Channel in Haa Alifu Atoll; 25 August 1983.

Station 33: 05°18'N, 73°02'E; 238 m; east of Baa Atoll; 26 August 1983.

Station 42: 04°22'N, 72°51'E; 213 m; north of Alifu Atoll; 27 August 1983.

Fraumas (Van der Knaap et al., 1991; Anderson et al., 1992):

Site 1: Flat bottom channel between Rasdhoo and Alifu Atolls at about 04°19'N, 72°55'E; 215 m; 9 March 1991.

Site 2: North Malé Atoll, outer atoll slope near Giraavaru; 180-200 m; 14 March 1991.

Site 3: North Malé Atoll, outer atoll slope near Hulhule Island; ca 200 m; March 1991.

CHECKLIST

PSEUDOTRIAKIDAE (false catsharks)

**Pseudotriakis microdon* Capello, 1868

During the course of slope shark fishing operations during March - April 1996 two specimens of the false catshark were caught, outside Thaa Atoll in about 600 m and Laamu Atoll in about 350-400 m. Both were mature females (234 and 302 cm TL) carrying two pups each. At 13.6 and 12.6 cm TL, and 23.8 and 24.1 cm TL respectively, these pups were larger than those (7.9 cm TL) reported by Forster et al. (1970) from off Cosmoledo Island in the Seychelles, but smaller than the Pacific specimens (44.7-120.2 cm TL) recorded by Yano (1992). All but the 23.6 cm TL pup were male. Surprisingly the ovaries of both of these gravid females were poorly developed. The left ovary of the smaller specimen (234 cm TL) was pleated, as described by Yano (1992), and measured 24.3 cm in length unstretched, while the right ovary was quite undeveloped. The vast majority of the ova it contained were in the 2-3 mm diameter range, while very small proportions were developing at 8-10 mm diameter. This observation contrasts strikingly with the much enlarged ovaries found in the females caught from further west in the Indian Ocean by Forster et al. (1970), one of which contained an estimated 20,000 ova of a mean diameter of 9 mm. It accords more closely with Yano's (1992) material, although the relative dearth of enlarged oocytes is surprising for this oophagous species. Fishermen from Laamu Atoll called this species hikandhi thun miyaru (shrew shark), on account of its odour.

Specimens: BMNH (uncatalogued), female, TL 302 cm (head only); BMNH (uncatalogued) (pups from 302 cm TL female); BMNH (uncatalogued) (pups from 234 cm TL female).

New genus, new species

Three specimens of an undescribed shark have been collected from the Maldives. They appear to represent an undescribed pseudotriakid genus, intermediate between *Gollum* and *Pseudotriakis* (L.J.V. Compagno, pers. comm., 1992 and 1994). All three are males, and all were taken by fishermen targeting *Centrophorus* using deep vertical longlines outside the atolls. The first specimen, 565 mm TL, was caught outside Alifushi in Raa Atoll in about 400 m on 4 October 1990. It is illustrated in colour by Anderson and Ahmed (1993). The second and third specimens, of 558 mm TL and 490 mm TL, were collected from outside Maafilaafushi in Lhaviyani Atoll in about 350 m on 7 October 1993. There are three other specimens extant from Socotra and the Gulf of Aden (M. Stehmann, pers. comm., 1996). This appears to be a species of only small adult size, as the two largest specimens from Maldives are mature males, and the largest specimen from the northwest Indian Ocean is only 534 mm TL.

Specimens: BPBM 34924 (1: 340 mm PCL; two other specimens sent to SAM).

TRIAKIDAE (houndsharks)

Mustelus manazo (Bleeker, 1854)

Six starspotted smoothhounds were caught during the R.V. *Farumas* reef fish resources survey (Van der Knaap et al., 1991; Anderson et al., 1992), all by bottom longline set in 150-200 m outside the atolls. All five specimens for which sex was recorded were females, and all four specimens for which stomach contents were determined had eaten crustaceans (Anderson and Ahmed, 1993). This species was recorded by MRS (1988) as *Mustelus mosis*, but a 71cm Maldivian specimen has been identified by P.C. Heemstra (pers. comm.), who is revising the genus, as *M. manazo* (Anderson and Ahmed, 1993; Randall and Anderson, 1993). Heemstra noted that the Maldivian specimen has an unusually large internarial space; in addition, Maldivian specimens are not obviously white-spotted. This species is known to be widely distributed on the continental margins in the northwestern Pacific (Compagno, 1984).

Specimens: BPBM 34733 (1: 71 cm PCL) and BPBM 34926 (1: 65 cm PCL).

CARCHARHINIDAE (requiem sharks)

Carcharhinus albimarginatus (Rüppell, 1837)

The silvertip shark is widely distributed and relatively common throughout the Maldives (Anderson and Ahmed, 1993). Nearly all records are of specimens that were caught in less than 100 m, but one individual weighing 70 kg recorded by Stromme (1983) and Anon. (1983) was caught at R.V. *Fridtjof Nansen* Station 27. Elsewhere in the Indo-Pacific the silvertip shark has previously been recorded to depths of about 800 m (Compagno, 1984). This species has several local names but is most often known in the Maldives as *kattafulhi miyaru* (Anderson and Ahmed, 1993).

Carcharhinus altimus (Springer, 1950)

The bignose shark was recorded from the Maldives by MRS (1992), Anderson and Ahmed (1993) and Randall and Anderson (1993). Maldivian fishermen only catch this species at night, outside the atolls using surface-set pelagic longlines over areas where the bottom depths are 200-500 m (Anderson and Ahmed, 1993). *Carcharhinus altimus* is usually categorised as a deep-benthic species (e.g. Compagno, 1984), however, Anderson and Stevens (1996) have demonstrated that at least some individuals are diurnal vertical migrators. Thus Maldivian specimens are likely to occur on shelf and upper slope areas by day, and in the epipelagic zone by night. Maldivian names for this shark include *mendhan miyaru* (midnight shark, in apparent reference to the time of its appearance in pelagic longline catches) and *theyo miyaru* (oil shark, in reference to the large yield of oil apparently obtained from their livers). The bignose shark is widely distributed circumglobally in tropical to warm temperate waters common in depth of 93-366 m (Anderson and Stevens, 1996).

Specimens: MRS-0380/92; SAM-32754 (two sets of dried jaws).

ODONTASPIDIDAE (sand tiger sharks)

Odontaspis ferox (Risso, 1810)

(Fig. 2)

The smalltooth sandtiger shark was first recorded from Maldives by MRS (1992) and Anderson and Ahmed (1993). During the course of slope shark fishing operations during March - April 1996 one 310 cm TL male was caught outside Thaa Atoll in about 300 m. Local fishermen called this shark *daiydhigu miyaru* (long tooth shark), *theyo miyaru* (oil shark, on account of its large liver) and *meedhaa miyaru* (rat shark, on account of its appearance). Occurs on continental slopes of all oceans; trawled in 400-420 m off Natal (Bass and Compagno, 1986).

Specimen: MRS-402/92 (one set of dried jaws).

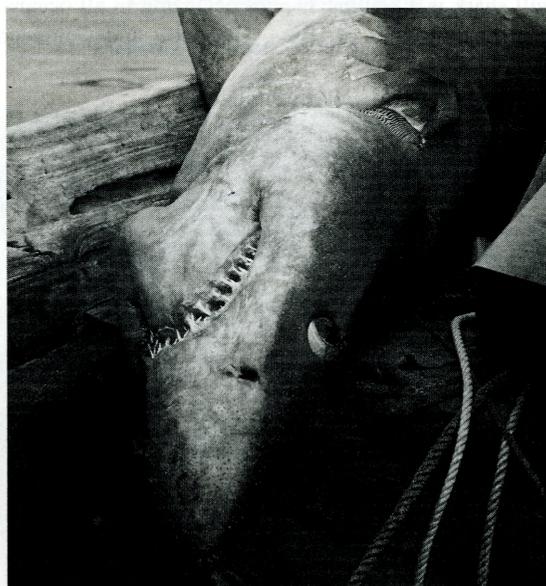


Figure 2. *Odontaspis ferox*, TL 310cm, male. Caught outside Thaa Atoll, April 1996. Photo by R. C. Anderson

CHLAMYDOSELACHIDAE (frilled sharks)

Chlamydoselachus anguineus Garman, 1884

Anderson and Ahmed (1993) provisionally recorded this species on the basis of evidence from deepwater gulper shark fishermen. Some of them report occasional catches of a species known locally as *ven miyaru* (eel shark), which they tentatively identified from drawings as *Chlamydoselachus anguineus*. This species occurs in depths of 100-600 m in all oceans from tropical to temperate regions (Bass, 1986).

HEXANCHIDAE (cowsharks)

Heptranchias perlo (Bonnaterre, 1788)

Stromme (1983) and Anderson and Ahmed (1993) recorded an 8.4 kg sharpnose sevengill shark caught by bottom trawl in 248 m at about 04°25'N 72°51'E, i.e. on the inter-atoll shelf close to Thoddoo island in Alifu Atoll, in August 1984 by the *Fridtjof Nansen*. Occurs circumglobally at depths of 50-1000 m (Bass, Heemstra and Compagno, 1986).

Hexanchus griseus (Bonnaterre, 1788)

(Fig. 3)

Recorded from Maldives by MRS (1992) and Anderson and Ahmed (1993). During the course of slope shark fishing operations undertaken by the authors during March - April 1996 a total of six specimens was caught outside Laamu and Thaa Atolls. These were 180-309 cm TL, and all immature. Fishermen from Laamu and Thaa Atolls report occasional catches of mature females. In contrast, fishermen from Alifushi in Raa Atoll say that despite large catches of *H. griseus* they have never seen females with eggs or embryos. This suggests that there may be some spatial segregation by size and sex. The Maldivian name for this species is *madu miyaru* (soft shark), a reference both to its sluggishness and to the texture of its meat. The bluntnose sixgill shark is a benthic species occurring in all oceans at depths of 100-1500 m (Bass, Heemstra and Compagno, 1986),

Specimens: BMNH (uncatalogued).

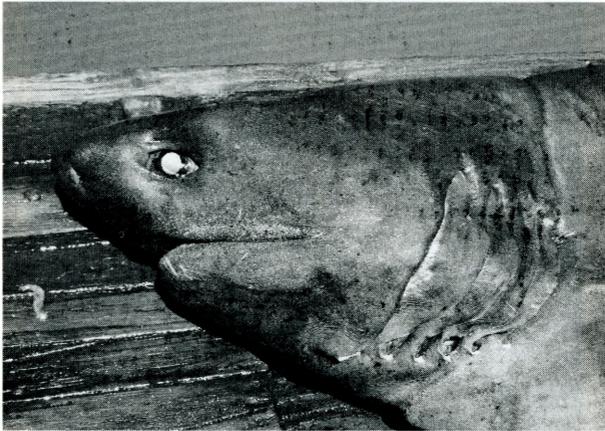


Figure 3. *Hexanchus griseus*. Caught outside Laamu Atoll, April 1996. Photo by R.C. Anderson

ECHINORHINIDAE (bramble sharks)

Echinorhinus brucus (Bonnaterre, 1788)

The bramble shark has not been positively identified from the Maldives. However, Anderson and Ahmed (1993) recorded this species on the basis of evidence from deepwater gulper shark fishermen. Many of them report occasional catches of a large spine-covered shark known locally as *berebedhi miyaru* (*berebedhi* is a type of thorny tree, and *miyaru* is shark). Fishermen consistently identified this species from drawings as *Echinorhinus brucus*. Known from all oceans except the eastern Pacific in depths of 10-400 m (Bass and Compagno, 1986).

DALATIIDAE (sleeper sharks)

Dalatias licha (Bonnaterre, 1788)

Anderson and Ahmed (1993) recorded the kitefin shark from the Maldives on the basis of a set of dried jaws purchased from a fisherman in Laamu Atoll in 1992. The shark from which the jaws came had been caught "some time before" on a deep vertical longline set for gulper sharks off the eastern side of Laamu Atoll. The fishing depth was unknown but probably within the range 400-600 m. The fisherman called this shark *kashineiy miyaru* (no spine shark). It is apparently rare in Maldives. The jaws

were collected only because the fisherman had not seen this species before, and we have encountered no other specimens. The jaws have the following dental formula: 8-1-8 / 9-1-9. There seems to be some doubt as to whether this species belongs in *Dalatias* or *Scymnorhinus* (see Bass, Compagno and Heemstra, 1986 and Eschmeyer, 1990). Occurs in tropical and warm temperate seas, at 37-1800 m, but most often below 200 m (Compagno, 1984).

Specimen: MRS-0397/92 (one set of dried jaws).

CENTROPHORIDAE (gulpersharks)

Anderson and Ahmed (1993) noted the presence of three species of *Centrophorus* in the Maldivian gulper shark fishery, but were unable to identify them. The same three species of *Centrophorus* were observed during the fishing operations undertaken by the authors in 1996. They were identified following Compagno (1984) and separated in the field by the characteristics noted below. The specific identifications remain tentative since the family is in need of revision.

****Centrophorus niaukang*** Teng, 1959

(Fig. 4)

A total of 37 Taiwan gulper shark were caught from the NE side of Thaa and Laamu Atoll at depths of 400-600 m, using multi-hook vertical longline during March - April 1996. The Taiwan gulper shark appears to be the most common species caught in the deepwater shark fishery of the Maldives. The denticles in *C. niaukang* are moderately smooth, and about 2/3 the length of the denticles of *C. squamosus* (Fig. 5). The pectoral inner lobe is moderately elongate, the tip barely extending to the first dorsal spine base. The fishery shows two distinct size classes corresponding to males (mode = 110 cm TL) and females (mode = 132 cm TL) (Fig. 6). This species was previously known only from off Taiwan, caught at 250 m (Compagno, 1984).

Specimens: BMNH (uncatalogued), TL 95-139 cm; BPBM 3492, 2: 615-640 PCL (in part).

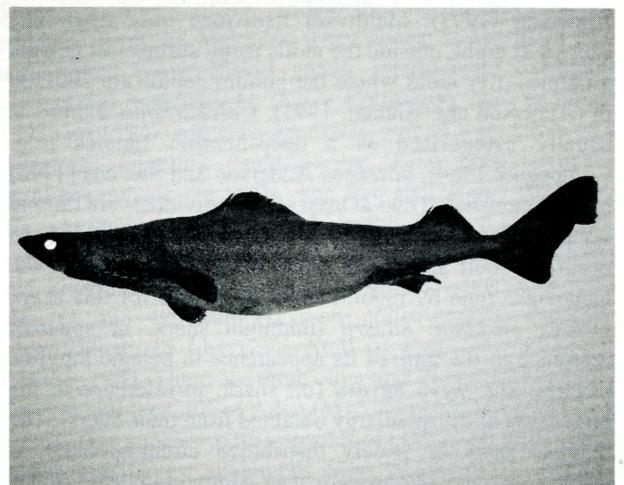


Figure 4. *Centrophorus niaukang*. Photo R.C. Anderson

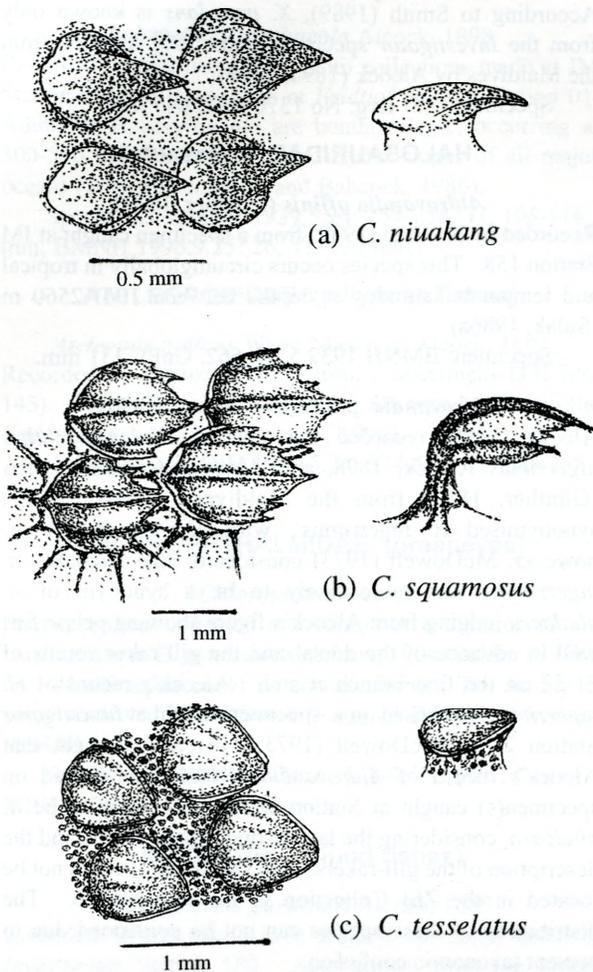


Figure 5. Denticles of three species of *Centrophorus*: (a) *C. niukang* (b) *C. squamosus* (c) *C. tessellatus*. Illustration by Hussein Zahir

****Centrophorus squamosus* (Bonnaterre, 1788)**

During the fishing operations undertaken in 1996, 18 *C. squamosus* were caught from outside Thaa and Laamu Atolls from depths of about 400-600 m. Compared to *C. niukang* and *C. tessellatus*, *C. squamosus* has more erect and elongate denticles, which makes the skin very rough (Figure 5). The inner lobe of the pectoral is quadrate. The leafscale gulper shark is widely distributed from the eastern Atlantic to the western Pacific in depths of 230-2400 m. In

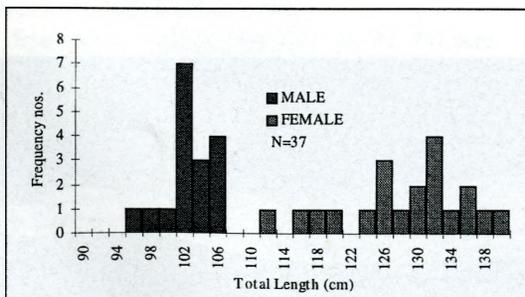


Figure 6. Size distribution of *Centrophorus niukang* in the Maldivian deepwater shark fishery

the Indian Ocean it was previously known only from southern Africa and Aldabra Island (Compagno, 1984).

Specimens: BMHN (uncatalogued), TL 78-118 cm; BPBM 3492, 2:615-640 PCL (in part).

****Centrophorus tessellatus* Garman, 1906**

Ten mosaic gulper shark were caught outside Thaa and Laamu Atolls in 400-600 m during March-April 1966. In *C. tessellatus*, the denticles are more flattened and block-like than those of *C. niukang* and *C. squamosus* (Figure 5). The pectoral inner lobe extends beyond the first dorsal fin base, approximately to the mid length of the first dorsal fin base. Previously recorded from the northwestern Pacific and Hawaii in 260-728 m (Compagno, 1984).

Specimens: BMNH (uncatalogued), TL 72-93 cm.

DASYATIDAE (stingrays)

****Dasyatis microps* (Annandale, 1908)**

(Fig. 7)

Dasyatis microps was caught at R.V. *Farumas* site 2 (Anderson et al., 1992), but the specimen was discarded. Photos were identified by Peter R. Last (CSIRO, Hobart, Australia). Patchily distributed from India to NW Australia at continental slope depths (Peter R. Last, pers. comm., October 1997).



Figure 7. *Dasyatis microps*, 231 cm TL, 156 cm DW; a caudal spine cut off by fisherman; north Male Atoll, 1991. Photo by R.C. Anderson

SYNAPHOBRANCHIDAE (cutthroat eels)

***Synaphobranchus brevadorsalis* (Günther, 1887)**

Recorded by Norman (1939) on the basis of two specimens (JM stn. 159) which could not be located in the BMNH collection, in February 1996. This species occurs in all oceans, but is limited to deep waters in the tropical and warm temperate waters (Robins and Robins, 1989). Elsewhere in the Indian Ocean, *S. brevadorsalis* has been recorded from 1075-2150 m (Quéro and Saldanha, 1995; Karrer, 1982).

Specimens: BMNH 1939.5.24: 654-655, TL 348 mm (not found).

***Synaphobranchus kaupi* Johnson, 1862**

Recorded by Alcock (1899) from a specimen caught at *Investigator* Station 217.

Known from Atlantic and Indo-Pacific slope waters; recorded from South Africa in about 800 m (Castle, 1986a).

Specimen: ZSI Reg. No 171/1, TL 390 mm.

OPHICHTHIDAE (snake eels and worm eels)

**Ophichthus* sp.

One specimen of *Ophichthus* was caught at *Farumas* Site 1. This is a new species currently being described by John E. McCosker (Californian Academy of Sciences, pers. comm.), together with additional material from New Caledonia.

Specimen: BPBM 34923 (335 mm TL).

CONGRIDAE (conger eels)

**Ariosoma* sp.

A specimen of *Ariosoma* sp. was also caught at *Farumas* Site 1. Owing to the current state of confusion in the taxonomy of Indo-Pacific *Ariosoma*, this specimen cannot be identified to species (Peter H. Castle, Victoria University of Wellington, New Zealand, pers. comm., 1996).

Specimen: BPBM 34922 (TL 320 mm).

Bathycongrus guttulatus (Günther, 1887)

Recorded by Norman (1939) from specimens caught at JM Station 145. Widely distributed in the Indo-Pacific, and found in depths of 420-1270 m (Ben Tuvia, 1993).

Specimens: BMNH 1939.5.24:618-620, TL 108-118 mm.

Bathuroconger vicinus (Vaillant, 1888)

Recorded by Norman (1939) from a specimen caught at JM Station 145. Known from South Africa at 630 m; also from the Mozambique Channel in 995-1020 m (Karrer, 1982) and the eastern tropical Atlantic (Castle, 1986b).

Specimen: BMNH 1939.5.24: 644, TL 225.

Congriscus maldivensis (Norman, 1939)

(Fig. 8)

Described by Norman (1939) from specimens caught at JM station 145. Two *Congriscus maldivensis* were also caught at *Fridtjof Nansen* Station 01. Elsewhere in the Indian Ocean this species has been recorded from about 700 m (Karrer, 1982).

Specimens: BHMN 1939.5.24: 610-612, TL 350-352 mm (holotype 352 mm); BMNH 1996.9.25: 43, TL 245 mm; MRS-0448/97, TL 216 mm).

Xenomystax trucidans (Alcock, 1894)

According to Smith (1989), *X. trucidans* is known only from the *Investigator* specimens (stn. 150) reported from the Maldives by Alcock (1894, 1899).

Specimen: ZSI Reg. No 13704, TL 645 mm.

HALOSAURIDAE (halosaurs)

Aldrovandia affinis (Günther, 1877)

Recorded by Norman (1939) from a specimen caught at JM Station 158. This species occurs circumglobally in tropical and temperate latitudes at depths between 1061-2560 m (Sulak, 1986a).

Specimen: BMNH 1939.5.24: 662, GnPL 131 mm.

Aldrovandia phalacra (Valliant, 1888)

Alcock (1899) recorded two species, *Halosaurichthys nigerrimus* Alcock, 1898, and *Aldrovandia mediorostris* (Günther, 1887) from the Maldives. Weber (1913) synonymised *H. nigerrimus* with *Aldrovandia affinis*; however, McDowell (1973) considered that Alcock's *H. nigerrimus*, was more likely to be a synonym of *A. phalacra* judging from Alcock's figure showing pelvic fins well in advance of the dorsal and the gill-raker counts of 21-22 on the first branchial arch. Alcock's record of *H. nigerrimus* was based on a specimen caught at *Investigator* Station 217. McDowell (1973: 114) also thought that Alcock's record of *Aldrovandia mediorostris* (based on specimen(s) caught at Station 150), was likely to be *A. phalacra*, considering the lateral-line plaque counts and the description of the gill-rakers. The specimen(s) could not be located in the ZSI Collection in December 1996. The distribution of these species can not be confirmed due to present taxonomic confusion.

Specimens: ZSI Reg No. none, GnPL 58 mm (*H. nigerrimus*); 13710 (*A. mediorostris*; not found).

Halosaurus carinicauda (Alcock, 1889)

Halosaurus (Halosaurichthys) carinicauda was first recorded from the Maldives as *H. parvipennis* by Alcock (1892) from specimens caught at *Investigator* Station 217. Alcock's specimens could not be located in the ZSI collection in December 1996. Another specimen was recorded by Norman (1939) from just outside the present Maldivian EEZ (JM Stn. 143); also known from Gulf of Aden, Andaman Sea, and Bali (McDowell, 1973).

Specimens: ZSI Reg. No 169/1, 173/1 (not found); BMNH 1939.5.24: 661, GnPL 122 mm.

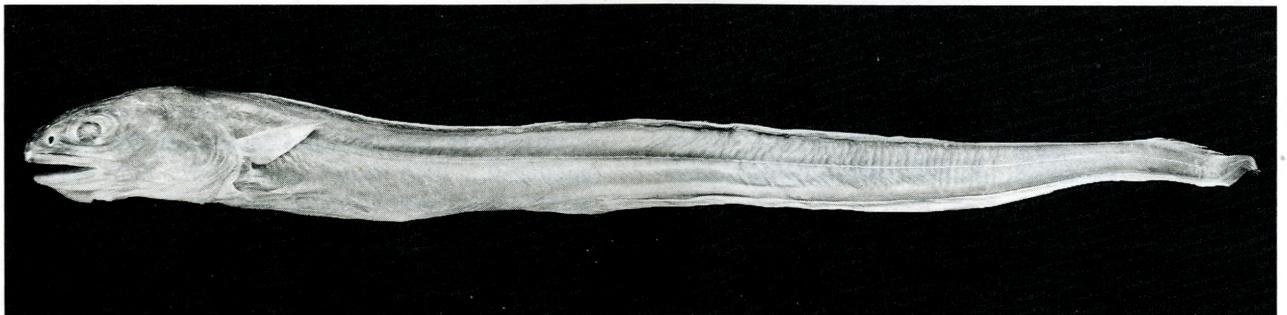


Figure 8. *Congriscus maldivensis*, BMNH 1939.5.24: 610-612 mm TL

PHOTICHTHYIDAE (lightfishes)

Polymetme corythaeola Alcock, 1898

Recorded by Norman (1939) from collections made at JM Station 145 and also taken at *Fridtjof Nansen* Station 01. Adults of *P. corythaeola* are benthopelagic, occurring at 300-500 m off continental and island slopes of all major oceans (Schaefer, Johnson and Babcock, 1986).

Specimens: BMNH 1939.5.24: 254-256, TL 105-116 mm; BMNH 1996.9.25: 26, TL 130 mm.

ATELEOPODIDAE (jellynose fishes)

Ateleopus indicus Wood-Mason & Alcock, 1891

Recorded by Norman (1939) from 3 specimens (JM Stn. 145). Otherwise known only from the type locality in the Andaman Sea (Eschmeyer et al., 1996).

Specimens: BMNH 1939.5.24: 574-576, TL 285-385 mm.

CHLOROPHTHALMIDAE (greeneyes)

**Chlorophthalmus* sp.

Four specimens collected at *Fridtjof Nansen* Station 42 are very similar to *C. punctatus* Gilchrist, 1904 (Sulak, 1986b), but identification could not be confirmed. The family is being reviewed by K. Sulak (National Biological Survey, Florida).

Specimens: BMNH 1996.9.25: 8-9, TL 110-143 mm; MRS-0454/97, TL 131-142 mm.

IPNOPIDAE (tripod fishes)

Bathypterois guentheri Alcock, 1889

Recorded by Alcock (1899) from a specimen taken at *Investigator* Station 150. Also known from the Indian Ocean between 800-1300 m and from the central western Pacific Ocean (Sulak, 1986b).

Specimen: ZSI Reg. No 13706, TL 53 mm.

Bathypterois atricolor (Alcock, 1896)

Recorded by Alcock (1899) from a specimen (*Investigator* Stn. 217) that could not be located in the ZSI collection in December 1996. Occurs world wide (except in the Atlantic north of 10(N) from 258-5150 m (Sulak, 1986b).

Specimen: ZSI Reg. No 167/1 (not found).

PARALEPIDIDAE (barracudinas)

**Lestidiops jayakari* (Boulenger, 1889)

Two specimens were taken at *Fridtjof Nansen* Station 01. Occurs world wide in tropical to temperate waters, mainly between 300-600 m (Post, 1986).

Specimens: BMNH 1996.9.25: 16, TL 232 mm; MRS-0457/97, TL 235 mm.

NEOSCOPELIDAE (blackchins)

Neoscopelus microchir Matsubara, 1943

Recorded as *Neoscopelus macrolepidotus* (non Johnson, 1863) by Norman (1939) from 15 specimens caught at JM Stn. 145. Known from South Africa, eastern and western Atlantic and from the western Pacific, at depths of 250-700 m (Hulley, 1986).

Specimens: BMNH 1939.5.24: 475-483, TL 34-149 mm.

POLYMIXIIDAE (beardfishes)

**Polymixia berndti* Gilbert, 1905

A Pacific beardfish was collected by the GOPA Survey. This species occurs in 300-500 m, and is widely distributed in the Indo-Pacific region (Heemstra, 1986a).

Specimen: BMNH 1997.9.17: 25, TL 132 mm.

OPHIDIIDAE (cusk eels)

Dicrolene nigricaudis (Wood-Mason and Alcock, 1891)

Norman (1939) recorded a specimen (JM Stn. 145; BMNH 1939.5.24: 1449, TL 135 mm) that was not found in the collection in February 1996. Known from the Andaman and Arabian Seas, in depths of 343-519 m (Shcherbachev, 1980).

Lamprogrammus brunswigi Brauer, 1906

Recorded as *Bassobythites brunswigi* by Norman (1939) from a specimen (JM Stn. 159; BMNH 1939.5.24: 1451, TL 850 mm) that could not be located in February 1996. Elsewhere in the Indo-Pacific this species has been caught at 800-1600 m (Cohen et al., 1991)

Monomitopus nigripinnis Alcock, 1889

Recorded by Alcock (1899) from specimen(s) (*Investigator* Stn.150) that could not be located in the ZSI collection in December 1996. Known from several localities in the Indian Ocean and in 700-1,200 m off South Africa (Nielsen and Cohen, 1986).

BATHYGADIDAE (bathygadids)

Bathygadus furvescens Alcock, 1894

Four specimens from the Maldives recorded initially as *B. furvescens* Alcock, 1894 (Alcock (1894 a, b) - Stn. 150; ZSI Reg. No. 13470, HL 108 mm; Norman (1939) - JM Stn. 143; BMNH 1939.5.24: 673-674, HL 39 and 47 mm (2 specimens of 3 preserved)). Howes and Crimmen (1990) assigned *B. furvescens* to the genus *Gadomus*, based on a specimen (BMNH 1896.9.11.2 from the Arabian Sea) which they wrongly designated as a syntype. According to Iwamoto and Merrett (1997) the move is questionable since the holotype is extant (ZSI 13470), clearly labelled, described and figured and has characters consistent with the genus *Bathygadus*. The other two preserved (JM) specimens also evidently belong to *Bathygadus* (neither with barbel; less damaged specimen with 2 not 4 retia mirabilia in swimbladder; but rays of paired fins in both broken), not *Gadomus*. Resolution of this situation requires further study.

Gadomus multifilis (Günther, 1887)

Recorded from the Maldives by Alcock (1899) as "*Bathygadus longifilis*" from 3 specimens (*Investigator* Stn. 217; ZSI Reg. No 168/8, 170/1, 172/1, HL 32, 33.5, and 41.5 mm). Norman (1939) also reported *G. multifilis* from the "Maldives area" (JM stn. 143) from 4 specimens (BMNH 1939.5.24: 681, HL 39 mm; BMNH 1939.5.24: 678-680, HL 34-39 mm). Indian Ocean specimens of this genus are currently being studied by Tomio Iwamoto (California Academy of Sciences; pers. comm., September, 1997). While he has yet to distinguish taxonomic units, he questions the correctness of the Gilbert and Hubbs' (1920)

identification of their material as this species. Alcock's (1899) "*Bathygadus longifilis*" may not be *G. multifilis*, as synonymized by Howes and Crimmen (1990: 195). Until this problem is resolved we are unable to determine distribution.

MACROURIDAE (grenadiers or rattails)

Caelorinchus quadricristatus (Alcock, 1891)

Recorded from the Maldives by Norman (1939) from specimens (BMNH 1939.5.24: 687-689, TL 107-190+ mm) collected at JM Station 145, but these specimens could not be located in February 1996. Apart from the type series which came from 338-741 m in the Andaman Sea, three other specimens (examined by Tomio Iwamoto, pers. comm., September, 1997) came from the Andaman Sea (1, 355-340 m) and from off Kenya (2, 454 m).

Hymenocephalus italicus Giglioli, 1884

Recorded as *H. heterolepis* Alcock, 1889 by Norman (1939) based on several specimens (JM Stn. 145; BMNH 1939.5.24: 705-716, HL 14-31 mm) that we identified from Cohen et al. (1990) as *H. italicus*, although they were not in a good state of preservation. Two additional specimens were taken at *Fridtjof Nansen* Station 01. Iwamoto and Anderson (1994) noted that the characteristics of this Atlantic species and of the Indian Ocean *H. heterolepis* overlapped somewhat making their distinction suspect, and Anderson (1997) synonymized *H. heterolepis* with *H. italicus*.

Specimens: BMNH 1996.9.25: 2, TL 133 mm; MRS-0446/97, TL 115 mm (head damaged).

Macrouroides inflaticeps (Smith & Radcliffe, 1912)

Norman (1939) recorded a specimen from JM Station 156. The collection depth was not known as the trawl was never on the bottom (Norman 1939). The specimen (BMNH 1939.5.24: 684, TL 360 mm) could not be located in February 1996. This species is known from the Philippines, Indian Ocean, tropical Atlantic and the eastern Pacific on the Nazca Ridge. It occurs from midwater to the bottom in bathyal and abyssal depths (747-4000 m) (Shcherbachev and Piotrovskiy, 1982).

Malacocephalus laevis (Lowe, 1843)

Alcock (1899) reported a specimen from *Investigator* Station 150 (ZSI Reg. No. 13517, HL 58 mm [body missing]). Norman (1939) recorded two specimens taken at JM Station 145 (BMNH 1939.5.24: 731-732, HL 62-69 mm). *Malacocephalus laevis* is common in the Atlantic and the Indian Oceans at depths of 200-1000 m (Iwamoto, 1986; Iwamoto and Anderson, 1994).

Nezumia sp.

The specimen recorded by Alcock (1899) from *Investigator* Station 150 (ZSI Reg. No. 13562, HL 36 mm) could not be identified owing to its present poor condition.

Sphagemacrurus pumiliceps Alcock, 1894

Alcock (1899) reported a specimen (ZSI Reg. No. 13561, HL 22 mm, TL 92+ mm) from *Investigator* Station 150. Elsewhere known from Mozambique to the Philippines in depths of 732-1880 m (Iwamoto, 1986).

Ventrifossa petersoni (Alcock, 1891)

Norman (1939) reported a specimen (BMNH 1939.5.24: 719, HL 23 mm) from JM Station 145. Doubtfully distinct from the closely-related *V. nigrodorsalis* Gilbert and Hubbs, 1920 (Tomio Iwamoto, pers. comm., September, 1997). If both are shown to be valid species on the basis of material collected recently from Vanuatu and New Caledonia, then *V. petersoni* is restricted to the northern Indian Ocean at slope depths, 289-1019 m (Weber and de Beaufort, 1929).

MORIDAE (deepsea cods)

**Physiculus roseus* Alcock, 1891

One specimen collected by the 1977 GOPA Survey. Widely distributed in the Indo-Pacific region in 300-510 m (Paulin and Roberts, 1997).

Specimen: BMNH 1997.9.17: 30, TL 160 mm.

CHAUNACIDAE (coffinfishes or sea toads)

**Chaunax pencillatus* McCulloch, 1915

The *Te Vega* Expedition collected a *C. pencillatus* from Station 131. Elsewhere in the Indo-Pacific this species has been recorded at 292-365 m (Eschmeyer et al., 1996).

Specimen: FMNH 71930:grp 631, TL 32 mm.

Chaunax pictus Lowe, 1846

Norman (1939) recorded two specimens (JM Stn. 145, BMNH 1939.5.24: 1901-1902, TL 48-140 mm) which could not be located in the collection, during February 1996. Widely distributed in the Atlantic Ocean; also known from Kwa-Zulu Natal, South Africa (Smith, 1986a).

OGCOEPHALIDAE (seabats)

Halicmetus ruber Alcock, 1891

Norman (1939) recorded *Halicmetus ruber* from two specimens (BMNH 1939.5.24: 1918-1919 TL 29-47 mm) caught at JM Station 145. Known from several localities in Indian and western Pacific Oceans (Masuda et al., 1984).

Halieutaea coccinae Alcock, 1889

Norman (1939) also reported two *Halieutaea coccinae* (JM Stn. 145, BMNH 1939.5.24: 1908-1909, TL 102-163 mm). Distributed in the Indo-Pacific region at continental slope depths (Paxton et al., 1989).

Halieutopsis micropus (Alcock 1891)

Alcock (1899) reported two *Dibranchius micropus* from *Investigator* Station 216 (ZSI Collection Reg. No. 114/1, 115/1), but they could not be located in December 1996. Widely distributed in the Indo-Pacific at depths below 500 m (Bradbury, 1986).

Malthopsis mitrigeria Gilbert & Cramer, 1897

Norman (1939) recorded a specimen caught at JM Station 145, and another was collected by the *Fridtjof Nansen* (Stn. 13). Known from South Africa to Hawaii in depths of more than about 500 m (Bradbury, 1986).

Specimens: BMNH 1939.5.24: 1917, TL 37 mm; BMNH 1997.9.17: 22, TL 28 mm.

TRACHICHTHYIDAE (roughies or slimeheads)

**Gephyroberyx darwini* (Johnson, 1866)

Three *G. darwini* were caught at *Fridtjof Nansen* Station 27. Known from Atlantic and Indian Oceans, Australia and the Philippines (Heemstra, 1986b).

Specimens: BMNH 1996.9.25: 4-5, TL 63-58 mm; MRS-0457/97, TL 58 mm.

BERYCIDAE (alfonsinos)

**Beryx splendens* Lowe, 1834.

(Fig. 9)

A specimen was taken at *Fridtjof Nansen* Station 01. During March - April 1996, another specimen (Fig. 9) was caught outside Thaa Atoll in about 300 m by vertical longline. Known from many localities in tropical and temperate parts of all oceans (Heemstra, 1986c).

Specimens: BMNH 1996.9.25: 42, TL 109 mm; BMNH (uncatalogued), SL 33.5 cm.

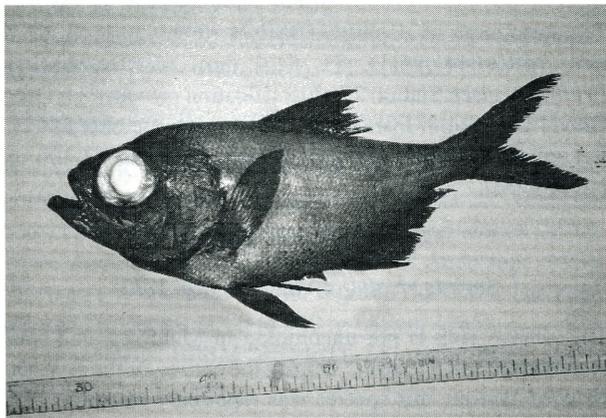


Figure 9. *Beryx splendens*, 335mm SL.

Photo by R.C. Anderson

MACRURUCYTTIDAE (zeniontids)

**Zenion leptolepis* (Gilchrist & von Bonde, 1924)

A total of five *Zenion leptolepis* were caught at two *Fridtjof Nansen* stations: four specimens at Station 01 and one at Station 27. Recorded from south and east Africa in 300-700 m (Heemstra, 1986).

Specimens: BMNH 1996.9.25: 21-22, TL 41 and 45 mm; MRS 0447/97(2), TL 418 and 395 mm; BMNH 1996.9.25: 13, TL 60 mm.

ZEIDAE (dories)

Cyttopsis rosea (Lowe, 1843)

Recorded as *Zen scutatus* by Norman (1939) from a specimen (BMNH 1939.5.24: 822, 126 mm) taken at JM Station 145. *Zen scutatus* (Gilchrist and von Bonde, 1924) was synonymized with *Cyttopsis rosea* by Heemstra (1980). Recorded at depths of 400-600 m from the Atlantic, Indian and Western Pacific Oceans (Heemstra, 1986d).

OREOSOMATIDAE (oreos)

Four specimens of an oreosomatid of as yet unknown generic affinity were caught at *Fridtjof Nansen* Station 01.

Specimens: BMNH 1997.9.17: 4-5, TL 62 and 75 mm; MRS 0463/97(2), TL 61 and 71 mm.

CAPROIDAE (boarfishes)

**Antigonia capros* Lowe, 1843

Four specimens of *A. capros* were caught at *Fridtjof Nansen* Station 17, and another specimen was collected by the GOPA Survey. Distributed world wide in tropical and subtropical oceans (Karrer and Post, in Quéro et al., 1990).

Specimens: BMNH 1996.9.25: 30-31, TL 100 and 113 mm; MRS 0452/97(2), TL 105 and 113 mm. BMNH 1997.9.17: 26, TL 62 mm (GOPA Survey).

**Antigonia indica* Parin & Borodulina, 1986

Two specimens were caught at *Fridtjof Nansen* Station 27. Known from Mozambique Channel, west coast of India and Andaman Islands (Parin and Borodulina, 1986).

Specimens: BMNH 1996.9.25: 29, TL 61-63 mm.

SCORPAENIDAE (scorpionfishes)

**Pontinus leda* Eschmeyer, 1969

A specimen was caught at *Fridtjof Nansen* Station 33. Known from South Africa and the eastern Atlantic (Eschmeyer, 1986).

Specimen: BMNH 1997.9.17: 19, TL 143 mm.

Pontinus nigerimum Eschmeyer, 1983

Randall and Anderson (1993) reported a specimen, from North Malé Atoll. A second specimen from 210 m in the same area was discarded (R.C. Anderson, pers. obs.). Known from the holotype taken off South Africa in 146 m (Eschmeyer, 1986)

HOPLICHTHYIDAE (ghost or spiny flatheads)

**Hoplichthys acanthopleurus* Regan, 1908

A spiny flathead was collected during the 1977 GOPA Survey. This species appears to be rare and is found only in the western Indian Ocean, off the Seychelles and off Natal, South Africa in 120-300 m (Smith, 1986b).

Specimen: BMNH 1997.9.17: 35, TL 200 mm.

TRIGLIDAE (gurnards)

**Satyrichthys investigatoris* (Alcock, 1898)

Two *S. investigatoris* were taken at *Fridtjof Nansen* Station 01. Another specimen was caught by the GOPA Survey. Heemstra (1986) noted that Miller (1974) considered that this species may be a synonym of *Peristethus hians* Gilbert and Cramer (1897). *S. investigatoris* is widely distributed in the Indian Ocean, and is recorded from off South Africa in 550 m (Heemstra, 1986e).

Specimens: BMNH 1996.9.25: 19, TL 98 and 112 mm; BMNH 1997.9.17: 24, TL 94 mm (GOPA)

Satyrichthys sp.

(Fig. 10)

Recorded from the Maldives as *Satyrichthys* sp. by Anderson et al. (1992) and by Randall and Anderson (1993). Four specimens were caught at R.V. *Farumas* Site 2; the largest and the smallest specimens are now at the Bishop Museum. Dead and partially decomposed specimens are on rare occasions washed up on Maldivian beaches.

Specimens: BPBM 34965 (2), TL 275 and 425 mm.

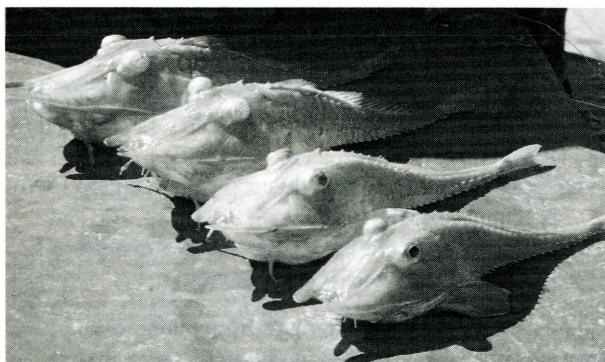


Figure 10. *Satyrichtys* sp., R.V. *Farumas* Survey, North Male Atoll 1991. Photo by R.C. Anderson

ACROPOMATIDAE (temperate ocean-basses)

**Howella sherbornii* (Norman, 1930)

A *Howella sherbornii* was caught at *Te Vega* Station 131. This species is known to be widely distributed in all 3 major oceans in the depth range 850-950 m (Heemstra, 1986).

Specimen: FMNH 71943, grp. 414, TL 50 mm.

Synagrops japonicus (Doderlein, 1884)

Recorded from the "Maldives area" by Norman (1939) from 12 specimens taken at JM Station 115, just outside the present range of the Maldivian EEZ. Another *S. japonicus* was collected by the GOPA Survey, and two more were caught at *Fridtjof Nansen* Station 01. Widely distributed in the Indo-Pacific region in depths of 180-400 m (Heemstra, 1986).

Specimens: BMNH 1939.5.24: 897, TL 133 mm; BMNH 1996.9.25: 23, TL 82 mm; BMNH 1997.9.17: 28, TL 186 mm.

**Synagrops* sp.

A single specimen of *Synagrops* sp. was caught at *Fridtjof Nansen* Station 27. Owing to the inconsistencies of the characters reported in literature (Heemstra, 1986), this species could not be identified to species level.

Specimen: BMNH 1996.9.25: 32, TL 45 mm.

Symphysanodon sp.

Five specimens of *Symphysanodon* sp. were taken at *Fridtjof Nansen* Station 01. The familial placement of *Symphysanodon* is uncertain, but following Nelson (1994) we place it here under the Acropomatidae. The species identification of the species represented here is also uncertain (William D. Anderson, Grice Marine Laboratory, South Carolina, pers. comm., 1997); the genus is in need of revision.

Specimens: BMNH 1997.9.17: 6-8, TL 143, 158 and 122 mm; MRS 0455/97 (2), TL 146 and 118 mm.

SERRANIDAE (groupers)

Epinephelus miliaris (Valenciennes, 1830)

Maldives record (MRS, 1987) from a specimen collected at *Farumas* Site 3. Additional specimens were subsequently caught in 20-170 m (Van de Knaap et al., 1991; Anderson et al., 1992; MRS, unpublished data). At other Indo-Pacific localities, adults have been recorded from depths of 18-180 m (Heemstra and Randall, 1993).

Epinephelus octofasciatus (Griffin, 1926)

Recorded from the Maldives (MRS, 1988) as *E. septemfasciatus* from a specimen caught at *Farumas* Site 2. Subsequently, specimens were caught in 140-170 m (MRS, unpublished data). *Epinephalus octofasciatus* is known from elsewhere in the Indo-Pacific in depths of 30-350 m (Randall and Heemstra, 1991).

OSTRACOBERYCIDAE (ostracoberycids)

Ostracoberyx dorygenys Fowler, 1934

Norman (1939) recorded *Ostracoberyx dorygenys* from two specimens (BMNH 1939.5.24: 824-825, TL 105 and 120 mm) caught at JM Station 145. Known from Japan to the Philippines (Masuda et al., 1984).

APOGONIDAE (cardinalfishes)

**Apogon (Jaydia) smithi* (Kotthaus, 1970)

Two specimens of *A. smithi* (BMNH 1996.9.20:1, SL 62.2 mm; MRS-0441/96(1), TL 51.9 mm) were caught at *Fridtjof Nansen* Station 27. Identification provided by Ofer Gon (J.L.B. Smith Institute of Ichthyology, October 1997). Recorded from the Indo-west Pacific region in 22-300 m (Gon, 1996).

CARANGIDAE (jacks)

Seriola rivoliana Valenciennes, 1833

The almaco jack is not uncommon in Maldives, and was recorded by MRS (1987). During the survey of the R.V. Dr *Fridtjof Nansen*, this species was reportedly caught at 234 m by bottom trawl (Stromme, 1983). During the R.V. *Farumas* reef fish resources survey, two specimens were caught by bottom-set longline in about 180 m on the outer slope of Laamu Atoll near Gaadhoo island (Anderson et al., 1992). The almaco jack is known as *andhun mas* in Dhivehi on account of its distinctive dark eyestripe, *andhun* being the Dhivehi name for kohl. *Seriola rivoliana* is a circumtropical species previously recorded to depths of 160 m in the Indian Ocean region (Kyushin et al., 1977).

LUTJANIDAE (snappers, jobfishes)

Aphareus rutilans Cuvier, 1830

Recorded by Allen (1985), MRS (1987) and Randall and Anderson (1993). It appears fairly regularly in commercial reef fish catches from the outer atoll slopes. During the R.V. *Farumas* reef fish resources survey, numerous specimens were caught by bottom-set longline in 60-210 m on the outer atoll slopes (Anderson et al., 1992). *Aphareus rutilans* has been recorded to depths of at least 100 m from various localities in the tropical Indo-Pacific (Allen, 1985). This species is known as *fashuvirankarumas* in Dhivehi, which is a reference to its sleek gill-rakers.

**Etelis carbunculus* Cuvier, 1828

(Fig. 11)

Two large ruby snappers were caught by multi-hook vertical longline in about 400 m on the outer atoll slope of Laamu Atoll by gulper shark fishermen. The first was taken in October 1992, and was called *loadhilamas* by the fishermen. The second specimen of 70 cm was caught in April 1996, east of Laamu Atoll; it was called *rankarumas*,

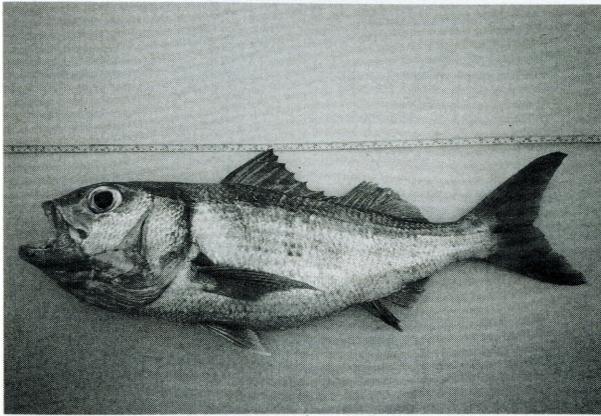


Figure 11. *Etelis carbunculus*, caught outside Laamu Atoll, April 1996. Photo by R.C. Anderson

in reference to its golden gill-rakers. The ruby snapper is widely distributed in the Indo-Pacific region at depths of 185-385 m (Forster et al., 1970).

Specimens: BMNH (uncatalogued), FL 79 cm (cut in half); BMNH, (uncatalogued), TL 80 cm (FL 70 cm).

Pristipomoides (Jordan, Evermann & Tanaka, 1927)

During the R.V. *Farumas* reef-fish resources survey several goldflag jobfish were caught by bottom-set longline between 80 m and 210 m on the outer atoll slopes (MRS, 1988; Anderson et al., 1992; Randall & Anderson, 1993). Elsewhere in the Indo-Pacific region *P. auricilla* has been recorded in depths of 90 to 360 m (Allen, 1985).

Specimens: BPBM 34734, TL 243 mm; MRS-P320/88, TL 372 mm.

Pristipomoides filamentosus (Valenciennes, 1830)

Two crimson jobfish were caught by bottom-set longline during the R.V. *Farumas* survey in about 150-200 m on the outer atoll slope of North Malé Atoll, near the island of Makunudhoo. Further specimens were subsequently caught in 90-150 m (MRS, 1987; Anderson et al., 1992; Randall & Anderson, 1993). At other Indo-Pacific localities *P. filamentosus* has been recorded from depths of 90-360 m (Allen, 1985).

Pristipomoides sieboldii (Bleeker, 1857)

During the R.V. *Farumas* reef fish resources survey, 7 lavender jobfish were caught by bottom-set longline between 140 m and 210 m on the outer slopes of Laamu and Malé Atolls (Anderson et al., 1992; Randall and Anderson, 1993). *Pristipomoides sieboldii* is known from 180-360 m at many localities of the Indo-Pacific region (Allen, 1985).

Specimens: BPBM 34978 (2), TL 295-300 mm.

CHAETODONTIDAE (butterflyfishes)

Prognathodes guyotensis (Yamamoto & Tameka, 1982)

The guyot butterflyfish was first recorded from the Maldives by Randall and de Bruin (1988) from a specimen caught at 202 m by bottom trawl during the *Fridtjof Nansen* Survey in 1983. Previously recorded from the Pacific Ocean at depths of 332-342 m.

Specimen: BPBM 30215 (1), SL 85 mm.

CEPOLIDAE (bandfishes)

****Acanthocephala limbata*** (Valenciennes, 1835)

A specimen was caught at *Fridtjof Nansen* Station 17. Recorded from depths of 80-100 m off Japan (Masuda et al., 1984).

Specimen: BMNH 1996.9.25: 12, TL 385 mm.

CHAMPSODONTIDAE (gapers)

****Champsodon seychellensis*** Regan, 1908

A specimen (BMNH 1996.9.25: 28, TL 70 mm) was caught at *Fridtjof Nansen* Station 01. Elsewhere in the Indian Ocean this species has been recorded from 57-115 m (Nemeth, 1994).

DRACONETTIDAE

****Centrodraco insolitus*** (McKay, 1971)

Two specimens were caught in a bottom trawl during the *Fridtjof Nansen* Survey in 1983. The station data were lost during transport of specimens to London, but the depth was known to be greater than 180 m. Previously known only from northwestern Australia, from depths around 350 m (Fricke, 1992).

Specimens: BMNH 1997.9.17: 36, TL 141 mm; MRS-0450/97(1), TL 133 mm.

GEMPYLIDAE (snake mackerels)

Promethichthys prometheus (Cuvier, 1832)

(Fig. 12)

The roudi escolar was recorded from the Maldives by MRS (1988) based on photographs of a specimen caught in "very deep water" (i.e. deeper than 200 m) by handline near the island of Fuvah Mulaku, in the south Maldives on the night of 3-4 January 1987. The roudi escolar is widely distributed in the tropical and warm-temperate waters of all oceans, in 100-750 m, although in the eastern Pacific it is apparently only known from the Sala y Gomez Ridge (Nakamura & Parin, 1993).

Specimen: MRS-P0329/88 (photographs only).

Rexea bengalensis (Alcock, 1894)

Stromme (1983) noted that "*Rexea promethoides*" was caught in relatively large numbers by bottom trawl at two consecutive *Fridtjof Nansen* stations (nos. 33 and 34) in 234-238 m. A specimen was also taken by the GOPA Survey. According to Nakamura and Parin (1993), the only species of *Rexea* known from the Maldives is *R. bengalensis*. The Bengal escolar is caught by local fisherman on rare occasions; the local name for this species is *theyo mas* (oilfish) referring to the greasy nature of the flesh. Recorded at other Indo-Pacific localities in 143-820 m (Nakamura & Parin, 1993).

Specimens: BMNH 1996.9.25: 20, TL 150 mm; BMNH 1996.9.25: 36-40, TL 120-178 mm (*Fridtjof Nansen*, Stn. 07); BMNH 1997.9.17: 23, TL 155 mm (GOPA Survey); MRS-0071/86, TL 150 mm; MRS-0449/97, TL 137 mm; MRS-0466/97, TL 135 mm.

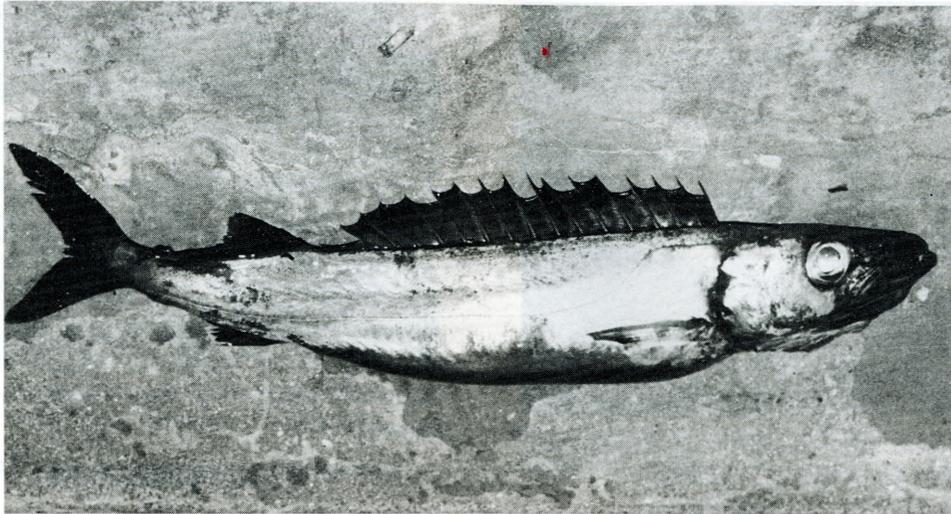


Figure 12. *Promethichthys prometheus*, caught off Fuvah Mulaku, 1987

TRICHIURIDAE (cutlassfishes)

Benthodesmus oligoradiatus Parin & Becker, 1970

Recorded from the Maldives area by Shcherbachev et al. (1986). Juveniles are mesopelagic from about 100 to 300 m. This benthopelagic species occurs in 375-600 m on seamounts and continental slopes of the northern Indian Ocean (Nakamura & Parin, 1993).

**Benthodesmus tenuis* (Günther, 1887)

Two specimens collected at *Te Vega* Station 131. Recorded in 200-850 m from tropical and temperate waters of all oceans except the eastern Pacific (Nakamura & Parin 1993).

Specimens: FMNH 88043, (2) TL 57 cm, D126, A76, V131 and TL 70 cm, D129, A73, V128; both specimens with pelvic fins below anterior end of pectoral fin base.

**Trichiurus auriga* Klunzinger, 1884

A specimen was caught at *Fridtjof Nansen* Station 27. *Trichiurus auriga* occurs from the Red Sea to the Timor Sea, in 250-350 m (Nakamura & Parin, 1993).

Specimen: BMNH 1996.9.25: 3, TL 285 mm.

NOMEIDAE (driftfishes)

**Cubiceps baxteri* McCulloch, 1923

Collected by the GOPA Survey; no other information available. A large species (may exceed 100 cm) widely distributed in all oceans (Haedrich, 1986).

Specimen: BMNH 1997.9.17: 27, TL 122 mm.

**Psenes* sp.

Recorded from a specimen (BMNH 1996.9.25:17, TL 109 mm) caught at *Fridtjof Nansen* Station 16. It is possible that this specimen was caught in midwater.

**Psenes arafurensis* Günther, 1889

One specimen (BMNH, 1997.9.17: 10, 101 mm) caught at *Fridtjof Nansen* Station 16. A second specimen (BPBM 37019: 79 mm) was collected from under a floating log that drifted into Thaa Atoll 20 December 1993.

BOTHIDAE (lefteye flounders)

Chascanopsetta prognathus Norman, 1939

(Fig. 13)

The holotype was caught at JM Station 145; another

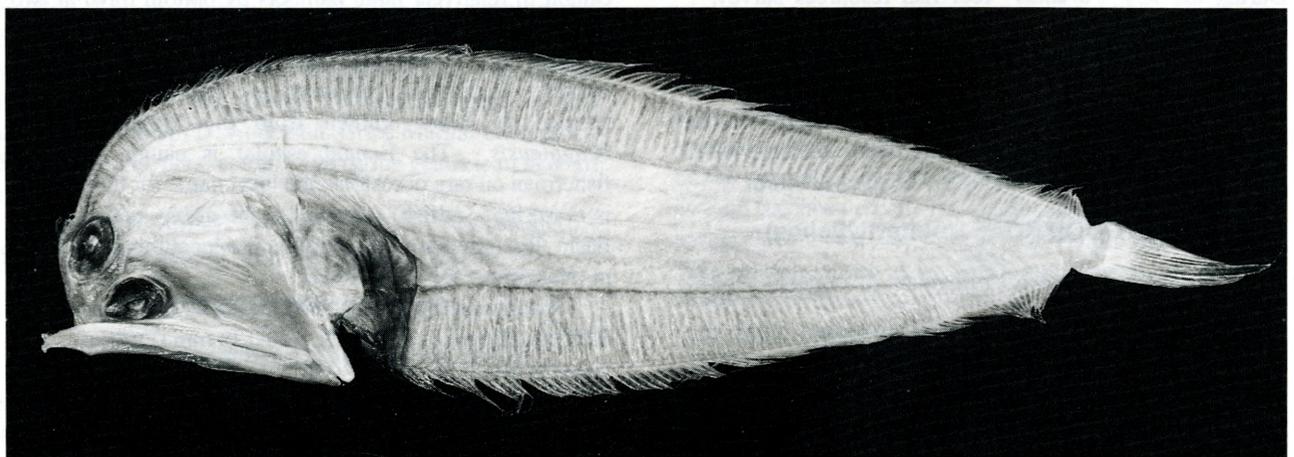


Figure 13. *Chascanopsetta prognathus*, BMNH 1939.5.24: 1738, 172mmTL (holotype)



Figure 14. *Marleyella maldiviensis*, BMNH 1939.5.24: 1797-1798, 75mm TL

specimen (BMNH 1997.9.17: 34, TL 158 mm) was collected by the GOPA Survey. Also known from Japan in 494-550 m (Amaoka & Yamamoto, 1984).

PLEURONECTIDAE (righteye flounders)

Marleyella maldiviensis (Norman, 1939)
(Fig. 14)

Two specimens (BMNH 1939.5.24: 1797-1798, TL 75-104 mm; holotype, female, 104 mm) caught at JM Station 157. Known only from the type locality, off Alifu Atoll.

Poecilopsetta albomaculata (Norman, 1939)
(Fig. 15)

Three specimens (BMNH 1939.5.24: 1744-1746, TL 96-130 mm, holotype 130 mm) from JM Station 153, appears to be known only from the type locality, southwest of Baa

Atoll (Quéro et al., 1988).

**Poecilopsetta natalensis* Norman, 1931

One specimen caught at *Fridtjof Nansen* Station 01 and another at Station 27. Recorded in 250-450 m at other Indo-Pacific localities (Heemstra, 1986).

Specimens: BMNH 1996.8.25: 27, TL 86 mm (stn. 01); BMNH 1996.8.25: 35, TL 92 mm (stn. 27).

CYNOGLOSSIDAE (tonguefishes)

Symphurus maldivensis Chabanaud, 1955
(Fig. 16)

Norman (1939) recorded this species as *S. marmoratus* from a specimen caught at JM Station 153 that was later described as a new species by Chabanaud (1955). No other records for this species are known. The family is being

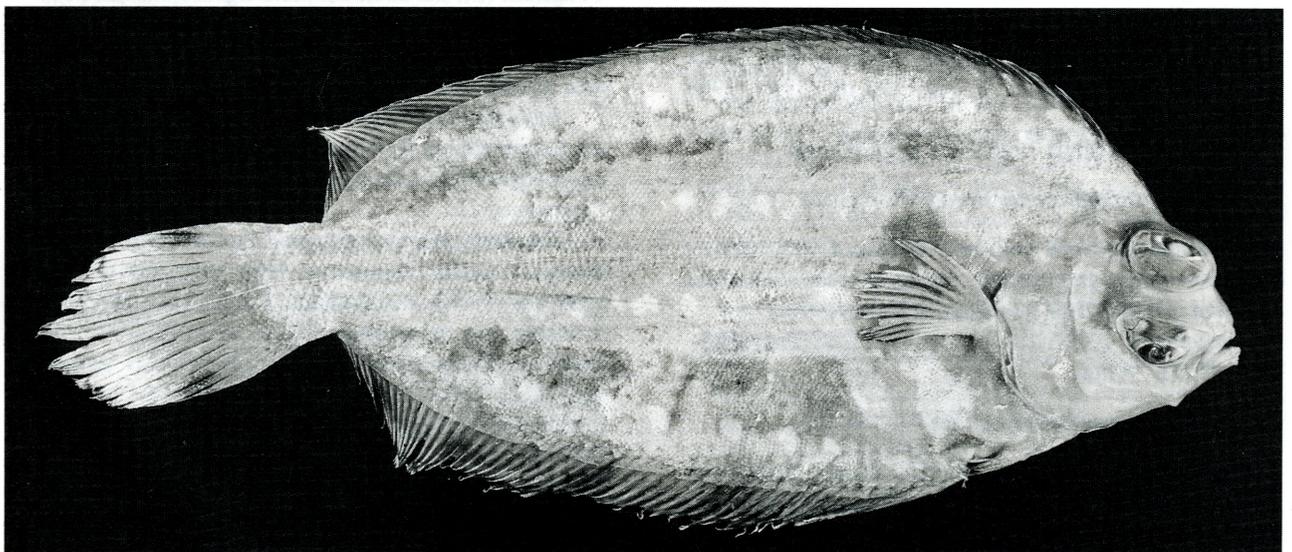


Figure 15. *Poecilopsetta albomaculata*, BMNH 1939.5.24: 1744-1746, 125mm TL

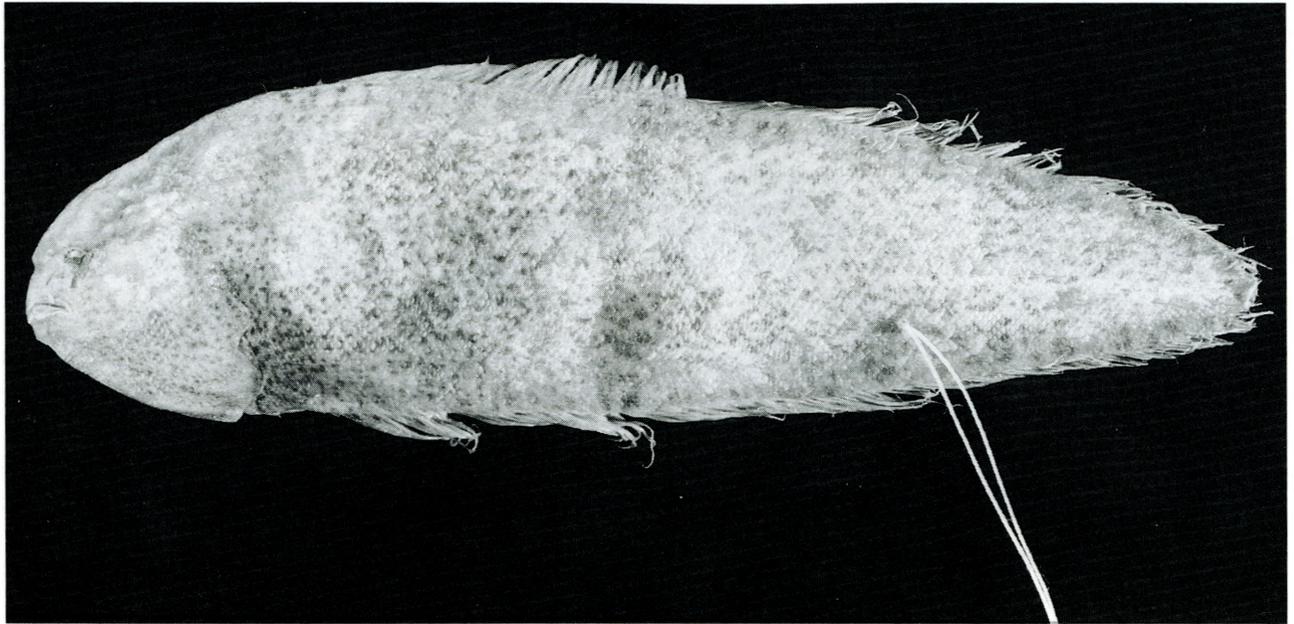


Figure 16. *Symphurus maldiviensis*, BMNH 1939.5.24: 1815, 110mm TL (Holotype)

revised by Thomas Munroe, of the U.S. National Marine Fisheries Service Systematics Laboratory, Washington, D.C.

Specimen: BMNH 1939.5.24: 1815, TL 110 mm (holotype).

Symphurus strictus Gilbert, 1905

The 14 specimens reported by Norman (1939) from JM Station 145, (BMNH 1939.5.24: 1816-24, TL 55-134 mm) could not be located in February, 1996. Known from Hawaii, Japan and off Maputo in 476 m (Heemstra, 1986).

TRIACANTHODIDAE (spikefishes)

**Atrophacanthus japonicus* (Kamohara, 1941)

A specimen was caught at *Fridtjof Nansen* Station 01. Known from Japan, Philippines, Celebes Sea, India, Tanzania and off Maputo in 180-1300 m. (Tyler, 1968, 1970).

Specimen: BMNH 1996.9.25: 1, TL 62 mm.

**Macrorhamphosodes uradoi* (Kamohara, 1933)

Two specimens were collected by the GOPA Survey. Elsewhere in the Indo-Pacific region *M. uradoi* has been recorded in 420-675 m (Matsuura & Tyler, 1997).

Specimens: BMNH 1997.9.17: 31, TL 88 mm; MRS-0467/97, TL 78 mm.

**Triacanthodes ethiops* Alcock, 1894

A specimen was taken at *Fridtjof Nansen* Station 42. Widely distributed in the Indo-Pacific region at depths of 330-420 (Matsuura & Tyler, 1997).

Specimen: BMNH 1996.9.25: 7, TL 68 mm.

DISCUSSION

Listed here are 99 demersal fish species recorded from below 180 m in the Maldives. Thirty-six species are recorded from the Maldives for the first time. Since the amount of sampling carried out at depths greater than 180 m is limited, it is likely that many more deep demersal species await discovery. Randall and Anderson (1993) recorded a total of 899 species of epipelagic and shore fishes from the Maldives, and their list did not include 84 of the species listed in the present paper. Thus, the total number of epipelagic and demersal fishes known from the Maldives is here raised to 982.

The four most speciose deep demersal families (numbers of species in parentheses) are: Macrouridae (7), Congridae (5), Lutjanidae (5) and Ogcocephalidae (4).

The distribution of Maldivian deep demersal fishes, in terms of the number of species from each zoogeographic area is as follows:

Indo-Pacific 28, Indo-west Pacific 10, Indian Ocean 13, Circumglobal 9, Circumtropical 9, Indo-west Pacific and Atlantic 6, Indian and Atlantic 9, Endemic 4, Unassigned 11.

Excluding the 11 unassigned species, 44% of the deep demersal species represented here have Indo-Pacific or Indo-west Pacific distributions. Comparative data are not available for the shallow water Maldivian fish fauna. However, this is much lower than the 80% of epipelagic and shore fishes in the Chagos that have comparable distributional ranges (Winterbottom and Anderson, 1997). In contrast, the proportion of species which have distributions that include the Atlantic or are circumglobal is much higher for deep demersal Maldivian fishes (37%) than for epipelagic and shore fishes from the Chagos (6%). These results are not unexpected, and reflect the more uniform habitat and widespread distribution of deeper-

dwelling species (Merrett and Haedrich, 1997). It should be noted, however, that some species recorded in this checklist are not well known, and therefore their recorded ranges must be considered provisional. In particular, it is likely that the four species currently known only from Maldives, and recorded here as endemics, will prove to be more widely distributed when further regional sampling is carried out.

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NEW RECORDS OF FISHES FROM THE MALDIVE ISLANDS, WITH NOTES ON OTHER SPECIES

by

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INTRODUCTION

The epipelagic and shore fishes of Maldives were reviewed by Randall and Anderson (1993) who recognized records of 899 species from the archipelago, including 201 new records. Of these 899 species, 32 were recorded by generic name only. Some of these could not be identified due to their poor condition or to their being juveniles, but most appeared to be undescribed.

The deep demersal fishes of Maldives are reviewed by Adam, Merrett and Anderson (1998; this *Bulletin*). They recorded 99 species of demersal fish from below 180 m; 83 of these were not recorded by Randall and Anderson (1993). Thus the total number of epipelagic and demersal fishes recorded from the Maldives was raised to 982.

The primary aim of this paper is to present details of new records of epipelagic and shore fishes from the Maldives since the review of Randall and Anderson (1993). The secondary aims of this paper are to update nomenclature of some of the fishes recorded by Randall and Anderson (1993), and to present new information on the occurrence and ecology of some Maldivian fishes.

Four small collections of Maldives fishes were overlooked by Randall and Anderson (1993). The first was made by the Royal Indian Marine Survey Ship *Investigator* in 1923 (Talwar, 1994). During the course of surveying Addu and Horsburgh (Goifulhafehendoo) Atolls, a collection of shore and shallow water animals was made. This collection is held at the Zoological Survey of India Museum, Calcutta. It has not been reviewed by us.

The second, from the Yale Seychelles Expedition of 1957 (Kohn, 1964), formerly part of the Bingham Oceanographic Collection, is deposited at the Peabody Museum of Natural History, Yale University. This collection has not been reported per se, but specimens of some species have been cited in review papers.

The third collection was made by Sten Munch-Petersen as part of a fisheries survey in 1977 and 1978, and reported by him (Munch-Petersen, 1980). Some of this collection was deposited in the Zoological Museum, Copenhagen. It has not been reviewed by us.

The fourth collection overlooked by Randall and Anderson (1993) was made by Ahmed Hafiz during a visit of the Norwegian Research Vessel *Dr Fridtjof Nansen* in 1983 (Stromme, 1983). This collection was mainly of deep-water species (which are reviewed by Adam et al.

1998), but some shallow-water specimens were also preserved. In addition, several species previously unrecorded from the Maldives are noted in the unpublished fishing logs of the *Dr Fridtjof Nansen* (Anon, 1983). Records based on these fishing logs are included here, sometimes tentatively, when there is some additional supporting evidence.

Two recent popular books of Indian Ocean fishes (Debelius, 1993; Göthel, 1994) both include numerous text references to fishes occurring in the Maldives, including several species not recorded from there by Randall and Anderson (1993). Correspondence with the authors revealed that in each case three new records were based on the author's own observations and/or photographs from the Maldives. These six new records are detailed in the text below.

Other recent publications on the fishes of Maldives include a review of sharks and shark fisheries (Anderson and Ahmed, 1993); a fourth volume of the Ministry of Fisheries and Agriculture's illustrated "Catalogue of Fishes of the Maldives" (MRS, 1992); and two small identification guides for tourists (Anderson and Hafiz, 1992; Mojetta and Amsler, 1994). Some recent publications purporting to show only Maldivian fishes (e.g. Amin, Willetts and Marshall, 1992; Mojetta, 1996) appear to contain photos of fishes taken outside of the Maldives; these publications are not considered any further here.

MATERIALS AND METHODS

The majority of our new records are based on underwater photographs. These photographs are presented, except in cases where the quality or contrast is sufficient for identification but not for publication. Lengths of most specimens are standard length (SL), taken from the tip of the snout to the base of the caudal fin. A few other fishes are recorded by total length (TL) or fork length (FL), the latter from the tip of the snout to the end of the shortest median caudal ray. Family names and sequence follow Nelson (1994). Specimens from the following institutions have been examined: the Natural History Museum, London (BMNH); the Bernice P. Bishop Museum, Honolulu (BPBM); the Marine Research Section, Malé, Republic of Maldives (MRS).

Species that have never been recorded from Maldives before are marked with a double asterisk (**). Those that have been recorded before but were not included in the checklist of Randall and Anderson (1993), are marked with a single asterisk (*). For a location map see Adam et al. (1998, Fig. 1). Authors and distributions are given only for species not listed by Smith and Heemstra (1986).

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CHECKLIST

PSEUDOCARCHARIIDAE (crocodile sharks)

***Pseudocarcharias kamoharai* (Matsubara, 1936)

One specimen (BPBM 37113, 108 cm TL, female, anterior half only). Caught about 140 nautical miles (260 km) west of south Baa Atoll by pelagic longline, at about 100-200 m depth, over about 4200 m. A second individual, a mature male of 110 cm TL, was caught about 180 nautical miles (330 km) east of South Malé Atoll in June 1995, at about 80-120 m depth, over about 3300 m; it was not collected.

ALOPIIDAE (thresher sharks)

***Alopias pelagicus* (Nakamura, 1935)

One female (head only, BPBM 37800), measured TL 237cm (120 cm precaudal length, upper caudal lobe 117 cm but tip of caudal broken); estimated total length about 245 cm. Snout relatively short and conical; no deep grooves behind eyes; no labial furrows. Teeth relatively small; lateral teeth with distinct cusplets. Colour medium grey above and white below; white not extending on to sides above pectoral or pelvic fin bases. Caught about 260 km west of south Baa Atoll by pelagic longline, depth 100-200, over about 4200 m.

DASYATIDAE (stingrays)

Himantura granulata (Macleay, 1883)

Himantura granulata was first recorded from the Maldives by Randall and Anderson (1993). Since then this species has been redescribed, in part on Maldivian material, by Ishihara et al. (1993). It has also been illustrated in colour from the Maldives by Debelius (1993, p. 33).

Pastinachus sephen (Forsskål, 1775)

Recorded from the Maldives by Randall and Anderson (1993) as *Hypolophus sephen*; the generic change follows Last and Stevens (1994). This is one of two stingray species (the other is *Taeniura meyeni*) that are regularly attracted to resort island beaches for feeding by tourists.

MYLIOBATIDAE (eagle rays)

***Aetomylaeus vesperilio* (Bleeker, 1852)

A video film of this eagle ray was taken near Kuredhoo in Lhaviyani Atoll in January 1994 by Stefania and Peter Lamberti; we have photographs taken from that film. This specimen was estimated to be about 2 m disc width (Stephania Lamberti, pers. comm., December 1994). Two other experienced diving instructors report seeing this species, one in North Malé Atoll and the other in Ihavandhippolhu Atoll in the far north of Maldives. Both of these rays were seen deeper than 40 m, and both were estimated to be in excess of 3 m disc width and 5 m total length. Even allowing for magnification due to underwater viewing it seems likely that this species grows to more than the 1.6 m disc width cited by Last and Stevens (1994). This record represents a major range extension for this species, which was previously known only from the western Pacific. Tropical Indo-west Pacific.

MURAENIDAE (Moray Eels)

***Uropterygius marmoratus* (Lacepède, 1803) (Fig. 1)

Two speckled grey moray eels, were photographed at night on lagoon reefs in Vaavu Atoll. The first was estimated to be about 30 cm TL, the second about 60-90 cm TL. Both were identified as *U. marmoratus* by John E. McCosker (pers. comm., June 1995 and August 1997).

OPHICHTHIDAE (snake eels and worm eels)

***Ophichthus bonaparti* (Kaup, 1856) (Fig. 2)

Photographed in deep lagoon near Ziyaarayifushi in North Malé Atoll.

***Pisodonophis cancrivorus* (Richardson, 1844) (Fig. 3)

Photographed in deep lagoon near Ziyaarayifushi in North Malé Atoll.

ENGRAULIDAE (anchovies)

**Stolephorus indicus* (van Hasselt, 1823)

Munch-Petersen (1980) recorded *S. indicus* from the livebait catch of a tuna fishing boat at Naifarua in Lhaviyani Atoll. Munch-Petersen (pers. comm., October 1994) noted that the specimens on which this record was based had been deposited at the Zoological Museum in Copenhagen but have apparently been lost; he further noted that he was not certain about the identification. *S. indicus* is likely to occur in Maldives so we retain this as a tentative record which needs confirmation.

CLUPEIDAE (herrings)

***Amblygaster leiogaster* (Valenciennes, 1847)

Several specimens from South Malé and Huvadho Atolls (MRS 0491-97, 6: 49-62 mm; MRS 0492-97, 215 mm; BPBM 37808, 238 mm). Lower gill-rakers 32-34. Our largest specimen is longer than the maximum size of 23 cm SL mentioned by Whitehead (1985). Tropical Indo-west Pacific.

SYNODONTIDAE (lizardfishes)

**Synodus indicus* (Day, 1873)

An underwater photograph of this species taken by RHK in North Malé Atoll in October 1994 is reproduced in Godfrey (1996, p.52). Indian Ocean.

***Synodus rubromarmoratus* Russell & Cressey, 1979 (Fig. 4)

We have two lots of underwater photographs of this species, both taken on sand/rubble bottoms. One taken in about 20 m near Guraidhoo in South Malé Atoll (Fig. 4), the other in 42 m near Maalhos in Baa Atoll. This record represents a major range extension, as this species was previously known only from the western Pacific.

*****Trachinocephalus myops*** (Forster in Bloch & Schneider, 1801)

Several specimens were caught by bottom trawl in 36-39 m inside Shaviyani Atoll by the *Fridtjof Nansen* on 24 August 1983 (MRS 0069-86, 19: 55-87 mm). We also have underwater photographs of this species, taken in the lagoon of Ziyaraiyfushi in North Malé Atoll.

LAMPRIDIDAE (opahs)

*****Lampris guttatus*** (Brünnich, 1788)

Two specimens, neither retained. One 101 cm, caught by pelagic longline about 180 nautical miles (330 km) east of South Malé Atoll in June 1995, at about 80-120 m depth, over about 3300 m. The second specimen 86 cm, (Fig. 5) caught by pelagic longline about 130 nautical miles (240 km) west of south Ari Atoll in July 1995, also at about 80-120 m depth, over about 4200 m.

ANTENNARIIDAE (frogfishes)

*****Antennarius maculatus*** (Desjardins, 1840)
(Fig. 5)

One white and red individual of about 10 cm TL (Fig. 6) was observed over a period of several months in late 1993 on Bathala Thila, near Bathala in Ari Atoll. Identification was confirmed by Theodore W. Pietsch (pers. comm., September 1994). We have underwater photographs of two other individuals, one from Fushifaru Bodu Giri in Ari Atoll, the other from South Malé Atoll. Previously known from Mauritius and tropical western Pacific.

*****Antennarius pictus*** (Shaw & Nodder, 1794)
(Fig. 6)

We have a photograph from South Malé Atoll.

EXOCOETIDAE (flyingfishes)

****Cheilopogon atrisignis*** (Jenkins, 1904)

The Maldives distribution of this species and the following records (Parin and Gibbs, 1984) were overlooked by Randall and Anderson (1993).

****Cheilopogon furcatus*** (Mitchill, 1815)

Parin and Gibbs (1984).

****Cheilopogon suttoni*** (Whitley & Colefax, 1938)

Parin and Gibbs (1984).

****Hirundichthys coromandelensis*** (Hornell, 1923)

Parin and Gibbs (1984).

****Parexocoetus brachypterus*** (Richardson, 1846)

Parin and Gibbs (1984).

****Prognichthys brevipinnis*** (Valenciennes, 1846)

Parin and Gibbs (1984).

****Prognichthys sealei*** Abe, 1955

Parin and Gibbs (1984).

HOLOCENTRIDAE (soldierfishes and squirrelfishes)

Myripristis botche Cuvier, 1829

Recorded from the Maldives by MRS (1988) and Randall and Anderson (1993) as *M. melanosticta* Bleeker, a junior synonym of *M. botche* (Randall and Greenfield, 1996).

*****Sargocentron melanospilos*** (Bleeker, 1858)
(Fig. 7)

A small school of this species has been photographed at 30-35 m adjacent to the wreck of the *Maldive Victory* in North Malé Atoll.

SYNGNATHIDAE (pipefishes and seahorses)

*****Doryrhamphus bicarinatus*** Dawson, 1981
(Fig. 8)

We have underwater photographs of this species from North Malé Atoll. On the original slides it is possible to discern 2.5 subdorsal trunk rings, and 2 ventral projections on the snout.

Doryrhamphus excisus excisus Kaup, 1856

This species was reported by Randall and Anderson (1993) on the basis of underwater observations only. We now have a specimen (MRS 0244-88, 43mm); total trunk rings 19, subdorsal trunk rings 4.

*****Halicampus mataafae*** (Jordan & Seale, 1906)
(Fig. 9)

Photographs of a snub-snouted pipefish were taken in about 10 m on the reef slope of Bathala Island, Ari Atoll, on 28 July 1995. It had about 51 rings, and was dark brown with about 10 pale narrow bars on the dorsum and upper sides. It is tentatively identified as *H. mataafae*; a specimen is required for confirmation.

Trachyrhamphus bicoarctatus (Bleeker, 1857)

Recorded by Randall and Anderson (1993) by name only. We now have one specimen (BPBM 37114, 240 mm TL) collected from Alimatha resort in Vaavu Atoll in August 1995, as well as underwater photographs.

*****Hippocampus kuda*** Bleeker, 1852
(Fig. 10)

This record is based on aquarium photographs of a single specimen of about 9 cm TL. It was collected from Malé harbour where it was attached to a floating piece of wood. Rings 11 + ?34; D 17.

SCORPAENIDAE (scorpionfishes)

****Ablabys binotatus*** (Peters, 1855)

Debelius (1993, p. 81) includes three photographs of *A. binotatus*, all taken in the Maldives by H. Voightmann; the one identified as *A. taenianotus* is *A. binotatus* (Helmut Debelius, pers. comm., August 1994). This species was previously known from the east coast of Africa.

SERRANIDAE (groupers)

**Cephalopholis polleni* (Bleeker, 1868)

Recorded from the Maldives by Smith-Vaniz et al. (1988) and Randall and Heemstra (1991) on the basis of an unconfirmed underwater sighting. Since no further records were forthcoming, this Maldives sighting was omitted by Randall and Anderson (1993) and Randall and Heemstra (1994). However, an underwater photo of *C. polleni* taken by Scott Michael in the Maldives and forwarded to the authors confirms its presence there.

***Epinephelus undulosus* (Quoy & Gaimard, 1824)

A single specimen (BPBM 36456, 495 mm SL, 582 mm TL) was purchased from Malé fish market on 10 July 1994. D XI,19; A III,8; P 19; GR 14+22=36. Colour pale brown; head with small close-set yellow dots dorsally; head orange-pink ventrally; no lateral wavy lines were apparent. It was caught by handline in daytime, within North Malé Atoll, while fishing for *Aprion virescens* (i.e. off the bottom in about 50 m). Two individuals of *E. undulosus* were taken by bottom trawl in 36-39 m inside Shaviyani Atoll by the R.V. *Dr Fridtjof Nansen* on 24 August 1983 (Anon, 1983) but not retained.

***Pogonoperca ocellata* Günther, 1859 (Fig. 11)

We have one specimen (MRS 0469-97, 193 mm) collected from Malé market (Fig. 12). D VIII,12; A II,7. We also have photographs of a pair in 42 m near Maalhos in Baa Atoll. The colour pattern of these individuals closely matches that of *P. ocellata*, described from Seychelles, and differs in several small but consistent details from that of *P. punctata* (Valenciennes in Cuvier and Valenciennes, 1830), described from Vanikola in the western Pacific. In particular, *P. ocellata* has white spots on the median fins and more extensive black markings on the body than *P. punctata*. The two were synonymized by Randall et al. (1971) who noted that this decision was tentative and that more specimens were needed. It now seems likely that these two are allopatric species, the former being confined to the western Indian Ocean, the latter being found from the eastern Indian Ocean to Polynesia. (The issue of the taxonomic status of Pacific and Indian Ocean sibling taxa is raised again in the Discussion).

PRIACANTHIDAE (bigeyes)

***Cookeolus japonicus* (Cuvier, 1829)

A specimen (BPBM 36792, 340 mm) was caught by handline in about 100-120 m on the outer slope of Ari Atoll, near Ukulhas Fushi on 27 May 1995. Several fishermen have recently started targeting snappers and groupers at this depth, as a result of which this species now appears fairly regularly on Malé market. Worldwide in tropical and warm temperate waters.

**Priacanthus blochii* Bleeker, 1853

Recorded from the Maldives by Debelius (1993, p.118); from a photograph taken by himself in Ari Atoll (Helmut Debelius, pers. comm., August 1994). We also have

photographs from South Malé Atoll. Indo-Pacific.

APOGONIDAE (cardinalfishes)

***Apogon fragilis* Smith, 1961 (Fig. 12)

Photographed in North Malé, South Malé and Vaavu Atolls. This species is differentiated from *A. gilberti* (Jordan and Seale, 1905) on the basis of a black spot on the opercle of the latter (Fraser and Lachner, 1985). *A. gilberti* is not known from the Indian Ocean.

***Apogon franssedai* Allen, Kuiter & Randall, 1994 (Fig. 13)

Photographed in 42 m near Maalhos in Baa Atoll. Recently recorded from the Chagos (Winterbottom and Anderson, 1997), before which this species was only known from the western Pacific. There are slight colour differences between individuals in our photographs and those from the type locality (Maldivian individuals have a shorter stripe above the eye and a white rather than a yellow dorsal); it is possible that these may represent a distinct species.

***Apogon holotaenia* (Regan, 1905)

We have one specimen (BPBM 37804, 47 mm). Collection details have been lost, but we believe this specimen was collected by Ahmed Hafiz during the 1983 survey of the *Fridtjof Nansen*; it was probably taken by bottom trawl inside an atoll. We also have photographs taken in about 35 m near Maalhos in Baa Atoll. Persian Gulf to India.

***Apogon sangiensis* Bleeker, 1857 (Fig. 14)

Photographed in Malé harbour. This specimen lacks the typical black anterior margin of the first dorsal fin. Previously known from the western Pacific.

Apogon savayensis Günther, 1871

Recorded by Randall and Anderson (1993) as *Apogon fuscus* Quoy and Gaimard, 1825. The original description of *A. fuscus* is not detailed enough to assign this name to any apogonid recognized today, and Bauchot and Desoutter (1986) noted that the type specimen was not found in the Muséum National d'Histoire Naturelle in Paris.

***Apogon* sp.

Thomas H. Fraser (pers. comm., September 1997) informs us that he has examined 26 Maldivian specimens of a species belonging to the *Apogon bandanensis* complex, which he will be describing as new. We also have underwater photographs of this species.

Fowleria vaiulae (Jordan & Seale, 1906)

The genera *Foa* and *Fowleria* are under revision by Gerald R. Allen and Thomas H. Fowler. Allen (pers. comm., June 1997) advises us that *Fowleria abocellata* Goren and Karplus, 1980 (recorded from the Maldives by Randall and Anderson, 1993) is a junior synonym of *F. vaiulae*.

*****Pseudamia hayashii*** Randall, Lachner & Fraser, 1985
(Fig. 15)

Photographed at night in a cave at 25 m near Maalhos in Baa Atoll.

MALACANTHIDAE (tilefishes)

*****Hoplolatilus cuniculus*** Randall & Dooley, 1974
(Fig. 16)

We have underwater photographs of this species that were taken in 40-50 m at two locations in North Malé Atoll. In addition we have seen an underwater photograph (taken by Mustag Hussein in 50 m near Malé) of one individual that appears to have a black dorsal fin; it is unclear if this is conspecific with *H. cuniculus*. Mauritius to Western Pacific.

*****Hoplolatilus* sp. 1**
(Fig. 17)

We have photographs of a black-tailed tilefish, taken in North Malé Atoll by JER and in South Malé Atoll by Jörg Aebi. This seems to be close to *Hoplolatilus frontocinctus*, but appears to be a new species.

*****Hoplolatilus* sp. 2**
(Fig. 18)

We have underwater photographs of a brilliant blue tilefish from South Malé Atoll. This appears to be a new species.

CARANGIDAE (jacks)

*****Carangoides gymnostethus*** (Cuvier, 1833)

One specimen (BPBM 37808, 695 mm; only head preserved). D IX+I,28; A III,25; GR 9+22=31. Purchased from Malé fish market 26 January 1997.

****Decapterus macrosoma*** Bleeker, 1851

Record by Munch-Petersen (1980) needs confirmation.

****Ulua mentalis*** (Cuvier, 1833)

Recorded by Munch-Petersen (1980) as *Ulua mandibularis*, a synonym of *U. mentalis* (Smith-Vaniz, 1984).

BRAMIDAE (pomfrets)

*****Brama orcini*** Cuvier, 1831

Two specimens (MRS 0473-97, 220 mm; BPBM 37806, 194 mm), both purchased from Malé fish market on 1 December 1996. Both reported to have been caught near Kudahithi in North Malé Atoll.

*****Taractes asper*** Lowe, 1843

One specimen (BPBM 37112, 640 mm; fin lobes cut by crew prior to freezing on board). Caught by pelagic longline in outer waters of Maldivian EEZ in mid-1995, but exact position and date unknown.

Taractichthys steindachneri (Döderlein, 1883)

Recorded from the Maldives by Randall and Anderson (1993) on the basis of a photograph only. That photograph was incorrectly stated as being of a fish taken in October 1986 off Raa Atoll. The photograph was taken by Ahmed Hafiz in October 1986 apparently of a fish from Malé market, (A. Hafiz, pers. comm., December 1996). We now have additional photographs of a specimen caught by pelagic longline in outer waters of Maldivian EEZ in mid-1995, but exact position and date unknown; specimen collected, but lost in failed freezer.

LUTJANIDAE (snappers)

Lutjanus rufolineatus (Valenciennes, 1830)

Recorded by Randall and Anderson (1993) as *L. bouton*. Allen (1995a) resurrected the name *L. rufolineatus* from synonymy for this Indo-west Pacific species. The true *L. bouton* is apparently restricted to the western Pacific.

CAESIONIDAE (fusiliers)

Some recent authors (Johnson, 1993; Nelson, 1994) treat the fusiliers as a subfamily (Caesioninae) of the Lutjanidae. On the advice of Kent E. Carpenter we maintain this group as a separate family.

****Pterocaesio trilineata*** Carpenter, 1987

A photograph of this species taken by RHK in the Maldives is reproduced in Godfrey (1996, p. 43). We have other photographs from several localities in North Malé, South Malé and Ari Atolls. Previously known from the western central Pacific.

*****Pterocaesio* sp.**

We have specimens and underwater photographs of a new species of fusilier with two broad yellow stripes. To be described by Kent E. Carpenter.

LETHRINIDAE (emperors)

*****Lethrinus ornatus*** Valenciennes, 1830

Photographs taken under the jetty of Kuda Huraa island, North Malé Atoll. Two specimens were seen in this area of fine sand and seagrass. Previously known from Sri Lanka to western Pacific.

NEMIPTERIDAE (threadfin breams)

*****Nemipterus furcosus*** (Valenciennes, 1830)

One specimen purchased from Malé fish market (MRS 0443-96, 163 mm). Previously known from Sri Lanka to western Pacific. D X,9; A III,7.

*****Nemipterus zysron*** (Bleeker, 1856-57)

A specimen (MRS 0437-94, 129 mm) collected from the stomach of a sliteye shark, *Loxodon macrorhinus*, caught by bottom longline in 43-49 m inside North Malé Atoll near Ihuru island. D X,9; A III,7; body depth 4.45 in SL. Indo-west Pacific.

MULLIDAE (goatfishes)

- ***Mulloidichthys vanicolensis*** (Valenciennes, 1831)
(Fig. 19)

Photographs of a school of this goatfish were taken at Keyodhoo Thila, Vaavu Atoll. We have also photographed this species underwater in Guraidhoo Channel, South Malé Atoll, in about 5 m. In addition, a photograph of a school of *M. vanicolensis* taken in Maldives was sent to the authors by Horst Moosleitner.

*****Upeneus* sp.**

We have an underwater photograph of a species of *Upeneus* that we are unable to identify with certainty. The same species was seen underwater in the lagoon of Farukolufushi, North Malé Atoll, by RCA.

PEMPHERIDAE (sweepers)

*****Pempheris* sp.**

Photographs of a species of *Pempheris* taken on the wreck of the S.S. *Crusader* on Gaafaru Reef, North Malé Atoll, in about 10 m. This appears to be a species close to *P. oualensis*, but specimens are needed for definite identification (Randall D. Mooi, pers. comm., September 1997).

MONODACTYLIDAE (monos)

- ***Monodactylus argenteus*** (Linnaeus, 1758)
(Fig. 20)

Photograph of a large school, taken under the jetty of Kuda Huraa island, North Malé Atoll.

POMACANTHIDAE (angelfishes)

- ***Centropyge acanthops*** (Norman, 1922)
(Fig. 21)

The specimen photographed in an aquarium in Malé in August 1995 was still alive in September 1997. This specimen originated in Addu Atoll in the south of Maldives, where this species is said to be not uncommon. Known from Somalia to South Africa, Mauritius and Chagos.

- ***Genicanthus caudovittatus*** (Günther, 1860)
(Fig. 22)

We have underwater photos of both sexes from the outer reef slope of South Malé Atoll. Previously known from the Red Sea, South Africa and Mauritius.

KYPHOSIDAE (rudderfishes)

- ***Kyphosus bigibbus*** Lacepède, 1801

One specimen (BPBM 37107, 63 mm) collected by hand from under a floating log that had drifted into Thaa Atoll, 20 December 1993.

CIRRHITIDAE (hawkfishes)

- ***Cirrhitichthys aprinus*** (Cuvier, 1829)
(Fig. 23)

Photographs from South Malé Atoll. Previously known from western Pacific.

POMACENTRIDAE (damselfishes)

- ***Amblyglyphidodon batunai*** Allen, 1995b
(Fig. 24)

Photographed adjacent to staghorn coral patches in a deep lagoon, North Malé Atoll. Previously known from Indonesia.

****Amblypomacentrus* sp.**

Recorded from the Maldives by Regan (1908) as *Dascyllus melanurus* (BMNH 1901.12.31.79: 2); overlooked by Randall and Anderson (1993). These preserved specimens appear to be conspecific with *A. breviceps*. However, underwater photographs of specimens of *Amblypomacentrus* from 30-35 m in the lagoon of Madivaru in North Malé Atoll show distinct colour differences from that species. The possibility that this represents an undescribed species is being investigated.

- ***Chromis pembrae*** Smith, 1960
(Fig. 25)

Many specimens of about 8 cm TL seen and photographed in 25-30 m on the outer reef wall of Vaavu Atoll adjacent to Fotheyo Channel (Fig. 27). We also have photographs from the outer reef of South Malé Atoll. Randall and Egmond (1994) presented a colour photo from the Seychelles (their Fig. 34) misidentified as *Chromis analis*.

Chrysiptera brownriggii (Bennett, 1828)

Listed by Randall and Anderson (1993) as *Chrysiptera leucopoma* (Lesson, 1830). Pethiyagoda, Raheem and Russell (1994) consider *C. leucopoma* to be a junior synonym of *C. brownriggii*.

- ***Neopomacentrus azysron*** (Bleeker, 1877)

One specimen (BPBM 37801, 31 mm); collection details lost, perhaps taken by Ahmed Hafiz in 1983 on the *Fridtjof Nansen*.

Plectroglyphidodon johnstonianus Fowler & Ball, 1924

Randall and Anderson (1993, p. 31) noted in their introduction to the family Pomacentridae that *P. johnstonianus* had not been recorded from the Maldives, but included it in their checklist on the basis of an underwater sighting. This inconsistency arose because the underwater sighting was made after the draft of the checklist was completed and the introductory remarks were not corrected due to an oversight. The individual recorded by Randall and Anderson was about 7 cm TL and was photographed in about 5 m in an area of rich *Acropora* and *Pocillopora* coral growth on Maagiri reef, North Malé Atoll. We have also seen this species on an outer reef in Haa Dhaalu Atoll, and have been sent photographs of another specimen from South Malé Atoll by Jörg Aebi.

- ***Pomacentrus nagasakiensis*** Tanaka, 1917
(Fig. 26)

Photographed in 30 m near Bathala in Ari Atoll. It appears to be fairly common in 25-35 m on sandflats with isolated coral patches.

*****Pristotis obtusirostris*** (Günther, 1862)

Two specimens (BPBM 37803, 2: 50-54 mm), collection details lost, perhaps collected by Ahmed Hafiz in 1983 on the *Fridtjof Nansen*. As noted by Randall (1995), *Pristotis jerdoni* (Day, 1873) is a junior synonym.

LABRIDAE (wrasses)

*****Bodianus bilunulatus*** (Lacepède, 1801)

An adult of about 25 cm TL was observed in about 40 m outside Mundhoo in Laamu Atoll on 19 December 1993 by RCA and Frank Siciliano.

*****Hologymnosus doliatus*** (Lacepède, 1801)
(Fig. 27)

Photographed near the wreck of the S.S. Sea Gull, Gaafaru Atoll. Also seen in Huvadhu Atoll by RCA.

*****Leptojulius cyanopleura*** (Bleeker, 1853)
(Fig. 28)

Photographed in 30 m near Bathala in Ari Atoll. Indo-west Pacific, but not previously known from oceanic islands (Randall, 1996).

Oxycheilinus arenatus (Valenciennes, 1840)

Recorded by Randall and Anderson (1993) as *Cheilinus arenatus*; change follows Westneat (1993).

Oxycheilinus digrammus (Lacepède, 1801)

Recorded by Randall and Anderson (1993) as *Cheilinus digrammus*; change follows Westneat (1993).

*****Pseudocheilinus octotaenia*** Jenkins, 1900

A specimen of about 8 cm TL photographed in 8 m outside of Gulhi Falhu, North Malé Atoll.

Pseudojuloides kaleidos Kuitert & Randall, 1995

Recorded by Randall and Anderson (1993) as *Pseudojuloides* sp.

*****Thalassoma hebraicum*** (Lacepède, 1801)

Several individuals, including a terminal male, were seen by RCA near Hithadhoo and Gan in Addu Atoll in the far south of the Maldives. Previously known from western Indian Ocean, from South Africa to Chagos.

****Xyrichtys pavo*** Valenciennes, 1840

Recorded by Göthel (1994). One specimen (MRS 0436-94, 255 mm) caught by handline in about 30 m inside Vaavu Atoll near Thinadhoo on 23 July 1994. D II+VII,12; A III,12; P 12; body depth 2.8 in SL. A second specimen (BPBM 37111, 300 mm) from Malé market. In addition we have photographs of juveniles from North and South Malé Atolls.

****New species, new genus**
(Fig. 29)

We have photographs from South Malé Atoll of a wrasse that appears to be a new species of a new genus that is presently being described by Randall and Fourmanoir.

SCARIDAE (parrotfishes)

Bolbometopon muricatum (Valenciennes, 1840)

Randall and Anderson (1993) recorded this distinctive parrotfish from the Maldives on the basis of underwater sightings only. We now have a photograph of a large (ca. 120 cm TL) individual taken in the channel adjacent to Rakeedhoo island in Vaavu Atoll, in about 8 m, on 16 December 1994.

Chlorurus capistratooides (Bleeker, 1849)

Recorded from the Maldives by Randall and Anderson (1993) as *Scarus capistratooides*. Recognition of this genus follows Bellwood (1994).

Chlorurus enneacanthus (Lacepède, 1802)

Recorded from the Maldives by Randall and Anderson (1993) as *Scarus enneacanthus*.

Chlorurus sordidus (Forsskål, 1775)

Recorded from the Maldives by Randall and Anderson (1993) as *Scarus sordidus*.

Chlorurus strongylocephalus (Bleeker, 1854)

Recorded from the Maldives by Randall and Anderson (1993) as *Scarus strongylocephalus*.

TRICHONOTIDAE (sanddivers)

Trichonotus elegans Shimada and Yoshino, 1984

Recorded by Randall and Anderson as *Trichonotus* sp. A photograph taken by RHK in the lagoon of Ziyaraiyufushi, North Malé Atoll is reproduced in Godfrey (1996, p. 52). We also have records from Fihalohi in South Malé Atoll.

BLENNIIDAE (blennies)

Blenniella chrysospilos (Bleeker, 1857)

Recorded by Randall and Anderson (1993) as *Istiblennius chrysospilos*. Assigned to *Blenniella* by Springer and Williams (1994).

Blenniella periophthalmus (Valenciennes, 1836)

Recorded by Randall and Anderson (1993) as *Istiblennius periophthalmus*. Assigned to *Blenniella* by Springer and Williams (1994).

****Omobranchus elongatus*** (Peters, 1855)

Record of Springer and Gomon (1975) overlooked by Randall and Anderson (1993).

****Omobranchus punctatus*** (Valenciennes, 1836)

Springer and Gomon (1975).

GOBIIDAE (gobies)

*****Amblygobius nocturnus*** (Herre, 1945)

One individual of about 6 cm TL observed by RCA in the lagoon of Farukolufushi, North Malé Atoll, in May 1997.

****Bryaninops amplus*** Larson, 1985

Recorded by Göthel (1994). One specimen (BPBM 36458) collected from a seawhip, *Junceella* sp., in 25 m at "Poodle Cave", Gulhi Falhu, North Malé Atoll. Identification confirmed by Helen K. Larson.

*****Bryaninops loki*** Larson, 1985
(Fig. 30)

We have photographs of this species on sea whips and gorgonians in 25 m and deeper.

*****Bryaninops natans*** Larson, 1985
(Fig. 31)

Widespread and locally abundant in association with branching corals, *Acropora*.

****Bryaninops ridens*** (Smith, 1959)

Recorded by Göthel (1994, photo on p. 261).

*****Bryaninops tigris*** Larson, 1985
(Fig. 32)

Locally abundant in association with black coral *Antipathes* sp.

*****Bryaninops yongei*** (Davis & Cohen, 1969)

One specimen (BPBM 36459) collected from an antipatharian seawhip, *Cirripathes* sp., in 28 m at "Hans Place", Gulhi Falhu, North Malé Atoll. Identification confirmed by Helen K. Larson. Fairly common in association with antipatharian seawhips, especially larger and deeper-dwelling ones.

*****Coryphopterus inframaculatus*** Randall, 1994
(Fig. 33)

We have photographs of several individuals from North and South Malé Atolls. The specimen illustrated was photographed in a cave at about 16 m on the outer reef slope at the southern end of North Malé Atoll.

*****Cryptocentrus fasciatus*** (Playfair & Günther, 1867)
(Fig. 34)

Photographed in about 10 m in the lagoon of Fulidhoo, Vaavu Atoll and at South Malé Atoll.

*****Cryptocentrus strigiliceps*** (Jordan & Seale, 1906)
(Fig. 35)

Photographed in Guraidhoo lagoon, South Malé Atoll in about 17 m in May 1997. Location details of other photographs taken in a sheltered lagoon, have been lost.

*****Exyrias bellissimus*** (Smith, 1959)
(Fig. 36)

Photographed in about 20 m in Guraidhoo lagoon, South Malé Atoll.

*****Gladigobius ensifer*** (Bleeker, 1865)
(Fig. 37)

Photographed in Farukolufushi lagoon North Malé Atoll, in 6 m. Also seen in Malé harbour.

Gobiodon rivulatus (Rüppell, 1830)

Randall and Goren (1993) noted that Maldivian *Gobiodon* were apparently distinct from Rüppell's *G. rivulatus* but were conspecific with specimens from Chagos identified as *G. rivulatus* by Winterbottom and Emery (1986). Harold and Winterbottom (cited in Winterbottom and Anderson, 1997) have concluded that Chagos specimens, and hence also Maldivian ones, are *G. rivulatus*.

Hazeus maculipinna (Randall & Goren, 1993)

Described from the Maldives by Randall and Goren (1993) as *Opua maculipinna*. Both Helen K. Larson and Douglass F. Hoese called our attention to the likelihood that the genus *Hazeus* Jordan and Snyder (1901) is a senior synonym of *Opua* E.K. Jordan (1925). One of us (JER) compared the type species of the two genera, *Opua nephodes* E.K. Jordan, 1925, and *Hazeus otakii* Jordan and Snyder, 1901, and could find no generic level differences between the two.

*****Oplopomus diacanthus*** Schultz, 1943
(Fig. 38)

Photographed in about 10 m in Fulidhoo lagoon, Vaavu Atoll, May 1996. We also have photographs from North Malé Atoll, including Malé harbour. Randall and Goren (1993) used *O. atherinoides* (Peters, 1855) mistakenly. Helen Larson informed us that of Peters' two syntypes of *atherinoides*, one is a species of *Favonigobius* and the other represents a new genus unrelated to the *Oplopomus/Hazeus* group.

*****Pleurosicya elongata*** Larson, 1990
(Fig. 39)

Photographed on a foliaceous sponge in North Malé Atoll.

*****Pleurosicya mossambica*** Smith, 1959

One specimen (BPBM 36457) collected from foliaceous grey sponge *Phyllospongia foliascens* in 16 m at "Hans Place", Gulhi Falhu, North Malé Atoll. Identification confirmed by Helen K. Larson. A second specimen (BPBM 37799, 15 mm) also collected in 16 m from grey foliaceous sponge, near Thilafushi, North Malé Atoll. Commonly found on the undersides of *P. foliascens*.

****Priolepis inhaca*** (Smith, 1949)

Recorded from the Maldives by Winterbottom and Burridge (1993). Jones and Kumaran (1967) recorded this species from the Lakshadweep, not the Maldives as reported by Winterbottom and Emery (1986, p. 58).

*****Trimma mendelsohni*** (Goren, 1978)
(Fig. 40)

Photographed at about 13 m on a wall at Banana Reef, North Malé Atoll, 19 November 1995. From the original slides it was determined to have D VI, I+11 and P ?19. The identification of this goby was provided by Richard Winterbottom. Previously known from the Red Sea to Madagascar.

Valenciennesa parva Hoese & Larson, 1994

Recorded by Randall and Goren (1993) and Randall and Anderson (1993) as *Valenciennesa* sp.

**Valenciennesa wardii* (Playfair & Günther, 1867)

Recorded from the Maldives by Hoese and Larson (1994).

MICRODESMIDAE (dartfishes and wormfishes)

***Ptereleotris grammica* Randall & Lubbock, 1982
(Fig. 41)

Photographed on the outer reef of South Malé Atoll.

**Ptereleotris hanae* (Jordan & Snyder, 1901)

The authors have photographs from the Maldives of what appears to be this species. However, as noted by Randall and Hoese (1985), these might be of the closely related *P. arabica*; specimens are needed for specific identification.

SIGANIDAE (rabbitfishes)

***Siganus javus* (Linnaeus, 1766)

We have poor photographs of a rabbitfish that resembles *Siganus javus* in all respects except that it has numerous fine wavy stripes dorsally, instead of spots. The photographs were taken on the shallow seagrass bed adjacent to Kuda Huraa island, North Malé Atoll, where a small school of about 6 individuals was seen, by RCA.

ACANTHURIDAE (surgeonfishes)

***Acanthurus guttatus* Forster in Bloch & Schneider, 1801

Observed by RCA in 1-2 m outside Kolamaafushi and Vilingili (both in Gaafu Alifu Atoll) and Fuvah Mulaku, in the southern Maldives. Also reported from surge zone of outer reef near Thinadhoo in Gaafu Dhaalu Atoll by Ahmed Hafiz. This species appears to be absent from the northern and central Maldives. It has been reported from the Chagos Archipelago (Winterbottom and Anderson, 1997) to the south of the Maldives, but not from the Lakshadweep to the north.

***Acanthurus maculiceps* (Ahl, 1923)

Observed on outer reef edge of North Malé Atoll near the islands of Lankanfinolhu and Meerufenfushi by RCA and Gaafaru by RHK. Previously known from western Pacific and the eastern Indian Ocean.

SPHYRAENIDAE (barracudas)

Sphyraena helleri Jenkins, 1901

Randall and Anderson (1993) listed *S. novaehollandiae*, but that is a temperate species from southern Australia. We tentatively record the Maldivian species as *S. helleri*.

GEMPYLIDAE (snake mackerels)

**Nealotus tripes* Johnson, 1865

The Maldives are included in the distribution map of Nakamura and Parin (1993). Not seen by us.

SCOMBRIDAE (tunas)

**Thunnus alalunga* (Bonnaterre, 1788)

The southern Maldives was included in the range maps of Collette and Nauen (1983) and IPTP (1988). These reports were overlooked by Randall and Anderson (1993). Also reported by fishermen in longline catches in the southern part of the Maldivian EEZ. Not seen by us.

Thunnus tonggol (Bleeker, 1851)

A 480 mm FL specimen was caught near Sato Thila in the One and a Half Degree Channel on 5 February 1994. It was examined and photographed by the senior author and M. Shiham Adam, but not retained. 22 gill-rakers on first gill arch; pectoral fin 28% FL; liver without ventral striations but with elongate right lobe; belly with distinct horizontal lines of dashes. The presence of this neritic species in the Maldives was regarded by Randall and Anderson (1993, p. 41) as questionable; it is certainly rare.

XIPHIIDAE (billfishes)

Tetrapturus angustirostris Tanaka, 1915

Randall and Anderson (1993) recorded this species from the distribution map of Nakamura (1975, p. 39). However, even though some parts of the Maldivian EEZ appear to be included in its range on that map, there is a gap in the reported range in the immediate area of the Maldives. We therefore present here a record of *T. angustirostris* from Maldivian waters. On 6 December 1995 a specimen about 1.8 m TL and 45-50 kg was caught by a sports fishing boat outside North Malé Atoll near Lankanfinolhu. No photographs were taken, but the spearfish was positively identified by the vessel's skipper, Captain William Morrell.

CITHARIDAE (largescale flounders)

**Brachypleura novaeseelandiae* Günther, 1862

Recorded by Regan (1908, as *B. xanthosticta* Alcock, 1889); synonymized with *B. novaeseelandiae* by Norman (1934). Both records were apparently based on two specimens collected by Stanley Gardiner. Overlooked by Randall and Anderson (1993).

BOTHIDAE (lefteye flounders)

**Engyprosopon hureaui* Quéro & Golani, 1990

Regan (1908) lumped three species of *Engyprosopon* from the Maldives under the name *Scaeops maldivensis*: *E. maldivensis*, *E. hureaui* and *E. macrolepis* (Amaoka, Mihara and Rivaton, 1993). Norman (1934) selected the largest of Regan's three syntypes as the lectotype of *E. maldivensis* (BMNH 1901.12.31.94, male). Amaoka, Mihara and Rivaton (1993) note that four paralectotypes of *E. maldivensis* (BMNH 1901.12.31.95-98, one male and three females) are, in fact, *E. hureaui*.

Engyprosopon macrolepis (Regan, 1908)

Recorded from the Maldives by Randall and Anderson (1993) as *Engyprosopon* sp. Amaoka, Mihara and Rivaton (1993) noted that Regan (1908) confused his Maldivian

specimens of *E. macrolepis* with *E. maldivensis* and *E. filimanus*: one paralectotype of *E. maldivensis* (BMNH 1901.12.31.95-98, one female) and one paralectotype of *E. filimanus* (BMNH 1901.12.31.106, one male) are in fact *Engyprosopon macrolepis*.

SAMARIDAE (samarid flounders)

Samariscus triocellatus Woods, 1966

Previously recorded from photographs only (Anderson and Hafiz, 1992, p. 80; Randall and Anderson, 1993). We now have a specimen (BPBM 36460, 28 mm) collected from the sandy bottom of a cave in 11m on the outer reef slope at the south end of North Malé Atoll. The distal third of the right pectoral fin is coloured dark brown. The fish typically waves this fin with a slow anticlockwise motion, spreading the distal portion out and up as it passes over the eyes. The significance of this behaviour is unclear. The fin may play some role in courtship or intraspecific competition, although specimens observed underwater wave their pectoral fins even when no other individuals of the same species appear to be present. Alternatively, the fin may act as a lure as seems to be the case with the modified dorsal fin rays of *Asterorhombus* (Amaoka, Senou and Ono, 1994; Senou, Amoaka and Ono, 1994; Lin, Shao and Shen, 1995), although it does appear rather large for such a role. Perhaps the fin is intended to look like a detached piece of weed to potential prey animals, distracting their attention from the approach of danger. This behaviour must endow some significant advantage since the movement of the fin can draw the attention of divers, and so presumably also the attention of potential predators, to the otherwise superbly camouflaged fish.

SOLEIDAE (soles)

*****Pardachirus pavoninus*** (Lacepède, 1802)

Photographs of a sole about 7 cm TL in the lagoon of Bathala Island, Ari Atoll appear to be this species, although specimens should be obtained for confirmation.

BALISTIDAE (triggerfishes)

*****Rhinecanthus cinereus*** (Bonnaterre, 1891)
(Fig. 42)

This little-known species was photographed on the outer reef slope of South Malé Atoll.

MONACANTHIDAE (filefishes)

****Pervagor aspricaudus*** (Hollard, 1854)

Photograph by Debelius (1993, p. 305); taken at Bandos in North Malé Atoll and identified by J.B. Hutchins (Helmut Debelius, pers. comm., August 1994).

OSTRACIIDAE (boxfishes)

*****Lactoria cornuta*** (Linnaeus, 1758)

One Maldivian specimen (BPBM 37100, 50 mm, collection details lost). Two specimens were caught by the *Fridtjof Nansen* on 25 August 1984 in 33-39 m, inside Haa Dhaalu Atoll (Anon., 1983). Since this species would be difficult to misidentify, this record is accepted as valid.

*****Lactoria fornasini*** (Bianconi, 1846)

A specimen (MRS 0437-94, 55 mm) was caught by trap in 47-66 m inside North Malé Atoll near Makunudhoo on 14 September 1988.

TETRAODONTIDAE (pufferfishes)

****Arothron caeruleopunctatus*** Matsuura, 1994

Matsuura (1994) identified photographs of "*Arothron stellatus*" from the Maldives published by Masuda (1984) and Masuda and Allen (1987) as *A. caeruleopunctatus*. One of us (RHK) believes that *A. caeruleopunctatus* is a junior synonym of *A. mappa*.

*****Canthigaster papua*** (Bleeker, 1848)
(Fig. 43)

Photographed at Banana Reef, North Malé Atoll. Allen and Randall (1977) regarded *C. papua* as a "form" of *C. solandri*. We now believe that the two are distinct species, based on consistent differences in colour pattern.

MOLIDAE (sunfishes)

*****Mola mola*** (Linnaeus, 1758)
(Fig. 44)

Mr. N.T. Hasen Didi supplied a photograph of a sunfish of at least 1.5 m TL caught by fishermen of Vaadhoo in Raa Atoll in September 1992. Mr. Hassan Hameez provided a sketch of a specimen about 1.4 m long and about 2.1 m between the tips of the dorsal and anal fins, which was caught by a game-fishing boat outside Fulidhoo in Vaavu Atoll on 30 December 1994.

DISCUSSION

Randall and Anderson (1993) recorded 899 species of epipelagic and shore fishes from the Maldives. Records of 30 shallow-water fish species from the Maldives were overlooked by those authors or have been published since that review. A further 78 species are recorded from the Maldives for the first time in this paper. Thus the total number of epipelagic and shore fishes known from the Maldives to date is 1007. Adam et al. (1998) recorded 99 deep demersal fishes from depths greater than 180 m in the Maldives; 83 of these were not recorded by Randall and Anderson (1993). The total number of demersal and epipelagic water fishes known from the Maldives to date is therefore 1090. These totals exclude mesopelagic and bathypelagic fishes, which have not yet been adequately studied.

The Maldives form the central, and largest, part of the Laccadive-Chagos Ridge. Winterbottom and Anderson (1997) recorded 773 species of shore and epipelagic fishes from the Chagos Archipelago to the south of the Maldives. Jones and Kumaran (1980) recorded 603 fish species from Lakshadweep (the Laccadives) to the north. While there may well be real differences in species numbers between the three archipelagoes, the numbers recorded to date probably reflect differences in sampling effort. The coral reef fish fauna is certainly similar in general composition throughout the three archipelagoes.

Nevertheless, there are regional differences. Anderson (1992, 1993; Anderson and Saleem, 1994) demonstrated that the fish fauna of the southern Maldivian atolls is somewhat different from that of the central and northern atolls. Winterbottom and Anderson (1997) noted that the fish fauna of the southern Maldives shows similarities with that of the Chagos. For example, several western Indian Ocean species are found in the southern Maldives and Chagos but not in the northern Maldives and Lakshadweep (e.g. *Centropyge acanthops* and *Thalassoma hebraicum*). This is not unexpected since the Chagos and, to a lesser extent, the southern Maldives are under the influence of the eastward flowing Equatorial Counter Current for much of the year, as well as the intermonsoonal Equatorial Jet, while areas to the north are not (Molinari, Olson and Reverdin, 1990; Winterbottom and Anderson, 1997).

Several more wide-ranging Indo-Pacific species also appear to be confined to the southern part of the Laccadives-Chagos reef chain (e.g. *Bodianus bilunulatus* and *Acanthurus guttatus*). The zone dividing the "north" and "south" Maldives appears to be in the region of Thaa Atoll (Anderson, 1992; Anderson and Saleem, 1994; RCA, unpublished data). Thaa Atoll is not only the most northerly of the single chain atolls in the south of the country, but also the most southerly of the atolls on the "central Maldivian plateau." These geomorphological features are thought among other things to have significant effects on pelagic productivity (as a result of interactions with the monsoon currents), which might in turn affect fish faunal composition.

There is some confusion over the correct taxonomic status of several species that show variation between the Pacific and Indian Oceans. Many are treated in the current literature as "forms" of a single species (e.g. the grouper *Cephalopholis urodeta* and the butterflyfish *Chaetodon unimaculatus*) even though there appears in some cases to be justification for recognizing them as separate species. In contrast, others are treated as separate species even though the justification for this seems limited. For example, the lionfish currently recognized as *Pterois volitans* from the Pacific and *P. miles* from the Indian Ocean appear to be one species (RHK, and William N. Eschmeyer, pers. comm.). There is a need for more detailed investigations, including genetic studies, of fish populations from the two Oceans, and in particular from the area of overlap in the eastern Indian Ocean, in order to resolve these problems.

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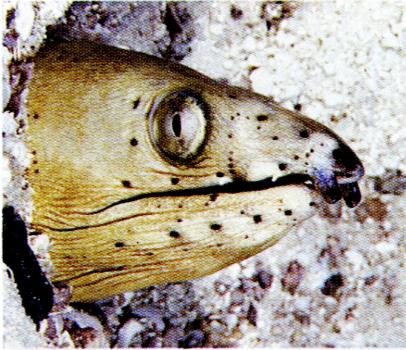
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1) *Uropterygius marmoratus*.



2) *Ophichthus bonaparti*.



3) *Pisodonophis cancrivorus*.



4) *Synodus rubromarmoratus*.



5) *Antennarius maculatus*.



6) *Antennarius pictus*.



7) *Sargocentron melanospilos*.



8) *Doryrhamphus bicarinatus*.

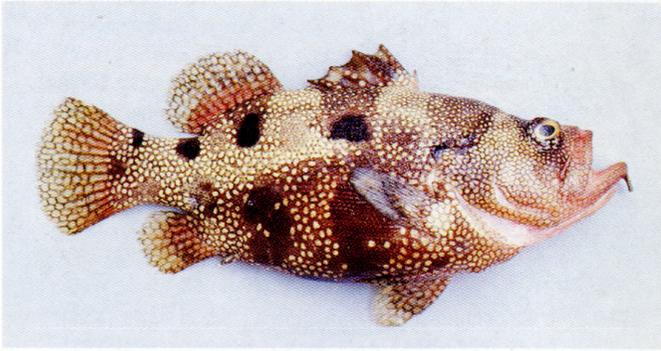


9) *Halicampus mataafae*.



10) *Hippocampus kuda*.

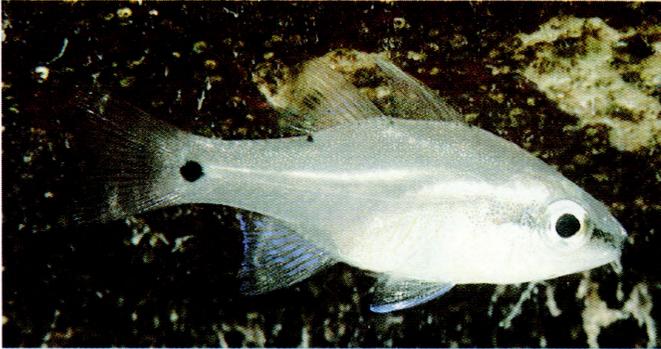
Plate 2



11) *Pogonoperca ocellata*.



12) *Apogon fragilis*.



13) *Apogon franssedai*.



14) *Apogon sangiensis*.



15) *Pseudamia hayashii*.



16) *Hoplolatilus cuniculus*.



17) *Hoplolatilus sp.1*.



18) *Hoplolatilus sp.2*.



19) *Mulloidichthys vanicolensis*.



20) *Monodactylus argenteus*.



21) *Centropyge acanthops*.



22) *Genicanthus caudovittatus*.



23) *Cirrhitichthys aprinus*.



24) *Amblyglyphidodon batunai*.



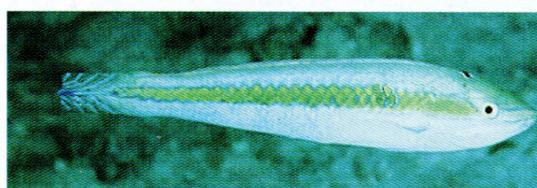
25) *Chromis pambae*.



26) *Pomacentrus nagasakiensis*.



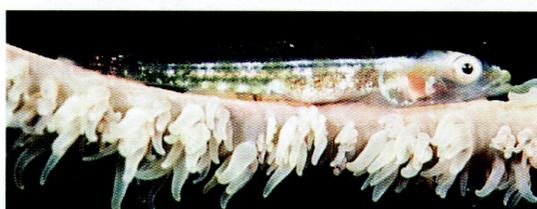
27) *Hologymnosus doliatus*.



28) *Leptojulis cyanopleura*.



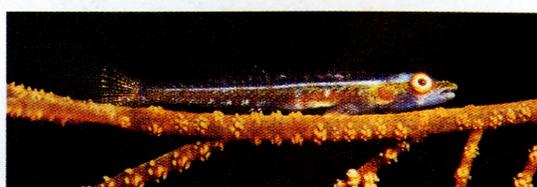
29) *Labrid* new genus, new species



30) *Bryaninops loki*.



31) *Bryaninops natans*.



32) *Bryaninops tigris*.



33) *Coryphopterus inframaculatus*.



34) *Cryptocentrus fasciatus*.



35) *Cryptocentrus strigilliceus*.



36) *Exyrias bellissimus*.



37) *Gladigobius ensifer*.



38) *Oplopomus diacanthus*.



39) *Pleurosicya elongata*.



40) *Trimma mendelssohni*.



41) *Ptereleotris grammica*.



42) *Rhinecanthus cinereus*.



43) *Canthigaster papua*.



44) *Mola mola*.

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STYLE OF THE HOUSE

Hyphens: Certain substantive compounds are hyphenated: gill-raker, soft-ray, type-species, type-locality, type-series, type-specimen. Other words often used together are not hyphenated unless they are used in adjectival expressions before a noun: anal fin / anal-fin rays; lateral line / lateral-line scales; gill arch / gill-arch filaments, etc.

Word usage: Although the following word pairs are often used interchangeably, we believe that consistent use of the first word as a noun and the second as an adjective will improve the precision of our writing: mucus / mucous; maxilla / maxillary; opercle / opercular; operculum / opercular. The operculum (= gill cover) comprises (usually) four separate bones: opercle, subopercle, preopercle and interopercle. The words preoperculum, suboperculum and interoperculum are unnecessary substitutes and not to be used for preopercle, subopercle and interopercle. The plural of operculum is opercula.

Decimal comma versus decimal point: Contrary to most journals published in South Africa and some European countries, we will not use a comma in place of a decimal point. Most computers do not read a comma as a decimal point. In addition, it is common in ichthyological papers to give sequences of measurements that include decimal numbers, with each measurement separated by a comma. If the comma is used to separate items in a series, as well as being used to indicate a decimal number, it will cause considerable confusion.

Fin formulae: Fin formulae will be designated as follows: D XII,10-12 indicates on continuous fin with 12 spines and 10-12 soft (segmented) rays; DX/I,10-12 indicates a fin divided to the base in front of the last spine; and D X+I,12 indicates two separate dorsal fins, the first with 10 spines and the second with 1 spine and 12 soft rays. If it is necessary to differentiate branched and unbranched soft-rays, lower-case Roman numerals will be used for unbranched rays and Arabic numerals for branched rays, e.g. D iii,8. Principal caudal-fin rays are defined as those that touch the hypural bones. The number of principal caudal rays is usually the number of branched rays plus two. If the principal caudal rays are in two separate groups, the number of rays in the dorsal group is given first: thus, "principal caudal rays 8+7" means that there are 15 principal caudal rays, with 8 rays in the dorsal group and 7 in the ventral group.

Abbreviations: Abbreviations normally end with a full stop: et al., e.g., etc., n.b., (note: these commonly used abbreviations of Latin words are not italicized). Dr (Doctor) and Mr (Mister) and compass directions (north, west, northwest, etc.) are abbreviated using capital letters without full stops: N, W, NW. We recommend the following abbreviations for ichthyological terms: SL - standard length, TL - total length, FL - fork length, GR - gill-rakers, LL - lateral line.

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