

# Fishes of the deep demersal habitat at Ngazidja (Grand Comoro) Island, Western Indian Ocean

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Underwater observations of the coelacanth, *Latimeria chalumnae* Smith, 1939, from a research submersible provided opportunities to study the deep demersal fish fauna at the Comoro Islands. The demersal habitat in depths of 150–400 m at the volcanic island of Ngazidja is low in fish diversity and biomass, compared with the shallow-water coral reef habitat of Ngazidja or the deep demersal habitats of other localities in the Indo-Pacific region. The resident deep demersal fish fauna at Ngazidja is dominated by the coelacanth, an ancient predator that is specially adapted for this low-energy environment. Other large fish predators are scarce in this environment, because of the heavy fishing pressure from local fishermen. Eighty-nine fish taxa (including 65 recognizable species) were recorded from videotapes, photographs, visual observations, fishermen's catches and ancillary attempts to sample the fish fauna with baited fish traps, gill nets, and hook and line. Although no coelacanth feeding events were seen, seven fish species are known from coelacanth stomach contents, and 64 other fish species in this habitat are considered potential prey of this dominant predator.

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## Introduction

During the course of *in situ* observations of coelacanths, *Latimeria chalumnae* Smith, from the research submersibles *Geo* and *Jago* at depths of 150–400 m at Ngazidja (Grand Comoro) Island, many observations and photographs were made of other fishes that occur in the the coelacanths' habitat. Most of these cohabitants are potential prey for *Latimeria*, several are competitors, and a few may be predators of the coelacanth (Table 1).

Collecting fishes, especially small cryptic species, from deep, rough-bottom habitat is a challenging enterprise; consequently, much of this deep demersal fish fauna is poorly known or undescribed.<sup>1</sup> Some of the fishes seen, videotaped, photographed or caught by us with traps or hook and line represent new records for the Comoros. Several species not previously reported from depths greater than 50 m are here documented at depths greater than 150 m. The purpose of this paper is to present a preliminary analysis of the fish fauna in the deep demersal habitat of the coelacanth and to discuss the ecological and zoogeographical relationships of these species.

Demersal fish include sedentary benthic fish that rest on the bottom, such as skates and rays, flatfish (flounders, soles, etc.), eels, scorpionfish and armoured gurnards (Peristediidae) and also more active (free-swimming) fish such as some sharks, snappers (Lutjanidae), groupers (Serranidae) and the oilfish, *Ruvettus pretiosus*, that usually occur within 3 or 4 metres of the bottom.

Of the 89 fish taxa that were seen, photographed or caught

(with hook and line or traps) in the daytime habitat of the coelacanth, we were able to identify 65 species (Table 1). For various reasons, the remaining taxa are identified only to genus or family level. Our list of the deep demersal fish at Ngazidja is obviously incomplete, as we made no attempt to collect small cryptic species (e.g. Scorpaenidae, Callionymidae, Draconettidae, Percophidae, Epigonidae and *Plectranthias*). In addition, larger, elusive species (e.g. congrid and ophichthid eels and several species of sharks) that are known to occur at depths of 150–400 m in the Western Indian Ocean but have not yet been seen or caught at these depths at Ngazidja are not included in our list.

In the remarks and discussion of the fishes of this deep demersal community, the interactions of the various species with the coelacanths are considered. This biased approach was necessary, because the coelacanths were the focus for most of our underwater observations. As a resident large predator, the coelacanth is certainly a major player in this deep demersal fish community; a consideration of its interactions with other fishes will have a heuristic effect in aiding researchers to understand this community better.

## Methods

Since 1987 when coelacanths were first filmed in their natural habitat using the research submersible *Geo*, eight expeditions were conducted to the Comoro Islands by H. Fricke, J. Schauer, K. Hissmann and various colleagues to study the coelacanths.<sup>2–4</sup> Observations and census efforts were concentrated in two areas along the southwest coast of Ngazidja. Area 1 was 8 km long by ~300 m wide, with coelacanth sightings concentrated in and near caves from 150–250 m depth. Area 2, also with a depth range of 150–250 m, was 5 km long by ~300 m wide and was located 35 km north of Area 1.

Fishes were observed and photographed by Fricke, Schauer, Hissmann and Heemstra with video or still cameras from the two-man research submersibles *Geo* and *Jago*. Most dives, observations and videotape recordings were done in Area 1 in depths of 150–400 m, the lower limit of diving with *Jago*.<sup>2–4</sup> Specimens were caught in 143–350 m with hook and line and baited fish traps by P.C. Heemstra in Area 1 and also by Heemstra, Smale and Baxter at the Recif Vailheu, a small flat-top seamount (11°30'S, 43°03'E) southwest of Ngazidja. Fishes found in the stomach contents of *Latimeria*<sup>5–7</sup> or reported from the deep demersal habitat of Grand Comoro<sup>8</sup> are listed in Table 1. A few pelagic (open water) fish (thresher sharks, *Alopias* spp.; hammerhead sharks, *Sphyrna* spp.; the manta ray, *Manta birostris*; and the ocean sunfish, *Mola*) were seen once or twice in the coelacanth habitat, but these pelagic species are rare visitors, with little or no impact on the deep demersal fish community, and have not been included as members of this community (Table 1). Sizes of fishes are given as total length (TL), fork length (FL, to tips of middle caudal fin rays of fish with forked tails) or standard length (SL, to base of caudal fin).

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Table 1. Fishes of the deep demersal habitat (100–400 m) at Ngazidja Island.

FAMILY: Species (interaction)	Status	Frequency	Distribution	Source
SQUALIDAE: <i>Centrophorus granulosus</i> (P, C)	Resident	OC	A, WIO	MNHN
<i>Cirrhitigaleus asper</i> (P? C)	Resident	OC	A, WIO	MNHN
SCYLIORHINIDAE: <i>Cephaloscyllium sufflans</i> (F, C)	Transient	Rare	WIOCI	SC <sup>7</sup> , V, P, MNHN
<i>Scylliorhinus comoroensis</i> (f)	Resident	OC		
ODONTASPIDIDAE: <i>Odontaspis ferox</i> (P, C)	Resident	OC	WW	V
RAJIDAE: Genus? (f)	Resident?	Rare	?	V
TORPEDINIDAE: <i>Torpedo</i> sp. (C)	Transient	Rare	CI	SAIAB & S
NARKIDAE: (X)	Resident?	Rare	CI?	V, P
LATIMERIIDAE: <i>Latimeria chalumnae</i>	Resident	Often	WIO	V, P, SAIAB
MURAENESOCIDAE: ? <i>Muraenesox</i> sp. (f, P, C)	Resident	UC	ICP?	P
CONGRIDAE: <i>Conger</i> sp. (f, P, C)	Resident	UC	IWP?	V
MURAENIDAE: <i>Gymnothorax hansii</i> (f, C)	Resident	UC?	CI	SAIAB
? <i>Gymnothorax meleagris</i>	Transient?	UC	ICP	V
NETTASTOMATIDAE: ? <i>Nettastoma solitarium</i> (f)	Resident	OC	WIO?	P, V
SYNAPHOBRANCHIDAE: <i>Ilyophis brunneus</i> (F)	Resident	Rare	WW	SC <sup>7</sup>
HALOSAURIDAE: Genus? (F)	Resident	UC	?	V
MYCTOPHIDAE: ? <i>Diaphus metopoclampus</i> (F)	Resident?	OC	A, IWP	SC <sup>7</sup>
SYNODONTIDAE: ? <i>Synodus rubromarmoratus</i> (f)	Transient	UC	IWP	P
PARALEPIDIDAE: Genus? (F)	Resident?	–	?	SC
ALEPISAUROIDAE: <i>Alepisaurus ferox</i> (C)	Transient	Rare	WW	SAIAB
MACROURIDAE: <i>Lucigadus ori</i> (f)	Resident	OC	WIO	V
OPHIIDAE: <i>Brotula multibarbata</i> (f)	Transient	UC	RS, ICP	P, V
CHAUNACIDAE: ? <i>Chaunax pictus</i> (f)	Resident	UC	A, IWP	V, P
OGCOEPHALIDAE: ? <i>Halieutaea coccinea</i> (f)	Resident?	UC	WIO	V, P
BERYCIDAE: <i>Beryx decadactylus</i> (F)	Resident	–	A, ICP	SC <sup>7</sup>
<i>Beryx splendens</i> (f)	Resident	UC	A, ICP	V
TRACHICHTHYIDAE: <i>Gephyroberyx darwini</i> (f, C)	Resident	Rare	A, IWP	V, P
MONOCENTRIDAE: <i>Monocentris japonica</i> (X)	Transient	O	RS, IWP	V, P
ANOMALOPIDAE: <i>Photoblepharon steinitzi</i> (f)	Transient	C	RS, WIO	V, SAIAB
HOLOCENTRIDAE: <i>Myripristis chryseres</i> (X)	Transient	Often	ICP	P, V
<i>Ostichthys delta</i> (X)	Resident	?		SAIAB
<i>Ostichthys kaianus</i> (X)	Resident	C	ICP	V, SAIAB
<i>Plectrypops lima</i> (f)	Transient	Rare	IWP	V
<i>Sargocentron</i> sp. (X)	Transient	UC	IWP?	V
POLYMIXIIDAE: ? <i>Polymixia berndti</i> (F)	Resident	–	ICP	SC <sup>5</sup>
AULOSTOMIDAE: <i>Aulostomus chinensis</i> (f, C)	Transient	Often	IP	V, P, SAIAB
FISTULARIIDAE: <i>Fistularia commersonii</i> (f, C)	Transient	–	IWP	SAIAB
SCORPAENIDAE: ? <i>Pontinus nigerimum</i> (f)	Resident?	UC	WIO	V, P
Unidentified scorpaenid (f)	Resident?	OC	?	V, P
PERISTEDIIDAE: ? <i>Satyrichthys engyceros</i> (X)	Resident	C	ICP	V, P
ANTIGONIIDAE: ? <i>Antigonia undulata</i> (f)	Resident	C	WIO	V, P
SERRANIDAE: <i>Aulacocephalus temmincki</i> (C)	Resident	Often	IWP	V, P, SAIAB
<i>Cephalopholis polleni</i> (f)	Transient	Often	ICP	MNHN
<i>Cephalopholis spiloparea</i> (f)	Transient	Rare	ICP	SAIAB
<i>Epinephelus miliaris</i> (f, C)	Resident	Rare	IWP	SAIAB
<i>Epinephelus morrhua</i> (f, C)	Resident	Rare	RS, ICP	L
<i>Epinephelus multinotatus</i> (f, C)	Resident	Rare	IWP	L, V
<i>Epinephelus poecilnotus</i> (f, C)	Transient	Rare	IWP	V
<i>Epinephelus radiatus</i> (f, C)	Transient	UC	RS, IWP	V
<i>Epinephelus tukula</i> (f, P, C)	Resident	Often	RS, IWP	V, P, SAIAB
<i>Holanthias borbonius</i> (f)	Resident	OC	WIO?	V
<i>Liopropoma</i> sp. (f)	Transient?	UC	ICP	SAIAB
<i>Variola louti</i> (f, C)	Transient	UC	ICP	V
SYMPHYSANODONTIDAE: <i>Symphysanodon</i> sp. (F)	Resident	C	WIO?	V, SC <sup>5</sup>
PRIACANTHIDAE: <i>Cookeolus japonicus</i> (f, C)	Resident	OC	WW	S
<i>Priacanthus hamrur</i> (f, C)	Transient	OC	RS, ICP	V, SAIAB
<i>Pristigenys nipponia</i> (f)	Resident	UC	IWP	P, V
APOGONIDAE: ? <i>Apogon fukuii</i> (f)	Resident	UC	IWP	V
<i>Coranthus polyacanthus</i> (F)	Resident	Often	IWP	V, P, SC <sup>5</sup>
Apogonid sp. 1 (f)	?	OC	?	V
Apogonid sp. 2 (f)	?	OC	?	V
EPIGONIDAE: <i>Epigonus</i> spp. (f)	Resident	Often	?	V
LUTJANIDAE: <i>Aphareus furca</i> (f, C)	Transient	Rare	ICP	SAIAB
<i>Aphareus rutilans</i> (f, P, C)	Transient	Rare	ICP	SAIAB
<i>Etelis carbunculus</i> (f, P, C)	Resident	UC	ICP	P, SAIAB
<i>Etelis coruscans</i> (f, P, C)	Resident	Rare	IWP	L SAIAB
<i>Parcaesio xanthura</i> (f)	Transient	UC	IWP	V, SAIAB
<i>Pristipomoides argyrogrammicus</i> (f)	Resident	Rare	ICP	SAIAB
<i>Pristipomoides auricilla</i> (f)	Resident	Rare	ICP	SAIAB
<i>Pristipomoides zonatus</i> (f)	Resident	UC	ICP	SAIAB, V

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Table 1 (continued)

FAMILY: Species (interaction)	Status	Frequency	Distribution	Source
MALACANTHIDAE: <i>Branchiostegus sawakinensis</i> (f)	Resident	Rare	RS, ICP	V
PENTACEROTIDAE: <i>Histiopertus typus</i> (X)	Resident	OC	RS, IWP	V
CARANGIDAE: <i>Caranx lugubris</i> (f, C)	Transient	Rare	WW	V
CIRRHITIDAE: <i>Cirrhitichthys guichenoti</i> (f)	Resident?	Rare?	WIO	V
POMACANTHIDAE: <i>Genicanthus caudovittatus</i> (f)	Transient	UC	RS, IWP	SAIAB
CHAETODONTIDAE: <i>Heniochus acuminatus</i> (f)	Transient	UC	IWP	V
<i>?Prognathodes</i> sp. (f)	Resident	UC	WIO	V
<i>Roa</i> sp. 2 (f)	Resident	UC	WIO	V
POMACENTRIDAE: <i>?Chromis</i> sp. (f)	Resident?	UC	?	V
LABRIDAE: <i>?Coris</i> sp. (f)	Transient?	UC	?	V
PINGUIPEDIDAE: <i>Parapercis</i> sp. (f)	Transient?	UC	?	V
TRIPTERYGIIIDAE (f)	Transient?	UC	?	V
CALLIONYMIDAE: <i>?Callionymus gardineri</i> (f)	Resident	UC	WIO	V
GEMPYLIDAE: <i>Neoepinnula orientalis</i> (f)	Resident	C	A, IWP	V
<i>Promethichthys prometheus</i> (f)	Resident	C	WW	SAIAB
<i>Ruvettus pretiosus</i> (f, P, C)	Resident	C	WW	L
?BOTHIDAE (f)	?	Rare	?	V
?CYNOGLOSSIDAE (f)	?	Rare	?	V
DIODONTIDAE: <i>Chilomycterus reticulatus</i> (f)	Transient	Rare	WW	V
TETRAODONTIDAE: <i>Canthigaster</i> sp. (f)	Transient	Rare	?	V

Interactions of species with *Latimeria chalumnae* are indicated in brackets after the taxon/species name and designated as follows: potential food (f), known food (F), potential predator (P), competitor (C) and no known direct interaction (X). Status refers to 'depth preference' for a species; if the species does not usually occur in less than 100 m, it is considered a 'Resident' member of the deep demersal fish community; if the species is more commonly found in less than 100 m, it is considered a 'Transient'. Frequency of occurrence: Rare (rare, seen once), UC (uncommon, 2–5 sightings); OC (occasional, seen 6–10 times); C (common, 10–20 sightings); often (more than 20 sightings). Distributions are as follows: A = Atlantic Ocean; CI = Comoro Is.; ICP = Indo-Central Pacific; IO = Indian Ocean; IP = Indo-Pacific, including Eastern Pacific; IWP = Indo-West Pacific; RS = Red Sea; WIO = Western Indian Ocean; WW = worldwide. Sources of the records: P (photograph), L (literature record for Grand Comoro), SAIAB (specimen caught at Ngazidja or Recif Vailheu and deposited at South African Institute for Aquatic Biodiversity, Grahamstown), MNHN (specimen caught by P. Fourmanoir at Ngazidja and deposited at Muséum National d'Histoire Naturelle, Paris), S (sight), SC (recorded as stomach contents from *Latimeria chalumnae*), V (video).

## Results

### Species accounts

#### SQUALIDAE (spiny dogfish)

Tallfin dogfish, *Centrophorus granulosus* (Bloch & Schneider, 1801) (Fig. 1)

Compagno<sup>9</sup> gave the distribution for this species [as '*Centrophorus uyato* (Rafinesque, 1810)'] as the Gulf of Mexico, eastern Atlantic, Mediterranean and southern Mozambique, with questionable records from India and Taiwan. Known from South Africa and southern Mozambique at depths of 274–480 m.<sup>10</sup> Compagno<sup>11</sup> reported a specimen [as *C. uyato*, MNHN1986-719] caught at Grand Comoro in 350 m. Attains 1.5 m; a large adult might eat a small coelacanth. Not seen from the submersible.

Roughskin spiny dogfish, *Cirrhigaleus asper* (Merrett, 1973) (Fig. 2)

This shark was originally described from the equatorial Western Indian Ocean, based on specimens from Aldabra, Astove, Farquhar, and Assumption islands. Compagno<sup>9</sup> added records from the Gulf of Mexico and South Africa. A Comoran specimen (MNHN1986-722) was caught in 320 m;<sup>11</sup> and the depth range for the species is 214–600 m. Attains 1.2 m; a large adult might be a predator of small coelacanths. This active predator was not seen from the submersible.

#### SCYLIORHINIDAE (catsharks)

Swell shark, *Cephaloscyllium sufflans* (Regan, 1921)

Not seen from the submersible, but a 48 cm TL specimen was found in the stomach of *Latimeria*.<sup>7</sup> This shark is also known from South Africa and Kenya in 40–600 m.<sup>12</sup> Appears to be endemic to the Western Indian Ocean. The small mouth and small size (maximum TL ~1 m) of this catshark would preclude it as a predator or a competitor of *Latimeria*.

Comoran catshark, *Scyliorhinus comoroensis* Compagno, 1988 (Fig. 4A)

This catshark was described from a 47 cm adult male (MNHN 1984-70) caught off Moroni in 400 m.<sup>11</sup> The species was recorded on video and photographed outside the caves at 270 m. The white mark on the rear of the head in the photograph of this shark published by Debelius<sup>13</sup> is an artefact of his publication. Attains 60 cm. This species is known only from Ngazidja in 40–400 m. It probably occurs at other Comoran islands and is likely to be found elsewhere in the Western Indian Ocean. Potential prey of *Latimeria*.

#### ODONTASPIDIDAE (raggedtooth sharks)

Bumpytail ragged-tooth, *Odontaspis ferox* (Risso, 1810) (Fig. 3)

This large, active shark was often seen near the bottom at depths of 150–300 m. Although it attains a length of at least 4.1 m, the relatively small, slender teeth of this species would be unsuited for attacks on adult coelacanths; but an adult shark would be capable of swallowing a small juvenile coelacanth. *Odontaspis ferox* feeds on bony fish, squid and shrimps.<sup>9</sup> Continental and insular shelves and upper continental slopes of all oceans in 13–420 m.

#### RAJIDAE (skates)

*Raja* sp.

A skate (probably genus *Raja*) was videotaped in the coelacanth habitat, outside the caves, but the depth was not recorded for this observation.

#### TORPEDINIDAE (electric rays)

Comoros electric ray, *Torpedo* sp. (Fig. 4B)

An electric ray of the genus *Torpedo* was seen on a sandy bottom outside the caves. It appears to be the same species that we collected in shallow water. The genus needs revision; according

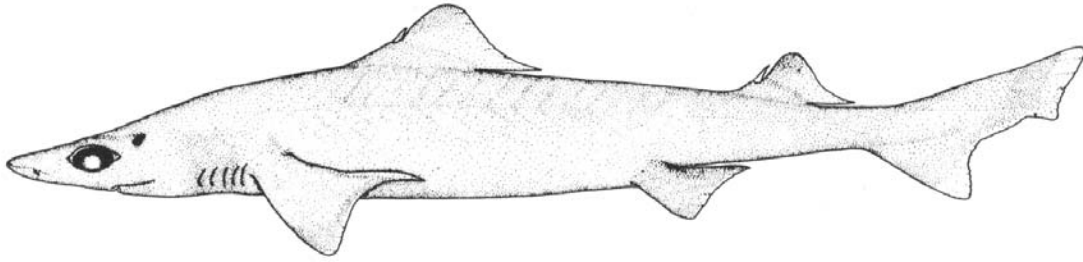


Fig. 1. *Centrophorus granulosus*, 85 cm male, Mozambique, drawn by John Bass.

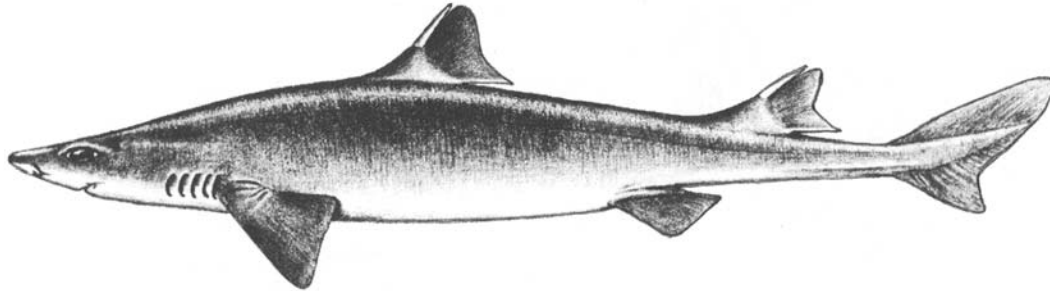


Fig. 2. Roughskin spiny dogfish, *Cirrhigaleus asper*, 118 cm female, Mozambique, drawn by John Bass.

to L.J.V. Compagno (pers. comm.) our Comoran specimen represents an undescribed species that is likely to be endemic to Ngazidja or the Comoro Is. Possible competitor of *Latimeria*; despite their small mouths, *Torpedo* species can swallow a fish with a length equal to half of the ray's disk width. Even juveniles are able to produce a strong electric shock, and presumably they would be avoided by a fish such as *Latimeria* with a well-developed electro-sensory capacity.

**NARKIDAE (sleeper rays)**

**Comoros numbfish (Fig. 4C)**

A narkid electric ray about 40 cm TL was videotaped and photographed on sand outside the caves. The image is good enough to assign this ray to the Narkidae, but it does not appear to be any of the known members of this family. It has two large, floppy dorsal fins, the disc is cardoid and there is a ventrolateral, fleshy finfold along each side of the lower surface of the tail. The dorsal surface is beige, with a darker anastomotic brownish pattern that, in some places, forms a series of close-set pale spots.

**LATIMERIIDAE (coelacanths)**

***Latimeria chalumnae* Smith, 1939**

The coelacanth is the dominant resident of this deep-reef

habitat. During the day, coelacanths are inactive, hiding in caves in a narrow zone between 135 and 300 m, where the substrate comprises steeply sloping, relatively barren, basaltic rock, with several caves.<sup>2</sup> Most caves are 2–3 m deep, narrowing towards the back from an entrance 2–3 m wide and 1–2 m high. A few larger caves (3 m high by 4 m deep and 4 m wide at the mouth) may accommodate as many as 16 coelacanths 1.0–1.8 m long and several smaller fishes at the same time.<sup>4</sup> Small juvenile coelacanths (less than 1 metre) were not observed in the study areas. At night, the coelacanths emerge to drift slowly over the bottom, apparently looking for food, and they usually move into depths of 300–400 m where the bottom is often sandy, with few rock outcrops.<sup>2–4</sup> *Latimeria* feed on fish and cephalopods. One night, a coelacanth tagged with an acoustic pinger was tracked as it descended to a depth of at least 690 m.

Resident populations of *Latimeria chalumnae* are known from Ngazidja and Anjouan in the Comoro Islands,<sup>3,4</sup> in the canyons off northern South Africa and off the coast of Tanzania.<sup>14</sup> Isolated individuals have been caught off Mozambique<sup>15</sup> and Kenya<sup>16</sup> and four specimens are known from the southwest coast of Madagascar.<sup>14</sup> *Latimeria* from Kenya, Mozambique, Madagascar and South Africa are genetically indistinguishable from the Comoran population.<sup>14,17</sup>

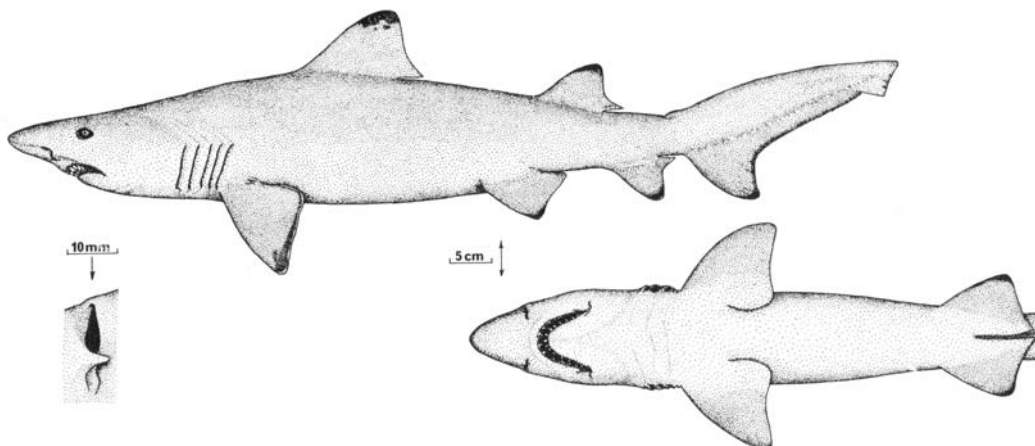


Fig. 3. Bumpytail ragged-tooth, *Odontaspis ferox*, 110 cm immature female, Durban, drawn by John Bass.

## MURAENESOCIDAE (pike congers)

? *Muraenesox* sp.

We have a photograph showing only the rear end of what appears to be a muraenesocid eel on sandy bottom outside of the caves. The head of a *Muraenesox* eel was collected on hook and line from a depth of 220 m at Grand Comoro in 1972;<sup>18</sup> the body of this eel was probably bitten off by a shark after the eel took the bait and before it was pulled to the surface. *Muraenesox* eels occur from shore to depths of 740 m. Two species are known from the Western Indian Ocean: *Muraenesox cinereus* (Forsskål, 1775) and *Muraenesox bagio* (Hamilton, 1822).<sup>19</sup> These eels, which may attain a length of 2 m, are known to include fish in their diet, might be predators of small coelacanths, and small eels could be prey for coelacanths.

## CONGRIDAE (conger eels)

? *Conger* sp.

A *Conger* eel of ~105 cm was recorded on videotape outside the caves at 253 m. This nondescript, grey, thick-bodied eel could be either of the species commonly known as *Conger wilsoni* (Bloch & Schneider, 1801) or *Conger cinereus* Rüppell, 1830.<sup>20</sup> Three congers of 0.75 m, 1.2 m and 1.4 m that were identified as *Conger wilsoni* were caught at Grand Comoro in 1972 at depths of 150–275 m.<sup>18</sup> The brief original description of *Gymnothorax wilsoni* Bloch and Schneider (1801) mentioned that this eel had red spots, but no known congrids have red spots, and no other descriptive information was given for this species.<sup>21</sup> Juvenile conger eels would be potential prey of *Latimeria*, and very large congers might be predators of small coelacanths.

## MURAENIDAE (moray eels)

? Guineafowl moray, *Gymnothorax meleagris* (Shaw & Nodder, 1795)

A brown moray with small yellow spots was recorded on videotape a few times outside the caves. Identification is uncertain without a good quality photograph or specimen.

*Gymnothorax hansii* Heemstra, 2004 (Fig. 4D)

This recently described species is known from only the three specimens (holotype, 101 cm, SAIAB 38673 and two paratypes 101 cm TL, male, SAIAB 74102 and 77 cm juvenile, USNM 376770) caught in 143 m off Itsoundzou, southwest coast of Ngazidja, during our 1991 expedition.<sup>22</sup> Adults are chestnut brown dorsally on head, body and most of tail; dorsal and anal fins brown anteriorly, blackish posteriorly, with a bright white margin from dorsal fin origin round tail tip to origin of anal fin; anterior nostril tube, posterior nostril mound and iris yellow; adult male with head and ventro-lateral part of body golden brown and several, irregular, distinct, dusky or black spots scattered over most of the body and dorsal fin; adult female with head paler below and a few faint dusky spots on body and tail; both sexes with pores on jaws set in white spots. The length of the head plus body is distinctly longer than the tail; dorsal fin origin at vertical midway between gill opening and rear edge of eye. Jaws closing completely when mouth is shut; teeth sharp, caniniform, slightly curved, uniserial on maxillae and dentaries; longest intermaxillary tooth equals 64% eye diameter. Branchial pores 2. Anterior nostril tubes reach beyond front of snout; rear nostrils irregular, set in a low fleshy mound, with opening directed dorso-posteriorly. Vertebral formula: 4 predorsal, 82–84 pre-anal and 183–185 total. This medium-sized moray is not large enough to be considered a predator of *Latimeria*. *G. hansii* is very similar to *Gymnothorax albimarginatus* Temminck & Schlegel, 1848, a deep-water moray of the western Pacific and Hawaiian Islands,

which differs slightly in having the anterior nostrils brown, a dark ocellus on nape, a faint line of tiny white dots along front part of lateral line, but no irregular dark spots or blotches on body; *G. albimarginatus* has 91–94 pre-anal vertebrae. *G. hansii* was not seen from the submersible.

## NETTASTOMATIDAE (witch eels)

? Solitary witch eel, *Nettastoma solitarium* Castle & Smith, 1981

A long slender eel, with a long pointed snout, well-developed median fins and no pectoral fins appears to be the species identified by Karrer<sup>23</sup> as the Atlantic witch eel, *Nettastoma melanurum* Rafinesque, 1810. She noted that the specimens she examined from off the west coast of Madagascar were the species described as *N. solitarium*<sup>24</sup> from the Philippines and Australia. This eel was recorded on video tape outside the coelacanth caves at a depth of 278–340 m.

## SYNAPHOBRANCHIDAE (cut-throat eels)

Brown cut-throat eel, *Ilyophis brunneus* Gilbert, 1892

A 49 cm specimen was found in the stomach of *Latimeria*.<sup>7</sup> Occurs worldwide on soft, silty substrate at depths of 700–2745 m.<sup>25</sup> Not seen from the submersible.

## HALOSAURIDAE (halosaurs)

? *Aldrovandia* sp.

Our video images of this eel are not good enough to determine the genus or species. Uncommon, seen outside the caves.

## MYCTOPHIDAE (lantern fishes)

? *Diaphus metopoclampus* (Cocco, 1829)

Found in the stomach of *Latimeria*.<sup>7</sup> This high-oceanic, mesopelagic species is rarely found near the bottom, but with the steeply sloping sides of a volcanic island, the mesopelagic and benthic slope habitats are in close proximity. Feeds on plankton. Some of the small silvery or dark fish that dart about in loose aggregations in the caves may be this lanternfish. Mediterranean, Atlantic, Indo-West Pacific.

## SYNODONTIDAE (lizardfishes)

? Redblotch lizardfish, *Synodus rubromarmoratus* Russell & Cressey, 1979 (Fig. 4E)

A lizardfish, estimated to be 17 cm TL, was photographed at 210 m; it has a pale body, with 5 reddish saddle bars, the first bar just behind the head and the last just in front of the caudal fin. This small (maximum size probably 20 cm TL) sedentary fish was seen in 206–341 m outside the caves. It resembles a colour photograph of *S. rubromarmoratus* taken in 20 m at the Maldives.<sup>26</sup> Previously known from the Maldives and Western Pacific. Potential prey of *Latimeria*.

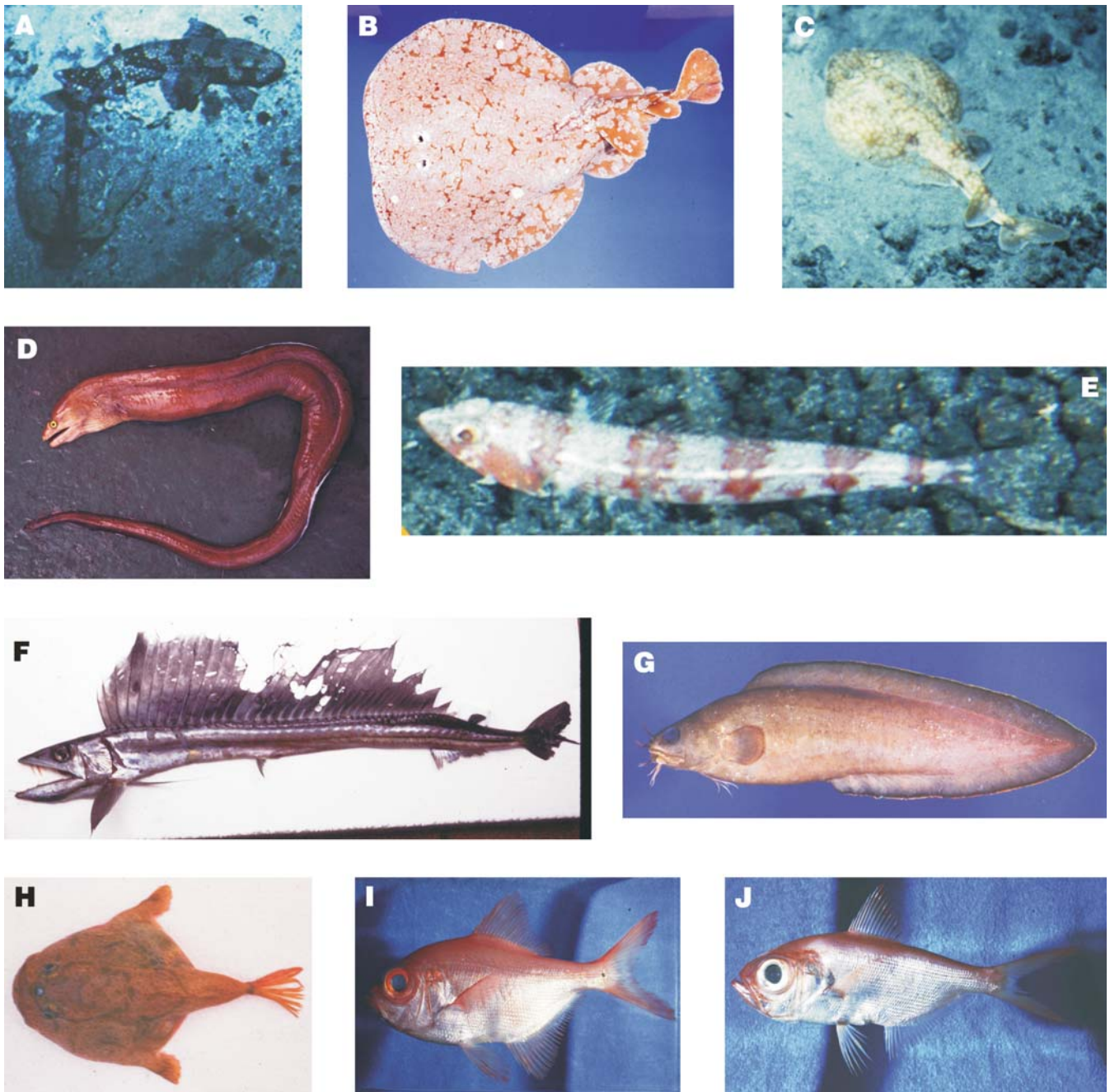
## PARALEPIDIDAE (barracudinas)

Stobbs photographed a 55+ cm paralepidid that he removed from the stomach of a 165 cm coelacanth caught by a local fisherman in May 1993 at the north end of Grand Comoro. The advanced state of digestion of this fish precluded determination of the species. No paralepidids were seen from the submersible.

## ALEPISAUROIDAE (lancetfishes)

Longsnout lancetfish, *Alepisaurus ferox* Lowe, 1833 (Fig. 4F)

Lancetfish occur worldwide in the lower epipelagic realm (100–1830 m) of the open ocean and are often caught on tuna longlines. A 71 cm SL specimen (SAIAB 45999) was caught with hook and line at Ngazidja in 250 m. The species attains a length



**Fig. 4.** Comoran catshark, *Scyliorhinus comoroensis*, TL ~40 cm; photograph from Jago, P.C.H. (B) Electric ray, *Torpedo* sp., 37 cm TL, Ngazidja; photograph P.C.H. (C) Narkid sleeper ray, ~40 cm TL, photograph from Jago, P.C.H. (D) Deepwater moray, *Gymnothorax hansii*, 101 cm TL, SAIAB 38673, Ngazidja, photograph P.C.H. (E) Redblotch lizardfish, *Synodus rubromarmoratus*, ~17 cm TL, depth 210 m, photograph from Jago, J.S. (F) Longsnout lancetfish, *Alepisaurus ferox*, 71 cm SL, SAIAB 45999, Ngazidja; photograph P.C.H. (G) Bearded brotula, *Brotula multibarbata*, 285 mm SL, SAIAB 46506, South Africa; photograph P.C.H. (H) Coffinfish ?*Chaunax pictus*, 17 cm SL, SAIAB 14078, Kenya; photograph P.C.H. (I) Deep alfonsino, *Beryx decadactylus*, 247 mm SL, SAIAB 34716, Madeira; photograph P.C.H. (J) Splendid alfonsino, *Beryx splendens*, 184 mm SL, SAIAB 34715, Madeira; photograph P.C.H.

of 2 m, and although it was not seen in the coelacanth habitat, it is likely to be an occasional visitor due to the proximity of the lower epipelagic realm to the steeply sloping bottom round the island. Despite the formidable dentition of lancetfish, the poorly ossified jaws and skeleton of this predator precludes its feeding on coelacanths.

#### MACROURIDAE (grenadiers)

##### Snub-nosed grenadier, *Lucigadus ori* (Smith, 1968)

Specimens of 17–37 cm were seen in 253–370 m outside the caves. Known from southern Africa and northern Madagascar in 275–550 m.<sup>27</sup> Tomio Iwamoto confirmed the identification of our video images. Potential prey of *Latimeria*.

#### OPHIDIIDAE (cusk eels)

##### Bearded brotula, *Brotula multibarbata* Temminck & Schlegel, 1846 (Fig. 4G)

A specimen ~11 cm TL was photographed on the bottom at a depth of 340 m. This cryptic, distinctive brotula is often taken in rotenone stations on coral reefs; juveniles are also occasionally caught near the surface in the open ocean; adults (30–90 cm) move to depths of 100–650 m.<sup>28</sup> Attains ~100 cm TL. This nocturnal species is rarely seen during the day. Feeds on crustaceans (mainly crabs) and small fish. Red Sea to South Africa, Maldives, Japan and central Pacific, including Hawaiian Is. Not seen in the caves.

## CHAUNACIDAE (coffinfishes)

?Mottled coffinfish, *Chaunax pictus* Lowe, 1846 (Fig. 4H)

We have video images and a photograph of a *Chaunax* estimated to be 34 cm TL sitting on the bottom at 400 m outside of the caves. The head and body are yellow or reddish-orange, with scattered papillae and mottled with red or yellow-brown spots and streaks; the caudal fin is long, about twice the length of the caudal peduncle; there are 11 rays in the dorsal fin, the rays are white and the dorsal-fin membrane is dark brown. This genus needs revision; consequently the distributions of the species are problematic. The type locality for *Chaunax pictus* is Madeira, and the species has been reported from South Africa and the Maldives.<sup>29</sup> Potential prey of *Latimeria*.

## OGCOEPHALIDAE (seabats)

## ?Halieutaea coccinea Alcock, 1889

A batfish ~10 cm TL was photographed on the bottom at ~300 m outside of the caves. The photograph was labelled 'Malthopsis seabat' by Debelius,<sup>13</sup> but the front of the head is too rounded to be a species of *Malthopsis*. This batfish appears to be *Halieutaea coccinea*. It attains a length of ~20 cm, and is a potential prey of *Latimeria*. Known from the Andaman Islands (eastern Indian Ocean) at 500 m; also reported from 494 m in the Maldives.<sup>29</sup>

## BERYCIDAE (alfonsinos)

Deep alfonsino, *Beryx decadactylus* Cuvier, 1829 (Fig. 4I)

A 35 cm SL specimen was found in the stomach of *Latimeria*.<sup>7</sup> Attains 60 cm. We did not see this distinctive berycid from the submersible. Atlantic and Indo-Central Pacific oceans in 200–805 m.<sup>30</sup>

Splendid alfonsino, *Beryx splendens* Lowe, 1834 (Fig. 4J)

We have video images of *B. splendens* outside the caves at 381 and 390 m. Attains 45 cm. Atlantic Ocean and Indo-Central Pacific in 160–800 m.<sup>30</sup> Two specimens were caught in the Maldives at 300 and 354 m.<sup>29</sup>

## TRACHICHTHYIDAE (roughies)

Big roughy, *Gephyroberyx darwini* (Johnson, 1866) (Fig. 5A)

Photographed on rocky bottom at 200 m outside the caves. Attains 60 cm. Atlantic, Indian and Western Pacific oceans in 9–1210 m.<sup>30</sup>

## MONOCENTRIDAE (pineapple fishes)

Pineapplefish, *Monocentris japonica* (Hottuy, 1782) (Fig. 5B)

We have video images and a photograph of *M. japonica* from depths of 200–300 m. Often seen in caves with the coelacanths. The stout, locking fin spines and hard spiny scales of this fish will deter most predators, such as the coelacanth. Attains 17 cm. Red Sea and Indo-West Pacific region in 3–400 m.<sup>31,32</sup>

## ANOMALOPIDAE (flashlight fishes)

Blue-lined flashlight fish, *Photoblepharon steinitzi* Abe & Haneda, 1973 (Fig. 5C)

*Photoblepharon steinitzi* is common in and outside the coelacanth caves during the day, and at night it usually ascends to the coral reef at depths of 3–20 m. We collected several specimens in shallow water. This species is endemic to the Red Sea and north-western Indian Ocean.<sup>33</sup>

## HOLOCENTRIDAE (squirrelfishes &amp; soldierfishes)

Yellowfin soldierfish, *Myripristis chryseres* Jordan & Evermann, 1903 (Fig. 5D)

We have several video images and a photograph of *M. chryseres*

showing the characteristic yellow median and pelvic fins. Specimens 14–20 cm TL were often seen in caves with the coelacanths in 182–239 m. South Africa, Réunion, Mauritius and Sri Lanka to the central Pacific; depth range 12–240 m.<sup>34,35</sup> The strong spines and spiny scales of this fish would discourage most predators.

Delta soldierfish, *Ostichthys delta* Randall, Shimizu & Yamakawa, 1982 (Fig. 5E)

Our 118 mm SL specimen (SAIAB 75280) was caught with a gill net in 114 m off Itsoundzou in September 2004. This rare, deep-water holocentrid was previously known from Réunion and American Samoa in the central Pacific. At Réunion,<sup>35</sup> the species was caught in 150–200 m.

Striped soldier, *Ostichthys kaianus* (Günther, 1880) (Fig. 5F)

Seen in caves at 182 and 192 m. In addition to video images of *O. kaianus*, we also have a specimen (SAIAB 33523) caught with hook and line and purchased in the market at Moroni. Attains 36 cm. The strong spines and spiny scales of this fish would discourage most predators. This deep-water soldierfish is known from Grand Comoro, Réunion, Indonesia, northwestern Australia and the Ryukyu Is. (Japan) in depths of 310–640 m.<sup>35</sup>

Shy soldierfish, *Plectrypops lima* (Valenciennes, 1831) (Fig. 5G)

We have video images of this small soldierfish outside the caves and below 200 m. The dorsal-fin spines are shorter and the tail fin lobes more rounded on *P. lima* than on other soldierfish.<sup>35</sup> Attains 16 cm. A cryptic nocturnal species, common on coral reefs, but rarely seen during the day; depth range 4–200 m. Indo-West Pacific.

*Sargocentron* sp.

We have video images of a squirrelfish (*Sargocentron* sp.) in and outside the caves.

## POLYMIXIIDAE (beardfishes)

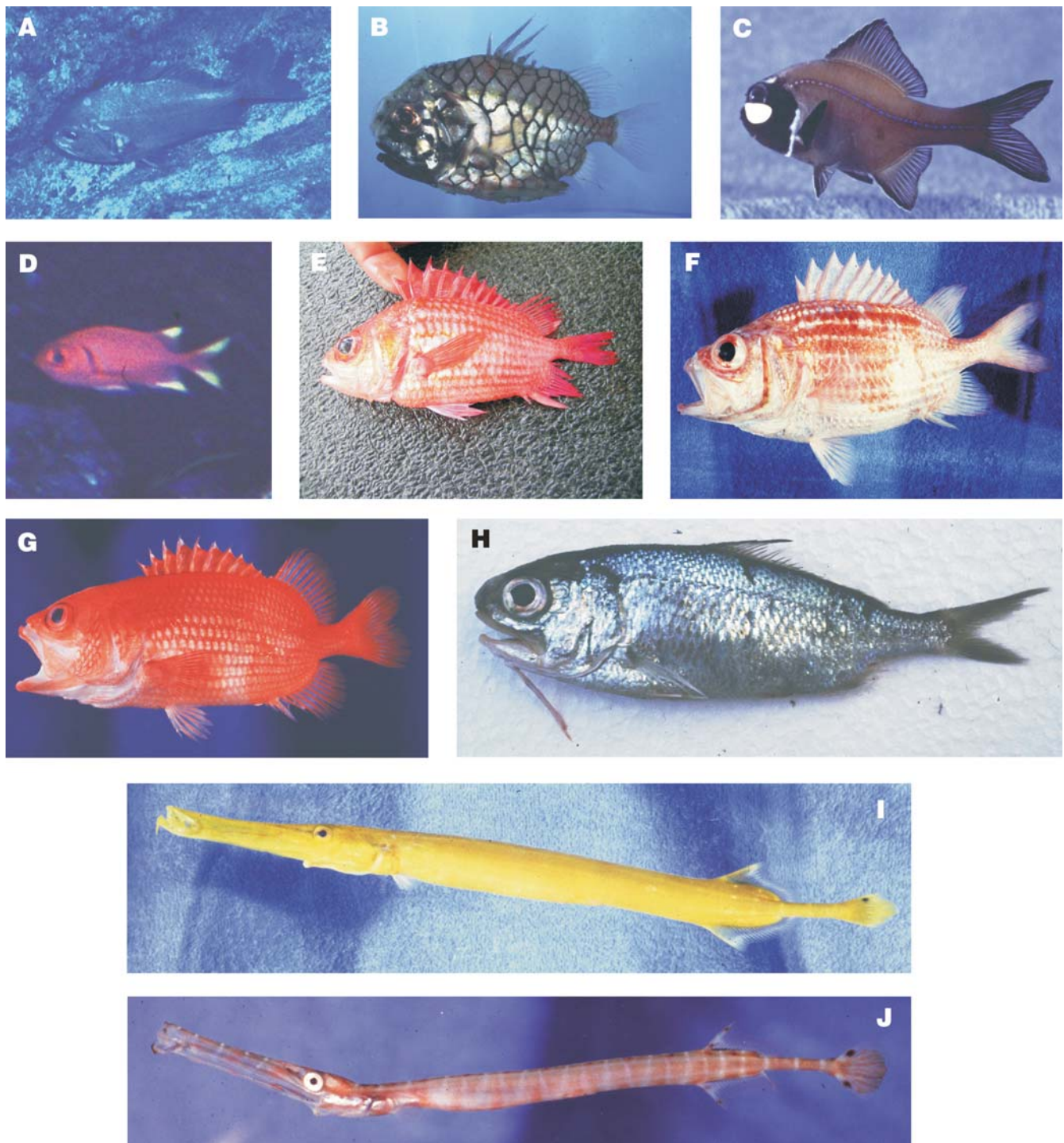
?Berndt's beardfish, *Polymixia berndti*, Gilbert 1905 (Fig. 5H)

Reported as *Polymixia nobilis* Lowe, 1836 from the stomach of *Latimeria*.<sup>5</sup> The species identity is questionable, as the specimen was represented by disarticulated bones and *P. nobilis* is not known from the Indo-Pacific region. Three species of *Polymixia* are known from the western Indian Ocean;<sup>36</sup> the species that Heemstra<sup>37</sup> identified as *P. nobilis* was later described as a new species, *Polymixia busakhini* Kotlyar, 1993. *Polymixia* species occur singly or in schools near the bottom in 18–660 m; they attain 20–40 cm and are not likely to compete with *Latimeria*. Our illustrated specimen (Fig. 5H) was collected in a trawl off Kenya at a depth of 301 m. Not seen from the submersible.

## AULOSTOMIDAE (trumpetfishes)

Chinese trumpetfish, *Aulostomus chinensis* (Linnaeus, 1766) (Fig. 5I & J)

*Aulostomus chinensis* (usually the xanthic morph) was often seen in the coelacanth caves in depths of 178–243 m. We have video images and a photograph of adults (~80 cm TL) in caves with the coelacanth, and specimens were also collected from shallow water. The usual diet of adults is small fish, but *A. chinensis* was occasionally videotaped picking blobs of unidentified white plankton from swarms attracted to the mouth of the caves by the lights of the submersible. Often seen in pairs in the coelacanth caves. Recorded from 61–122 m in the Hawaiian Is.<sup>34</sup> A pelagic juvenile, 12 cm SL (SAIAB 39608) was collected near the hull under the mother-ship, *Deep Salvage I*. Known from South Africa, Maldives and widely distributed on coral reefs of the Indo-Pacific region.<sup>38,39</sup>



**Fig. 5.** (A) Roughy, *Gephyroberyx darwini*, photograph from Jago, J.S. (B) Pineapplefish, *Monocentris japonica*, 110 mm SL, SAIAB 74669, Bazaruto, Mozambique. (C) Flashlight fish, *Photoblepharon steinitzi*, live fish ~10 cm TL, collected in ~15 m, north of Moroni, Ngazidja, P.C.H. (D) Yellowfin soldier, *Myripristis chryseres*, photograph from Jago, P.C.H. (E) Delta soldier, *Ostichthys delta*, 118 mm SL, SAIAB 75280 fish collected in 114 m at Ngazidja; photograph K. Sink. (F) Striped soldier, *Ostichthys kaianus*, 220 mm SL, SAIAB 33523, Moroni fish market; photograph P.C.H. (G) Shy soldier, *Plectrypops lima*, 112 mm SL, SAIAB 40349, South Africa; photograph P.C.H. (H) Dusky beardfish, *Polymixia berndtii*, 134 mm SL, SAIAB 14019, Kenya; photograph P.C.H. (I) Trumpet fish, *Aulostomus chinensis*, 30 cm SL, SAIAB 33512, yellow morph from Ngazidja; photograph P.C.H. (J) *Aulostomus chinensis*, 12 cm SL pelagic juvenile, SAIAB 39608, Ngazidja; photograph P.C.H.

#### FISTULARIIDAE (flutemouths)

Smooth flutemouth, *Fistularia commersonii* Rüppell, 1838 (Fig. 6A)

We collected a juvenile, 155 mm TL, SAIAB 39463, at Ngazidja; usually seen on or near coral reefs. Flutemouth has been recorded to depths of 128 m.<sup>40</sup> Reported from South Africa, Maldives<sup>39</sup> and widely distributed in the Indo-Pacific region.<sup>41</sup> Not seen from submersible.

#### SCORPAENIDAE (scorpionfishes)

?Eyelash scorpionfish, *Pontinus nigerimum* Eschmeyer, 1983 (Fig. 6B)

We photographed a scorpionfish that we think is this species sitting on rocky bottom outside the caves in 250 m. The head and body are orange, with irregular yellow blotches on the head, small white spots on the body and a long, slender, unbranched, pale tentacle on supraorbital rim above each eye. Twenty speci-



mens (from a total catch of over 100 specimens) were collected from a single trawl in 196 m southeast of Bazaruto, Mozambique. The supraorbital tentacle of these specimens varied from long, slender and completely white to black, or proximal half black with distal half white, or short and black, or short and white or completely absent. Attains ~30 cm. Known from South Africa (KwaZulu-Natal), Mozambique and the Maldives (Malé, 190 m).<sup>39</sup>

#### Unidentified scorpaenids

Scorpionfish of various sizes and nondescript colour patterns were incidentally recorded on videotape, usually outside the caves.

#### PERISTEDIIDAE (armoured gurnards)

?Bearded gurnard, *Satyrichthys engyceros* (Günther, 1872) (Fig. 6C)

We have photographs and video images of this benthic species on rocky bottom at 279 m outside the caves. The preopercle spine is too long for *Satyrichthys adeni* (Lloyd, 1907), and the rostral extensions are more slender and wider apart than in *Satyrichthys investigatoris* (Alcock, 1898).<sup>42</sup> Our fish appears to be ~25 cm long and looks very similar to the Hawaiian specimen in the photograph identified as *Satyrichthys engyceros* by Chave and Mundy.<sup>34</sup> Not seen in caves. The bony armour of this fish (comprising interlocking spiny scales) is thought to deter predators. Attains 32 cm TL. Previously known from the western Central Pacific.

#### ANTIGONIIDAE (deep boarfishes)

?Wavybrow boarfish, *Antigonia undulata* Parin & Borodulina, 2005 (Fig. 7F)

Our photograph shows a deep-bodied, pale silvery fish with a distinct dark red band from dorsal-fin origin to and over the pelvic fins, dark red band from nape through the eye onto the cheek and a red bar at front end of the caudal peduncle. At least 3 species of *Antigonia* are known from the region north and west of Madagascar.<sup>43</sup> We saw specimens 10–15 cm TL in 253–285 m outside the caves.

#### SERRANIDAE (anthiines, groupers, soapfish)

Goldribbon soapfish, *Aulacocephalus temmincki* Bleeker, 1857 (Fig. 6D)

We have video images of this distinctive species from a cave at 180 m; seen in or near the caves on several occasions. New record for the Comoros. Our records represent a considerable increase in the putative depth range (20–120 m) of this species. Attains 40 cm TL. The skin contains a toxin that is distasteful to predators. Western Indian Ocean, including Red Sea, South Africa, Mozambique and Comoros to the Central Pacific.<sup>44</sup>

Harlequin hind, *Cephalopholis polleni* (Bleeker, 1868) (Fig. 6E)

We did not see this small grouper from the submersible. Attains 43 cm TL. Known from 10–120 m at the Comoros and other oceanic islands of Indo-Central Pacific region.<sup>8,45,46</sup>

Strawberry hind, *Cephalopholis spiloparea* (Valenciennes, 1828) (Fig. 6F)

Known from depths of 10–108 m; we collected this small grouper in 20–25 m off Iconi on the west coast of Ngazidja. The small size (less than 22 cm TL) and deep-water habitat of this cryptic grouper make it less vulnerable (compared to larger groupers) to fishing. Based on museum fish collections, *C. spiloparea* is probably the most common species of grouper on Indo-West Pacific coral reefs below 30 m.<sup>45,46</sup> Known in Western Indian Ocean from Mozambique, Zanzibar, Maldives<sup>39</sup> and Comoros. Not seen from Jago.

Netfin grouper, *Epinephelus miliaris* (Valenciennes, 1830) (Fig. 6G)

Widely distributed in Indo-West Pacific region, including Zanzibar, Kenya, Aldabra, Maldives<sup>39</sup> and Comoros in 18–180 m.<sup>8,45,46</sup> Attains 53 cm TL. Not seen from Jago.

Comet grouper, *Epinephelus morrhua* (Valenciennes, 1833) (Fig. 6H)

Known from 80–370 m at continental and insular localities of the Indo-West Pacific region, including South Africa, Mozambique, Tanzania, Kenya, Maldives,<sup>39</sup> and Comoros.<sup>45,46</sup> Attains 73 cm TL. Not seen from Jago.

White-blotched grouper, *Epinephelus multinotatus* (Peters, 1876)

Western Indian Ocean from southern Mozambique to Pakistan, Seychelles, Madagascar, Mauritius, Réunion, and Grand Comoro Island.<sup>8,45,46</sup> Depth range 13–123 m.

Dot-dash grouper, *Epinephelus poecilnotus* (Temminck & Schlegel, 1842) (Figs 6I & J)

Adults have been taken in 45–375 m from continental and insular localities in the Indo-West Pacific region, including South Africa, Mozambique, Kenya and the Comoros.<sup>45,46</sup> Attains 63 cm TL. Not seen from Jago.

Oblique banded grouper, *Epinephelus radiatus* (Day, 1867) (Figs 7A & B)

A clear video image of a specimen ~30 cm TL of this distinctively coloured grouper shows it sitting in a crevice just outside a cave. New record for the Comoros. Adults have been caught in 80–160 m; juveniles have been found in 18 m; attains 70 cm TL. Known from Mauritius, Réunion, Chagos, southern India to southern Japan.<sup>45,46</sup>

Potato grouper, *Epinephelus tukula* Morgans, 1959 (Fig. 7C)

We have a video image of this distinctive grouper, which was seen only once below 100 m; *E. tukula* is more common in depths of 10–40 m, but adults are known to depths of 350 m.<sup>46</sup> Attains 2 m TL. Large adults would be potential predators of small *Latimeria*. Widely distributed in Indo-West Pacific region from South Africa, Mozambique, Tanzania, Kenya, Seychelles and Comoros to Australia and Japan.

Royal anthiine, *Odontanthias borbonius* (Valenciennes, 1828) (Fig. 7D)

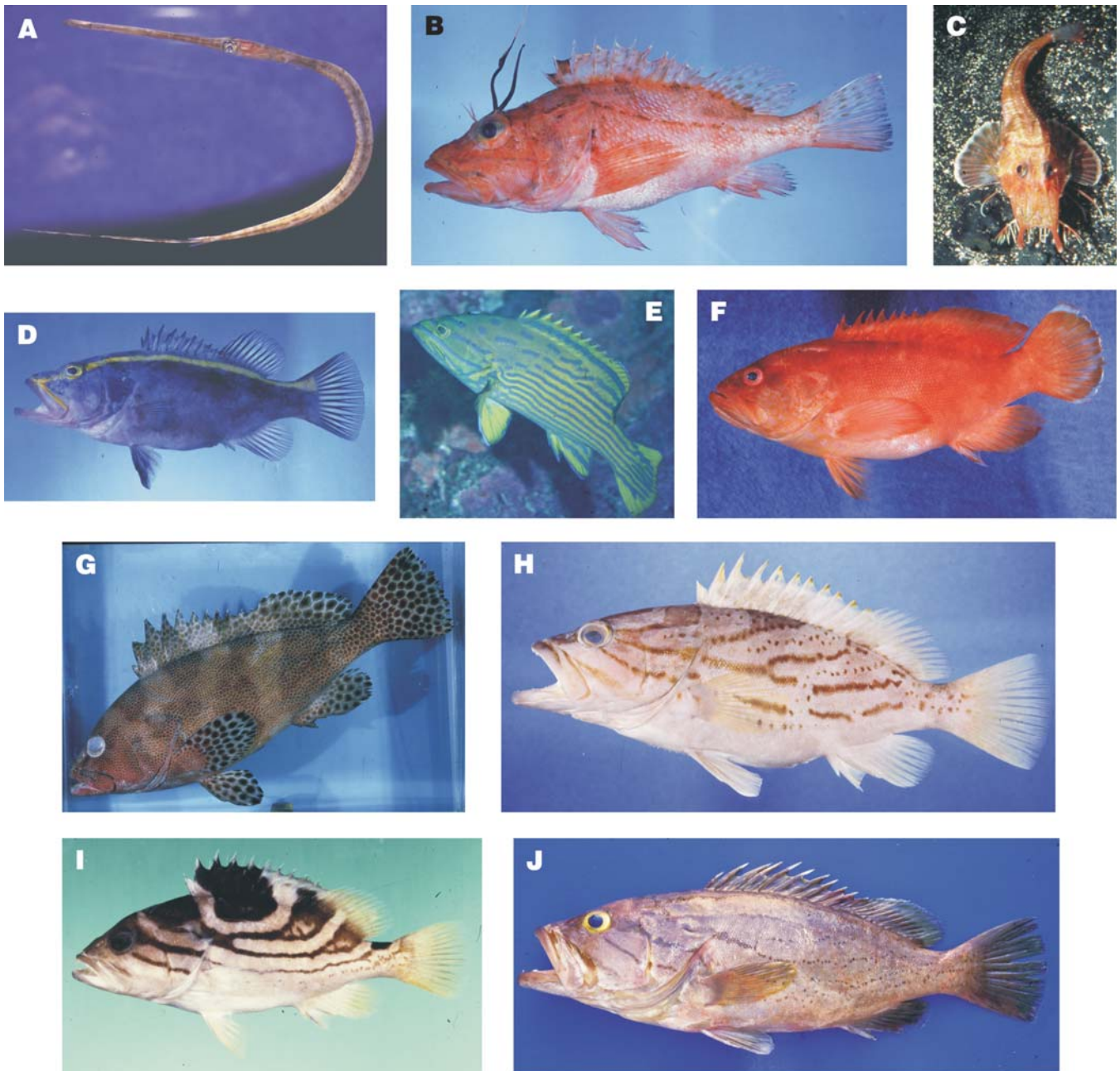
Solitary males of this distinctive species were often seen in and near the caves in 180–270 m. Sometimes one or two males were observed with loose groups of several smaller females. Attains ~15 cm SL. A male (SAIAB 39605, 110 mm SL) was caught off the southwest coast of Ngazidja on hook and line in about 150 m. *Anthias ornatus*,<sup>8</sup> which was described from the Comoros, is a synonym.<sup>45</sup> Occurs in 70–300 m at South Africa, the Comoros, Madagascar, Réunion, Mauritius and Japan.<sup>45</sup>

*Liopropoma* sp.

We have video images of a species of *Liopropoma* that was occasionally seen in or near the caves with the coelacanth. Three species of *Liopropoma* are known from the Western Indian Ocean: *L. africanum* (Smith, 1954), *L. susumi* (Jordan & Seale, 1906) and *L. lunulatum* (Guichenot, 1862).<sup>47</sup> The first two are small species (~10 cm TL) that differ greatly in size and colour from the Comoran fish. Although the shape and size (~20 cm) of this fish match *L. lunulatum*, the colour pattern lacks black spots on the rear of the body, which are characteristic for *L. lunulatum*.

Yellow-edged lyretail, *Variola louti* (Forsskål, 1775) (Fig. 7E)

This common, piscivorous, coral reef grouper is known from



**Fig. 6.** (A) Flutemouth, *Fistularia commersonii*, juvenile 155 mm TL, collected from Ngazidja; photograph P.C.H. (B) Eyelash scorpionfish, *Pontinus nigerimus*, 167 mm SL, Bazaruto, Mozambique; photograph P.C.H. (C) Bearded gurnard, ?*Satyrichthys engyceros*, ~25 cm TL, Ngazidja, photograph from Jago, HF. (D) Goldribbon soapfish, *Aulacocephalus temmincki* 19 cm SL, SAIAB 56599, South Africa; photograph P.C.H. (E) Harlequin hind, *Cephalopholis polleni*, photograph taken at Pulau, Western Pacific by John Randall. (F) Strawberry hind, *Cephalopholis spiloparea*, 133 mm SL, SAIAB 28272, Moroni fish market, Ngazidja; photograph P.C.H. (G) Netfin grouper, *Epinephelus miliaris*, 43 cm SL, SAIAB 21169; Bassas da India (Mozambique Channel); photograph P.C.H. (H) Comet grouper, *Epinephelus morrhua*, 249 mm SL, SAIAB 46005; Ngazidja; photograph P.C.H. (I) Dot-dash grouper, *Epinephelus poecilnotus*, 112 mm SL, juvenile from Durban; photograph P.C.H. (J) *Epinephelus poecilnotus*, 36 cm TL, subadult, South Africa; photograph S. Chater.

depths of 3–240 m. Not seen from *Jago*. Like most groupers, this lyretail is rare at the Comoro Islands. Widely distributed in Indo-Central Pacific area, from Red Sea and South Africa to the Pitcairn Islands.<sup>45,46</sup>

#### SYMPHYSANODONTIDAE (deep fusiliers)

Yellowspot deep fusilier, *Symphysanodon* sp. (Fig. 7G)

Common in the caves; also recorded from the stomach of *Latimeria*.<sup>5</sup> Our photograph and video tapes show a pinkish purple fish, with a bright yellow spot on the opercle; the lower caudal fin lobe is yellow and the upper lobe is pink with a white tip; the dorsal fin is hyaline yellow. This species appears to be undescribed.<sup>48</sup> We saw specimens of 12–18 cm TL in 235–264 m.

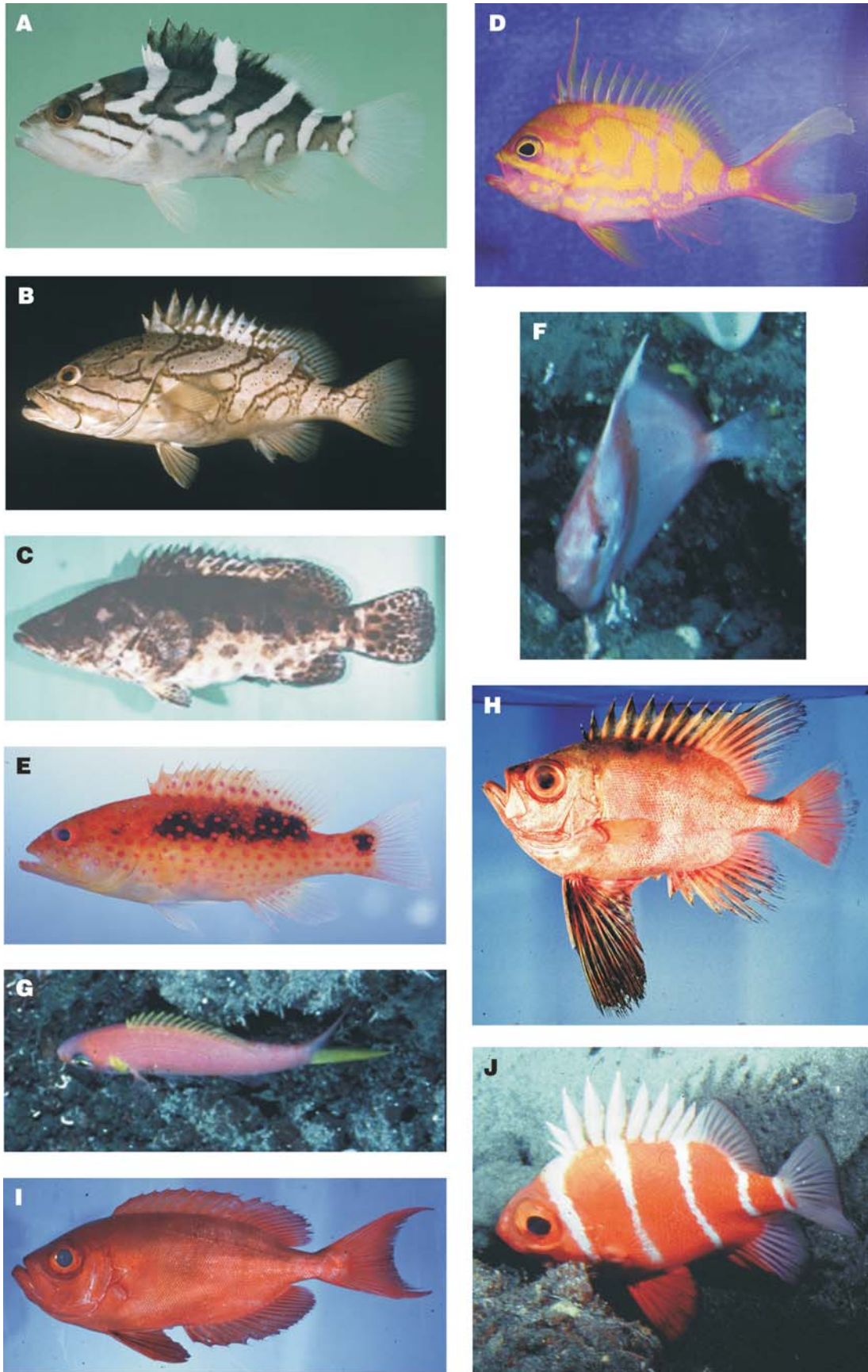
#### PRIACANTHIDAE (bigeyes)

Bulleye, *Cookeolus japonicus* (Cuvier, 1829) (Fig. 7H)

This distinctive species was recognized by the shape of the fins, especially the enormous pelvic fins.<sup>49</sup> Attains 68 cm. Known from 60–400 m in the Indo-Pacific region from South Africa to Japan, Korea, Hawaii and Baja California.<sup>34,49</sup>

Crescent-tail bigeye, *Priacanthus hamrur* (Forsskål, 1775) (Fig. 7I)

We have video images of *P. hamrur* in and near caves with the coelacanths; a 195 mm SL fish (SAIAB 39382) was caught on hook and line in about 150 m, and we also collected specimens from the coral reefs at Ngazidja. Attains 45 cm. Widely distributed



**Fig. 7.** (A) Oblique banded grouper, *Epinephelus radiatus*, 41 mm SL, Mauritius, photograph J.E. Randall. (B) *Epinephelus radiatus*, 295 mm SL, Okinawa, photograph J.E. Randall. (C) Potato grouper, *Epinephelus tukula*, 32 cm SL, SAIAB 11445; Durban; photograph P.C.H. (D) Royal anthiine, *Holanthias borbonius*, 110 mm SL, SAIAB 39605, Ngazidja; photograph P.C.H. (E) Yellow-edged lyretail, *Variola louti*, 52 mm SL, SAIAB 59158, South Africa; photograph P.C.H. (F) Deep boarfish, ?*Antigonina indica*, photograph from Jago, J.S. (G) *Symphysanodon* sp., 200 m, photograph from Jago, J.S. (H) Bulleye, *Cookeolus japonicus*, 175 mm SL, SAIAB 44182, South Africa; photograph P.C.H. (I) Crescent-tail bigeye, *Priacanthus hamrur*, 195 mm SL, Mozambique; photograph P.C.H. (J) Japanese bigeye, *Pristigenys nipponia*, photograph from Jago, J.S.

from Red Sea and South Africa to the central Pacific in 2–250 m.<sup>49</sup>

Japanese bigeye, *Pristigenys nipponia* (Cuvier, 1829) (Fig. 7J)

We have video images and photographs of *P. nipponia* from 262 m. Attains 32 cm TL. Indo-West Pacific from South Africa to Japan and Australia; reported in 80–300 m.<sup>49</sup>

#### APOGONIDAE (cardinalfishes)

?Blue cardinalfish, *Apogon fukuui* Hyashi, 1990 (Fig. 8A)

Video images show a small bluish-green cardinalfish, with two horizontal dark stripes on the head and body, one above the eye and one through the eye, the latter extending posteriorly to a large dark spot at base of caudal fin. *Apogon fukuui* was originally described from Japan, and recently found in South African waters (O. Gon, pers. comm.)

Deep cardinalfish, *Coranthus polyacanthus* (Vaillant, 1877) (Fig. 8B)

This large, distinctive cardinalfish was often seen in the caves with coelacanths; also reported from the stomach of *Latimeria*.<sup>5</sup> Usually solitary, but sometimes seen in pairs or in groups of three to seven fish. The black bar at the base of the tail fin is faint or absent on some fish. This species is rare in collections, because of its deep-water habitat (150–276 m) and the difficulty of collecting specimens. Known only from Ngazidja, Réunion (150 m depth) and Indonesia.<sup>50</sup>

Apogonid sp. 1

This species has a dark stripe from the eye to the tip of the snout and a dark spot mid-laterally at the base of the caudal fin. Occasionally seen in the vicinity of the coelacanth caves.

Apogonid sp. 2

This pale yellow-green, schooling species has a pale head with two dark horizontal stripes, one posteriorly from the eye and one below the eye from mouth to opercle; it also has a large dark spot on the upper part of the caudal fin base. Seen occasionally in or near the caves.

#### EPIGONIDAE (slender cardinalfishes)

*Epigonus* spp.

Species of *Epigonus* were common, solitary, sedentary, and scattered in or near the caves. Specimens of 5–15 cm TL (perhaps more than one species) were seen sitting on the bottom in 178–400 m. The dorsal fin is turquoise with a black margin and the pelvic fins are black; these colour pattern features are not illustrated or mentioned for any of the three species known from the southwestern Indian Ocean.<sup>51,52</sup>

#### LUTJANIDAE (snappers)

Smalltooth jobfish, *Aphareus furca* (Lacepède, 1802) (Fig. 8C)

We purchased a fresh (not frozen) specimen (SAIAB 33522) from the Moroni fish market in October 1986; this fish was probably caught at Ngazidja. Attains 70 cm FL. Not seen from *Jago*. Tropical Indo-Central Pacific, including South Africa, Mozambique, Tanzania, Madagascar and Comoros to Hawaii. Depth range 1–122 m.<sup>34,53,54</sup>

Rusty jobfish, *Aphareus rutilans* Cuvier, 1830 (Fig. 8D)

In May 1993, we caught a 47 cm SL *A. rutilans* (SAIAB 45980) in 267–350 m at the Recif Vailheu. Widely distributed in Indo-Central Pacific region, including South Africa, Mozambique, Kenya, Madagascar and Comoros to Hawaii;<sup>34,53</sup> reported as common in 60–210 m at the Maldives in 1991.<sup>29</sup> Attains 110 cm FL. Not seen from *Jago*. Previous depth range 100–250 m.<sup>34,53</sup>

Ruby snapper, *Etelis carbunculus* Cuvier, 1828 (Figs 8E & F)

A 30 cm SL *E. carbunculus* (RUSI 39117) was caught with hook

and line in 1991 from 130 m at Ngazidja; also common (May 1993) in 267–350 m at the Recif Vailheu. In the lights of the submersible, the fish appears bright yellow. In 1969 this species [reported as '*Etelis marshi* (Jenkins, 1903)'] was abundant in 100–450 m at the Seychelles.<sup>54</sup> Attains 111 cm FL. Widely distributed in Indo-Central Pacific region, including Mozambique, Tanzania, Kenya, Madagascar, Seychelles, Mauritius and Comoros to Hawaii. Depth range 89–485 m.<sup>34,53</sup>

Scarlet snapper, *Etelis coruscans* Valenciennes, 1862 (Fig. 8F)

We collected a 43 cm SL fish (RUSI 45972) in May 1993 from 267–350 m at the Recif Vailheu. Attains at least 100 cm FL. Not seen from *Jago*. Reported [as '*Etelis carbunculus*'] in 185–385 m at the Seychelles.<sup>54</sup> Widely distributed in Indo-Central Pacific region, including South Africa, Mozambique, Tanzania, Kenya and Comoros to Hawaii. Depth range 90–396 m.<sup>34, 53-55</sup>

Yellowtail fusilier, *Paracaesio xanthura* (Bleeker, 1869) (Fig. 8G)

A group of ~20 *Paracaesio xanthura* were videotaped milling about at the mouth of a cave. First record for the Comoros. The species was originally described from Nossi-Bé, Madagascar; widely distributed in Indo-Central Pacific region, including South Africa, Mozambique, Tanzania, Kenya, Seychelles and Comoros. Depth range 20–250 m.<sup>53</sup> Feeds on plankton.

Ornate jobfish, *Pristipomoides argyrogrammicus* (Valenciennes, 1831) (Fig. 8H)

Our 29 cm SL fish, (SAIAB 45975) caught in 267–350 m at the Recif Vailheu, is the first record of this species from the Comoros. Known from the western Central Pacific region; the only previous record from the Western Indian Ocean was Mauritius.<sup>53</sup> Attains 40 cm. Not seen from *Jago*. Previous depth range 70–300 m.<sup>53</sup>

Goldflag jobfish, *Pristipomoides auricilla* (Jordan, Evermann & Tanaka, 1927) (Fig. 8I)

A 24 cm SL specimen, SAIAB 45984, caught in May 1993 from 267–350 m at the Recif Vailheu is the first record of this species from the Comoros. Previously known from Indo-Central Pacific, and reported [as '*Pristipomoides auricilla*'] from 80–210 m in the Maldives.<sup>29</sup> Attains 45 cm FL. Not seen from *Jago*. Depth range 90–360 m.<sup>34,53</sup>

Oblique-banded jobfish, *Pristipomoides zonatus* (Valenciennes, 1830) (Fig. 8J)

Reported from 70–120 m at Grand Comoro and Anjouan;<sup>8,55</sup> a 29 cm SL specimen (SAIAB 46001) was caught in 1993 in 267–350 m at the Recif Vailheu, and we have video images of this distinctive species in and near the caves. Widely distributed in Indo-Central Pacific region, including South Africa, Mozambique, Tanzania, Kenya, Madagascar, Seychelles, Comoros and Hawaii. Attains 50 cm FL. Known from 70–352 m.<sup>34,53</sup>

#### MALACANTHIDAE (tilefishes)

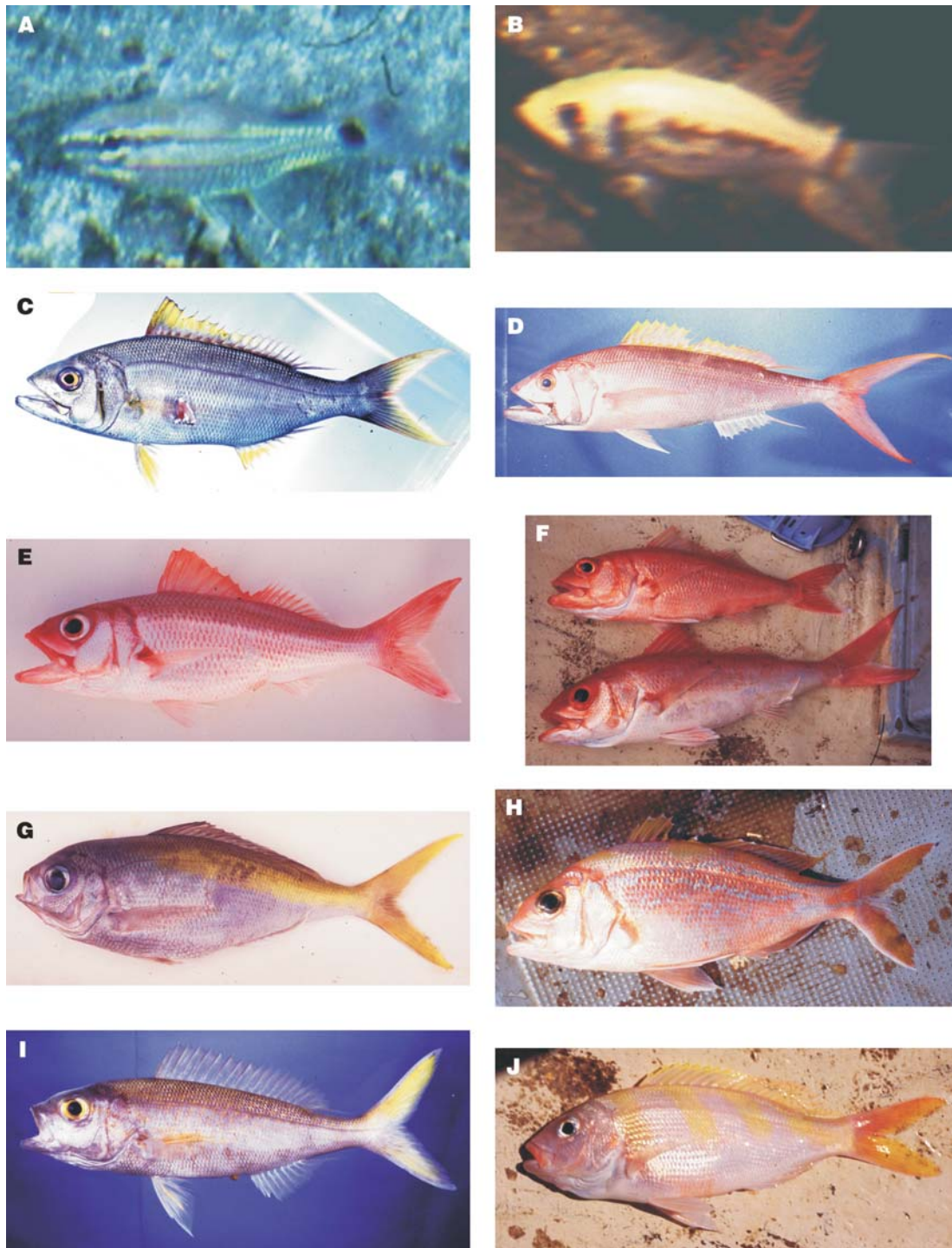
Spotted tilefish, *Branchiostegus sawakinensis* Amirthalingam, 1969

We have video images and a very poor photograph of what appears to be a solitary *B. sawakinensis* from 310 and 340 m. This fish is greenish-yellow dorsally and silvery below, with about 16, narrow, dark, vertical bars on the body. Attains 60 cm TL. Not seen in the caves; apparently avoids the submersible. Red Sea to South Africa; previous depth range 45–150 m.<sup>56</sup>

#### PENTACEROTIDAE (armourheads)

Sailfin armourhead, *Histioporus typus* Temminck & Schlegel, 1844 (Fig. 9A)

We have excellent video images of *H. typus* swimming near the



**Fig. 8.** (A) Blue cardinalfish, *Apogon fukuii*. (B) Deep cardinalfish, *Coranthus polyacanthus*, photograph from Jago, P.C.H. (C) Smalltooth jobfish, *Aphareus furca*, 165 mm SL, SAIAB 59130, South Africa; photograph P.C.H. (D) Rusty jobfish, *Aphareus rutilans*, 47 cm SL, SAIAB 45980, Recif Vailheu; photograph P.C.H. (E) Ruby snapper, *Etelis carbunculus*, 30 cm SL, SAIAB 39117, Ngazidja; photograph P.C.H. (F) *E. carbunculus*, 75 cm SL (above), *E. coruscans*, 87 cm SL below, Recif Vailheu; specimens not kept. (G) Yellowtail fusilier, *Paracaesio xanthura*, 24 cm SL, SAIAB 38880, Ngazidja; photograph P.C.H. (H) Ornate jobfish, *Pristipomoides argyrogrammicus*, 29 cm SL, SAIAB 45975, Recif Vailheu; photograph P.C.H. (I) Goldflag jobfish, *Pristipomoides auricilla*, 240 mm SL, SAIAB 45984, Recif Vailheu; photograph P.C.H. (J) Oblique-banded snapper, *Pristipomoides zonatus*, 286 mm SL, Recif Vailheu; photograph P.C.H.

bottom at 370 m. Attains 35 cm; the deep body and strong fin spines would discourage predators. Widely distributed in Indo-West Pacific region, including the Red Sea, South Africa, Oman, Philippines, Japan and Australia. Depth range 40–400 m.<sup>57</sup>

#### CIRRHITIDAE (hawkfishes)

Longsnout hawkfish, *Cirrhichthys guichenoti* Sauvage, 1880 (Fig. 9C)

We have video images of this distinctive hawkfish swimming

upside down at the front of a cave in 260 m. Previously known from Réunion and Mauritius in ~20–30 m.<sup>58</sup> Recently collected in South Africa (Aliwal Shoal south of Durban; SAIAB 62498).

#### POMACANTHIDAE (angelfishes)

Swallowtail angelfish, *Genicanthus caudovittatus* (Günther, 1860) (Fig. 9D)

We have video images of this angelfish below 100 m, and a 11 cm SL specimen (SAIAB 39606) was caught in 120–200 m.

Known from coral and rocky reefs of the Red Sea, Kenya, Mozambique, South Africa, Maldives and Mauritius. Depth range 20–200 m.<sup>59</sup>

#### CHAETODONTIDAE (butterflyfishes)

##### Coachman, *Heniochus acuminatus* (Linnaeus, 1758)

We have video images of this common coral reef species at a cave in 178 m. Widely distributed in Indo-West Pacific region, including South Africa, Mozambique, Tanzania, Kenya, Madagascar and Comoros.<sup>59</sup>

##### ?*Prognathodes* sp.

We have two poor photographs of a butterflyfish rather like *Prognathodes guezeti* in the coelacanth habitat. The snout is longer than that of *Roa* sp. and it seems to have white pelvic fins; but the body has two broad, dark brown bars narrowing ventrally; and the black eye-band seems to run ventrally below the eye, unlike that of *P. guezeti*, which curves onto the snout.

##### *Roa* sp.

This undescribed butterflyfish was photographed by J. Schauer at ~200 m. The two photographs published by Kuitert<sup>60</sup> show a white fish with two broad black bars on the body, the first bar runs from spinous dorsal fin across pectoral-fin base and extends completely over pelvic fins; second bar descends ventrally from black soft-dorsal fin base across rear end of body, caudal peduncle and curves posteriorly over rear part of anal fin; a black eye-bar extends from nape through eye to lower part of head. Margin of soft dorsal fin and base of caudal fin white; caudal fin hyaline. The colour pattern does not match any known species of butterflyfish.<sup>59,60</sup>

#### CARANGIDAE (jacks, kingfishes)

##### Black jack, *Caranx lugubris* Poey, 1860 (Fig. 9C)

We have video images of *C. lugubris* at 180 m. Attains 85 cm FL. Circumtropical, often found in deep water; known mainly from islands in 12–354 m.<sup>31,34,61</sup> This active predator was not seen in the caves.

#### POMACENTRIDAE (damselfishes)

##### ?*Chromis* sp.

We have video images of what appears to be a greyish brown species of *Chromis* at ~170 m. Most damselfish and most species of *Chromis* occur on coral reefs, but a few species of *Chromis* are known from below 100 m.<sup>62</sup>

#### LABRIDAE (wrasses)

##### ?*Coris* sp.

We have video images of a small labrid with a pale orange-brown body, 3 small white spots between dorsal fin and lateral line, black spot at centre of dorsal fin, white-edged black saddle on peduncle preceded by a vertically elongate white spot. Most wrasses occur on coral reefs, but this fish was seen near the caves in 180 m.

#### PINGUIPEDIDAE (sandsmelts)

##### *Parapercis* sp.

We have video images of a *Parapercis* sitting on sand at ~200 m. Most species of *Parapercis* occur on or near coral reefs.

#### TRIPTERYGIIDAE (triplefins)

We have video images of a tripterygiid outside the caves at ~200 m. Most tripterygiids occur on or near coral reefs.

#### CALLIONYMIDAE (dragonets)

##### ?Longtail dragonet, *Callionymus gardineri* Regan, 1908

Our photographs of this callionymid show the head and body pale grey, mottled with irregular, red, yellow and orange blotches; dorsal surface of eye balls white; caudal fin longer than 50% SL and with pale bluish spots on dorsal edge of fin. The very long caudal fin and deep habitat (previously reported from 30–180 m) are characteristic for this dragonet.<sup>63</sup> Live colours have not been reported for this species.

#### GEMPYLIDAE (snake mackerels, oilfish)

##### Sackfish, *Neoepinnula orientalis* (Gilchrist & von Bonde, 1924)

We have video images of this fish at 180–210 m. Known from 200–570 m in the Indo-Central Pacific region off South Africa, Mozambique, Tanzania, Kenya, Madagascar, Seychelles and Central Pacific region.<sup>64</sup> Attains 30 cm SL.

##### Roudi, *Promethichthys prometheus* (Cuvier, 1831) (Fig. 9I)

This species, called 'roudi' by Comoran fishermen, is the preferred bait when fishing for oilfish. Attains 100 cm SL. We caught specimens (SAIAB 39381) with hook and line at Grand Comoro in 150–200 m. The species occurs worldwide (in Eastern Pacific Ocean only at the Sala y Gomez Ridge) in depths of 100–750 m.<sup>64</sup>

##### Oilfish, *Ruvettus pretiosus* (Cocco, 1829) (Fig. 9J)

The oilfish is highly prized by the Comoran people for its medicinal properties; the local name for this species is 'nessa'. Caught at night by local fishermen with hand lines at depths of 150–500 m. Worldwide in depths of 100–700 m.<sup>64</sup> The maximum size of '3 m total length' given by Nakamura and Parin<sup>64</sup> for the oilfish is dubious; the verified maximum size is 2 m TL. Feeds on fish, squid and crustaceans. An oilfish of 1–2 m TL is a predator that would be capable of eating small coelacanths. Not seen from the submersible.

#### ?BOTHIDAE (flounders)

Video images show what appears to be a bothid fish outside the caves.

#### CYNOGLOSSIDAE (tonguefishes)

##### *Cynoglossus* sp.

Video images show a *Cynoglossus* species with two distinct, black eye-spots near the tail, one in the dorsal and one in the anal fin. This fish was photographed outside the caves. Depth ~200 m.

#### DIODONTIDAE (porcupinefishes & burrfishes)

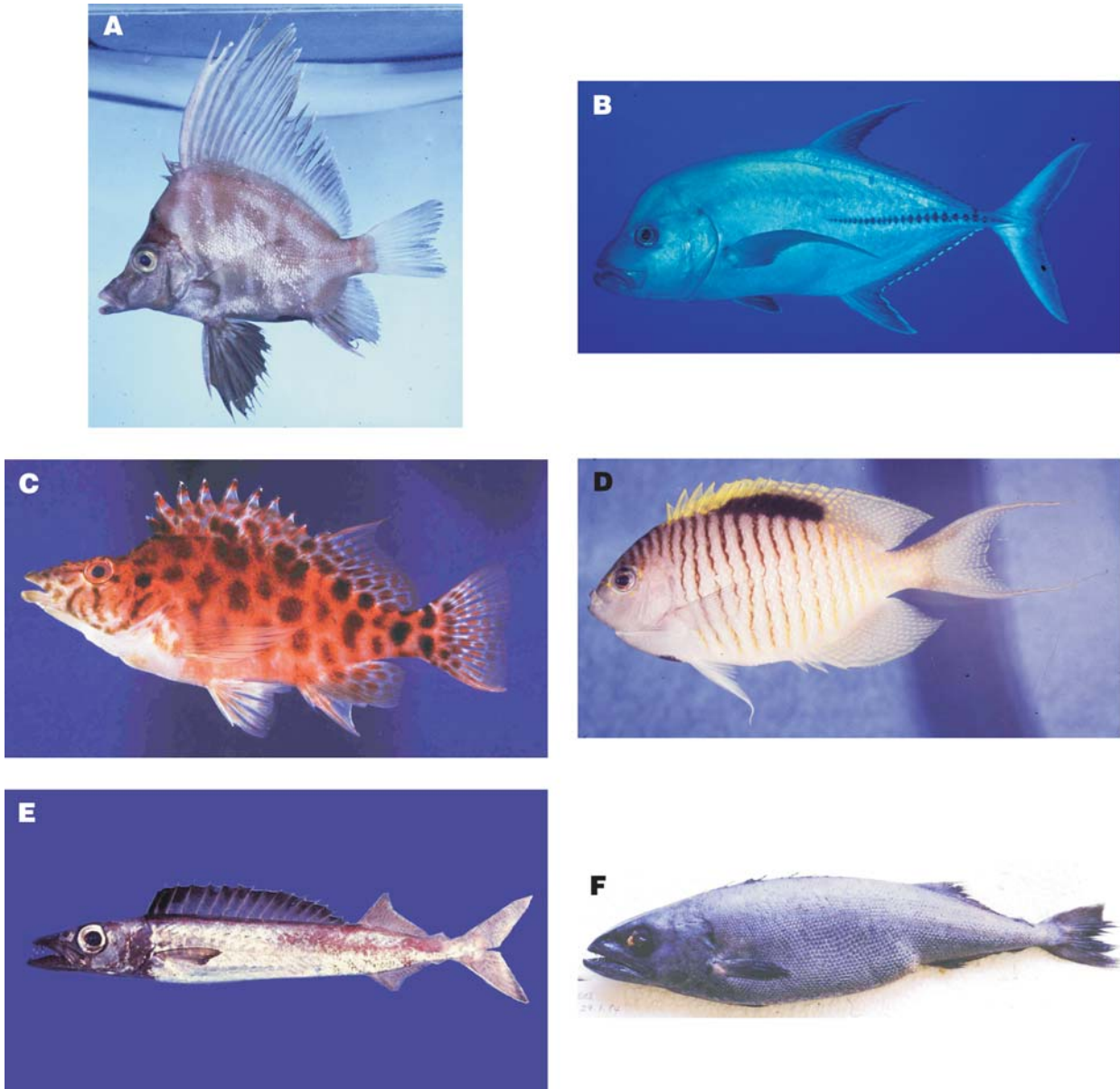
##### Spotfin burrfish, *Chilomycterus reticulatus* (Linnaeus, 1758)

A *Chilomycterus reticulatus* ~30 cm TL was videotaped at the entrance to a cave in ~140 m. The species is known worldwide in warm temperate waters.<sup>65</sup> Although few predators are able to swallow adult diodontids, small juveniles would be potential prey for a coelacanth.

#### TETRAODONTIDAE (puffers & tobies)

##### Toby, *Canthigaster* sp.

A small toby with the distinctive long snout of *Canthigaster* was videotaped at the mouth of a cave. The image was not large enough to show any details of the colour pattern. Although many tetraodontids are poisonous to cats, dogs and humans, fish predators seem immune to their toxin. This toby is a potential prey for coelacanths.



**Fig. 9.** (A) Sailfin armourhead, *Histiopertus typus*, 150 mm SL, Mozambique; photograph P.C.H. (B) Black jack, *Caranx lugubris*, Marshall Is., photograph J.E. Randall. (C) Longsnout hawkfish, *Cirrhitichthys guichenoti*, 112 mm SL, SAIAB 40434, South Africa; photograph, P.C.H. (D) Swallowtail angelfish, *Genicanthus caudovittatus*, 112 mm SL, SAIAB 39606, Ngazidja; photograph, P.C.H. (E) Roudi, *Promethichthys prometheus*, 375 mm SL, SAIAB 39381, Ngazidja; photograph, P.C.H. (F) Oilfish, *Ruvettus pretiosus*, 32 cm SL, SAIAB 25931, South Africa; photograph P.C.H.

## Discussion

Eighty-nine fish taxa were recognized from the deep demersal fish community at Ngazidja (Table 1). Our list of the deep demersal fish species at Ngazidja is obviously incomplete, as we made no attempt to collect small cryptic species (e.g. Scorpaenidae, Callionymidae, Draconettidae, Percophidae, Epigonidae, and *Plectranthias*). In addition, larger, elusive species (e.g. congrid and ophichthid eels and several species of sharks) that are known to occur at depths of 100–400 m in the Western Indian Ocean, but have not yet been seen or caught at these depths at Ngazidja, are not included in our list.

It is well known that demersal fish species diversity decreases with depth.<sup>67,68</sup> Based on fish survey work performed in the Comoros in the 1950s<sup>8,55</sup> and unpublished fish surveys carried out in the 1970s (J. McCosker), 1988 (R. Winterbottom & R. Stobbs) 1986 and 1993 (P.C. Heemstra & M.J. Smale), the number of fish species in shallow water (less than 50 m) at Ngazidja is probably about 700 to 800. Compared with the shallow-water

coral reef ecosystem, the dearth of visible or conspicuous fishes in the habitat of the Comoran coelacanths is a result of several factors. The absence of herbivores, for example parrotfish (Scaridae), surgeonfish (Acanthuridae) and most damselfish (Pomacentridae), is a result of the absence of the algae that are their principal food. The scarcity of plankton feeders, e.g. *Pseudanthias* spp. (Serranidae, subfamily Anthiinae), fusiliers (Caesionidae), damselfish (*Chromis* spp.), sweepers (Pempheridae) and sponges is a consequence of the low light levels and scarcity of plankton in this deep habitat.

Of the 71 deep demersal fish species that are potential prey for coelacanths, only eight species are known from the stomach contents of *Latimeria*. This low number of known prey species is a result of the small number of coelacanths for which stomach contents have been recorded. Ten of the fish species known from the coelacanths' habitat are possible predators of juvenile coelacanths, and 27 species are likely competitors (for food) of coelacanths.

The rarity or apparent absence in the Comoran deep demersal habitat of several large predators (*Centrophorus granulosus*, *Cirrhigaleus asper*, *Epinephelus miliaris*, *E. morrhuia*, *E. poecilonotus*, *Aphareus furca*, *A. rutilans*, *Etelis carbunculus*, *Etelis coruscans* and *Pristipomoides argyrogrammicus*), which are known from the Comoros, but were rarely (if ever) seen from the submersible, is primarily a result of the heavy fishing pressure on these highly prized fishes by the Comoran fishermen. The markedly lower catch rate at Grand Comoro (6 fish caught on 21 nights of fishing in 1972) was one-seventh of the mean catch rate at five uninhabited nearby islands in the Seychelles that were surveyed in 1969 with the same methods.<sup>18,54</sup> The dearth of large demersal fish at Ngazidja in the 1990s also contrasted with the abundance of large demersal fish at the Recif Vaillheu, a small seamount located 30 km WSW of Iconi on the southwest coast of Ngazidja. This seamount rises to within 10 m of the surface and is capped with reef corals that support an abundance of fishes. From the 1960s to 1993, little fishing was done on this shoal because it is too far for the local fishermen to paddle their small dugout canoes. In May 1993, Heemstra, Smale, S. Baxter and 8 Comoran fishermen visited the Recife Vaillheu in a 12-m motor launch. More than 20 large lutjanids and groupers and two *Carcharhinus* sharks were caught in 6 hours of fishing with hook and line.

At Ngazidja, as on many overpopulated and impoverished tropical islands in the oceans of the world, the coral reef fish community is over-exploited by local fishers.<sup>69</sup> At low tide the shallow reefs and lagoons are scoured by women with fine-mesh nets and spears for anything that moves. The Comoran fishermen fish over the reef in dugout canoes every day that the weather allows. The narrow fringing reef that surrounds the steeply sloping coast of Ngazidja is only 100–200 m wide, and it can support only a small population of reef fishes. The herbivorous or plankton-feeding fish are caught in traps and nets or speared, and the fish predators are taken with hook and line. As a result of the heavy fishing pressure, larger reef fish are rare. The low numbers of large piscivorous predators (such as sharks, oilfish, snappers and groupers) at Ngazidja may actually benefit *Latimeria* by reducing predation of their young and reducing competition for the same prey.

The majority of fish species known from the deep demersal (100–400 m) habitats of tropical and subtropical waters are widely distributed in the Indo-Pacific region, ranging from the Red Sea and east coast of Africa to Hawaii, the Great Barrier Reef, and the central Pacific.<sup>26,29–32,34,39,40,46,54,55,68</sup> In the deep demersal habitat at Ngazidja, 41 of the 65 fishes identified to species are members of this Indo-Pacific fish fauna; six species are known from the Atlantic Ocean and Indo-Central Pacific; two species occur in the Atlantic and Western Indian Ocean; 13 species are endemic to the Western Indian Ocean; eight species are of worldwide distribution; and two species (*Scyliorhinus comoroensis* and *Gymnothorax hansii*) are known only from Ngazidja; although these two endemic Comoran species are likely to be found at the other Comoran islands.

About 150 fish species are known from the shallower South African coelacanth habitat (100–200 m) in the canyons off the north coast of KwaZulu-Natal.<sup>70</sup> The South African coelacanth habitat also differs from the Ngazidja habitat in the much greater abundance of fishes in the canyons.<sup>70</sup>

Elaine Heemstra assisted with identification of fishes on the videotapes and finding pertinent literature. Kerry Sink and Sean Baxter each added another species to our collection of fishes from the deep demersal habit at Ngazidja. We thank Kate Moots for editorial assistance.

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