

Additions to the Fish Faunas of Lord Howe, Norfolk, and Kermadec Islands, Southwest Pacific Ocean¹

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ABSTRACT: Eighty-nine new fish records are reported from three subtropical island groups of the Southwest Pacific Ocean: Lord Howe (12 species), Norfolk (64), and Kermadec (13) islands. The coastal fish faunas of these islands are now reasonably well known, but further study is likely to result in discovery of additional species. Diversity of coastal fishes declines eastward, with Lord Howe having the greatest diversity and the Kermadecs the least.

THREE ISLAND GROUPS OCCUR in the subtropical belt of the Southwest Pacific Ocean: Lord Howe (31.5° S), Norfolk (29.0° S), and Kermadec (29.2–31.3° S) islands (Figure 1). The Lord Howe group (hereafter called Lord Howe) has the most tropical fauna of the three and possesses the Pacific's southernmost coral reef (Veron 1986). A reef 6 km long fringes about 25% of the Lord Howe Island coastline and encloses a large, shallow lagoon. Sixty-eight species of hermatypic corals have been recorded from the group despite their subtropical location (Veron 1986; F. J. Brook, Department of Conservation, Whangarei, New Zealand, pers. comm.).

The Norfolk group (hereafter called Norfolk) consists of Norfolk, Nepean, and Phillip islands. Their coastlines are mainly rocky, but a coral reef 1 km long fringes about 3% of the Norfolk Island coastline and encloses a small lagoon. Thirty-nine species of hermatypic corals have been recorded (F. J. Brook, pers. comm.).

The Kermadec group (hereafter called the Kermadecs) consists of a chain of islands spread over about 250 km of ocean (Francis et al. 1987). Coral reefs are not present, but hermatypic coral colonies are common (Schiell et al. 1986). Only 14 species of hermatypic corals are known from the Kermadecs (F. J. Brook, pers. comm.), although this number is likely to increase with further collecting.

The fish faunas of all three island groups have been studied recently. Species lists exist for Lord Howe (Allen et al. 1976), Norfolk (Hermes 1986), and the Kermadecs (Paulin and Stewart 1985, Francis et al. 1987). The effort expended in collecting and observing fishes has varied considerably among the three groups, as have the methods used for compiling species lists. Fish diversity and the number of tropical species are greatest at Lord Howe and decrease eastward, paralleling the trends in coral diversity and reef development.

The purpose of this paper is to report new fish records resulting from recent visits to the three island groups.

METHODS

To facilitate faunal comparisons, discussions of species diversity are restricted to coastal fishes. They are defined here as those species likely to be encountered within 1 km of land and 50 m of the surface. This definition includes neritic pelagic species, but not oceanic pelagics. The numbers of coastal fishes reported here on the basis of lists provided by other authors do not always agree with their counts, because of the different criteria adopted and the subjectivity involved in deciding whether or not to include some species. Identical criteria have been used for all three island groups in this paper.

The new records reported here come from a variety of sources. Lord Howe records are based mainly on my underwater photographs

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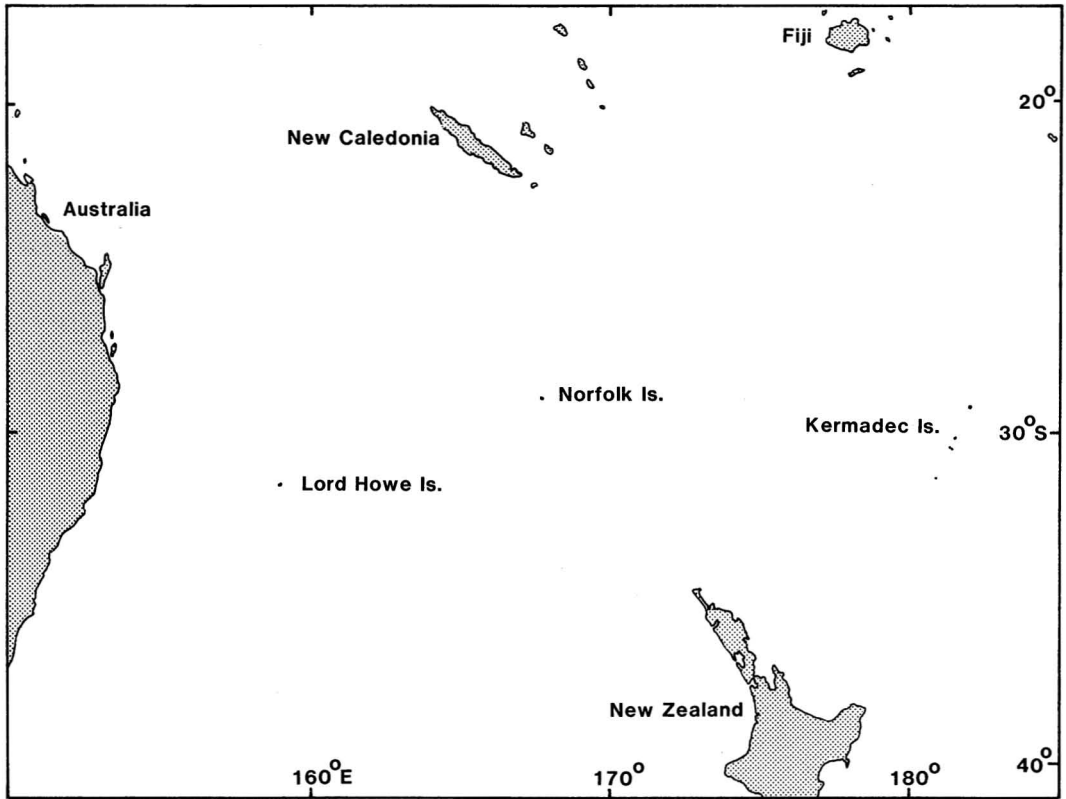


FIGURE 1. Map of the Southwest Pacific Ocean showing the subtropical location of Lord Howe, Norfolk, and Kermadec islands.

and sightings during the periods of 30 June–6 July 1988 and 24 May–3 June 1989. Norfolk records are based on (1) photographs and sightings made by me and M. Williams in the Kingston Lagoon during the period of 9–12 July 1988; (2) photographs and sightings made throughout Norfolk and Nepean islands by me, J. E. Randall (Bishop Museum, Honolulu), and five other divers during 11–26 November 1989; and (3) photographs and sightings provided by Norfolk residents. Kermadecs records are based mainly on photographs and videotape provided by M. Fraser, a staff member of the New Zealand Meteorological Service based on Raoul Island from October 1987 to September 1988.

Sightings were only regarded as valid if the species involved is unlikely to have been confused with other similar species. Unless other-

wise stated, photographic and sight records were made by me.

Many of the new Norfolk records are based on fish caught and photographed by B. McCoy, a Norfolk resident. None of his specimens were retained, and in most cases collection data are unavailable.

NEW RECORDS

Eighty-nine new fish records are reported here: 12 from Lord Howe, 64 from Norfolk, and 13 from the Kermadecs. Six species are recorded from two of the island groups. Of the new records, 85 are coastal fishes (Table 1). Sixty-seven of the new records are based on color photographs reproduced here. This total includes specimens held in private or uncurated collections, which were photo-

TABLE 1
RECORDS OF COASTAL FISHES FROM LORD HOWE,
NORFOLK, AND THE KERMADEC ISLANDS

	NUMBER OF COASTAL FISHES		
	PREVIOUSLY REPORTED	NEW RECORDS	TOTAL
Lord Howe group	388 ^a	12	399
Norfolk group	162 ^b	60	218
Kermadec group	118 ^c	13	123

NOTE: Totals incorporate recent taxonomic revisions of some fish families and reidentification of some existing specimens. Only species identified to at least generic level are included.

^a Allen et al. (1976).

^b Hermes (1986).

^c Paulin and Stewart (1985) and Francis et al. (1987).

graphed and treated as photographic records. Three of the new records are based on photographs whose quality is too poor for reproduction (but they may be examined on request to the author), and two others are based on video or movie film. Eight of the new records are based on specimens that have been deposited in the National Museum of New Zealand, Wellington (NMNZ), and Bishop Museum, Honolulu (BPBM). The remaining nine records are based on underwater sightings.

LORD HOWE GROUP

OPHICHTHIDAE

Leiuranus semicinctus (Lay & Bennett, 1839)

One specimen, 72 cm total length, in formalin in Lord Howe Island Museum (Figure 2). No collection data available. Widespread in the tropical Indo-Pacific.

HOLOCENTRIDAE

Sargocentron rubrum (Forsskål, 1775)

One seen under a ledge at 2 m depth at Far Rocks in the main lagoon (Plate IA). Widespread in the tropical Indo-West Pacific.

LUTJANIDAE

Lutjanus quinquelineatus (Bloch, 1790)

One seen at 2 m depth at Sylph's Hole (Plate IB). Widespread in the tropical Indo-West Pacific.

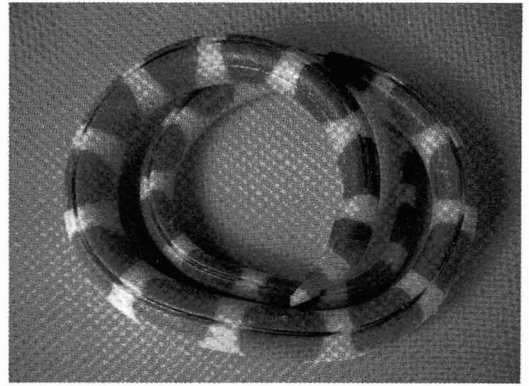


FIGURE 2. *Leiuranus semicinctus* (Photo: M. P. Francis).

HAEMULIDAE

Plectorhinchus schotaf (Forsskål, 1775)

Three seen at 8 m depth off Middle Beach (Plate IC). Photograph identified by R. J. McKay (Queensland Museum, Brisbane). Two also photographed by J. Deacon at Tenth of June Island. Widespread in the tropical Indo-West Pacific.

KYPHOSIDAE

Kyphosus cinerascens (Forsskål, 1775)

Three seen at 2 m depth at Ned's Beach. Identified by the height of the soft dorsal fin, which significantly exceeded the height of the spiny dorsal fin (Myers 1989). Widespread in the tropical Indo-West Pacific.

Kyphosus sydneyanus (Günther, 1886)

Large school seen at 1–3 m depth off King's Beach in the main lagoon (Plate ID). Also known from Norfolk, southern Australia, and northern New Zealand.

POMACANTHIDAE

Pomacanthus imperator (Bloch, 1787)

One seen by K. Ryan at 27–30 m depth at North Islet (Plate IE). Widespread in the tropical Indo-West Pacific.

POMACENTRIDAE

Abudefduf bengalensis (Bloch, 1787)

One seen at 1 m depth at Far Rocks in the main lagoon and another at 1 m at Ned's

Beach. Identified by their shape and color (Allen 1975). Widespread in the tropical Indo-West Pacific.

Dascyllus reticulatus (Richardson, 1846)

One seen on an *Acropora* plate at 20 m depth at Noddy Island. Identified by its shape and color (Allen 1975). Widespread in the tropical Indo-West Pacific.

CHEILODACTYLIDAE

Cheilodactylus fuscus Castelnau, 1879

One seen on two consecutive days (probably the same individual) at 2–3 m depth at Ned's Beach. Identified by its shape and color (Coleman 1983). Also known from southeastern Australia and (rarely) northeastern New Zealand.

ACANTHURIDAE

Prionurus microlepidotus (Lacepède, 1804)

Five seen at 8 m depth off Middle Beach (Plate IF). Otherwise known only from eastern Australia.

OSTRACIIDAE

Lactoria diaphana (Bloch & Schneider, 1801)

Two specimens in Lord Howe Island Museum, one in formalin (43 mm SL, Figure 3) and one dried (78 mm SL). No collection data available. Widespread in the tropical Indo-Pacific.

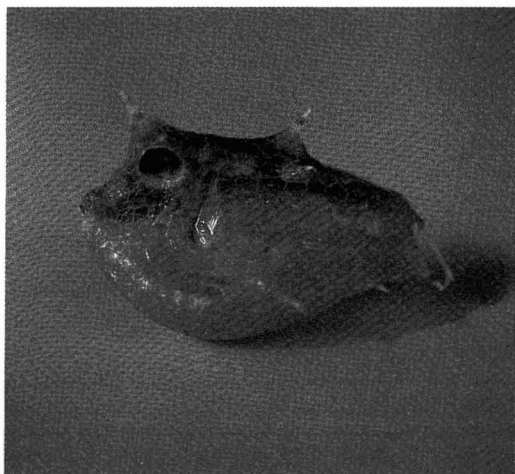


FIGURE 3. *Lactoria diaphana* (Photo: M. P. Francis).

NORFOLK GROUP

MYLIOBATIDAE

Myliobatis tenuicaudatus Hector, 1877

Seen regularly in Kingston Lagoon (Plate IIA). Also known from the Kermadecs and northern New Zealand. Possibly conspecific with *M. australis* Macleay, 1881, from southern Australia.

DASYATIDAE

Taeniura melanospila Bleeker, 1853

One seen at 15 m depth at Fig Valley, one at 17 m at Nepean Island (Plate IIB), and one at 1 m at Kingston wharf. Widespread in the tropical Indo-West Pacific.

MURAENIDAE

Echidna nebulosa (Thunberg, 1789)

One seen regularly by J. Marges at 3 m depth in Kingston Lagoon throughout 1988–1989 (Figure 4). Widespread in the tropical Indo-Pacific.

Enchelycore ramosus (Griffin, 1926)

One seen at 13 m depth at Nepean Island (Plate IIC) and another at 22 m in Duncombe Bay. Occurs in the subtropical South Pacific from eastern Australia to Easter Island.

CONGRIDAE

Conger wilsoni (Bloch & Schneider, 1801)

One seen at night at 2 m depth in Kingston Lagoon (Figure 5). Photographs identified by P. H. J. Castle (Victoria University of Wellington). Occurs from southern Africa to New Zealand in subtropical and warm temperate waters.

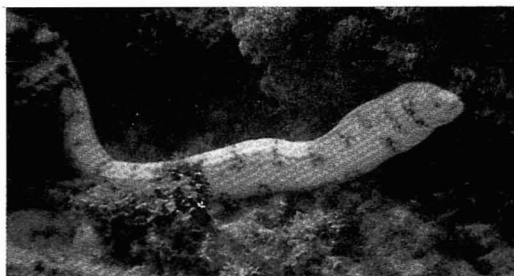


FIGURE 4. *Echidna nebulosa* (Photo: J. Marges).

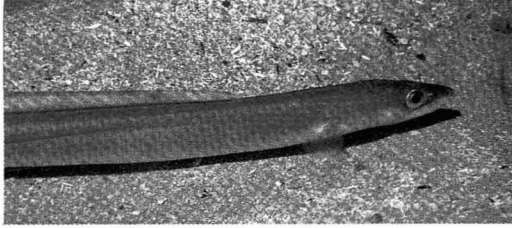


FIGURE 5. *Conger wilsoni* (night) (Photo: M. P. Francis).

OPHICHTHIDAE

Leiuranus semicinctus (Lay & Bennett, 1839)

One seen by M. Williams at 2 m depth in Kingston Lagoon (Plate IID). Widespread in the tropical Indo-Pacific.

SYNODONTIDAE

Synodus similis McCulloch, 1921

One collected at 16 m depth in Duncombe Bay (143 mm SL, NMNZ P.24534). The specimen agrees with Cressey's (1981) description except that the pectoral fin falls short of a line drawn between the pelvic and dorsal fin origins. Note also that Cressey's description of the palatine teeth (p. 38) is incorrect, though the correct tooth pattern is reported in the key (p. 4) (R. Cressey, National Museum of Natural History, Washington D.C., pers. comm.). Also identified by color (Francis 1988). Occurs from eastern Australia to Rapa Island in subtropical waters.

GONORYNCHIDAE

Gonorynchus greyi (Richardson, 1845)

One collected at night at 2 m depth in Kingston Lagoon (180 mm SL, NMNZ P.24535). Distinguished from *G. forsteri* Ogilby, 1911, the only other congener found in Australasia, by its low lateral line scale count (175 versus > 190 for *G. forsteri*). Identified by C. Ferraris (American Museum of Natural History, New York). Also known from Australia, Lord Howe, the Kermadecs, and northern New Zealand.

ANTENNARIIDAE

Antennarius pictus (Shaw & Nodder, 1794)

Photograph taken by D. Greenwood of specimen washed ashore after storm at Cas-

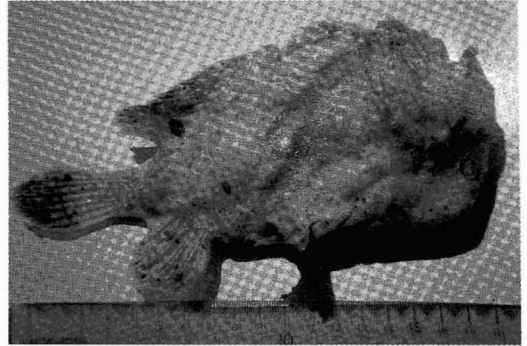


FIGURE 6. *Antennarius pictus* (Photo: D. Greenwood).

cade wharf in July 1987 (Figure 6). Photograph identified by T. W. Pietsch (University of Washington, Seattle). Widespread in the tropical Indo-West Pacific.

HEMIRAMPHIDAE

Euleptorhamphus viridis (van Hasselt, 1823)

One collected by O. and B. Evans under a white tern nest (Figure 7); specimen not kept. Widespread in the tropical and subtropical Indo-Pacific.

BERYCIDAE

Centroberyx affinis (Günther, 1859)

Photographs taken by B. McCoy of three fish caught 7 km south of Phillip Island, September 1987 (one shown in Figure 8). Also known from the Kermadecs, Australia, New Caledonia, and New Zealand.

SCORPAENIDAE

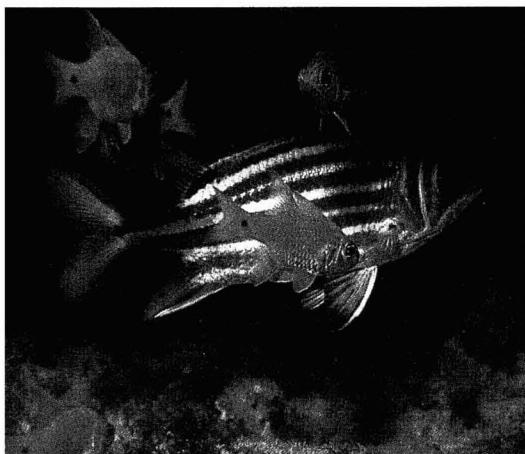
Ablabys taenianotus (Cuvier, 1829)

One collected at 2 m depth in Kingston Lagoon (NMNZ P.24462). Identified by S. G. Poss (Gulf Coast Research Laboratory Museum, Ocean Springs, Mississippi). Widespread in the tropical Indo-West Pacific.

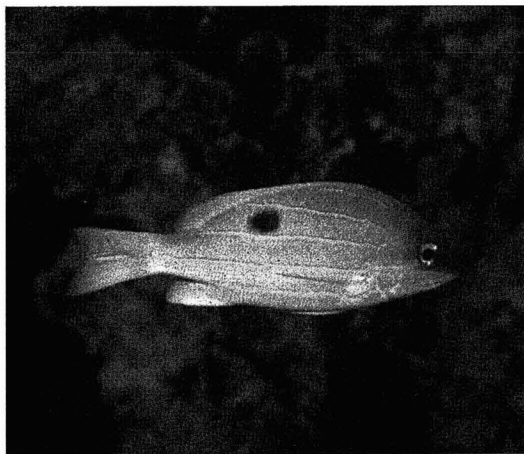
SERRANIDAE

Caprodon ?krasyukovae Kharin, 1983

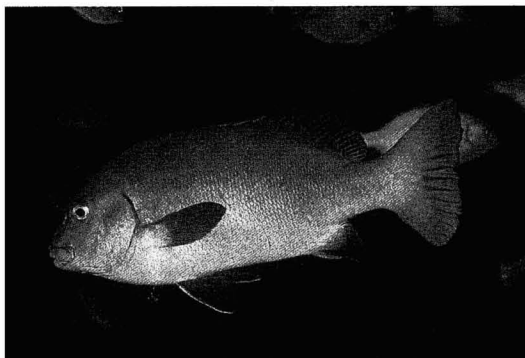
I tentatively identify as this species a fish photographed by B. McCoy (Figure 9). This fish differs from *C. longimanus* (Günther, 1859), which is common at the Kermadecs and in northern New Zealand, in having



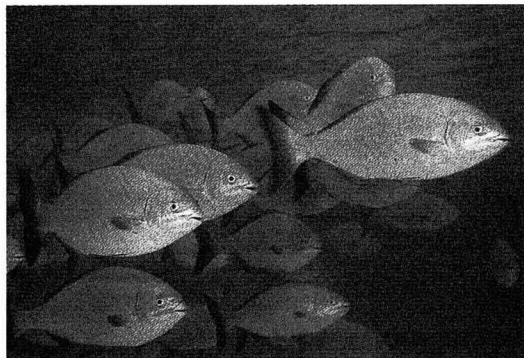
A. *Sargocentron rubrum* (Photo: M. P. Francis).



B. *Lutjanus quinquelineatus* (Photo: M. P. Francis).



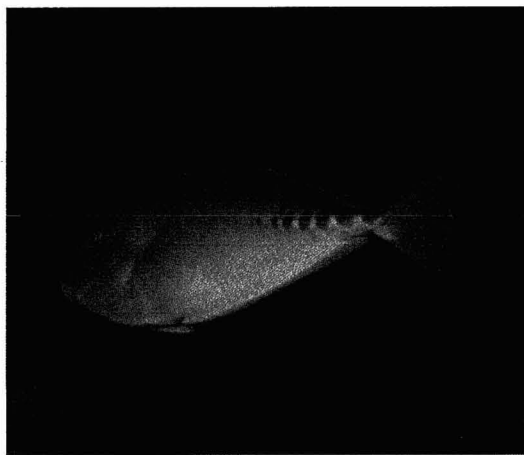
C. *Plectorhinchus schotaf* (Photo: M. P. Francis).



D. *Kyphosus sydneyanus* (Photo: M. P. Francis).



E. *Pomacanthus imperator* (Photo: K. Ryan).

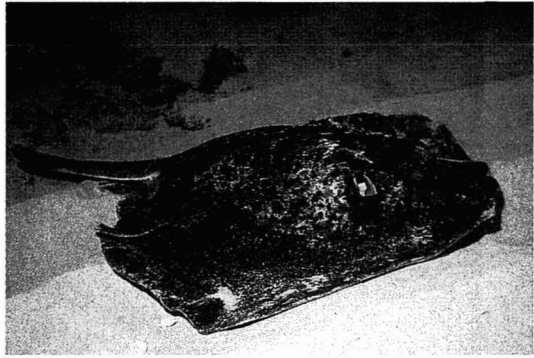


F. *Prionurus microlepidotus* (Photo: M. P. Francis).

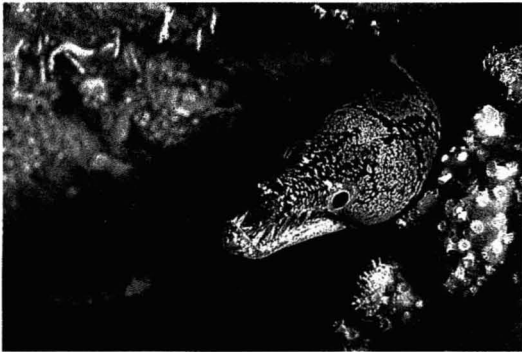
Plate II



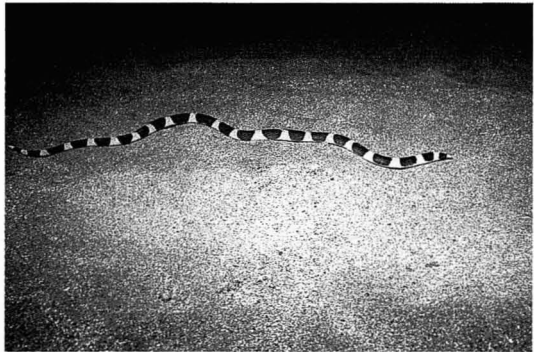
A. *Myliobatis tenuicaudatus* (Photo: J. E. Randall).



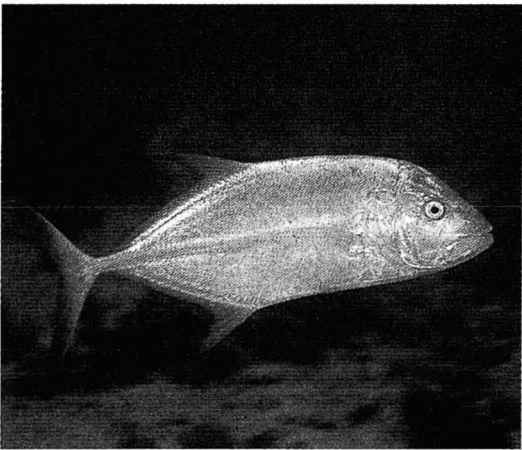
B. *Taeniura melanospila* (Photo: M. P. Francis).



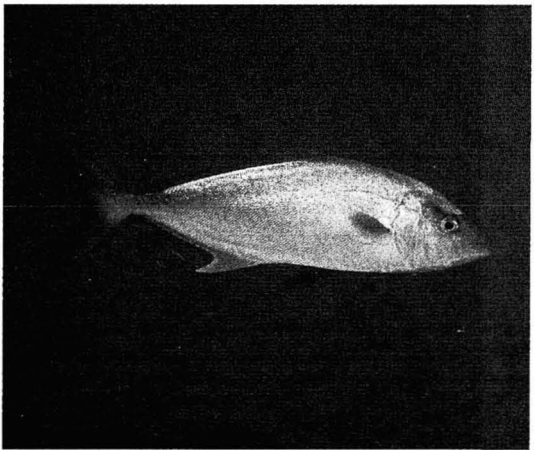
C. *Enchelycore ramosus* (Photo: M. P. Francis).



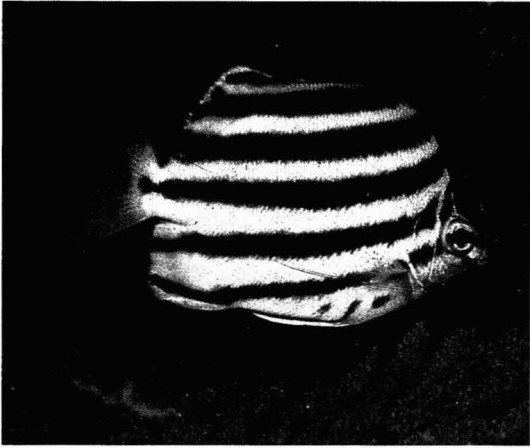
D. *Leiuranus semicinctus* (Photo: M. W. Williams).



E. *Caranx melampygus* (Photo: M. P. Francis).



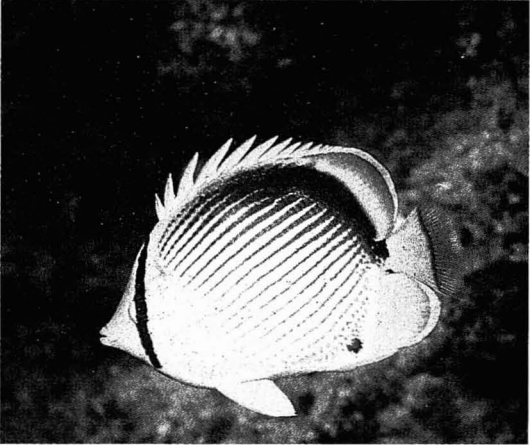
F. *Seriola rivoliana* (Photo: C. Wilson).



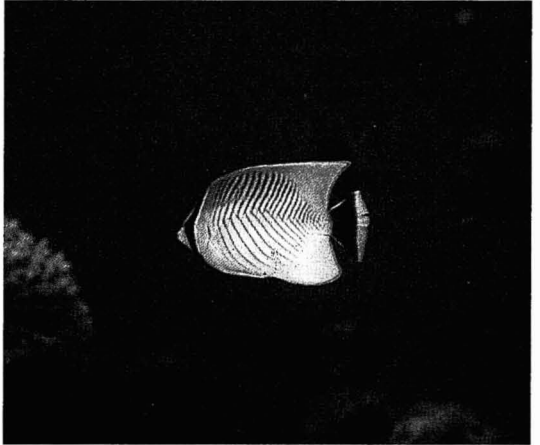
A. *Microcanthus strigatus* (Photo: M. P. Francis).



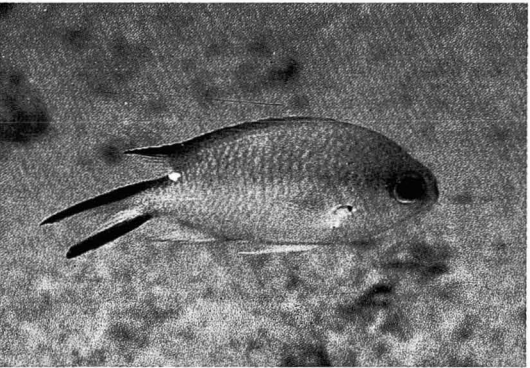
B. *Platax teira* (Photo: M. P. Francis).



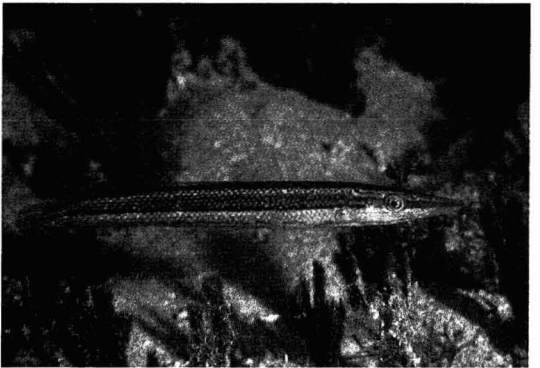
C. *Chaetodon melannotus* (Photo: M. P. Francis).



D. *Chaetodon trifascialis* (Photo: M. P. Francis).

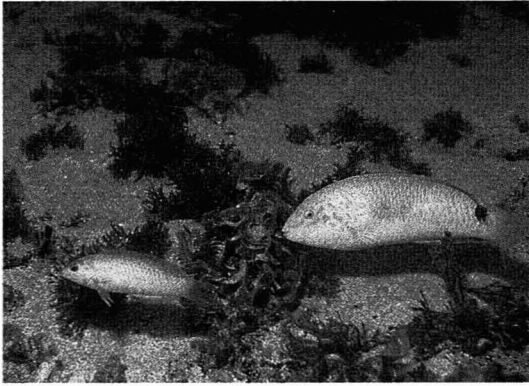


E. *Chromis fumea* (Photo: M. P. Francis).

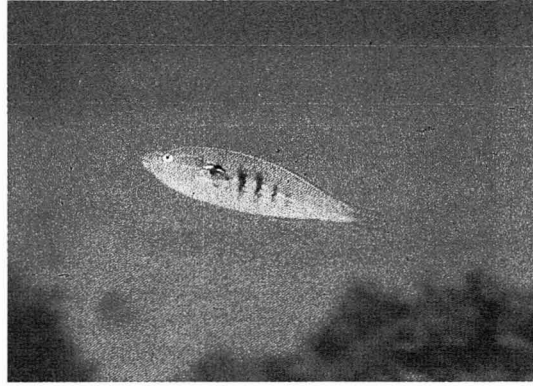


F. *Cheilio inermis* (initial phase) (Photo J. E. Randall).

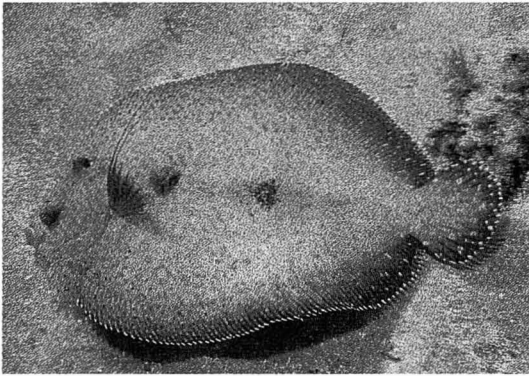
Plate IV



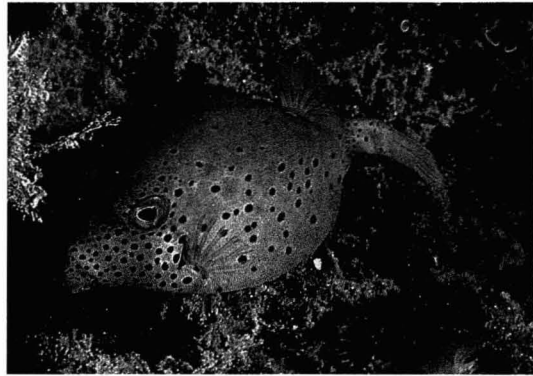
A. *Halichoeres trimaculatus* (left, initial phase; right, terminal phase) (Photo: M. P. Francis).



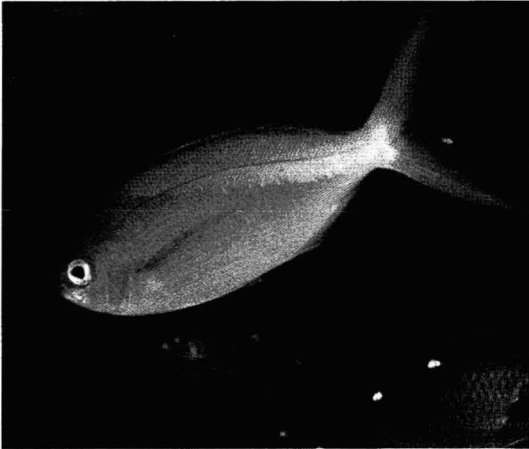
B. *Stethojulis maculatus* (terminal phase) (Photo: M. P. Francis).



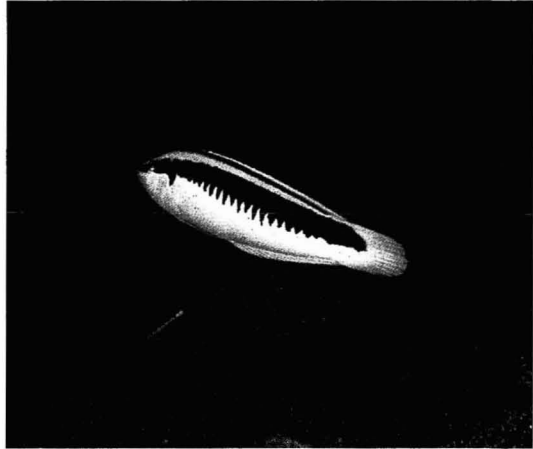
C. *Bothus mancus* (Photo: M. P. Francis).



D. *Ostracion cubicus* (Photo: J. E. Randall).



E. *Paracaesio xanthura* (Photo: M. P. Francis).



F. *Coris picta* (Photo: M. Fraser).

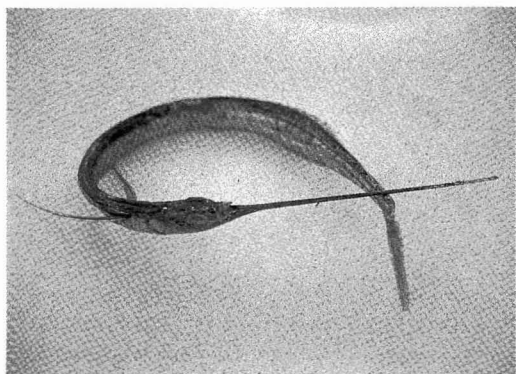


FIGURE 7. *Euleptorhamphus viridis* (Photo: M. P. Francis).

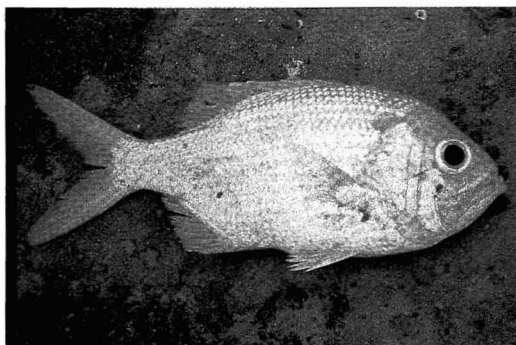


FIGURE 8. *Centroberyx affinis* (Photo: B. McCoy).

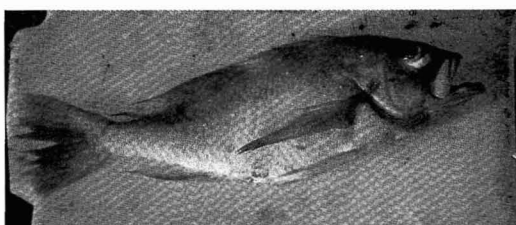


FIGURE 9. *Caprodon?krasyukovae* (Photo: B. McCoy).

elongated posterior dorsal and anal rays that reach the origin of the caudal, and an irregularly shaped posterior margin of the caudal fin. *Caprodon longimanus* has short dorsal and anal rays and an emarginate caudal (Francis 1988). *Caprodon krasyukovae* is known only from the holotype caught on the Lord Howe

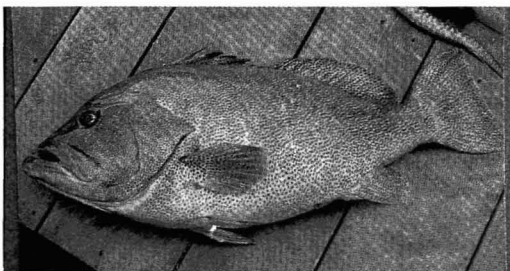


FIGURE 10. *Epinephelus cyanopodus* (Photo: B. McCoy).

Rise (Kharin and Dudarev 1983), and it appears to have a damaged tail. A revision of the genus and collection of Norfolk specimens are required before a definite identification is possible.

Epinephelus cyanopodus (Richardson, 1846)

Photograph taken by B. McCoy (Figure 10). Photograph identified by J. E. Randall. Widespread in the tropical West Pacific.

Pseudanthias pictilis (Randall & Allen, 1978)

One initial phase specimen collected by J. E. Randall at 25 m depth in Ball Bay (60 mm SL, BPBM 34251). At least two others seen at the same locality. Also known from Lord Howe, New Caledonia, and eastern Australia.

Pseudanthias squamipinnis (Peters, 1855)

One initial phase fish seen by J. E. Randall at 25 m depth in Ball Bay. Identified by its shape and color (Myers 1989). Widespread in the tropical and subtropical Indo-West Pacific.

APOGONIDAE

Apogon kallopterus Bleeker, 1878

Two seen by J. E. Randall at 2 m depth in Kingston Lagoon (Figure 11). Widespread in the tropical Indo-West Pacific.

CARANGIDAE

Caranx melampygus Cuvier, 1833

Two seen on three consecutive days at 2 m depth in Kingston Lagoon (Plate IIE). Widespread in the tropical Indo-Pacific.



FIGURE 11. *Apogon kallopterus* (night) (Photo: J. E. Randall).

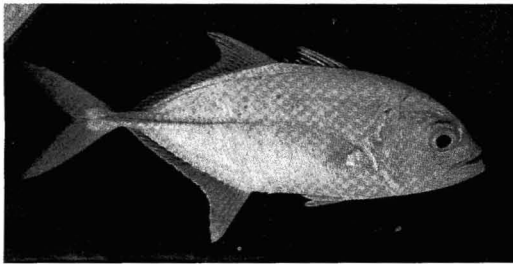


FIGURE 12. *Caranx sexfasciatus* (Photo: B. McCoy).



FIGURE 13. *Elagatis bipinnulatus* (Photo: B. McCoy).

Caranx sexfasciatus Quoy & Gaimard, 1825

Photograph taken by B. McCoy (Figure 12). Photograph identified by W. F. Smith-Vaniz (Academy of Natural Sciences, Philadelphia). Widespread in the tropical Indo-Pacific.

Elagatis bipinnulatus (Quoy & Gaimard, 1825)

Photograph taken by B. McCoy (Figure 13). About 10 fish seen in a school of *Seriola lalandi* Valenciennes, 1833, at 18 m depth



FIGURE 14. *Naucrates ductor* (Photo: B. McCoy).

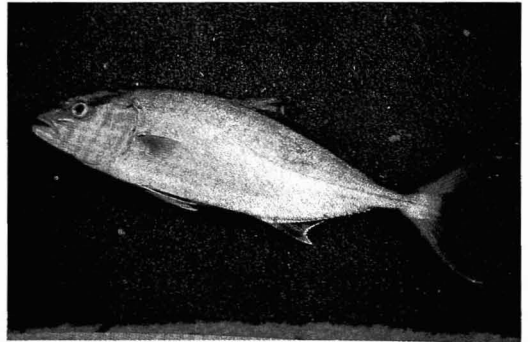


FIGURE 15. *Seriola dumerili* (Photo: B. McCoy).

in Duncombe Bay. Worldwide in tropical waters.

Naucrates ductor (Linnaeus, 1758)

Photograph taken by B. McCoy of fish caught off Kingston wharf in April 1978 (Figure 14). Worldwide in tropical waters.

Seriola dumerili (Risso, 1810)

Photograph taken by B. McCoy (Figure 15). Photograph identified by W. F. Smith-Vaniz. Worldwide in tropical and subtropical waters.

Seriola hippos Günther, 1876

Photograph taken by B. McCoy (Figure 16). Photograph identified by W. F. Smith-Vaniz. Occurs in subtropical and temperate waters of Australia and New Zealand.

Seriola rivoliana Valenciennes, 1833

Two seen by C. Wilson in Duncombe Bay (Plate IIF). Photograph identified by W. F. Smith-Vaniz. Worldwide in tropical and subtropical waters.

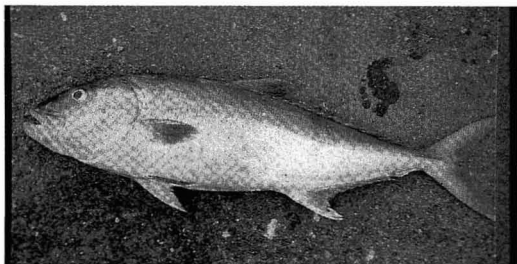


FIGURE 16. *Seriola hippos* (Photo: B. McCoy).

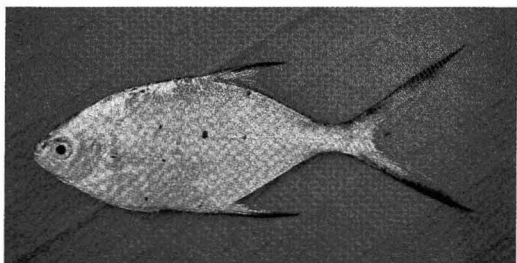


FIGURE 17. *Trachinotus baillonii* (Photo: B. McCoy).

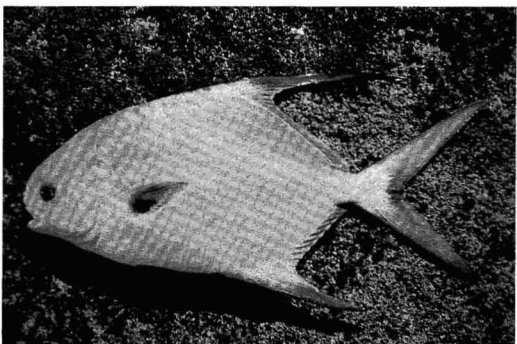


FIGURE 18. *Trachinotus blochii* (Photo: B. McCoy).

Trachinotus baillonii (Lacepède, 1801)

Photograph taken by B. McCoy of fish caught in Cemetery Bay, February 1977 (Figure 17). Widespread in the tropical Indo-Pacific.

Trachinotus blochii (Lacepède, 1801)

Photograph taken by B. McCoy of fish caught in Kingston Lagoon, April 1980 (Figure 18). Two fish also regularly seen by J.

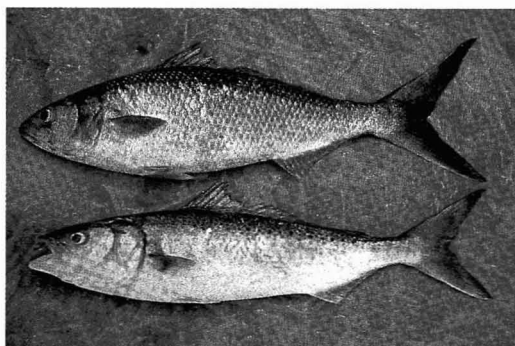


FIGURE 19. *Arripis?esper* (top) and *A. trutta* (bottom) (Photo: B. McCoy).

Marges in Kingston Lagoon between July 1986 and mid-1989. Widespread in the tropical Indo-West Pacific.

ARRIPIDAE

Arripis?esper Whitley, 1951

I tentatively identify as this species a fish photographed by B. McCoy (Figure 19, upper fish). It differs from *A. trutta* (Bloch & Schneider, 1801) (Figure 19, lower fish) in having a longer caudal fin, larger eye, maxilla almost reaching the rear margin of the eye (cf. reaching the middle of the eye), and color pattern (the former lacks black spots). Morphometric differences between the species are given by Paulin et al. (1989). Also known from the Kermadecs and northern New Zealand; possibly more widespread in Australasia.

CAESIONIDAE

Pterocaesio digramma (Bleeker, 1865)

Photograph taken by B. McCoy (Figure 20). Photograph identified by K. E. Carpenter (Kuwait Institute for Scientific Research, Kuwait). Widespread in the tropical West Pacific.

LUTJANIDAE

Lutjanus kasmira (Forsskål, 1775)

Photograph taken by B. McCoy (Figure 21). Another fish seen regularly by J. Marges at 2 m depth in Kingston Lagoon between July 1986 and late 1988 and a large school reported in Duncombe Bay in 1990. Widespread in the tropical Indo-Pacific.



FIGURE 20. *Pterocaesio digramma* (Photo: B. McCoy).

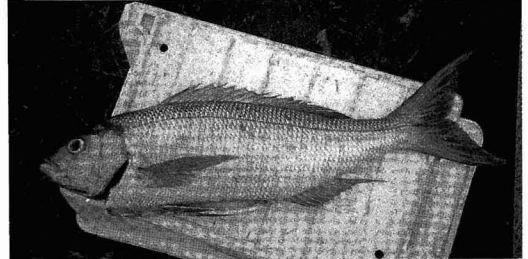


FIGURE 23. *Pristipomoides ?filamentosus* (Photo: B. McCoy).

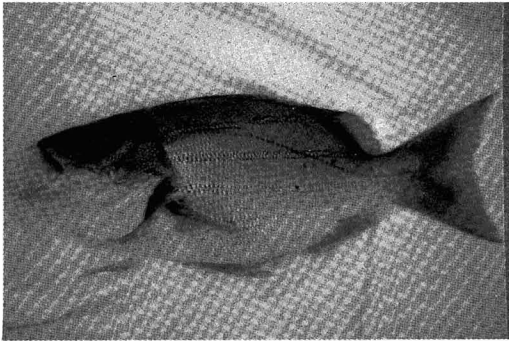


FIGURE 21. *Lutjanus kasmira* (Photo: B. McCoy).

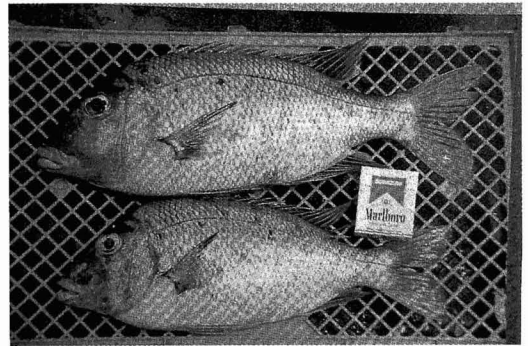


FIGURE 24. *Gymnocranius euanus* (Photo: B. McCoy).

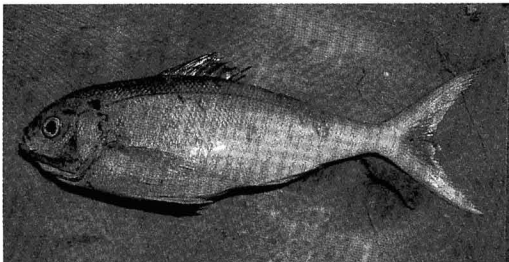


FIGURE 22. *Paracaesio xanthura* (Photo: B. McCoy).

Paracaesio xanthura (Bleeker, 1869)

Photograph taken by B. McCoy of fish caught in Duncombe Bay, December 1980 (Figure 22). Widespread in the tropical Indo-West Pacific.

Pristipomoides ?filamentosus (Valenciennes, 1830)

One photograph taken by B. McCoy (Figure 23), and another taken by L. Quintal of fish caught in May 1989. Photographs tenta-

tively identified by G. R. Allen (Western Australian Museum, Perth) and W. D. Anderson (Grice Marine Biological Laboratory, Charleston), respectively. Widespread in the tropical Indo-West Pacific.

LETHRINIDAE

Gymnocranius euanus Günther, 1879

Photographs taken by B. McCoy of three fish (Figure 24 shows two of them). Photographs identified by G. R. Allen. Widespread in the tropical West Pacific.

MULLIDAE

Parupeneus spilurus (Bleeker, 1854)

Common at 0–5 m depth in Kingston Lagoon (Figure 25). Reported by most authors as *P. signatus* (Günther, 1867), a junior synonym (J. E. Randall, pers. comm.). Widespread in the West Pacific.



FIGURE 25. *Parupeneus spilurus* (Photo: M. P. Francis).

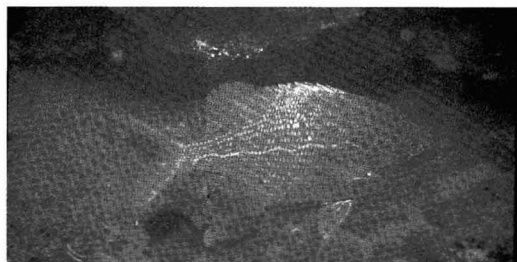


FIGURE 26. *Kyphosus cinerascens* (Photo: M. P. Francis).

Upeneus sp.

Ten specimens of an undescribed species of *Upeneus* were collected from large schools at 20 m depth in Duncombe Bay (46–62 mm SL, BPBM 34254, 34256). The species is close to *U. bensasi* (Temminck & Schlegel, 1844) but differs in having significantly higher gill raker counts. It will be described by J. E. Randall and P. Guézé. Probably the same species as fish photographed at the Kermadecs (see below) and reported from northern New Zealand as *U. bensasi* by Russell and Ayling (1976).

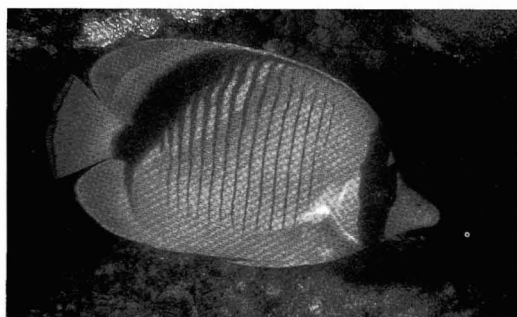


FIGURE 27. *Chaetodon lineolatus* (Photo: J. E. Randall).

PEMPHERIDIDAE

Parapriacanthus ransonneti Steindachner, 1870

Two fish collected from very large school at 20 m depth in Duncombe Bay (55 mm and 56 mm SL, NMNZ P.24537). Widespread in the tropical West Pacific.

KYPHOSIDAE

Kyphosus cinerascens (Forsskål, 1775)

One seen at 16 m depth at Nepean Island (Figure 26). Widespread in the tropical Indo-West Pacific.

MICROCANTHIDAE

Microcanthus strigatus (Cuvier, 1831)

Three seen at 0.5–1 m depth in Kingston Lagoon (Plate IIIA). Also known from Lord Howe, Australia, New Caledonia, and perhaps other Southwest Pacific localities.

EPHIPPIDAE

Platax teira (Forsskål, 1775)

One caught in Cascade Bay in January 1988 on display in Coral Reef Oceanarium in November 1989 (Plate IIIB). A school of 10–12 also seen by M. Christian and M. Davis at 16 m depth at Nepean Island. Widespread in the tropical Indo-West Pacific.

CHAETODONTIDAE

Chaetodon lineolatus Cuvier, 1831

One seen regularly under an *Acropora* plate at 1 m depth in Kingston Lagoon in 1988–1989 (Figure 27). Widespread in the tropical Indo-West Pacific.

Chaetodon melannotus Bloch & Schneider, 1801

Several seen at 2–3 m depth in Kingston Lagoon (Plate IIIC). Widespread in the tropical Indo-West Pacific.



FIGURE 28. *Heniochus monoceros* (Photo: M. P. Francis).

Chaetodon trifascialis Quoy & Gaimard, 1825

Three seen at 1–3 m depth in Kingston Lagoon (Plate IIID). Widespread in the tropical Indo-Pacific.

Chaetodon trifasciatus Park, 1797

One seen at 2 m depth in Kingston Lagoon. Identified by its shape and color (Myers 1989). Widespread in the tropical Indo-West Pacific.

Heniochus monoceros Cuvier, 1831

One seen regularly at 2 m depth in Kingston Lagoon in 1988–1989 (Figure 28) and another at 18 m in Duncombe Bay. Widespread in the tropical Indo-Pacific.

POMACANTHIDAE

Chaetodontoplus conspicillatus (Waite, 1900)

One seen several times by J. Marges and other Norfolk Island divers in Anson Bay during 1988–1989. Photograph available on request. Also known from Lord Howe, eastern Australia, and New Caledonia.

PENTACEROTIDAE

Evistias acutirostris (Temminck & Schlegel, 1844)

One seen by K. Coop. Identified by its shape and color (Francis 1988). Also known from Lord Howe and the Kermadecs. Scattered antitropical distribution in the West

Pacific (i.e., occurs in northern and southern hemispheres *outside* the tropics).

POMACENTRIDAE

Chromis flavomaculata Kamohara, 1960

One collected from a group of four at 9 m depth in Duncombe Bay (27 mm SL, NMNZ P.24538). Specimen identified by J. E. Randall; it agrees with Allen's (1975) description except that it has 15 tubed lateral line scales instead of 17–18. Another fish seen at 20 m in Duncombe Bay. Antitropical in the West Pacific.

Chromis fumea (Tanaka, 1917)

Common at 0–5 m depth in Kingston Lagoon (Plate IIIE). This is probably the species reported as "*Chromis n. sp.*" by Hermes (1986). Occurs in scattered West Pacific localities, plus Western Australia.

Plectroglyphidodon johnstonianus Fowler & Ball, 1924

One collected at 11 m depth in Duncombe Bay (54 mm SL, NMNZ P.24539). Specimen identified by J. E. Randall. Four others seen at 10–23 m off Fig Valley and in Duncombe Bay. Widespread in the tropical Indo-West Pacific.

CHEILODACTYLIDAE

Nemadactylus macropterus (Bloch & Schneider, 1801)

Photograph taken by B. McCoy (Figure 29). Widespread in the temperate Indo-West Pacific.

LABRIDAE

Bodianus perditio (Quoy & Gaimard, 1834)

Photograph taken by B. McCoy of fish



FIGURE 29. *Nemadactylus macropterus* (Photo: B. McCoy).

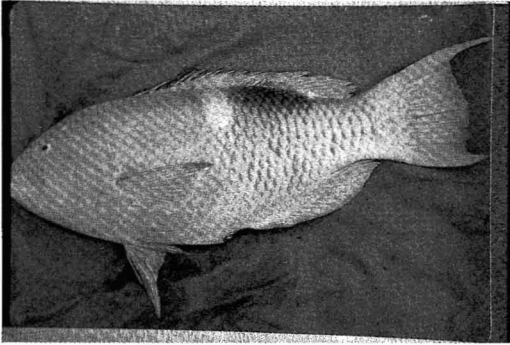


FIGURE 30. *Bodianus perditio* (Photo: B. McCoy).

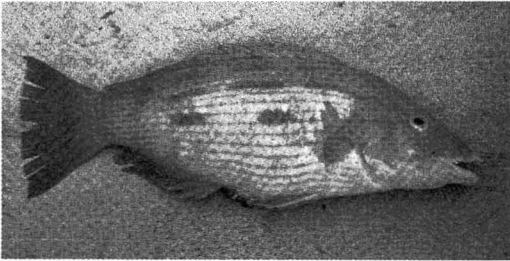


FIGURE 31. *Bodianus vulpinus* (initial phase) (Photo: B. McCoy).

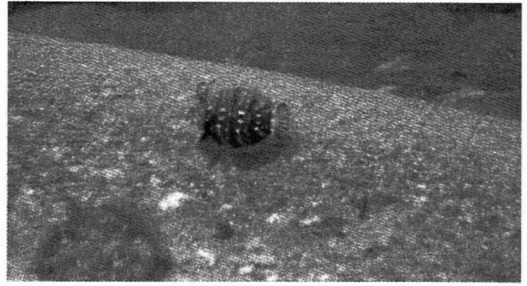


FIGURE 32. *Novaculichthys taeniourus* (Photo: M. P. Francis).

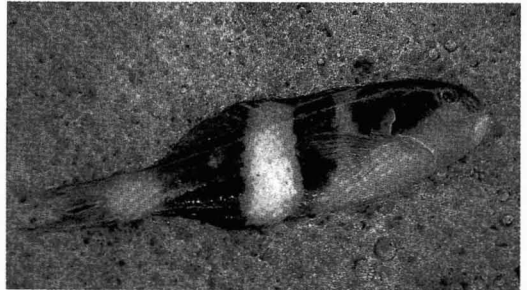


FIGURE 33. *Thalassoma janseni* (Photo: B. McCoy).

caught 2 km south of Phillip Island, September 1979 (Figure 30). One juvenile seen at 28 m depth in Ball Bay. Antitropical distribution in Indo-Pacific.

Bodianus vulpinus (Richardson, 1850)

Photograph taken by B. McCoy of initial phase fish caught 2 km south of Phillip Island, September 1979 (Figure 31). Photograph of terminal phase fish provided by M. Christian (photographer unknown). Antitropical distribution in Pacific plus Western Australia.

Cheilio inermis (Forsskål, 1775)

Initial phase fish seen occasionally at 1–3 m depth in Kingston Lagoon (Plate III F). Widespread in the tropical Indo-Pacific.

Halichoeres trimaculatus (Quoy & Gaimard, 1834)

Seen occasionally at 1–3 m depth in Kingston Lagoon (Plate IV A). Widespread in the tropical Pacific and eastern Indian Ocean.

Novaculichthys taeniourus (Lacepède, 1801)

Three adults and one juvenile (Figure 32) seen at 1 m depth in Kingston Lagoon. Widespread in the tropical Indo-Pacific.

Stethojulis maculatus Schmidt, 1930

A small group of at least five initial phase and one terminal phase fish seen at 0–2 m depth in Kingston Lagoon (Plate IV B). Regarded as a Japanese endemic (Shepard and Randall 1976) until Winterbottom and Burridge-Smith (1987) reported it from Fiji. The latter authors suggested that *S. maculatus* may have been introduced to Fiji via ballast water; however, the discovery of the species at Norfolk Island suggests that it may simply have a restricted antiequatorial distribution.

Thalassoma janseni (Bleeker, 1856)

Photograph taken by B. McCoy (Figure 33). Widespread in the tropical Indo-West Pacific.



FIGURE 34. *Naso annulatus* (Photo: M. P. Francis).



FIGURE 35. *Katsuwonus pelamis* (Photo: B. McCoy).

ACANTHURIDAE

Naso annulatus (Quoy & Gaimard, 1825)

At least two seen at 1–5 m depth in Kingston Lagoon (Figure 34). Widespread in the tropical Indo-Pacific.

SCOMBRIDAE

Katsuwonus pelamis (Linnaeus, 1758)

Photograph taken by B. McCoy (Figure 35). Worldwide in tropical and subtropical waters.

Thunnus albacares (Bonnaterre, 1788)

One caught in Duncombe Bay in November 1989 (Figure 36); specimen not kept. Worldwide in tropical and subtropical waters.

BOTHIDAE

Bothus mancus (Broussonet, 1782)

One seen at 4 m depth in Kingston Lagoon

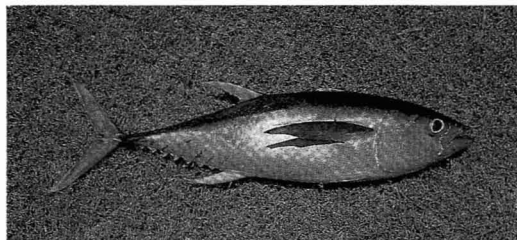


FIGURE 36. *Thunnus albacares* (Photo: M. P. Francis).

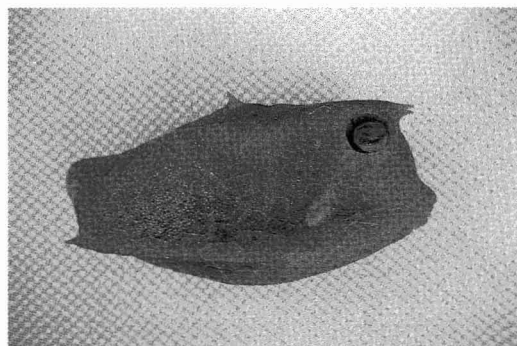


FIGURE 37. *Lactoria diaphana* (Photo: M. P. Francis).

(Plate IVC). Widespread in the tropical Indo-Pacific.

MONACANTHIDAE

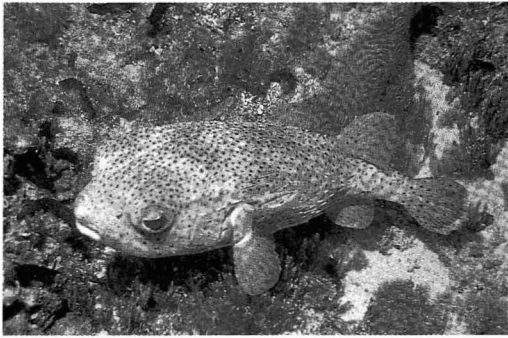
Brachaluteres ?taylori Woods, 1966

One *Brachaluteres* seen several times by J. Marges at 0–1 m depth in Kingston Lagoon. Hutchins and Swainston (1985) recognized four species in their revision of the genus. The Norfolk Island fish is most likely *B. taylori*, as that species is common at Lord Howe and is known from a single specimen from New Zealand (Paulin et al. 1989). Norfolk Island specimens are required to confirm this identification. Occurs in the tropical West Pacific.

OSTRACIIDAE

Lactoria diaphana (Bloch & Schneider, 1801)

One taken from the stomach of an *Epinephelus daemeli* (Günther, 1876) caught 11 km northwest of Cascade wharf, October 1989 (138 mm carapace length, Figure 37). Widespread in the tropical Indo-West Pacific.

FIGURE 38. *Diodon hystrix* (Photo: M. P. Francis).*Ostracion cubicus* Linnaeus, 1758

At least 12 juveniles seen at 20–28 m depth in Ball Bay and Duncombe Bay (Plate IVD). One adult also seen by K. Coop. Widespread in the tropical and subtropical Indo-Pacific.

DIODONTIDAE

Diodon hystrix Linnaeus, 1758

Several seen at 0–2 m depth in Kingston Lagoon (Figure 38), one seen at 22 m in Duncombe Bay, and one on display in the Coral Reef Oceanarium in November 1989. Worldwide in tropical waters.

KERMADEC GROUP

ODONTASPIDIDAE

Odontaspis ferox (Risso, 1810)

At least six seen by E. Gosse and L. Kennedy at 30–35 m depth on the northeast side of L'Esperance Rock in October 1986; photographed with still and movie cameras. Worldwide antitropical distribution.

BELONIDAE

Ablennes hians (Valenciennes, 1846)

Photograph taken by L. Andrews of fish caught at Fishing Rock, Raoul Island, in 1976 (Figure 39); specimen not kept. Photograph identified by B. B. Collette (National Museum of Natural History, Washington D.C.). Worldwide in tropical and subtropical waters.

HOLOCENTRIDAE

Myripristis berndti Jordan & Evermann, 1905

One seen several times by M. Fraser and R.

FIGURE 39. *Ablennes hians* (Photo: L. Andrews).FIGURE 40. *Myripristis berndti* (Photo: R. V. Grace).

Grace off Boat Harbour, Meyer Island, in 1988 (Figure 40). Widespread in the tropical Indo-Pacific.

ECHENEIDIDAE

Echeneis naucrates Linnaeus, 1758

One videotaped by M. Fraser at Meyer Island in June 1988, attached to a large *Epinephelus daemeli* (Günther, 1876). Worldwide in tropical and subtropical waters.

LUTJANIDAE

Lutjanus kasmira (Forsskål, 1775)

One seen several times by M. Fraser and R. Grace off southwestern Meyer Island in 1988 (Figure 41). All these sightings seem to be of the same individual, and it is possible that it is also the same fish reported by Francis et al. (1987) as *Lutjanus* sp. Widespread in the tropical Indo-Pacific.

Paracaesio xanthura (Bleeker, 1869)

School of at least five seen off northeastern Meyer Island in October 1985 (Plate IVE). Widespread in the tropical Indo-West Pacific.

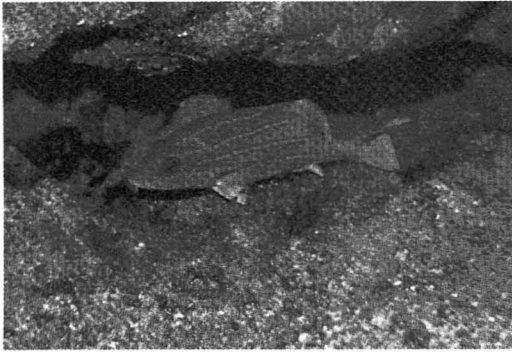


FIGURE 41. *Lutjanus kasmira* (Photo: M. Fraser).



FIGURE 43. *Chaetodon auriga* (Photo: M. Fraser).

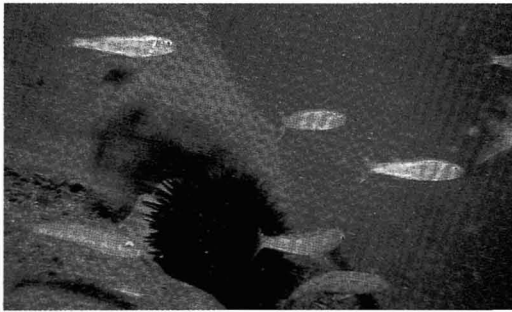


FIGURE 42. *Upeneus* sp. (Photo: M. Fraser).

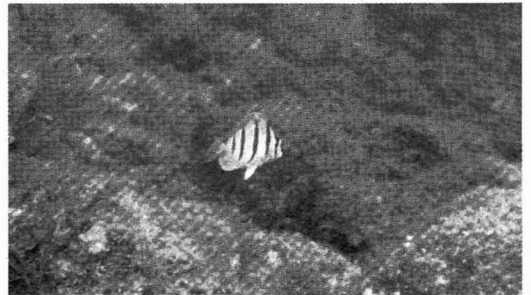


FIGURE 44. *Acanthurus triostegus* (Photo: M. Fraser).

MULLIDAE

Upeneus sp.

School seen regularly by M. Fraser off Fishing Rock, Raoul Island, in 1988 (Figure 42). Probably the same as the undescribed *Upeneus* collected at Norfolk Island (see above).

CHAETODONTIDAE

Chaetodon auriga Forsskål, 1775

Two seen by M. Fraser off southwestern Meyer Island in May 1988 (Figure 43). Widespread in the tropical Indo-Pacific.

CHEILODACTYLIDAE

Nemadactylus douglasii (Hector, 1875)

One caught at L'Esperance Rock in September 1988; specimen not kept. Identified by R. Grace by its color and elongated pectoral fin rays (Francis 1988). Also known from

southeastern Australia and northern New Zealand.

LABRIDAE

Coris picta (Bloch & Schneider, 1801)

Two seen by M. Fraser off Boat Harbour, Meyer Island, in September 1988 (Plate IVF). Antitropical distribution in the West Pacific.

Stethojulis bandanensis (Bleeker, 1851)

One initial phase fish seen by M. Fraser at 2–3 m depth in Boat Harbour, Meyer Island, in September 1988. Photograph available on request. Widespread in the tropical Pacific.

ACANTHURIDAE

Acanthurus triostegus (Linnaeus, 1758)

One seen twice by M. Fraser at 2–3 m depth in Boat Harbour, Meyer Island (Figure 44). Widespread in the tropical Indo-Pacific.

BALISTIDAE

Rhinecanthus rectangulus (Bloch & Schneider, 1801)

One seen twice by M. Fraser at 2–3 m depth in Boat Harbour, Meyer Island. Photograph available on request. Widespread in the tropical Indo-Pacific.

New total numbers of coastal fishes, including new records reported here, and incorporating recent taxonomic revisions of some fish families and reidentifications of some existing specimens, are given in the last column of Table 1.

DISCUSSION

The fish fauna of Lord Howe was intensively studied by Allen et al. (1976), so few additional records were expected. Only one of the new records reported here (*Kyphosus sydneyanus*) is of a common species, and its presence may previously have been overlooked because of its similarity to other members of the genus. Eight of the new Lord Howe records (67%) are based on three or fewer individuals of species that are widespread in the tropical Pacific.

The Norfolk fauna has been moderately well studied: Hermes' (1986) list was based almost entirely on an unpublished list of fishes compiled by D. F. Hoese, L. H. Hodgson, and J. R. Paxton of the Australian Museum, Sydney. Hoese and three other ichthyologists spent 3 weeks collecting and observing fishes at Norfolk in 1975, and examined Norfolk specimens in the Museum collection. The 64 new records reported here significantly increase the known fauna. Nevertheless, reefs deeper than 25 m remain virtually unexplored, and small cryptic fishes are not well represented. Further collecting on deep reefs with lines and spears and on shallow and deep reefs with rotenone would add more fishes to the fauna. Most of the new Norfolk records (69%) are of species that are widespread in the tropical Pacific.

Fourteen species of coastal fishes are known from both Lord Howe and the Ker-

madecs, but not at intervening Norfolk. It is likely that most of these species will eventually be recorded from Norfolk also, taking the total number of coastal species there to over 230.

The Kermadecs fauna is moderately well known, apart from small and cryptic species. Francis et al. (1987) added 34 new records after spending 1 month diving throughout the group in 1985. Eight of the new records reported here (62%) are based on one or two individuals of species that are widespread in the tropical Pacific.

The new records reported here increase our understanding of the fish faunas of the subtropical islands of the Southwest Pacific. Significant additions have been made to the Norfolk fauna. A high proportion of the new records at all three island groups are of "stray" tropical species (i.e., only a small number of individuals are known, and it is unlikely that they form local breeding populations). The island groups are located in subtropical waters, and the strays are at the southern extremes of their geographic ranges. Their appearance in subtropical waters is probably haphazard, resulting from an influx of larvae from tropical areas. Larval availability depends on the length of the larval life of each species, the strength of oceanic currents (especially the East Australian Current), and the degree of southward displacement of the Tropical Convergence during summer. Now that the faunas of the islands are moderately well known, future additions will increasingly be of stray tropical species. Smaller numbers of additional records may be expected from temperate strays from Australia and New Zealand and from better sampling of deep reef habitats and small cryptic species.

There is a clear trend of decreasing species diversity from west to east (Table 1), paralleling that of coral diversity and degree of reef development. Such trends are probably due to a mixture of factors, including water temperatures and proximity to upstream sources of larval recruits. Coral reefs themselves provide fishes with a diverse array of habitat types, shelter, and food; a high degree of reef development almost certainly contributes to high fish diversity.

ACKNOWLEDGMENTS

I thank all those who provided photographs and sightings, especially M. Christian, M. Fraser, J. Marges, and B. McCoy. K. Ryan, J. Deacon, K. Christian, and J. Marges provided valuable diving assistance. Many ichthyologists willingly assisted with species identifications and are individually credited in the text. In particular, I thank Jack Randall for his continued support, interest, and expertise during the last five years. The trip to Norfolk Island in November 1989 was partially funded by the Australian National Parks and Wildlife Service, and I am grateful to them and the Norfolk Island Government for their assistance during our visit.

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