

Annotated Checklist of the Fishes of Johnston Island¹

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ABSTRACT: A total of 271 fishes are listed from Johnston Island, an atypical atoll lying at 16°45' N, 169°30' W, 470 miles south of the nearest reef of the Hawaiian Islands. Three of these fishes, *Parupeneus barberinus*, *Acanthurus nigricauda*, and *Ostracion cubicus* are doubtful records. Eight are listed only by genus. The following 88 species represent new records for the island: the carcharhinid shark *Galeocerdo cuvier*; the albulid *Albula glossodonta*; the congrid eel *Conger oligoporus*; the muraenid eels *Gymnothorax berndti*, *G. buroensis*, *G. flavimarginatus*, *G. nudivomer*, *G. nuttingi*, and *Uropterygius inornatus*; the synodontids *Saurida flamma* and *Synodus englemani*; the carapid *Carapus mourlani* the morid *Physiculus grinnelli*; the holocentrids *Myripristis chryseres*, *M. kuntee*, *Neoniphon aurolineatus*, *Pristilepis oligolepis*, and *Sargocentron xantherythrum*; the scorpaenids *Dendrochirus barberi*, *Pontinus macrocephalus*, *Scorpaena colorata*, *Scorpaenodes kelloggi*, and *Scorpaenopsis diabolus*; the triglid *Satyrichthys engyceros*; the serranids *Anthias fucinus*, *A. ventralis*, *Epinephelus quernus*, *Holanthias elizabethae*, *H. fuscipinnis*, *Plectranthias helena*, and *Promicrops lanceolatus*; the callanthiid *Grammatonotus laysanus*; the priacanthid *Cookeolus boops*; the bramid *Eumegistus illustris*; the emmelichthyid *Erythrocles scintillans*; the lutjanids *Aphareus rutilans*, *Etelis carbunculus*, *E. coruscans*, *Pristipomoides auricilla*, *P. filamentosus*, and *P. zonatus*; the lutjanoid *Symphysanodon maunaloae*; the kyphosid *Kyphosus cinerascens*; the mullid *Parupeneus pleurostigma*; the apogonid *Epigonus* sp.; the malacanthid *Malacanthus brevirostris*; the carangids *Carangoides ferdau*, *Caranx ignobilis*, *Decapterus macarellus*, *Elagatis bipinulatus*, and *Seriola dumerili*; the coryphaenid *Coryphaena hippurus*; the sphyraenid *Sphyraena barracuda*; the labrids *Coris ballieui*, *Macropharyngodon geoffroy*, *Polyplepion russelli*, *Pseudojuloides cerasinus*, and *Xyrichtys aneitensis*; the scarid *Scarus rubroviolaceus*; the mugiloidids *Parapercis roseoviridis* and *P. schauinslandi*; the percophid *Chromonema chryseres* and *C. squamiceps*; the chaetodontids *Chaetodon lineolatus*, *C. miliaris*, *C. modestus*, *C. tinkeri*, and *Heniochus dipreutes*; the pomacanthids *Centropyge fisheri*, *C. potteri*, and *Holacanthus arcuatus*; the oplegnathid *Oplegnathus punctatus*; the acanthurids *Acanthurus blochii dussumieri*, *A. thompsoni*, *Naso hexacanthus*, and *N. unicornis*; the scombrids *Acanthocybium solanderi*, *Euthynnus affinis*, *Katsuwonus pelamis*, and *Thunnus albacares*; the istiophorid *Makaira nigricans*; the blennioid *Cirripectes variolosus*; the gobiids *Priolepis aureoviridis* and *Ptereleotris heteroptera*; the triacanthodid *Hollardia goslinei*; the balistid *Sufflamen fraenatus*; and the tetraodontid *Canthigaster inframacula*.

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The fish fauna of Johnston Island is impoverished compared to the Hawaiian Islands and Marshall Islands. This is probably due to its isolation, small size, and paucity of marine habitats. The majority of the fishes are wide-ranging Indo-Pacific species which occur in Hawaii and elsewhere in Oceania. Thirty-nine of the Johnston fishes are otherwise known only from the Hawaiian Islands, in contrast to only 11 Central Pacific species which do not range to Hawaii (of these, five are eels). As stated by Gosline (1955), Johnston Island may be regarded as an outlier of the Hawaiian faunal area.

Two species previously believed to be endemic to Johnston Island are now shown to be wide-ranging. The only known fishes of the atoll that are possibly endemic are a *Scorpaenodes*, a *Genicanthus*, and a *Naso* (the latter three known only from observations from a submersible), all of which occur at depths greater than 100 m. It seems more likely, however, that they range beyond Johnston Island.

Some common Hawaiian fishes such as *Chaetodon miliaris*, *Centropyge potteri*, and *Pervagor spilosoma* are extremely rare at Johnston Island; they may be only waifs that have drifted in as larvae from the Hawaiian area.

JOHNSTON ISLAND IS AN ATOLL IN the Central Pacific Ocean located at 16°45' N; 169°30' W. It is separated by 470 mi of deep water from the nearest Hawaiian reef area, French Frigate Shoals. Kingman Reef in the Line Islands lies 750 mi to the southeast, and the Marshall Islands 1250 mi to the southwest. As might be expected from its proximity to and position downcurrent from the Hawaiian Archipelago, its marine fauna is dominantly Hawaiian, although impoverished compared to Hawaii.

Johnston Island is located at the northern limit of the Line Islands seamount chain near the junction with the Marcus-Necker Ridge. It arises from an abyssal plane at 4950 m depth and was probably formed by an episode of alkalic volcanism during the late Cretaceous (estimated age, 85 m.y.b.p.; Keating, ms.). Geologist B. Keating has pointed out that Johnston is an atypical atoll since it no longer has a ring reef structure exposed above sea level. A reef is present only along the north and west (leeward) margins of the carbonate platform. The platform appears to have been tilted, submerging the eastern margin (Keating, ms.). Beyond the platform edge the bottom slopes steeply to abyssal depths. Large caves with stalactites and stalagmites were observed by Keating at Johnston Island from the research submarine *Makali'i* at depths of 210 m and 366 m. Since such caves

can be formed only on land, it is clear that the island has subsided at least 366 m.

The physical oceanography of Johnston Island is known from two early studies. One emphasized circulation patterns of the lagoon and nearshore waters (Kopanski and Wennekens 1966). The other examined seasonal variation in offshore current flow (Barkley 1972). A detailed study of circulation patterns around Johnston Island has been completed (Lobel 1984). In general, the large-scale flow past the island is toward the west. Johnston Island is situated in the northern margin of the North Equatorial current. The flow is fairly strong and steady in winter and weak and variable in summer (Kopanski and Wennekens 1966). Ocean eddies develop in the lee when current flow past the island exceeds approximately 1.25 knots (Barkley 1972). These eddies sometimes remain nearshore for several days before moving off to the west/northwest (Lobel 1984). At other times, current flow toward the north/northwest has been observed (Kopanski and Wennekens 1966; Patzert et al. 1978; McNally et al. 1983; Lobel 1984). It is clear from our knowledge of the current patterns that larval fishes could drift from Hawaii to Johnston, and depending on the time of year, from Johnston to the Northwestern Hawaiian Islands.

Smith and Swain (1883) reported the first fishes from Johnston Island from a collection

made by a captain of a vessel belonging to the North Pacific Guano Company. They recorded 27 species, of which 5 were described as new (none of these, however, are valid). The fishes were deposited in the U.S. National Museum of Natural History.

Fowler and Ball (1924, 1925) recorded 72 species of fishes from Johnston Island taken during the *Tanager* Expedition of 1923 to the Northwestern Hawaiian Islands, Johnston, and Wake. They named the damselfish *Plectroglyphidodon johnstonianus* as a new genus and species (both valid taxa). This collection was deposited at the Bernice P. Bishop Museum, Honolulu, and a set of duplicates was sent to the Academy of Natural Sciences of Philadelphia.

The Johnston Island locality given for specimens of two species of fishes, *Parupeneus barberinus* and *Acanthurus nigricans* (= *nigricauda*), by Fowler and Ball (1925) may be in error. *Tanager* Expedition specimens of both are in the fish collection of the Bishop Museum, and we can confirm the identifications. Both are common inshore fishes throughout the islands of Oceania except Hawaii. No specimens of either of these fishes have been taken in the more extensive fish collecting that followed the *Tanager* Expedition, nor have any observations been made of them. The possibility must be admitted that they were mislabeled (perhaps the true locality was Wake Island). Although we retain the two species in our list below, we believe that further specimens, photos, or reliable underwater observations should be obtained to confirm these records.

Halstead and Bunker (1954) conducted a survey of fish poisoning at Johnston Island. They collected 60 species of fishes to test for toxicity. No illustrations are given of the fishes, and no taxonomic information is presented with them. Only three of their species of Johnston fishes were deposited at the National Museum of Natural History: *Thalassoma duperrey*, *Scarus perspicillatus*, and *S. brunneus* (= *S. psittacus*). In our listing of Johnston fishes below we have accepted the names of Halstead and Bunker, or obvious corrections thereof, when it is clear from our knowledge of the fish fauna what species they

probably had. We are unable, however, to pass judgment on their *Scarus duperrey* and *Kentrocapros hexagonus*, and we cast some doubt on their identification of *Ostracion cubicus*.

Leonard P. Schultz collected fishes at Johnston Island in 1947 which were deposited in the U.S. National Museum of Natural History. Among his specimens are the holotype and one paratype of a new snake eel, *Muraenichthys johnstonensis*, named by Schultz and Woods (1949). Gosline (1951) placed *M. johnstonensis* in a new monotypic genus *Schultzidia*.

In their *Fishes of the Marshall and Marianas Islands*, Schultz and collaborators (1953–1966) mentioned 29 species of fishes from Johnston Island, some merely listed in tables of meristic data. Two new angelfishes, *Centropyge flammeus* and *C. nigriocellus* (the former not valid), were described, as was one moray, *Uropterygius dentatus* (invalid), and a new subspecies of filefish, *Pervagor melanocephalus johnstonensis*. Four other new species of fishes from the Marshall Islands included paratypes from Johnston Island. The one Johnston paratype of *Halichoeres biocellatus* (USNM 112942, 41 mm SL), however, is a misidentification of *H. ornatissimus* (Garrett).

Gosline (1955) analyzed the inshore fish fauna of Johnston Island based on previous reports; collections made by him, V. E. Brock, and Y. Yamaguchi in February, 1951; and three additional small collections. He listed 158 species from the island; of these he saw specimens of 118. In reference to the species on his list which he did not examine he wrote, "some of these almost certainly represent misidentifications."

Brock, Jones, and Helfrich (1965) published the results of their ecological reconnaissance of the marine fauna of Johnston Island. In their Appendix D they listed the species of inshore fishes recorded from the island in three columns: those from Smith and Swain (1883), Fowler and Ball (1925), and Halstead and Bunker (1954) in the first column; Gosline (1955) in the second; and their own collections in the third (115 species, of which 24 were new records).

New records of one or two species of fishes (or in one case of a new species) from Johnston Island have been published by Allen and Burgess (1970), Randall (1972*a, b*), Randall and Allen (1973), and Randall and Swerdloff (1973).

J. E. Randall collected fishes at Johnston Island for the Bishop Museum in July 1968 and again in June 1969. In early September 1983 the research submarine *Makali'i* of the Hawaii Undersea Research Laboratory, University of Hawaii, was brought to the atoll for a series of 35 dives over a period of 2 months. Three dives were made by Randall, seven by P. Lobel, and three by E. H. Chave. Other marine scientists who made dives resulting in photographs, videotapes, or observations of fishes mentioned herein were Catherine R. Agegian, Lucius G. Eldredge, Reginald M. Gooding, Barbara H. Keating, Gerald M. Ludwig, James E. Maragos, and Stephen Ralston. The submarine pilots were Bohdan Bartko, Terrance R. Kerby, and David C. Foster, the Science Coordinator E. H. Chave, and the on-site operations manager Michael E. Sullivan. Dives were made to a maximum of 400 m. Fishes were observed from the submersible (many of these recorded on color videotape), and numerous color photographs were taken. Some of the photos, although the fishes were identifiable, did not warrant reproduction in the present report due to low quality. The videotapes and photographs of the dives are on file at the Hawaii Undersea Research Laboratory. Some limited collections of fishes were made from the *Makali'i* with rotenone and sodium cyanide. The fishes were picked up with a suction device with a 3-in. intake pipe. The manipulator claw was used on two occasions for larger fishes. Specimens have been deposited at the Bishop Museum. A deep fishing survey, primarily for lutjanid fishes, was carried out at Johnston Island by the Honolulu Laboratory of the National Marine Fisheries Service from the *Townsend Cromwell* on 3–5 November 1983. The results will be published by Ralston, Gooding, and Ludwig (ms.) who kindly allowed us to briefly report on their snapper catch in the present paper. Randall and Lobel returned to Johnston Island in April

1984 for a final week of fish collecting and photography.

The following checklist represents all of the fishes presently known from Johnston Island. The families of fishes are given in approximate phylogenetic sequence. Within each family the genera and species are listed alphabetically. Those species marked with an asterisk (*) are new records for the atoll. The illustrations of fishes herein depict new records, confirm doubtful records, and document unusual abundance or depth records. Twenty-five of these figures constitute the new records (i.e., no specimens collected). The author and date of description are given for each species, followed by the first record from Johnston Island. Explanations and references are given for recent nomenclatorial changes. The following abbreviations are used: BPBM for Bernice P. Bishop Museum; USNM for U.S. National Museum of Natural History; SL for standard length; FL for fork length; TL for total length; and C and V for Cuvier and Valenciennes. All observations, photographs, and collections from *Makali'i* are for the period September–October 1983.

A zoogeographic discussion follows the checklist.

CHECKLIST

FAMILY ALOPIIDAE (THRESHER SHARKS)

Alopias sp.

Observed in 183 m from *Makali'i* by C. Agegian and B. Bartko.

FAMILY CARCHARINIDAE (REQUIEM SHARKS)

Carcharhinus amblyrhynchos (Bleeker, 1856)

Carcharhinus menisorrh (non Müller and Henle) Brock, Jones, and Helfrich 1965.

Common on the outer reef slope at Johnston Atoll and occasional in the lagoon. Sighted by most observers from the submersible *Makali'i*; maximum depth 274 m.

Carcharhinus sp.

A shark of this genus estimated at 2 m total length was sighted by Ralston in 248 m. It may have been *C. galapagensis* (Snodgrass and Heller, 1905).

**Galeocerdo cuvier* (Peron and Lesueur, 1822)

Occasionally caught by residents of Johnston Island for sport. One estimated at 1.8 m was examined at the Sand Island dock by Chave. A juvenile was observed by the support divers during one launching of the *Makali'i*.

Triaenodon obesus (Rüppell, 1837); Brock, Jones, and Helfrich 1965

A common species at Johnston Island, in both the lagoon and outer reef areas. Observed by Ralston in 122 m from *Makali'i*. Randall (1977) reported on a study of the biology of this shark, partly from data obtained at Johnston.

FAMILY MYLIOBATIDIDAE (EAGLE RAYS)

Aetobatis narinari (Euphrasen, 1790); Fowler and Ball 1925

FAMILY MOBULIDAE (MANTAS)

Manta sp.

Three subadults caught in a turtle net by George Balazs. Others observed in shallow water by Chave. One was sighted from the submarine in 120 m by Ralston.

FAMILY ALBULIDAE (BONEFISHES)

**Albula glossodonta* (Forsskål, 1775)

Bonefish have been observed, sometimes in a small school, by A. J. Dee and others off East Island, North Island, and a sand-rubble area just inside the barrier reef northeast of North Island. Dee provided a photograph of a bonefish caught by a fisherman which could not be obtained as a specimen. Formerly it

was believed there was a single circumtropical species of the genus *Albula*, *A. vulpes*. Shaklee and Tamaru (1981), however, have shown that there are two species in the Hawaiian Islands (and elsewhere in the Indo-Pacific region), neither of which is *vulpes*. On the basis of a count of about 75 scales from the photo, Shaklee (pers. comm.) concludes that the species is probably *A. glossodonta*.

FAMILY CONGRIDAE (CONGER EELS)

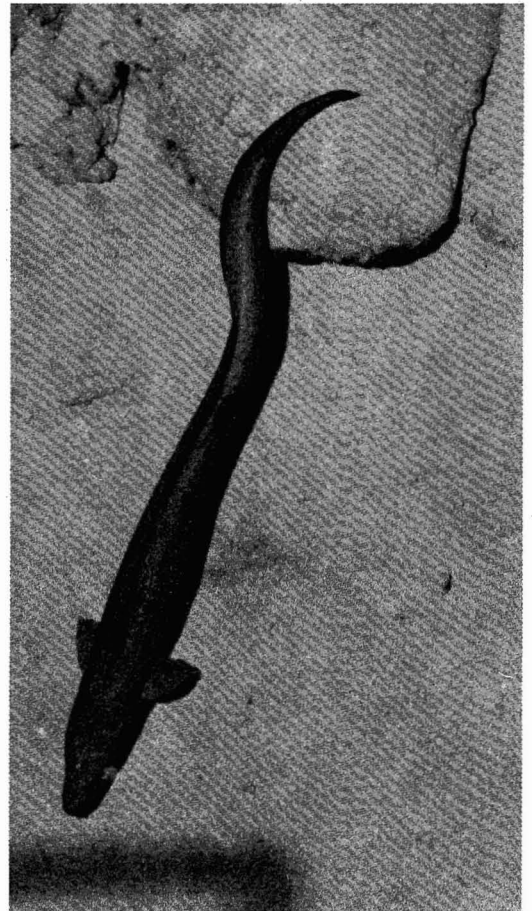
Conger cinereus Rüppell, 1830*Conger noordziekkii* Bleeker; Gosline, 1955.

FIGURE 1. *Conger oligoporus*, photo from submarine in 356 m (J. Randall).

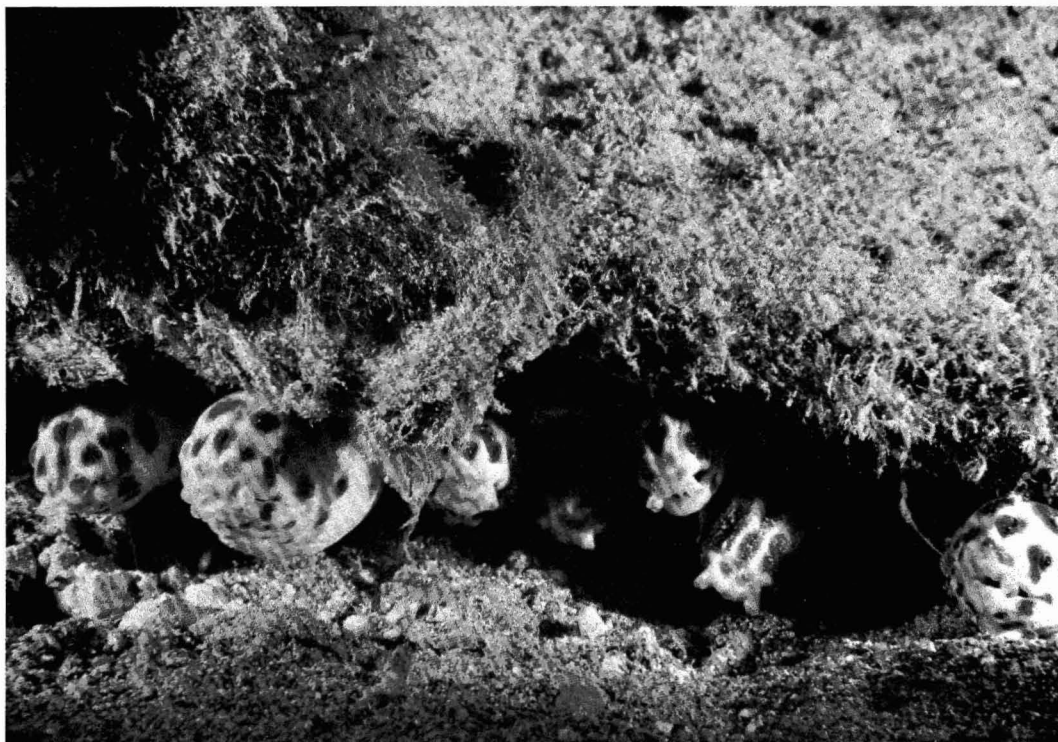


FIGURE 2. *Myrichthys maculosus*, underwater photo, 2 m (J. Randall).

**Conger oligoporus* Kanazawa, 1958

Observed and photographed (Figure 1) by Randall at a depth of 356 m from the research submarine *Makali'i*. Also observed by Chave in a subsequent submarine dive.

FAMILY OPHICHTHIDAE (SNAKE EELS)

Brachysomophis sauropsis Schultz, 1943; Gosline 1955

McCosker (1977) has written that this nominal species may be conspecific with *Brachysomophis crocodilinus* (Bennett) and *B. henshawi* Jordan and Snyder.

Leiuranus semicinctus (Lay and Bennett, 1839); Fowler and Ball 1925

Muraenichthys cookei Fowler, 1928; Gosline 1955

Muraenichthys gymnotus Bleeker, 1864; Gosline 1955

Muraenichthys schultzei Bleeker, 1857; Fowler and Ball 1925

Myrichthys bleekeri Gosline, 1951

Myrichthys colubrinus (non Boddaert) Fowler and Ball, 1925.

Myrichthys maculosus (Cuvier, 1817).

Myrichthys stypurus Smith and Swain, 1883. Common inshore in harbor area at Johnston Atoll off a fish-cleaning site (Figure 2). Observed and photographed on three submarine dives in the depth range of 120–262 m (Figure 3).

Phyllophichthus xenodontus Gosline, 1951; Brock, Jones, and Helfrich 1965



FIGURE 3. *Myrichthys maculosus*, photo from submarine in 262 m (C. Agegian).

Schizmorhynchus labialis (Seale, 1917)

Leptenchelys labialis Gosline, 1955.

Schultzidia johnstonensis (Schultz and Woods, 1949)

Muraenichthys johnstonensis Schultz and Woods, 1949.

FAMILY MORINGUIDAE (WORM EELS)

Moringua ferruginea Bliss, 1883

Moringua macrochir (non Bleeker) Gosline, 1955. Castle (1968) regarded Hawaiian speci-



FIGURE 4. *Gymnothorax berndti*, from a videotape taken from submarine in 218–230 m (J. Maragos).

mens identified as *M. macrochir* by Gosline and Strasburg (1956) as *M. ferruginea*.

FAMILY MURAENIDAE (MORAYS)

Anarchias allardicei Jordan and Starks in Jordan and Seale, 1906; Gosline 1955

Anarchias cantonensis (Schultz, 1943); Gosline 1955

Anarchias seychellensis Smith, 1962

Anarchias leucurus (non Snyder) Gosline, 1955.

Echidna leucotaenia Schultz, 1943; Gosline 1955

Echidna polyzona (Richardson, 1844); Gosline 1955

Echidna unicolor Schultz in Schultz and collaborators, 1953; Brock, Jones, and Helfrich 1965

Gymnomuraena zebra (Shaw, 1797)

Echidna zebra Gosline, 1955.

**Gymnothorax berndti* Snyder, 1904

Videotaped and photographed (Figure 4) from *Makali'i* at 218–230 m.

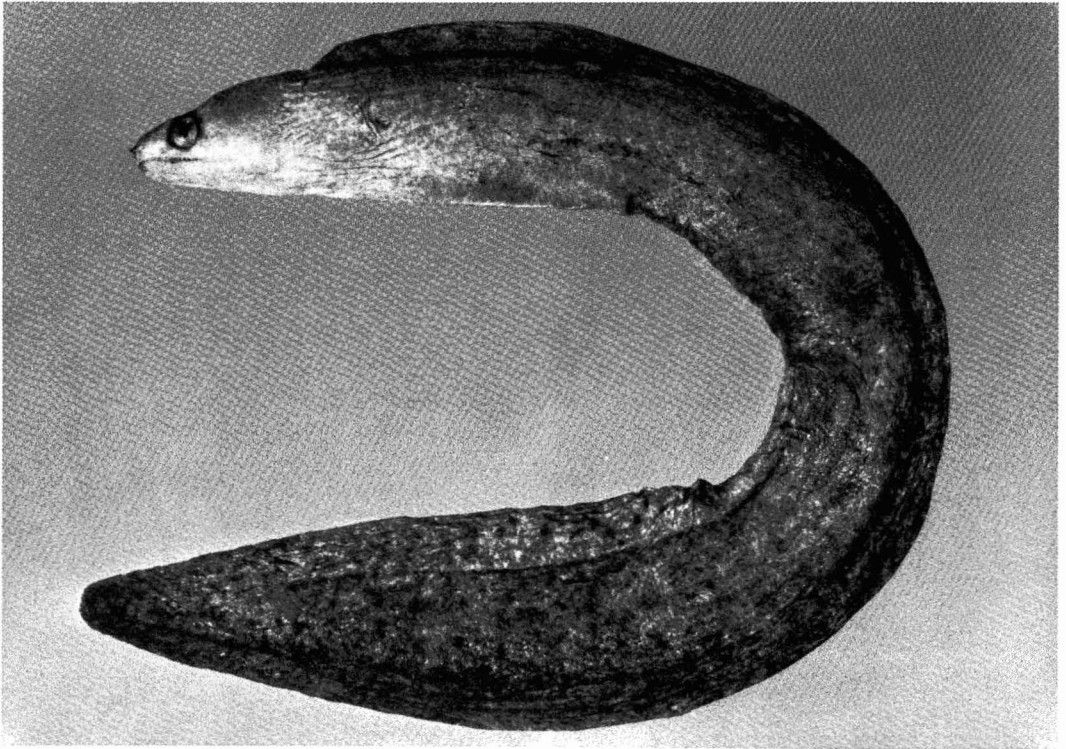


FIGURE 5. *Gymnothorax buroensis*, BPBM 29607, 255 mm TL, 12.5 m (J. Randall).

**Gymnothorax buroensis* (Bleeker, 1857)

Three specimens (BPBM 29607, 154–255 mm TL) were collected with rotenone outside the reef about 500 m northeast of the small boat channel in 12.5 m by Randall, Lobel, and associates on 9 April 1984. The largest was photographed (Figure 5).

Gymnothorax eurostus (Abbott, 1860); Gosline 1955

Gosline (1955) regarded the record of *Gymnothorax buroensis* Bleeker by Halstead and Bunker (1954) as a probable misidentification of *G. eurostus*.

**Gymnothorax flavimarginatus* (Rüppell, 1828)

One specimen, BPBM 29608, 815 mm TL (Figure 6) was collected at the same station as the two *G. buroensis* mentioned above.

Gymnothorax fuscomaculatus (Schultz in Schultz and collaborators, 1953)

Rabula fuscomaculata Schultz in Schultz and collaborators 1953. McCosker and Rosenblatt (1975) showed that *Rabula* Jordan and Davis was based on an aberrant specimen of *Gymnothorax mordax* (Ayers), thus is not a valid genus. The species *fuscomaculatus* may require a new generic name.

Gymnothorax gracilicaudus Jenkins, 1903; Gosline 1955

Gymnothorax javanicus (Bleeker, 1859); Halstead and Bunker 1954

This moray, the largest of the Indo-Pacific species, is notorious for causing ciguatera. Over 1000 of these eels weighing 4.5 kg or more were collected from Johnston Atoll during the years 1963 to 1971 by personnel of the Hawaii Institute of Marine Biology, Univer-

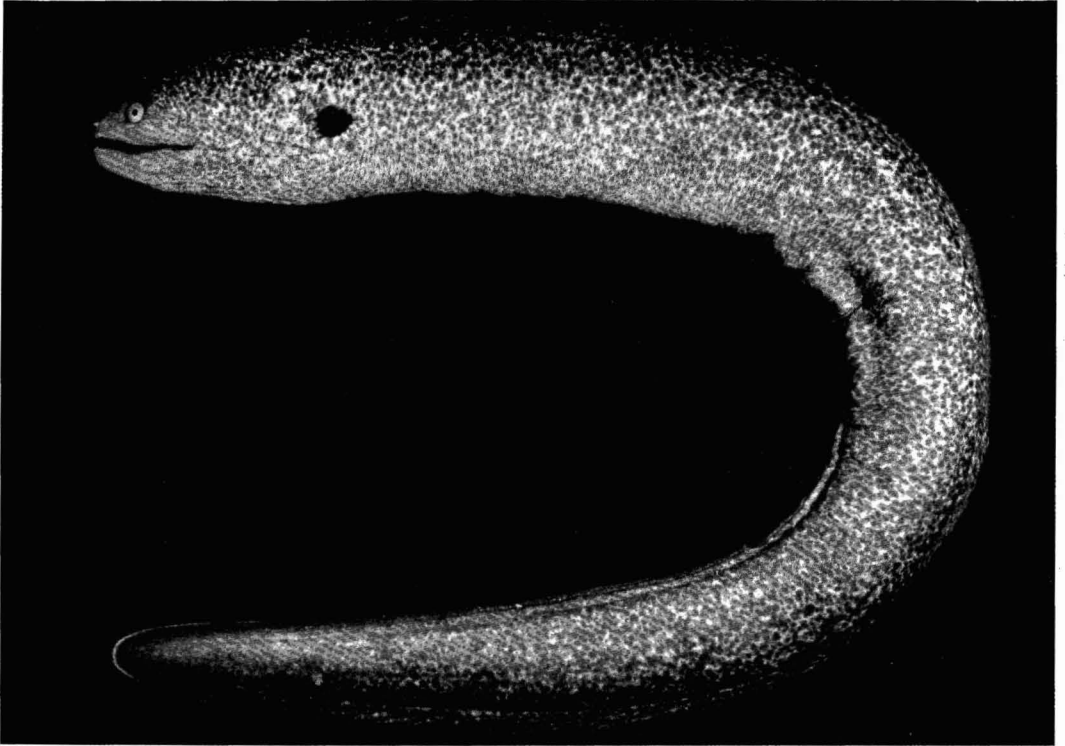


FIGURE 6. *Gymnothorax flavimarginatus*, BPBM 29608, 815 mm TL, 12.5 m (J. Randall).

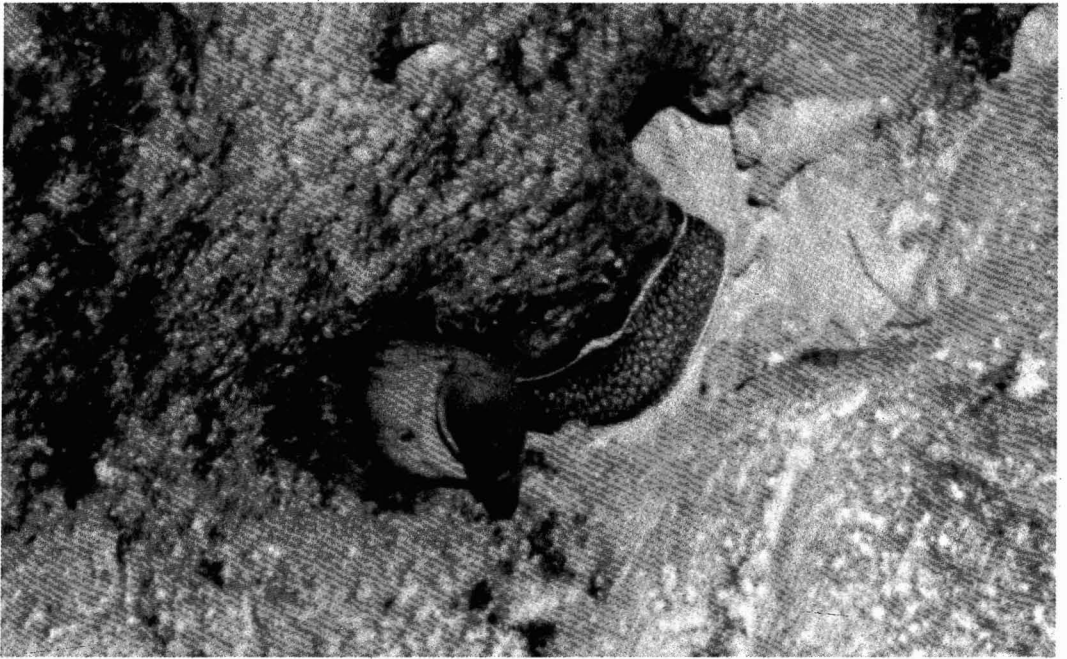


FIGURE 7. *Gymnothorax nuttingi*, photo from submarine at 300 m (S. Ralston).

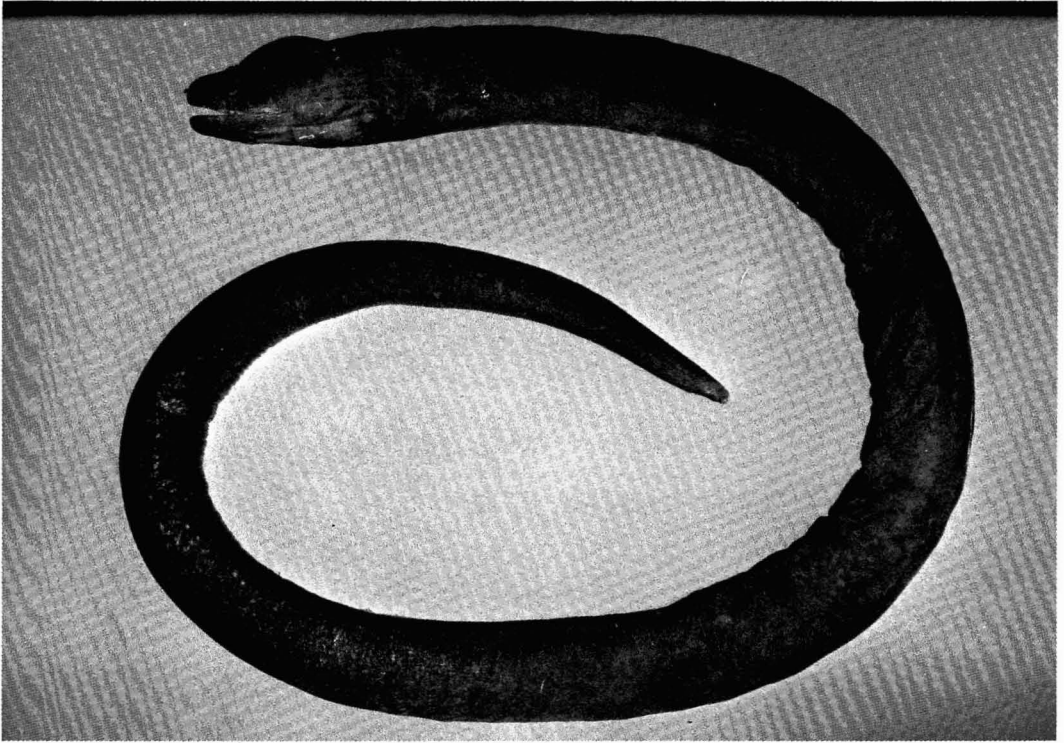


FIGURE 8. *Uropterygius inornatus*, BPBM 8941, 563 mm TL, 7 m (J. Randall).

sity of Hawaii (R. Brock 1972). Ciguatoxin was extracted from these specimens for biochemical and pharmacological research. The moray mentioned by Schultz in Schultz and collaborators (1953:108), which may reach a length in excess of 7 or 8 ft, is not *Enchelynassa canina* but *Gymnothorax javanicus* (the late V. E. Brock, pers. comm.).

Gymnothorax meleagris (Shaw and Nodder, 1795); Fowler and Ball 1925

**Gymnothorax nudivomer* (Playfair and Günther, 1867)

One submarine observation by Randall in 183 m; the yellow mouth was clearly visible. Videotaped on two subsequent dives in 144–216 m.

**Gymnothorax nuttingi* Snyder, 1904

Observed and photographed (Figure 7) on several submarine dives in the depth range of

229–300 m. When only the head is visible, the blue eye is a useful character for identification.

Gymnothorax pindae (Smith, 1962)

Gymnothorax moluccensis (non Bleeker) Gosline, 1955. Randall and McCosker (1975) reidentified Johnston Island and Hawaiian material of this moray as *G. pindae*.

Gymnothorax undulatus (Lacepède, 1803); Gosline 1955

Siderea picta (Ahl, 1789)

Lycodontis picta Fowler and Ball, 1925.

Uropterygius fuscoguttatus Schultz, 1953

**Uropterygius inornatus* Gosline, 1958

One specimen, BPBM 8941, 563 mm TL (Figure 8), collected with rotenone by Randall,

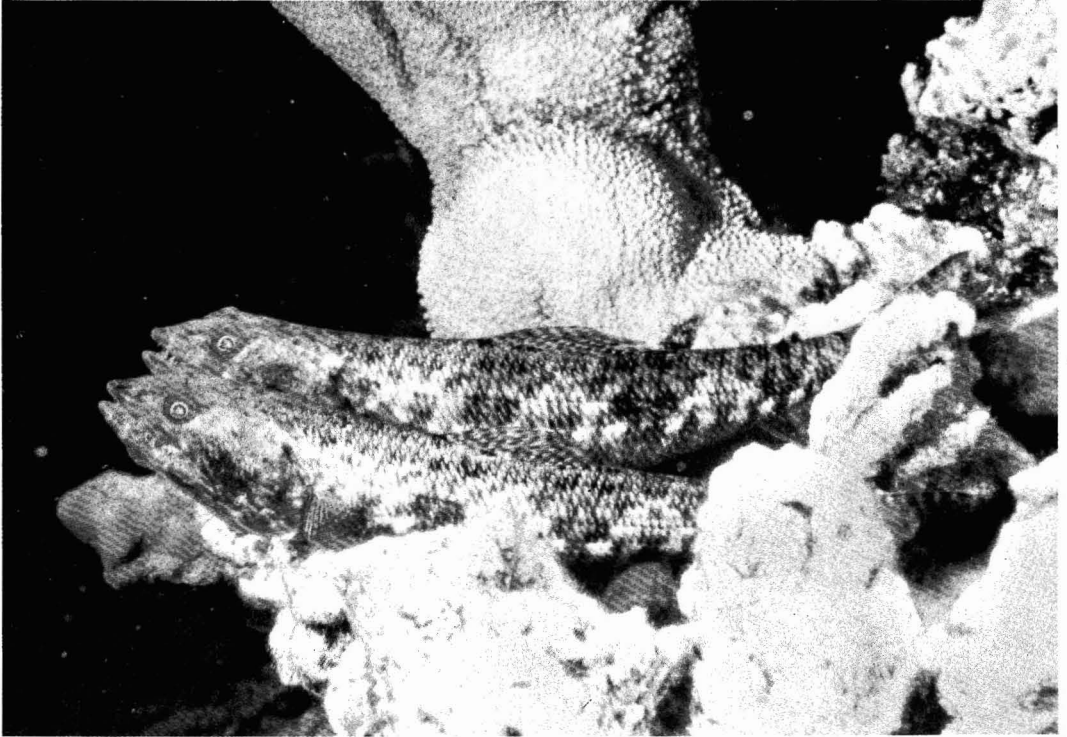


FIGURE 9. *Synodus englemani*, underwater photo, 3 m. Both fish collected (BPBM 29625, 180–190 mm SL) (J. Randall).

R. L. Bowers, and A. C. Banner outside the ocean reef northeast of the small boat channel in 7 m on 26 July 1968.

Uropterygius macrocephalus (Bleeker, 1865)

Uropterygius knighti Schultz in Schultz and collaborators 1953, as reported by Brock, Jones, and Helfrich (1965). McCosker et al. (ms.) have shown that *U. knighti* and the eastern Pacific *U. necturus* (Jordan and Gilbert) are synonymous with *U. macrocephalus*.

Uropterygius polyspilus (Regan, 1909); Gosline 1955

Uropterygius supraforatus (Regan, 1909)

Uropterygius dentatus Schultz, 1953.

Uropterygius tigrinus (Lesson, 1829)

Gymnomuraena tigrina Smith and Swain, 1883.

FAMILY XENCONGRIDAE (FALSE MORAYS)

Kaupichthys hyoprroides (Stromann, 1896)

Kaupichthys diodontus Schultz, 1943; Brock, Jones, and Helfrich 1965. Böhlke and Smith (1968) showed that *K. hyoprroides*, based on the leptocephalus stage, is the oldest name for this circumtropical eel.

FAMILY SYNODONTIDAE (LIZARDFISHES)

**Saurida flamma* Waples, 1982

Robin S. Waples (pers. comm.) has examined two specimens of this species (USNM 229987, 161–181 mm SL) from Johnston Island. He has also found material from elsewhere in Oceania besides Hawaii and Johnston.

Saurida gracilis (Quoy and Gaimard, 1824); Brock, Jones, and Helfrich 1965



FIGURE 10. *Carapus mourlani*, BPBM 29362, 126 mm TL, taken from holothurian collected in 116 m (J. Randall).

Synodus binotatus Schultz in Schultz and collaborators 1953

**Synodus englemani* Schultz in Schultz and collaborators 1953

One specimen, BPBM 9728, 212 mm SL, caught trolling a lure near the main island in 1969 by Major Robert Gregory. Two adults were photographed underwater by Randall on coral in the Johnston lagoon at a depth of 3 m (Figure 9), and both were speared (BPBM 29625, 180–190 mm SL).

Synodus variegatus (Lacepède, 1803); Brock, Jones, and Helfrich 1965

No specimens available to confirm this record.

FAMILY CARAPODIDAE (PEARLFISHES)

**Carapus mourlani* (Petit, 1934)

Three specimens, BPBM 29362, 126 mm TL and BPBM 29369, 120–131 mm TL (Figure 10), from sea cucumbers (*Stichopus* sp.) collected by Agegian from *Makali'i* in 106 m and 116 m. This fish was identified by Jeffrey T. Williams and John E. Olney.

FAMILY MORIDAE (MORID CODS)

**Physiculus grinnelli* Jordan and Jordan, 1922

One specimen (BPBM 29264, 62 mm SL) collected with rotenone from submarine at a depth of 168 m by Lobel and Foster.

FAMILY OPHIDIIDAE
(BROTULAS AND CUSK EELS)

Brotula townsendi Fowler, 1900; Gosline 1955

FAMILY BELONIDAE (NEEDLEFISHES)

Platybelone argalus (Lesueur, 1821)

Belone persimilis Günther, as reported by Schultz in Schultz and collaborators (1953) and *Belone platyura* Bennett, as reported by Gosline (1955), are here regarded as *Platybelone argalus*, following Collette and Berry (1965). The name *platyura* may be used for the subspecific form in the Indo-Pacific region.

FAMILY HEMIRAMPHIDAE (HALFBEAKS)

Hyporhamphus acutus (Günther, 1871); Gosline 1955

Collette (1974) regards the Hawaiian and Johnston island populations of this halfbeak as a subspecies, *Hyporhamphus acutus pacificus* (Steindachner), distinct from *H. a. acutus* elsewhere in Oceania.

FAMILY EXOCOETIDAE (FLYINGFISHES)

Cypselurus poecilopterus (Valenciennes in C and V, 1846); Fowler and Ball 1925

Cypselurus simus (Valenciennes in C and V, 1846); Fowler and Ball 1925

Exocoetus volitans Linnaeus, 1758; Woods and Schultz in Schultz and collaborators 1953

One specimen from 17° N 176° W.

FAMILY AULOSTOMIDAE (TRUMPETFISHES)

Aulostomus chinensis (Linnaeus, 1766); Smith and Swain 1883

Observed in shallow water at the atoll and photographed in 122 m from *Makali'i* by Agegian. Strasburg, Jones, and Iversen (1968) reported this species from the small research submarine *Asherah* off Oahu to a maximum of 113 m.

FAMILY FISTULARIIDAE (CORNETFISHES)

Fistularia commersonii (Rüppell, 1838)

Fistularia petimba (non Lacepède) Fowler and Ball, 1925; we follow Fritzsche (1976) in this nomenclature.

FAMILY SYNGNATHIDAE
(PIPEFISHES AND SEA HORSES)

Doryrhamphus excisus Kaup, 1856

Doryrhamphus melanopleura (Bleeker), as reported by Brock, Jones, and Helfrich 1965, is a junior synonym of *D. excisus* (Dawson 1981).

FAMILY HOLOCENTRIDAE (SQUIRRELFISHES)

Myripristis amaenus (Castelnau, 1873)

Myripristis murdjan (non Forsskål) Fowler and Ball, 1925.

Myripristis argyromus Jordan and Evermann, as reported by Gosline (1955), is a junior synonym of *M. amaenus* (Greenfield 1974).

Myripristis berndti Jordan and Evermann, 1903; Halstead and Bunker 1954

**Myripristis chryseres* Jordan and Evermann, 1903

One specimen, BPBM 29268, 197 mm SL (Figure 11), collected with rotenone from the *Makali'i* by Randall and Foster at a depth of 113 m. Common under ledges to depths of 235 m (Figure 12). Strasburg, Jones, and Iversen (1968) reported this species to 171 m off Oahu from the submarine *Asherah*.

**Myripristis kuntee* Valenciennes in C and V, 1831

Two specimens, BPBM 29603, 142–147 mm SL (Figure 13), were collected with rotenone from beneath a ledge in 12.5 m outside the reef northeast of the small boat channel which lies north of the west end of the main island by Randall, Lobel, and associates on 9 April 1984.

**Neoniphon aurolineatus* (Liénard, 1839)

Observed and photographed (Figure 14) from *Makali'i* at 113–160 m. Seen by Strasburg, Jones, and Iversen (1968) off Oahu from the submarine *Asherah* to 146 m. Randall and Heemstra (1985) noted that *Neoniphon aurolineatus* is the oldest name for this species (usually reported as *Flammeo scythrops* Jordan and Evermann).

Neoniphon sammara (Forsskål, 1775)

Holocentrus sammara Halstead and Bunker, 1954.

Plectrypops lima (Valenciennes in C and V, 1831)

Holotrachys lima Gosline, 1955.

**Pristilepis oligolepis* (Whitley, 1941)

Observed by Ralston from *Makali'i* in 165–348 m. Photographed in 233 m (Figure 15). *Pristilepis* and the related genus *Ostichthys* were revised by Randall, Shimizu, and Yamakawa, 1982.

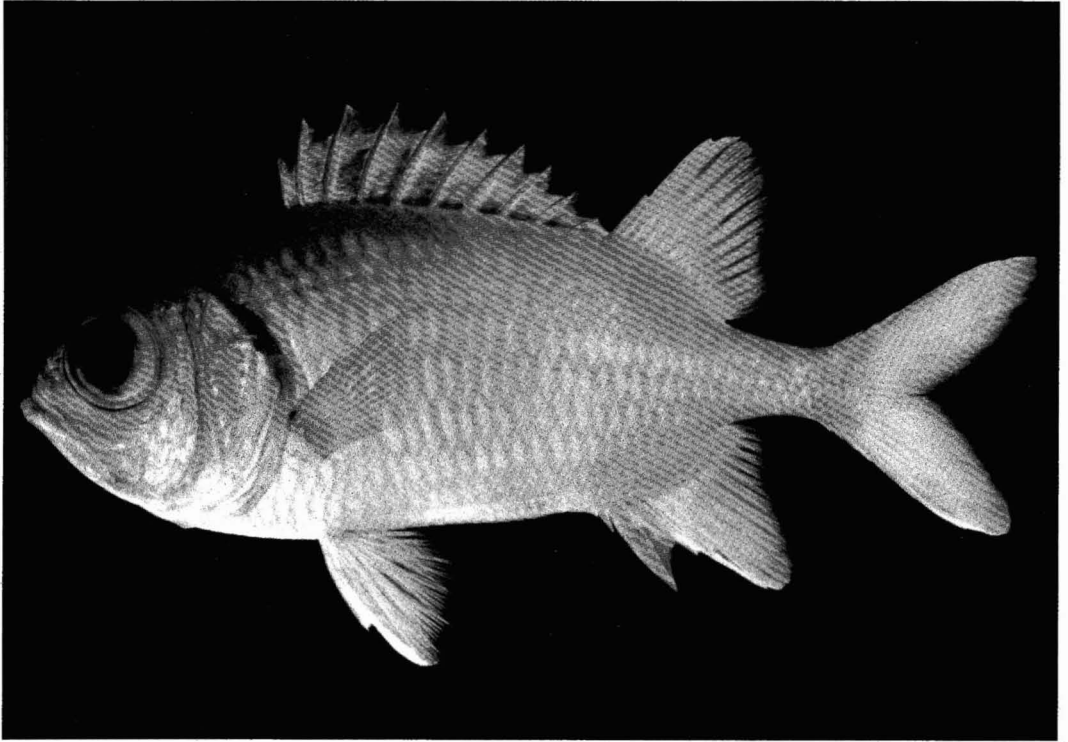


FIGURE 11. *Myripristis chryseres*, BPBM 29268, 197 mm SL, 113 m (J. Randall).



FIGURE 12. Aggregation of *Myripristis chryseres* (and four *Neoniphon aurolineatus*), photo from submarine in 152 m (S. Ralston).



FIGURE 13. *Myripristis kuntee*, BPBM 29603, 142 mm SL, 12.5 m (J. Randall).

Sargocentron microstoma (Günther, 1859)

Holocentrus microstomus Fowler and Ball, 1925. No specimens have been collected since the *Tanager* Expedition in 1923; one individual was photographed from *Makali'i* in 183 m (Figure 16), an unusual depth for this shallow-water species.

Sargocentron punctatissimum (Cuvier, 1929)

Holocentrus lacteoguttatus (Cuvier), as reported by Fowler and Ball 1925. Randall and Heemstra (1985) have shown that *S. punctatissimum* has priority over *S. lacteoguttatum*.

Sargocentron spiniferum (Forsskål, 1775)

Holocentrus leo Cuvier, as reported by Smith and Swain 1883. More common at Johnston Island than the Hawaiian Islands.

Deepest observation at the atoll, 122 m. Reported to 110 m off Oahu by Strasburg, Jones, and Iversen (1968) from the submarine *Asherah*.

Sargocentron tiere (Cuvier in C and V, 1829)

Holocentrus erythraeus (Günther), as reported by Smith and Swain 1883.

**Sargocentron xantherythrum* (Jordan and Evermann, 1903)

Five specimens (BPBM 29604, 115–126 mm SL) of this Hawaiian endemic species were collected with rotenone from beneath a ledge outside the reef about 500 m northeast of the small boat channel by Randall, Lobel, and associates on 9 April 1984. The largest was photographed (Figure 17).



FIGURE 14. *Neoniphon aurolineatus*, photo from submarine in 113 m next to discarded military vehicle (J. Randall).

FAMILY SCORPAENIDAE (SCORPIONFISHES)

**Dendrochirus barberi* (Steindachner, 1900)

John L. Earle discovered one individual of this Hawaiian species in 4 m off the recreation dock at Johnston Island. It was photographed underwater (Figure 18) and speared by Randall (BPBM 29576, 97 mm SL).

**Pontinus macrocephalus* (Sauvage, 1882)

The most common deep-water scorpaenid at Johnston Island. Observed and photographed from the *Makali'i* at depths of 198–366 m (Figure 19).

**Scorpaena colorata* (Gilbert, 1905)

Photographed from *Makali'i* in 272 m.

**Scorpaenodes kelloggi* (Jenkins, 1903)

One specimen, BPBM 29620, 25 mm SL (Figure 20), was collected with rotenone at the same station as the *Sargocentron xantherythrum* cited above.

Scorpaenodes parvipinnis (Garrett, 1864); Brock, Jones, and Helfrich 1965

Scorpaenodes sp.

This unidentified scorpionfish appears to be a species of *Scorpaenodes*. It was videotaped

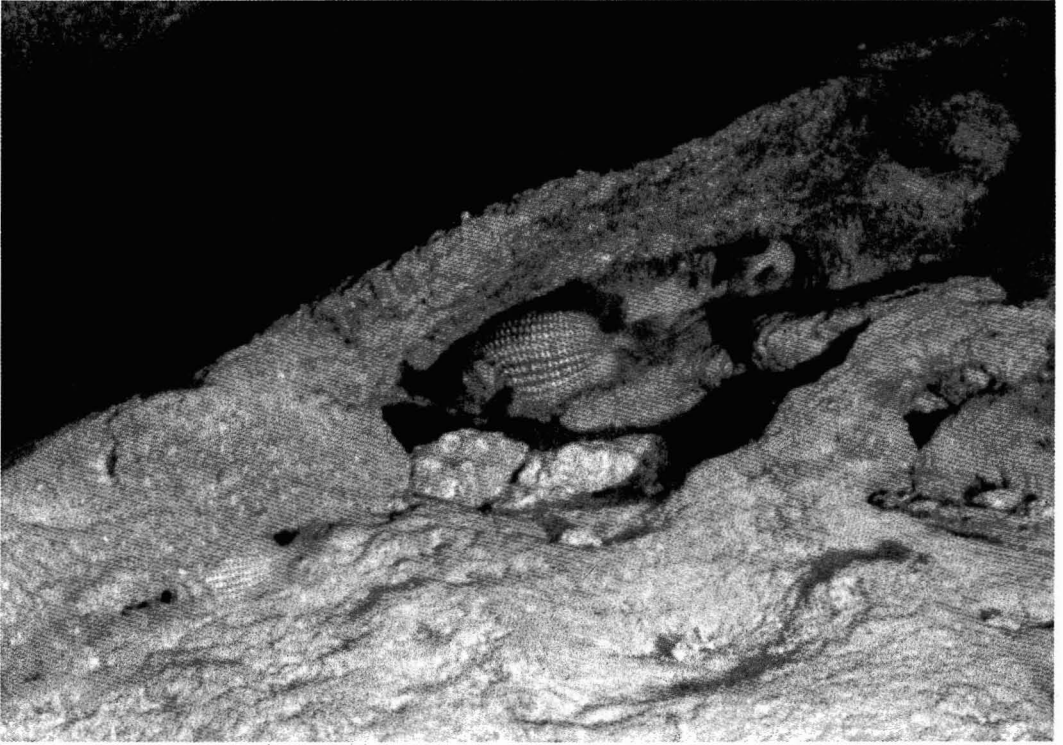


FIGURE 15. *Pristilepis oligolepis*, photo from submarine in 223 m (S. Ralston).



FIGURE 16. *Sargocentron microstoma* (and *Myripristis chryseres* above and to the right), photo from submarine in 183 m (E. Chave).



FIGURE 17. *Sargocentron xantherythrum*, BPBM 29604, 126 mm SL, 12.5 m (J. Randall).



FIGURE 18. *Dendrochirus barberi*, BPBM 29576, 97 mm SL, 4 m (J. Randall).



FIGURE 19. *Pontinus macrocephalus*, photo from submarine in 340 m (E. Chave).

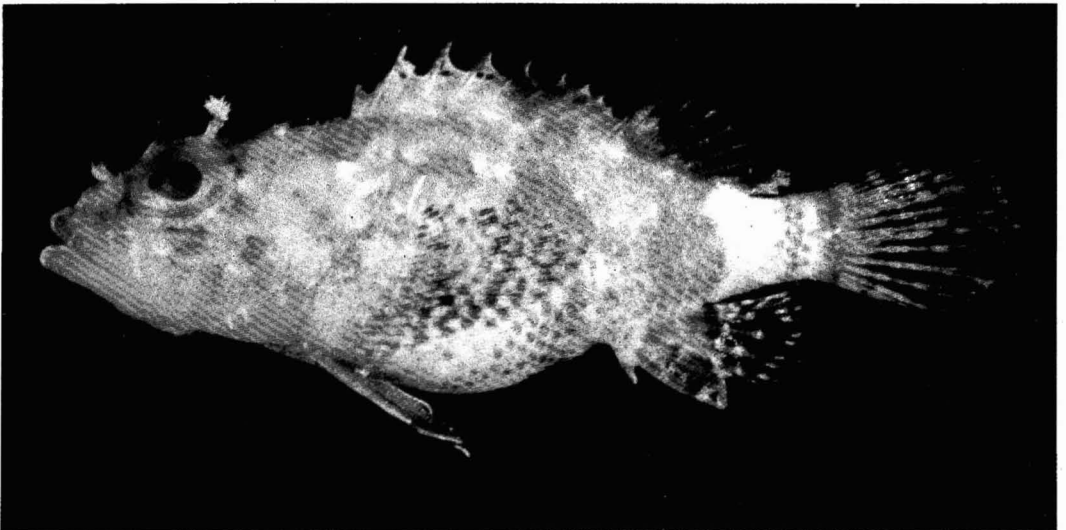


FIGURE 20. *Scorpaenodes kelloggi*, BPBM 29620, 25 mm SL, 12.5 m (J. Randall).



FIGURE 21. *Scorpaenodes* sp., from a videotape taken from submarine in 220 m (C. Agegian).

in 220 m. Figure 21 is a photo of the video-screen. The dark bars and other markings were deep red.

**Scorpaenopsis diabolus* (Cuvier in C and V, 1829)

One specimen, BPBM 8935, 119 mm SL (Figure 22) collected on 26 July 1968 with rotenone by Randall, R. L. Bowers, and A. C. Banner in 7 m outside the ocean reef NE of small boat channel. A second specimen (BPBM 29577, 180 mm SL) was speared by Randall off the recreation dock on 6 April 1984.

Sebastapistes ballieui (Sauvage, 1875); Gosline 1955

Sebastapistes coniora (Jenkins, 1903); Gosline 1955

FAMILY TRIGLIDAE (SEA ROBINS)

**Satyrichthys engyceros* (Günther, 1871)

Observed and photographed (Figure 23) from *Makali'i* at 370–400 m.

FAMILY SERRANIDAE (GROUPERS AND SEABASSES)

**Anthias fucinus* Randall and Ralston, 1984

Described from Hawaiian and Johnston Island material. Juvenile specimens were collected at Johnston with rotenone by Lobel from the *Makali'i* at 214–237 m. Observed at depths of 150–270 m. The most common benthic fish at the atoll over much of its depth range.

**Anthias ventralis* Randall, 1979

Observed by Ralston from the *Makali'i* in 107 m.

**Epinephelus quernus* Seale, 1901

Encountered on nearly all the submarine dives at Johnston in the depth range of 125 to 350 m and often photographed (Figure 24).

**Holanthias elizabethae* (Fowler, 1923)

Adults and juveniles observed and videotaped by the authors and others from *Makali'i* at depths of 155 to 262 m.

**Holanthias fuscipinnis* (Jenkins, 1901)

Sighted by Randall, Chave, and Ralston from *Makali'i* in 158–213 m. Less common at Johnston than *Holanthias elizabethae*.

Luzonichthys sp.

Observed by Ralston from *Makali'i* in 107 m. Possibly *Luzonichthys earlei* Randall (1981), but it will be necessary to obtain a specimen to determine the species.

**Plectranthias helenae* Randall, 1980

Photographed in 220 m from *Makali'i*.

**Promicrops lanceolatus* (Bloch, 1790)

One specimen, BPBM 13991, 940 mm SL, taken by hook and line by a fisherman in the Johnston lagoon on 12 July 1971. Brought to Bishop Museum by Richard E. Brock and

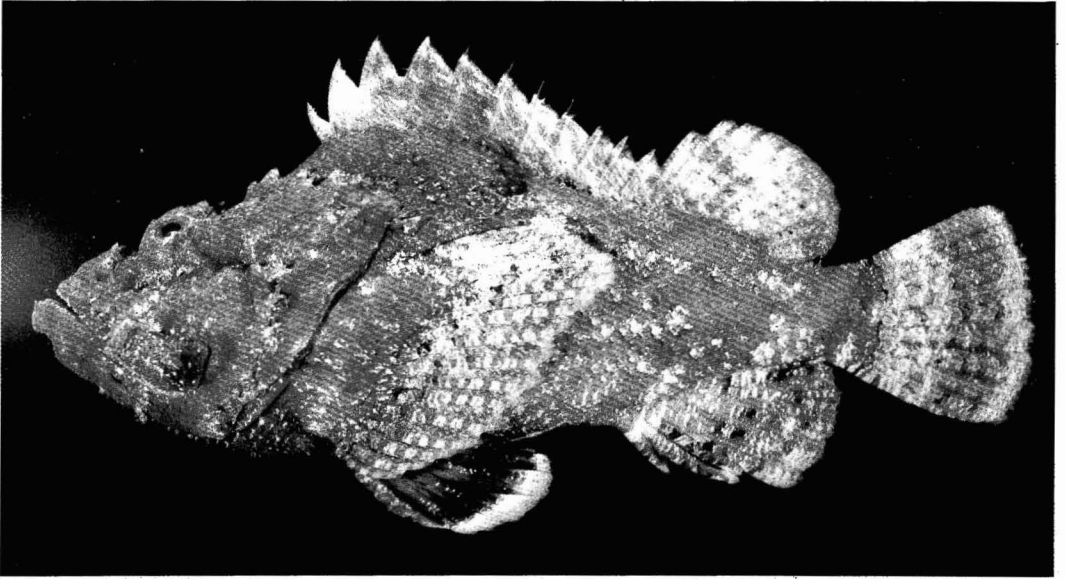


FIGURE 22. *Scorpaenopsis diabolus*, BPBM 8935, 119 mm SL, 7 m (J. Randall).



FIGURE 23. *Satyrichthys engyceros*, photo from submarine in 370 m (J. Randall).



FIGURE 24. *Epinephelus quernus*, photo from submarine in 262 m (P. Lobel).

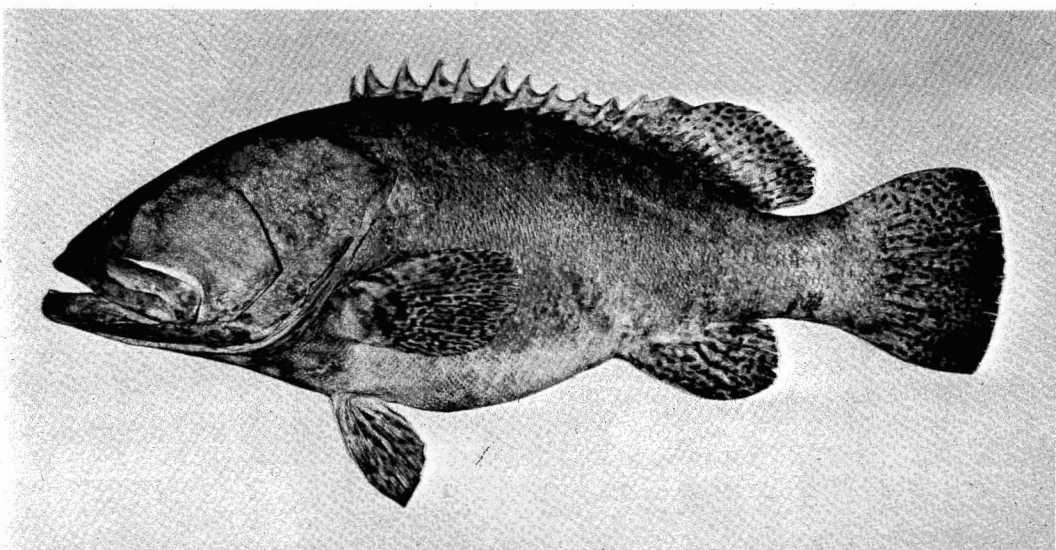


FIGURE 25. *Promicrops lanceolatus*, BPBM 13991, 940 mm SL (J. Randall).

photographed (Figure 25). The fish had a spiny lobster in its stomach.

Pseudogramma polyacantha (Bleeker, 1856); Gosline 1955

FAMILY CALLANTHIIDAE

**Grammatonotus laysanus* Gilbert, 1905

Videotaped by Ralston from *Makali'i* in 354 m (Figure 26). The white spot on the back of this fish was red at times. The same color pattern was observed on submarine dives in the principal Hawaiian Islands by Ralston and Chave. The spot is not mentioned in the color description by Katayama, Yamamoto, and Yamakawa (1982), but it may be evident only in life. The distinctive caudal fin shape (rounded with a long filament from each corner), long pelvic fins, and elongate soft portions of the dorsal and anal fins leave little doubt of the identification as *Grammatonotus laysanus*.

FAMILY PRIACANTHIDAE (BIGEYES)

**Cookeolus boops* (Schneider in Bloch and Schneider, 1801)

Moderately common for a fish its size (to about 35 cm) at Johnston Island in the depth range of 165–260 m. The Figure 27 photograph was taken by Gooding at 205 m.

Priacanthus cruentatus (Lacepède, 1801); Halstead and Bunker 1954

FAMILY CIRRHITIDAE (HAWKFISHES)

Amblycirrhitus bimacula (Jenkins, 1903)

Paracirrhites bimacula Gosline, 1955.

Cirrhitus pinnulatus (Schneider in Bloch and Schneider, 1801)

Cirrhitus maculatus Lacepède, as reported by Fowler and Ball 1925. Schultz (1950) ob-



FIGURE 26. *Grammatonotus laysanus*, from a videotape taken from submarine in 354 m (S. Ralston).

served that the *Cirrhitus* in Hawaii and Johnston Island is colored differently from those elsewhere in the Pacific. He applied the specific name *alternatus* Gill to this form; he was followed by Gosline (1955) and Gosline and Brock (1960). Randall (1963) noted that the color differences are not as marked as stated by Schultz; he employed the name *pinnulatus* for the species throughout the Indo-Pacific region. The Hawaiian-Johnston population can be differentiated by having narrow irregular orange-brown bands on the head with few discreet spots, in contrast to spots and short bands for fish extralimital to the Hawaiian-Johnston area. Randall pointed out that the oldest trivial name for the Hawaiian variant is *maculosus* Bennett.

Paracirrhites arcatus (Cuvier in C and V, 1829); Brock, Jones, and Helfrich 1965

Paracirrhites forsteri (Schneider in Bloch and Schneider, 1801); Brock, Jones, and Helfrich 1965

FAMILY KUHLIIDAE (FLAGTAILS)

Kuhlia marginata (Cuvier in C and V, 1829)

Kuhlia taeniura (non Cuvier) Smith and Swain, 1883. Gosline (1955) has discussed the occurrence of *K. marginata* at Johnston and



FIGURE 27. *Cookeolus boops*, photo from submarine in 205 m (R. Gooding).

provided a comparison with *K. sandvicensis* (Steindachner).

observed by Ralston from *Makali'i* at the entrance to a large cave in 300 m.

FAMILY BRAMIDAE (POMFRETS)

**Eumegistus illustris* Jordan and Jordan, 1922

One adult of 70.3 cm FL was caught by hook and line in 280 m from the *Townsend Cromwell* during the fishing survey at Johnston in early November 1983. The fish was not retained. It was identified by Ralston from the color illustration and brief description in Masuda, Araga, and Yoshino (1975).

FAMILY EMMELICHTHYIDAE (ROVERS)

**Erythrocles scintillans* (Jordan and Thompson, 1905)

An aggregation of about 25 adults was

FAMILY LUTJANIDAE (SNAPPERS)

Aphareus furca (Lacepède, 1801)

Aphareus furcatus Brock, Jones, and Helfrich 1965.

Pristipomoides sieboldii (non Bleeker) Fowler and Ball, 1925. The specimen reported by Fowler and Ball (BPBM 3999, 360 mm SL) as *P. sieboldii* is *Aphareus furca*, a common roving predator in the Johnston lagoon and outer reef areas. Videotaped at 122 m by Ralston from *Makali'i*.

**Aphareus rutilans* Valenciennes in C and V, 1830

Ralston observed this species at Johnston Island from *Makali'i* at depths of 189–250 m.



FIGURE 28. *Etelis carbunculus*, photo from submarine in 253 m (S. Ralston).

None were caught, however, during the subsequent deep-water fishing survey at the atoll.

**Etelis carbunculus* Cuvier in C and V, 1828

Photographed from *Makali'i* in 253 m (Figure 28). Five specimens caught by the National Marine Fisheries Service in 244–366 m. Often misidentified as *Etelis marshi* (Jenkins), as pointed out by Anderson (1981).

**Etelis coruscans* Valenciennes, 1862.

Observed occasionally from *Makali'i*; recorded fleetingly on videotape by Randall and Bartko at a depth of 293 m. Four were caught by the National Marine Fisheries Service in 250–357 m. As shown by Anderson (1981), many authors such as Gosline and Brock (1960) have misidentified this red snapper as *Etelis carbunculus*.

**Pristipomoides auricilla* (Jordan, Evermann and Tanaka, 1927)

Two juveniles, BPBM 29269, 61–68 mm SL (Figure 29) collected by Randall and Bartko from *Makali'i* with sodium cyanide at a depth of 208–220 m. Occasional adults seen and videotaped in 195–250 m; one photographed in 254 m (Figure 30).

**Pristipomoides filamentosus* Valenciennes in C and V, 1830)

Forty-three adults were caught by the National Marine Fisheries Service at Johnston Island in 122–260 m. This is the species known as *ōpakapaka* in the Hawaiian Islands which has been misidentified as *Pristipomoides microlepis* (Bleeker) by Gosline and Brock (1960) and others (Kami 1973).

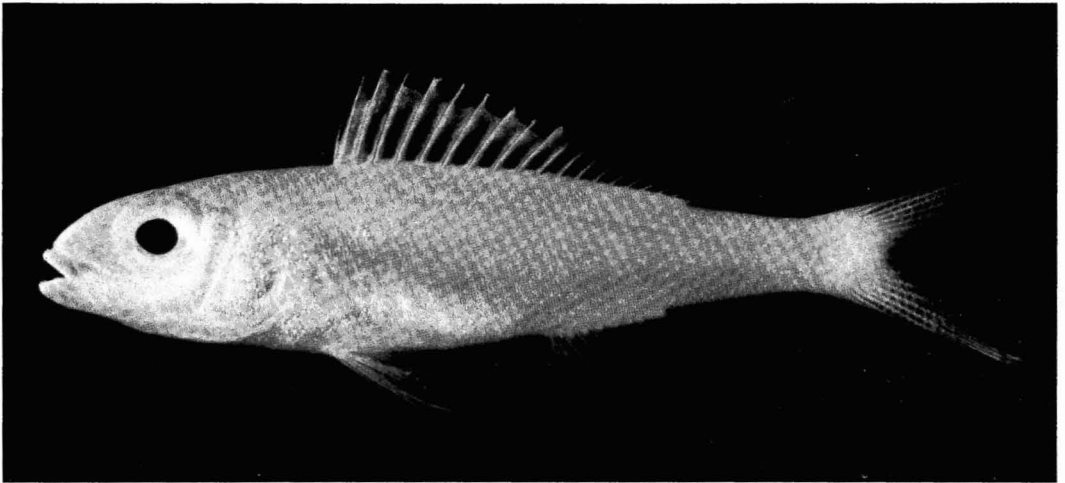


FIGURE 29. *Pristipomoides auricilla*, BPBM 29269, 68 mm SL, 208–220 m (J. Randall).



FIGURE 30. *Pristipomoides auricilla*, photo from submarine in 254 m (S. Ralston).

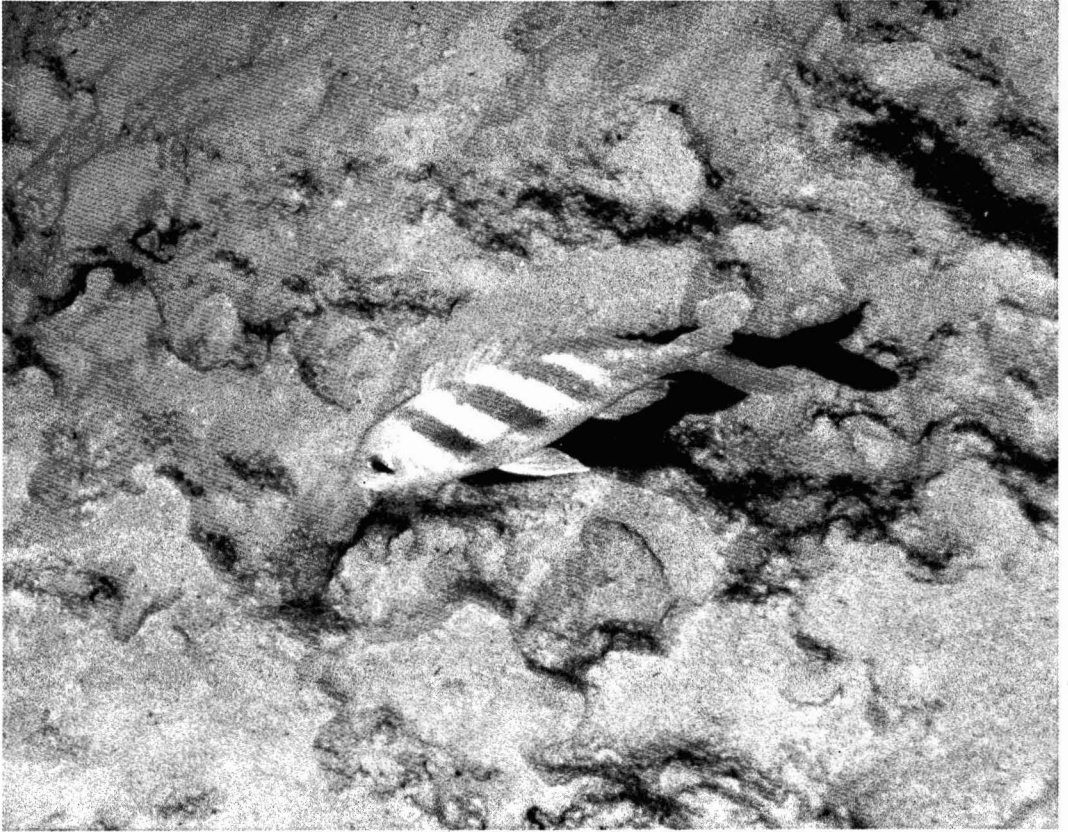


FIGURE 31. *Pristipomoides zonatus*, photo from submarine in 275 m (P. Lobel).

**Pristipomoides zonatus* (Valenciennes in C and V, 1830)

Seen and photographed by several observers from *Makali'i* (Figure 31). Thirty-two specimens were collected by the National Marine Fisheries Service in 204–293 m. Reported (as *Rooseveltia brighami*) at 110 m off Oahu by Strasburg, Jones, and Iversen (1968).

**Symphysanodon maunaloae* Anderson, 1970

Five specimens, BPBM 29266, 47–51 mm SL, were collected with rotenone by Lobel and Bartko from *Makali'i* at a depth of 274 m and one by Chave and Foster in 305 m (BPBM 29371, 55.5 mm SL). Observed at depths of 230–366 m. Gloerfelt-Tarp and Kailola (*Trawled Fishes of Southern Indonesia and*

Northwestern Australia; 1984) recorded this species from southern Indonesia. Most recent authors have classified *Symphysanodon* in the Lutjanidae. Johnson (1980), however, has concluded that it is a primitive percoid not closely related to the lutjanids. He assigns it to no existing family. It is here retained in the Lutjanidae pending further study.

FAMILY KYPHOSIDAE (SEA CHUBS)

Kyphosus bigibbus Lacepède, 1802; Halstead and Bunker 1954

The Halstead-Bunker record is here confirmed by a specimen (BPBM 29591, 202 mm SL) speared by Randall in 3 m in the Johnston Island lagoon after being photographed underwater (Figure 32).



FIGURE 32. *Kyphosus bigibbus*, BPBM 29591, 202 mm SL, 3 m (J. Randall).

**Kyphosus cinerascens* (Forsskål, 1775)

Several individuals observed by the authors in the Johnston lagoon, and one photographed (Figure 33).

Kyphosus vaigiensis (Quoy and Gaimard, 1825); Gosline 1955

FAMILY MULLIDAE (GOATFISHES)

Mulloides flavolineatus (Lacepède, 1801)

Upeneus preorbitalis Smith and Swain, 1883. Often identified as *Mulloidichthys samoensis* (Günther), a junior synonym.

Mulloides vanicolensis (Valenciennes in C and V, 1831)

Upeneus vanicolensis Smith and Swain, 1883.

Mulloidichthys auriflamma (non Forsskål), Halstead and Bunker, 1954. A large aggregation of adults was observed by Randall and

Foster from *Makali'i* in 113 m taking shelter in a discarded vehicle on sand. Several were collected with rotenone from beneath the concrete ramp at Johnston Island (where the level of illumination is very low) by Randall, Lobel, Earle, and Merrill on 7 April 1984; one was preserved (BPBM 29587, 156 mm SL).

Parupeneus barberinus (Lacepède, 1801)

Upeneus barberinus Fowler and Ball, 1925. No specimens have been taken since the one obtained by Fowler and Ball (BPBM 4068, 285 mm SL), and there have been no underwater sightings. A locality error seems probable for this specimen.

Parupeneus bifasciatus (Lacepède, 1801)

Upeneus crassilabris Valenciennes, as reported by Smith and Swain 1883. Photographed in 46 m from *Makali'i*.

Parupeneus cyclostomus (Lacepède, 1801)

Parupeneus chryserydros (Lacepède), as re-

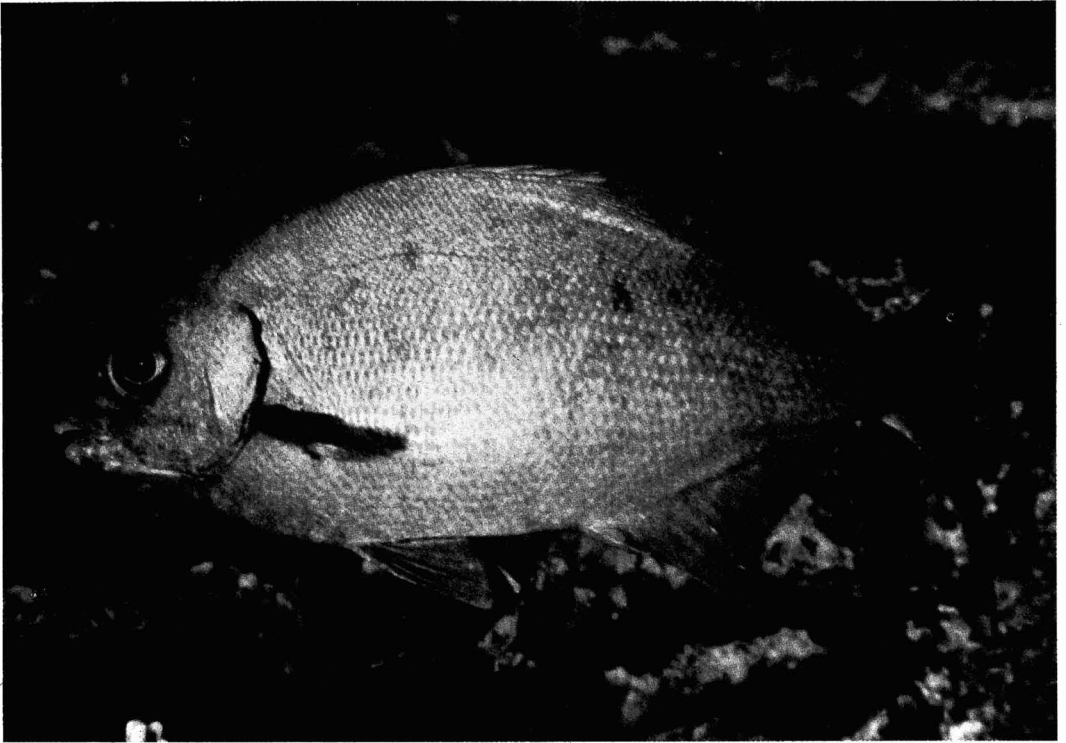


FIGURE 33. *Kyphosus cinerascens*, underwater photo, 3 m (J. Randall).

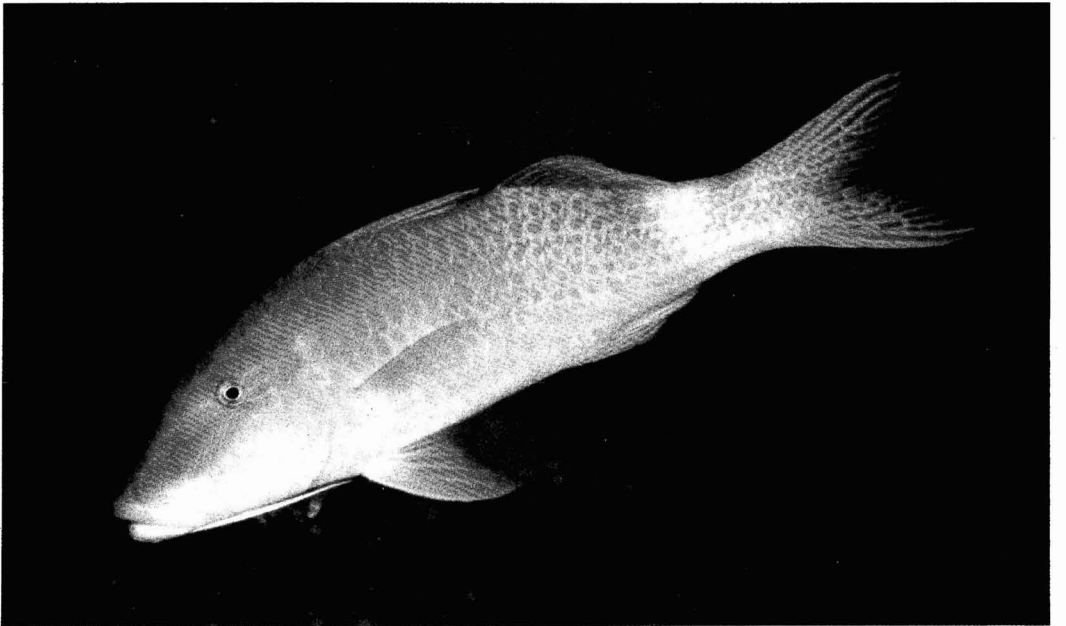


FIGURE 34. *Parupeneus cyclostomus*, underwater photo, 9 m (J. Randall).

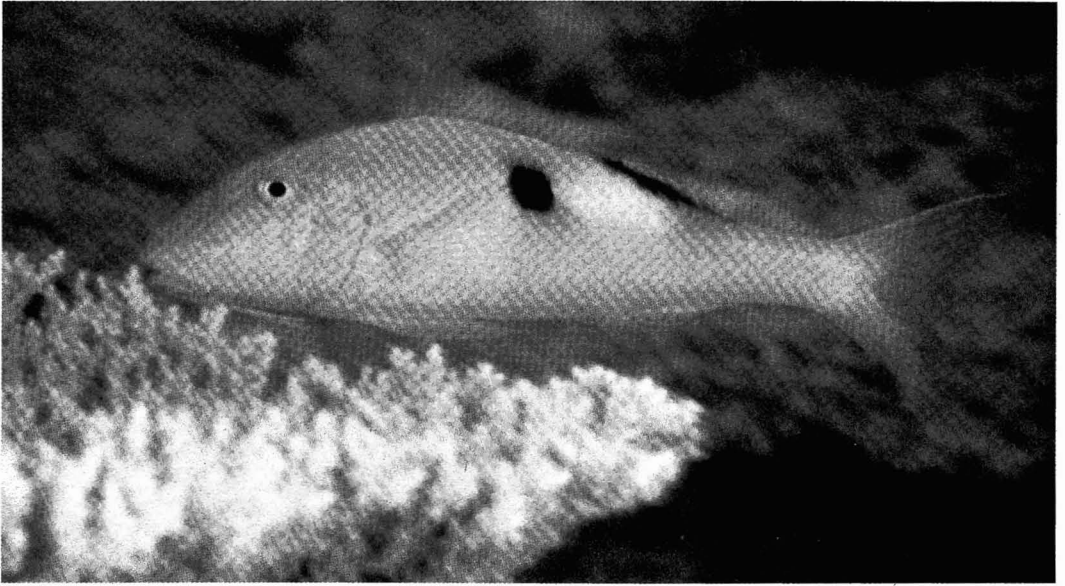


FIGURE 35. *Parupeneus pleurostigma*, underwater photo, 6 m (J. Randall).

ported by Halstead and Bunker, 1964. Photographed at 92 m from *Makali'i* by Maragos. Underwater photos taken in the Johnston lagoon (Figure 34).

Parupeneus multifasciatus (Quoy and Gaimard, 1825)

Upeneus velifer Smith and Swain, 1883. A common shallow-water goatfish at Johnston Island which was occasionally seen from the *Makali'i*; the deepest observation, 125 m, by Ralston. Strasburg, Jones, and Iversen (1968) reported the species off Oahu from the submersible *Asherah* to 140 m.

**Parupeneus pleurostigma* (Bennett, 1830)

The existence of an adult of this species in the Johnston lagoon was pointed out by A. J. Dee. An underwater photo (Figure 35) was taken of this fish (which was difficult to approach).

FAMILY APOGONIDAE (CARDINALFISHES)

Apogon coccineus Rüppell, 1838

Apogon erythrinus Snyder, as reported by Gosline 1955.

Apogon kallopterus Bleeker, 1856

Amia frenata (Valenciennes), as reported by Fowler and Ball 1925.

Apogon snyderi Jordan and Evermann, as reported by Gosline 1955.

Apogon taeniopterus Bennett, 1835

Apogon menesemus Jenkins, as reported by Gosline 1955. Although Fraser and Lachner (ms.) regard the Hawaiian *A. menesemus* as a distinct species, we prefer to consider it a subspecies of *A. taeniopterus*.

Apogonichthys perdix Bleeker, 1854

Apogon waikiki (Jordan and Evermann), as reported by Gosline 1955. Regarded as a junior synonym of *Apogonichthys perdix* by Randall (ms.).

**Epigonus* sp.

One specimen (BPBM 29370, 43 mm SL) collected by Eldredge and Foster in 366 m from *Makali'i*. This fish and other specimens from the Hawaiian Islands represent a new species being described by Ofer Gon of the J. L. B.

Smith Institute of Ichthyology in Grahamstown, South Africa. Fishes of the genus *Epigonus* were seen more often at Johnston than any others in the depth range of 330–370 m. Observers recorded these as *E. fragilis* (Jordan and Jordan), but when the single specimen turned out to be undescribed, it was realized that the submarine sightings could have been just the new species or both it and *E. fragilis*.

Pseudamiops gracilicauda (Lachner in Schultz and collaborators, 1953); Gosline 1955

FAMILY MALACANTHIDAE (SAND TILEFISHES)

**Malacanthus brevirostris* Guichenot, 1858

Two subadults of this species were observed by Randall and Lobel outside the reef northeast of the small boat channel at a depth of 22 m.

FAMILY CARANGIDAE (JACKS)

**Carangoides ferdau* (Forsskål, 1775)

A single adult individual of this barred species was observed at close range by Randall in 8 m over a sand-rubble bottom off the recreation dock of Johnston Island. William F. Smith-Vaniz has advised the use of the name *Carangoides ferdau* for this species. Most recent authors have identified it as *C. gilberti* (Jordan and Seale).

Carangoides orthogrammus (Jordan and Gilbert, 1881)

Caranx gymnostethoides (non Bleeker) Smith and Swain, 1883. We follow Smith-Vaniz (pers. comm.) in applying the name *orthogrammus* to this species instead of *C. ferdau* (Forsskål) as used by most authors. Two individuals were observed in 3 m in the Johnston lagoon accompanying a large eagle ray (*Aetobatis narinari*), and one of 280 mm FL was speared. Randall observed this species of jack cruising slowly over sand in 112 m from

Makali'i, and Ralston recorded it from 103–168 m (Figure 36). Fowler and Bean (1925) reported a specimen of *Caranx dasson* Jordan and Snyder from Johnston Island. This specimen is not extant at the Bishop Museum or the Academy of Natural Sciences of Philadelphia. *C. dasson* is a junior synonym of *Carangoides equula* (Temminck and Schlegel). Smith-Vaniz regards a record of *C. equula* from Johnston as questionable. The Fowler and Bean specimen was probably *C. orthogrammus*.

**Caranx ignobilis* (Forsskål, 1775)

A single adult of this large species was observed by Randall outside the reef northeast of the small boat channel in 13 m, and one was photographed underwater by A. J. Dee (Figure 37).

Caranx lugubris Poey, 1861

Caranx ascensionis (Osbeck), as reported by Fowler and Ball 1925. Although *C. ascensionis* is the oldest name for this species, William F. Smith-Vaniz is petitioning the International Commission on Zoological Nomenclature to suppress it in favor of the widely used *C. lugubris*. Observed from *Makali'i* on nearly all dives in the depth range of 122 to 354 m. This fish is occasionally seen as shallow as 12 m in outer reef areas.

Caranx melampygus Cuvier in C and V, 1833; Halstead and Bunker 1954

Observed to a maximum depth of 190 m from *Makali'i* by Ludwig. Strasburg, Jones, and Iversen (1968) reported this jack in Hawaiian waters off Oahu to 140 m. The most common carangid at the atoll.

**Decapterus macarellus* (Cuvier in C and V, 1833)

Two specimens obtained from fishermen by A. J. Dee at Johnston Island (BPBM 29650, 255–257 mm FL) in April 1984. Unfortunately, the fish were gutted and the gills removed.



FIGURE 36. *Carangoides orthogrammus*, photo from submarine in 119 m (S. Ralston).

**Elagatis bipinnulatus* (Quoy and Gaimard, 1825)

Young observed in the lagoon by Chave. Small schools of adults seen in 43 to 150 m from *Makali'i* by Gooding and Ralston (Figure 38).

Scomberoides lysan (Forsskål, 1775)

Scomberoides sancti petri (Cuvier), as reported by Smith and Swain 1883; a junior synonym of *S. lysan* (Smith-Vaniz and Staiger, 1973).

Selar crumenophthalmus (Bloch, 1793)

Trachurops crumenophthalmus Gosline, 1955.

**Seriola dumerili* (Risso, 1810)

This circumtropical species was sighted from the submarine *Makali'i* by all observers in the depth range of a few to 335 m and often photographed (Figure 39).

FAMILY CORYPHAENIDAE (DOLPHINS)

**Coryphaena hippurus* Linnaeus, 1758

When the *Makali'i* reached the surface from an ascent from 250 m, Randall observed a group of four individuals (each about 500 mm TL) of this pelagic species within 2 m of the submersible.



FIGURE 37. *Caranx ignobilis*, underwater photo, 14 m (A. J. Dee).

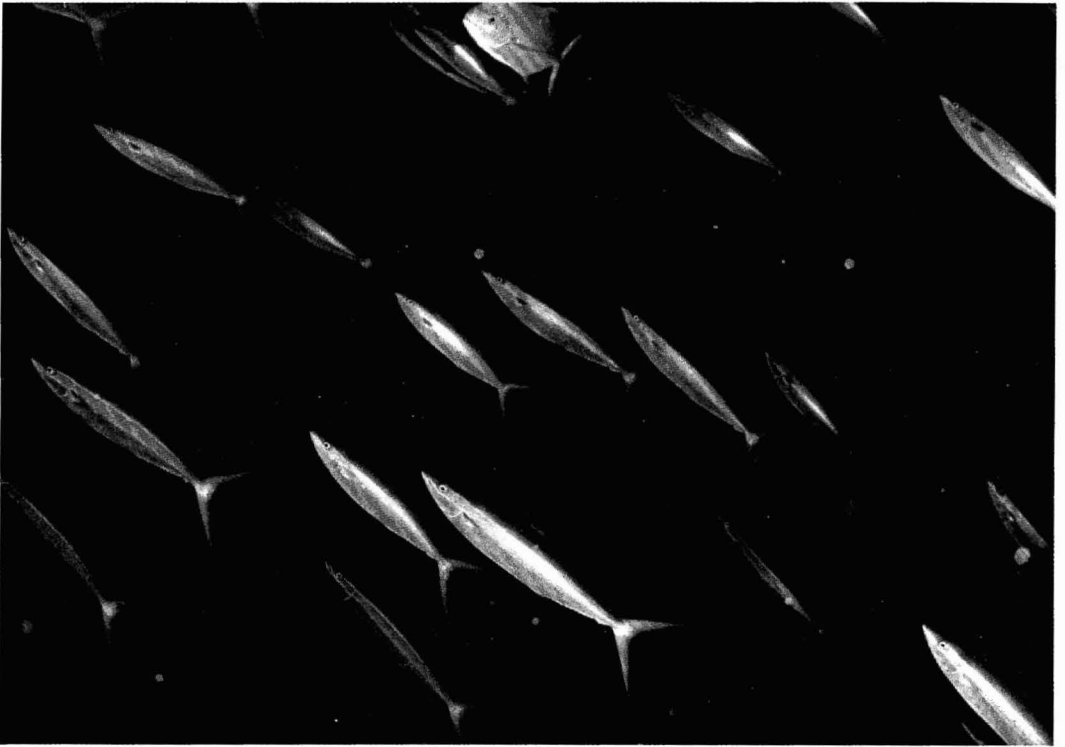


FIGURE 38. *Elagatis bipinnulatus*, photo from submarine in 120 m (S. Ralston).

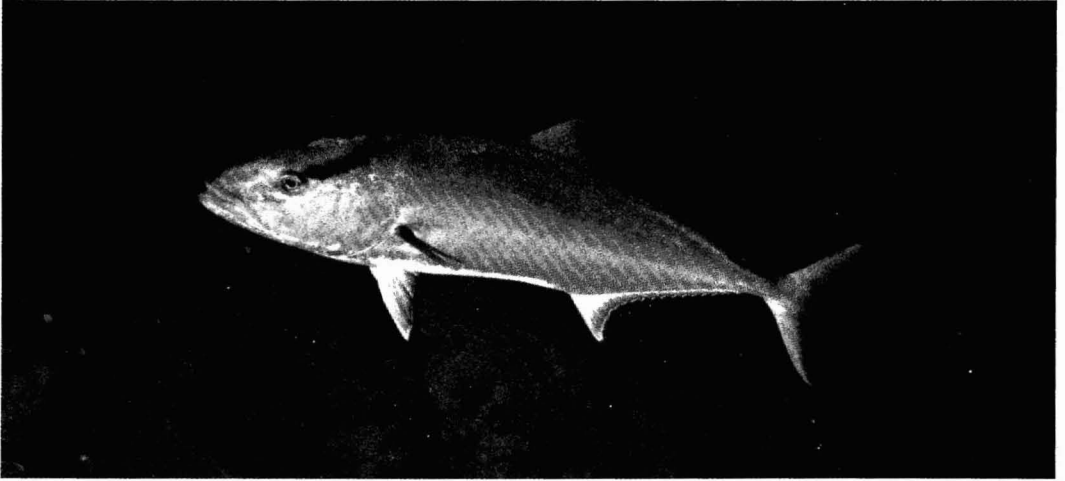


FIGURE 39. *Seriola dumerili*, photo from submarine at 250 m (S. Ralston).

FAMILY ECHENEIDIDAE (REMORAS)

Remora remora (Linnaeus, 1758); Gosline 1955

FAMILY MUGILIDAE (MULLET)

Chaenomugil leuciscus (Günther, 1871)

Neomyxus chaptalii (Eydoux and Souleyet), as reported by Fowler and Ball 1925. We follow James M. Thomson (ms.) in the use of the name *Chaenomugil leuciscus* for this mullet.

FAMILY POLYNEMIDAE (THREADFINS)

Polydactylus sexfilis (Valenciennes in C and V, 1831)

Polynemus kuru Smith and Swain, 1883.

FAMILY SPHYRAENIDAE (BARRACUDAS)

**Sphyraena barracuda* (Walbaum, 1792)

We have not observed this species at Johnston, but it is known by local sport fishermen who have caught it in outer reef areas. Also, a large individual at East Island has been

hooked on more than one occasion but has always escaped.

Sphyraena helleri Jenkins, 1901

Sphyraena japonica (non Valenciennes) Fowler and Bean, 1925.

FAMILY POMACENTRIDAE (DAMSELFISHES)

Abudefduf sordidus (Forsskål, 1775); Fowler and Ball 1925

Chromis acares Randall and Swerdloff, 1973

Chromis vanderbilti (non Fowler) Gosline, 1955.

Chromis agilis Smith, 1950

Chromis dimidiatus (non Klunzinger) Fowler and Bean, 1925.

Chromis leucurus (non Gilbert) Gosline, 1955.

Chromis verater Jordan and Metz, 1912; Randall and Swerdloff 1973

Observed from *Makali'i* to depths of 140 m at Johnston Island. Figure 40 shows one in-



FIGURE 40. *Chromis verator* (circled) in a school of *Hemitaurichthys thompsoni*, photo from submarine in 69 m (C. Agegian).

dividual in an aggregation of *Hemitaurichthys thompsoni*. One specimen (BPBM 29605, 120 mm SL) was collected with rotenone in 12.5 m by Randall, Lobel, and associates. This damselfish has been collected to depths of 183 m in the Hawaiian Islands.

Dascyllus albisella Gill, 1862; Gosline 1955

Plectroglyphidodon imparipennis (Vaillant and Sauvage, 1875)

Abudefduf imparipennis Fowler and Ball, 1925.

Plectroglyphidodon johnstonianus Fowler and Ball, 1924

Plectroglyphidodon phoenixensis Schultz, 1943

Abudefduf albofasciatus (non Hombron and Jacquinot), as reported by Fowler and Ball 1925.

FAMILY LABRIDAE (WRASSES)

Anampses cuvier Quoy and Gaimard, 1824; Randall 1972a

Randall (1972a) reported two Bishop Museum specimens from Johnston Island, one of which was illustrated in color. The species is rare at the atoll.

Bodianus bilunulatus (Lacepède, 1801)

Harpe bilunulata Smith and Swain, 1883. Three adults were reported by Smith and Swain. One specimen (BPBM 29623, 185 mm SL) was obtained by Randall by spear in 13 m

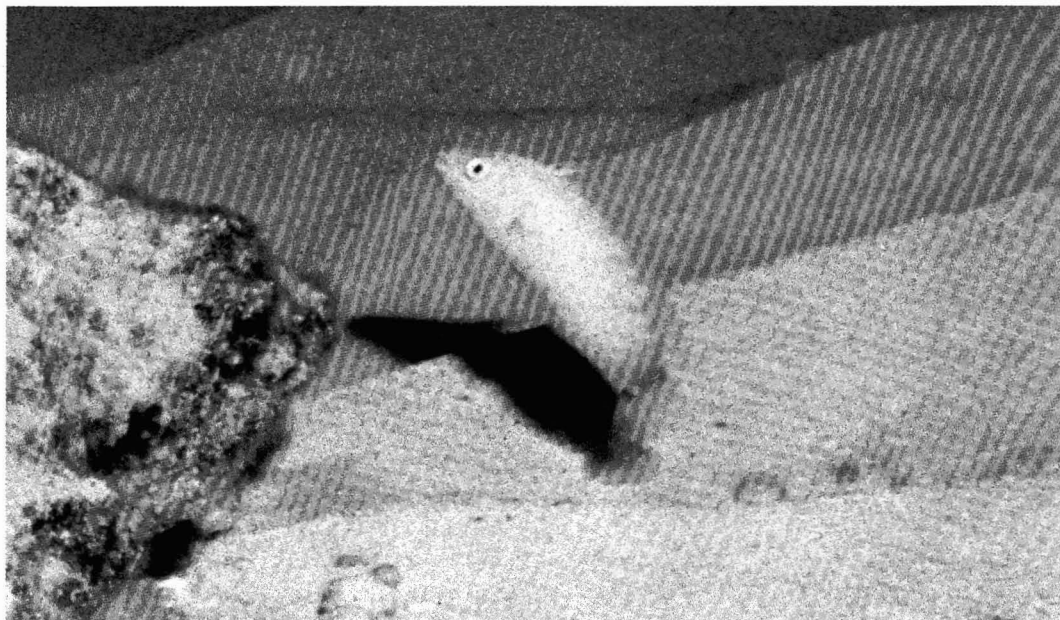


FIGURE 41. *Coris ballieui*, underwater photo, 21 m (J. Earle).

outside the barrier reef northeast of the small boat channel on 10 April 1984. Videotaped by Bartko and Kerby in 131 m from *Makali'i*. Submarine observations by Lobel to 140 m. This species is less common at Johnston Island than in the Hawaiian Islands. Gomon and Randall (1978) classified the Hawaiian population of this wrasse as a distinct subspecies, *Bodianus bilunulatus albotaeniatus* (Valenciennes). It is this subspecies which occurs at Johnston.

Cheilinus unifasciatus Streets, 1877

Chilinus digramma (non Lacepède) Smith and Swain, 1883.

Cheilinus rhodochrous (non Playfair and Günther) Gosline, 1955. A common species at Johnston Island. One sighting by Ralston in 122 m from *Makali'i*.

Cheilio inermis (Forsskål, 1775); Brock, Jones, and Helfrich 1965

**Coris ballieui* Vaillant and Sauvage, 1875

Only one individual of this endemic

Hawaiian species was observed at Johnston Island. It was seen by Randall and John L. Earle outside the reef northeast of the small boat channel in 21 m (Figure 41).

Coris gaimard (Quoy and Gaimard, 1824); Brock, Jones, and Helfrich 1965

Not uncommon at Johnston in the depth range of 2 to 50 m.

Epibulus insidiator (Pallas, 1770); Fowler and Ball 1925

Known in Hawaii only from the Northwestern Hawaiian Islands. Common at Johnston Atoll.

Gomphosus varius Lacepède, 1801

Gomphosus tricolor Quoy and Gaimard, as reported by Fowler and Ball 1925. Strasburg and Hiatt (1957) have shown that *G. tricolor* is the male form of *G. varius*, the latter name having priority. Randall observed pair spawning of this species in the Johnston lagoon on 26 June 1969.

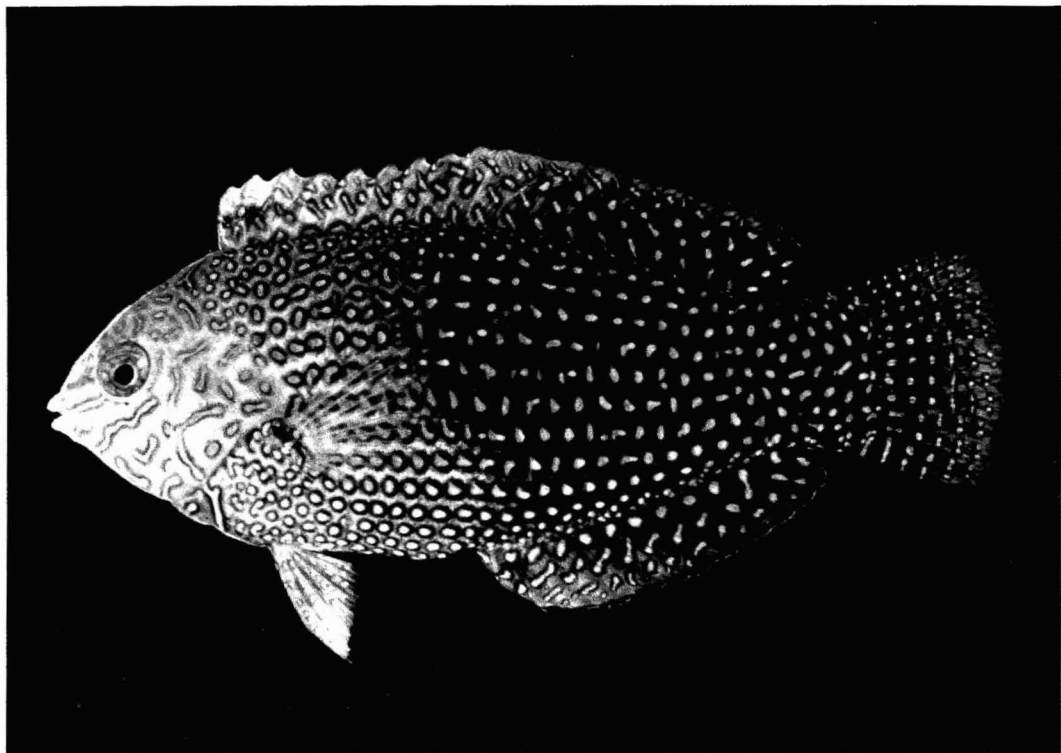


FIGURE 42. *Macropharyngodon geoffroy*, ♀, BPBM 29621, 69 mm SL (J. Randall).

Halichoeres ornatissimus (Garrett, 1863);
Fowler and Ball 1925

Labroides phthirophagus Randall, 1958; Brock,
Jones, and Helfrich 1965

Adults of this species at Johnston Island
differ slightly in color from the Hawaiian
population; the yellow color is less brilliant at
Johnston.

**Macropharyngodon geoffroy* (Quoy and
Gaimard, 1824)

Only one individual of this endemic
Hawaiian wrasse was observed at Johnston
Island. It was speared by Randall in 21 m out-
side the barrier reef northeast of the small
boat channel on 10 April 1984. The specimen,
BPBM 29621, 69 mm SL (Figure 42), is a ripe
female.

Novaculichthys taeniourus (Lacepède, 1801);
Gosline 1955

**Polylepion russelli* (Gomon and Randall,
1975)

Observed from *Makali'i* at depths of
244–280 m (Figure 43). A juvenile of about
100 mm TL was videotaped by Randall in
315 m. Its most striking marking is a large
pale-edged black spot at the upper base of the
caudal fin. On adults this spot is red and less
distinct.

Pseudocheilinus octotaenia Jenkins, 1900; Gos-
line 1955

Pseudocheilinus tetrataenia Schultz, 1960

Pseudocheilinus hexataenia (non Bleeker)
Fowler and Bean, 1925.



FIGURE 43. *Polylepion russelli*, photo from submarine in 275 m (R. Gooding).

**Pseudojuloides cerasinus* (Snyder, 1904)

One female (BPBM 29622, 62 mm SL) was speared outside the barrier reef northeast of the small boat channel in 21 m by Randall and photographed (Figure 44). Rare at Johnston where it was seen only in outer reef areas.

Stethojulis balteata (Quoy and Gaimard, 1824)

Stethojulis axillaris (Quoy and Gaimard), as reported by Gosline 1955. Randall and Kay (1974) have shown that *S. axillaris* is the initial phase and *S. balteata* the terminal male of the same species; the latter name has page priority.

Thalassoma ballieui (Vaillant and Sauvage, 1875)

Julis verticalis Smith and Swain, 1883.

Thalassoma duperrey (Quoy and Gaimard, 1924)

Julis clepsydralis Smith and Swain, 1883. The hybrid of *Thalassoma duperrey* and *T. lutescens* is not uncommon at Johnston Island; it is under study by Randall and Lobel. The cross *T. duperrey* × *T. quinquevittatum* is occasionally seen at the atoll.

Thalassoma lutescens (Lay and Bennett, 1839)

Thalassoma aneitense (Günther), as reported by Fowler and Ball 1925.

Thalassoma purpureum (Forsskål, 1775); Fowler and Ball 1925

Thalassoma quinquevittatum (Lay and Bennett, 1839); Gosline 1955

Thalassoma trilobatum (Lacepède, 1801)

Thalassoma fuscum (Lacepède) as reported

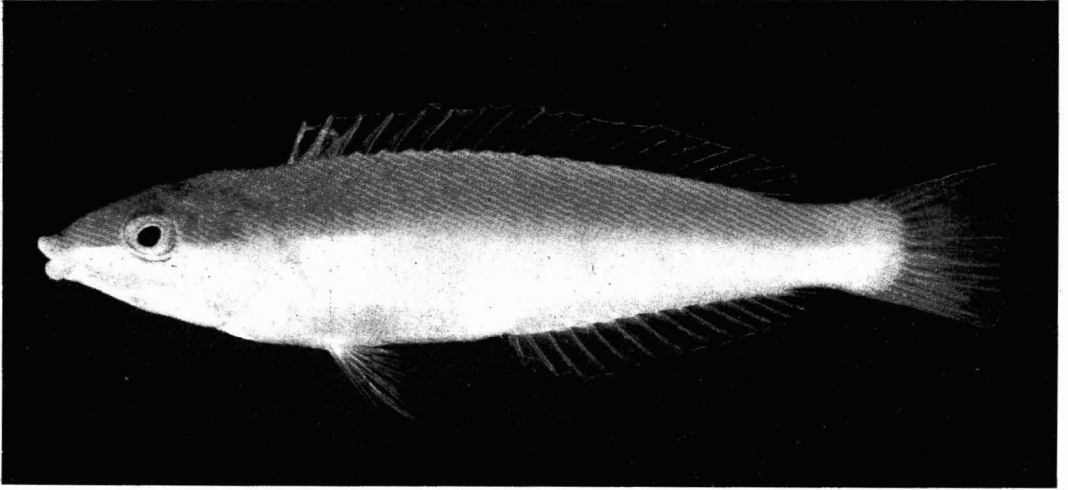


FIGURE 44. *Pseudojuloides cerasinus*, ♀, BPBM 29622, 62 mm SL, 21 m (J. Randall).

by Brock, Jones, and Helfrich 1965. Randall and Edwards (1984) have determined that *T. fuscum* (Lacepède) is a homonym.

**Xyrichtys aneitensis* (Günther, 1862)

Randall observed one adult over sand bottom at a depth of 92 m from the submersible *Makali'i*.

FAMILY SCARIDAE (PARROTFISHES)

Calotomus carolinus (Valenciennes in C and V, 1839)

Calotomus sandvicensis (Valenciennes) as reported by Gosline 1955. Bruce and Randall (in press) have shown that the name *sandvicensis* is a junior synonym of *carolinus*, based on page priority of the latter.

Scarus dubius Bennett, 1828; Gosline 1955

Randall and Choat (1980) have shown that *Scarus lauia* Jordan and Evermann is the terminal male of this endemic Hawaiian-Johnston species.

Scarus perspicillatus Steindachner, 1879; Smith and Swain 1883

Scarus psittacus Forsskål, 1775

Scarus brunneus Jenkins and *Scarus forsteri* Valenciennes, as reported by Halstead and Bunker 1954. Randall and Ormond (1978) have shown that *S. psittacus* is the oldest name for this parrotfish; they described a neotype.

**Scarus rubroviolaceus* Bleeker, 1849

Two subadults were observed by Randall in the Johnston lagoon just inside the reef northeast of North Island; the largest (estimated 170 mm TL) was photographed (Figure 45).

Scarus sordidus Forsskål, 1775; Fowler and Ball 1925

Scarus erythrodon Valenciennes, as reported by Fowler and Ball, is the initial phase of *S. sordidus*.

FAMILY MUGILOIDIDAE (SANDPERCHES)

**Parapercis roseoviridis* (Gilbert, 1905)

Observed and videotaped by Randall and Chave from *Makali'i* at depths of 240–300 m.

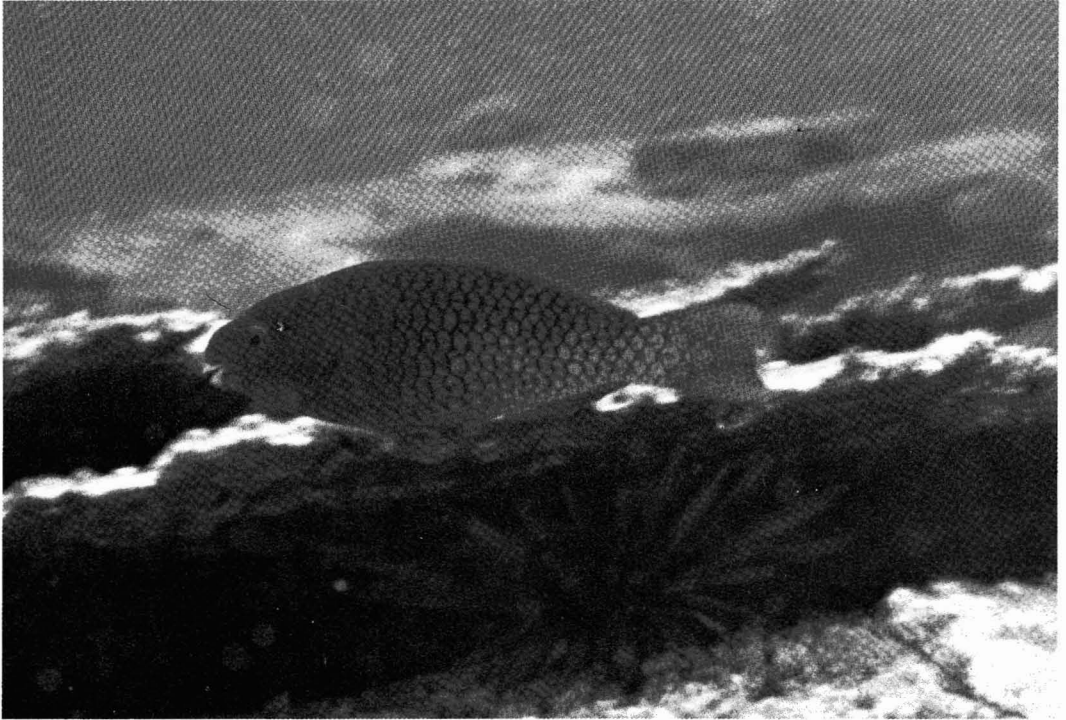


FIGURE 45. *Scarus rubroviolaceus*, initial phase, underwater photo, 4 m (J. Randall).

**Parapercis schauinslandi* (Steindachner, 1900)

Videotaped by Ralston from *Makali'i* in 107 m.

FAMILY PERCOPHIDIDAE

**Chrionema chryseres* Gilbert, 1905

Observed and videotaped by Chave and others from *Makali'i* in 350 to 396 m.

**Chrionema squamiceps* Gilbert, 1905

Videotaped by Randall in 304 m and by Agegian in 302 m. Translucent blue in life with a row of blackish spots along lower side. This identification is tentative.

FAMILY BOTHIDAE (LEFTEYE FLOUNDERS)

Bothus mancus (Broussonet, 1782)

Platophrys mancus Smith and Swain, 1883.

FAMILY CHAETODONTIDAE (BUTTERFLYFISHES)

Chaetodon auriga Forsskål, 1775

Chaetodon setifer Bloch, as reported by Smith and Swain 1883.

Chaetodon citrinellus Cuvier in C and V, 1831; Halstead and Bunker 1954

Chaetodon ephippium Cuvier in C and V, 1831; Fowler and Ball 1925.

**Chaetodon lineolatus* Cuvier in C and V, 1831

One individual observed by Randall at Donovan's Reef, Johnston Island in July 1968. A second was observed in the lagoon by John L. Earle in April 1984.

**Chaetodon miliaris* (Quoy and Gaimard, 1835)

The most abundant butterflyfish in the Hawaiian Islands but rare at Johnston Island.

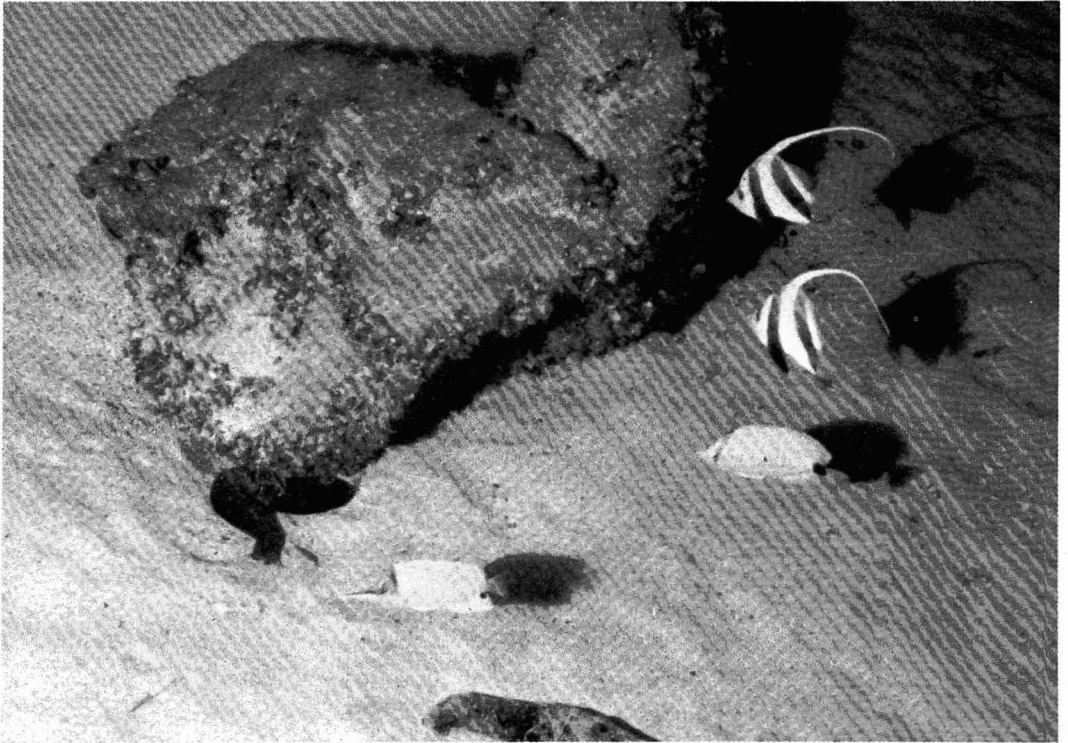


FIGURE 46. Two individuals of *Heniochus diphreutes* (upper right), one of *Chaetodon miliaris* (center right), and one of *Forcipiger flavissimus* (lower), photo from submarine in 94 m (C. Agegian).

One individual photographed from *Makali'i* (Figure 46). It seems likely that there is no breeding population of this species at Johnston. The few individuals there may have drifted in as larvae from the Hawaiian area.

**Chaetodon modestus* Temminck and Schlegel, 1842

Observed and photographed by the authors and other observers (Figure 47) from *Makali'i* in 113 to 253 m.



FIGURE 47. *Chaetodon modestus* (left) and *Myripristis chryseres*, photo from submarine in 177 m (J. Randall).

Chaetodon multicinctus Garrett, 1863

Chaetodon punctato-fasciatus (non Valenciennes) Fowler and Ball, 1925.

Chaetodon ornatissimus Solander in C and V, 1831; Fowler and Ball 1925

Chaetodon quadrimaculatus Gray, 1831; Fowler and Ball 1925

Chaetodon reticulatus Cuvier in C and V, 1831; Brock, Jones, and Helfrich 1965



FIGURE 48. Aggregation of *Hemitaurichthys thompsoni* with one individual of *Acanthurus dussumieri* (lower circle) and one of *A. thompsoni* (upper right circle), photo from submarine in 56 m (J. Maragos).

**Chaetodon tinkeri* Schultz, 1951

Observed and photographed by the authors and others from *Makali'i* in 55–160 m.

Chaetodon trifasciatus Mungo Park, 1797; Fowler and Ball 1925

Chaetodon unimaculatus Bloch, 1787; Fowler and Ball 1925

Forcipiger flavissimus Jordan and McGregor, 1898

Forcipiger longirostris (non Broussonet) Brock, Jones, and Helfrich, 1965. Randall and Caldwell (1970) clarified the classification of the two species of *Forcipiger*. Submarine observations of *F. flavissimus* were made to a

depth of 114 m, and one photo was taken (Figure 46). The true *F. longirostris* has not been sighted at Johnston Island but could be expected to occur there.

Hemitaurichthys thompsoni Fowler, 1923; Brock, Jones, and Helfrich 1965

Deepest submarine observation at Johnston Island, 114 m. One aggregation joined *Makali'i* at 69 m (Figure 40) and accompanied it to lesser depths. Another school was photographed from the submarine in 56 m (Figure 48).

**Heniochus diphreutes* Jordan, 1903

Observed and photographed (Figures 46, 49) from *Makali'i* in 113–210 m.

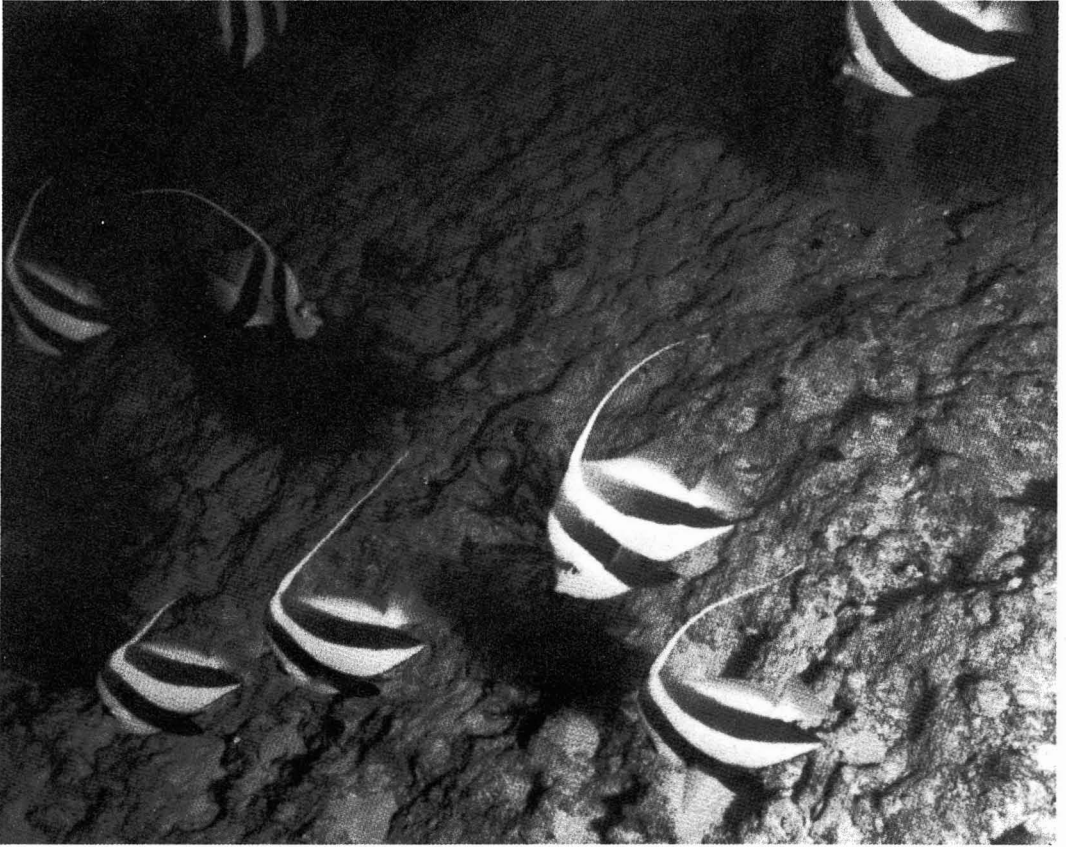


FIGURE 49. *Heniochus diphreutes*, photo from submarine in 137 m (S. Ralston).

Megaprotodon trifascialis (Quoy and Gaimard, 1825)

Megaprotodon strigangulus (Gmelin), as reported by Brock, Jones, and Helfrich 1965. Burgess (1978) has shown that *M. strigangulus* (Gmelin) is a *nomen nudum*, hence invalid. This butterflyfish, classified by some authors in *Chaetodon*, is very common in the lagoon of Johnston Island but exceedingly rare in the principal Hawaiian Islands. This is no doubt related to the absence of corals of the genus *Acropora*, the main food of *M. trifascialis*, in the principal Hawaiian Islands, in contrast to an abundance of these corals, particularly *A. cytheria*, at Johnston.

FAMILY POMACANTHIDAE (ANGELFISHES)

**Centropyge fisheri* (Snyder, 1904)

One individual sighted by Lobel from *Makali'i* at a depth of 85 m. He was not certain of his identification and agrees that confirmation of this record is needed.

Centropyge loriculus (Günther, 1873)

Holocanthus loriculus Fowler and Ball, 1925.

Centropyge flammeus Woods and Schultz in Schultz and collaborators, 1953.

Centropyge nigriocellus Woods and Schultz in Schultz and collaborators 1953

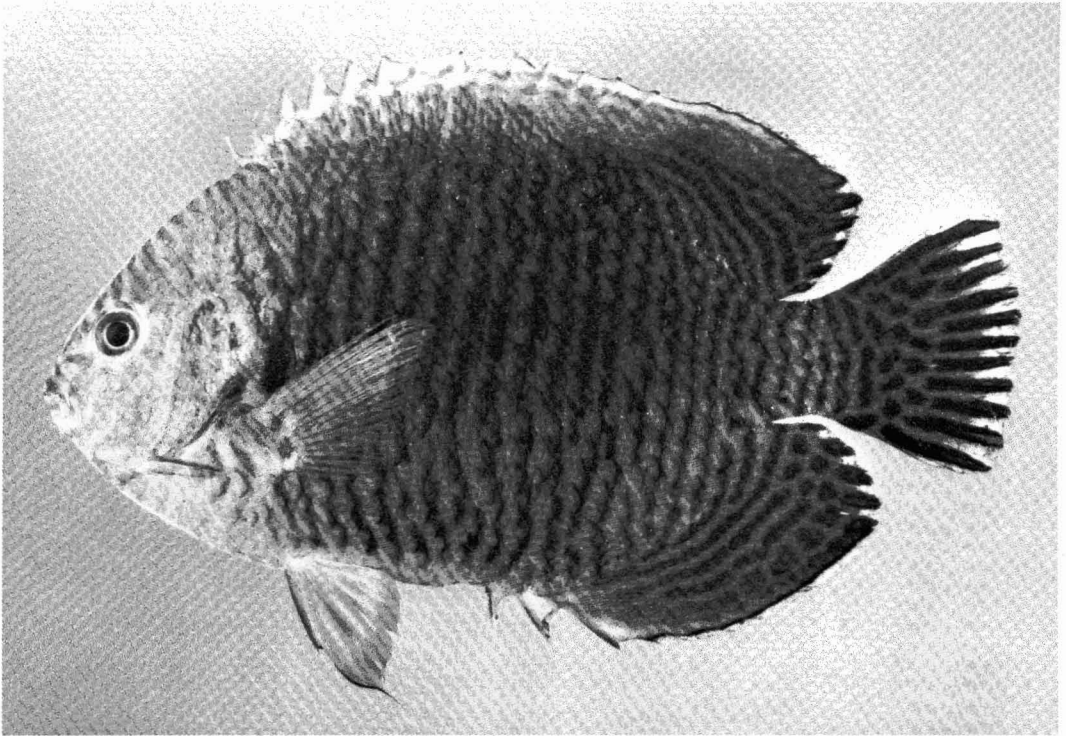


FIGURE 50. *Centropyge potteri*, BPBM 29606, 92 mm SL, 12.5 m (J. Randall).

**Centropyge potteri* (Jordan and Metz, 1912)

One specimen, BPBM 29606, 92 mm SL (Figure 50), collected with rotenone by Randall, Lobel, and associates outside the barrier reef northeast of the small boat channel in 12.5 m. Only one other individual sighted (by Lobel in the lagoon).

Genicanthus sp.

Observed by Ralston in 128 m. According to him, it was not *Genicanthus personatus* or any known species of the genus.

**Holacanthus arcuatus* Gray, 1831

Observed by Lobel and others on the outer reef slope of Johnston Atoll to a maximum depth of 183 m. Strasburg, Jones, and Iversen (1968) reported it to 131 m off Oahu from observations from the submarine *Asherah*.

FAMILY OPLEGNATHIDAE (KNIFEJAWS)

**Oplegnathus punctatus* (Temminck and Schlegel, 1844)

One adult of about 350 mm TL was observed by Randall and Lobel in the Johnston lagoon at a depth of 3 m. Chave observed others in the harbor area.

FAMILY ZANCLIDAE (MOORISH IDOL FAMILY)

Zanclus cornutus (Linnaeus, 1758)

Zanclus canescens (Linnaeus), as reported by Fowler and Ball 1925. Maximum depth of observation from *Makali'i* at Johnston Island, 125 m. Strasburg, Jones, and Iversen (1968) reported the species to 183 m off Oahu from the research submarine *Asherah*.

FAMILY ACANTHURIDAE (SURGEONFISHES)

Acanthurus achilles Shaw, 1803

Hepatus achilles Fowler and Ball, 1925.

**Acanthurus blochii* Valenciennes in C and V 1835

One specimen, BPBM 8989, 243 mm SL, speared by Randall on the ocean reef in 2 m on 28 July 1968. Usually identified as *Acanthurus mata* (Cuvier), but this is the oldest name for the surgeonfish most authors have called *A. bleekeri* Günther (Randall, ms.).

**Acanthurus dussumieri* Valenciennes in C and V, 1835

One adult individual was sighted by Ralston from Makali'i in 131 m. Another was photographed in a mixed aggregation of fishes dominated by *Hemitaurichthys thompsoni* (Figure 48).

Acanthurus glaucopareius Cuvier, 1829; Brock, Jones, and Helfrich 1965

Acanthurus guttatus Schneider in Bloch and Schneider, 1801; Brock, Jones, and Helfrich 1965

Acanthurus nigricauda Duncker and Mohr, 1929

Hepatus nigricans Fowler and Ball, 1925. These authors reported three specimens of this surgeonfish from Johnston Island and one from Wake Island, giving the lengths as 305 to 323 mm. Bishop Museum, however, has only one Fowler and Ball specimen from Johnston (BPBM 4286, 185 mm SL, 253 mm TL) and three from Wake Island (BPBM 4285, 200 to 216 mm SL, 272 to 316 mm TL). Since there is no other record of this species from Johnston, we never observed it there, and the number of specimens and their lengths do not agree with the text of Fowler and Ball, we admit to the possibility of locality error for this species.

Acanthurus nigroris Valenciennes in C and V, 1835

Hepatus lineolatus (Bleeker), as reported by Fowler and Ball 1925.

Acanthurus elongatus (non Lacepède), Gosline, 1955. It is odd that the wide-ranging *A. nigrofuscus* (Forsskål) has not been found at Johnston.

Acanthurus olivaceus Schneider in Bloch and Schneider, 1801

Hepatus olivaceus Fowler and Ball, 1925.

**Acanthurus thompsoni* (Fowler, 1923)

One adult individual photographed (Figure 48) from Makali'i in an aggregation of *Hemitaurichthys thompsoni*.

Acanthurus triostegus (Linnaeus, 1758); Smith and Swain 1883

Randall (1956) classified the Hawaiian and Johnston Island populations of this wide-ranging surgeonfish as *Acanthurus triostegus sandvicensis* Streets.

Ctenochaetus hawaiiensis Randall, 1955; Brock, Jones, and Helfrich 1965

Ctenochaetus marginatus (Valenciennes in C and V, 1835)

Ctenochaetus cyanoguttatus Randall, as reported by Brock, Jones, and Helfrich 1965. Randall (ms.) has concluded that *C. marginatus* (Valenciennes), a new name for *Acanthurus guttatus* (non Bloch and Schneider) Kittlitz, seems to be the same species as *C. cyanoguttatus*.

Ctenochaetus strigosus (Bennett, 1828); Fowler and Ball 1925; Randall 1955

Ctenochaetus striatus (non Quoy and Gaimard); Halstead and Bunker, 1954.

**Naso hexacanthus* (Bleeker, 1855)

Observed by Randall and others from Makali'i at depths of 46–164 m. Two adults observed at close range by Randall and Lobel while diving with SCUBA outside the reef northeast of the small boat channel in 18 m.

Naso lituratus (Schneider in Bloch and Schneider, 1801)

Acanthurus literatus Fowler and Ball, 1925.

**Naso unicornis* (Forsskål, 1775)

Rare at Johnston Island. One (BPBM 29593, 272 mm SL) speared by Randall in the lagoon.

Naso sp.

A small school of an unidentified species of *Naso* was videotaped by Gooding from *Makali'i* at a depth of 122 m. It was also observed by Ralston. The fish were constantly in motion and never clearly seen. They are at least as elongate as *N. hexacanthus* and lack any protuberance on the forehead. The caudal fin seems truncate without filaments. No markings were seen on the head or body, but there is a conspicuous large round dark spot basally on the caudal fin.

Zebrasoma flavescens (Bennett, 1828); Fowler and Ball 1925

Common at Johnston. Deepest submarine observation, 50 m.

Zebrasoma veliferum (Bloch, 1797); Brock, Jones, and Helfrich 1965

FAMILY SCOMBRIDAE (TUNAS AND MACKERELS)

**Acanthocybium solanderi* (Cuvier in C and V, 1831)

This species, *Katsuwonus pelamis*, and *Thunnus albacares* were caught by fishermen at Johnston Island and examined by Chave at the landing site.

**Euthynnus affinis* (Cantor, 1849)

A single large individual of this small tuna was observed near the surface over a depth of 30 m outside the reef northeast of the small boat channel. Sport fishermen at Johnston, who know the fish by the common name

kawakawa, catch it occasionally in the outer reef areas.

**Katsuwonus pelamis* (Linnaeus, 1758)

**Thunnus albacares* (Bonaterre, 1788).

FAMILY ISTIOPHORIDAE (BILLFISHES)

**Makaira nigricans* Lacepède, 1802

Caught by fishermen at Johnston Island and examined by Chave.

FAMILY BLENNIIDAE (BLENNIES)

**Cirripectes variolosus* (Valenciennes in C and V, 1836)

Jeffrey T. Williams has identified material of this species in the U.S. National Museum of Natural History (USNM 198731, 32:31.5–66.8 mm SL). These fish were collected with rotenone at Sand Island by B. Amerson.

Cirripectes vanderbilti (Fowler, 1938)

Rupiscartes variolosus (non Valenciennes) Fowler and Ball, 1925. We follow J. T. Williams (pers. comm.) in applying the name *Cirripectes vanderbilti* to the Hawaiian populations of *Cirripectes* related to *C. variolosus*.

Exallias brevis (Kner, 1868); Gosline 1955

Istiblennius gibbifrons (Quoy and Gaimard, 1824)

Rupiscartes gibbifrons Fowler and Ball, 1925. Schultz and Chapman in Schultz and collaborators (1960) described *Istiblennius afileinuchalis* from the Phoenix Islands and Swains Island and *I. rodenbaughi* from the northern Marshall Islands. We believe these nominal forms should be regarded as subspecies of *I. gibbifrons*. Thus, the Hawaiian population would be *I. gibbifrons gibbifrons*. The Johnston Island specimens of this species (Figure 51) appear to be the same as the



FIGURE 51. *Istiblennius gibbifrons gibbifrons*, BPBM 29588, ♀ above, 81 mm SL, ♂ below, 85 mm SL, concrete ramp in lagoon, 0.1 m (J. Randall).

Hawaiian. Chave and Eckert (1974) recorded *I. afinuchalis* from Fanning Island, Line Islands.

Nemateleotris magnifica Fowler, 1938; Randall and Allen, 1973.

FAMILY GOBIIDAE (GOBIES)

Bathygobius cocosensis (Bleeker, 1854)

Bathygobius fuscus (non Rüppell) Fowler and Bean, 1925.

Eviota epiphanes Jenkins, 1903

Eviota viridis (non Waite) Brock, Jones, and Helfrich, 1965.

Gnatholepis anjerensis (Bleeker, 1850); Gosline 1955

**Priolepis aureoviridis* (Gosline, 1959)

Three specimens, BPBM 11054, 20 to 36 mm SL (Figure 52), collected with rotenone outside ocean reef northeast of small boat channel in 7 m by Randall, R. L. Bowers, and A. C. Banner on 26 July 1968. The use of the generic name *Priolepis* to replace *Quisquilius* and *Zonogobius* was advised by Douglass F. Hoese (pers. comm.).

Priolepis farcimen (Jordan and Evermann, 1903)

Zonogobius farcimen Gosline, 1955. In addition to Hawaii and Johnston, the Bishop

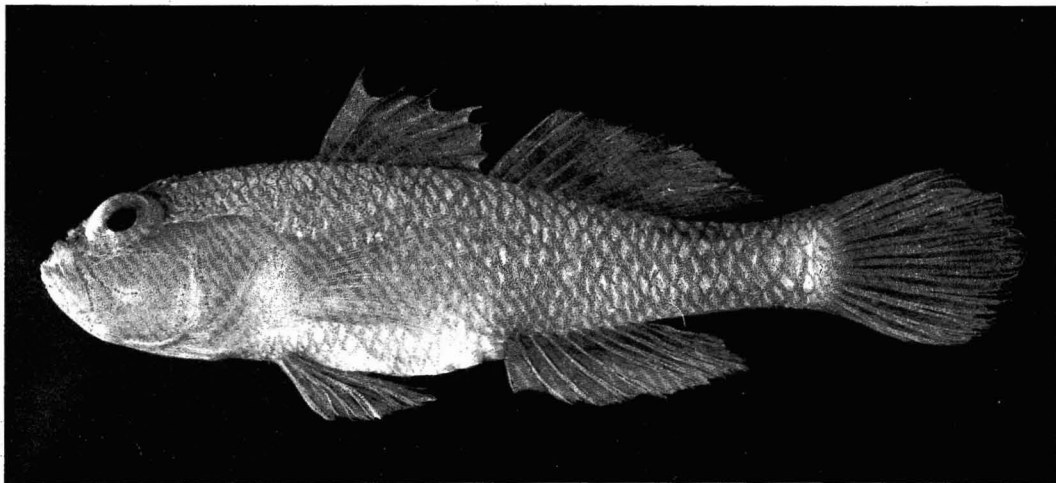


FIGURE 52. *Priolepis aureoviridis*, BPBM 11054, 36 mm SL, 7 m (J. Randall).

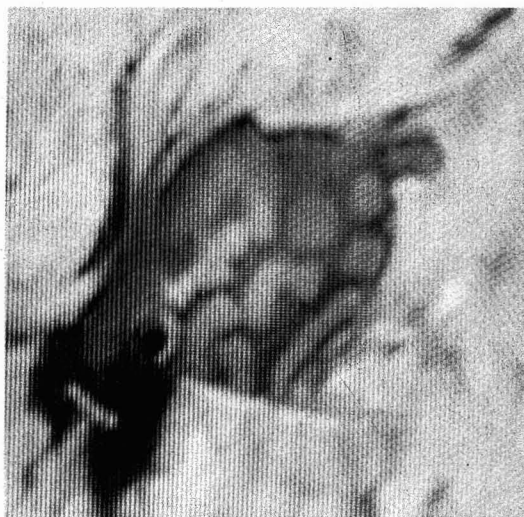


FIGURE 53. Juvenile of *Hollardia goslinei*, from videotape taken from submarine in 335 m (B. Keating).

Museum has specimens of this goby from the northern Marshall Islands, Minami Tori Shima (Marcus Island), Pitcairn Group, Austral Islands, and Tonga Islands.

**Ptereleotris heteroptera* (Bleeker, 1855)

Observed by Chave in 8 m while SCUBA diving off the east camera-stand "islet." We are

not certain of this identification. A specimen or photograph should be obtained to confirm the record.

Trimma unisquamis (Gosline, 1959)

Hazeus unisquamis Gosline, 1959; Brock, Jones, and Helfrich, 1965.

FAMILY TRIACANTHODIDAE (SPIKEFISHES)

**Hollardia goslinei* Tyler, 1968

A juvenile videotaped from *Makali'i* in 335 m. A photo of the videoscreen (Figure 53) was identified by James C. Tyler.

FAMILY BALISTIDAE (TRIGGERFISHES)

Melichthys niger (Bloch, 1786).

Balistes buniva Lacepède, as reported by Smith and Swain 1883. Very abundant at Johnston (Figure 54).

Melichthys vidua (Solander in Richardson, 1844)

Balistes vidua Fowler and Ball, 1925.

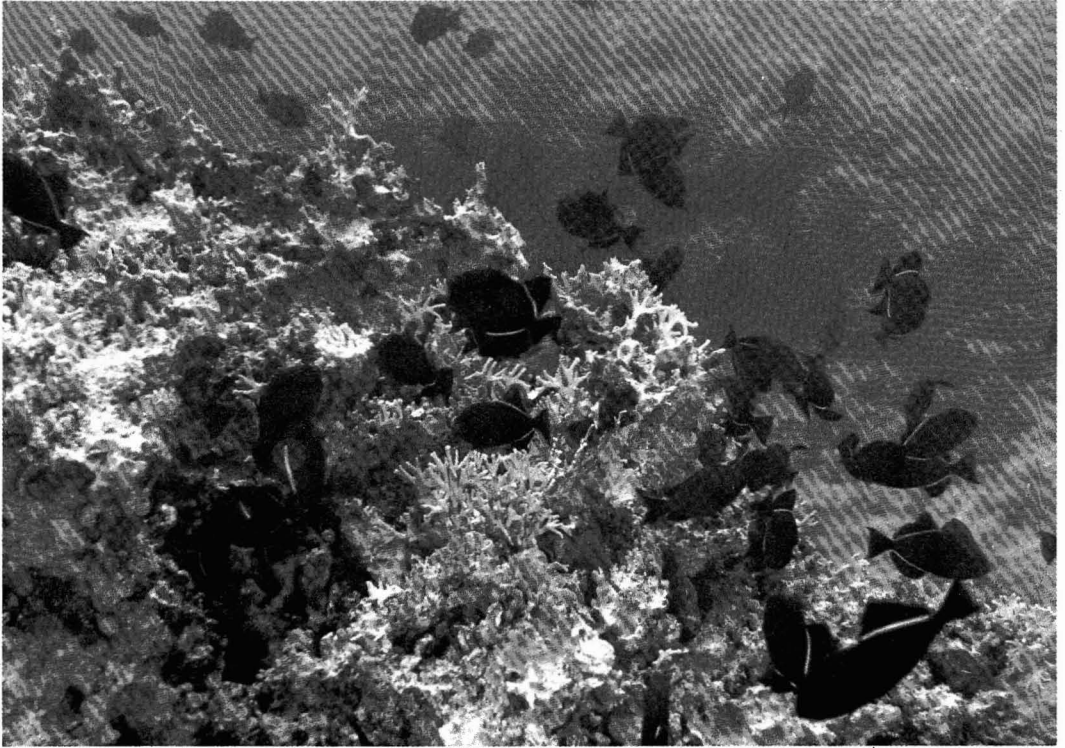


FIGURE 54. *Melichthys niger*, underwater photo in 12 m (J. Randall).

Rhinecanthus aculeatus (Linnaeus, 1758)

Balistes aculeatus Smith and Swain, 1883.

Sufflamen bursa (Bloch and Schneider, 1801)

Balistes bursa Brock, Jones, and Helfrich, 1965.

**Sufflamen fraenatus* (Latreille, 1804)

Numerous individuals observed by the authors and others from *Makali'i* at depths of 60 to 186 m. Also observed by Randall and Lobel while diving with SCUBA in outer reef areas at depths of 18 to 22 m.

Xanthichthys auromarginatus (Bennett, 1831)

Melichthys ringens (non Osbeck) Halstead and Bunker, 1954. This triggerfish was observed, videotaped, and photographed by the authors and others from *Makali'i* in the depth

range of 85 to 147 m (Figure 55). Observed by Randall and Lobel while SCUBA diving outside the reef in 22 m. The genus was revised by Randall, Matsuura, and Zama (1978).

FAMILY MONACANTHIDAE (FILEFISHES)

Aluterus scriptus (Osbeck, 1757)

Alutera scripta Brock, Jones, and Helfrich, 1965.

Cantherhines dumerilii (Hollard, 1854)

Amanes carolae (Jordan and McGregor), as reported by Halstead and Bunker 1954.

Cantherhines sandwichiensis (Quoy and Gaimard, 1824)

As pointed out by Randall (1964), the specimen from Johnston Island reported as *Mon-*



FIGURE 55. *Xanthichthys auromarginatus*, photo from submarine in 107 m (B. Keating).

acanthus sandwichiensis by Fowler and Ball (1924) was probably *Cantherhines dumerilii* because the length given for the specimen, 280 mm, is larger than attained by *C. sandwichiensis*. The presence of *C. sandwichiensis* at Johnston, however, can be confirmed by BPBM 6028, 129 mm SL, collected with a spear by Gerald R. Allen in 2 m on 29 January 1969.

Pervagor aspricaudus (Hollard, 1854)

Monacanthus melanocephalus Fowler and Ball, 1925.

Pervagor melanocephalus johnstonensis Woods in Schultz and collaborators, 1966.

Hutchins (ms.) has shown that the Indo-Pacific species of *Pervagor* which has been misidentified in Hawaii and Johnston Island as *P. melanocephalus* is *P. aspricaudus* (Hollard). The true *P. melanocephalus* (Bleeker) is restricted to the western Pacific.

Pervagor spilosoma (Lay and Bennett, 1839); Allen and Burgess (1970)

Allen and Burgess reported collecting a specimen of this filefish at Johnston Island, but it could not be located. Another collected in 1965 at the atoll by Robert S. Jones and associates is at the Bishop Museum (BPBM 15185, 100 mm SL). Randall observed an individual of this species in 1969; it is obviously rare at Johnston, in contrast to its periodic abundance in the Hawaiian chain. It is probable there is no breeding population at the atoll; all individuals there may have drifted in as larvae from the Hawaiian area.

FAMILY OSTRACIIDAE (TRUNKFISHES)

Ostracion cubicus Linnaeus, 1758; Halstead and Bunker 1954

The single specimen (apparently no longer

extant) reported by Halstead and Bunker represents the sole record for the species from Johnston. We did not observe the species at the atoll and therefore question this record.

Ostracion meleagris Shaw in Shaw and Nodder, 1796

Ostracion punctatum Bloch and Schneider, as reported by Smith and Swain 1883.

Ostracion lentiginosus Bloch and Schneider, as reported by Fowler and Ball 1925. Randall (1972b) showed that *O. lentiginosus* is the male phase (and a junior synonym) of *O. meleagris*. He classified the Hawaiian and Johnston Island populations as a distinct subspecies, *O. m. camurum* Jenkins.

Ostracion whitleyi Fowler, 1931

Ostracion solorensis (non Bleeker) Fowler and Ball, 1925. Gosline (1955) listed this trunkfish (as *O. solorensis*) as a Central Pacific species reaching Johnston Island but not the Hawaiian Islands. However, Randall (1972b) has shown that it occurs in Hawaii (though rare there) and is otherwise known only from the Marquesas (type-locality), Society Islands, and Johnston. The true *O. solorensis* is found from Indonesia to the Solomon Islands and the Philippines.

FAMILY TETRAODONTIDAE (PUFFERS)

Arothron hispidus (Linnaeus, 1758); Allen and Burgess 1970

No specimens available to confirm the Allen and Burgess record.

Arothron meleagris (Bloch and Schneider, 1801)

Tetrodon meleagris Smith and Swain, 1883.

**Canthigaster inframacula* Allen and Randall, 1977

One individual sighted by Randall from *Makali'i* at a depth of 235 m. One videotaped in 274 m by Eldredge.

Canthigaster jactator (Jenkins, 1901); Halstead and Bunker 1954

FAMILY DIODONTIDAE (PORCUPINEFISHES)

Diodon hystrix Linnaeus, 1758; Smith and Swain 1883

A large adult sighted at 137 m from *Makali'i* by Ralston.

ZOOGEOGRAPHIC DISCUSSION

The foregoing list of Johnston Island fishes totals 271; 3 of these are doubtful, 8 are listed by genus only (4 of which may represent undescribed species), and 88 are new records. This is not a large fish fauna compared to the Hawaiian Islands, where the number of fish species is estimated at 680 (Randall 1981), or the Marshall Islands, where 817 are recorded (Randall and Randall, in press). While it is admitted that the fish collecting effort has been greater in Hawaii and the Marshall Islands, it is obvious that a comparable effort at Johnston could not significantly alter the magnitude of the different number of fish species of these three insular areas.

The explanation for the impoverished fauna of Johnston Island is in part due to the paucity of habitats. The lagoon is not enclosed by a ring of reef and islets as seen in most atolls. There is a reef only along the northwest side. The four islets, all in the lagoon, are very low (maximum height 2 m) and sandy; there is no rocky shore on which surf can break (thus the suitable habitat for many blennioid fishes is lacking). There are no estuarine areas. Seagrass beds or dense algal flats have not been noted. The lagoon is shallow (maximum depth about 15 m); therefore there are no protected deep water areas. The lagoon is remarkable for the high coral cover, but only 29 species of corals are reported for the atoll, compared to about 40 for the Hawaiian Islands (James E. Maragos, pers. comm.).

Another factor is the small size of the atoll and its isolation. The greatest length of its shoal water is a scant 7 mi. It is therefore a

small target for larvae of marine animals drifting from distant shores.

As one becomes familiar with the fishes of Johnston Island, an awareness emerges of the many species that appear to be absent that would be expected to be there. Examples are the wide-ranging Indo-Pacific *Carcharhinus limbatus*, *C. melanopterus*, *Tylosurus* spp., *Anthias bicolor*, *Plectranthias nanus*, *Oxyrrhites typus*, *Aprion virescens*, *Monotaxis grandoculis*, *Alectis ciliaris*, *Atule mate*, *Stegastes fasciolatus*, *Upeneus taeniopterus*, *Antigonia capros*, *Chaetodon lunula*, *C. kleinii*, *Forcipiger longirostris*, *Acanthurus nigrofuscus*, *A. xanthopterus*, *Naso brevirostris*, *Rhinecanthus rectangulus*, *Canthigaster amboinensis*, and *C. coronata*. Among the common Hawaiian endemic fishes, the following have not yet been recorded from Johnston: *Pterois sphex*, *Scorpaenopsis cacopsis*, *Anthias thompsoni*, *Cirrhitops fasciatus*, *Parupeneus porphyreus*, *Abudefduf abdominalis*, *Chromis ovalis*, *C. hanui*, *Cirrhilabrus jordani*, *Coris venusta*, *Chaetodon fremblii*, *Plagiotremus ewaensis*, and *P. goslinei*. Especially conspicuous by their absence are any clupeoid or atherinid fishes. The relatively high clarity of the sea at Johnston Island, as one finds at atolls in general, reflects a paucity of plankton. This and the lack of brackish habitats may in part explain the apparent absence from Johnston of these small schooling plankton-feeding fishes. It should be noted that *Anthias thompsoni*, *Abudefduf abdominalis*, *Chromis hanui*, *C. ovalis*, and *Cirrhilabrus jordani* are also mainly zooplankton feeders.

Several abundant Hawaiian endemic fishes, such as *Chaetodon miliaris*, *Centropyge potteri*, and *Pervagor spilosoma*, are known from only one or two specimens or sightings at Johnston Island. We believe that these species do not have breeding populations at Johnston. The few individuals that have been collected or observed may have been waifs that drifted in as larvae from the Hawaiian area. If this is correct, other Hawaiian species may eventually be found as stragglers to Johnston. Gosline (1955) has given the average annual sea surface temperature for Midway as 22°C, for Oahu as 24.5°C, and for Johnston as 26°C. The warmer water of Johnston might preclude

the spawning or early development of fishes that are adapted to the Hawaiian environment, particularly if their reproduction is geared to the colder time of the year.

In his discussion on the nature and relationships of the Johnston Island fish fauna, Gosline (1955) addressed two questions: (1) to what extent has the isolation of Johnston Island given rise to endemism, and (2) to what extent has Johnston acted as a stepping stone or filter bridge between the Hawaiian biota and that of the Line Islands to the south.

With respect to endemism in fishes, Gosline remarked that only two species of Johnston fishes were then not recorded from elsewhere, the angelfishes *Centropyge flammeus* Woods and Schultz and *C. nigriocellus* Woods and Schultz. *C. flammeus* is now known to be a junior synonym of *C. loriculus* (Günther) which is wide-ranging in Oceania, and *C. nigriocellus* has since been collected by Randall in the Society Islands and Line Islands and by Victor G. Springer in the Hermit Islands off New Guinea. The only possible endemic fishes at the atoll are three apparent undescribed species: a *Scorpaenodes* (videotaped from the submersible *Makali'i*), a *Genicanthus* (from a brief sighting from *Makali'i*), and an unidentified *Naso* (also observed and videotaped from *Makali'i*). However, all are from depths greater than 100 m and probably range beyond Johnston Island.

Randall (1955) noted that the Johnston Island population of *Ctenochaetus strigosus* differs slightly in color (the pale edge to the orbit is restricted to posterior rim), and the caudal fin is slightly more emarginate than Hawaiian specimens of the species. This surgeonfish is even more different in the Society Islands and Tuamotus where it has a lunate white caudal fin. The color of the cleaner wrasse *Labroides phthirophagus* at Johnston Island is slightly different from that in Hawaii (see above, under Family Labridae). So also is the color of the terminal male of the endemic Hawaiian parrotfish *Scarus perspicillatus* (this form at Johnston has very little green). Further comparisons of Hawaiian and Johnston Island material of the same species may reveal more differentiation at the population level. However, if the differences are only in

TABLE 1

CENTRAL PACIFIC FISHES THAT HAVE REACHED JOHNSTON ISLAND BUT NOT HAWAII

<i>Muraenichthys gymnotus</i>	<i>Kuhlia marginata</i>
<i>Muraenichthys schultzei</i>	<i>Plectroglyphidodon phoenixensis</i>
<i>Myrichthys bleekeri</i>	<i>Chromis acares</i>
<i>Echidna leucotaenia</i>	<i>Centropyge nigriocellus</i>
<i>Gymnothorax buroensis</i>	<i>Cirripectes variolosus</i>

color, the possibility of the effect of different habitats or of diet on coloration should be considered.

For the purpose of assessing the importance of Johnston Island as a "filter bridge," Gosline divided the fishes of his list into three groups: those Central Pacific species reaching Johnston but not Hawaii; those Hawaiian species reaching south to Johnston but not beyond; and those found both in Hawaii and in the Central Pacific. He listed 14 species of fishes in the first group, 16 in the second, and 86 in the third. This, he wrote, "indicates that at the present time Johnston is acting as a filter bridge for fishes passing in both directions," and "of those tropical fishes that have reached Johnston, the great majority seem to have passed on through to Hawaii."

Much additional collecting of fishes has taken place since Gosline made his analysis of the Johnston fish fauna, and many systematic papers have appeared, resulting in numerous changes in scientific names and expansion of our knowledge of the distribution of Indo-Pacific fishes. Thus, of Gosline's list of 14 Central Pacific fishes that have reached Johnston but not Hawaii, only 6 remain, to which 4 others may be added (Table 1).

His second list of fishes, the Hawaiian species reaching south to Johnston but not beyond, can be reduced by the seven species now known to be more wide-ranging: *Gymnothorax eurostus*, *Apogon menesemus* (= *taeniopterus*), *Apogonichthys waikiki* (= *perdix*), *Chromis leucura* (Gosline's Johnston *leucura* is *agilis*), *C. vanderbilti* (Gosline's *vanderbilti* is *acares*, not yet known from Hawaii), *Haliichoeres ornatissimus*, and *Priolepis farcimen*. However, his list can be increased by 40 endemic Hawaiian fishes now known to range to Johnston, as well as four other species that occur only in southern Japan, Hawaii, and Johnston Island. Table 2 is a compilation of

these 44 species and the Hawaiian-Johnston migrants listed by Gosline.

Therefore, only 11 non-Hawaiian species of fishes are found at Johnston Island, in contrast to 53 endemic Hawaiian or Hawaiian-Japanese species which do not extend beyond Johnston. Some of the 17 deeper water fishes common to both Hawaii and Johnston probably occur at other Central Pacific islands where there has not been comparable collecting and submarine observation.

There are many species of fishes at the atolls of the Line Islands (as well as the Phoenix Islands to the south and the Marshall Islands to the southwest of Johnston) which are absent from both the Hawaiian Islands and Johnston Islands. Among the more conspicuous and abundant of these are scorpionfishes of the genus *Pterois* (expect the Hawaiian endemic *P. sphex*), groupers of the genera *Cephalopholis*, *Epinephelus* (expect the deep-water *E. quernus*, endemic to Hawaii and Johnston), *Plectropomus*, and *Variola*, snappers of the genus *Lutjanus*, the fusiliers (Caesionidae), the emperors of the genera *Lethrinus* and *Gnathodentex*, the hawkfishes *Cirrhichthys oxycephalus* and *Paracirrhites hemistictus*, the cardinalfish genus *Cheilodipterus* and several species of *Apogon*, the pompanos (*Trachinotus*), the sweepers (Pempheridae), numerous species of damselfishes such as *Chromis caerulea*, *C. margaritifera*, *C. lepidolepis*, *Chrysiptera glauca*, *Dascyllus aruanus*, *Plectroglyphidodon dickii*, *Pomacentrus coelestis*, *P. vaiuli*, and *Stegastes nigricans*, many wrasses such as *Bodianus axillaris*, *Cheilinus trilobatus*, *C. undulatus*, *Coris aygula*, *Haliichoeres hortulanus*, *H. trimaculatus*, *Hemigymnus fasciatus*, *Labroides bicolor*, *L. dimidiatus*, *Stethojulis bandanensis*, *Thalassoma amblycephalum*, *T. hardwicke*, and *T. lunare*, the parrotfishes *Cetoscarus bicolor*, *Hipposcarus longiceps*, *Scarus brevifilis*, *S.*

TABLE 2

ENDEMIC HAWAIIAN OR HAWAIIAN-JAPANESE FISHES REACHING JOHNSTON ISLAND BUT NOT BEYOND

<i>Conger oligoporus</i>	<i>Labroides phthiropagus</i>
<i>Muraenichthys cooki</i>	<i>Macropharyngodon geoffroy</i>
<i>Gymnothorax nuttingi</i>	<i>Polyplepion russelli</i>
<i>Uropterygius inornatus</i>	<i>Stethojulis balteata</i>
<i>Uropterygius supraforatus</i>	<i>Scarus dubius</i>
<i>Sargocentron xantherythrum</i>	<i>Scarus perspicillatus</i>
<i>Dendrochirus barberi</i>	<i>Parapercis roseoviridis</i>
<i>Scorpaena colorata</i>	<i>Chironema chryseres</i>
<i>Sebastapistes ballieui</i>	<i>Chironema squamiceps</i>
<i>Anthias fucinus</i>	<i>Chaetodon miliaris</i>
<i>Epinephelus quernus</i>	<i>Chaetodon multicinctus</i>
<i>Holanthias elizabethae</i>	<i>Centropyge fisheri</i>
<i>Holanthias fuscipinnis</i>	<i>Centropyge potteri</i>
<i>Plectranthias helenae</i>	<i>Holacanthus arcuatus</i>
<i>Grammatonotus laysanus</i>	<i>Oplegnathus punctatus</i>
<i>Cirrhitus pinnulatus maculatus</i>	<i>Cirripectes vanderbilti</i>
<i>Erythrocles scintillans</i>	<i>Eviota epiphanes</i>
<i>Parupeneus multifasciatus</i>	<i>Priolepis aureoviridis</i>
<i>Epigonus</i> sp.	<i>Trimma unisquamis</i>
<i>Pseudamiops gracilicauda</i>	<i>Acanthurus triostegus sandvicensis</i>
<i>Chromis verater</i>	<i>Hollardia goslinei</i>
<i>Dascyllus albisella</i>	<i>Cantherhines sandwichiensis</i>
<i>Anampses cuvier</i>	<i>Pervagor spilosoma</i>
<i>Bodianus bilunulatus alboataeniatus</i>	<i>Ostracion meleagris camurum</i>
<i>Coris ballieui</i>	<i>Canthigaster inframacula</i>
<i>Thalassoma ballieui</i>	<i>Canthigaster jactator</i>
<i>Thalassoma duperrey</i>	

frenatus, *S. frontalis*, *S. ghobban*, *S. globiceps*, *S. niger*, *S. oviceps*, and *S. schlegeli*, the butterflyfishes *Chaetodon bennetti*, *C. meyeri*, *C. punctatofasciatus*, *C. semeion*, *C. ulietensis*, and *C. vagabundus*, the angelfishes *Centropyge bispinosus*, *C. flavissimus*, and *Pygoplites diacanthus*, the surgeonfishes *Ctenochaetus striatus* and *Zebrasoma scopas*, the rabbitfishes (Siganidae), blennies of the genera *Aspidontus*, *Cirripectes* (except three Hawaiian species), *Entomacrodus* (except two Hawaiian endemics), and *Istiblennius* (except *I. gibbifrons* and *I. zebra*), gobies of the genera *Amblyeleotris*, *Amblygobius*, *Gobiodon*, *Istigobius* and *Valenciennesa*, and the triggerfishes *Balistapus undulatus*, *Balistoides viridescens*, *Odonus niger*, and *Pseudobalistes flavimarginatus*. The absence of these fishes (and many others) at Johnston Island indicates little movement of fish larvae from the Line Islands and other Central Pacific atolls to Johnston.

Furthermore, when the distribution of Hawaiian endemic species and subspecies with their closest relatives from the Line Islands is examined, the Hawaiian form rather

than the Line Islands form is found to have colonized Johnston Island (Table 3). The one exception is the related pair, *Kuhlia sandvicensis* and *K. marginatus*, the former being absent from Johnston (see Gosline 1955).

It is clear, as Gosline has pointed out, that some endemic Hawaiian fishes have "travelled from Hawaii to Johnston," and he has correctly labelled Johnston Island as an "outlier of the Hawaiian faunal area." However, his case for a significant component of species of fishes that may have moved from Johnston to Hawaii has been weakened by collections and systematic studies since 1955. We believe that the great majority of fishes that have colonized the Hawaiian Islands have come from the Ryukyu Islands and southern Japan, beginning with the Kuroshio Current, and arriving at seamounts or low islands at the northwestern end of the Hawaiian Chain. This possibility is exemplified by the trajectory of satellite-tracked drogues deployed in the Kuroshio Current off Japan, some of which reached the vicinity of the Northwestern Hawaiian Islands (McNally et al. 1983).

TABLE 3

DISTRIBUTION OF PAIRS OF CLOSELY RELATED SPECIES OR SUBSPECIES OF CENTRAL PACIFIC FISHES

HAWAII ISLANDS AND JOHNSTON ISLAND	LINE ISLANDS
<i>Cirrhitus pinnulatus maculosus</i>	<i>Cirrhitus pinnulatus pinnulatus</i>
<i>Apogon taeniopterus menesemus</i>	<i>Apogon taeniopterus taeniopterus</i>
<i>Dascyllus albisella</i>	<i>Dascyllus trimaculatus</i>
<i>Anampses cuvier</i>	<i>Anampses caeruleopunctatus</i>
<i>Acanthurus triostegus sandvicensis</i>	<i>Acanthurus triostegus triostegus</i>
<i>Zebrasoma flavescens</i>	<i>Zebrasoma scopas</i>
<i>Istiblennius gibbifrons gibbifrons</i>	<i>Istiblennius gibbifrons afinuchalis</i>
<i>Cantherhines sandvicensis</i>	<i>Cantherhines pardalis</i>
<i>Ostracion meleagris camurum</i>	<i>Ostracion meleagris meleagris</i>
<i>Canthigaster jactator</i>	<i>Canthigaster janthinopterus</i>

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