

Annotated Checklist of the Fishes of Midway Atoll, Northwestern Hawaiian Islands¹

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ABSTRACT: A total of 266 species of fishes are listed from Midway Atoll in the Northwestern Hawaiian Islands, of which 258 are reef and shore fishes. The inshore fish fauna of Midway is impoverished by comparison with the 457 species of reef and shore fishes known from the main Hawaiian Islands (Hawaii to Niihau). The fewer fish species reported from Midway must be due partially to less collecting effort. However, the cooler sea temperature and lack of certain high-island habitats at the atoll are probably the principal causes of the disparity. Some species attain larger size at Midway than in the main Hawaiian Islands, and an explanation is proposed for Midway fishes being more easily approached, in general, by divers.

MIDWAY ATOLL in the Northwestern Hawaiian Islands (Figure 1) lies at 28° 12' N, 177° 23' W, about 2100 km (1300 miles) west northwest of Honolulu. Only Kure Atoll, the northernmost coral atoll in the world, about 100 km from Midway, lies farther to the west in the Hawaiian Archipelago. Pearl and Hermes Reef, about 130 km southeast of Midway, is the nearest land to the east. Midway Atoll (Figure 1, inset) is approximately circular, nearly 10 km in diameter, and includes two islands on the south side, Sand Island (with the airstrip and naval facilities)

and uninhabited Eastern Island. The atoll was first reported and claimed by the United States in 1859. In 1903 President Theodore Roosevelt placed it under the control of the U.S. Navy where it remains today, not formally a part of the state of Hawaii.

Were it not for the famous Battle of Midway (3–5 June 1942), regarded as the major turning point of World War II in the Pacific, few people would be aware of Midway Atoll. It has received the attention of marine biologists and fishery biologists only in recent years.

The islands and reefs that compose the Hawaiian Archipelago form a continuous chain without large gaps that could foster an isolation effect in the marine biota within the chain. However, because of the archipelago's great length and considerable span in latitude (from 19° N at the southern end of the island of Hawaii to more than 28° N at Midway and Kure), differences in the marine fauna and flora might be expected between the latitudinal extremes. Furthermore, the Northwestern Hawaiian Islands are low islands and reefs that lack freshwater and brackish habitats, and hence many substrata, that are present at the high islands to the southeast.

The first fishes collected at Midway Atoll were taken by the scientific party of the U.S. Bureau of Fisheries steamer *Albatross* in

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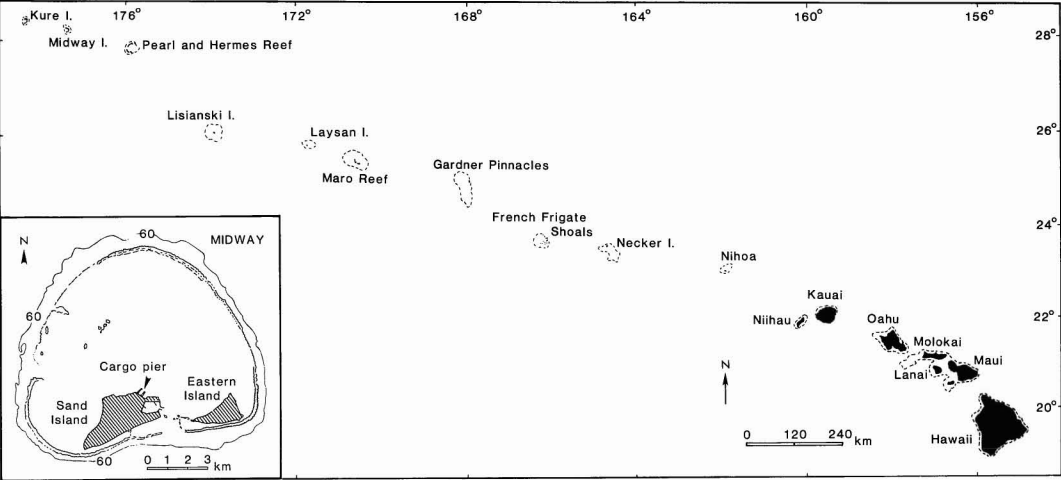


FIGURE 1. Hawaiian Islands; the main islands are shown in black. *Inset*, Midway Atoll.

November 1907; these were deposited at the U.S. National Museum of Natural History, Washington, D.C. (USNM). Only six species of *Albatross* fishes from Midway are currently cataloged there, two of which were reported by Fowler and Bean (1928). Five other lots of single species of Midway fishes collected at later dates are housed at the USNM.

The Tanager Expedition of the Bishop Museum visited Midway Atoll briefly in 1923. Reporting on the fishes collected during this expedition, Fowler and Ball (1925) listed only one fish from the atoll, the carangid *Atule mate* (Cuvier), which was deposited in the Bishop Museum.

William A. Gosline used rotenone to make a collection of fishes at Midway on 29 June 1950 with assistance of personnel of the Pacific Oceanic Fishery Investigations (now the Honolulu Laboratory of the National Marine Fisheries Service) from the R/V *Hugh M. Smith*. These specimens were deposited initially in the fish collection of the University of Hawaii but were transferred in 1974 to the Bernice P. Bishop Museum, Honolulu (BPBM), along with the bulk of the University's fish collection. Fifteen lots of Gosline's specimens are extant; they now bear BPBM numbers and are listed by species below. Also included in the transfer were single specimens of five species of Midway fishes speared on 2 June

1973 by Leighton R. Taylor, then of the Hawaii Cooperative Fishery Research Unit of the University of Hawaii.

The R/V *Spencer F. Baird* stopped at Midway Atoll on 11–12 November 1953. Three species of fishes were speared in the lagoon by John McGowan; these were deposited at the Scripps Institution of Oceanography (SIO).

In his revision of the surgeonfish genus *Acanthurus*, Randall (1956) reported on 17 specimens of *A. triostegus* (L.) caught with a beach seine at Midway Atoll in 1950 by personnel of the Pacific Oceanic Fishery Investigations. These fish included the largest specimen of the species, 213 mm SL, of many studied throughout the Indo-Pacific and Eastern Pacific regions. The largest of over 5000 adults examined on Oahu measured 175 mm SL. Randall attributed the larger size of this surgeonfish at Midway to the colder sea temperature there.

In their *Handbook of Hawaiian Fishes*, Gosline and Brock (1960) specifically mentioned only two species of fishes from Midway, the jack *Caranx cheilio* [= *Pseudocaranx dentex* (Bloch & Schneider)], which they reported as not common around the main Hawaiian Islands but abundant from French Frigate Shoals to Midway, and the blenny *Entomacrodus marmoratus* (Bennett), which they noted can reach about 6 inches (150 mm)

in length at Midway but only 4 or 5 inches (100–125 mm) at Oahu.

The R/V *Alexander Agassiz* made a stop at Midway Atoll on 24–25 September 1968 during its cruise Styx VII. Nine species of fishes collected by Richard C. Rosenblatt and associates were deposited at the Scripps Institution of Oceanography.

In April 1980 a symposium was held at the University of Hawaii entitled, "Status of Resource Investigations in the Northwestern Hawaiian Islands." Among the papers was one by Hobson (1980) that compared the fish communities of Midway and other Northwestern Hawaiian Islands with those of the Kona coast of the island of Hawaii. Another by Okamoto and Kawamoto (1980) reported on visual underwater censuses of fishes that included 71 such transects at Midway. They did not list the fishes from each of the transects except the 17 species common to all. They also compared the fish fauna of the Northwestern Hawaiian Islands with that of the main Hawaiian Islands (Hawaii to Kauai and Niihau), noting that many of the inshore species of the northwestern end of the chain appear to be larger than conspecifics in the main Hawaiian Islands. A paper by Parrish et al. (1980) summarized trophic studies on fishes carried out mainly in the lagoons of Midway Atoll and French Frigate Shoals.

The Hawaii Cooperative Fishery Research Unit of the University of Hawaii conducted research on the shallow-water demersal fish communities of the lagoon of Midway Atoll and other sites in the Northwestern Hawaiian Islands during the period 1980–1985. Major emphasis was on trophic relationships (Sorden 1982, Parrish et al. 1984, 1986, Norris and Parrish 1988, Sudekum et al. 1991), recruitment to the reef habitat (Schroeder 1985, 1987), and the effects on fish communities from removal of piscivorous predators (Schroeder 1989). The research did not emphasize records or distribution of fishes, but Norris and Parrish (1988: Table 1) listed 52 piscivorous species of fishes from the Northwestern Hawaiian Islands.

A second symposium at the University of Hawaii, "Resource Investigations in the Northwestern Hawaiian Islands," was held

in May 1983 and published in two volumes. Of significance to Midway was a paper by Hobson (1984) similar to that of 1980 and a report by Okamoto and Kanenaka (1984) on 574 fish transects in the Northwestern Hawaiian Islands from 1977 to 1982, of which 52 were at Midway; their Table 2 includes a list of 127 species of fishes from Midway.

In the *Fishery Atlas of the Northwestern Hawaiian Islands* (Uchida and Uchiyama 1986), 40 fishes are listed from Midway, of which five are pelagic (four scombrids and *Coryphaena hippurus* Linnaeus) and one, the snapper *Etelis carbunculus* Cuvier, is from relatively deep water (192–219 m). The greater number of species of marine animals reported in the atlas from other Northwestern Hawaiian Islands and reefs indicates that less fishing effort was spent at Midway.

In September of 1989 and again in 1991, the first three authors and associates spent a week at Midway Atoll with support of the U.S. Navy to document the inshore fish fauna of the atoll by diving, limited collecting, and underwater photography. The second and fifth authors returned to Midway 28 May–2 June 1992 to continue the fieldwork. We tended to save small specimens of the various species of fishes to conserve museum space.

We present below the list of inshore fishes now known from Midway. Those species represented by specimens at the Bernice P. Bishop Museum are listed by BPBM number, the number of specimens, and their length. Unless otherwise indicated, the length recorded for specimens is standard length (SL), taken from the tip of the snout to the base of the caudal fin. The length for a few fishes such as eels is given as total length (TL). Some species are represented by photographs, all of which are of Midway fishes. The photographs were taken by the authors, John P. Hoover, and Lisa Privitera. We are able to report some species only as sight records. We then list other authors' records if they recorded the same species from Midway. We have made general remarks on the relative abundance of the fishes that we observed underwater, using the categories abundant, common, fairly common, occasional, and rare. We have also commented on the principal habitat and depth at

which we observed the fishes. We must emphasize that our comments on abundance are based primarily on the dives of the first three authors in 1989 and 1991, which were mainly outside the lagoon on the south side of the atoll. In 1992 the second and fifth authors made several dives in the lagoon and noted that the relative abundance of many species of fishes was different.

This annotated list of fishes is important not only in documenting the species we found at Midway, but in revealing those that appear to be absent. After the checklist, we present a discussion of the differences of the Midway fish fauna from that of the main Hawaiian Islands.

Family CARCHARHINIDAE (Requiem Sharks)

Carcharhinus amblyrhynchos (Bleeker, 1856)

Two seen in 1989, none in 1991. A study of age and growth of this shark by Radtke and Cailliet (1984) and De Crosta et al. (1984) included specimens from Midway. De Crosta et al. also studied the age and growth of the following two species.

Carcharhinus galapagensis (Snodgrass & Heller, 1905)

Figure 2

Uchida and Uchiyama (1986) reported this shark from 38 m. Four were seen by us off the west end of the atoll in 1989. In 1991 this species was encountered on nearly every dive beyond the surge zone outside the lagoon, and it often restricted our diving and collecting efforts. As many as 10 at one time came within close range of us. On one calm day we located a small dropoff at 46 m with a depth recorder off the west side of the atoll and were pre-

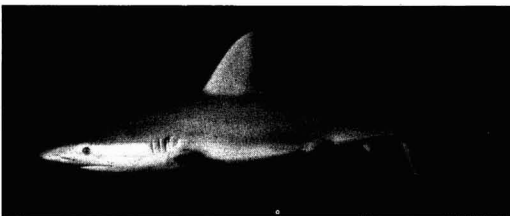


FIGURE 2. *Carcharhinus galapagensis* and *Labroides phthirophagus* (J. Randall).

paring to dive at this site. Galapagos sharks up to an estimated 2 m in total length soon congregated around our boat. By the time we had counted more than 20, we prudently decided not to dive in the area.

Galeocerdo cuvier (Peron & Lesueur, 1822)

Figure 3

The presence of the tiger shark in the lagoon waters of Midway during the period of June to August is well known because of its predation on fledgling Laysan albatross. We saw no sharks of this species in September of either 1989 or 1991, but could readily identify a photograph of a large one caught at Midway that was displayed at the dive office (reproduced herein as Figure 3). In May 1992 an individual of this species, estimated to be 2.3 m in length, was observed at the surface; it came alongside the dive boat as one of us (T.H.) was entering the boat from a dive in the lagoon.



FIGURE 3. *Galeocerdo cuvier* (Coral Kings Dive Club).

FIGURE 4. *Triaenodon obesus* (J. Earle).*Triaenodon obesus* (Rüppell, 1837)

Figure 4

The whitetip reef shark has been classified in the Triakidae, Hemigaleidae, and Carcharhinidae. Compagno (1973) is followed in placing it in the Carcharhinidae. We observed one individual of this shark in 1989 at Midway, none in 1991, and two in 1992 under the cargo pier in the lagoon, one of which was photographed.

Family MYLIOBATIDAE (Eagle Rays)

Aetobatis narinari (Euphrasen, 1790)

A few individuals seen outside the lagoon, none near enough to photograph. Okamoto and Kanenaka (1984) recorded this ray from Midway.

Family MOBULIDAE (Manta Rays)

Manta sp.

Figure 5

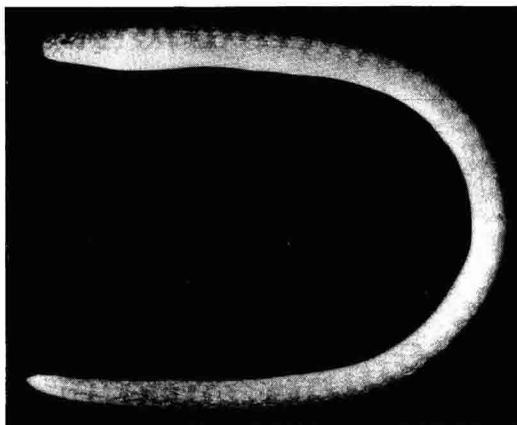
Occasional individuals were observed in both 1989 and 1991 from the surface to 25 m. The genus *Manta* is in great need of revision, so we refrain from attempting identification to species.

Family MURAENIDAE (Moray Eels)

Anarchias seychellensis (Smith, 1962)

Figure 6

BPBM 34834, 7: 79–181 mm. Collected with rotenone in the lagoon near the cargo pier. Vertebral counts of six of these specimens, 122–126. This species may prove to be a junior synonym of *A. leucurus* (Snyder) (Y. Hatooka, pers. comm.).

FIGURE 5. *Manta* sp. (J. Randall).FIGURE 6. *Anarchias seychellensis*, BPBM 34834, 181 mm TL (J. Randall).*Echidna nebulosa* (Ahl, 1789)

Recorded from Midway by Okamoto and Kanenaka (1984). Not observed by us.

Enchelycore pardalis (Schlegel, 1846)

Figure 7

BPBM 35380, 225 mm TL. The third most common moray; notably more abundant at Midway than in the main Hawaiian Islands. Observed both within and outside the lagoon.

Enchelynassa canina (Quoy & Gaimard, 1824)

One specimen, 294 mm TL, collected with rotenone on a lagoon reef by personnel of the

FIGURE 7. *Enchelycore pardalis* (J. Randall).

Hawaii Cooperative Fishery Research Unit, but not retained.

Gymnomuraena zebra (Shaw, 1797)

One large adult clearly observed by J.L.E. at an inshore rotenone station near the cargo pier in the lagoon, but not collected.

Gymnothorax albimarginatus (Temminck & Schlegel, 1846)

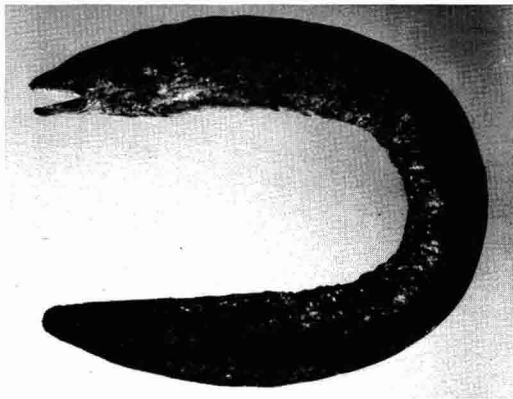
Figure 8

Occasional, both within and outside the lagoon. A moray of this species about 700 mm long bit the wrist of one of us (T.H.). The bite was more painful than would be expected from the nature of the wound; pain radiated to the upper arm, thus suggesting the existence of a venom. This species has some slightly serrate teeth. Another species of moray with serrate teeth, *G. ocellatus* Agassiz, has a venomous bite. William Eger (pers. comm.) was bitten on the hand by an eel of this species taken in a beach seine at Mayaguez, Puerto Rico, and severe pain extended to his chest. Puerto Rican fishermen who were present were well aware that bites from this eel are venomous.

Gymnothorax eurostus (Abbott, 1860)

Figure 9

BPBM 34832, 4: 76–144 mm TL; BPBM 34877, 2: 209–245 mm TL; sio 68-498, 3: 190–530

FIGURE 8. *Gymnothorax albimarginatus* (J. Randall).FIGURE 9. *Gymnothorax eurostus*, BPBM 34877, 245 mm TL (J. Randall).

mm TL. Judging from rotenone collections, this is the most common moray at Midway; however, it is not often seen. As noted by Gosline and Brock (1960), the color pattern of this species is highly variable.



FIGURE 10. *Gymnothorax flavimarginatus* (J. Earle).

Gymnothorax flavimarginatus (Rüppell, 1830)

Figure 10

Reported from Midway by Okamoto and Kanenaka (1984) and listed among the piscivorous fishes of the atoll and French Frigate Shoals by Parrish et al. (1986) and Norris and Parrish (1988). Not seen in 1989 or 1991, but one was photographed in 1992 in 15 m outside the lagoon.

Gymnothorax meleagris (Shaw & Nodder, 1795)

Recorded from Midway by Okamoto and Kanenaka (1984), Parrish et al. (1986), and Norris and Parrish (1988). Not seen in 1989, 1991, or 1992.

Gymnothorax pindae Smith, 1962

Figure 11

BPBM 34833, 2: 74–158 mm TL; BPBM 34878, 2: 163–209 mm TL; SIO 68-498, 3: 120–200 mm TL. Bishop Museum specimens were collected with rotenone on reefs outside the lagoon at depths of 8 and 25 m. Reported from the Hawaiian Islands as *G. moluccensis* (Bleeker) by Gosline and Brock (1960).

Gymnothorax steindachneri Jordan & Evermann, 1903

Plate 1A

BPBM 34789, 290 mm TL; BPBM 34796, 2: 270–358 mm TL; BPBM 34879, 2: 183–195 mm TL; BPBM 34893, 5: 340–420 mm TL; BPBM 34938, 125 mm TL. The second most common

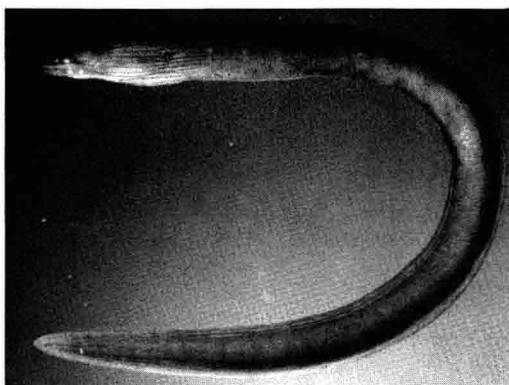


FIGURE 11. *Gymnothorax pindae*, BPBM 34833, 158 mm TL (J. Randall).

moray at Midway; occurs both within and outside the lagoon. Reported from 42–46 m by Uchida and Uchiyama (1986).

Gymnothorax undulatus (Lacepède, 1803)

BPBM 34929, 1120 mm, only the head saved; stomach with a partly digested individual of *Pervagor spilosoma* (Lay & Bennett). Listed from Midway by Okamoto and Kanenaka (1984), Parrish et al. (1986), and Norris and Parrish (1988). Not seen in 1989, 1991, or 1992.

Uropterygius supraforatus (Regan, 1909)

Figure 12

BPBM 34835, 201 mm TL; SIO 68-498, 295 mm TL. The Bishop Museum specimen was taken from reef outside the lagoon in 8 m. The

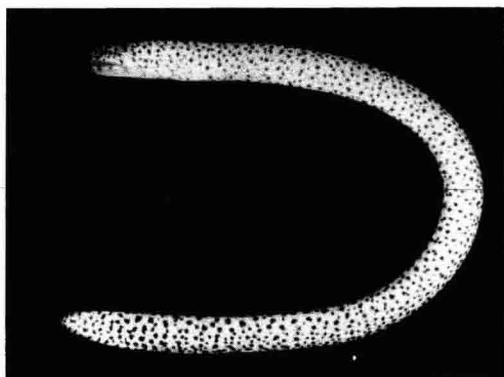


FIGURE 12. *Uropterygius supraforatus*, BPBM 34835, 201 mm TL (J. Randall).

Scripps specimen, which was collected in the lagoon, was initially identified as *U. dentatus* Schultz; Gosline (1958) placed this in the synonymy of *U. supraforatus*. Rare.

Family OPHICHTHIDAE (Snake Eels)

Apterichtus flavicaudus (Snyder, 1904)

Reported from Midway by McCosker (1979) from one specimen housed at the Scripps Institution of Oceanography (SIO 68-487, 366 mm TL). He gave the vertebral counts for Hawaiian specimens, including Midway, as 155–166.

Callichelys luteus Snyder, 1904

One large specimen of this species, SIO 68-497, 1038 mm TL, was collected with a dipnet at the surface at night by Richard C. Rosenblatt and crew of the R/V *Alexander Agassiz* on 24 September 1968. It was reported by McCosker (1979).

Cirrhimuraena playfairii (Günther, 1870)

One specimen of this species, SIO 68-497, 294 mm TL, was taken at the same nightlight station as *Callichelys luteus*. Reported from Midway by McCosker (1979).

Ichthyapus vulturis (Weber & de Beaufort, 1916)

BPBM 24939, 2: 177–300 mm TL, from the lagoon. Parrish et al. (1986) and Norris and Parrish (1988) listed this species among the dominant piscivorous fishes of Midway Atoll and French Frigate Shoals. Randall and McCosker (1975) and McCosker (1977) placed *Caecula* (*Sphagebranchus*) *platyrhyncha* Gosline (1951) in the synonymy of *I. vulturis*.

Muraenichthys cookei Fowler, 1928

Figure 13

BPBM 34894, 7: 140–183 mm TL, collected by Gosline and others in 1950; BPBM 34836, 2: 122–155 mm TL, collected with rotenone at the cargo pier in the lagoon in 3–5 m.

Myrichthys maculosus (Cuvier, 1817)

BPBM 34933, 443 mm TL; SIO 68-497, 3: 375–390 mm TL. The Bishop Museum specimen was taken from the lagoon in 6 m. Occasional within and outside the lagoon. Listed from Midway by Okamoto and Kanenaka (1984).

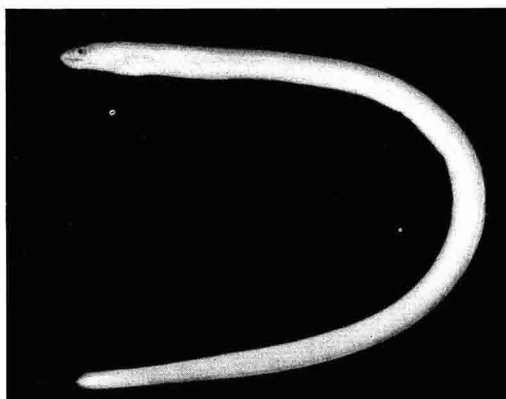


FIGURE 13. *Muraenichthys cookei*, BPBM 34894, 140 mm TL (J. Randall).

Schultzidia johnstonensis (Schultz & Woods, 1949)

BPBM 34895, 160 mm TL. Collected with rotenone by Gosline in 1950 from "Midway reef."

Family CONGRIDAE (Conger Eels)

Ariosoma marginatus (Vaillant & Sauvage, 1875)

BPBM 34937, 235 mm TL, collected in the lagoon in 6 m. Castle (1980) showed that *A. bowersi* (Jenkins) is a junior synonym of *A. marginatus*.

Conger cinereus marginatus (Valenciennes, 1841)

Figure 14

BPBM 34872, 186 mm TL, from the lagoon in 3–5 m near the cargo pier. Reported from 22 m by Uchida and Uchiyama (1986).

Conger oligoporus Kanazawa, 1958

Recorded among the piscivorous fishes of Midway Atoll and French Frigate Shoals by Parrish et al. (1986) and Norris and Parrish (1988). Laysan Island and Maro Reef were the localities of the three paratypes of *C. oligoporus*.

Family CLUPEIDAE (Herrings and Sardines)

Spratelloides delicatulus (Bennett, 1831)

BPBM 34862, 2: 39–48 mm. Occasional. The two specimens were speared from a small



FIGURE 14. *Conger cinereus marginatus* and *Labroides phthiophagus* (J. Randall).

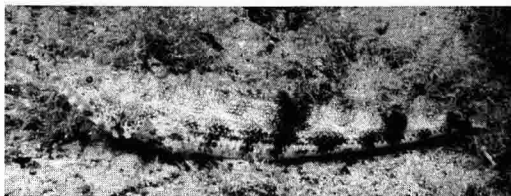


FIGURE 15. *Saurida gracilis* (J. Randall).

dense school in about 0.5 m in the surge zone of the seaward reef outside the lagoon.

Family SYNODONTIDAE (Lizardfishes)

Saurida gracilis (Quoy & Gaimard, 1824)

Figure 15

BPBM 34793, 156 mm; BPBM 34804, 144 mm; BPBM 34883, 2: 67–113 mm. Waples (1982) reported eight specimens, 125–224 mm SL, from Midway, which included the two of USNM 227958. Common in lagoon.

Synodus dermatogenys Fowler, 1911

BPBM 34903, 87 mm, from the lagoon.

Synodus ulae Schultz, 1953

Plate 1B

BPBM 34780, 79 mm; BPBM 34805, 147 mm; BPBM 35374, 201 mm. Common, especially in the lagoon. Of 52 species of piscivorous fishes studied at French Frigate Shoals and Midway Atoll (mainly the latter) by Parrish et al. (1986) and Norris and Parrish (1988), the species for which they reported the largest number of diet samples, 107 specimens, was *S. ulae*, thus reflecting its abundance and availability.

Synodus variegatus (Lacepède, 1803)

Recorded among a list of piscivorous fishes of Midway Atoll and French Frigate Shoals by Parrish et al. (1986) and Norris and Parrish (1988) as *S. englemanni* Schultz, following Cressey (1981). Waples and Randall (1988) showed that *S. englemanni* is a junior synonym of *S. variegatus*.

Family OPHIDIIDAE (Brotulas)

Brotula multibarbata Temminck & Schlegel, 1846

BPBM 34849, 57 mm TL. Fairly common outside the lagoon; a cryptic species rarely seen except at night or when turning over rocks. Seems more common at Midway than in the main Hawaiian Islands.

Family ANTENNARIIDAE (Frogfishes)

Antennarius coccineus (Lesson, 1830)

Figure 16

BPBM 34812, 19 mm; BPBM 34851, 31 mm, both from reefs outside the lagoon in the

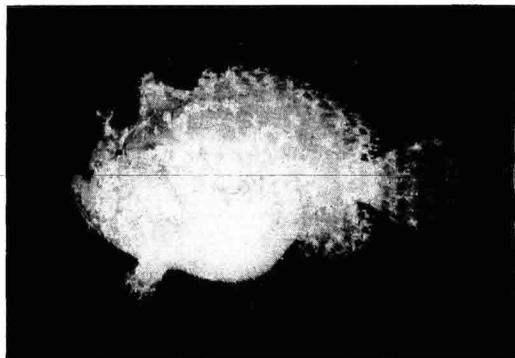
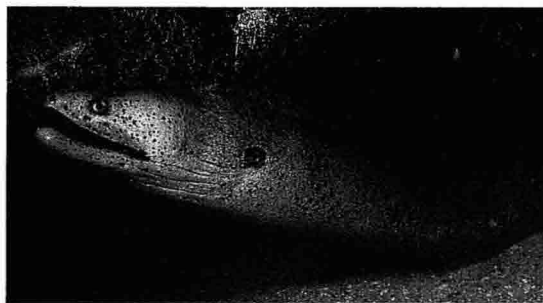
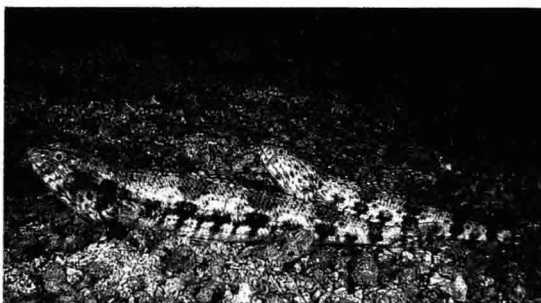


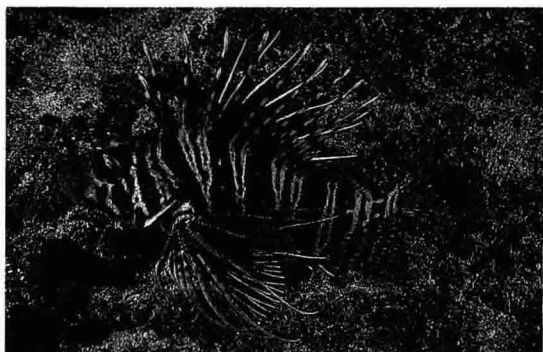
FIGURE 16. *Antennarius coccineus*, BPBM 34812, 42 mm SL (J. Randall).



A. *Gymnothorax steindachneri* (J. Randall).



B. *Synodus ulae* (J. Randall).



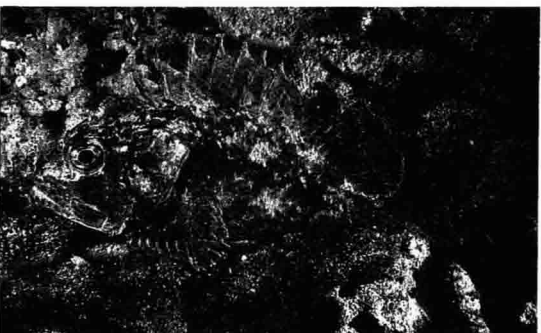
C. *Pterois sphex* (J. Randall).



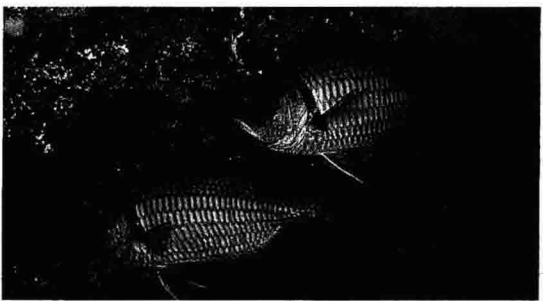
D. *Scorpaenopsis brevifrons* (J. Randall).



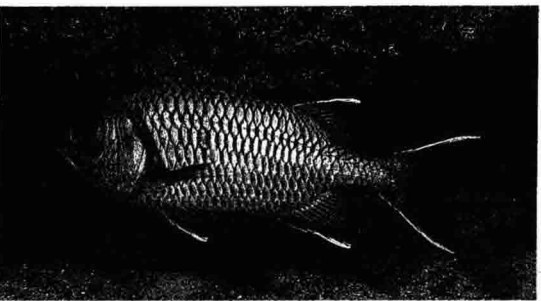
E. *Scorpaenopsis cacopsis* (J. Randall).



F. *Sebastapistes ballieui* (J. Randall).



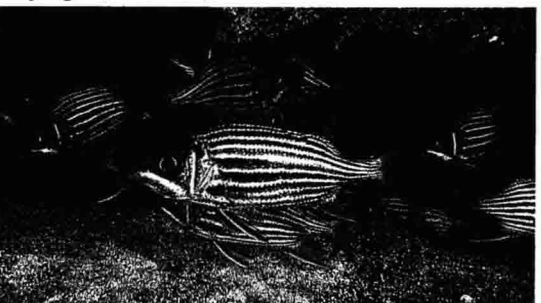
G. *Myripristis amaena* (J. Randall).



H. *Myripristis berndti* and juvenile *Labroides phthirophagus* (J. Randall).



I. *Myripristis chryseres* (R. Pyle).



J. *Sargocentron xantherythrum* (J. Randall).



A. *Cirrhitus pinnulatus* (J. Randall).



B. *Paracirrhites arcatus* (J. Hoover).



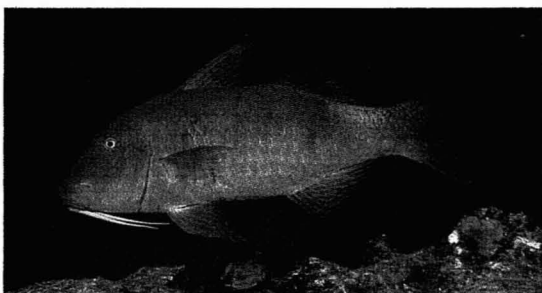
C. *Cheilodactylus vittatus* (J. Randall).



D. *Apogon maculiferus* (J. Randall).



E. *Parupeneus chrysonemus* (J. Randall).



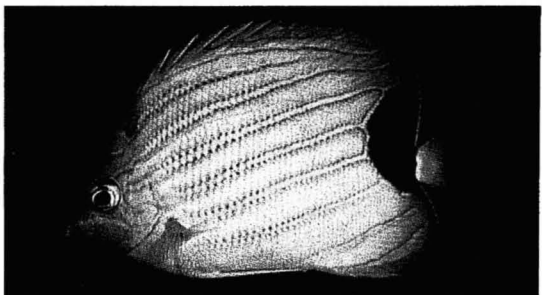
F. *Parupeneus cyclostomus* (J. Randall).



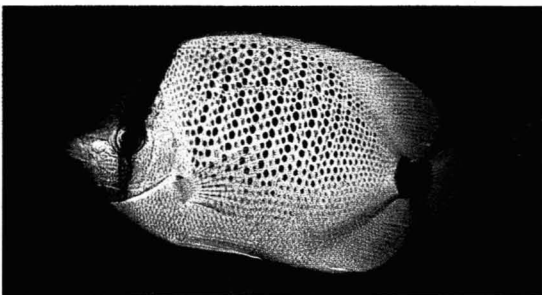
G. *Parupeneus porphyreus* (J. Randall).



H. *Evisias acutirostris* (J. Randall).



I. *Chaetodon fremblii* (J. Randall).



J. *Chaetodon miliaris* (J. Randall).

depth range of 8–24 m. Also obtained from lagoon reefs, but not retained. Parrish et al. (1986) and Norris and Parrish (1988) included *A. drombus* Jordan & Evermann among the piscivorous fishes of Midway Atoll and French Frigate Shoals. Pietsch and Grobecker (1987) regarded *A. drombus* as a junior synonym of *A. coccineus*.

Antennarius commersoni (Latreille, 1804)

BPBM 34927, 98 mm; speared in lagoon. Illicium (modified first dorsal spine) twice as long as second dorsal spine; dorsal soft rays 13; anal rays 8; pectoral rays 11.

Antennarius pictus (Shaw & Nodder, 1794)

BPBM 34907, 99 mm; BPBM 34928, 137 mm. Illicium twice as long as second dorsal spine; dorsal soft rays 12; anal rays 7; pectoral rays 10; largest (a fully ripe female) black, the tips of pectoral rays white. Collected on lagoon reefs.

Antennatus tuberosus (Cuvier, 1817)

Figure 17

BPBM 34847, 41 mm; BPBM 34852, 42 mm. Collected outside the lagoon from rubble bottom in 22–26 m.

Family Atherinidae (Silversides)

Atherinomorus insularum (Jordan & Evermann, 1903)

Recorded from Midway by Okamoto and Kanenaka (1984) as *Pranesus insularum* (Jordan & Evermann).

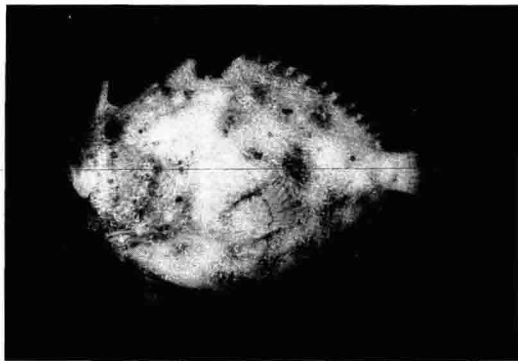


FIGURE 17. *Antennatus tuberosus*, BPBM 34847, 41 mm SL (J. Randall).

Family Hemiramphidae (Halfbeaks)

Hyporhamphus acutus pacificus (Steindachner, 1900)

The U.S. National Museum of Natural History has a specimen of this subspecies (USNM 215345, 51 mm SL) collected by night-lighting in the harbor at Sand Island, Midway, on 28 June 1950 by Joseph E. King of the Pacific Oceanic Fishery Investigations (later the Honolulu Laboratory of the National Marine Fisheries Service). Identified by Bruce B. Collette.

Family Belontiidae (Needlefishes)

Platybelone argalus platyura (Bennett, 1832)

Figure 18

BPBM 34787, 337 mm; BPBM 35363, 420 mm. Common in the lagoon; numerous under the main cargo pier.

Tylosurus acus (Lacepède, 1803)

Figure 19

BPBM 35364, 990 mm SL (head saved). This specimen, the only one collected, was caught

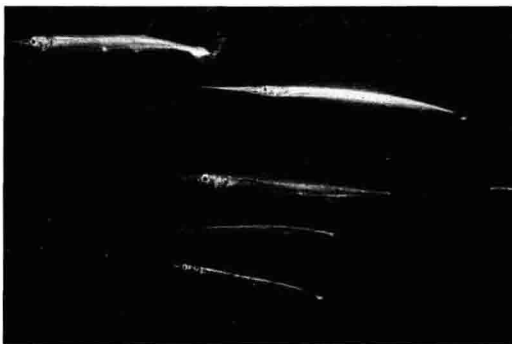


FIGURE 18. *Platybelone argalus platyura* (J. Randall).

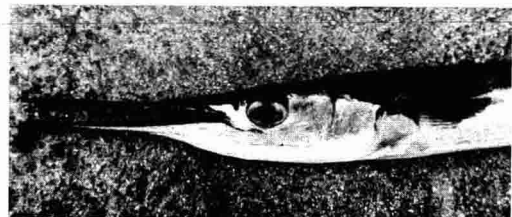


FIGURE 19. *Tylosurus acus*, BPBM 35364, 990 mm SL (J. Earle).

by hook and line at the surface outside the lagoon over a depth of 20 m. It has a bladelike bony keel projecting ventrally from the tip of the lower jaw, hence the morphological form *T. appendiculatus* (Klunzinger), regarded as a junior synonym. For discussion, see Randall (1980).

Tylosurus crocodilus (Peron & Lesueur, 1821)

Listed from Midway as *Strongylura gigantea* (Temminck & Schlegel), a junior synonym of *T. crocodilus*, by Okamoto and Kanenaka (1984). In 1989 we observed a large individual of the genus *Tylosurus* but not well enough to determine if the species was *acus* or *crocodilus*.

Family PEGASIDAE (Sea Moths)

Eurypegasus papilio (Gilbert, 1905)

BPBM 34934, 46 mm; only one specimen collected, from 6–7 m in the lagoon. We follow Palsson and Pietsch (1989) in placing this species in the genus *Eurypegasus*.

Family AULOSTOMIDAE (Trumpetfishes)

Aulostomus chinensis (Linnaeus, 1758)

BPBM 34909, 192 mm. Common within and outside the lagoon in various reef habitats. Listed by Parrish et al. (1986) and Norris and Parrish (1988) among the piscivorous fishes of Midway Atoll and French Frigate Shoals; also reported by Okamoto and Kanenaka (1984).

Family FISTULARIIDAE (Cornetfishes)

Fistularia commersonii Rüppell, 1838

BPBM 34910, 360 mm. Fairly common on or near reefs outside the lagoon. Included in the list of piscivorous fishes of Midway and French Frigate Shoals by Parrish et al. (1986) and Norris and Parrish (1988); also reported from Midway by Okamoto and Kanenaka (1984).

Family SYNGNATHIDAE (Pipefishes and Sea Horses)

Doryrhamphus excisus excisus (Kaup, 1856)

BPBM 34798, 3: 22–42 mm. Common on reefs both in and outside the lagoon; very



FIGURE 20. *Dendrochirus barberi* (J. Randall).

cryptic, hence rarely observed. Until the revision of Indo-Pacific pipefishes by Dawson (1985), most authors identified this species as *D. melanopleura* (Bleeker).

Family SCORPAENIDAE (Scorpionfishes)

Dendrochirus barberi (Steindachner, 1901)

Figure 20

BPBM 34792, 59 mm, from a piling of the cargo pier in the lagoon. Uchida and Uchiyama (1986) reported it from 27 m. As noted in the figure, this species may hide among the branches of *Pocillopora meandrina* Dana. Schroeder (1987) listed it among the fishes that colonized small artificial reefs at Midway. About 100 specimens were collected during the ecological studies at Midway by the Hawaii Cooperative Fishery Research Unit from 1980 to 1985.

Pterois sphex Jordan & Evermann, 1903

Plate IC

BPBM 35399, 49 mm. Occasional, in caves or under ledges inside and outside the lagoon. Parrish et al. (1986) and Norris and Parrish (1988) included *P. sphex* in the list of piscivorous fishes of Midway Atoll and French Frigate Shoals.

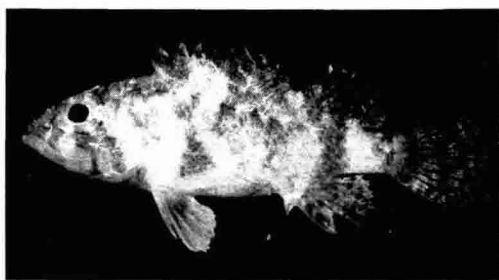


FIGURE 21. *Scorpaenodes hirsutus*, BPBM 34842, 35 mm SL (J. Randall).

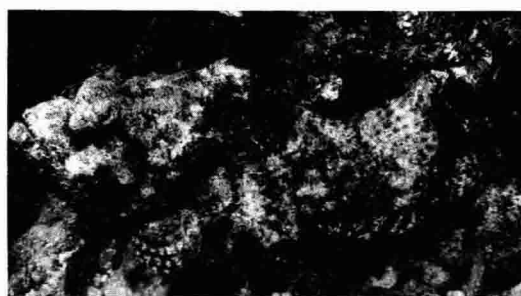


FIGURE 23. *Scorpaenopsis diabolus* (J. Randall).



FIGURE 22. *Scorpaenodes littoralis* (J. Randall).

Scorpaenodes hirsutus (Smith, 1957)

Figure 21

BPBM 34842, 3: 35–38 mm, collected from caves in seaward reef zone in 8 m. First recorded from the Hawaiian Islands by Eschmeyer and Randall (1975).

Scorpaenodes kelloggi (Jenkins, 1903)

Recorded among a list of piscivorous fishes of Midway Atoll and French Frigate Shoals by Parrish et al. (1986) and Norris and Parrish (1988).

Scorpaenodes littoralis (Tanaka, 1917)

Figure 22

BPBM 34797, 2: 37–64 mm; BPBM 34840, 2: 32–38 mm. Common on hard substrata with cover inside and outside the lagoon, but cryptic; 63 specimens were collected by the Hawaii Cooperative Fishery Research Unit.

Scorpaenopsis brevifrons Eschmeyer & Randall, 1975

Plate ID

BPBM 34777, 127 mm; BPBM 34863, 2: 120–

134 mm. Occasional in reef areas both inside and outside the lagoon.

Scorpaenopsis cacopsis Jenkins, 1901

Plate IE

BPBM 34841, 2: 46–107 mm. Occasional on reefs within and outside the lagoon.

Scorpaenopsis diabolus (Cuvier, 1829)

Figure 23

BPBM 34931, 133 mm. Occasional on or near reefs inside and outside the lagoon. Included among the major piscivorous fishes of Midway Atoll and French Frigate Shoals by Parrish et al. (1986) and Norris and Parrish (1988), as were the other scorpaenids *S. cacopsis*, *Dendrochirus barberi*, and *Sebastapistes ballieui*.

Sebastapistes ballieui (Sauvage, 1875)

Plate IF

BPBM 34771, 2: 80–93 mm; BPBM 34882, 54 mm; BPBM 35368, 43 mm. Lagoon; more readily in the open by night than by day. Schroeder (1987) found it among the most common fishes that colonized small artificial reefs in the Midway lagoon; ca. 150 specimens were collected at stations in the lagoon by the Hawaii Cooperative Fishery Research Unit.

Sebastapistes coniota Jenkins, 1903

Figure 24

BPBM 34772, 2: 25–34 mm, from lagoon reef in 2 m; BPBM 34843, 5: 30–75 mm, from reef outside the lagoon in 8 m. Obtained with rotenone.

Sebastapistes galactacma Jenkins, 1903

BPBM 34773, 31 mm. Rare; our single speci-

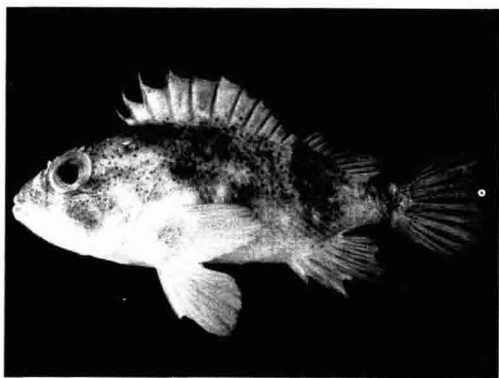


FIGURE 24. *Sebastapistes coniota*, BPBM 34843, 75 mm SL (J. Randall).

men taken from a reef outside the lagoon in 22 m.

Taenianotus triacanthus Lacepède, 1802

BPBM 34800, 58 mm. Occasional on reefs both within and outside the lagoon.

Family CARACANTHIDAE
(Orbicular Velvetfishes)

Caracanthus typicus Kroyer, 1844

BPBM 34766, 3: 33–37 mm; BPBM 34864, 2: 34–38 mm; SIO 68-541, 3: 27–31 mm. Common among the branches of *Pocillopora meandrina*. Previous authors have considered the name *typicus* as a synonym of the wide-ranging *C. maculatus* (Gray). William N. Eschmeyer (pers. comm.), however, regards *typicus* as a valid species confined to the Hawaiian Islands.

Family HOLOCENTRIDAE (Squirrelfishes)

Myripristis amaena (Castelnau, 1873)

Plate IG, FIGURE 56

BPBM 34826, 103 mm. Common in caves inshore on seaward reefs outside the lagoon.

Myripristis berndti Jordan & Evermann, 1903

Plate IH

We found this to be the most common species of the genus at Midway. Seen more often on reefs outside than in the lagoon.



FIGURE 25. *Myripristis kuntzei* (J. Hoover).

Myripristis chryseres Jordan & Evermann, 1903

Plate II

Fairly common in caves and under ledges outside the lagoon, generally at depths greater than 20 m.

Myripristis kuntzei Cuvier, 1831

Figure 25

Occasional; usually on reefs outside the lagoon. Surprisingly, Hobson (1980) reported it as representing more than 10% of the fishes counted on 30 transects at Midway and Kure.

Neoniphon sammara (Forsskal, 1775)

BPBM 15123, 2: 153–195 mm. Occasional on well-developed lagoon reefs.

Plectrypops lima (Valenciennes, 1831)

BPBM 34827, 121 mm. Found only in the darker part of caves outside the lagoon.

Pristilepis oligolepis (Whitley, 1941)

One individual seen under the cargo pier in 9 m (unusually shallow for this species). Hobson (1980) reported *Ostichthys pilwaxii* (Steindachner) [= *O. archiepiscopus* (Valenciennes)] among the fishes observed in shallow water at Midway but not elsewhere in the Hawaiian Islands. This identification does not seem correct because *O. archiepiscopus* is known only from the depth range of 146–360 m (Randall et al. 1982). Hobson (1984) listed *P. oligolepis* from Midway without indicating that it is a correction of his 1980 record of *O. pilwaxii*.

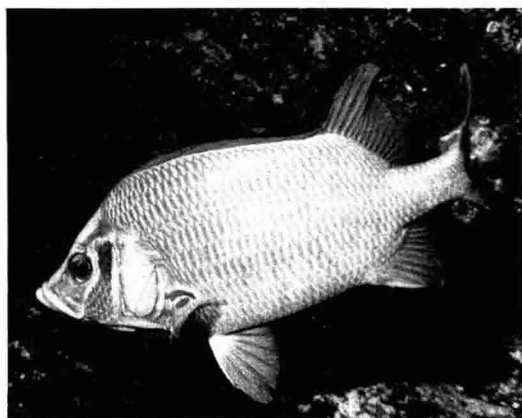


FIGURE 26. *Sargocentron spiniferum* (J. Earle).



FIGURE 27. Juvenile *Sargocentron xantherythrum*, BPBM 34808, 48 mm SL (J. Randall).

Sargocentron diadema (Lacepède, 1802)
BPBM 34801, 2: 123–124 mm. Common in lagoon.

Sargocentron ensiferum (Jordan & Evermann, 1903)

Recorded from Midway by Okamoto and Kanenaka (1984); not observed by us.

Sargocentron punctatissimum (Cuvier, 1829)
BPBM 34828, 113 mm. Common inshore on exposed reefs outside the lagoon.

Sargocentron spiniferum (Forsskal, 1775)
Figure 26

Rare; a few observed in caves outside the lagoon beyond the surge zone. Listed from Midway by Okamoto and Kanenaka (1984).

Sargocentron xantherythrum (Jordan & Evermann, 1903)

Figure 27, Plate IJ

BPBM 34808, 48 mm. Common, especially in caves and under ledges outside the lagoon.

Family SERRANIDAE (Groupers and Sea Basses)

Epinephelus quernus Seale, 1901

Figure 28

BPBM 35381, 66 mm. Adults occasional outside the lagoon. Uchida and Uchiyama (1986) reported it from Midway in the depth range of 26–219 m. We observed adults in as



FIGURE 28. *Epinephelus quernus* (J. Randall).

little as 8 m on seaward reefs. Four small specimens (140–289 mm) were speared at two stations in the lagoon by personnel of the Hawaii Cooperative Fishery Research Unit. Seki (1984a) studied the food habits of this grouper from specimens collected in the Northwestern Hawaiian Islands.

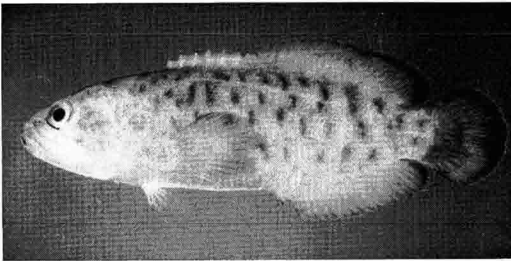
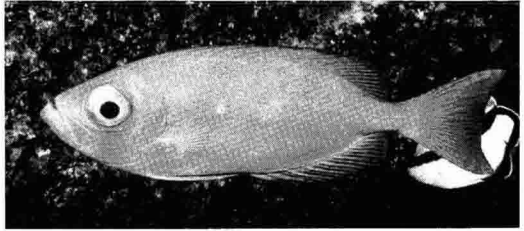
Plectranthias nanus Randall, 1980

BPBM 34779, 29 mm; BPBM 34844, 35 mm. Common but very cryptic; found by turning over rocks on a rubble bottom.

Pseudanthias thompsoni (Fowler, 1923)

Figure 29

Locally common outside the lagoon at dropoffs at depths greater than about 20 m.

FIGURE 29. *Pseudanthias thompsoni* (J. Randall).FIGURE 30. *Pseudogramma bilinearis*, BPBM 34825, 62 mm SL (J. Randall).FIGURE 31. *Kuhlia sandvicensis* (J. Earle).FIGURE 32. *Priacanthus meeki* (J. Randall).

Uchida and Uchiyama (1986) recorded this species from 64 m at Midway.

Pseudanthias ventralis hawaiiensis (Randall, 1979)

BPBM 34782, 52 mm. Rare at Midway; a few seen on a dropoff at 25 m outside the lagoon.

Pseudogramma bilinearis (Schultz, 1943)

Figure 30

BPBM 34825, 2: 62–67 mm. Specimens obtained with rotenone from a cave outside the lagoon in 8 m; never seen while diving. Often classified in the genus *Aporops*.—

Family KUHLIIDAE (Flagtails)

Kuhlia sandvicensis (Steindachner, 1876)

Figure 31

Listed by Uchida and Uchiyama (1986) at a depth of 1 m. Locally common in the surge zone outside the lagoon; also sighted in the lagoon.

Family PRIACANTHIDAE (Big Eyes)

Heteropriacanthus cruentatus (Lacepède, 1801)

Rare. Reported from Midway by Okamoto and Kanenaka (1984), Uchida and Uchiyama (1986) from a depth of 29 m, and Schroeder (1987) from the lagoon.

Priacanthus meeki Jenkins, 1903

Figure 32

BPBM 34761, 70 mm. Common in the lagoon and occasional outside. One individual photographed by Marjorie Awai rapidly altered its color from deep red to pinkish silver.

Family CIRRHITIDAE (Hawkfishes)

Amblycirrhitus bimacula (Jenkins, 1903)

BPBM 34817, 3: 25–69 mm. Obtained with rotenone outside the lagoon from a reef in 8 m; not seen while diving.

Cirrhitops fasciatus (Bennett, 1828)

BPBM 34818, 2: 54–82 mm. Common on reefs inside and outside the lagoon.

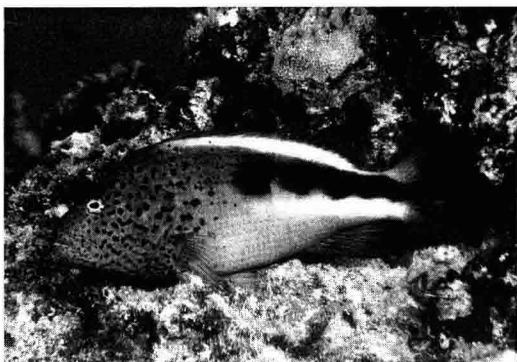


FIGURE 33. *Paracirrhites forsteri* (J. Randall).

Cirrhites pinnulatus (Bloch & Schneider, 1801)
Plate IIA

BPBM 34819, 105 mm. Common in the outer surge zone outside the lagoon; a few individuals seen as deep as 23 m; occasional on reefs in the lagoon.

Paracirrhites arcatus (Cuvier, 1829)
Plate IIB

BPBM 35366, 38 mm. Rare, especially in the lagoon. Reported from Midway by Okamoto and Kanenaka (1984).

Paracirrhites forsteri (Bloch & Schneider, 1801)
Figure 33

BPBM 35382, 155 mm. Common on reefs inside and outside the lagoon.

Family CHEILODACTYLIDAE (Morwongs)

Cheilodactylus vittatus Garrett, 1864
Plate IIC

Fairly common on reefs outside the lagoon with good cover; rare in the main Hawaiian Islands. The late postlarval stage reaches large size. One of about 56 mm TL taken from the nest of a white tern at Laysan Island was described as *Gregoryina gygis* by Fowler and Ball (1924) and classified in the new family Gregoryinidae. Norman (1957) allocated *Gregoryina* to the genus *Goniistius* (now regarded as a subgenus of *Cheilodactylus*), and Randall (1983) concluded that it was a postlarva of *C. vittatus*. Uchida and Uchiyama (1986) obtained specimens at Midway from depths of 2–55 m.

Family APOGONIDAE (Cardinalfishes)

Apogon crassiceps Garman, 1903

BPBM 34813, 8: 29–44 mm. Taken with rotenone from a reef outside the lagoon in 8 m. We have observed this species only at night in deep recesses of caves. *Apogon erythrinus* Snyder is a junior synonym. The closely related *A. coccineus* Rüppell differs in having a longitudinal dusky streak on the side of the caudal peduncle and more numerous gill rakers.

Apogon kallopterus Bleeker, 1856

BPBM 34868, 2: 40–43 mm. This most widespread species of the genus, and at many localities the most common, was only occasionally encountered at Midway; occurs in reefs both within and outside the lagoon.

Apogon maculiferus Garrett, 1863
Plate IID

BPBM 34814, 57 mm; BPBM 34869, 84 mm. Common on reefs within and outside the lagoon. Uchida and Uchiyama (1986) recorded it from Midway in the depth range of 31–48 m.

Apogon taeniopterus Bennett, 1835

One adult observed during a night dive in the lagoon in 3 m near the cargo pier by the senior author. Sometimes identified as *A. menesemus* Jenkins and regarded as a Hawaiian endemic, but we prefer to treat it as a junior synonym of the wide-ranging *A. taeniopterus*.

Foa brachygramma (Jenkins, 1903)
Figure 34

BPBM 34763, 27 mm; BPBM 34785, 21 mm. Common in the lagoon. Schroeder (1987) found it among the most common fishes that colonized his small artificial reefs in the Midway lagoon.

Pseudamiops sp.

BPBM 34815, 25 mm, from a reef outside the lagoon in 8 m. An undescribed species apparently endemic to the Hawaiian Islands; previously identified as *P. gracilicauda* (Lachner). Rare at Midway; generally seen only in caves at night.



FIGURE 34. *Foa brachygramma*, night (J. Randall).

Family MALACANTHIDAE (Sand Tilefishes)

Malacanthus brevirostris Guichenot, 1848

Occasional outside the lagoon, generally at depths greater than 20 m. Underwater photograph on file at the Bishop Museum.

Family ECHENEIDIDAE (Remoras)

Remora remora (Linnaeus, 1758)

Two specimens, BPBM 35419, 93–198 mm, were taken from a female tiger shark, 4039 mm precaudal length, caught in the lagoon by personnel of the Hawaii Cooperative Fishery Research Unit.

Family CARANGIDAE (Jacks)

Alectis ciliaris (Bloch, 1788)

One immature individual about 200 mm TL (disregarding trailing filaments) was sighted in calm water near shore in 1989 by two of us (J.L.E. and R.L.P.).

Atule mate (Cuvier)

One specimen reported from Midway by Fowler and Ball (1925), BPBM 3870, 57 mm fork length. Scutes and scales in straight portion of lateral line 38; gill rakers 9 + 25; body depth 3.4 in FL.

Carangoides ferdau (Forsskål, 1775)

Figure 35

Occasional, both within and outside the lagoon.

Carangoides orthogrammus Jordan & Gilbert, 1881

Figure 36

Occasional in the lagoon (James E. Norris,

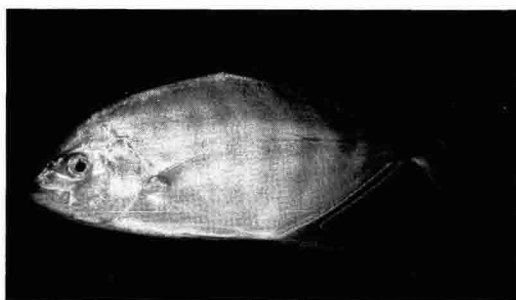


FIGURE 35. *Carangoides ferdau* (J. Randall).



FIGURE 36. *Carangoides orthogrammus* (J. Randall).

pers. comm.) and outside the lagoon where it was usually seen at depths greater than 20 m.

Caranx ignobilis (Forsskål, 1775)

Figure 37

This largest of jacks was the most common of the genus at Midway. Schools of adults often circled divers closely on seaward reefs outside the lagoon, and occasional individuals were seen in the lagoon. Sudekum et al. (1991) studied the food habits and other aspects of the biology of this jack and *C. melampygus* at Midway and other Northwestern Hawaiian Islands.

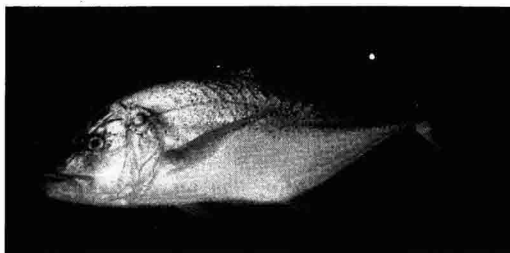
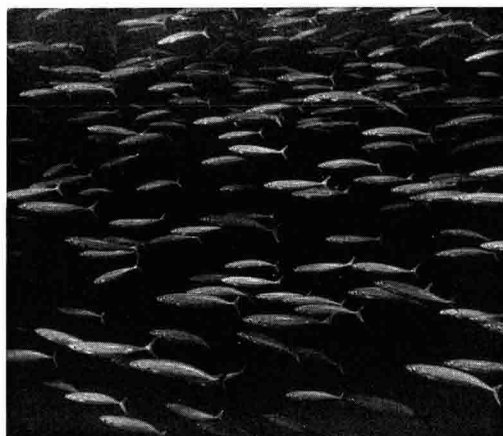
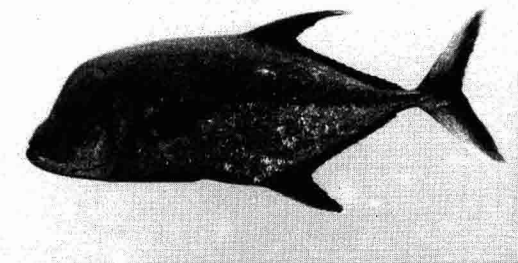
Caranx lugubris Poey, 1860

Figure 38

Rare. A few sighted in outer reef areas.

Caranx melampygus Cuvier, 1833

Figure 39

FIGURE 37. *Caranx ignobilis* and diver (J. Earle).FIGURE 39. *Caranx melampygus* (J. Randall).FIGURE 40. *Decapterus macarellus* (J. Earle).FIGURE 38. *Caranx lugubris* (J. Randall).

Fairly common, both within and outside the lagoon.

Caranx sexfasciatus Quoy & Gaimard, 1824

Occasional. A few schools sighted outside the lagoon.

Decapterus macarellus (Cuvier, 1833)

Figure 40

Small schools were fairly common outside the reef and occasional in the lagoon, but no specimens were collected.

Elagatis bipinnulata (Quoy & Gaimard, 1825)

Rare. A few seen outside the lagoon at depths greater than 20 m.

Gnathanodon speciosus (Forsskal, 1775)

Rare. Uchida and Uchiyama (1986) reported it from Midway in 1–2 m.

Pseudocaranx dentex (Bloch & Schneider, 1801)

Figure 41

Common, especially in the lagoon; resident schools under and near the cargo pier. Gosline and Brock (1960) and others have noted that this species (identified as *Caranx cheilio* Snyder in most early papers dealing with Hawaiian fishes) is much more common in the North-western Hawaiian Islands than in the main

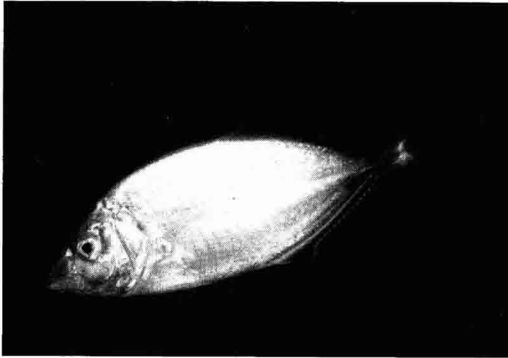


FIGURE 41. *Pseudocaranx dentex* (J. Randall).

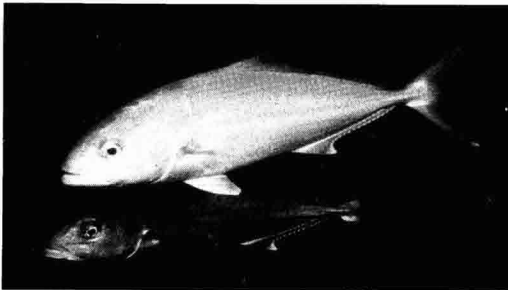


FIGURE 42. *Seriola dumerili* (J. Randall).

islands of the archipelago. Uchida and Uchiyama (1986) recorded it from Midway in 1–128 m. Seki (1984b) studied the food habits from specimens taken from Nihoa to Kure.

Scomberoides lysan (Forsskål, 1775)

Occasional solitary individuals seen cruising in open water outside the lagoon.

Selar crumenophthalmus (Bloch, 1793)

Reported from Midway in the depth range of 1–31 m by Uchida and Uchiyama (1986). Not seen by us.

Seriola dumerili (Risso, 1810)

Figure 42

Fairly common; small groups of subadults observed under the cargo pier in the lagoon. Reported from 1–128 m by Uchida and Uchiyama (1986). This species has been implicated as a cause of ciguatera more than any other in Hawaiian waters (Ito and Uchida 1980). Humphreys and Kramer (1984) studied the

food habits from specimens from the Hawaiian Islands.

Seriola lalandi Valenciennes, 1833

Listed from a depth of 1 m by Uchida and Uchiyama (1986). Not observed by us.

Family CORYPHAENIDAE (Dolphins)

Coryphaena equiselis Linnaeus, 1758

W. O. Works and J. P. Ludwig collected *C. equiselis* (spelled *equisetis* by many authors) from a fairy tern on Midway in September 1963. The specimen (USNM 210577, 78 mm SL) is in the collection of the U.S. National Museum of Natural History.

Coryphaena hippurus Linnaeus, 1758

Reported from Midway waters by Uchida and Uchiyama (1986).

Family LUTJANIDAE (Snappers)

Aphareus furca (Lacepède, 1802)

Rare; observed over reefs outside the lagoon. Listed from Midway by Okamoto and Kanenaka (1984). Underwater photograph on file at the Bishop Museum.

Aprion virescens Valenciennes, 1830

Figure 43

Fairly common outside the lagoon. Uchida and Uchiyama (1986) reported it from 18 m.

Etelis carbunculus Cuvier, 1828

Uchida and Uchiyama (1986) reported this deep-water snapper from 192–219 m at Midway. Undoubtedly other deep-water lutjanid fishes occur at the atoll.

Lutjanus kasmira (Forsskål, 1775)

Figure 44

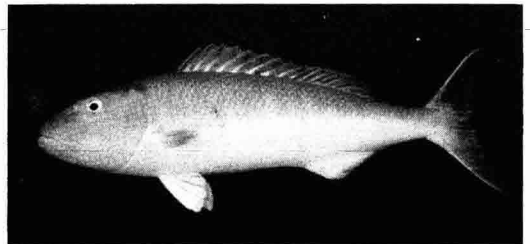
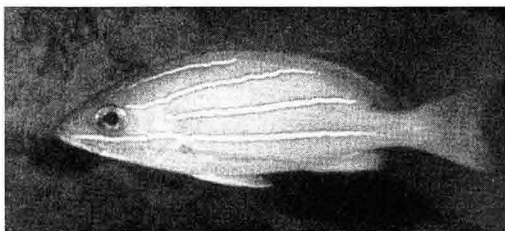


FIGURE 43. *Aprion virescens* (J. Randall).

FIGURE 44. *Lutjanus kasmira* (J. Hoover).FIGURE 45. *Mulloidichthys vanicolensis* (J. Randall).

Rare. Three observed under the cargo pier in the lagoon in 1992.

Family MULLIDAE (Goatfishes)

Mulloidichthys flavolineatus (Lacepède, 1801)

BPBM 15308, 156 mm. The most common goatfish in the lagoon and fairly common outside. Usually encountered by day in relatively stationary aggregations. Hobson (1980) reported that it represented more than 10% of the fishes counted on 30 transect lines at Midway and Kure.

Mulloidichthys pflugeri (Steindachner, 1900)

None observed in 1989 or 1991, but small aggregations were observed by two of us (J.L.E. and T.H.) on three occasions in 1992 outside the reef in 20 m.

Mulloidichthys vanicolensis (Valenciennes, 1831)

Figure 45

Common in aggregations, mainly on or near reefs outside the lagoon at depths greater than 20 m. Abundant at times in some places

in the lagoon, either as separate schools or mixed with *M. flavolineatus*.

Parupeneus bifasciatus (Lacepède, 1801)

Rare. Two specimens, 201–209 mm, speared in the lagoon by personnel of the Hawaii Cooperative Fishery Research Unit, for stomach-content analysis, but not retained. Not observed in 1989–1992.

Parupeneus chrysonemus (Jordan & Evermann, 1903)

Plate IIE

BPBM 34775, 5: 120–165 mm; BPBM 34848, 95 mm. Fairly common at depths greater than about 25 m outside the lagoon in relatively open areas near reefs. Uchida and Uchiyama (1986) listed it from 60–64 m at Midway. Found only in deep water in the main Hawaiian Islands.

Parupeneus cyclostomus (Lacepède, 1801)

Plate IIF

Occasional, mainly on reefs outside the lagoon, generally at depths greater than 20 m.

Parupeneus multifasciatus (Quoy & Gaimard, 1825)

BPBM 34876, 50 mm. Fairly common, especially on reefs outside the lagoon.

Parupeneus pleurostigma (Bennett, 1830)

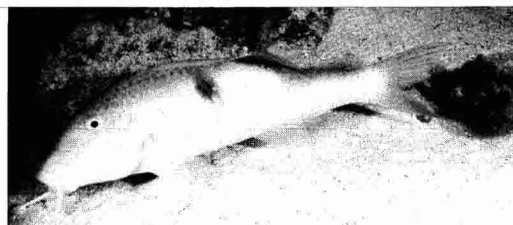
Figure 46

BPBM 34935, 244 mm. Common; seen more often outside than in the lagoon.

Parupeneus porphyreus (Jenkins, 1903)

Plate IIG

BPBM 15305, 8: 119–162 mm. Occasional, usually outside the lagoon, some of surprisingly large size. Reported from 2–64 m by Uchida and Uchiyama (1986).

FIGURE 46. *Parupeneus pleurostigma* (J. Randall).

Family KYPHOSIDAE (Sea Chubs)

Kyphosus bigibbus Lacepède, 1802

Figure 47

Abundant, particularly on reefs just seaward of the surge zone outside the lagoon. This is clearly the dominant reef fish at Midway in terms of biomass outside the lagoon (and common in the lagoon as well). The only *Kyphosus* listed by Hobson (1980) and Okamoto and Kanenaka (1984) from Midway was *K. cinerascens*. Although the latter occurs at Midway, it is distinctly the least common of the three species found at Midway. Hobson (1984) corrected his listing of *cinerascens* to *bigibbus*. Schools of *K. bigibbus* often feed en masse on benthic algae, swamping the territorial damselfish *Stegastes fasciolatus* (Ogilby). Yellow color morphs are seen occasionally, as well as mixed yellow and gray individuals. One all-white individual was sighted.

Kyphosus cinerascens (Forsskål, 1775)

Figure 48

Rare. Three individuals of this species were observed under the cargo pier in the lagoon.

FIGURE 47. *Kyphosus bigibbus* (J. Earle).FIGURE 48. *Kyphosus cinerascens* (J. Randall).*Kyphosus vaigiensis* (Quoy & Gaimard, 1825)

Small schools of this species are occasionally seen, especially in the lagoon. One adult was speared in the vicinity of the cargo pier to confirm the identification (it had 14 dorsal soft rays and 13 soft anal rays); it was not preserved.

Family EPHIPPIDAE (Spadefishes)

Platax boersii Bleeker, 1852

BPBM 34889, 333 mm. Speared by Alan K. Tomita from under the cargo pier in the lagoon on 10 April 1980. Dorsal rays V,32; anal rays III,24; pectoral rays 17; lateral-line scales about 52; teeth tricuspid, the cusps about equal in length; body orbicular, the dorsal profile of head smoothly convex. Identification aided by Kishimoto et al. (1988), who reviewed the Japanese species of *Platax*. Reported by Randall et al. (1993) as a first record of the genus from the Hawaiian Islands. Several individuals seen under the pier on 6 April 1980 by Thomas F. Hourigan (pers. comm.). None observed by us at the pier or elsewhere in 1989, 1991, or 1992.

Family PENTACEROTIDAE
(Armored Boarfishes)

Evistias acutirostris (Temminck & Schlegel, 1844)

Plate IIH

Rare; the few individuals we observed were in caves outside the lagoon at depths greater than 25 m.

Family CHAETODONTIDAE (Butterflyfishes)

Chaetodon auriga Forsskål, 1775

Figure 49

BPBM 35383, 144 mm. Common in the lagoon, occasional outside. Reported from Midway by Okamoto and Kanenaka (1984).

Chaetodon ephippium Cuvier, 1831

Recorded from Midway by Okamoto and Kanenaka (1984). Not seen by us.

Chaetodon fremblii Bennett, 1829

Plate III

BPBM 35384, 105 mm. Common on reefs outside the lagoon, fairly common in lagoon.

Chaetodon kleinii Bloch, 1790

BPBM 34865, 37 mm. We observed only four small juveniles (one collected) of this species in 1991, all from about 25 m outside the lagoon on sparse rubble substratum.

Chaetodon miliaris Quoy & Gaimard, 1824

Plate IIJ

BPBM 35385, 3: 39–92 mm. One 101-mm

specimen speared in the lagoon by John McGowan on 12 November 1953 during a visit to the atoll by the R/V *Spencer F. Baird*. This fish was identified by Carl L. Hubbs of the Scripps Institution of Oceanography and transferred to W. I. Follett of the California Academy of Sciences. Abundant; the most common butterflyfish at Midway.

Chaetodon multicinctus Garrett, 1863

Plate IIIA

BPBM 35375, 52 mm. Fairly common on reefs outside the lagoon and occasional within. Not reported by Hobson (1980) or Okamoto and Kanenaka (1984) from Midway, but the latter authors listed it from Pearl and Hermes Reef and Kure Atoll. Four specimens collected in 1992 all had a dusky red bar on the caudal peduncle (Plate IIIA), in contrast to the black bar seen on individuals from the main Hawaiian Islands.

Chaetodon ornatissimus Cuvier, 1831

Occasional, both in relatively shallow and deeper reefs outside the lagoon; rare in the lagoon. Underwater photograph on file at the Bishop Museum.

Chaetodon trifasciatus Park, 1797

Figure 50

Occasional, both within and outside the

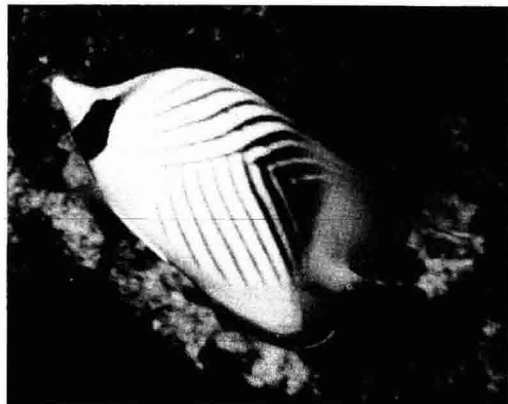


FIGURE 49. *Chaetodon auriga* (J. Earle).

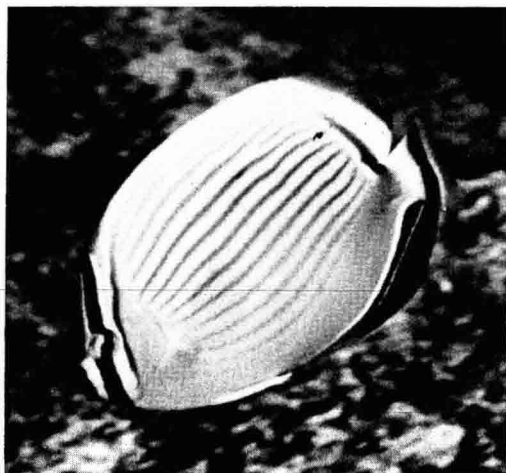


FIGURE 50. *Chaetodon trifasciatus* (J. Earle).



FIGURE 51. *Chaetodon unimaculatus* (J. Earle).

lagoon. Listed from Midway by Okamoto and Kanenaka (1984).

Chaetodon unimaculatus Bloch, 1788

Figure 51

Rare. Occasional pairs seen on the seaward reef outside the lagoon, some as shallow as 2–3 m. Also recorded by Okamoto and Kanenaka (1984).

Forcipiger flavissimus Jordan & McGregor, 1898

Plate IIIB

Common, especially outside the lagoon. Listed by Okamoto and Kanenaka (1984).

Hemitaurichthys thompsoni Fowler, 1923

Rare. Three individuals seen in 1989 in an aggregation of *Chromis verater* Jordan & Metz outside the lagoon at a depth of 18 m.

Heniochus diphreutes Jordan, 1903

Figure 52

Fairly common. Usually observed in small aggregations on reefs outside the lagoon at depths of 20–25 m. This species in Hawaii was misidentified as *H. acuminatus* (L.) until Allen and Kuiter (1978) showed that there are two closely related fishes that have been called *H. acuminatus*. Unlike the true *acuminatus*, *H. diphreutes* often forms schools; it is the only species of the genus in the Hawaiian Islands.

Family POMACANTHIDAE (Angelfishes)

Centropyge fisheri (Snyder, 1904)

Plate IIIC



FIGURE 52. *Heniochus diphreutes* (L. Privitera).

BPBM 34858, 48 mm. Occasional on rubble bottoms outside the lagoon in about 23 m.

Centropyge interruptus (Tanaka, 1918)

Plate IIID

BPBM 34859, 105 mm. This species was reported as a new record from the Hawaiian Islands by Ralston (1981), based on one female from Kure Atoll. We found it fairly common in a distinctive habitat of well-developed reef dominated by *Porites compressa* Dana, outside the lagoon in the depth range of about 15–27 m. Pyle (1990a) wrote an article about collecting *C. interruptus* at Midway.

Centropyge potteri (Jordan & Metz, 1912)

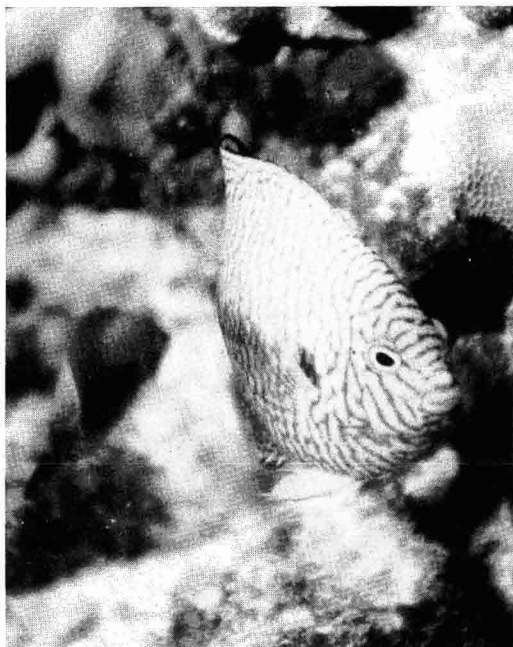
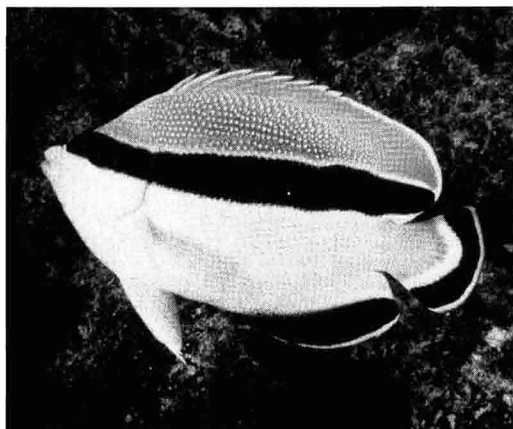
Figure 53

BPBM 34837, 71 mm. Abundant; clearly the most common species of the family at Midway; occurs mainly on or near reefs outside the lagoon from the shallows to deep Scuba-diving depths.

Desmoholacanthus arcuatus (Gray, 1831)

Figure 54

Occasional on reefs outside the lagoon, generally at depths greater than 20 m. Usually placed in the genus *Holacanthus*; we provisionally follow Fowler (1941) in classifying

FIGURE 53. *Centropyge potteri* (L. Privitera).FIGURE 54. *Desmoholacanthus arcuatus* (J. Randall).

this species in the monotypic genus *Desmoholacanthus*. Toyama (1988) wrote an article on this and other angelfishes of Midway.

Genicanthus personatus Randall, 1975
Plate III E, F

BPBM 31971, 6: 136–160 mm; BPBM 34774, 133 mm; also six specimens donated by us to

the U.S. National Museum of Natural History (USNM 308842). Fairly common at sections of reef with ledges and caves outside the lagoon at depths of 20 m or more. This is an example of a species that is found in the main Hawaiian Islands in deeper depths than normally penetrated by Scuba divers. Previously reported from Midway by Toyama (1988) and Pyle (1990b).

Family OPLEGNATHIDAE (Knifejaws)

Oplegnathus fasciatus (Temminck & Schlegel, 1844)

Figure 55

Occasional both within and outside the lagoon in reef areas, generally in less than 10 m. Well known from Japanese seas. This and the following species are rare in the main Hawaiian Islands. We have seen only one photograph of a subadult of *O. fasciatus* from the island of Hawaii.

Oplegnathus punctatus (Temminck & Schlegel, 1844)

Figure 56

Occasional; seen on reefs within and outside the lagoon, usually in less than 10 m, most often in or near caves. This and the above species seem to be immigrants to the Hawaiian Islands from Japan. The Bishop Museum has adult specimens from Kure Atoll, Maro Reef, Oahu, and Maui.

Family MUGILIDAE (Mulletts)

Mugil cephalus Linnaeus, 1758

Recorded from Midway by Uchida and Uchiyama (1986).

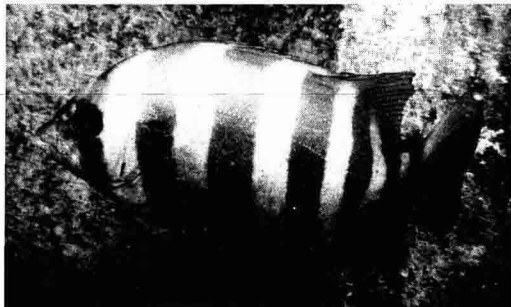
FIGURE 55. *Oplegnathus fasciatus* (J. Randall).



FIGURE 56. *Oplegnathus punctatus* and *Myripristis amaena* (J. Randall).

Neomyxus leuciscus (Günther, 1871)

BPBM 34788, 41 mm; only this one juvenile collected in 1989; none seen in 1991 or 1992.

Family POLYNEMIDAE (Threadfins)

Polydactylus sexfilis (Valenciennes, 1831)

BPBM 34888, 191 mm. Occasional in lagoon shallows. Uchida and Uchiyama (1986) obtained specimens from depths of 1–27 m.

Family POMACENTRIDAE (Damsel-fishes)

Abudefduf abdominalis (Quoy & Gaimard, 1825)

Plate IIIG

Common on reefs both within and outside the lagoon.

Abudefduf sordidus Forsskål, 1775

Figure 57

Fairly common in the shallows of exposed reefs outside the lagoon; also seen at the boat ramp in the lagoon.

Chromis hanui Randall & Swerdloff, 1973

Figure 58

BPBM 34838, 2: 35–50 mm. Abundant on reefs outside the lagoon, usually at depths greater than 10 m.

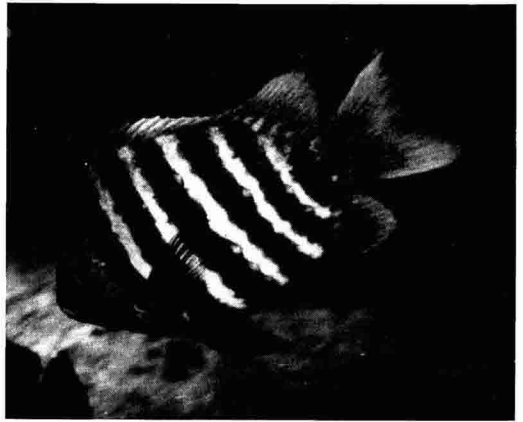


FIGURE 57. *Abudefduf sordidus* (J. Earle).

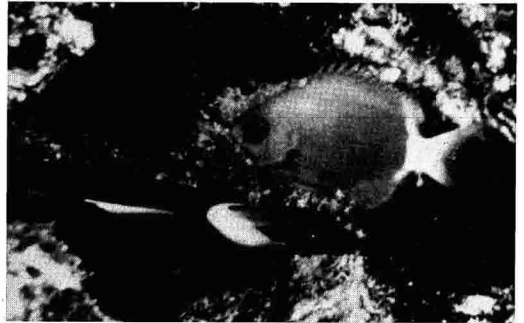


FIGURE 58. *Chromis hanui* and tail of *Melichthys vidua* (J. Hoover).

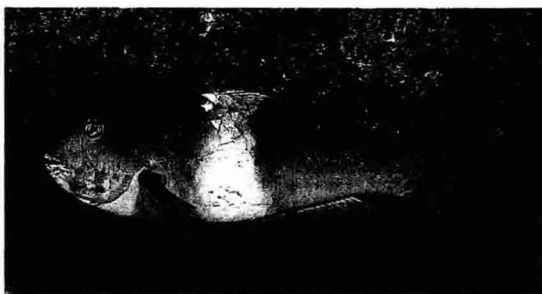
Chromis ovalis (Steindachner, 1900)

Figure 59

BPBM 35386, 2: 91–94 mm. The most abundant fish at Midway in reef areas outside the lagoon between about 6 and 25 m, often in large aggregations. Uchida and Uchiyama (1986) reported specimens from the depth range of 37–64 m. In September we noted many individuals about 75 mm in TL, usually in schools, with the subadult pattern of a broad bright iridescent blue stripe from upper edge of eye to dorsal part of caudal peduncle, broadly bordered above by yellow, this color extending into the dorsal fin. In the main Hawaiian Islands the adult color pattern has been attained by September.



A. *Calotomus zonarchus*, female (J. Randall).



B. *Calotomus zonarchus*, male (J. Randall).



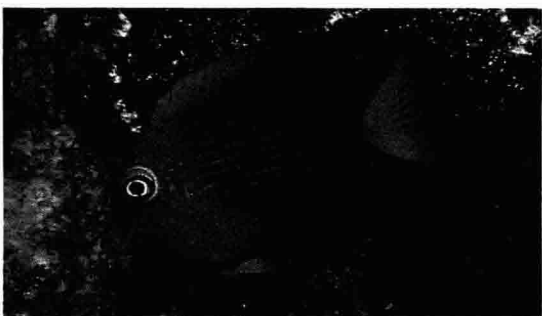
C. *Scarus perspicillatus*, initial phase (J. Randall).



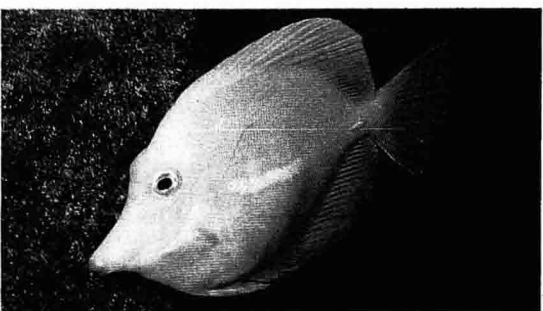
D. *Scarus perspicillatus*, terminal male, and *Thalassoma duperrey* (J. Randall).



E. *Acanthurus olivaceus* (J. Earle).



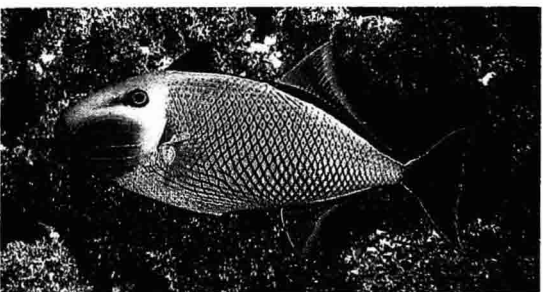
F. Juvenile *Ctenochaetus strigosus* (J. Randall).



G. *Zebrasoma flavescens* (J. Hoover).



H. *Zebrasoma veliferum* (J. Hoover).



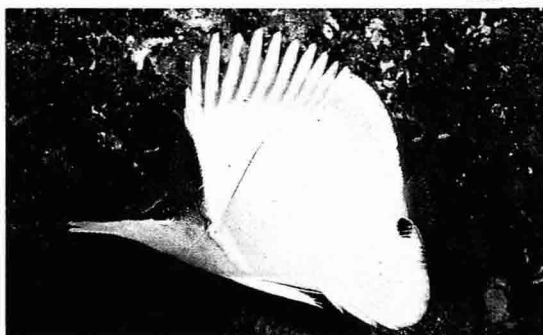
I. *Xanthichthys mento*, male (J. Randall).



J. *Aluterus scriptus* (J. Earle).



A. *Chaetodon multicinctus* (J. Earle).



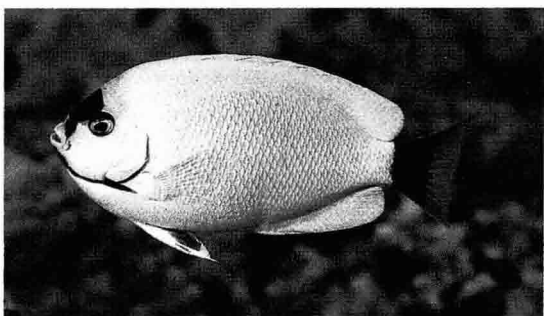
B. *Forcipiger flavissimus* (J. Hoover).



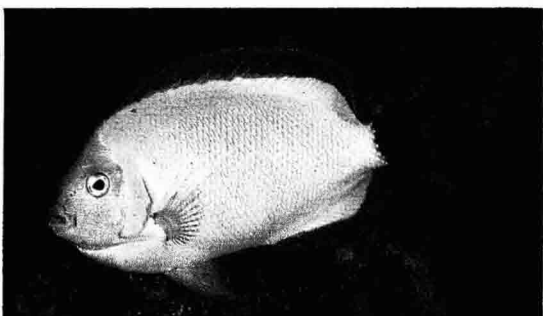
C. *Centropyge fisheri* (R. Pyle).



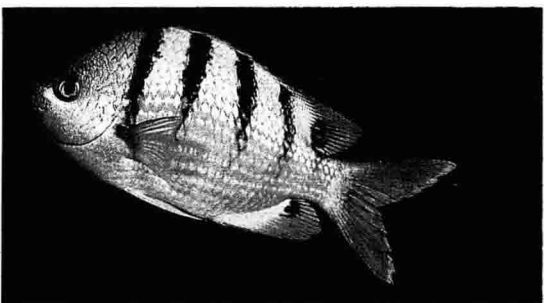
D. *Centropyge interruptus* (J. Randall).



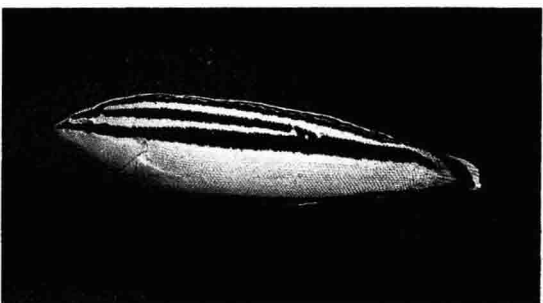
E. *Genicanthus personatus*, female (R. Pyle).



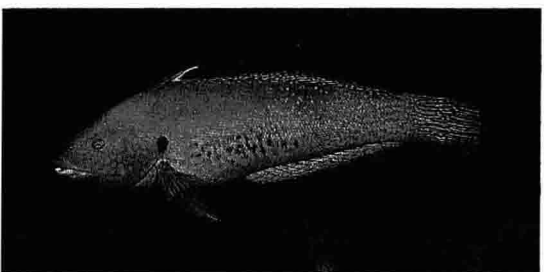
F. *Genicanthus personatus*, male (J. Randall).



G. *Abudefduf abdominalis* (J. Randall).



H. *Coris flavovittata*, female (J. Randall).



I. *Coris flavovittatus*, male (J. Randall).



J. *Pseudocheilinus octotaenia* (J. Hoover).

FIGURE 59. *Chromis ovalis* (J. Randall).FIGURE 61. *Chromis verater* (J. Randall).

Chromis verater Jordan & Metz, 1912

Figure 61

Abundant outside the lagoon on reefs at depths greater than about 12 m.

Dascyllus albisella Gill, 1862

BPBM 34850, 11 mm. Common, especially where branching corals provide shelter. Schroeder (1987) found it among the fishes most apt to colonize small artificial reefs in the Midway lagoon.

Plectroglyphidodon johnstonianus Fowler & Ball, 1924

BPBM 34839, 33 mm. Occasional on shallow reefs outside the lagoon.

Stegastes fasciolatus (Ogilby, 1889)

Abundant from 1.5 to 25 m. Fowler and Bean (1928) reported 10 specimens from the *Albatross* collection made at Midway in 1907 as *Pomacentrus nigricans* (Lacepède); now cataloged as USNM 257701.

Family LABRIDAE (Wrasses)

Anampses chrysocephalus Randall, 1958—

BPBM 35376, 50.5 mm. Fairly common outside the lagoon at depths greater than about 20 m. Okamoto and Kanenaka (1984) recorded it from Midway.

Anampses cuvier Quoy & Gaimard, 1824

Figure 62

BPBM 35387, 2: 61–112 mm. Fairly common

FIGURE 60. *Chromis vanderbilti* (J. Earle).

Chromis vanderbilti (Fowler, 1941)

Figure 60

BPBM 35373, 42 mm. Occasional; observed on reefs outside the lagoon in depths from 2 to 20 m. Reported from Midway by Okamoto and Kanenaka (1984).

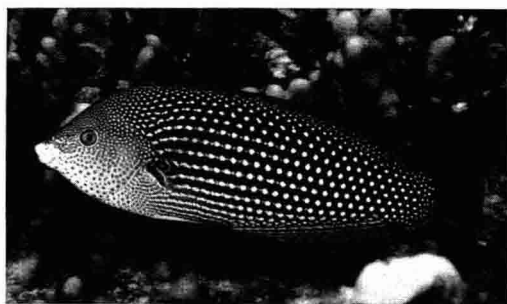


FIGURE 62. *Anampses cuvier*, female (J. Randall).



FIGURE 63. *Bodianus bilunulatus albotaeniatus*, male (J. Randall).

in reef areas outside the lagoon from about 2 to 15 m.

Bodianus bilunulatus albotaeniatus (Valenciennes, 1839)

Figure 63

BPBM 35388, 37 mm. Common outside the lagoon in 3–25 m and occasional within. Uchida and Uchiyama (1986) obtained specimens from the depth range of 6–49 m.

Cheilinus bimaculatus Valenciennes, 1839

BPBM 34875, 3: 41–63 mm; BPBM 34908, 2: 56–58 mm. Common outside the lagoon on rubble bottom at depths greater than about 20 m; occasional in the lagoon.

Cheilinus unifasciatus Streets, 1877

Figure 64

Fairly common, especially outside the lagoon, in about 8–25 m. The U.S. National Museum of Natural History has an *Albatross* specimen, USNM 153685, 175 mm TL, collected in November 1907; reported by Fowler and

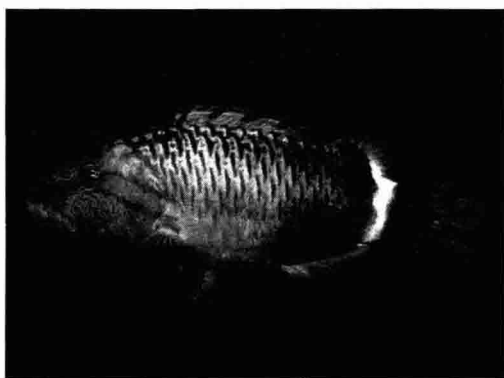


FIGURE 64. *Cheilinus unifasciatus* (J. Randall).

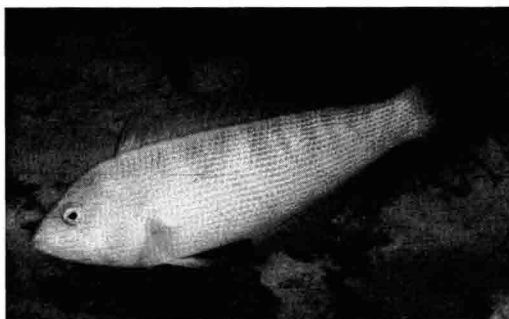


FIGURE 65. *Coris ballieui*, female (J. Randall).

Bean (1928). Often misidentified as *C. rhodochrous* Playfair & Günther, an Indian Ocean species.

Cheilio inermis (Forsskal, 1775)

Rare; observed in about 4–5 m outside the lagoon. Listed from Midway and Kure by Hobson (1980).

Cirrhilabrus jordani Snyder, 1904

BPBM 34809, 54 mm. Occasional small groups seen outside the lagoon at the base of a dropoff in about 23 m.

Coris ballieui Vaillant & Sauvage, 1875

Figures 65, 66

BPBM 34898, 230 mm. Common outside the lagoon in its habitat of sand and rubble substrata and low-profile reefs, generally at depths greater than 20 m. This is probably the *Coris* sp. reported by Uchida and Uchiyama

FIGURE 66. *Coris ballieui*, male (J. Randall).

(1986) from 40–44 m at Midway. *Coris ballieui* is known to a depth of 81 m (Randall 1985).

Coris flavovittata (Bennett, 1829)

Plate IIIH,I

BPBM 34899, 207 mm. Common in reef areas outside the lagoon from 2–25 m, occasional in the lagoon.

Coris gaimard (Quoy & Gaimard, 1824)

Rare; observed outside the lagoon at depths of about 20 m.

Coris venusta Vaillant & Sauvage, 1875

BPBM 34900, 65 mm. Common, especially outside the lagoon at depths of about 2–10 m. Recorded from Midway by Okamoto and Kanenaka (1984).

Cymolutes lecluse (Quoy & Gaimard, 1824)

BPBM 34906, 150 mm. Rare; observed over sand substrata in the lagoon; one speared. Reported among the piscivorous fishes of Midway Atoll and French Frigate Shoals by Parrish et al. (1986) and Norris and Parrish (1988). Known only from the Hawaiian Islands (Schultz in Schultz and collaborators 1960).

Epibulus insidiator (Pallas, 1770)

Recorded from Midway by Hobson (1980) and Okamoto and Kanenaka (1984). Not observed by us.

Gomphosus varius Lacepède, 1801

Figure 67

Rare outside the lagoon but fairly common

FIGURE 67. *Gomphosus varius*, initial phase (J. Earle).FIGURE 68. *Macropharyngodon geoffroy* (J. Randall).

on lagoon patch reefs. Recorded by Okamoto and Kanenaka (1984).

Halichoeres ornatissimus (Garrett, 1863)

BPBM 34887, 12 mm. Occasional outside the lagoon in 6–20 m.

Labroides phthirophagus Randall, 1958

Figure 14

BPBM 34829, 2: 31–42 mm. Fairly common in a variety of reef habitats.

Macropharyngodon geoffroy (Quoy & Gaimard, 1824)

Figure 68

Occasional on shallow reefs outside the lagoon.

Novaculichthys taeniourus (Lacepède, 1801)

Rare; seen outside the lagoon in about 25 m.

Pseudocheilinus evanidus Jordan & Evermann, 1903

Observed on lagoon reefs by James E. Norris. Rare; not seen by us in 1989–1992.

Pseudocheilinus octotaenia Jenkins, 1900

Plate IIIJ

BPBM 35369, 27 mm. Abundant on well-developed reefs outside the lagoon at depths from about 6 to 25 m; our one specimen was taken on a lagoon reef. Okamoto and Kanenaka (1984) listed it from Midway.

Pseudocheilinus tetrataenia Schultz, 1960

Observed on lagoon reefs by James E. Norris. Rare; not seen by us in 1989–1992.

Pseudojuloides cerasinus (Snyder, 1904)

Figure 69

Fairly common outside the lagoon on rubble and low-profile reefs at an average depth of about 22 m.

Stethojulis balteata (Quoy & Gaimard, 1824)

BPBM 34932, 122 mm SL, a terminal-phase male. Fairly common in shallow reef areas outside and inside the lagoon. Recorded from Midway by Okamoto and Kanenaka (1984).

Thalassoma ballieui (Vaillant & Sauvage, 1875)

Figure 70

BPBM 34830, 2: 25–42 mm; SIO 68-498,

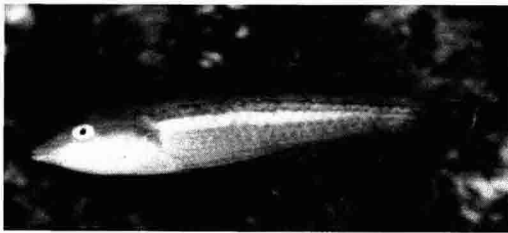


FIGURE 69. *Pseudojuloides cerasinus*, male (J. Randall).

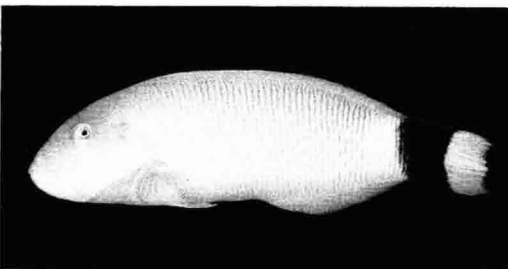


FIGURE 70. *Thalassoma ballieui* (J. Randall).

185 mm. Common, much more so than in the main Hawaiian Islands, and reaches notably larger size at Midway. Recorded from depths of 1–60 m by Uchida and Uchiyama (1986).

Thalassoma duperrey (Quoy & Gaimard, 1824)Plate IVD (with *Scarus perspicillatus*)

BPBM 34831, 3: 37–60 mm; BPBM 34901, 113 mm. Abundant, though not as common as in the main Hawaiian Islands.

Thalassoma purpurum (Forsskål, 1775)

BPBM 34892, 14: 64–225 mm. Common outside the lagoon on shallow reefs exposed to surge. Recorded from Midway by Okamoto and Kanenaka (1984). An out-of-focus photograph of this species from Midway is on file at Bishop Museum.

Thalassoma trilobatum (Lacepède, 1801)

Occasional on shallow reefs outside the lagoon. Hobson (1984: Table 5) stated that *T. umbrostigma* (Rüppell) (= *umbrostygma*) is the female of *T. fuscum* (Lacepède) (= *trilobatum*). As shown by Randall and Edwards (1984), it is the initial phase (may be either male or female) of *T. purpurum*.

Xyrichtys pavo Valenciennes, 1840

Rare; one juvenile of about 60 mm TL sighted by one of us (J.L.E.) in 25 m on sand outside the lagoon.

Family SCARIDAE (Parrotfishes)

Calotomus zonarchus (Jenkins, 1903)

Plate IVA,B

BPBM 34791, 127 mm; BPBM 34881, 79 mm. Common both within and outside the lagoon.

Scarus dubius Bennett, 1828

Figures 71, 72

Common; more seen outside than inside the lagoon; abundance greater than in the main Hawaiian Islands. Occurs to depths of at least 20 m.

Scarus perspicillatus Steindachner, 1879

Plate IVC,D

Abundant, both within and outside the lagoon; the most common species of the family at Midway. May be seen in surprisingly shallow water for such a large fish.

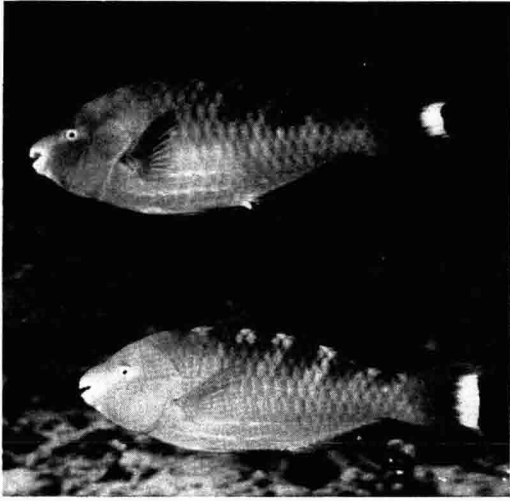


FIGURE 71. *Scarus dubius*, initial phase (J. Randall).

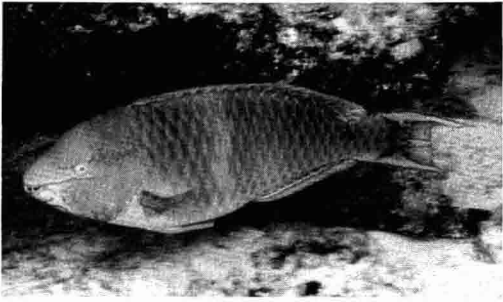


FIGURE 72. *Scarus dubius*, terminal male (J. Randall).

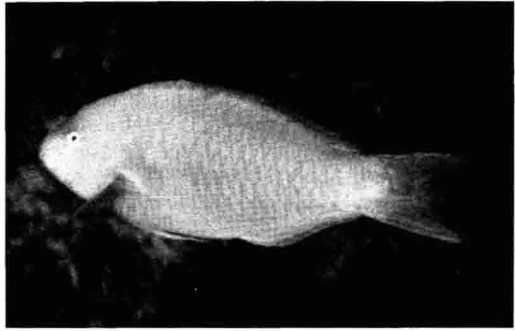


FIGURE 73. *Scarus psittacus*, terminal male (J. Randall).

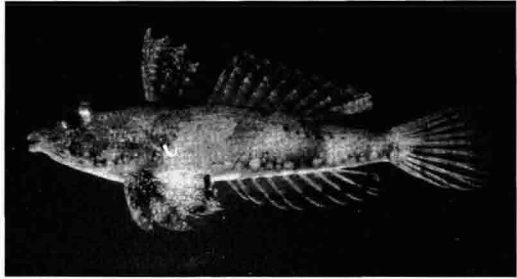


FIGURE 74. *Callionymus corallinus*, BPBM 34853, 29 mm SL (J. Randall).

Scarus psittacus Forsskål, 1775

Figure 73

Occasional, both on lagoon reefs and on reefs outside the lagoon.

Scarus sordidus Forsskål, 1775

Reported from Midway by Okamoto and Kanenaka (1984). Not observed by us in 1989, 1991, or 1992. At many localities where this species occurs, it is the most common of the parrotfishes.

Family CALLIONYMIDAE (Dragonettes)

Callionymus corallinus Gilbert, 1905

Figure 74

BPBM 34853, 29 mm. Only one specimen

collected, from 24 m outside the lagoon, by J.L.E. in 1991.

Callionymus sp.

BPBM 34807, 13.5 mm. An undescribed species of which there is additional adult material from the main Hawaiian Islands at the Bishop Museum. This dragonette is characterized as follows: dorsal spines IV, the first three long, about 2.4 in SL; rays of second dorsal fin unbranched except the last, the distal margin of fin slightly concave; gill opening at level of center of eye; preopercular spine with five spinules on upper edge, the end one recurved (four spinules on this juvenile, the distal one only slightly curved); lower edge of preopercular spine without a basal antrorse spinule; snout about equal to orbit diameter in adults (shorter in juvenile); lateral line highly arched above pectoral fin; caudal fin slightly rounded, a little shorter than head; two small jet black spots above base of pelvic fin.

Family CREEDIIDAE (Sandburrowers)

Crystallodytes cookei Fowler, 1923

BPBM 34885, 38 mm. A single specimen taken by J.L.E. in 3 m from a sand patch outside the lagoon.

Limnichthys donaldsoni Schultz, 1960

BPBM 34767, 23 mm; BPBM 34820, 21.5 mm. The 21.5-mm specimen was collected outside the lagoon from a sand patch at the entrance to a cave in 8 m.

Family PINGUIPEDIDAE (Sandperches)

Parapercis schauinslandi (Steindachner, 1900)

BPBM 34778, 51 mm. Common outside the lagoon on relatively flat substrata of sand and coral rubble at depths of about 25 m.

Family TRIPTERYGIIDAE (Triplefins)

Enneapterygius atriceps (Jenkins, 1903)

Figure 75

BPBM 34558, 2: 17–18.5 mm; BPBM 34803, 21 mm; BPBM 34846, 18: 19–24 mm; BPBM 34896, 23 mm. Curiously, the 18 specimens of BPBM 34846 are all in the female color form. Abundant in its habitat of shallow structured reef outside the lagoon; occasional in the lagoon. It was the most numerous of 40 species taken in a small rotenone station in 8 m.

Family BLENNIIDAE (Blennies)

Cirripectes obscurus (Borodin, 1927)

Figure 76

BPBM 34861, 149 mm. Fairly common in the surge zone in less than 2 m. The largest species

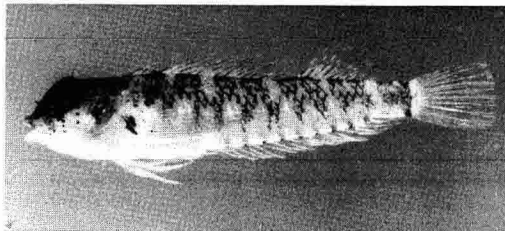


FIGURE 75. *Enneapterygius atriceps*, female, BPBM 34558, 17 mm SL (J. Randall).

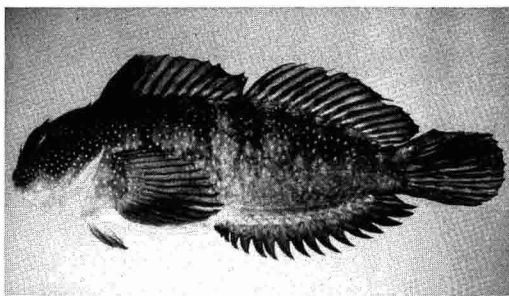


FIGURE 76. *Cirripectes obscurus*, BPBM 34861, 149 mm SL (J. Randall).

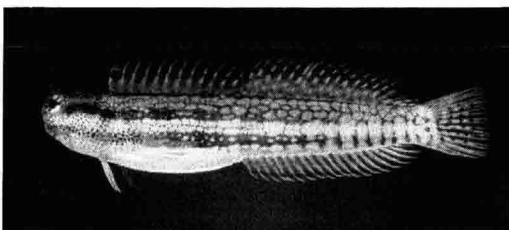


FIGURE 77. *Istiblennius gibbifrons*, BPBM 34860, 67 mm SL (J. Randall).

of the genus, and this specimen the largest recorded.

Cirripectes vanderbilti (Fowler, 1938)

BPBM 34764, 41 mm; BPBM 34816, 10: 25–65 mm. Abundant outside the lagoon; the 10 specimens were collected in the 8-m station mentioned above for *Enneapterygius atriceps*.

Entomacrodus marmoratus (Bennett, 1828)

BPBM 34762, 6: 37–115 mm; BPBM 34890, 37: 51–132 mm. Common in intertidal rocky habitat; the specimens came from a concrete boat ramp in the lagoon.

Exallias brevis (Kner, 1968)

Rare. One 95-mm specimen speared in the lagoon just inside the barrier reef by the Hawaii Cooperative Fishery Research Unit, but not retained. Not observed in 1989–1992.

Istiblennius gibbifrons (Quoy & Gaimard, 1824)

Figure 77

BPBM 15234, 23: 41–69 mm; BPBM 34765, 40 mm; BPBM 34860, 5: 43–67 mm. Common outside the lagoon on shallow exposed reefs;

occurs more seaward than most species of the genus.

Plagiotremus ewaensis (Brock, 1948)

BPBM 34806, 65 mm. Fairly common outside the lagoon. Our one specimen was collected by R.L.P. outside the reef off Sand Island in 13 m; it was bright blue with a broad black lateral stripe that became orangish with blackish edges on the head; ventral part of head orange; fins orange.

Family Gobiidae (Gobies)

Asterropteryx semipunctatus Rüppell, 1830

BPBM 35370, 6: 18.5–33 mm. These specimens were collected on a lagoon reef in 10 m.

Eviota epiphanes Jenkins, 1903

BPBM 34786, 4: 10–16 mm; BPBM 34821, 9: 10–14 mm. These specimens were collected outside the lagoon in 8–25 m. Lachner and Karnella (1980) included specimens from Midway in their account of this endemic Hawaiian goby.

Fusigobius sp.

BPBM 34854, 2: 23–26 mm; BPBM 34769, 2: 16–21 mm. An undescribed species; very similar to *Fusigobius* sp. 3 of Masuda et al. (1984: Plate 240 M). Found throughout the Hawaiian Archipelago; previously misidentified as *F. neophytus* Günther.

Gnatholepis sp.

BPBM 15137, 23 mm; BPBM 34770, 2: 30–33; BPBM 34795, 22 mm; BPBM 34873, 5: 29–37 mm. Abundant in various habitats, generally on sand immediately adjacent to reef. Schroeder (1987) found it among the most common fishes to settle out on small artificial reefs in the Midway lagoon. The name *G. anjerensis* Bleeker has been applied to this species in Hawaii by previous authors. *Gnatholepis anjerensis* is the type species of the genus *Gnatholepis* for which there is no type specimen (description based on a sketchy drawing). Until *G. anjerensis* is tied to a known species by neotype designation, it is best not to use the name.

Priolepis eugenius (Jordan & Evermann, 1903)

BPBM 34784, 2: 20–29 mm; BPBM 34822, 21 mm; BPBM 34855, 26 mm; BPBM 34874, 6:

27–29.5 mm; BPBM 34891, 18.5 mm; BPBM 35371, 32.5 mm; SIO 68-498, 4: 16–28 mm. Abundant both inside and outside the lagoon, but not seen in the open while diving. Also among the most common fishes to colonize small artificial reefs in the Midway lagoon (Schroeder 1987). Our specimens have come from the depth range of 3–26 m.

Priolepis farcimen (Jordan & Evermann, 1903)

BPBM 34782, 12 mm; BPBM 34856, 15 mm; BPBM 34867, 13.5 mm; BPBM 34942, 21 mm. Common within and outside the lagoon from depths of less than 2 to at least 25 m.

Priolepis limbatoquamis (Gosline, 1959)

BPBM 34802, 17 mm; BPBM 34823, 2: 15–20 mm; BPBM 34857, 17 mm. Common but not seen in the open; the specimens were collected on reefs both within and outside the lagoon from 3 to 26 m.

Trimma unisquamis (Gosline, 1959)

BPBM 34824, 7: 13–18 mm. Specimens collected with rotenone outside the lagoon on a well-developed reef in 8 m.

Family ZANCLIDAE (Moorish Idol)

Zanclus cornutus (Linnaeus, 1758)

Fairly common on lagoon reefs as well as on reefs outside the lagoon. Underwater photograph on file at the Bishop Museum.

Family ACANTHURIDAE (Surgeonfishes)

Acanthurus achilles Shaw, 1803

Listed by Schroeder (1989) from a lagoon patch reef in Welles Harbor. Not seen by us in 1989, 1991, or 1992, even in its typical inshore outer reef habitat.

Acanthurus blochii Valenciennes, 1835

BPBM 34884, 80 mm. A few juveniles and subadults were observed in the lagoon, and one was speared. Most authors have misidentified this species as *A. mata* (Cuvier); Randall (1988) showed that *mata* is the valid name for the species formerly called *bleekeri* Günther.

Acanthurus dussumieri Valenciennes, 1835

Listed from Midway by Okamoto and

Kanenaka (1984). Not observed by us, but from the latitudinal distribution of the species (as far north as Iwate Prefecture, Japan, and as far south as New Zealand), it is expected at the atoll.

Acanthurus leucopareius (Jenkins, 1903)

BPBM 34810, 2: 33–42 mm. Abundant inshore on reefs outside the lagoon. This species and *Acanthurus triostegus* often feed in dense aggregations that overwhelm the defenses of guarding territorial damselfishes.

Acanthurus nigrofasciatus (Forsskal, 1775)

One specimen collected on a lagoon reef by personnel of the Hawaii Cooperative Fishery Research Unit, along with *A. nigroris*. Identified by the fourth author and James E. Norris. Used for gut content analysis but not saved. None seen in 1989–1992.

Acanthurus nigroris Valenciennes, 1835

BPBM 34811, 2: 42–49 mm; BPBM 34897, 131 mm. Abundant on reefs outside the lagoon from depths of less than 2 to over 20 m.

Acanthurus olivaceus (Bloch & Schneider, 1801)

Plate IVF

Occasional, mainly outside the lagoon. Listed from Midway by Okamoto and Kanenaka (1984).

Acanthurus thompsoni (Fowler, 1923)

Occasional outside the lagoon, usually at depths greater than 20 m. An underwater photograph is on file at the Bishop Museum.

Acanthurus triostegus sandvicensis Streets, 1877

Figure 78

Abundant inshore, especially outside the lagoon. From counts made outside the windward reef at Midway, Hobson (1980) ranked this surgeonfish as the most common of all the fishes. However, the population diminishes greatly with depth, so few individuals are seen below about 15 m.

Ctenochaetus strigosus (Bennett, 1828)

Plate IVF

BPBM 35389, 127 mm. Common, particularly outside the lagoon from about 6 to 25 m.

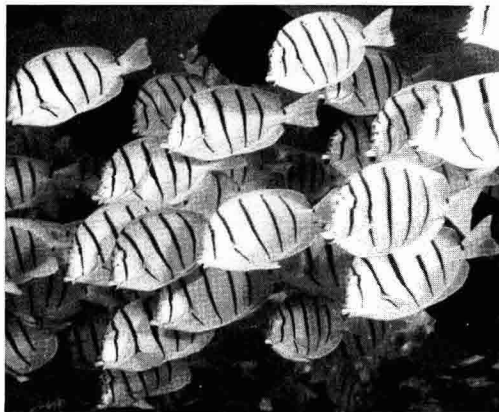


FIGURE 78. *Acanthurus triostegus sandvicensis* (J. Randall).

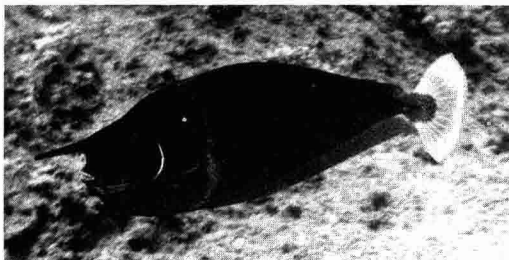


FIGURE 79. *Naso brevirostris* (J. Randall).

Some yellow juveniles were seen at a small dropoff in 26 m, along with others of about the same size and slightly larger that were yellowish brown with slightly diagonal bluish longitudinal lines on the body.

Naso annulatus (Quoy & Gaimard, 1824)

Rare; two subadults observed at the edge of a dropoff outside the lagoon in 26 m by J.E.R. and Lisa Privitera.

Naso brevirostris (Valenciennes, 1835)

Figure 79

Occasional over reefs outside the lagoon. The adult of Figure 79 was photographed in 9 m.

Naso hexacanthus (Bleeker, 1855)

Rare; only two individuals sighted outside the lagoon southeast of Sand Island, one of which was distantly photographed (photo on file at Bishop Museum).

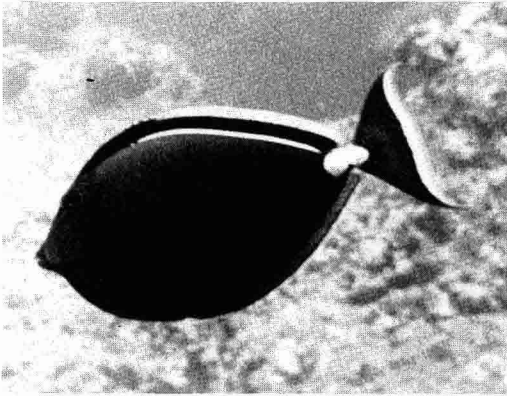


FIGURE 80. *Naso lituratus* (J. Earle).

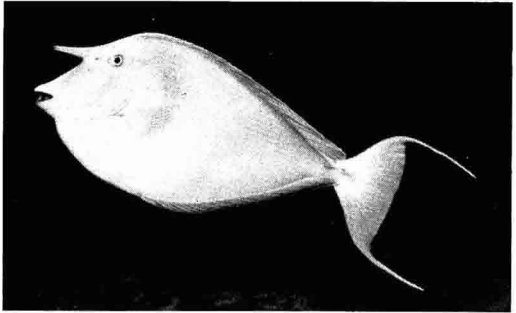


FIGURE 82. *Naso unicornis* (J. Randall).

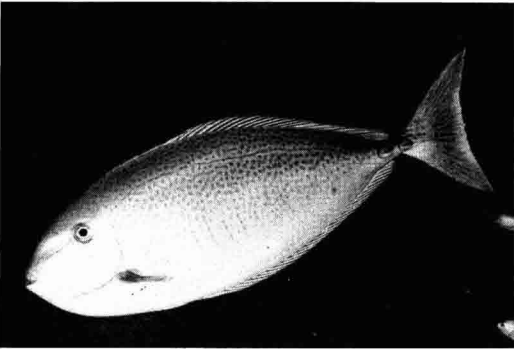


FIGURE 81. *Naso maculatus* (J. Randall).

Naso lituratus (Bloch & Schneider, 1801)
Figure 80
Rare; seen only outside the lagoon.

Naso maculatus Randall & Struhsaker, 1981
Figure 81
Occasional over reefs outside the lagoon at depths greater than 20 m; usually observed in small groups.

Naso unicornis (Forsskål, 1775)
Figure 82—

Three specimens (USNM 146714) were obtained in November 1907 when the steamer *Albatross* visited Midway. This species is fairly common on reefs outside the lagoon from inshore to at least 20 m.

Zebrasoma flavescens (Bennett, 1828)
Plate IVG
BPBM 35365, 43 mm. Common on patch

reefs in the lagoon, occasional outside the lagoon, in contrast to its abundance in the main Hawaiian Islands. Recorded from Midway by Okamoto and Kanenaka (1984).

Zebrasoma veliferum (Bloch, 1797)
Plate IVH

Occasional on reefs both in and outside the lagoon, usually within the depth range of 8–20 m. Also recorded from Midway by Okamoto and Kanenaka (1984).

Family SCOMBRIDAE (Tunas and Mackerels)

The following scombrid fishes were reported from Midway Atoll by Uchida and Uchiyama (1986): *Acanthocybium solandri* (Cuvier, 1831), *Euthynnus affinis* (Cantor, 1949), *Katsuwonus pelamis* (Linnaeus, 1758), *Thunnus albacares* (Bonnaterre, 1788), and *T. obesus* (Lowe, 1839). The only one we observed while diving was *E. affinis*. One of us (R.L.P.) observed an individual of *T. albacares* jump fully out of the sea outside the Midway lagoon about 10 m from the boat.

Family BOTHIDAE (Lefteye Flounders)

Asterorhombus sp.

Figure 83

BPBM 34871, 2: 79–98.5 mm. These two flatfish were taken with rotenone in the lagoon near the base of the cargo pier. They appear to represent an undescribed species. Dorsal rays 85–88, the first broad and twice as long as the second; anal rays 68–69; pectoral rays on ocular side 12, on blind side 10–11; lateral-line scales 67–68. body depth 2.2 in SL.

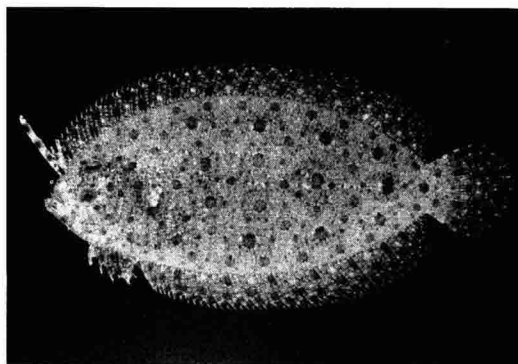


FIGURE 83. *Asterorhombus* sp., BPBM 34871, 98.5 mm SL (J. Randall).

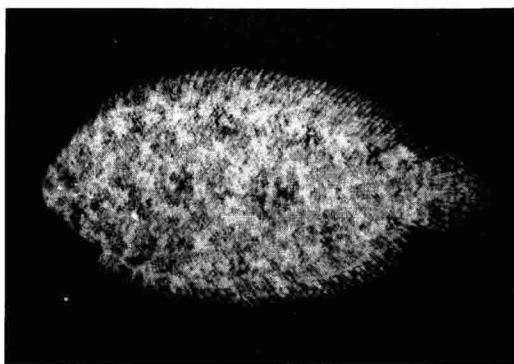


FIGURE 85. *Aseraggodes* sp., BPBM 34845, 42 mm SL (J. Randall).



FIGURE 84. *Bothus mancus* (J. Randall).

Bothus mancus (Broussonet, 1782)

Figure 84

Rare; only one large male seen on a reef outside the lagoon in 25 m in 1989–1992.

Bothus pantherinus (Rüppell, 1828)

BPBM 34905, 128 mm SL, speared in lagoon. Dorsal rays 91; anal rays 69.

Engyprosopon hawaiiensis Jordan & Evermann, 1903

BPBM 34902, 2: 55–56 mm, collected from the lagoon. Dorsal rays 74–75; anal rays 53–58; pectoral rays 11; lateral-line scales 43; body depth 1.8–1.85 in SL; interorbital space slightly greater than eye diameter; whitish, the body and median fins of orbital side finely flecked with yellow and dark brown.

Family SOLEIDAE (Soles)

Aseraggodes sp.

Figure 85

BPBM 34845, 42 mm. An undescribed species represented by additional specimens from the main Hawaiian Islands. This specimen has 71 dorsal rays, 54 anal rays, 61 lateral-line scales, no membrane connecting dorsal and anal fins to caudal fin, snout not overlapping lower jaw, and pelvic fins short, about 3 in head. It was taken from a sand patch outside the lagoon at the entrance to a cave in 8 m.

Family BALISTIDAE (Triggerfishes)

Melichthys niger (Bloch, 1786)

BPBM 34904, 198 mm. Fairly common outside the lagoon over reefs in the depth range of about 12–25 m. Listed by Okamoto and Kanenaka (1984) from Midway.

Melichthys vidua (Solander, 1844)

Figure 58 (with *Chromis hanui*)

Occasional on reefs outside the lagoon at about the same depth range as *M. niger*. Also listed from Midway by Okamoto and Kanenaka (1984).

Sufflamen bursa (Bloch & Schneider, 1801)

Fairly common on reefs outside the lagoon over a range in depth of 3 to 26 m. An underwater photograph is on file at the Bishop Museum.

Sufflamen fraenatus (Latreille, 1804)

Occasional in the deeper reef areas outside the lagoon from 25 to at least 30 m. Underwater photograph on file at the Bishop Museum.

Xanthichthys auromarginatus (Bennett, 1831)

Rare; a few seen among individuals of *X. mento* at a short dropoff outside the lagoon in 26 m.

Xanthichthys mento (Jordan & Gilbert, 1881)

Plate IVI

Abundant on reefs outside the lagoon at depths greater than 15 m. This triggerfish tends to be attracted to divers; if a diver remains for some minutes at a site with adequate cover for reef fishes, dozens of these fish often appear and swim closely around.

Family MONACANTHIDAE (Filefishes)

Aluterus scriptus (Osbeck, 1765)

Plate IVJ

Occasional both within and outside the lagoon. One juvenile was observed in September 1989 in the Sand Island harbor next to a boat ramp drifting vertically at the surface; it resembled a floating mangrove pod.

Cantherhines dumerilii (Hollard, 1854)

Figure 86

Rare; observed only on reefs outside the lagoon in about 15–20 m.

Cantherhines verecundus E. K. Jordan, 1925

Figure 87

Occasional both inside and outside the lagoon at variable depths. An adult at a piling

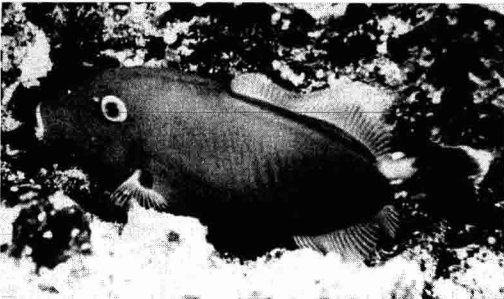


FIGURE 86. *Cantherhines dumerilii* (J. Hoover).

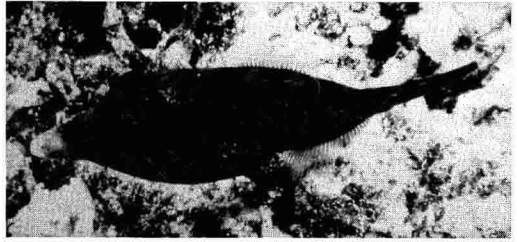


FIGURE 87. *Cantherhines verecundus* (J. Hoover).

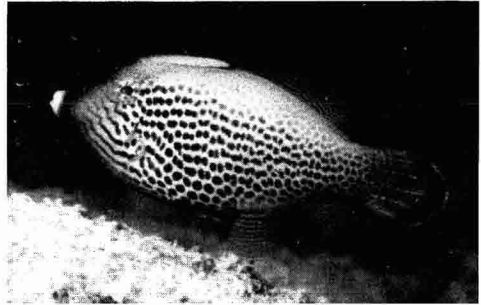


FIGURE 88. *Pervagor spilosoma* (J. Randall).

of the main cargo pier in the lagoon avoided one of us trying to take its photograph by consistently moving to the opposite side of the piling.

Pervagor spilosoma (Lay & Bennett, 1839)

Figure 88

BPBM 15277, 85 mm; BPBM 34790, 68 mm. One 142-mm specimen, collected in 1953 from the R/V *Spencer F. Baird* of the Scripps Institution of Oceanography was deposited in the California Academy of Sciences. Fairly common, particularly in the lagoon. This endemic filefish undergoes a population explosion in Hawaiian waters in certain years, probably as a result of high survival of the larvae in the pelagic realm (perhaps as a result of reduced predation by tunas). Schroeder (1987) reported it as composing more than half of all recruits to small artificial reefs in the Midway lagoon in 1984. The following year it accounted for less than 1% of the recruits. We did not see this fish in 1989, but a few were observed in 1991 and 1992.

Family OSTRACIIDAE (Trunkfishes)

Lactoria fornasini (Bianconi, 1846)

Figure 89

BPBM 35390, 81 mm. Occasional both within and outside the lagoon, generally on open bottoms with little coral cover.

Ostracion meleagris camurum Jenkins, 1901

Figure 90

BPBM 35362, 105 mm. Occasional on reefs both within and outside the lagoon. Okamoto and Kanenaka (1984) recorded it from Midway.

Ostracion whitleyi Fowler, 1931

Figure 91



FIGURE 89. *Lactoria fornasini* (J. Randall).



FIGURE 90. *Ostracion meleagris camurum* (J. Hoover).

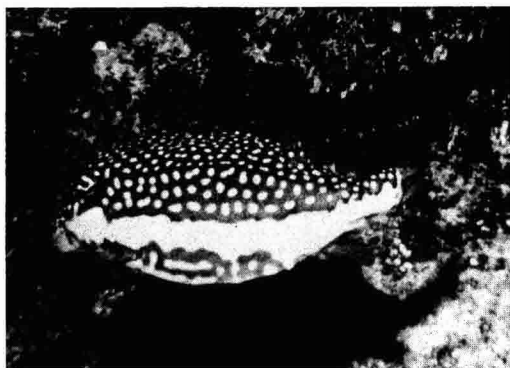


FIGURE 91. *Ostracion whitleyi* (T. Hayes).

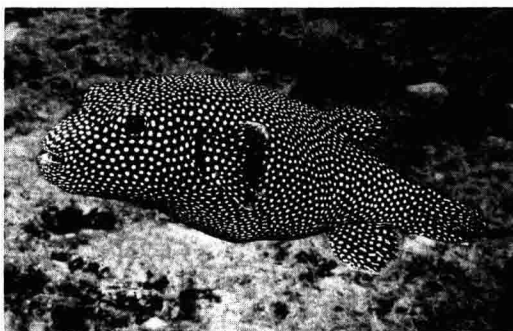


FIGURE 92. *Arothron meleagris* (J. Randall).

Rare. One female individual photographed outside the lagoon in 15 m.

Family TETRAODONTIDAE (Puffers)

Arothron hispidus (Linnaeus, 1758)

BPBM 35391, 115 mm. Rare. Observed only in the lagoon.

Arothron meleagris (Bloch & Schneider, 1801)

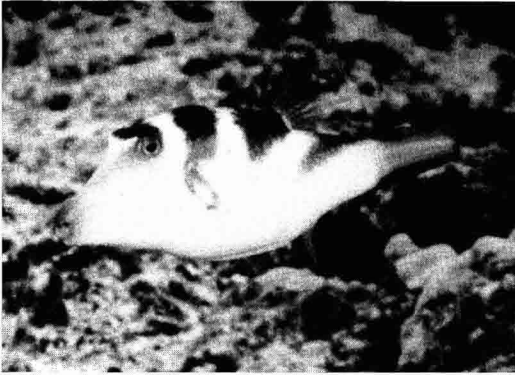
Figure 92

Occasional on reefs outside the lagoon. The yellow color form was not sighted.

Canthigaster coronata (Vaillant & Sauvage, 1875)

Figure 93

BPBM 35367, 83 mm. Occasional outside the lagoon on open rubble and sand substrata near reefs.

FIGURE 93. *Canthigaster coronata* (J. Earle).FIGURE 95. *Diodon hystrix*, night (J. Randall).FIGURE 94. *Chilomycteris reticulatus* (J. Randall).*Canthigaster jactator* (Jenkins, 1901)

BPBM 35361, 45 mm. Abundant. Seen in all habitats where we dived except open stretches of bare sand.

Canthigaster rivulata (Temminck & Schlegel, 1850)

BPBM 34776, 95 mm. Rare; observed only on reefs outside the lagoon at depths greater than 25 m.

Family DIODONTIDAE (Porcupinefishes)

Chilomycteris reticulatus (Linnaeus, 1758)

Figure 94

Rare; two individuals seen in 1989, both on reefs outside the lagoon; none observed in 1991 or 1992. The photographed fish (Figure 94) was so unafraid that it was held by the tail.

Diodon holocanthus Linnaeus, 1758

One specimen in the Scripps Institution of Oceanography (sio 60-76, 226 mm SL) collected from a coral head in the lagoon on 12 November 1953 during the TransPac Cruise of the R/V *Spencer F. Baird*. Rare; only a few seen by us outside the lagoon in deep reef areas. Reported by Okamoto and Kanenaka (1984) from Midway.

Diodon hystrix Linnaeus, 1758

Figure 95

Occasional; found on reefs both inside and outside the lagoon.

DISCUSSION

The above list of Midway fishes totals 266. Of these, seven are pelagic species, and one is a snapper from deep water, so the total number of reef and shore fishes known from Midway is 258. Our diving and fish collecting did not extend below 30 m at Midway. A total of 457 species of reef and shore fishes are known from comparable depths off the high islands at the southeastern end of the chain. Therefore, the shallow-water fish fauna of Midway appears impoverished by comparison.

We can suggest several reasons for this disparity. First, there has been far more collecting effort in the main Hawaiian Islands. However, it is obvious that even with comparable effort the number of species of shallow-water fishes at Midway will not approach that of the high islands.

Another possible basis for the difference in the fish fauna is the relatively small size of Midway. The atoll is only about 10 km in diameter, and the seaward shelf zone is narrow. Furthermore, we found very little cover for reef fishes outside the lagoon below about 28 m, the approximate lower depth of a short dropoff that occurs in places along the southern side of the atoll. We could find no escarpments deeper than 30 m except for a small one located in 46 m at the west side of the atoll. The prevalence of Galapagos sharks in 1991 prevented our making a dive at this site (see account of this shark above). Midway is thus a small target for drifting postlarval fish, and the limited amount of suitable habitat for reef fishes accentuates the problem of successful larval settlement.

More important is the limited variety of habitats. As mentioned above, there are none of the brackish areas and mud bottoms that provide distinctive habitats at high islands. Furthermore, we found no beds of seagrass, mangroves, or rich algal flats. The lack of significant freshwater run-off from the land means a reduced supply of nutrients entering the sea, hence less primary productivity. Another factor is the lack of mountainous terrain on atolls. The mountains of the larger high islands provide a lee from the prevailing winds; as a result, the lee shores are generally less exposed to heavy seas. Some species of fishes are found only or primarily in the calmer sea along lee shores of high islands. The lack of basaltic rock, particularly along the shore, could explain the absence of some fish species at atolls like Midway. Most of the shoreline of Sand Island at Midway is sand with little beach rock. We found no area of well-developed rock pools along the shore.

The principal factor limiting the fish fauna of Midway is probably the lower sea temperature during winter months. The sea surface temperatures in the Kure-Midway area dropped to 16.7°C during 4 yr of the period 1944–1963 (Gross et al. 1969). Even in June 1992, during our last visit to Midway, the sea was cool; we recorded sea surface temperatures to 19.4°C.

Okamoto and Kanenaka (1984: Table 2) listed the fish species recorded by transects at

TABLE 1

SPECIES OF FISHES FOUND AT THE SOUTHEASTERN END OF THE NORTHWESTERN HAWAIIAN ISLANDS BUT NOT KNOWN FROM MIDWAY OR KURE

<i>Sargocentron ensiferum</i>
<i>Chaetodon citrinellus</i>
<i>Chaetodon lunula</i>
<i>Centropyge loriculus</i>
<i>Chromis agilis</i>
<i>Calotomus carolinus</i>
<i>Plectroglyphidodon sindonis</i>
<i>Acanthurus guttatus</i>
<i>Acanthurus xanthopterus</i>
<i>Istiblennius zebra</i>
<i>Plagiotremus goslinei</i>
<i>Rhinecanthus aculeatus</i>
<i>Rhinecanthus rectangulus</i>
<i>Cantherhines sandwichiensis</i>
<i>Canthigaster amboinensis</i>

10 islands and reefs from Nihoa to Kure. Some fishes that are present at the southeastern end of the Northwestern Hawaiian Islands drop out at various points before reaching Midway and Kure. Table 1 is a list of these species. Our new records of fishes from Midway have eliminated some that were in this category in the Okamoto-Kanenaka table.

Hobson (1980) noted the absence of *Plectroglyphidodon imparipennis* (Vaillant & Sauvage) and *P. sindonis* (Jordan & Evermann) at islands or reefs northwest of French Frigate Shoals and suggested that this distribution might be related to the absence of exposed basalt, the last remnant of which is Gardner Pinnacles. Okamoto and Kanenaka (1984), however, listed *P. imparipennis* at islands beyond French Frigate Shoals to and including Midway, and Schroeder (1989) reported it from lagoon patch reefs. On 2 days of calm seas we made a special effort to observe this damselfish in its shallow exposed outer reef habitat at Midway, but we failed to see it.

Temperature is probably not the only limiting factor for fishes that do not extend their range from the high islands to the Northwestern Hawaiian Islands, as indicated in the habitat discussion above. However, temperature limitation is a strong possibility for those species that show a marked diminution in

population in a northwesterly direction within the main Hawaiian Islands. The island of Hawaii at 19–20° N has slightly warmer sea temperatures than Kauai at 22° N. If a tropical species is living at the lower limit of its temperature tolerance at the island of Hawaii, it may find the waters of Kauai too cool. Such limitation may not affect a species once it has settled from the plankton, but it could affect the reproduction or the development. Larvae originating at the island of Hawaii may be able to colonize islands to the northwest but may not reproduce there, or, if spawning does occur, the eggs and/or larvae may not develop in the cooler water. Examples of fishes that occur in the main Hawaiian Islands but are not known from the Northwestern Hawaiian Islands are listed in Table 2. The fishes of Tables 1 and 2 are species that may be seen in the open by divers. Most of the records of reef and shore fishes from the Northwestern Hawaiian Islands before our work at Midway were based on underwater observations, as by visual transect census.

Four species of fishes intentionally introduced from French Polynesia in 1955–1956, *Cephalopholis argus*, *Lutjanus fulvus*, *L. gibbus*, and *L. kasmira*, are established in the main Hawaiian Islands; three of these have not colonized the entire Hawaiian chain. *C. argus* occurs only to Niihau, *L. fulvus* to French Frigate Shoals (Parrish et al. 1980), and *L. gibbus* remains a rare catch from Oahu to

Hawaii. *Lutjanus kasmira*, previously reported to Laysan (Parrish et al. 1980), is here recorded from Midway. The other three introduced species may not have extended their range throughout the Hawaiian Islands because of some limiting factor such as temperature, or there may not have been sufficient time for such distant dispersal.

Conversely, there are species at Midway and Kure that have not been found in the main Hawaiian Islands or are extremely rare there (hence probably not present as breeding populations). Examples are *Oplegnathus fasciatus*, *O. punctatus*, *Centropyge interruptus*, *Genicanthus personatus*, and *Epibulus insidiator*. The first three fishes mentioned are known otherwise only from Japan. Several other species of fishes are much more common in the Northwestern Hawaiian Islands than in the main islands (e.g., *Enchelycore pardalis*, *Gymnothorax albimarginatus*, *G. steindachneri*, *Brotula multibarbata*, *Cheilodactylus vittatus*, *Pseudocaranx dentex*, *Evistias acutirostris*, *Kyphosus bigibbus*, *Coris flavovittata*, *Thalassoma ballieui*, and *Calotomus zonarchus*). The populations of the two wrasses, however, are probably reduced in part by the greater fishing pressure in the main Hawaiian Islands. It seems clear that the greater fishing effort in the high island region has reduced the populations and depressed the size structure of a number of popular game and commercial species, such as jacks, goatfishes, and soldierfishes.

Still other species that are readily found above depths of 30 m at Midway occur only in deeper water in the main Hawaiian Islands. Examples are *Myripristis chryseres*, *Epinephelus quernus*, *Pseudocaranx dentex*, *Parupeneus chrysonemus*, *Genicanthus personatus*, *Naso maculatus*, and *Xanthichthys mento*. The difference in depth at which these species occur at the extreme ends of the Hawaiian chain is probably also a temperature effect. The cooler sea temperature encountered in relatively shallow water at Midway can be found in the main Hawaiian Islands only in much deeper water.

Hobson (1980) listed the 10 most abundant species of fishes outside the windward reef at Midway in 1977 and 1979. His estimates were based on fishes counted in visual census tran-

TABLE 2

SPECIES OF FISHES KNOWN FROM THE PRINCIPAL HAWAIIAN ISLANDS BUT NOT RECORDED FROM THE NORTHWESTERN HAWAIIAN ISLANDS

<i>Siderea hilonis</i>
<i>Gorgasia hawaiiensis</i>
<i>Synodus capricornis</i>
<i>Chaetodon lineolatus</i>
<i>Chaetodon reticulatus</i>
<i>Forcipiger longirostris</i>
<i>Hemitaurichthys polylepis</i>
<i>Acanthurus nigricans</i> ^a
<i>Ctenochaetus hawaiiensis</i>
<i>Pervagor aspricaudus</i> ^b
<i>Canthigaster epilampra</i>

^a *A. glaucopareius* of most previous authors.

^b *P. melanocephalus* of most previous authors.

TABLE 3

THE TEN MOST COMMON SPECIES OF FISHES OF THE
OUTER REEF ZONE ON THE SOUTH SIDE OF MIDWAY
ATOLL IN 1989-1992

<i>Chromis ovalis</i>
<i>Chromis verater</i>
<i>Kyphosus bigibbus</i>
<i>Acanthurus nigroris</i>
<i>Acanthurus leucopareius</i>
<i>Chaetodon miliaris</i>
<i>Chromis hanui</i>
<i>Thalassoma duperrey</i>
<i>Stegastes fasciolatus</i>
<i>Acanthurus triostegus sandvicensis</i>

sects, hence small and cryptic species (which can be very common) were probably not included or were underrepresented. Because *Acanthurus triostegus* was listed as the most abundant species, his observations must have been in relatively shallow water.

Those of us who conducted fieldwork at Midway in 1989, 1991, and 1992 collectively made a list of what we believe to be the 10 most common species of fishes for our primary dive area on the southern side of the atoll outside the lagoon from the shallows to 30 m (Table 3). Our choices were not based on counts but on general impressions of abundance.

Other species approaching the abundance of the group listed in Table 3 include *Canthigaster jactator*, *Centropyge potteri*, *Scarus perspicillatus*, *Thalassoma ballieui*, and *Pseudochelinus octotaenia*. Still others worthy of mention as a second level of abundance are *Coris flavovittata*, *Abudefduf abdominalis*, *Mulloidichthys vanicolensis*, *Scarus dubius*, and *Myripristis berndti*. If we had included very small benthic species and the larger fishes that are usually hidden in the reef, such as moray eels, the following species would surely be listed among the most common: *Enneapterygius atriceps*, *Priolepis eugenius*, *Cirripectes vanderbilti*, *Gnatholepis* sp., *Gymnothorax eurostus*, and *Sargocentron xantherythrum*.

As discussed for several species in the systematic section and noted by other authors, a

number of fishes attain notably larger size at Midway than in the main Hawaiian Islands. We find it a paradox that some tropical fishes living near the limit of their tolerance for low temperature grow to larger size in such localities. Examples of fishes that reach a larger size at Midway include *Thalassoma ballieui*, *Acanthurus triostegus sandvicensis*, and *Entomacrodus marmoratus*.

Another perplexing characteristic of Midway reef fishes, which is also true for the fishes of Laysan and French Frigate Shoals, is how unafraid they are of Scuba divers. Indeed, some of the fishes appear to be attracted to divers. This was mentioned above for schools of the huge jack *Caranx ignobilis* and for the triggerfish *Xanthichthys mento*. It is even more apparent for *Chromis verater* and *C. ovalis*, the most common fish at the atoll outside the lagoon. A diver remaining in one place on the reef where there is cover for reef fishes is soon surrounded by numerous individuals of these and other small species. It can be very disconcerting when they come between a photographer and his or her photographic objective. One explanation of why these island fishes show little fear of divers might be the relatively few persons who have dived at Midway. With negligible spearfishing, the fishes have not learned to fear divers. However, those of us who have dived in remote areas rarely visited by divers have not seen the fishes as unwary as those of these three Northwestern Hawaiian Islands. One speculative explanation involves the presence of the Hawaiian monk seal, *Monachus schauinslandi* Matschie, at these islands (far more common in the past than today). From tagging with sonic devices, it has been determined that the monk seal is more active at night in the sea than during daylight hours and probably does most of its feeding then (DeLong et al. 1984). Analysis of spewings and fecal material indicates that it eats benthic fishes, cephalopods (mainly octopuses), and spiny lobsters (W. G. Gilmartin, pers. comm.). It has been observed to feed on spiny lobsters during the day (McDonald 1982) but apparently not on fishes at that time. At night it would have the advantage of feeding on diurnal fishes that are in a state of

torpor. During the day the reef fishes are not being attacked by the seal, so they may not regard it as a threat and allow it to venture near. Also, by its contact with the substratum, the seal may move rocks or stir up food items for fishes; furthermore, its fecal matter is probably fed upon by some reef fishes. The green sea turtle, *Chelonia mydas* (Linnaeus) is common at these low islands (again, more so in the past than currently), and it is no threat to fishes. Perhaps the reef fishes, not having encountered or rarely encountered humans in the sea, treat the slow-swimming, clumsy divers as they do monk seals and sea turtles.

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