posterior margin of maxillary nearly reaching below middle of pupil; nostrils very small, well separated, in front of eye; gill-opening a short vertical slit; dorsal spines flexible, hardly distinguishable from rays, and of about equal height; posterior dorsal and anal rays broadly joined to caudal by membrane; caudal rounded, 1.5 in head; pectoral rounded, 1.3; ventral long, of 2 rays, and reaching two-thirds the length of space to origin of anal; no lateral line; head and body naked. Color in life (No. 03551), uniformly black; in alcohol, very dark brown, almost blackish, with very faint or indistinct markings on side; caudal and pectoral grayish.

A diminutive inhabitant of the coral reefs of the Hawaiian Islands; found also in Samoa. We have 20 specimens from Honolulu (18 of them collected by Jenkins) and 7 collected by us on the reef at Waikiki. The *Albatross* also found it at Honolulu.

Petroscirtes ater Günther, Fische der Südsee, 199, 1877, Tahiti.
Aspidontus brunneolus Jenkins, Bull. U. S. Fish Comm., XXII, 1902 (Sept. 23, 1903), 510, fig. 50, No. 50718 U. S. Nat. Mus.; coll. O. P. Jenkins, **Honolulu**; Snyder, op. cit. (Jan. 19, 1904), 536 (Honolulu).

Genus 249. SALARIAS Cuvier.

Teeth uniform, in 1 row only, strong, close-set, compressed laterally, hooked on the end, extremely long and thin and in great number; no canines. In the young individuals the teeth are arranged like a harpsichord; head compressed on top; upper lip fleshy and swollen; forehead entirely vertical; intestines spiral, more slender and longer than in other Blennies.

Salarias Cuvier, Règne Animal, Ed. 2, II, 238, 1829 (*quadripinnis*).
Scartes Jordan & Evermann, Check-List Fishes, 471, 1896 (*rubropunctatus*); name preoccupied.
Scartichthys Jordan & Evermann, Fishes North and Mid. Amer., III, 2395, 1898 (*rubripunctatus*).

a. Dorsal fin connected with caudal; D. XIII, 22 ..... *zebra*, p. 501
aa. Dorsal not connected with caudal.
b. Dorsal XII, 21; anal 23; body elongate ..... *edentulus*, p. 503

419. Salarias zebra Vaillant & Sauvage. Figs. 223 and 223a.

Head 4.4 in length; depth 4.8; eye 4.5 in head; snout 2.75; width of mouth 2; interorbital 3 in eye; D. XIII, 22; A. 25; P. 14; V. 2.

Body elongate, compressed, its greatest depth at middle of belly; depth of head 1.2 in its length; width of head 1.25; cheeks swollen; anterior profile very steep, vertical, convex; mouth very broad,

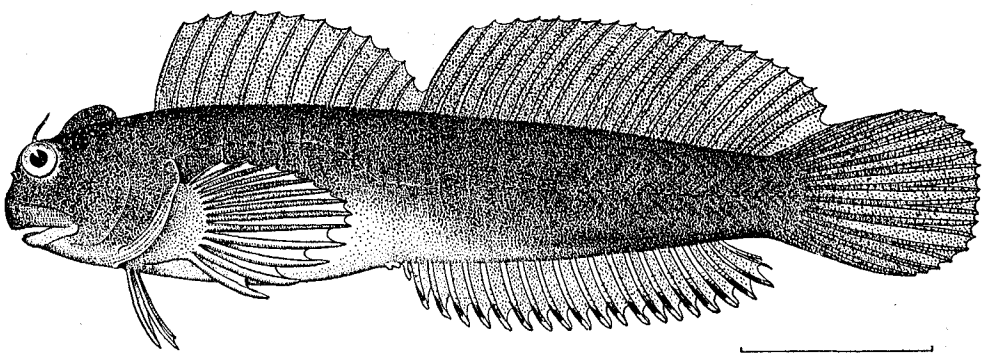

FIG. 223.—*Salarias zebra* Vaillant & Sauvage.

low, slightly inferior; maxillary reaching a little beyond middle of eye; teeth very fine, villiform, movable, and forming an edge; lips rather fleshy, covering the teeth; eye high and anterior in head, with a fleshy appendage above equal to the snout; top of head with a high fleshy median flap, its base equal to width of mouth: nostrils small, close together, anterior with short flap; interorbital space very narrow, concave; spinous dorsal beginning just before posterior margin of gill-opening, and just behind flap on top of head; dorsal spines flexible, base of fin 3.25 in trunk; fifteenth dorsal ray 1.2 in head, and third spine 1.5; eighth anal ray 1.75; caudal long, rounded, 3.9; pectoral with lower rays longest, fin pointed, equal to head; ventral short, of 2 broad rays, 1.8 in head; lateral line strongly

arched at first, then running straight along middle of side of tail, pores rather few. Described from an example (No. 863) 5.1 inches long, taken at Honolulu.

A large example from the coral rocks at Waianae was blackish-brown when fresh, with more or less distinct dark crossbars alternating with golden bars or split patches. These are most distinct in the young and fade in spirits. In some about 8 golden spots along base of dorsal, obscure and fading in spirits. A small example shows a bunch of small blue spots on snout, which were not noticed on any others. The fins, which are nearly black in spirits, the dorsal, anal, and caudal were rich blue-black in life; no white edging to any fin, the outer half of the anal distinctly blacker; no black or white speckling on body; pectoral and ventrals blackish.

An example 2 inches long, also from the coral reefs of Waianae, was blackish or dark reddish-brown in life, the belly livid bluish; side with 12 narrow pairs of dark stripes, with a pale olive spot between each pair; dorsal and anal more or less clearly dark edged, especially the latter. This example had much greater powers of leaping than the others.

Other examples from the same locality had the anal very conspicuously white-edged in life, also with more spotting and color. Some had fine dark dots, and oblique dark streaks on soft dorsal. The dark-paired crossbars on side and golden spots at base of soft dorsal are much the same. Ventrals paler than in the other examples.

Color when fresh, of still another example, dark olive with short pale olive bars, rather faint, the dark bars in pairs; dorsal dark olive, with about 8 dark crossbars; anal blue-black, pale flesh-color

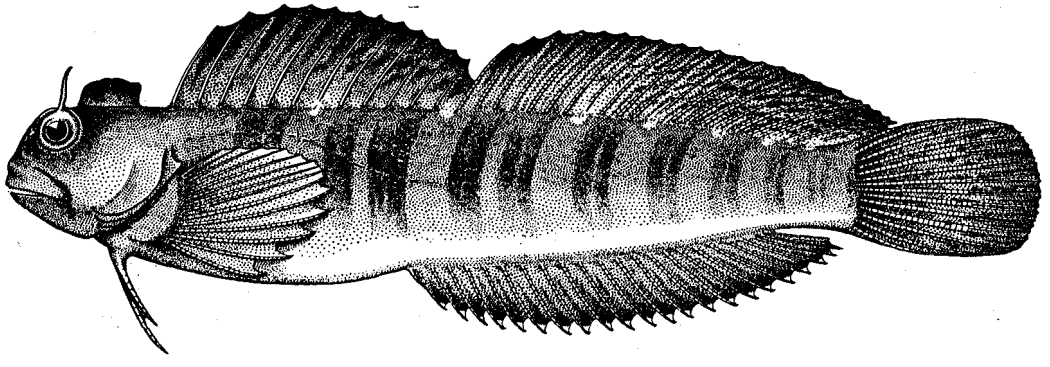

FIG. 223a.—*Salarias zebra* Vaillant & Sauvage. Type of *Salarias cypho* Jenkins.

at base, the tips white; caudal dark olive, blue-black below, no spots at base; pectoral somewhat dusky; ventrals rather pale.

Color in alcohol, deep brown, slightly tinged with dusky purple; upper surface darker, and side with about 18 broad, darker brown vertical crossbars arranged in pairs; belly pale or soiled brown; vertical fins and pectoral blackish; basal portion of anal gray; soft dorsal with oblique blackish lines; upper margin of anal rather broadly whitish; ventral gray.

Females differ a little from the males in coloration, being paler in alcohol, and with the belly and lower surface more or less bluish; margin of anal narrowly whitish; the ocular filament short and slender; crest on top of head rather low and shorter than in the male. Many of the females taken in June and July are gravid with ova, and the males show large testes.

One of the most abundant blennies occurring among the Hawaiian Islands; represented in our collections by a series of 171 examples from Waianae, averaging 2.9 inches in length, the largest being 5.3 inches and the smallest 1 inch, and 81 from Kailua, averaging 2.8 inches, the largest 5.6 and the smallest 0.9 inches in length. We have examined 65 examples from Hilo, the average length being 2.8 inches, the largest 4.75, and the smallest 1.1 inches; 1 from Moanalua 1.5 inches long, and 55 from Honolulu, 1.2 to 4.4 inches in length, averaging 2.7, collected by Doctor Jenkins.

Salarias zebra Vaillant & Sauvage, Rev. Mag. Zool. (3) (III), 1875, 281, **Sandwich Islands**; Snyder, Bull. U. S. Fish Comm., XXII, 1902 (Jan. 19, 1904), 536 (Honolulu; Hilo; Pauko Bay, Hawaii; Hanalei Bay, Kauai; station 3829, Lanai; Laysan Island; station 3881, between Maui and Lanai).

Salarias cypho Jenkins, Bull. U. S. Fish Comm., XXII, 1902 (Sept. 23, 1903), 506, fig. 47, **Honolulu** (type, No. 50697, U. S. N. M., coll. O. P. Jenkins).

420. Salarias edentulus Schneider.

Dorsal XII, 21; A. 23; depth 6.5 in total length; head 6; a simple and slender tentacle above the orbit and another at the nostril, the former as long as diameter of eye; canine teeth none; dorsal fin deeply notched, not continuous with caudal, anterior portion scarcely lower than posterior, which is higher than anal fin. Grayish, with darker cross-bands; fins yellowish, rays of dorsal dotted with brown; anal with a brownish margin; caudal with 2 or 3 brown transverse bands. (Günther.)

This species was not seen by us, but it has been recorded from the Hawaiian Islands by Steindachner and by Fowler.

Blennius edentulus Schneider, Syst. Ichth., 172, 1801, **Huaheine, Society Islands** (on *Blennius truncatus* Forster MS.).
Salarias edentulus, Günther, Cat., III, 252, 1861 (after Schneider); Steindachner, Denks. Ak. Wiss. Wien, LXX, 1900, 499 (Laysan); Fowler, Proc. Ac. Nat. Sci. Phila. 1900, 517 (Sandwich Islands).

Genus 250. EXALLIAS Jordan & Evermann, new genus.

Exallias Jordan & Evermann, new genus of *Blenniidæ* (type, *Salarias brevis* Kner).

This genus is related to *Salarias* from which it differs in the short, deep body, and the small number of soft rays in the dorsal and anal fins.

421. Exallias brevis (Kner). "*Paó'okauila.*" Fig. 224.

Head 3.25 in length; depth 2.65; eye 1.5 in snout; snout 2.65 in head; width of mouth 2.35; interorbital 1.25 in eye; D. XI, 13; A. 15; P. 15; V. 4.

Body short, compressed, greatest depth at middle of belly; depth of head equal to its length; width of head 1.4; cheek flattened, not swollen; anterior profile steep, oblique; mouth broad, low,

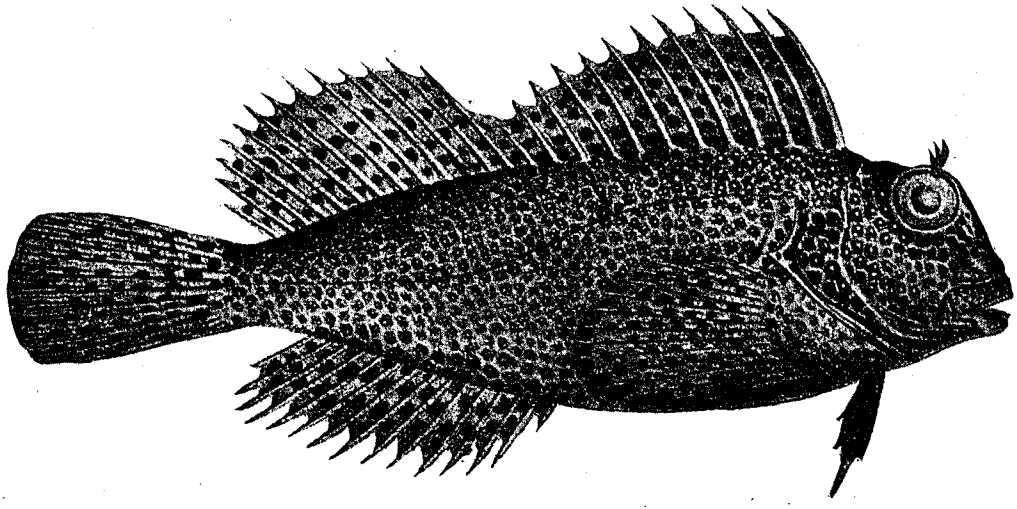

FIG. 224.—*Exallias brevis* (Kner); after Günther.

inferior; snout very blunt, rounded; maxillary reaching below anterior margin of pupil; teeth very fine, forming an edge; upper lip thin, with many small fleshy filaments, lower lip plaited; a pore on each side of the mandible in front, back of which are several fleshy filaments; eye high, in about the first two-fifths of the head; above each eye a rather broad fleshy flap ending in a fringe of cirri; nostrils rather close together on side of snout in front of eye, first with a broad ciliated fleshy flap; a fringe of cirri across top of head; interorbital space rather broad, slightly elevated at first, then slightly concave just over eye; dorsal fin deeply notched; spines rather flexible, second 1.25 in head; third dorsal ray 1.4; membranes between anal rays deeply incised; fifth anal ray 2 in head; caudal 1.1, margin truncate; pectoral pointed, a trifle longer than eye, lower rays enlarged, and those just below middle longest; pectoral short, median ray longest, 1.7 in head; caudal peduncle compressed, 2.5,

Color in life (No. 03552), spots brown with yellowish tinge, interspaces whitish; brown spots on dorsal, caudal and pectoral surrounded by yellow; anal rays with bluish tinge.

Color in alcohol pale gray-brown, head, anterior part of body, and fins with small round dark-brown spots, those on opercle, in front of pectoral, and on belly, large; caudal with spots arranged in 6 cross series; side with 5 broad bands of dark-brown blotches.

Honolulu, not common. We have 2 examples, and Jenkins obtained 12. Length 2.2 to 4.6 inches.

Salarias brevis Kner, Sitzb. Ak. Wiss. Wien, LVIII, 1868, 334, taf. 6, fig. 18; Günther, Fische der Südsee, IV, 203, taf. 18, fig. C, 1877; Jenkins, Bull. U S. Fish Comm., XXII, 1902 (Sept. 23, 1903), 506 (Honolulu); Fowler, Proc. Ac. Nat. Sci. Phila. 1900, 518 (Honolulu).

Blennius brevipinnis Günther, Cat., III, 226, 1861, **Sandwich Islands; west coast of Central America**; Günther, Fische der Südsee, II, 194, 1877 (west coast Isthmus of Panama; Sandwich Islands); the Hawaiian references erroneous, as *brevipinnis* is a Panama species and does not occur in Hawaii.

Salarias leopardus Day, Proc. Zool. Soc. Lond. 1869, 518, **dredged off Galle Harbor by Dr. J. Anderson.**

Blennius leopardus, Day, Fishes of India, 325, pl. LXVIII, fig. 6, 1878 (specimen in the Berlin Museum from the Sandwich Islands).

Group OPHIDIOIDEA.

This group, as a whole, agrees with the *Blennioidea* in all respects, except that no spines are developed in any of the fins, save sometimes in the posterior part of the dorsal. From the *Anacanthini*, with which the *Ophidioidea* agree in the jugular ventrals and in the absence of spines, they are separated by the form of the hypercoracoid, which is perforate, as in ordinary fishes. The group is a very large and varied one, widely distributed in all seas. The characters here used are all superficial, no comparative study of the skeletons having been made.

a. Pseudobranchiæ well developed, very rarely small or obsolete.
b. Ventral fins jugular, inserted much behind the eye, often wanting, never filamentous.
c. Gill-membranes broadly united, free from isthmus; ventrals wanting ..... *Congrogadidæ*, p. 504
aa. Pseudobranchiæ absent or rudimentary.
d. Ventral fins entirely wanting; no scales.
e. Vent at throat ..... *Fierasferidæ*, p. 505
ee. Vent normal in position ..... *Lycodapodidæ*, p. 506
dd. Ventral fins well developed; vent posterior, normal; dorsal fin single, low; ventral fins short..... *Brotulidæ*, p. 506
ddd. Ventral fins reduced to simple filaments ..... *Ateleopidæ*, p. 506

Family XCVII. CONGROGADIDÆ.

Body elongate, compressed, naked, or covered with very small scales. Head compressed. Mouth moderate, horizontal, the lower jaw the longer; teeth moderate, no barbels. Gills 4, a slit behind the fourth; pseudobranchiæ present. Gill-membrances more or less broadly connected, free from the isthmus. Dorsal fin long and low, beginning near the tip of the pectoral or the middle of body, of slender, jointed rays; anal similar to dorsal, both connected with the caudal fin; tail tapering; pectoral fins small; ventral fins wanting. Vent remote from the head, without papilla. Vertebræ numerous. As here understood, this family consists of a few species of shore fishes of the Pacific.

Genus 251. CONGROGADUS Günther.

Body elongate, compressed, eel-like, covered with very small scales; vertical fins united, long; ventrals none. Cleft of the mouth of moderate width, with the lower jaw prominent. Jaws with a single series of small teeth, closely set; palate smooth. Branchiostegals 6; gill-openings of moderate width, gill-membranes united below the throat, not attached to the isthmus; gills 4, a slit behind the fourth; pseudobranchiæ well developed. Vent remote from the head. Air-bladder and pyloric appendages none.

Machærium Richardson, Ann. & Mag. Nat. Hist., XII, 1843, 175; preoccupied.
Congrogadus Günther, Cat., IV, 388, 1862 (*subducens*).

422. Congrogadus marginatus Vaillant & Sauvage.

Head 6.5 to 7 in total length; 40 teeth in each jaw, those of the middle of the upper jaw longer than the others and curved backward; insertion of dorsal above base of pectoral; vent considerably nearer snout than end of body.

Body uniform brownish; head of deeper shade; a very narrow black border along the dorsal and upper lobe of caudal.

Known only from the type, said to have been taken at the Hawaiian Islands.

Congrogadus marginatus Vaillant & Sauvage, Rev. Mag. Zool., III, 282, 1875, **Sandwich Islands.**

Family XCVIII. FIERASFERIDÆ.—Pearl Fishes.

Body elongate, compressed, tapering into a long and slender tail; no scales; teeth cardiform on jaws, vomer, and palatines; canine teeth often present; no barbels; lower jaw included; vent at the throat; gill-membranes somewhat united, free from the isthmus; no pseudobranchiæ; no pyloric cœca; vertical fins very low, confluent, without spines; no ventral fins; pectoral fins present or absent. Small shore fishes of tropical seas, often living in shells of mollusks, echinoderms, etc., being especially often commensal with the pearl oyster and with the larger *Holothuria*.

Genus 252. FIERASFER Cuvier.

Gill-membranes little connected, leaving the isthmus bare; no distinct caudal fin; pectoral fins developed. A genus with few poorly defined species, only one of which is known from Hawaiian waters.

Fierasfer Cuvier, Règne Anim., Ed. 1, II, 239, 1817 (*imberbe=acus*).
Echiodon Thompson, Proc. Zool. Soc. Lond. 1837, 55 (*drummondi*).
Diaphasia Lowe, Proc. Zool. Soc. Lond. 1843, 92 (*acus*).
Oxybeles Richardson, Voy. Erebus and Terror, Fishes, 74, 1844–48 (*homei*).
Porobronchus Kaup, Ann. Mag. Nat. Hist. 1860, 272 (larva of *Fierasfer acus*).
Carapus Gill, Proc. Ac. Nat. Sci. Phila. 1864, 152 (after Rafinesque, 1810).
Vexillifer Gasco, Bull. Assoc. Nat. Med. Napoli 1870, 59 (larva of *Fierasfer acus*).
Lefroyia Jones, Zoologist, IX, 1874, 3838 (*bermudensis*).

423. Fierasfer umbratilis Jordan & Evermann. Plate 61.[a]

Head 10.2 in length; depth 15.2; eye 5 in head; snout 4.8; mouth 2.6; interorbital 4.5.

Body very elongate, compressed; tail very long and tapering gradually in a long point; head elongate, conic, its depth 2 in length, width 2.25; snout rather broad, conic, and produced beyond mandible; mandible broad, flattened below; mouth nearly horizontal, broad, the gape reaching below posterior margin of eye; premaxillary teeth minute, confined to anterior half of jaw, apparently in a single series. The mandibular and palatine teeth seem also in a single series, those on side of mandible directed laterally toward angle of mouth, none of them enlarged; 2 or 3 vomerine teeth, the largest in the mouth, and arranged in a longitudinal series. Eye rather small, anterior, without eyelid, and placed about first quarter of head; nostrils well separated, anterior with elevated rim, posterior a short, crescent-like slit; interorbital space rather broad, convex; gill-opening low, inferior, rather long; gill-membrane free from isthmus, its angle nearly an eye diameter distant from posterior margin of eye; dorsal fin almost rudimentary, very low and thin; anal rather broad, in middle its height about 0.75 in eye, from which point it gradually decreases to tip of tail, where it is rudimentary, like dorsal; tail ending in a fleshy point, caudal fin apparently absent; pectoral small but relatively large, 3.1 in head, rays very minute; lateral line distinct, running down along middle of side on posterior half of tail; no scales.

Color when fresh (field No. 03506), pale olivaceous, with pale greenish spots; a pale bluish streak in each spot over lateral line; pale purplish oblong spots on lower half of body; head greenish-olive, with pale green spots closely set on cheek and jaw; pale purplish dots on upper part of cheek and behind eye; first dorsal same as body, but the spots yellowish; a black spot behind first and second rays, tips pale; rays of second dorsal checked alternately with yellowish-green and white; caudal same as second dorsal, but margin yellowish; anal yellowish olive, tip blackish; pectoral and ventrals pale; iris greenish-yellow; dull red streaks radiating from pupil.

Color in alcohol brown; head and end of tail dark sooty or blackish brown, the color formed of dark points; greater part of anal fin, lower surface of body anteriorly and pectoral and branchiostegal membranes pale straw color; lower surface of trunk more or less blotched with pale brown.

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[a] *Jordanicus umbratilus* on plate.

Described from the type (No. 03506) taken at Hilo, where 2 examples were also taken by Jordan and Sindo in 1901. Later 3 examples were sent from the same place by Mr. Henry W. Henshaw, taken from the cavity of a holothurian; another specimen was dredged by the *Albatross*. This species, which also occurs in the South Seas, is readily distinguished from most related species by its dark, nontranslucent coloration. It is very properly made the type of a distinct genus by Doctor Gilbert in Section II.

F. boraborensis from Borabora, briefly described by Kaup, has the pectoral 6 to 7 times in head.

Fierasfer umbratilis Jordan & Evermann, Bull. U. S. Fish Comm., XXII, 1902 (Apr. 11, 1903), 206, Hilo; Jordan & Snyder, Proc. U. S. Nat. Mus., XXVII, 1904, 946 (Hilo).

Family XCIX. ATELEOPIDÆ.

Body terminating in a long, compressed, tapering tail, naked; one short anterior dorsal and no other; anal very long, continuous with the caudal; ventrals reduced to simple filaments, attached to the humeral arch; no pseudobranchiæ.

Genus 253. ATELEOPUS Schlegel.

Head with the snout much protruding and obtusely rounded, the cleft of the mouth being at the lower side of the head; maxillaries protractile in a downward direction; body and tail compressed, elongate, naked; one short dorsal, the rudimentary second dorsal of the *Macruridæ* having entirely disappeared; one long anal, continued on to the caudal; ventral reduced to a filament which is composed internally of 2 rays, intimately connected by a common membrane; this fin inserted at the symphysis of the humeri; teeth in jaws villiform, in bands; vomer and palatine bones smooth. The single Hawaiian species of this genus is fully described by Doctor Gilbert in "Deep-sea Fishes."

Ateleopus Schlegel, Fauna Japonica, Poiss., 255, 1846 (*japonicus*).

Podateles Boulenger, Ann. Mag. Nat. Hist., X, 7th ser., 1902, 403 (*japonicus*); on account of *Atelopus* Duméril & Bibron, a genus of batrachians.

Family C. LYCODAPODIDÆ.

Deep-sea fishes allied to the *Fierasferidæ*, differing chiefly in the normal position of the vent, which is remote from the head, and just before the anal fin; gill-openings large, the membranes united anteriorly only, free from the isthmus, as in *Fierasfer*. Pseudobranchiæ wanting; no scales; no lateral line; no ventral fins. One genus with 4 known species, from the North Pacific.

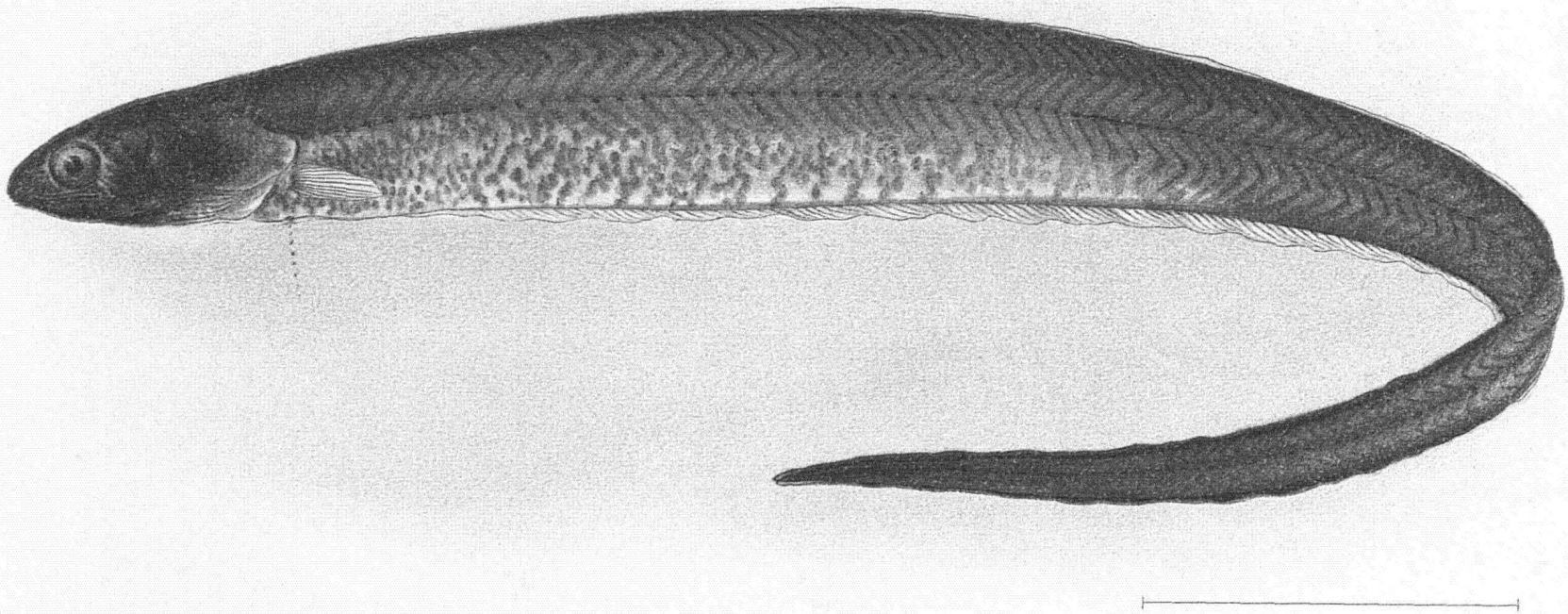
The single Hawaiian genus and species fully described in Section II.

Family CI. BROTULIDÆ.

Body elongate, compressed, regularly tapering behind, the tail generally subtruncate at base of caudal fin, not isocercal; vent submedian; scales cycloid and minute, embedded in the lax skin, which more or less envelopes the fins, sometimes wanting; mouth large, with teeth usually in broad bands on jaws, vomer, and palatines; gill-openings very large, the membranes mostly free from the isthmus; vertical fins united or continuous at base of caudal; dorsal fin beginning not far from nape; caudal narrow or pointed; ventral fins small, few-rayed, attached to the humeral arch and more or less in advance of pectoral. Pyloric cæca few (1 or 2), rarely obsolete or in increased number (12); maxillaries generally enlarged behind and produced toward the upper angle. Pseudobranchiæ small or wanting, hypercoracoid with the usual foramen, as in blennioid fishes. These fishes are closely related to the *Zoarcidæ*. In spite of curious external resemblances to the *Gadidæ*, their affinities are decidedly with the blennioid forms rather than with the latter. Species largely of the depths of the seas; 2 species in Cuba degenerated into blind cave-fishes.

Genus 254. BROTULA Cuvier.

Body elongate, compressed, covered with minute, smooth scales; eyes moderate; mouth medium, with villiform teeth on jaws, vomer, and palatines; lower jaw included; each jaw with 3 barbels on each side. Dorsal fin long and low, the dorsal and anal joined to the caudal. Ventral fins close



JORDANICUS UMBRATILIS (JORDAN & EVERMANN). TYPE.

JULIUS BIEN & CO. LITH. N.Y.

together, very slender, each of 2 rays separated at the tip. Eight branchiostegals. Air-bladder large, with 2 horns posteriorly. One pyloric cœcum. Vertebræ 16+39=55. Tropical.

Brotula Cuvier, Règne Animal, 2d ed., II, 335, 1829 (*barbata*).

a. Upper jaw with 6 barbels; interorbital narrower than eye ..... *marginalis*, p. 507
aa. Upper jaw with 8 barbels; interorbital equaling eye ..... *multicirrata*, p. 508

424. Brotula marginalis Jenkins. Fig. 225.

Head 4.9 in length; depth 5.75; eye 4.75 in head; snout 4.25; interorbital 6.5; maxillary 2.1; D. 121; A. 100; C. 11; P. 24; V. 2; scales 12–160–32.

Body elongate, compressed, rather deep; head elongate, small, compressed, attenuated, its depth 1.5 in length, width 2; upper profile of head slightly convex from snout to occiput; snout a trifle larger than eye, conic; mouth large, oblique, jaws nearly equal, and maxillary reaching nearly to posterior margin of eye; upper edge of maxillary slipping under broad orbital bones, its distal expanded extremity about equal to eye; lips rather thick and fleshy, upper with 4 long barbels and 2 small ones; mandible with 6 rather long barbels; each posterior nostril with a barbel, and anterior with short flap; teeth in jaws minute, in narrow bands; vomer and palatines with bands of minute teeth; tongue thick, sharply pointed, free in front; two posterior nasal apertures, the anterior with a long barbel, the posterior circular; interorbital space and top of head convex; gill-opening large, isthmus narrow grooved; gillrakers short; compressed, few developed; pseudobranchiæ and gill-filaments

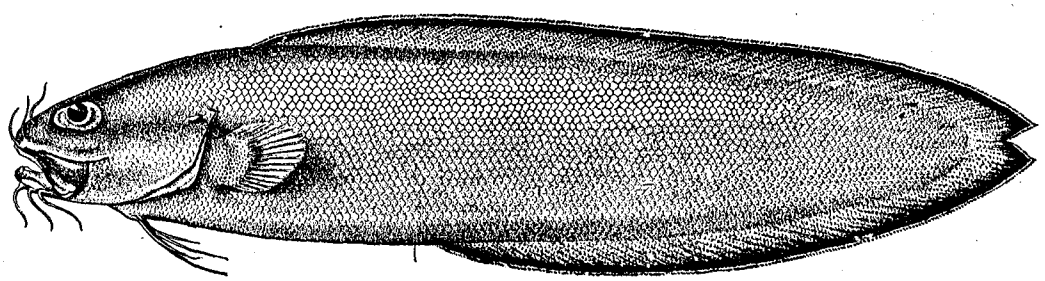


FIG. 225.—*Brotula marginalis* Jenkins; from the type.

fine, numerous; opercle with a sharp spine above; dorsal, anal, and caudal continuous, the latter rounded; origin of dorsal about over first quarter of pectoral, gradually sloping up in height; pectoral short, rounded, 2 in head; ventral bifid, compressed, 2.1 in head, and free portion of outer ray equal to remaining joined portion; height of dorsal and anal in middle about equal to eye; body covered with small cycloid scales, extending out on the fins where they are very minute; head scaled except on lips, maxillary, throat and branchiostegal membrane; lateral line superior, running along upper part of side to base of caudal, tubes far apart, distributed generally 2 or 3 scales distant from one another.

Color in life, raw umber, paler toward belly, head slightly darker; pectoral at base same as general color, outer half lighter; anal at base same color as rest of body, nearly black along outer portion, and with a narrow white edge; caudal slightly darker than general color; dorsal same as caudal; eye blue.

Color in alcohol, rich dark brown, the pigment easily slipping from scales, which when thus exposed are white; vertical fins dark gray brown, becoming blackish toward margin, which is narrowly whitish; pectoral brownish on middle basal portion, outer part pale brown; lips brownish with blackish tinge on side; lower surface of head more or less whitish, especially along branchiostegals.

Described from the type (field No. 03388) taken at Honolulu. Other specimens were obtained by the *Albatross*.

Brotula marginalis Jenkins, Bull. U. S. Fish Comm. 1899 (June 8, 1901), 403, fig. 16, **Honolulu** (type, No. 49694, U. S. Nat. Mus.); Jenkins, Bull. U. S. Fish Comm., XXII, 1902 (Sept. 23, 1903), 510 (Honolulu, type); Snyder, op. cit. (Jan. 19, 1904), 536 (Honolulu).

425. Brotula multicirrata Vaillant & Sauvage.

Head 5 in total length; depth 5; interorbital equaling eye; snout a little longer than eye; maxillary reaching line of posterior edge of orbit; teeth villiform, uniform in size; palatine band short, oval; opercle terminated by a rather strong spine; 6 barbels on mandible, 8 on the upper jaw; dorsal inserted above middle of pectoral; distance of anus from head greater than length of head; pectoral rounded, 2 in head; ventral filaments bifid at the end, 2 in head; scales rather large; lateral line little marked.

Close to *B. multibarbata*, distinguished by the position of the dorsal and the number of barbels.

Known from the original description, and from specimens collected by J. K. Townsend and now in the Museum of the Philadelphia Academy. Another specimen was recently received by the Bureau of Fisheries from Mr. Berndt at Honolulu.

Brotula multicirrata Vaillant & Sauvage, Rev. Mag. Zool. (3), III, 1875, 282, **Sandwich Islands**; Jordan & Snyder, Proc. U. S. Nat. Mus., XXVII, 1904, 946 (Honolulu).

Brotula townsendi Fowler, Proc. Ac. Nat. Sci. Phila. 1900, 518, pl. XX, fig. 3, **Sandwich Islands** (Type, No. 8981, Ac. Nat. Sci. Phila.).

Suborder ANACANTHINI.—The Jugular Fishes.

Vertical fins very long, destitute of true spines; tail isocercal, the posterior vertebræ progressively smaller; ventrals jugular, without spines; hypercoracoid typically without perforation or foramen; no pseudobranchiæ. The osteological characters of this group, called by him *Gadoidea*, are thus given by Doctor Gill:

"Jugulares with the orbito-rostral portion of the cranium longer than the posterior portion, the cranial cavity widely open in front; the supraoccipital well developed, horizontal and cariniform behind, with the exoccipitals contracted forward and overhung by the supraoccipital, the exoccipital condyles distant and feebly developed, with the hypercoracoid entire, the hypocoracoid with its inferior process convergent toward the proscapula, and the fenestra between the hypercoracoid and hypocoracoid." (Gill, Proc. Ac. Nat. Sci. Phila. 1884, 170.)

A large and important group, chiefly confined to the cold depths of the ocean and the northern seas. From all other typical fishes they are separated by the entire hypercoracoid.

a. Caudal fin present; tail not greatly elongate; body tapering or coniform behind, with many procurrent caudal rays above and below; suborbitals moderate.

b. Frontal bones normal, not forming a triangular excavated area above; ribs normal; chin with a barbel (rarely obsolete) ..... *Gadidæ*, p. 508

aa. Caudal fin wanting; tail very long, tapering behind; suborbitals very broad ..... *Macrouridæ*, p. 509

Family CII. GADIDÆ.—The Codfishes.

Body more or less elongate, the caudal region moderate, coniform behind, and with the caudal rays procurrent above and below; vent submedian; suborbital bones moderate; scales small, cycloid; mouth large, terminal; chin with a barbel, more or less developed; gill-openings very wide; gill-membranes separated or somewhat united, commonly free from the isthmus; no spines, the fin rays all articulated; dorsal fin extending almost the length of the back, forming 1, 2, or 3 fins; anal fin long, singled or divided; caudal fin distinct, or confluent with the dorsal and anal; ventral fins jugular, but attached to the pubic bone, each of 1 to 8 branched rays; gills 4, a slit behind the fourth; no pseudobranchiæ; edge of preopercle usually covered by skin of head; pyloric cœca usually numerous, but sometimes few or none; air-bladder generally well developed. Genera about 25, species about 140; an important family, many of its members being highly valued as food; inhabiting chiefly the northern seas, sometimes venturing into the oceanic abysses. One genus (*Lota*) is confined to the fresh waters.

a. Ventral fins rather broad, each of about 6 rays ..... *Antimora*, p. 508

aa. Ventral fins very slender, each of 1 or 2 rays ..... *Læmonema*, p. 509

Genus 255. ANTIMORA Günther.

This group differs from *Lepidion* in the form of the snout, the backward position of the vent, the imperfect division of the anal, in which latter respect it approaches *Mora*. In *Lepidion* the snout is subconical, obtusely rounded; in *Antimora* it forms a flat, triangular lamina, sharply keeled at the

sides, resembling the snout of *Macrourus*. Body elongate, compressed, tapering into a slender tail; scales very small; head entirely scaly, even to the gill-membranes; snout depressed, thin and flat, projecting beyond the mouth; mouth rather large; chin with a barbel; jaws with bands of villiform teeth; a small roundish patch of teeth on vomer, none on palatines; dorsal fins 2, the first short, its anterior ray produced into a long filament; anal fin deeply notched, almost separated into 2 fins; ventral fins with 6 rays, 1 of them filamentous; caudal truncate; branchiostegals 7. Deep-water fishes.

The single Hawaiian species is fully described in Section II.

Antimora Günther, Ann. Mag. Nat. Hist. 1876, 2 (*rostrata*).

Genus 256. LÆMONEMA Günther.

Body of moderate length, covered with small scales; fins naked; a separate caudal; 2 dorsal fins and 1 anal, the anterior dorsal composed of 5 rays; ventrals reduced to a single long ray, bifid at its end; bands of villiform teeth in jaws; a small group of vomerine teeth, none on the palatine bones; chin with a barbel; branchiostegals 7. Deep sea.

The single Hawaiian species is fully described in Section II.

Læmonema Günther, Cat. Fish. Brit. Mus., IV, 356, 1862 (*yarrellii*).

Family CIII. MACROURIDÆ.—The Grenadiers.

Body elongate, tapering into a very long compressed tail, which ends in a point; scales moderate, usually keeled or spinous, sometimes smooth; suborbital bones enlarged, sometimes cavernous; teeth villiform or cardiform, in bands, on the jaws only; tip of lower jaw with a barbel; premaxillary protractile; dorsal fins 2, the first short and high, of stiff, spine-like branched rays; the second dorsal very long, usually of very low feeble rays, continued to the end of the tail; anal fin similar to the second dorsal, but usually much higher; no caudal fin; ventrals small, subjugular, each of about 8 rays; branchiostegals 6 or 7; lateral line present; gills $3\frac{1}{2}$ or 4, a slit behind the fourth; gillrakers small; gill-membranes free or narrowly united to the isthmus, usually more or less connected; pseudobranchiæ wanting or rudimentary; pyloric cœca numerous; air-bladder present. Genera 18; species about 50, chiefly of the northern seas, all in deep water; differing from the cod-fishes chiefly in the elongate and degenerate condition of the posterior part of the body. Doctor Gill succinctly defines the group as "Gadoidea with an elongated tail tapering backward and destitute of a caudal fin, postpectoral anus, enlarged suborbital bones, inferior mouth, subbrachial ventrals, a distinct anterior dorsal, and a long second dorsal and anal converging on end of tail."

A family of deep-water fishes, descriptions of the several Hawaiian species of which will be found in Section II.

Suborder HETEROSOMATA.—The Flat-fishes.

"Cranium posteriorly normal; anteriorly with twisted vertex, to allow 2 orbits on the same side, or 1 vertical and 1 lateral; basis cranii not quite simple. Dorsal fin long, of jointed rays; superior pharyngeals 4, the third longest, much extended forward, the inferior separate." (Cope.) This suborder includes the two families *Pleuronectidæ* and *Soleidæ*. Its nearest relationship is probably with the *Gadidæ*, although the developed pseudobranchiæ and the thoracic ventral fins indicate an early differentation from the anacanthine fishes. In the very young fishes the 2 sides of the body are alike and the eyes are 1 on each side, with normal cranium.

Family CIV. PLEURONECTIDÆ.—The Flounders.

Body strongly compressed, oval or elliptical in outline; head unsymmetrical, the cranium twisted, both eyes being on the one side of the body, which is horizontal in life, the eyed side being uppermost and colored, the blind side lowermost and usually plain. In the very young fish the bones of the head are symmetrical, 1 eye on each side, and the body is vertical in the water. In most species the cranium becomes twisted, bringing the upper eye over with it. Eyes large, well separated. Mouth small or large, the dentition various, the teeth always present; premaxillaries protractile; no supplemental maxillary bone; pseudobranchiæ present. Gills 4, a slit behind the fourth; lower pharyngeals

separate; no air-bladder; preopercle with its margin usually distinct, not wholly adnate or hidden by the skin of the head; vent not far behind head, the viscera confined to the anterior part of the body. Scales various, rarely absent, usually small. Lateral line usually present, extending on the caudal fin, sometimes duplicated or wanting. Dorsal fin long, continuous, of soft rays only, beginning on the head; anal similar, shorter; caudal various, sometimes coalescent with dorsal and anal; pectorals inserted rather high, rarely wanting; ventrals under the pectorals, usually of several soft rays, one of them sometimes wanting. Fishes mostly carniverous, inhabiting sandy bottoms in all seas, some species ascending rivers. Many of them are important food fishes. Genera about 55; species nearly 500.

a. Mandibular membranes forming a gular pouch ..... *Pelecanichthys*, p. 510
aa. Mandibular membranes not forming a gular pouch.
  b. Scales small, 80 to 140.
    c. Scales about 140; maxillary more than one-half head ..... *Chascanopsetta*, p. 511
    cc. Scales 80 to 100; maxillary about one-third length of head.
      d. Teeth in each jaw in narrow villiform bands; origin of dorsal over middle of eye ..... *Poecilopsetta*, p. 512
      dd. Teeth in jaws not in villiform bands; origin of dorsal not over middle of eye.
        e. Interorbital broad and concave; dorsal 92; A. 69; caudal convex ..... *Platophrys*, p. 512
        ee. Interorbital narrower; dorsal 112; anal 91; caudal not convex ..... *Anticitharus*, p. 514
  bb. Scales large, 36 to 46 ..... *Engyprosopon*, p. 514

Genus 257. PELECANICHTHYS Gilbert & Cramer.

Eyes and color on the left side; mouth symmetrical, of enormous extent, gape about as long as head; mandible extending anteriorly far beyond tip of snout, the projecting portion decurved and falciform, the rami very slender and flexible, each rotating inward, so that the teeth of the 2 rami meet and interlock in the closed mouth, instead of being opposed to those of the upper jaw; mandibular membranes voluminous, forming a veritable gular pouch and permitting wide divarication of the mandibular rami, which can be also closely apposed for their entire length. The posterior angle forms a slender process, projecting beyond the mandibular articulation and extending behind the posterior margin of the opercle; premaxillary, maxillary, and palatopterygoid formed of 3 very slender bony rods, parallel and closely juxtaposed for the greater part of their length; branchiostegals 7; gillrakers absent; preopercular margin free; dorsal and anal fins very long, the former commencing on the snout; caudal peduncle extremely short, a low fin-fold joining dorsal and anal with rudimentary caudal rays; caudal lanceolate; ventrals unsymmetrical, the left slightly more anteriorly placed, inserted on the ridge of the abdomen, its membrane leading to base of first anal ray; vent displaced well to the right side of the ridge slightly in advance of front of anal, a small papilla (genital papilla?) occupying a corresponding position to the left of the ridge; scales excessively fine; lateral line single, conspicuous, continued on to the caudal fin; with a short, low anterior arch.

Pelecanichthys Gilbert & Cramer, Proc. U. S. Nat. Mus., XIX, 1897 (Feb. 5), 432 (*crumenalis*).

426. Pelecanichthys crumenalis Gilbert & Cramer. Fig. 226.

Head (horizontal length) 4.3 to 4.5 (5.25 in smallest specimen); depth 3.5 to 3.6 (4 in smallest); D. 121; A. 88; P. 13 or 14; V. of both sides with 6 rays; about 230 to 240 pores in the course of the lateral line.

Body slender, excessively compressed, tapering slowly and uniformly toward tail, the 2 outlines very weakly arched for the greater part of their extent. Anterior outline of head strongly decurved, the physiognomy resembling that of *Glyptocephalus*. Bases of dorsal and anal fins wide, translucent, sharply marked off from rest of body, constituting together half the greatest depth of body. Abdomen very short.

Head very obliquely placed, the eyes closly approximated near the upper anterior profile, the cheeks narrow, oblique, upper limb of preopercle nearly horizontal, lower limb nearly vertical; mandible extending beyond premaxillaries for over one-fourth its length; rami so articulated as to permit a slight inward and outward rotation on their long axes, in addition to other movements; gular membrane large and loose, falling into folds when the jaws are closed; the entire mechanism of the lower jaw seems adapted to seizing food between the rami, and forcing it down between and below them. Teeth in both jaws in a somewhat uneven single series, those in mandible largest, smaller teeth

irregularly alternating with the larger ones in both jaws. Posterior third of each jaw toothless; palate smooth. Anterior nostril with an overarching flap or short tube; posterior nostril without tube.

Eyes elliptical, nearly even, long axis of lower eye very oblique. Oblique diameter of upper orbit 3.75 in head; snout short, five-sevenths diameter of upper eye. Interorbital space narrow, grooved, the width one-fifth diameter of upper eye.

Dorsal fin beginning above anterior nostril, the first few rays slightly displaced toward the blind side; pectoral narrow, pointed, about 1.75 in length of head, that of blind side apparently shorter; caudal lanceolate in a young individual (mutilated in adult), the middle rays 1.25 in head.

Jaws, snout, and interorbital space naked; head and body elsewhere covered with minute cycloid scales; lateral line nearly axial, its anterior arch low, above the head, the posterior downward curve abrupt, above base of pectoral; length of arch nearly equal to half depth of body.

Color in alcohol, head and body light brown, the outlines of the scales dusky, the wide bases of dorsal and anal fins semitranslucent; abdomen in the adult with narrow vertical stripes of blue-black, alternating with wider muscular bands which are of the ground-color; head and anterior median portion of trunk with faint darker brown spots about one-third size of pupil. In addition to these, the median part of body is marked with about 45 larger round spots, darker than the others, but still faint and ill-defined. These are nearly as large as eye, and are arranged on anterior part of trunk in 7 lengthwise series, all but 3 of which gradually disappear on tail. The larger spots are much more distinct in the young than in adults. Mouth and gill-cavity white; peritoneum black; fins dusky. Taken in deep water about the Hawaiian Islands at depths of 238 to 344 fathoms.

Found only in the Pailolo Channel and its approaches, and in the southerly continuation of the Kaiwi Channel, where it was originally obtained. Three specimens 7 to 10 inches long, from stations 3472 and 3476, were obtained by the *Albatross* in December, 1891, while engaged in surveying a cable route between California and Honolulu. Other examples were collected by the *Albatross* in 1902.

Pelecanichthys crumenalis Gilbert & Cramer, Proc. U. S. Nat. Mus., XIX, 1897 (Feb. 5), 433, pl. XLVII, **Albatross Station 3472 or 3476, near Hawaiian Islands** (type, No. 48738 U. S. N. M.).

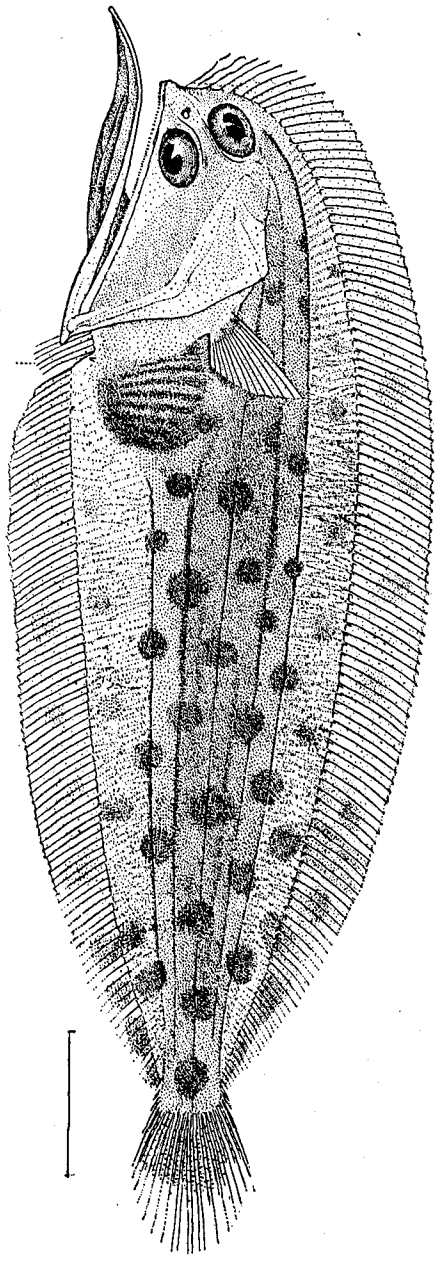


FIG. 226.—*Pelecanichthys crumenalis* Gilbert & Cramer; from the type.

Genus 258. CHASCANOPSETTA Alcock.

Mouth very wide, the maxillary being more than half the length of the head; jaws and teeth equally developed on both sides, each jaw being armed with a single row of long, slender, depressible teeth; eyes on left side; dorsal fin commencing near tip of snout, its rays, and those of the anal, being simple, slender, and scaleless; scales minute, membranous, hardly imbricate; lateral line with a strong curve above the pectoral; gill-openings wide,

the gill-membranes united to the isthmus in front; gill-rakers none. One Hawaiian species, described in Section II.

Chascanopsetta Alcock, Journ. Asiatic Soc., Bengal, LXIII, Pt. II, No. 2, 1894, 128 (*lugubris*)

Genus 259. PŒCILOPSETTA Günther.

Mouth rather narrow, the length of the maxillary being one-third of that of the head, each jaw with a narrow band of villiform teeth; vomerine and palatine teeth none; the dorsal fin commences above middle of eye; scales very small; gill-membranes united below the throat. The single Hawaiian species of this genus is fully described by Doctor Gilbert, in Section II.

Pœcilopsetta Günther, Zool. Challenger Rept., Shore Fishes, I, Parts I–VI, 49, 1880 (*colorata*).

Genus 260. PLATOPHRYS Swainson.

Eyes and color on left side; body ovate, strongly compressed; mouth of the large type, but comparatively small; the maxillary .33 or less of length of head; teeth small, subequal, in 1 or 2 series; no teeth on vomer or palatines; interorbital space broad and concave, broadest in adult males; gill-rakers moderate; dorsal fin beginning in front of eye, all its rays simple; ventral of colored side on ridge of abdomen; caudal convex behind; pectoral of left side usually with 1 or more filamentous rays, longest in the male; scales very small, ctenoid, adherent; lateral line with a strong arch in front. Coloration usually variegated.

The sexual differences are greater than usual among flounders, and the different sexes have often been taken for different species. As a rule, in the males the pectoral fin on the left side is much prolonged, the interorbital area is much widened and very concave, and there are some tubercles about the snout and lower eye. The young fishes, as is usually the case, resemble the adult females. Lately Doctor Emery has shown that the larval flounder, known as *Peloria heckeli*, is in all probability the young of *Pleuronectes podas*. The generic name *Coccolus*, based on forms slightly more mature than those called *Peloria*, probably belongs here also. We have seen no larval forms so young as those which have been described as *Peloria heckeli*, but we have examined small transparent flounders, one with the eyes quite symmetrical, taken in the Gulf Stream, and another with the eyes on the left side, taken at Key West, which may be larvæ of *Platophrys ocellatus*. The figures published by Emery seem to make it almost certain that the corresponding European forms belong to *P. podas*, although some doubt as to this is expressed by Facciola. The species of *Platophrys* are widely distributed through the warm seas, no tropical waters being wholly without them. All are extremely closely related and can be distinguished with difficulty. On the other hand, the variations due to differences of age and sex are greater than in any other of the Hawaiian genera.

Solea Rafinesque, Indice d'Ittiologia Siciliana, 52, 1810 (*rhomboide*); not of Quensel, 1806.
Platophrys Swainson, Nat. Hist. Class'n Fishes, II, 302, 1839 (*ocellatus*).
Peloria Cocco, Intorno ad Alcuni Pesci del mar di Messina, Giorn. del Gabin., 1844, 21–30, Lettre di Messina (*heckeli*, a larval form of *P. podas*); not *Pelorus* of Montfort, 1808.
? *Coccolus* Bonaparte in Cocco, Alcuni Pesci Messina, 21, 1844 (*annectens*); larval form, probably of *P. podas*, with the right eye in transit to the left side).
Bothus Bonaparte, Catologo Metodico Persi Europei, 49, 1846 (*podas*); not of Rafinesque.
Rhomboidichthys Bleeker, Act. Soc. Sci. Indo-Nederl. Manad. and Makassar, T, 1856, 67 (*myriaster*)
Platophrys Bleeker, Versl. Kon. Ak. Weten., XIII, 1862, 426 (*ocellatus*).

a. Anal rays about 70 ..... *pantherinus*, p. 512
aa. Anal rays about 80 ..... *mancus*, p. 513

427. Platophrys pantherinus (Rüppell). "*Pakii;*" "*Uiui.*"

Head 3.6 in length; depth 2; eye 3.9 in head; snout 4; interorbital 5.4; maxillary 3.2; D. 92; A. 69; P. 1, 9; V. 6; scales 31–88–36.

Body elongate, very deep and compressed, ellipsoid; head a little deeper than long, orbicular, the upper profile evenly convex; snout obtuse; jaws slightly produced; mouth curved, oblique; lips rather broad, fleshy; maxillary reaching below anterior portion of eye, but not to pupil, its distal expanded extremity 2 in eye; teeth in jaws minute, forming rather broad bands; eyes well separated, lower anterior, its posterior margin midway in length of head, upper nearly half an eye diameter posterior; margin of preopercle obtuse, and, like that of gill-opening, undulate; nostrils close together in front of

upper rim of orbit, each with a short fleshy tube; several bony elevations in front and above lower eye; interorbital space deep, concave; from the posterior portion of each eye are 2 fleshy filaments; gill-opening large, gillrakers small; scales covering head except on lips, about eyes and part of interorpital space; small scales extending upon greater portion of dorsal and anal and caudal rays; pectoral and ventral without scales, lateral line strongly arched for a short distance in front, then straight to base of caudal; extremities of most all dorsal rays free, those anteriorly on head free for greater part of their length; dorsal beginning well forward on snout, first ray 3.2 in head, second 1.9, third 1.6, fourth 2, sixtieth 2.5; anal somewhat simllar to dorsal, only anterior rays with their extremities short, first 4 in head, fortieth 2.6; caudal elongate, middle rays pointed, 1.3; pectoral very long, the upper rays produced beyond the caudal for a distance equal to depth of caudal peduncle; membranes of pectoral extending only for a short distance; ventrals close together, left larger, its base 1.8 in head, first ray 3, second 2.6, third 2.1, fourth 1.25; right ventral with base 5, first ray 3.7, fifth 2.8; right pectoral 1.7; caudal peduncle rather deep, compressed, 2.8. Described from an example (No. 05303) from Honolulu.

In life (No. 03257) was sand color, the ocelli light grayish brown, bluish gray, and some with blackish edgings; fins similar. Color, when fresh, of examples from Hilo, centers of large ocelli clear deep yellow; some other spots and marks of yellow, besides grayish, bluish, brown and blackish; 4 yellow spots above and 4 below lateral line in series; then centers of ocelli above noted.

Color in alcohol, grayish brown on the left side, with numerous pale blue rings of spots bordered with dusky; a large dusky blotch at beginning of straight portion of lateral line and another about midway in the latter; everywhere small indistinctly defined whitish spots; dorsal pale gray with 12 large brownish spots formed on bases of rays, rest of fin speckled with brownish and whitish; anal similar to dorsal with 8 large brownish spots formed on bases of rays; caudal speckled with whitish and brown, base with pale blue spots; pectoral rays pale gray with brownish cross-lines, membrane black with white reticulating lines; ventral grayish with brown and whitish spots; right side yellowish white, scales on side of head with brown dots.

Young examples have short pectorals and are deeper. The variation in scales is as low as 67 in a lateral series in one small example; others are found with 75 or 80. This species is common among the Hawaiian Islands. The collection contains 39 examples from Honolulu and 20 from Hilo, ranging in length from 1.5 to 7.75 inches. Specimens were obtained by Doctor Jenkins in 1889 and by the *Albatross* in 1902.

Rhombus pantherinus Rüppell, Atlas Reis. Nordl. Af., Fische., 121, pl. 31, fig. 1, 1828, **Red Sea;** Streets, Bull. U. S. Nat. Mus., No. 7, 57, 1877 (Honolulu Harbor).

Passer marchioncssarum Valenciennes, Voy. Venus, 344, pl. 9, 1850, **Marquesas Islands.**

Rhombus sumatranus Bleeker, Verh. Bat. Gen., XXIV, 1852, 14, **Sumatra.**

Rhomboidichthys pantherinus, Günther, Cat., IV, 436, 1862 (Mauritius; Madagascar; Amboyna; Fiji Ids.); Streets, Bull. U. S. Nat. Mus., No. 7, 57, 1877 (Honolulu); Günther, Rep. Shore Fish., Challenger, Zool., I, Part VI, 61, 1880 (Honolulu).

Platophrys pantherinus, Steindachner, Denks. Ak. Wiss. Wien, LXX, 1900, 511 (Honolulu); Jenkins, Bull. U. S. Fish Comm., XXII, 1902 (Sept. 23, 1903), 510 (Honolulu).

Rhombus parvimanus Bennett, Proc. of the Committee Zool. Soc. London, I, 1830-1, 168, **Mauritius.**

Platophrys mancus, Jordan & Snyder, Proc. U. S. Nat. Mus., XXVII, 1904, 946 (Honolulu).

428. Platophrys mancus (Broussonet).

Head 3.28 (4.25) in length; depth 2 (2.25); D. 98; A. 78; scales about 95; Br. 6.

Body elliptical, the profile continuous with the dorsal curve, the snout projecting, and the nasal bones forming a prominent knob; ventral outline a regular and gentle curve from gill-opening to caudal peduncle; lower jaws produced beyond upper, a pointed knob below and behind symphysis. Head not much higher than long; mouth moderately oblique, small for a large-mouthed species, the maxillary reaching little beyond anterior rim of eye, 2.66 in head; pointed teeth in 2 series in each jaw, those of the inner and larger series becoming somewhat smaller posteriorly, the teeth on maxillary not extending as far back on the blind side; the outer series of few small teeth; eyes small, the lower orbit 7 in head, the upper one slightly smaller; lower orbit wholly in advance of upper, the concave interorbital space 2.83 in head; orbital rim a sharp ridge without distinct knobs. Nostrils apparently wanting; cheeks and opercles more or less scaly; gillrakers rather long, the length of longest 2 in upper orbit; 10 on lower part of arch, none above. Scales cycloid, not deciduous, similar on

both sides, but without accessory scales on the blind side. Dorsal fin beginning on the snout, the first ray on the blind side, about as long as superior orbit, the rays gradually increasing in height to the posterior third of the fin, where they are 2.66 in head, thence rapidly decreasing to end of fin; anal similar, its highest rays not opposite the highest part of dorsal, but a little farther back; pectoral of eyed side falcate, the second ray one-fourth longer than head, produced into a filament; pectoral of blind side 1.83 in head; ventrals moderate, when depressed reaching past front of anal; caudal bluntly pointed, 1.6 in head.

Coloration in spirits, everywhere mottled with gray and brown; the fins (except pectoral on blind side) marked with same colors, but the spots more nearly round and less complicated; on the colored side there is a large, irregular blackish blotch behind pectoral, a round black spot on the lateral line halfway between head and caudal fin; about 12 blackish spots at regular intervals on dorsal fin, 6 or 7 similar ones on anal; the ventral on the eyed side marked like the anal; the colors and spots extending over on the blind side on the nasal bones, premaxillary, chin, and interopercle. The skinny flap in the mouth between the teeth and vomer is also spotted. Length 16 inches.

This species is common in the South Seas and has been recorded from Johnston Island. It resembles *P. pantherinus*, but is more variegated, has a larger number of anal rays (about 80) and the arch of the lateral line is different. The figures of *P. pavo* and *P. pantherinus* in Bleeker's Atlas show the 2 species well.

Pleuronectes mancus Broussonet, Ichthyol., c., duab., pls. 3 and 4, 1782, **Pacific.**
Platophrys mancus, Smith & Swain Proc. U. S. Nat. Mus., V, 1882, 142 (Johnston Island).
Rhombus pavo Bleeker, Kokos, III, 177, **Cocos Island.**
Rhomboidichthys pavo, Günther, Cat., IV, 435, 1864 (China; Ancityum).

Genus 261. ANTICITHARUS Günther.

Mouth wide, or rather wide; maxillary more than one-third length of head; teeth conical, unequal, in a single series in both jaws; no vomerine and palatine teeth; origin of dorsal on snout; scales of moderate size, smooth, deciduous; lateral line strongly curved above pectoral; eyes on left side; gill-membranes broadly united below throat; gillrakers short and lancolate. The single Hawaiian species of this genus is fully described in Section II.

Anticitharus Günther, Zool. Challenger Rept., I, Parts I–VI, Shore Fishes, 47, 1880 (*polyspilus*).

Genus 262. ENGYPROSOPON Günther.

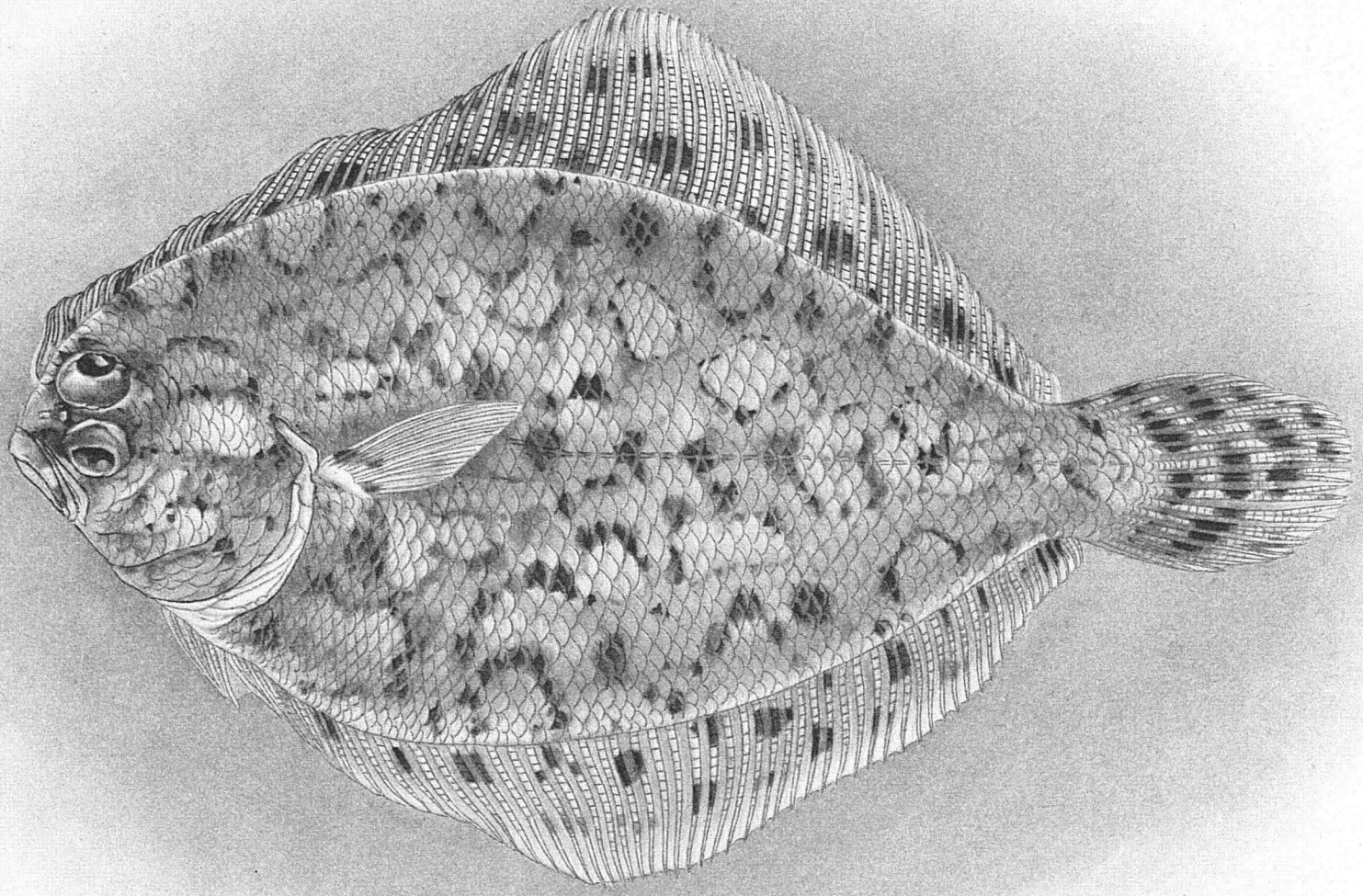
This genus is allied to *Platophrys*, differing in the large adherent scales and the narrow interorbital space. Gillrakers few and short.

a. 46 scales in a longitudinal series.....*hawaiiensis*, p. 514
aa. 36 scales in a longitudinal series.....*arenicola*, p. 515

429. Engyprosopon hawaiiensis Jordan & Evermann. Fig. 227.

Head 3.8 in length; depth 1.75; eye 3.25 in head; snout 4.25; interorbital 6.3; maxillary 2.8; D. 79; A. 56; P. 1, 10; V. 1, 5; scales 14–46–15.

Body elongate, deep, rather ovoid, greatest depth about end of pectoral; head very deep, its length 0.7 in depth; upper profile very convex in front, steep; snout short, obtuse; jaws small, produced a little, the mandible slightly projecting; lips rather thin; mouth curved a little, very oblique, the small maxillary reaching a little beyond front margin of eye; teeth in jaws very small, sharp-pointed; eyes well separated, lower anterior placed in first third of head, the upper about two-fifths an eye diameter posterior; nostrils close together, with elevated rims; interorbital space a little more than half an eye diameter in width, deeply concave; gill-opening small; gillrakers rather short; scales large, finely ctenoid, very small on rays of vertical fins; lateral line strongly arched at first for first two-ninths its length, then straight to base of caudal; dorsal beginning on snout, the anterior rays free for only a short portion of their extremities, first 5 in head, fiftieth 2.1, this the highest region of the fin; anal more or less similar, first 3.25, thirtieth 2; caudal rounded, middle rays longest, 1.1; pectoral short, pointed, 1.4; ventrals rather broad, base of left 3, first and last rays about equal; right ventral smaller; caudal peduncle compressed, its depth 1.9.



ENGYPROSOPON ARENICOLA JORDAN & EVERMANN. TYPE.

JULIUS BIEN & CO. LITH. N.Y.

Color in alcohol, dark olivaceous brown, fins dark gray-brown, each ray finely specked with olivaceous brown; left pectoral specked with dark brown, right pectoral dull creamy or brownish white, like the right side of body.

Type, No. 50657, U. S. N. M., taken at Hilo, the only example we have seen, 3 inches long.

Engyprosopon hawaiiensis Jordan & Evermann, Bull. U. S. Fish Comm., XXII, 1902 (April 11, 1903), 207, Hilo.

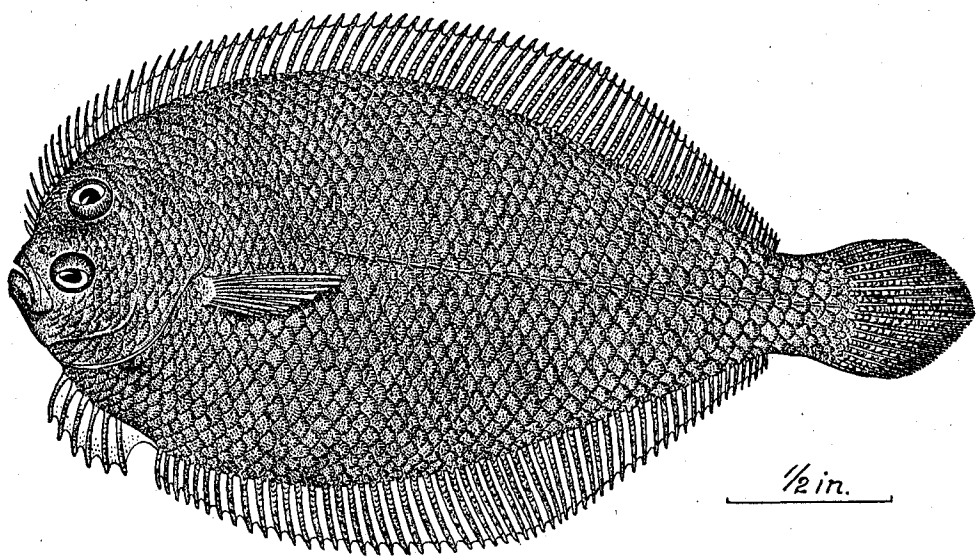


FIG. 227.—*Engyprosopon hawaiiensis* Jordan & Evermann; from the type.

430. Engyprosopon arenicola Jordan & Evermann. Plate 62.

Head 3.6 in length; depth 1.9; eye 4.3 in head; maxillary 3; D. 78; A. 57; P. I, 11; V. 5; scales 14–36–17.

Body elongate, very deep, rather ovoid, the greatest depth at tip of pectoral; head much deeper than long, the upper profile steep, strongly convex; snout obtuse; jaws very oblique, mandible slightly projecting; maxillary very oblique, reaching below anterior margin of eye; lips rather thin, fleshy, fringed along margins; teeth in jaws minute, sharp-pointed; eyes close together, lower anterior placed about first third of length of head; upper eye about one-third an eye diameter posterior; nostrils well separated, with raised fleshy rims forming a flap; interorbital space very narrow, concave; gill-opening rather small, restricted to side; gillrakers small, short, few; scales large, finely ctenoid; lateral line strongly arched for anterior fourth of its length, then straight to base of caudal; anterior dorsal rays free distally for one-half their length, first ray 3 in head, forty-fifth 1.8, which is the highest region of the fin; anal similar to dorsal, but anterior rays not free for half their length; first ray 3.5, thirtieth 1.8; caudal elongate, median rays longest, equal to head; pectoral short, pointed, 1.5; ventrals rather large, the left with its base 5 in head, first ray 3.6, last 2.6, almost entirely in front of the right, which is much smaller; caudal peduncle broad, compressed, its depth 2.2 in head.

Color in alcohol, very pale brown; side marked with many large incomplete rings of blackish or dusky, and with a number of dusky spots in between; fins whitish, the vertical or unpaired with large blackish spots on membranes between rays and similar small ones scattered about, those of caudal forming about 4 cross-bands; several dusky spots at base of pectoral; right side whitish.

We have seen but 2 examples, both taken at Hilo: Type, No. 50658, U. S. N. M., 2.5 inches long. Cotype, No. 7471, L. S. Jr. Univ. Mus., 1.9 inches long.

Engyprosopon arenicola Jordan & Evermann, Bull. U. S. Fish Comm., XXII, 1902 (April 11, 1903), 207, Hilo.

Family CV. SOLEIDÆ.—The Soles.

Body oblong or elongate, usually scaly; mouth very small, much twisted toward the eyed side; the teeth in villiform bands, very small or obsolete; eyes small, close together, with or without a bony ridge between them; edge of preopercle adnate, concealed by the skin and scales; gill openings narrow, the gill membranes adnate to the shoulder girdle above; pectoral fins small or wanting; ventral fins small, one or both sometimes wanting. Small fishes living on sandy bottoms, similar to the Pleuronectidæ in structure, but much degraded, the fins and teeth having lost many of their distinctive qualities; the vertebræ usually in increased numbers. Species numerous in the warm seas, and those of sufficient size valued as food.

Genus 263. SYMPHURUS Rafinesque. Tongue-Fishes.

Body elongate, more or less lanceolate in outline, with the eyes and color on the left side; eyes small, very close together, with no distinct interorbital ridge between them; mouth small, twisted toward the blind side; teeth little developed, in villiform bands; edge of preopercle covered by the scales; gill-openings narrow, the gill-membranes adnate to the shoulder-girdle above, joined together and free from the isthmus below; pectoral fins wanting (in the adult); vertical fins more or less confluent; scales ctenoid; lateral line wanting; ventral fin of eyed side only present, free from the anal; head without fringes.

The 2 Hawaiian species are fully described in Section II.

Symphurus Rafinesque, Indice d'Ittiologia Siciliana, 52, 1810 (*nigrescens*).
Bibronia Cocco, Alcuni Pesci del mare de Messina, 15, 1844 (*ligulata;* larval form).
Plagusia Cuvier, Règne Animal, Ed. 2, II, 344, 1829 (based on *Plagusia* of Brown); name preoccupied in Crustaceans, Latreille, 1806.
Plagiusa Bonaparte, Catalogo Metodico, 51, 1846 (*lactea*); substitute for *Plagusia* preoccupied.
Aphoristia Kaup, Archiv für Naturgesch. 1858, 106 (*ornata*).
Glossichthys Gill, Cat. Fish. E. Coast N. A., 51, 1861 (*plagiusa*).
Ammopleurops Günther, Cat., IV, 490, 1862 (*lacteus=nigrescens*).
Bascanius Schiodte, Naturhist. Tydsskr., V, 269, 1867 (*twdifer;* larval form).
Acedia Jordan in Jordan & Goss, Review Flounders and Soles, 321, 1889 (*nebulosus*).

Order M. PEDICULATI.

Carpal bones notably elongate, forming a kind of arm (pseudobrachium) which supports the broad pectoral. Gill-opening reduced to a large or small foramen situated in or near the axil, more or less posterior to the pectorals. Ventral fins jugular if present; anterior dorsal reduced to a few tentacle-like, isolated spines; soft dorsal and anal short; no scales. First vertebra united to cranium by a suture; epiotics united behind supraoccipital; elongate basal pectoral radii (actinosts), reduced in number; no interclavicles; post-temporal broad, flat, simple; upper pharyngeals 2, similar, spatulate, with anterior stem and transverse blade; basis of cranium simple, no air-duct to the swim-bladder. Marine fishes, chiefly of the Tropics and the oceanic abysses. The group is an offshoot from the Acanthopteri, its chief modification being in the elongation of the actinosts and in the position of the gill-opening. The *Batrachoididæ* are perhaps its nearest relatives.

a. Gill-openings in or behind the lower axil of the pectoral; mouth large, terminal.
b. Pseudobranchiæ present; pseudobrachia with 2 actinosts; head broad, depressed, the enormous mouth with very strong teeth; ventrals present ..... *Lophiidæ*, p. 516
bb. Pseudobranchiæ none; pseudobrachia with 3 actinosts.
c. Ventrals present; arm angulate, the pseudobrachia elongate ..... *Antennariidæ*, p. 517
cc. Ventrals wanting, arm not angulate, the pseudobrachia moderate ..... *Ceratiidæ*, p. 523
aa. Gill-openings in or behind the upper axil of the pectoral; mouth small, usually inferior ..... *Ogcocephalidæ*, p. 523

Family CVI. LOPHIIDÆ.—The Anglers.

Head wide, depressed, very large; body contracted, conical, tapering rapidly backward from the shoulders; mouth exceedingly large, terminal, opening into an enormous stomach; upper jaw protractile; maxillary without supplementary bone; lower jaw projecting; both jaws with very strong, unequal, cardiform teeth, some of the teeth canine-like, most of them depressible; vomer and palatines

usually with strong teeth; gill-openings comparatively large, in the lower axil of the pectorals; pseudobranchiæ present; gillrakers none; gills 3; skin mostly smooth, naked, with many dermal flaps about the head; spinous dorsal of 3 isolated, tentacle-like spines on the head, and 3 smaller ones behind, forming a continuous fin; second dorsal moderate, similar to the anal; pectoral members scarcely geniculated, each with 2 actinosts and with elongate pseudobrachia; ventrals jugular, 1, 5, widely separated, large, much enlarged in the young. Young with the head spinous; pyloric cœca present. Two genera, with 4 or 5 species, living on sea bottoms, at moderate or great depths; remarkable for their great voracity.

Genus 264. LOPHIOMUS Gill.

This genus is closely allied to *Lophius* in external characters, but it is strikingly distinguished by the reduced number of its vertebræ, which are only 18 or 19, a fact associated with its tropical habitat.

The single Hawaiian species is fully described by Doctor Gilbert in Section II.

Lophiomus Gill, Próc. U. S. Nat. Mus. 1882, 552 (*setigerus*).

Family CVII. ANTENNARIIDÆ.—Frog Fishes.

Head and body more or less compressed; mouth vertical or very oblique, opening upward; lower jaw projecting; jaws with cardiform teeth; premaxillaries protractile; gill-openings small, pore-like, in or behind the lower axils of the pectorals; no pseudobranchiæ; gills 2½ or 3; skin naked, smooth, or prickly; pectoral members forming an elbow-like angle; pseudobrachia long, with 3 actinosts; ventral fins present, jugular, near together; spinous dorsal of 1 to 3 serrated, tentacle-like spines; soft dorsal long, larger than anal; pyloric cœca none. Inhabitants of tropical seas, often living on or among floating seaweed, and enabled, by filling the capacious stomach with air, to sustain themselves on the surface of the water; therefore widely dispersed by currents in the sea.

a. Head compressed; a rostral spine or tentacle, followed by 2 larger spines; palatine teeth developed; dorsal spines disconnected.
  b. Skin covered with prickles; ventrals short ..... *Antennarius*, p. 517
aa. Head cuboid; a single rostral spine or tentacle received in a groove; soft dorsal low ..... *Chaunax*, p. 523

Genus 265. ANTENNARIUS Commerson.

Body oblong, compressed, very deep through the occipital region, tapering behind; breast tumid; mouth rather large, more or less oblique, or even vertical; cardiform teeth on jaws, vomer, and palatines; eye small; skin with small granules or spinules, these usually forked, and often with numerous fleshy slips; first dorsal spine developed as a small rostral tentacle; second and third dorsal spines strong, covered with skin, often with numerous fleshy filaments; soft dorsal high and long; anal short and deep; caudal fin rounded, the peduncle free; pectoral fin wide, with a rather wide wrist, at the lower posterior angle of which are the very small gill-openings; ventral fins short. Fantastic-looking fishes, often gayly colored. Very numerous in warm seas.

Antennarius Commerson in Lacépède, Hist. Nat. Poiss., I, 323, 1798; footnote only; not accepted by Lacépède.
Histrio Fischer, Zoognosia, 3d ed., I, 1813, 70, 78. Definition incorrect; through a slip of the pen, "corpus depressum" written instead of "corpus compressum." No type mentioned. Fischer's *Lophius histrio* (Bloch, IV, 10, pl. CXI) is a true *Antennarius* according to Dr. Gill, probably *A. scaber*.
Les Chironectes (*Antennarius* Commerson) Cuvier, Règne Animal, 1st ed., I, 310, 1817; Ed. 2d, II, 251, 1829. *Chironectes* preoccupied in mammals by *Chironectes* Illiger, 1811.
Batrachops Goldfuss, Handbuch Zoologie, 1820 (substitute for *Chironectes*).
a. Bait long and slender, when depressed reaching middle of second dorsal spine.
  b. Eye comparatively small, about 3.5 in snout ..... *sandvicensis*, p. 518
  bb. Eye larger, about 2.5 in snout ..... *commersonii*, p. 518
    c. Anal with 6 rays ..... *leprosus*, p. 519
    cc. Anal with 7 rays ..... *laysanus*, p. 520
aa. Bait shorter, when depressed not reaching middle of second dorsal spine.
  d. Bait longer than first dorsal spine.
    e. Bait terminated by a filament ..... *bigibbus*, p. 520
    ee. Bait terminated by a fleshy knob or caruncle.
      f. Second dorsal spine closely bound down to the back, movable only at the tip ..... *drombus*, p. 521
      ff. Second dorsal spine not bound down to the back, movable to an upright position ..... *duescus*, p. 522
  dd. Bait not as long as first spine ..... *nexilis*, p. 523

431. Antennarius sandvicensis (Bennett).

Entire length 4.5 inches; depth of body 2 inches. Color, dull-orange or yellow-red, with circular black spots on the body and fins. Eyes small and placed high in the head; when touched or threatened instantly retiring for protection beneath the upper eyelid. Iris red. Jaws and palate armed with many rows of teeth. Lower jaw protruding beyond upper. Forehead furnished with a long and rigid filament or barbel, which, from its use as a bait for prey, has obtained for this family of fish the name of "anglers." The fins on the upper surface of the body are peculiarly arranged. The first (which I dare call a dorsal) is composed of one stout spinous ray, with a membrane attached, and is placed in front of the summit of the head; the second is similarly formed, and situated immediately behind the head; the third occupies the posterior two-thirds of the back, and is composed of 12 branched rays. Rays of the anal fin 7; caudal 9.

The pectoral fins bear a very close resemblance to the anterior extremities of a frog or lizard, and the 10 distinct rays, at the termination of each, complete the comparison by their resemblance to toes. A long membranous air-tube, communicating with the gills, passes beneath the integuments of this fin, and opens as a circular orifice at its joint or elbow.

The solitary example of this species, which we obtained from the shores of Oahu, Sandwich Islands, continued alive for many hours after it had been removed from the water. During this time its abdomen and throat remained distended to a great size, but previous to death both air and water were evacuated from the mouth, and the body collapsed. Dissection proved that the cavity of the stomach was the part thus distended. The fish has no ribs, though it has a very distinct sternum. The swim-bladder is small and of ovoid form. (Bennett.)

We have one specimen from Honolulu which agrees closely with fig. C, plate 100, in Günther's "Fische der Südsee" regarded by him as a variety of *A. commersonii*. Our specimen is probably identical with Bleeker's *horridus* and appears to be Bennett's *Lophius sandvicensis*. It shows the following characters:

Eye very small, its diameter contained 3 times in length of maxillary; "bait" hair-like, its length equal to that of maxillary, reaching beyond base of second spine when depressed, the tip with a cluster of short filaments; first spine reaching base of second when depressed, surrounded by thickened tissue, the membrane extending from near tip of spine to base of second, very thin; second spine easily elevated, connected with occiput by a thick membrane, the spine surrounded by a large amount of tissue, its width equal to diameter of eye; spine when depressed not reaching soft dorsal; dorsal of the same height throughout, just reaching base of caudal when depressed; rays 12; anal reaching beyond base of caudal, its edge rounded; length of space between base of anal and caudal one-half that between base of dorsal and caudal; caudal rounded, its length 2.5 in length of body; anal opening at base of pectoral. Skin with very fine prickles, a few small cutaneous flaps on head, chin, and back.

Color in spirits, light gray, thickly mottled and spotted with dark gray; a few white-edged blackish spots on body and fins, located as follows: At base of second dorsal spine, origin of dorsal, between eighth and ninth dorsal rays, on side between origin of dorsal and base of pectoral, on side posterior to pectoral, on anal fin, on upper and on lower edge of caudal.

Known to us only from one specimen, which is 3.07 inches long.

Lophius sandvicensis Bennett, Nar. Whaling Voy., II, 258, 1840, **Oahu, Hawaiian Islands.**
Antennarius horridus Bleeker, Nat. Tjds. Ned. Ind., V, 1853, 83, **Celebes, Flores, Solor,** and **Amboyna.**
Antennarius sandvicensis, Jordan & Snyder, Proc. U. S. Nat. Mus., XXVII, 948, 1904 (Honolulu).

432. Antennarius commersonii (Lacépède).

Head 3 in length; depth 1.7; eye 3.5 in snout; snout 2.5 in head; maxillary 1.25; width of mouth 1.5; D. I–I–12; A. 7; P. 10; V. 5.

Body deep, compressed, rather thick at pectoral region; head deep, profile above oblique, below convex; snout short, very broad, convex above; mouth very large, slightly oblique forward; mandible large, vertical, with small knob at symphysis, and lower portion slightly produced; teeth in jaws in bands, slender, sharp-pointed, depressible; teeth on palatines similar; tongue large, thick, fleshy; eye very small, high, anterior; nostrils close together, anterior with raised fleshy rim; interorbital space very broad, elevated, uneven; bait long, reaching middle of second spine; extremity of bait bifid, one portion a broad cutaneous flap, the other forming a bunch of fleshy tentacles; no pit on top of head; first dorsal spine united to top of head by a membrane, and depressible; second spine large, adnate to

top of head; dorsal rather high, thick, margin between rays incised, length of base 2.25 in body, and last ray not adnate to caudal peduncle by membrane; anal rounded, its base half that of dorsal, and last ray adnate on lower portion with caudal peduncle; caudal rounded; pectoral very broad; ventral small, inserted below anterior part of second dorsal spine; caudal peduncle compressed, its depth half length of head; head with many mucous pores, those above marked more or less by excrescences; lateral line superior and distinct at first till under second dorsal, then obsolete and running down toward anus; no cutaneous flaps.

Color in alcohol, deep blackish brown, the side marbled with a deeper color; a large blackish brown spot on basal portion of posterior dorsal rays, and a similar one on same portion of anal; several blackish spots on side; tips of caudal, anal, and outer portions of pectoral and ventral rays pale or whitish brown; a whitish spot above base of pectoral.

Described from an example (No. 2153) taken at Honolulu by Dr. Jenkins, which, with another obtained there by the *Albatross*, is the only example we have seen. The species is known by its very dark coloration, and is widely distributed in the tropical Pacific.

Lophius commersonii Lacépède, Hist. Nat. Poiss., I, 327, 1798, **South Seas.**

Chironectes commersonii, Cuvier, Mém. Mus. Hist. Nat., III, 431, pl. 18, fig. 1, 1817.

Antennarius commersonii, Cantor, Cat. Malay. Fish., 204, 1850 (Singapore); Günther, Fische der Südsee, V, 163, pls. 100, figs. B & C and pl. 106, 1876 (Raiatea; Bonham Island; Tahiti; Sandwich Islands; Society Islands; Zanzibar; Huahine; Navigator Islands); Steindachner, Denks. Ak. Wiss. Wien, LXX, 1900, 497 (Laysan); Fowler, Proc. Ac. Nat. Sci. Phila. 1900, 519 (Sandwich Islands); Jenkins, Bull. U. S. Fish Comm., XXII, 1902 (Sept. 23, 1903), 511 (Honolulu); Snyder, op. cit. (Jan. 19, 1904), 537 (Honolulu).

Chironectes niger Garrett, Proc. Cal. Ac. Nat. Sci., III, 1868, 107, **Sandwich Islands.**

433. Antennarius leprosus (Eydoux & Souleyet). Fig. 228.

Head (to end of opercle) 2.8 in length; depth 1.7; eye 2.5 in snout; snout 3.5 in head; maxillary 1.8; width of mouth 1.8; interorbital 1.4; D. I–I–12; A. 6; P. 10; V. 6.

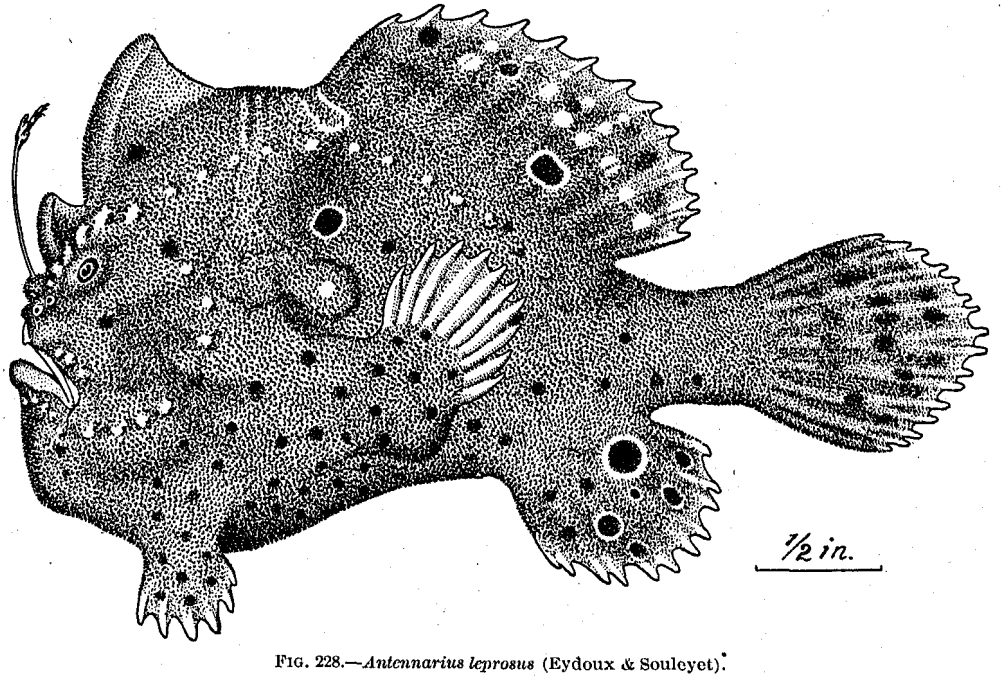


FIG. 228.—*Antennarius leprosus* (Eydoux & Souleyet).

Body very deep, compressed, back well elevated; head very deep, with bluntly conic profile in front and above; snout broad, surface uneven; mouth broad, maxillary very oblique, reaching well below posterior margin of eye; mandible large, with symphyseal knob, and projecting slightly; lips rather thin; teeth in broad bands in jaws, sharp pointed, more or less unequal in size, and depressible

backwards; vomer and palatines with patches of sharp pointed small teeth; tongue large, broad, thick; nostrils with elevated fleshy rims, rather close together near end of snout; interorbital space broad, elevated; bait reaching to middle of second spine, bifid and rather broad at extremity; first spine large, very rough, adnate by membrane, 2.6 in head; second spine larger, similar, 1.75; eighth dorsal ray 1.5; anal rounded, third ray 1.7; caudal rounded, median rays longest, about 1.2; pectoral broad, upper median rays longest, fourth 2; ventrals small, rounded; caudal peduncle compressed, its depth 2.35; pores on head and upper side of back with rough excrescences, those which form lateral line running back below posterior part of soft dorsal, then obliterated; skin rather rough velvety, fins also rough.

Color in alcohol (No. 554) grayish brown, more or less marbled with dusky; a ragged brown blotch from between second dorsal spine and soft dorsal and a pale ocellus above pectoral; margin of vertical fins whitish, submarginal portions mottled with white, black, and gray; a large black ocellus on basal portion of posterior dorsal and anal rays; a black ocellus above base of pectoral; belly and lower side spotted all over with black.

Described from an example (No. 554) taken at Honolulu. We have examined also 1 specimen 5.1 inches long collected by Doctor Jenkins at Honolulu, where the *Albatross* obtained yet another example.

Chironectes leprosus Eydoux & Souleyet, Zool. Voy. Bonite, I, 187, pl. 5, fig. 3, 1841, **Sandwich Islands.**
Antennarius multiocellatus var. *leprosa*, Günther, Cat., III, 195, 1861 (Sandwich Islands).
Chironectes rubrofuscus Garrett, Proc. Cal. Ac. Nat. Sci., III, 1868, 64, **Sandwich Islands.**
Antennarius rubrofuscus, Jenkins, Bull. U. S. Fish Comm., XXII, 1902 (Sept. 23, 1903), 511 (Honolulu); Snyder, op. cit. (Jan. 19, 1904), 537 (Honolulu).

434. Antennarius laysanius Jordan & Snyder. Plate 63.

Mouth large, the width equal to length of maxillary, 4.5 times diameter of eye; "bait" long and slender, reaching middle of second spine when depressed, the tip with a small knob bearing filaments, one of which is lanceolate, seven-eighths the length of rod, the others short and thread-like. First spine inserted above anterior edge of orbit, reaching base of second spine when depressed, connected posteriorly with head by a thin membrane, the free edge of which is convex, the tip of spine with a movable joint; second spine equal in length to maxillary, immovably and closely attached throughout its length to the occiput and back, the tip with a small, movable joint; soft dorsal not connected with second spine by a membrane or crest, separated from the caudal by a space equal in length to 2.5 times diameter of eye, the last rays when depressed not reaching base of caudal; rays 12, the longest (posterior) equal in length to distance between base of bait and tip of first spine when depressed; posterior margin of fin rounded; anal when depressed reaching base of caudal, rays 7, about equal in length to those of dorsal; caudal rounded; gill-opening at base of pectoral.

Skin hispid with minute, simple, and bilobed prickles; upper half of eye covered with thick prickly skin; minute, filamentous, dermal appendages scattered about over the sides and back, especially prominent below dorsal spines and fin, none on ventral surface.

Color in spirits, yellowish white, densely clouded with dusky; a small ocellus midway between base of pectoral and origin of soft dorsal, many small black spots scattered about on breast and belly, an oblong black spot half as large as eye on posterior half of soft dorsal, a row of black spots along edge of dorsal fin, a large one on base of anal and 2 near border of fin, caudal with a few spots as large as pupil; dorsal, caudal, and anal narrowly edged with white; pectorals white below, dusky above; chin dusky, with an indistinct light ocellus; tongue with small black spots. Known only from the type (No. 8439, Stanford University Museum), a specimen 3.8 inches long collected at Laysan Island by Mr. Max Schlemmer.

Antennarius laysanius Jordan & Snyder, Proc. U. S. Nat. Mus., XXVII, 1904, 947, **Laysan Island.**

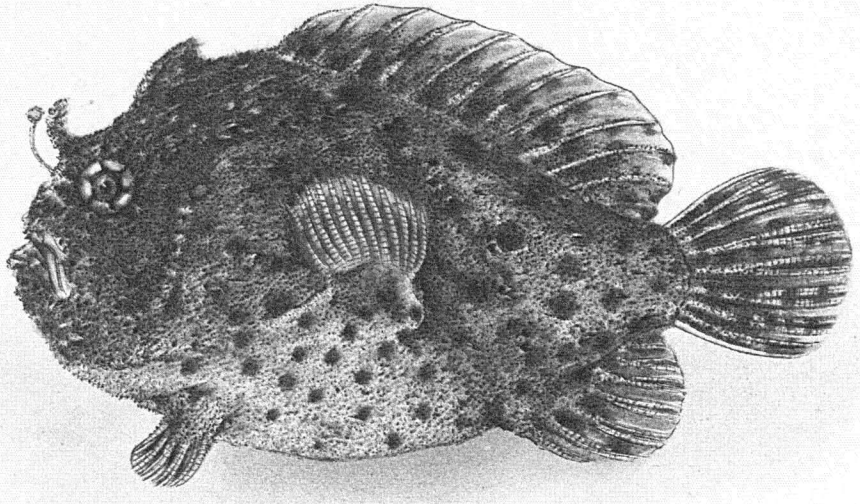
435. Antennarius bigibbus (Lacépède).

Head 2.25 in length; depth 1.5; eye 4 in head; snout 5; maxillary 2.2; width of mouth 2.2; D. I–I–12; A. 7; P. 11; V. 5.

Body deep, compressed, back elevated; head deep, with blunt conic profile in front, somewhat oblique above; snout broad, obtuse, conic, smooth; mouth broad, very oblique, nearly vertical; teeth in jaws small, sharp pointed; lips rather thin; mandible large, slightly projecting; eye small, high,

ANTENNARIUS LAYSANIUS JORDAN & SNYDER. TYPE.

JULIUS BIEN & CO. LITH. N.Y.



ANTENNARIUS DROMBUS JORDAN & EVERMANN. TYPE.

JULIUS BIEN & CO. LITH. N.Y.

anterior; nostrils circular, close together, with rounded fleshy rims; side of snout with a convex groove running from eye toward tip; top of head with groove, the anterior dorsal spine free and depressible within; second dorsal spine not depressible, very robust, and forming a large hump on back in front; bait longer than first spine, apparently with undivided filament at extremity and not reaching to base of second spine; dorsal rays moderately high, base of fin 1.7 in trunk, and last ray adnate to caudal peduncle by membrane; anal rounded, lower portion adnate to caudal peduncle by membrane; caudal elongate, rounded; pectoral broad; ventral small, about under end of second dorsal spine; body rough, pores on head and in lateral line with rough excrescences; no dermal flaps; lateral line curving down to front of anal fin.

Color in alcohol, pale creamy, or creamy white, the sides marbled with brown; fins more or less pale; caudal with a dark brown submarginal cross-line and two similar lines close together across middle of fin; anal with a submarginal brown longitudinal line, a similar median dark brown longitudinal band; pectoral and ventral with brown margins and base narrowly of same color.

Described from an example taken by Doctor Jenkins, at Honolulu. Four others were taken by him, 1 by us, and 3 by the *Albatross*. These are 1 to 1.25 inches long.

Lophius bigibbus Lacépède, Hist. Nat. Poiss., I, 325, 1798, **no locality given.**
Chironectes tuberosus Cuvier, Mém. Mus. Hist. Nat., III, 1817, 432, **Isle of France.**
Antennarius unicornis Bennett, Zool. Journ., III, 1828, 374, pl. 9, fig. 1, **Madagascar.**
Chironectes reticulatus Eydoux & Souleyet, Voy. Bonite, Poiss., 186, pl. 5, fig. 2, 1841, **Sandwich Islands.**
Antennarius tuberosus, Bleeker, Nat. Tyds. Ned. Ind., XVI, 1858, 240.
Antennarius bigibbus, Günther, Cat., III, 199, 1861 (Madagascar); Günther, Fische der Südsee, V, 165, taf. CV, fig. B. 1876 (Paumotu, Sandwich, and Huahuie islands); Jenkins, Bull. U. S. Fish. Comm., XXII, 1902 (Sept. 23, 1903), 511 (Honolulu); Snyder, op. cit. (Jan. 19, 1904), 537 (Honolulu).

436. Antennarius drombus Jordan & Evermann. Plate 64.

Head (to end of opercle) 2.5 in length; depth 1.75; eye 5 in head; snout 4; width of mouth 2; D. I–I–12; A. 7; P. 12; V. 5.

Body very deep, compressed, back elevated; head deep, with blunt conic profile in front, somewhat oblique above; snout broad, obtuse, surface uneven; mouth broad, large, nearly vertical; maxillary concealed under skin, reaching below anterior part of eye; lips fleshy; teeth in jaws minute, in narrow bands; teeth on palatines rather large, sharp-pointed, none on vomer; tongue broad, thick; mandible large, with fleshy knob at symphysis, projecting; nostrils circular, well separated, with rounded fleshy rims; interorbital space convex, roughened; top of head with rather large concave pit; eye high, anterior; bait rather short, only reaching a little beyond first spine, with fleshy caruncle at extremity; dorsal spines short, first free, rough, depressible in pit on top of head; second dorsal spine twice length of first, equal to width of mouth, depressible, and united with skin of back to its tip; posterior dorsal rays longest, and the last, like that of anal, united to caudal peduncle by a membrane; anal similar, rounded, elongate, 1.5 in head; pectoral broad; ventral small, rounded; caudal peduncle small, compressed, its depth equal to interorbital space; body rather rough, mucous pores on head and in lateral line with excrescences; side of body with many pointed cutaneous flaps; second dorsal spine and first dorsal ray very rough, also with cutaneous flaps; lateral line very convex, running down toward middle of base of anal.

Color in alcohol, pale plumbeous gray, more or less spotted or mottled with darker; belly and lower surface rather pale, the spots distinct; fins all more or less pale with dark spots, some at basal portions of dorsal and anal darker; iris blackish with radiating lines of golden.

The above description is from the type, No. 50659, U. S. N. M. (field No. 541), taken at Waikiki, near Honolulu.

Another example (field No. 539) shows some differences: Head (to end of opercle) 2.5 in length; depth 1.7; eye 3 in head; maxillary 1.8; width of mouth 1.7; interorbital 3.7; D. I–I–12; A. 7; P. 12; V. 5.

Body very deep, compressed, back elevated; head deep, gibbous, with blunt conic profile in front, somewhat oblique above; snout broad, obtuse, short, surface uneven; mouth large, obliquely vertical; maxillary large, reaching a little beyond front portion of eye; lips fleshy; teeth in jaws minute, sharp, in bands; teeth on roof of mouth large, sharp-pointed; tongue large, broad, thick; mandible large, with knob at symphysis, projecting; nostrils well separated, close to end of snout, each with elevated fleshy rims, the anterior higher; interorbital space broad, elevated, uneven; top of head with rather large pit; eye high, anterior; bait short, reaching tip of first dorsal spine, with caruncle at extremity;

dorsal spines short, depressible; first dorsal spine half length of second, free, depressible in pit on top of head; second dorsal spine large, joined by skin to its tip; dorsal rays of about equal height, seventh 1.3 in head, and the last, like lower portion of last anal ray, adnate to caudal peduncle by a membrane; anal rounded; caudal elongate, rounded; pectoral broad; ventral small; body rather rough, mucous pores on head and lateral line with excrescences; many cutaneous flaps along the lateral line and anterior region of dorsal; lateral line convex, running down to above middle of anal.

Color in alcohol, dark gray-brown; edges of vertical fins whitish, the pale border rather broad and very distinct along posterior, dorsal, anal, and caudal rays; side with about 6 large round blackish spots; caudal with some pale or indistinct mottlings; pectoral and ventral with rather broad margins, median portion dusky; iris more or less silvery.

A. drombus seems most nearly related to *A. nummifer* Cuvier & Valenciennes, originally described from Malabar. Probably the specimens from the South Seas referred to the latter belong rather to *A. drombus*. *A. nummifer* is said to be red in color with dark spots, and, as figured by Doctor Day, differs in several respects from *A. drombus*. Both these species differ from *A. commersonii* and its numerous allies or variants (*A. niger*, *A. leprosus*, *A. rubrofuscus*, and *A. sandvicensis* from Hawaii) in the shortness of the first dorsal spine or fishing rod. This is scarcely longer than the second spine in *A. drombus*, but in *A. commersonii* it is twice as long.

Our collections contain but 2 examples of this species, the type, No. 50659, U. S. N. M. (field No. 541), and cotype, No. 7472, Stanford Univ. Mus. (field No. 539), both taken on the reef at Waikiki, near Honolulu. This species is also known from Samoa, where it was obtained by Jordan and Kellogg.

Antennarius drombus Jordan & Evermann, Bull. U. S. Fish Comm., XXII, 1902 (April 11, 1903), 207, **Honolulu.**

437. Antennarius duescus Snyder. Plate 65, fig. 2.

Head, body, and fins, except the edges of the latter, covered with bifid and trifid prickles; small dermal filaments scattered here and there, a conspicuous one, somewhat longer than diameter of eye, above and a little behind base of pectoral; gill-opening small, circular, located far back, half way between axil of pectoral and anal opening; "bait" slender and hair-like, the length equal to depth of caudal peduncle, the fleshy tip a flat, folded membrane with minute tentacles; first dorsal spine seated close to "bait," slender, without a membrane, its shaft covered with minute granules, the tip with a small, fleshy knob, slightly shorter than the "bait," not quite reaching base of second when depressed; second spine strong, curved backward, its length equal to distance between gill-opening and anus, capable of free movement up to a vertical position, the posterior membrane fleshy; dorsal rays 12, the highest contained 3 times in base of fin; fin extending far posteriorly, the length of the free caudal peduncle equal to diameter of pupil; anal rays 7, equal in length to those of the dorsal; caudal rounded posteriorly, its length contained 3.5 times in head and body.

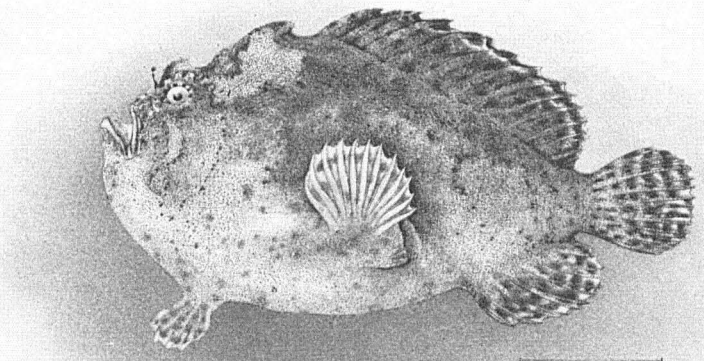
Color in spirits, pale brick red, the dorsal, anal, and caudal darker on the edges; rayed portion of pectorals and ventrals gray below, dusky above; head and body sparsely clouded and spotted with dusky and gray; a large, irregular crossband on chin, extending upward a little beyond mouth; a dusky cloud above pectoral; a large, gray spot, bordered with dusky, on the head between snout and pectoral; a small, ocellated gray spot below the latter, and a similar one on body midway between gill-opening and dorsal fin; caudal peduncle with a narrow, vertical, gray band bordered with dusky; mouth immaculate within; prickles white.

In life, purplish lilac throughout (the color of the algæ brought up in the trawl), save for a few pinkish spots and the tips of pectorals and ventrals, which were whitish.

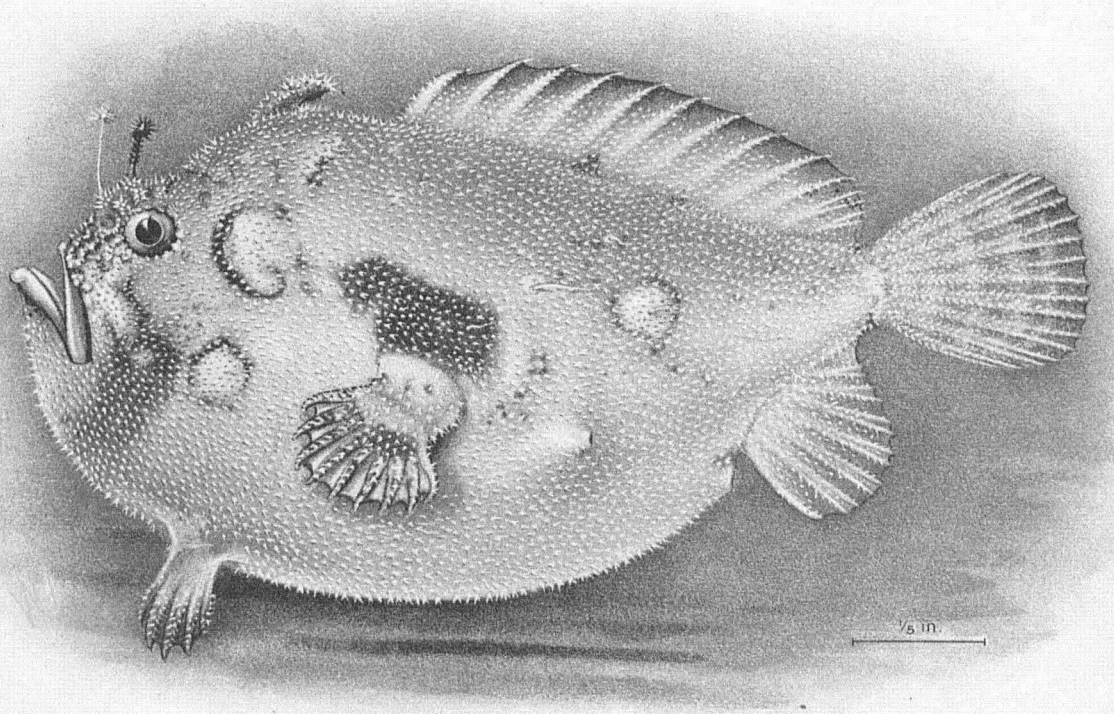
Described from type, No. 50884, U. S. Nat. Mus., 1.8 inches long. A smaller specimen, 0.75 of an inch long, cotype, No. 7736, Stanford Univ. Mus., differs from type only in size; in life it was light bronze colored on upper parts, yellowish bronze below, a wide pinkish crescent on upper part of opercles. Station 3872, between Maui and Lanai, depth 32 to 43 fathoms. Another specimen, 0.75 of an inch long, is from station 4128, vicinity of Kauai, depth 75 fathoms; the body is brownish black except on the nape, where there is a small cloud of reddish color; fins narrowly edged with red.

The species is distinguished by the following set of characters: First and second dorsal spines with thickened fleshy tips; dorsal and anal extending far posteriorly, length of free caudal peduncle equal to diameter of pupil; gill-opening located midway between axil of pectoral and the anal opening.

Antennarius duescus Snyder, Bull. U. S. Fish Comm., XXII, 1902 (Jan. 19, 1904), 537, pl. 13, fig. 24, **Albatross Station 3872, between Maui and Lanai.**



1. ANTENNARIUS NEXILIS SNYDER.



2. ANTENNARIUS DUESCUS SNYDER.

A. HOEN & CO., LITH.

438. Antennarius nexilis Snyder. Plate 65, fig. 1.

"Bait" short, equal in length to longitudinal diameter of eye, the fleshy tentacle half as long as the rod, with 7 filaments. First spine curved backward, its length equal to 1.5 times the longitudinal diameter of eye; when depressed, the tip not reaching over half way between its base and the base of second spine, no membrane connecting posterior part of spine with the head; second dorsal spine equal in length to distance between its base and tip of snout, very closely bound down throughout its length to the back, the tip with a movable joint; soft dorsal with 12 rays, the middle ones equal in height to distance between tip of snout and base of third spine; fin extending posteriorly to bases of caudal rays; anal rays 7, equal in length to the dorsal rays; edge of fin rounded, extending posteriorly as far as the dorsal; caudal rounded posteriorly, 3.5 in the length; pectoral rays 12.

Body and fins covered with granules and prickles, the latter usually bifid or trifid, many of them having fleshy tentacles; a lateral line of pores begins on snout, passes over eye, curves downward to a level with lower margin of eye, extends backward to a point below base of second or third dorsal ray, then bends downward and backward to a point above the origin of anal, from which it runs backward to lower edge of base of caudal; another line of conspicuous pores extends from the chin downward, curving far below the mouth, then upward, joining the lateral line behind the eye; other large pores are present on the chin and head.

Color gray, with duksy spots and clouds, large and close together on the dorsal parts of body; eye with radiating dark and light elongate spots; a large, irregular, reddish orange spot on the nape; a few small spots of same color on snout and face; fins closely covered with black spots a little larger than the pupil, the membranes of the fins near their edges white; pectorals and ventrals white and almost without spots on ventral sides; inside of mouth without dark color.

The description is from the type, No. 50883, U. S. Nat. Mus., taken at Honolulu. In another example, cotype, 7735, Stanford Univ. Mus., the upper parts of the head and body are almost covered with reddish clouds, the tint more intense anteriorly. First spine 1.33 times as long as diameter of eye.

Antennarius nexilis Snyder, Bull. U. S. Fish Comm., XXII, 1902 (Jan. 19, 1904), 537, pl. 13, fig. 23, **Honolulu.**

Genus 266. CHAUNAX Lowe.

Head very large, depressed cuboid; mouth large, subvertical, jaws and palate with bands of small teeth; skin with small, sharp spines; spinous dorsal reduced to a small tentacle above the snout, retractile into a groove; soft dorsal moderate, low; anal short; ventrals small; gills 2½; no pseudobranchiæ; muciferous channels very conspicuous; lateral line prominent, undulate; another series of mucuous tubes extending from lower jaws to axil, and still another backward from snout and maxillary to a point behind eye, where it ceases, uniting with a vertical line which extends from the lateral line to the lower line; these lines thus inclose a quadrate area on the cheek; gill-openings small, well behind pectoral under front of soft dorsal.

The single Hawaiian species of this genus is fully described in Section II.

Chaunax Lowe, Trans. Zool. Soc. Lond., III, 1846, 339 (*pictus*).

Family CVIII. CERATIIDÆ.—The Sea-Devils.

Head and body compressed; mouth terminal, more or less oblique; gill-openings small, in the lower part of the axils; no pseudobranchiæ; spinous dorsal represented by one or more tentacles; pectoral members not geniculated, with short pseudobrachia and 3 actinosts; no ventral fins; fishes of the open seas, usually inhabiting considerable depths; uniform blackish in color.

The single Hawaiian genus and species of this family are fully described in Section II.

Family CIX. OGCOCEPHALIDÆ.—The Bat-Fishes.

Head very broad and depressed, the snout more or less elevated, the trunk short and slender. Mouth not large, subterminal or inferior, the lower jaw included; teeth villiform or cardiform. Gill-openings very small, above and behind the axils of the pectoral fins. Body and head covered with bony tubercles or spines. Spinous dorsal reduced to a small rostral tentacle, which is retractile into a cavity under a prominent process on the forehead; in one genus the rostral tentacle is obsolete; soft

dorsal and anal fins small and short; ventrals well developed; pectoral fins well developed, the base strongly angled, with long pseudobrachia and 3 actinosts. Branchiostegals 5, no pseudobranchiæ.

a. Disk with the frontal region elevated, and the snout more or less produced fo: ward; the tail stout; orbits lateral; teeth on vomer and palatines; rostral tentacle present ....*Malthopsis*, p. 524

aa. Disk with the frontal region depressed, not elevated above the rest; eyes r tly superior; snout rounded, obtuse in front; tail slender.

c. Disk subcircular; gills 2½; mouth rather large, subvertical; prickles rather trong .....*Halieutæa*, p. 525

cc. Disk subtriangular; gills 2; prickles very strong ....*Dibranchus*, p. 525

Genus 267. MALTHOPSIS Alcock.

Resembling *Ogcocephalus*, but having only 2 gills on each side instead of 2.5. (Goode & Bean.)

Malthopsis Alcock, Ann. & Mag. Nat. Hist. 1891, 26 (*luteus*).

439. Malthopsis mitriger Gilbert & Cramer. Fig. 229.

Branchiostegals 4; D. I, 4 or 5; A. 4; P. 14; V. 1, 5; pores of lateral line behind disk 9.

Disk strongly depressed, triangular, its greatest width (exclusive of the posterior lateral projections) 1.66 in length of body exclusive of caudal, its depth about 4; body behind disk tapering nearly uniformly; body nearly everywhere covered with radially striated tubercular plates; gular region and

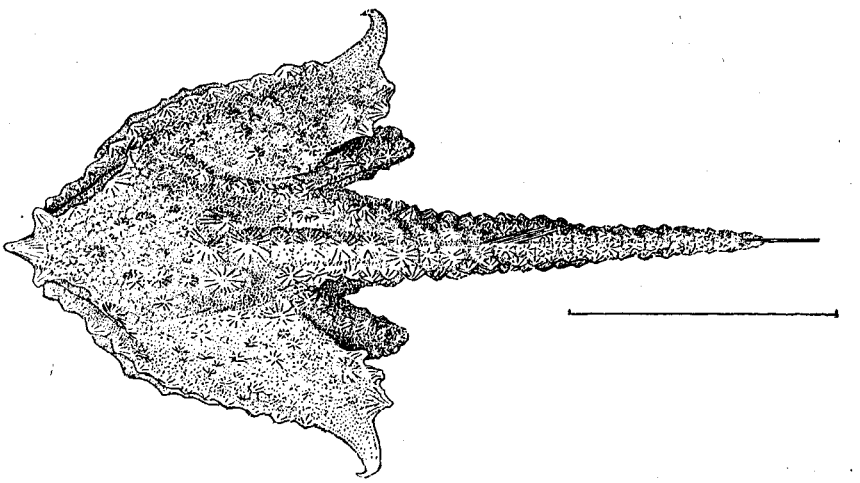


FIG. 229.—*Malthopsis mitriger* Gilbert & Cramer; from the type.

branchiostegal membranes naked; vent in center of a naked, somewhat elliptical basin surrounded by a ridge of tubercles; a shallow pit behind base of ventrals; head vertical in front; the tentacular pit triangular, higher than wide, its upper angle on level with upper edge of pupil, the pit surmounted by a large conical median tubercle projecting upward and slightly forward, the length about 2 in orbit; at each side of this tubercle a smaller one projecting upward and outward; the club-shaped tentacle when extended not quite reaching front of upper jaw; eyes large, the orbits strongly convergent, distance between their anterior edges 2.5 in distance between their posterior edges; mouth somewhat oblique; bands of very minute teeth on jaws, vomer, and palatines; width of mouth and diameter of orbit about equal; gills 2 on each side, only a narrow membrane on first arch; gillrakers minute; subopercular spine flat, long, extending laterally and armed at tip with 2 to 5 small spinelets; pectoral about 4.5 in length of body, the rays very close-set; ventrals about 7 and caudal 6 in length of body; vertical fins weak. Color in alcohol, body and all the fins pale yellowish; peritoneum dusky. In water of moderate depths about the Hawaiian Islands.

Malthopsis mitriger Gilbert & Cramer, Proc. U. S. Nat. Mus., XIX, 1897 (Feb. 5, 1897), 434, pl. XLVIII, figs. 1, 2, Albatross Sta. 3467, 3472, or 3476 (type, No. 47709 U. S. N. M.).

Genus 268. HALIEUTÆA Cuvier & Valenciennes.

Head very large, broad, depressed, its outline nearly circular; cleft of mouth wide, horizontal; jaws with small cardiform teeth; no teeth on vomer or palatines; skin everywhere covered with small stellate spines; forehead with a transverse bony ridge, beneath which is a tentacle, retractile into a cavity, the only rudiment of the spinous dorsal fin; soft dorsal and anal very short, far back; gills $2\frac{1}{2}$, the anterior gill-arch without laminæ. Branchiostegals 5; vertebræ 17. Pacific Ocean.

The single Hawaiian species of this genus is fully described in Section II.

Halieutæa Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 455, 1837 (*stellatus*).

Genus 269. DIBRANCHUS Peters.

Head merged in body, very large, much depressed, forming a broadly ovate disk, with margin laterally prolonged; cranial portion not elevated; the interorbital area low, narrow, with orbits partly superior; supraoral cavity large, protected above by a transverse bony ridge; mouth terminal, horizontal, wide; lower jaw convex; teeth in cardiform bands, none on vomer or palatines; gills 2, no gill-rakers, gill-openings small, anterior to pectorals; rostral tentacle retractile, trilobate at tip; skin with numerous strong stellate spines above and below, those at margins of disk especially strong, 3-pointed. Distinguished from related genera by the reduction of the gills to 2 pairs.

The 2 Hawaiian species of this genus are fully described in Section II.

Dibranchus Peters, Monatsber. Kon. Ak. Wiss. Berlin, 1876, 736 (*atlanticus*).

INTRODUCTION OF ADDITIONAL SPECIES.

The fresh waters of the Hawaiian Islands are too limited to justify extensive experiments in acclimatization. The streams are necessarily short, and during the rainy season they become raging torrents, while in the dry season they are either totally dry or else a series of stagnant pools. The principal streams are on Kauai, Oahu, and Hawaii. The only native fishes in the streams are species of gobies, known collectively as oopu, which have some value as food, but which are not highly esteemed. Opae, or shrimp, are also abundant.

The waters among and adjacent to the islands teem with fishes and other denizens of the sea, however, but in spite of this fact numerous efforts have been made to introduce additional species.

Black bass.—During the summer of 1897 a number of the citizens of Hilo procured a shipment of black bass from the California Fish Commission. In October 90 of them (about 6 inches in length) were shipped from San Francisco on a sailing packet, and 55 were living when the vessel arrived at Hilo. Through some oversight they remained on board several days, 34 of them dying in the meantime. The remaining 21 were at last planted in the Wailuke River near Rainbow Falls, but the next day there was a heavy freshet in the river, and as the fish were never seen again it is supposed they were unable to resist the torrent and were swept out to sea and destroyed.

The large-mouthed black bass would probably thrive in the fresh-water ponds, and as these waters are filled with shrimp there would be an abundant food supply for them, and the temperature and other conditions would seem to be fairly favorable.

Carp (*Cyprinus carpio*) were introduced some years ago, and are now found on the islands of Maui and Kauai. On the former they are quite common in the irrigation reservoirs and ditches near Wailuke, where they were first planted, but are not often sold, as owing to their muddy flavor they are popular only with the Japanese and Chinese, who catch and eat them. On Kauai they are found in irrigation ditches and in a few of the fish ponds, and are sold principally to the Japanese and Chinese.

Cat-fish.—About 10 years ago the late Charles Arnold, of Hilo, introduced the common bullhead (*Ameiurus nebulosus*), which he secured from California and placed in various ponds near Hilo, but none has ever been seen since. Another species of catfish (*Clarias magur*) was introduced from China a few years ago and is now occasionally found in the fresh waters near Honolulu.

China-fish (*Ophicephalus striatus*).—This species, brought by the Chinese from China, is now fairly common in the vicinity of Honolulu. It is commonly found in the irrigation ditches and fresh-water ponds and generally sold alive to the Chinese.

Gold-fish (*Carassius auratus*).—These fish were introduced originally from China, but there is no record as to the date. As early as 1867 shipments were being made to San Francisco. They are raised principally in the irrigation ditches around Honolulu, but a few are also found on the larger of the other islands, especially on Maui, near Wailuke. They are sold alive in the market, and are eaten mainly by the Chinese and Japanese.

Salmon.—In 1876 some salmon and trout eggs were sent to Honolulu by the California Fish Commission in exchange for 100 awas, which it was designed to plant in California waters. There is no record of the outcome of the experiment.

Trout.—The first attempt to introduce trout was that above mentioned, in 1876. In 1894 a consignment of 1,000 brook trout (*Salvelinus fontinalis*) was secured from the California Fish Commission and planted in Waimea River, on Kauai, but the fish were soon lost sight of. Similarly, nothing was ever seen or heard of a dozen trout brought to Hilo in 1896 and planted in Wailuke River near Rainbow Falls. As the streams either dry up entirely in the dry season, or become mere pools, in which the water gets very warm, they are not suited to trout, which require pure, cold water.

Frogs.—The date of the introduction of frogs is uncertain, but it is known that some were brought to the islands previous to 1867. During that year a shipment from California was placed in the fresh waters around Honolulu. In the Honolulu Pacific Commercial Advertiser, under date of September 4, 1869, appeared the following item:

> Mr. C. P. Ward has imported a few frogs and placed them in a pond at "Sunny South," his country residence at Pawaa [Oahu]. Some years since the agricultural society introduced some, which were placed in taro patches near Dr. Hillebrand's residence, and soon disappeared—supposed to have been killed by the rats.

In October, 1879, a shipment of 6 dozen frogs, brought from Contra Costa County, Cal., in a barrel with a little water, was landed at Hilo. The frogs were of two varieties, one dark green and the other mottled, and were planted in various places around Hilo, where they soon became abundant. In 1900 a few were taken for market, and the following year a few were shipped to Honolulu. It is probable that catching them for market will soon prove remunerative.

Frogs were soon introduced on most of the other islands, and are said to have greatly assisted in the decrease of sickness among the numerous herds of cattle, particularly on Kauai, by keeping stagnant pools clean and eating the fluke (*Fasciola hepatica*), a worm which infests the grass and slime in and around the pools. Cattle and sheep eating the grass swallow the fluke, which works its way into the liver, sometimes killing the animal. Frogs have also assisted materially in thinning out some of the noxious insects.

Terrapin.—A species of terrapin was introduced by the late Charles Arnold, of Hilo, about 1890. Several individuals have been caught since, but nothing has been seen or heard of any during the last few years.

Oysters.—Although it had been transplanted to the Pacific coast, it was not at first supposed that the eastern oyster would stand transportation as far as Honolulu. An attempt was apparently made in 1871, but without any important results.

In 1883 Mr. Allan Herbert, of Honolulu, purchased 300 eastern oysters at San Francisco and planted them at Kalihi, but a heavy freshet from the stream covered

them up. Again, in 1893, the matter was taken up by Hon. John F. Colburn, of Honolulu, who writes as follows regarding his experiments:

In the month of October, 1893, I imported from Mr. M. B. Moraghan, of San Francisco, three cases of oysters for the purpose of planting. Two of the cases contained about 1,000 Eastern transplanted, and one case contained about 3,000 of the native California. They were brought down on the steamship *Australia*, in the ice house, and arrived in apparently good order. I at once had them removed to my pond at Manana Ewa, and planted in a depth ranging from 1 foot to 2 feet of water.

Some three months after I made a thorough search of the different places where I had planted oysters, and found that the native California were all dead, and of the Eastern transplanted about 50 per cent were still living, though considerably sunk into the soft mud at the bottom of the pond. I had these taken up and put down again, and some three months afterwards I examined them again and found they had started to grow; the new shell forming was easily noticeable. I continued my practice of taking them up at different intervals of time until the early part of 1895, when I was so elated with the prospect of my success that I made arrangements with Mr. Moraghan to send me down more Eastern transplanted, with two objects in view: (1) To have fresh eastern oysters to supply the oyster eaters of our city, and (2) to have them answer for the purpose of seed for propagating.

I imported 38,614 from San Francisco by the steamship *Australia*, having them come in five different trips of the vessel. About two-thirds were brought down on the open deck in boxes, and were wet down every morning when decks were being washed down. The balance came in the ice house. With the former way my loss was more in number, but the latter way was the most expensive. On deck I could get the oysters landed for about $10 a ton measurement, but through the ice house the charges were 5 cents a pound for freight.

As fast as the oysters would arrive I would have them sent down to my pond and laid out. In a month or so afterwards they would get very thin and be unfit for the market. However, I allowed them to recuperate by getting acclimated to the conditions of my pond as well as to the food.

In the latter part of 1895 I discovered young oysters clinging to stones and dead oyster shells. I have watched them very carefully, and at different intervals of this year I have found more young ones. Of course, the young are not as many as I would like to see, still I trust that in time I will be able to boast of a bed of Hawaiian oysters reared from the seed of the American eastern oyster. From those I have imported I am in a position to furnish to those desiring oysters a mess of them fresh from the water. The last lot has been now about eighteen months in my pond, and are in fine and fat condition, having grown twice their original size.

Fresh sea water empties into my fish pond through gates, and a large spring of fresh water also runs into it, thereby making the water a little brackish.[a]

During the last few years very little attention has been paid to the beds, and there are but few oysters left on them now, but in 1901 there was considerable agitation of the subject of oyster planting among some of the leading white and native citizens, with the prospect that the industry would be taken up and established on a paying basis.

DESCRIPTIONS OF PRINCIPAL INTRODUCED SPECIES.

Order NEMATOGNATHI.—The Catfishes.

Parietals and supraoccipital confluent; 4 anterior vertebræ coössified, and with ossicula auditus or weberian apparatus; no mesopterygium; basis cranii and pterotic bone simple; no coronoid bone; third superior pharyngeal bone wanting, or small and resting on the fourth; second directed backward; 1 or 2 pairs of basal branchihyals; 2 pairs of branchihyals; suboperculum wanting, or modified into the uppermost branchiostegal; mesocoracoid present; premaxillary forming border of mouth above, except in one family, Diplomystidæ, in which the maxillaries also bear teeth; interclavicals present; no scales; skin naked or with bony plates.

[a] Report on the work of the Steamer *Albatross*, by Lieut. Com. J. F. Moser, U. S. N. Report of Commissioner of Fish and Fisheries for 1897.

"This division is the nearest ally to the sturgeons (Chondrostei) among Physostomous fishes, and I imagine that future discoveries will prove that it has been derived from that division by descent. In the same way the Isospondylous fishes are nearest the Halecomorphi, and have probably descended from some Crossopterygian, near the Haplistia, through that order. The affinity of the catfishes to the sturgeons is seen in the absence of symplectic, the rudimentary maxillary bone, and, as observed by Parker, in the interclavicles. There is a superficial resemblance in the dermal bones." (Cope.)

This group comprises the *Siluridæ* and their relatives, now divided into several families by Dr. Gill.

Two families are represented among the species introduced in Hawaiian waters:

a. Dorsal and anal fins elongate; each of many rays ..... *Clariidæ*, p. 530
aa. Dorsal and anal fins much shorter, the former usually of fewer than 10 rays ..... *Siluridæ*, p. 531

Family CLARIIDÆ.

Body oblong or elongate, and naked; head depressed, furnished with long barbels; mouth terminal, teeth villiform or granular; body naked; opercle present; dorsal and anal nearly coextensive with the caudal portion of the vertebral column; gill-membranes not confluent with the skin of the isthmus, remaining separate to the chin; dorsal fin uniformly composed of feeble rays, or its posterior portion modified into an adipose fin; intestine short, arranged in longitudinal folds. Confined to tropical Africa, Asia, and the East Indies.

Genus CLARIAS (Gronow) Scopoli.

Body oblong, compressed and elongate; head depressed, broad; eye small, with a free orbital margin; cleft of mouth transverse, anterior, of moderate width; jaws each with a band of villiform teeth, and a band of villiform or granular teeth across the vomer; one pair of nasal, one of maxillary and 2 pairs of mandibulary barbels; upper and lateral parts of head osseous, or covered with only a very thin skin; dendritic, accessory branchial organ attached to convex side of second and fourth branchial arches, and received in a cavity behind the gill-cavity proper; dorsal long, extending from neck to caudal; anal long; pectoral with a pungent spine; ventrals 6-rayed; adipose fin none. Tropical Africa, Asia, and the East Indies.

Clarias Gronow, Zoophyl., 100, 1763 (nonbinomial).
Clarias Scopoli, Introd. Study Nat. Hist., 1777.
Macropteronotus Lacépède, Hist. Nat. Poiss., V, 84, 1803 (*charmuth*).

Clarias fuscus (Lacépède).

Head (measuring from tip of snout to opercle) 5.2; depth 5; D. 64; A. 46; P. 1, 9; V. 6; space between origin of dorsal and occiput 6.3 in the space between the latter and tip of the snout; width of head 1.3 in its length (to end of occiput); interorbital space a little over 2, about 2.17 in head (to end of occiput); width of head 1.3; snout 4.5; pectoral 2.25.

Body oblong, rather short and compressed; head rather small, broad and depressed; snout very broad, rounded and depressed; eye very small and anterior; mouth broad, nearly terminal, edge of snout projecting very slightly beyond mandible; lips and lower surface of maxillary barbels strongly papillose, though the former are rather thin; barbels all well developed, the longest, which are the maxillaries, not reaching base of ventrals; all the others at least as long as head; teeth in villiform bands in jaws and on vomer; anterior nostrils in small tubes near tip of snout, the posterior pair directly behind base of nasal barbels, with narrow short flaps; interorbital space and top of head convex; gill-openings broad; fontanelle rather large, the anterior elongate and shaped like a spear-head, the point reaching between the eyes; top of head smooth; pores along lateral line some little distance apart, forming a series slightly decurved, a short distance at first to middle of side and then straight to base of caudal; origin of dorsal about midway between bases of pectoral and ventral, of more or less uniform height and not continuous with caudal; origin of anal a trifle nearer base of caudal than tip of snout; caudal 1.75 in head to end of occiput; pectoral reaching origin of dorsal or a trifle beyond, and the spine, which has its outer edge with a number of small denticulations, two-thirds the length of the fin; ventrals small, a short distance in front of anal, and reaching quite a little distance beyond.

Color in alcohol, brown, all the fins more or less dark, and the lower surface of head and belly pale or soiled whitish; side of body with a number of small and rather indistinct pale round dots forming 10 or more vertical series and joined below by a longitudinal series which runs along the lower part of the trunk.

Described from an example 5.25 inches long, collected at Honolulu, where the species has been introduced from China, in all probability, by the Chinese.

Macropteronotus fuscus Lacépède, Hist. Nat. Poiss., V, 88, pl. 2, fig. 2, 1803, **China.**
Clarias fuscus, Günther, Cat., V, 18, 1864.
Clarias pulicaris Richardson, Voy. Sulp., Fish., 135, pl. 62, figs. 5 and 6, 1844-5.

Family SILURIDÆ.—The True Catfishes.

Body more or less elongate, naked or covered with bony plates; no true scales; anterior part of head with 2 or more barbels, the base of the longest pair formed by the small or rudimentary maxillary; margin of upper jaw formed by premaxillaries only; subopercle absent; opercle present; dorsal fin usually present, short, above or in front of the ventrals; adipose fin usually present; anterior rays of dorsal and pectoral usually spinous; air-bladder usually present, large, and connected with the organ of hearing by means of the auditory ossicles; lower pharyngeals separate.

After the removal of numerous aberrant forms as distinct families, the family of *Siluridæ* contains more than 100 genera and upward of 900 species. Most of them are fresh-water fishes, inhabiting the rivers of warm regions, particularly South America, North America, and Africa; comparatively few are marine and these few are mostly tropical; especially characteristic of the Amazon region in South America. No fish of this family is native to the Hawaiian Islands; the only species now occurring there was introduced from the United States.

The siluroid recorded from the Hawaiian Islands by Günther under the name of *Arius dasycephalus* (Cat. Fish. Brit. Mus., V, 157, 1864), belongs to the genus *Galeichthys* (*Hexanematichthys*) and doubtless came from Panama.

Genus AMEIURUS Rafinesque.

Body moderately elongated, robust anteriorly, the caudal peduncle much compressed; head large, wide; supraoccipital extending backward, terminating in a more or less acute point, which is entirely separate from the second interspinal buckler; skin covering the bones thick; eyes rather small, but developed; mouth large, the upper jaw in most species the longer; teeth in broad bands on the premaxillaries and dentaries; band of upper jaw convex in front, of equal breadth, and without backward prolongation at the angle; dorsal between the pectorals and ventrals higher than long, with a pungent spine and about 6 branched rays; adipose fin short, inserted over the posterior half of the anal; anal fin of varying length, with 15 to 35 rays, the usual number being 20 or 21; caudal fin short, truncate in typical species, more or less forked in those species which approach the genus *Ictalurus;* ventrals each with one simple and 7 branched rays; pectoral fins each with a stout spine which is commonly retorse-serrate behind; lateral line usually incomplete. Species very numerous, swarming in every pond and sluggish stream in the eastern United States; especially characteristic of quiet waters.

Ameiurus nebulosus (Le Sueur). *Common Bullhead.*

Head 3.7 in length; depth 5; eye 7.5 in head; snout 3; D. 1, 7; A. 20, its base 5 in body.

Body elongate, tapering posteriorly; head broad; eye small; mouth large, lower jaw included; maxillary barbel reaching base of pectoral; humeral process nearly equaling snout; least depth of caudal peduncle equal to snout; origin of dorsal fin midway between tip of snout and adipose fin.

Color in alcohol, dark above, mottled on sides, pale below; barbels all dark; dorsal dark; caudal, anal, pectorals, and ventrals paler.

Description from a specimen 13 inches long, taken in a rice ditch at Honolulu. Other specimens are in the collection made by Doctor Jenkins.

This is the common bullhead, so abundant and generally distributed throughout the eastern United States in lakes, ponds, and sluggish streams, from the Great Lakes to Texas and Florida and east to Maine. Some years ago it was introduced into the Sacramento, San Joaquin, and Gila rivers and other

waters of the Pacific coast of the United States, and from California into the Hawaiian Islands, where it is now a common fish in the ponds, rice ditches, and more sluggish streams on Oahu and Hawaii.

Pimelodus nebulosus Le Sueur, Mém. Hist. Nat. Paris, V, 149, 1819, **Lake Ontario.**
Amiurus nebulosus, Gill, Proc. Bost. Soc. Nat. Hist., VIII, 1861, 44; Jordan & Evermann, Fishes North & Mid. Amer., I, 140, 1896.

Order EVENTOGNATHI.—The Carps.

Plectospondylous fishes with the lower pharyngeal falciform, parallel with the gill-arches; 2 upper pharyngeal bones; brain-case produced between orbits; jaws without teeth; dorsal fin present; no adipose fin; ventrals abdominal; gill-openings restricted, the gill-membranes attached to the isthmus. Streams and lakes of North America, Europe, and Asia, the species excessively numerous.

Family CYPRINIDÆ.—The Carps.

Cyprinoid fishes with the margin of the upper jaw formed by the premaxillaries alone and the upper pharyngeal bones well developed, falciform, nearly parallel with the gill-arches, each provided with 1 to 3 series of teeth in small number, 4 to 7 in the main row, and a smaller number in the others, if more are present; head naked; body scaly except in a few genera; barbels 2 or 4, or absent; belly usually rounded, rarely compressed, never serrated; gill-openings moderate, the membrane broadly joined to the isthmus; branchiostegals always 3; gills 4, a slit behind the fourth; pseudobranchiæ usually present; no adipose fin; dorsal fin short or elongate; ventral fins abdominal; air-bladder usually large, commonly divided into an anterior and a posterior lobe, not inclosed in a bony capsule, rarely wanting; stomach without appendages, appearing as a simple enlargement of the intestines. Fishes mostly of moderate or small size, inhabiting the fresh waters of the Old World and of North America.

Genus CARASSIUS Nilsson.

Body oblong, compressed and elevated; mouth terminal, without barbels; teeth 4–4, molar but not compressed; scales large; lateral line continuous; dorsal fin very long, with the third ray developed into a stout spine, which is serrated behind; anal short, with a similar spine; ventrals well forward. Large fishes of the fresh waters of Europe and America.

Carassius Nilsson, Prodromus Ichthy. Scand., 1832 (*carassius*).

Carassius auratus (Linnæus). Goldfish.

D. II, 18; A. II, 7; scales 26; teeth 4–4.

Body stout, covered with large scales; dorsal and anal fins with the spines strong, coarsely serrated. Coloration olivaceous, usually orange, or variegated in domestication. Length 12 inches. China and Japan, and introduced into the Hawaiian Islands.

We have specimens from Honolulu, Heeia, a stream at Moanalua, and Kilihi Creek. The variations are innumerable.

Cyprinus auratus Linnæus, Syst. Nat., Ed. X, 322, 1758, **China; Japan.**
Carassius auratus, Günther, Cat., VII, 32, 1868.

Family OPHICEPHALIDÆ.

Body elongate, anteriorly subcylindrical, covered with scales of moderate size; head depressed, covered with shield-like scales superiorly; lateral line with an abrupt curve, or subinterrupted; cleft of the mouth lateral, wide; teeth in the jaws and on the palate; eyes lateral; gill-opening wide, the gill-membranes of both sides joined below the isthmus; 4 gills; pseudobranchiæ none; a cavity accessory to the gill-cavity for the purpose of retaining water, a superbranchial organ not being developed; air-bladder present; one long dorsal and an anal fin, without spines; ventral fins absent, or thoracic, and composed of 6 rays, the outer of which is not branched; vertebræ in considerable number (52–61); the caudal vertebræ are provided with ribs, the abdominal cavity being continued to below the caudal portion.

Genus OPHICEPHALUS Bloch.

Ventral fins present; pyloric appendages 2; fine teeth in the jaws, on the vomer and the palatine bones, sometimes intermixed with larger ones.

Fresh waters of the East Indies; one species introduced into the Hawaiian Islands.

Ophicephalus striatus Bloch.

Head 3 in length; depth 4.5; eye 8.5 in head; snout 5.9; D 42; A. 29; scales 7–59–12.

Body oblong, compressed posteriorly; head long, rather pointed; profile concurrent over eyes; mouth slightly oblique; lower jaw thick, slightly projecting; small teeth on outer edge of jaws; larger canine-like teeth in a single row and set wide apart, on inner side of each jaw; vomer with small teeth; dorsal long, its anterior base slightly behind base of pectorals, length of rays increasing posteriorly; caudal rounded; anal similar to dorsal, but not so long; tips of pectoral and ventrals nearly on same line; lateral line descending, one row of scales just posterior to vent.

Color in alcohol, dark brownish or blackish above, becoming marbled and mottled with whitish on side; top of head dark grayish; side of head lighter, with a broad gray bar from eye to opercular opening, bounded above and below by somewhat narrower black bars; under parts of head mottled with white and dark; middle of side with an irregular light longitudinal line, below which is a series of large, irregular black spots; lower part of side and belly pale, with irregular oblong black markings; caudal peduncle with a narrow black bar at base of caudal fin; vertical fins mottled with white and grayish; other fins pale.

This description from a specimen (No. 03585) 13 inches long, taken at Honolulu, where the species was introduced doubtless from Borneo.

Our collection from Honolulu contains 10 specimens, ranging in length from 6.2 to 10.5 inches.

Ophicephalus striatus Bloch, Ichthyologie, VII, 141, 1793, **Malabar.**
Ophicephalus wrahl Lacépède, Hist. Nat. Poiss., III, 552, 1801, **Coromandel; Tranquebar.**
Ophiocephalus chena Hamilton-Buchanan, Fishes of the Ganges, 62, 367, 1822, **Goyalpara, India.**