

II.—THE DEEP-SEA FISHES OF THE HAWAIIAN ISLANDS.

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The second season of investigations by the U. S. Fish Commission in the Hawaiian Islands—the period from March to August, 1902—was devoted primarily to the study of the fauna of the deeper waters. The work was conducted from the steamer *Albatross*, under the general supervision of Dr. David S. Jordan and Dr. Barton W. Evermann. The writer, as naturalist in charge, had immediate responsibility for the scientific conduct of the cruise, and was ably assisted by Prof. Charles C. Nutting, of the University of Iowa, and by Mr. John O. Snyder and Mr. Walter K. Fisher, of Stanford University.

An exhaustive survey was attempted of all offshore fishing banks, and a thorough exploration of the channels between the islands and the deeper slopes out to the 1,000-fathom line. The region to be covered included the Hawaiian Islands proper, and the series of shoals and reefs, with infrequent rock islets, which form a continuation of the Hawaiian group to the northwest. The westernmost point to be reached was the island of Laysan. As thus outlined, the area to be explored comprised a narrow strip reaching from 18° to 26° north latitude and from 156° to 172° west longitude, and extending from southeast to northwest a distance of 1,300 miles.

The investigation proved extremely difficult on account of the nature of the sea bottom, which, at all depths, was such as to render dredging very arduous and uncertain. The configuration of the ocean floor was for the most part irregular, with steep slopes. Even in those localities of limited extent where the slopes were gentle and uniform, and were covered with fine sediments, the trawl was likely at any time to encounter masses of coral, or outcroppings of lava, or even in the deeper waters consolidated oozes, all of which worked disaster to the gear and prevented successful results. Of the 344 trials with tangles, dredge, or trawl, about one-third were total failures; and many of the others were nearly barren of results. The use of the trawl for commercial fishing is out of the question in any part of this region, with the possible exception of a small district lying off the harbor of Kahului, on the island of Maui, where there is a smooth sand bottom on which a commercial trawl could be safely worked. So far as known, however, there are no market fishes to be had there in abundance, and the region is too far from any center of population.

The most successful trawling grounds for scientific purposes were found between 200 and 400 fathoms along the seaward extensions of the Pailolo and Kaiwi Channels, which lie between Maui and Molokai and between Molokai and Oahu. Toward the northeast these channels soon open upon a nearly level plateau, 10 to 15 miles in width, carrying a depth of about 300 fathoms. The sediments are fine sand and mud, and are in certain lines comparatively free from obstructions. At the seaward edge of this plateau, however, foul bottom is at once encountered, and a steep and wholly impracticable slope leads abruptly down to oceanic depths. For depths of less than 200 fathoms the richest ground discovered was undoubtedly the inter-island portion of the Pailolo Channel, where a bottom of dead shells and corallines proved very productive. Off Kahului on Maui, as already stated, and off Honolulu and Waialua on Oahu, are gentle sandy slopes where dredging is possible out to 300 fathoms, but the inshore portions are comparatively barren. Beyond 400 fathoms no satisfactory working grounds could be found in any part of this region. The best that were discovered lie off the eastern shore of Kauai. Here life was abundant and the forms discovered were of extreme interest, but the bottom had a rapid seaward slope and was treacherous. By dredging parallel with the shore line, successful hauls were occasionally made, and most of our material from depths greater than 400 fathoms came from this locality. The series of shoals to the northwest of the Hawaiian group were left practically unexplored. The single trip to Laysan Island was devoted largely to hydrographic work; hence a few dredge hauls in the vicinity of Laysan and a series near Bird Island represent the meager biological results obtained from the western portion of the cruise. No truly bathybial fishes were secured at Laysan, but the reef species and those of the shore platform out to 100 fathoms indicated the unbroken extension of the Hawaiian fauna to include these islands and shoals.

The first contribution to the knowledge of Hawaiian deep-sea fishes appeared in 1897,^a being based on the results of 8 dredge-hauls taken by the *Albatross* in 1891, in the Kaiwi Channel. Of the 26 species then secured, all but 5 were described as new. The probability entertained at that time that the slopes about the islands would be found to contain an assemblage of species largely distinct from those of any other region has been fully borne out by more extensive exploration. In the present paper there are recorded 111 species living at depths of 100 fathoms or more, and of these all are peculiar to the Hawaiian province, so far as is now known, except the 10 named below. *Squalus mitsukurii*, *Chimæra purpurescens*, and *Antigonia steindachneri* are known from Japan; *Synodus kaianus* and *Nannobranchium nigrum* are forms occurring in the East Indies; *Serrivomer beanii* and *Caulolepis longidens* are supposed to inhabit both coasts of the United States; *Antimora microlepis* is from the Pacific coast of North America; and *Neoscopelus microlepidotus* and *Sternoptyx diaphana* are species of partly pelagic habit, ranging widely in both Atlantic and Pacific. In the case of *Squalus*, *Chimæra*, and *Antimora*, it has been possible to make direct comparison of specimens; but with the others mentioned, identification is based on comparison with published descriptions and figures only.

An analysis of the list of species recorded in the present paper shows conclusively that the bathybial fishes of Hawaii, like those of its reefs and shores, have been

^aGilbert, C. H., and Cramer, Frank: Report on the fishes dredged in deep water near the Hawaiian Islands, with descriptions and figures of twenty-three new species. Proc. U. S. Nat. Mus., vol. 19, 1897, pp. 403-436, plates 36-48.

derived as a whole from the west and south, and not from the east or north. In its entire facies, the fauna is strikingly unlike that of the Pacific coast of Mexico and Central America, and resembles strongly the assemblage of forms discovered by the *Albatross* and the *Challenger* off the coasts of Japan and the East Indies. Some of its members find their nearest known affines in the Bay of Bengal. In addition to the identical species already mentioned as occurring in Japan or the East Indies, the list includes species of the following genera: *Promyllantor*, *Polyipnus*, *Macrorhamphosus*, *Ichthyocampus*, *Pegasus*, *Polymixia*, *Antigonia*, *Stethopristes*, *Cyttomimus*, *Aracana*, *Tænianotus*, *Bembradium*, *Hoplichthys*, *Bembrops*, *Chrionema*, *Pteropseron*, *Champsodon*, *Draconetta*, *Ateleopus*, *Pæcilopssetta*, *Tæniopssetta*, *Samariscus*, *Anticitharus*, *Chascanopssetta*, and *Chaunax*, all of which have close relatives in Japan, the South Seas, or the Bay of Bengal, but are quite unrepresented along the eastern shores of the Pacific. Even the more characteristically bathybial forms, such as the macrurids, indicate a similar relation, as is shown by the presence of *Gadomus*, *Melanobranchus*, *Optonurus*, *Hymenocephalus*, *Malacocephalus*, and *Trachonurus*. Among the above-named genera, *Polymixia*, *Antigonia*, *Gadomus*, *Melanobranchus*, *Hymenocephalus*, and *Malacocephalus* have close representatives in the eastern Atlantic as well as in the western Pacific, a fact of some interest when considered in connection with the known distribution of many shore forms of Japan and the South Seas, which are unrepresented along the Pacific coast of America, but are present either as identical or as closely related species in the Mediterranean and neighboring waters.

In this paper are included all the fishes obtained with the dredge, trawl, or tangles, and also the scopelids among those taken at the surface. Other pelagic forms from the surface are reserved for a subsequent paper.

Family SCYLLIORHINIDÆ.

Catulus spongiceps, new species.

Type, adult female, 50 cm. long, from station 4151, vicinity of Bird Island, depth 313 to 800 fathoms; type, No. 51590, U. S. Nat. Mus.

Length of head, exclusive of branchial area, 22 hundredths of total length; horizontal diameter of eye 3; preocular length of snout 11.5; preoral length of snout 8.5; greatest width of head 15; interocular width 10.5; length of spiracle 1, slightly exceeding its distance from eye; least distance between nostrils 4.5; length of nostril 3.5; extreme width of mouth 12.5; width of attachment of pectorals 8.5; length of anterior pectoral margin 11.5; distance between pectorals and ventrals 11.5; base of ventrals 10; distance between ventrals and front of anal 3.5; base of anal 15; base of dorsals 7; distance between dorsals 10.5; length of caudal measured below, 29.

Body compressed and deep, its greatest width about $\frac{2}{3}$ its greatest depth; head depressed, the snout flat and rather broad; snout very soft and spongy, everywhere porous, the most conspicuous pores arranged in a pair of narrowly lanceolate patches on lower side of snout, each patch containing 2 series of pores in its posterior portion and 3 anteriorly; length of the patch equal to internarial width; nasal valves widely separated, the anterior and posterior terminating in thickened rounded lobes, and bearing no cirrus; spiracles behind eye and a little below its longitudinal axis; front of upper jaw well in advance of eye, its angle slightly in advance of vertical from hinder margin of orbit; a thick fold at angle of mouth continued on lower jaw half the distance to symphysis, and along upper jaw three-fourths as far; teeth typically with 5 cusps, but sometimes with either 4 or 3; lateral cusps better developed in the lower jaw than in the upper, and stronger on the sides than in the middle of each jaw; 18 oblique rows in each side of upper jaw.

Dorsal fins of equal length and height, separated by an interval 1.5 times their length at base, which equals half the width of the mouth; anterior dorsal inserted largely above base of ventrals, not more than one-fourth its base being behind them; second dorsal originating above middle of anal fin and terminating slightly in advance of its end; base of anal fin 2.3 times that of second dorsal, and 4 times its distance from base of ventrals; pectoral with a long base, the length of which equals its distance from base of ventral; pectoral short, rounded, its tip scarcely reaching half way to base of ventrals.

Skin densely covered with minute slender spines, which bear no cusps at their bases; margins of fins and an area behind each of them naked.

Color uniform warm brown.

Only the type is known, an adult female containing a mature egg in each oviduct.

Family SQUALIDÆ.

Squalus mitsukurii Jordan & Snyder.

Station 4085, north coast of Maui, 267 to 283 fathoms.

Etmopterus villosus, new species. Plate 66.

Type, 170 mm. long, from station 3824, off the south coast of Molokai, depth 222 to 498 fathoms; type, No. 51583, U. S. Nat. Mus.

Length of head to first gill-cleft 22.5 hundredths of total length; interorbital width 8; preoral length of snout 11; preocular length of snout 8; least distance between nostrils 4; longitudinal diameter of orbit 7; distance between spiracles 7.5; width of mouth 11; distance from tip of snout to first dorsal spine 38; length of first dorsal spine 5; base of first dorsal 6; space between dorsals 16; length of second dorsal spine 8; base of second dorsal 6; length of upper caudal lobe 24; length of pectoral 10.

Lateral margins of snout nearly parallel, the terminal portion very abruptly and bluntly rounded; width of snout equal to that of interorbital space; anterior nasal flap narrow and pointed, the posterior widened horizontally and concave on its anterior face; longitudinal diameter of eye slightly exceeding half interorbital width; spiracle a short transverse slit, its length one-fifth the interval between spiracles; mouth wide, little arched, the extreme width equaling preoral length of snout; fold at angle of mouth well developed and continued for a short distance along both jaws, its length from angle of mouth equaling to $\frac{2}{3}$ preoral length of snout; upper teeth in 27 transverse rows, most of the teeth functioning at the same time; each tooth with a central point and a pair of shorter lateral cusps; but one functional series of 29 teeth in mandible, forming an almost complete cutting edge, the single point of each tooth directed nearly horizontally away from the middle line.

Insertion of anterior dorsal spine midway between tip of snout and base of upper caudal lobe, and slightly nearer to second spine than to the line joining the spiracles; length of the first spine nearly equal to base of fin; interspace between dorsals equals distance from tip of snout to spiracles.

Skin thickly beset with small plates, which bear each a slender spine; along the back, and especially on the tail, these prickles are arranged in lengthwise series; fins largely smooth, with patches of prickles on their basal portions only; small areas immediately behind dorsal, pectoral, and ventral fins naked; lips and buccal groove, nostrils, spiracles, and eye naked, head otherwise uniformly covered.

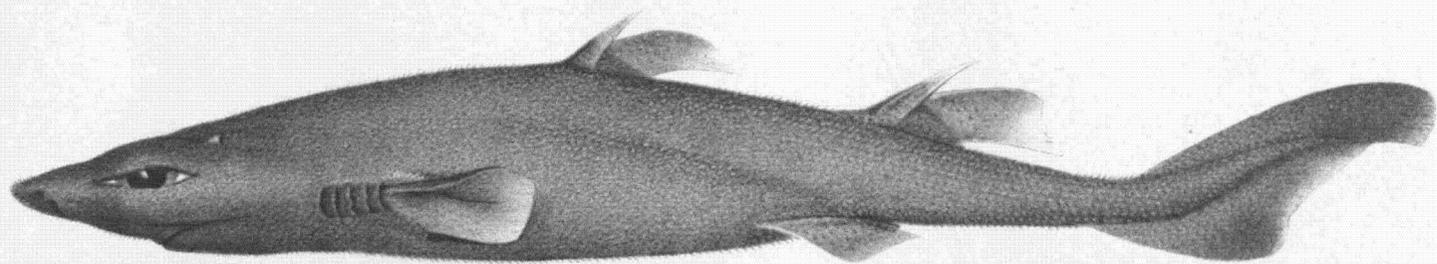
Color warm brown; lower side of head, breast, and abdomen purplish black; dorsals black on basal and anterior portions, broadly white otherwise; caudal lobes black, the intermediate portion light-margined; pectorals and ventrals dusky with white posterior edges.

Only the type known.

Centroscyllum ruscosum, new species. Fig. 230.

Type, 222 mm. long, from station 3997, vicinity of Kauai, depth 418 to 429 fathoms; type, No. 51585, U. S. Nat. Mus.

Length of head, exclusive of branchial area, 22 hundredths of total length; width of snout 12, slightly exceeding interorbital width; preoral length of snout 10, preocular length of snout 7; longitudinal diameter of eye 6.5; width of mouth 11; distance between spiracles 9; least distance between



ETMOPTERUS VILLOSUS GILBERT. TYPE.

nostrils 5; distance from tip of snout to first dorsal spine 36; length of first dorsal spine 5; base of first dorsal 6; distance between dorsals 17; length of second dorsal spine 8; base of second dorsal 7; length of upper caudal lobe 25.

Width of snout slightly more than half length of head measured to first gill-cleft; anterior nostrils opening in the anterolateral margins of snout, large, round, directed forward; anterior nasal valve broad and triangular, completely overlapping posterior valve, which is horizontally expanded and somewhat intricately folded; distance between inner angles of posterior nasal slits half the length of preoral portion of snout; eyes very large, equaling the axial length of snout in advance of orbits; distance between angles of mouth very slightly less than half length of head; a short fold extending backward from angle of mouth for a distance less than its continuation forward alongside of either jaw; the upper and lower labial folds are equal in length, and but little more than half diameter of pupil; teeth small, equal and similar in both jaws, each consisting of a central cusp and a smaller pair of lateral cusps; several series of teeth function at the same time in each jaw; lower surface of snout studded with large pores, some of these forming a narrow V-shaped patch between the nostrils; pores on upper surface of snout arranged in 2 linear patches which extend along upper margins of orbits and are continuous anteriorly with the arms of the inferior V-shaped patch; the spiracles are transverse slits, well behind orbits, and slightly behind angles of mouth, their length one-third diameter of orbit, the distance between them equal to length of snout.

First dorsal spine inserted well behind pectoral axil, slightly nearer extremity of snout than base of upper caudal lobe, and midway between second dorsal spine and spiracle; second dorsal spine midway between first dorsal fin and base of upper caudal lobe; distance between ventrals and pectorals equal to length of head (exclusive of gill-region). The type is a young male, in which the claspers do not nearly extend to margin of ventral fins.

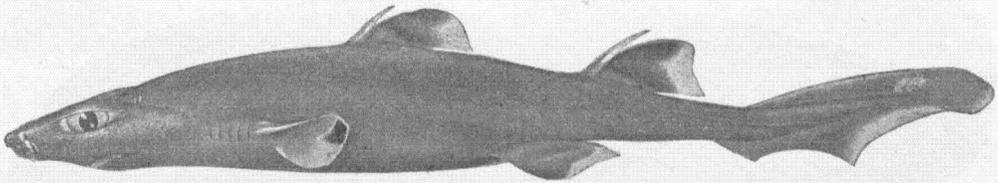


FIG. 230.—*Centroscyllium ruscosum* Gilbert, new species. Type.

Head and body smooth in the young (type specimen), with a very few minute scattered prickles, somewhat more numerous along sides of tail, and wholly wanting on anterior part of body, on fins, and on head. Cotype hispid.

Lower parts black, shading into a light brown near median dorsal line; paired fins and dorsals blackish, with wide white margins; caudal lobes uniform blackish, the lower intervening portion of fin lighter, but not white.

An adult male, 40 cm. long, from station 3989, vicinity of Kauai, 385 to 500 fathoms, is considered a cotype of this species, but the snout and head generally are so badly distorted as to make comparisons difficult. The entire head and body are covered with rather distinct fine prickles, borne upon small stellate bases. Many of the teeth have 4 or 5 cusps, a small outer cusp being frequently developed at the base of one or both lateral cusps. The claspers are fully developed and reach more than half way from their inner base to the origin of the lower caudal lobe, each bearing near its tip a pair of lateral slender hooked spines, between which is a median soft prolongation tapering rapidly to a point and bearing the distal prolongation of the groove. White margin of fins narrower than in the type.

This species is closely allied to *C. niger* Garman, from the vicinity of the Galapagos Islands, but seems to differ in proportions of eye and snout, and in certain details of position of the fins. The prickles seem also more numerous and finer. Nothing can be said concerning its relations with *C. ornatum* Alcock, from the Bay of Bengal and the Arabian Sea.

Only the type and the cotype known.

Family CHIMÆRIDÆ.

Chimæra purpurescens, new species. Fig. 231.

Type, a female, 90 cm. long, from station 4183, vicinity of Kauai, depth 957 to 1,067 fathoms; type, No. 51592, U. S. Nat. Mus.

Head and body very robust, deep and compressed, depth 4.4 in length measured to end of second dorsal fin; snout high and compressed, without appendages, protruding beyond nostrils for a distance about equaling diameter of orbit; eye large, nearly circular, the diameter of exposed portion very slightly exceeding the interorbital width, which is 0.2 the length of head; front of eye midway in length of head; distance from nostrils to tip of snout contained 2.8 times in length of head; anterior dental laminae of upper jaw with 7 enamel rods on each side the median line; first and second enamel rods on each side of median line in lower jaw very widely spaced, ending in acute points with deeply concave border between them, the length of the points slightly exceeding anterior laminae of upper jaw; four sensory canals intersect at a point vertically below hinder margin of orbit; one canal runs upward and backward from point of intersection in direction of dorsal spine, meeting, almost at right angles on level of upper rim of orbit, a line descending from the nape; posteriorly to the point of union, the latter describes a sharp curve with the convexity directed downward, and then becomes the lateral line, the undulations of which are few and faint.

Dorsal spine comparatively slender and nearly straight, containing no posterior groove, and not

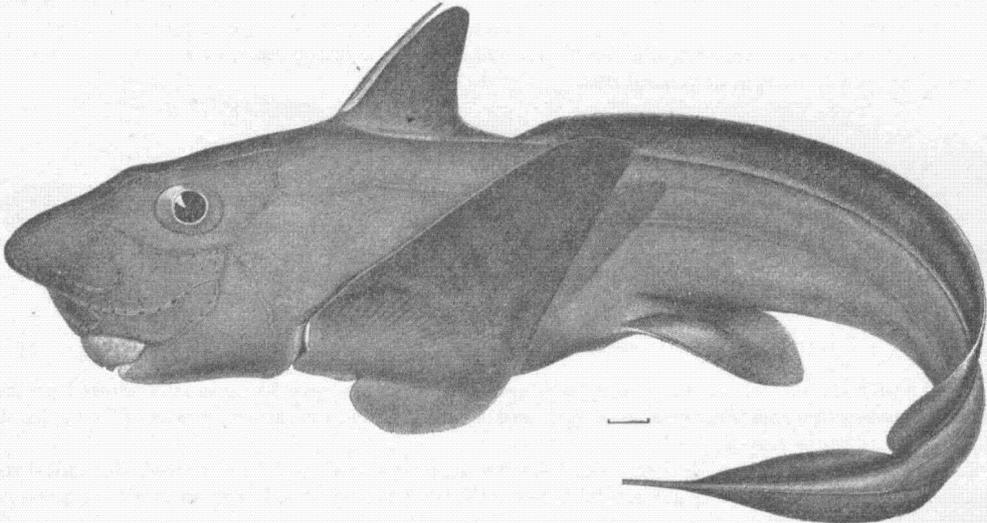


FIG. 231.—*Chimæra purpurescens* Gilbert, new species. Type.

serrate along postero-lateral angles; the soft rays are attached nearly to its tip, as can be made out by the torn membrane adhering to it; anterior angle of soft portion of fin evenly rounded, protruding slightly beyond the spine; posterior rays short, the last joined to the back by a low membrane connecting it with first ray of second dorsal; distance between base of last ray of first dorsal and origin of second dorsal equal to two-thirds the height of the first; first dorsal spine, when declined, reaches slightly beyond the origin of second dorsal; the soft portion of the first dorsal and the membrane joining it to the second are contained in a deep groove; length of spine contained 1.7 times in head; the second dorsal rises rapidly, reaching its greatest height opposite tips of pectorals, where it is about 0.2 the length of head, its margin entire, nonsinuate throughout; notch between second dorsal and "caudal" deep, but not to base of fin; no distinct anal fin, the fin on lower side of tail regularly diminishing in height anteriorly, and without notch; pectoral not falcate, extending well beyond base of ventrals, and longer than head; ventrals contained 1.6 times in length of head; tail broken at a distance of 18 cm. behind end of second dorsal, very slender at that point, and probably not produced to form a filament.

Color uniform purplish or plum color throughout.

Only the type is known from Hawaiian waters, but a large specimen from Japan has recently been identified with this species by Prof. J. O. Snyder.

Family SYNAPHOBRANCHIDÆ.

Synaphobranchus brachysomus, new species. Fig. 232.

Type, 71 cm. long, from station 4019, vicinity of Kauai, depth 409 to 550 fathoms; type, No. 51591, U. S. Nat. Mus.

Length of head from tip of snout to front of gill-slit 13 hundredths of total length; greatest depth of body 10; distance from tip of snout to front of dorsal 30; distance from tip of snout to front of anal 28; to upper axil of pectoral 14; distance from tip of snout to upper axil of pectoral exceeding the distance from the latter to front of anal; dorsal beginning but little behind vent, everywhere lower than anal. Length of snout 36 hundredths of length of head; length of buccal cleft 65; diameter of eye 14; interorbital width opposite middle of eyes 22; depth of snout at front of orbit 28; greatest width of head 39; width of gill-slit 21; length of pectoral 53.

Head slender, flattened above, its upper profile evenly curved, nuchal region not gibbous; snout ending in a fleshy tip extending well beyond front of vomer and slightly beyond mandibular tip; front of vomer about opposite anterior nostril; posterior nostril a round pore with margins very slightly raised; anterior nostril a short tube directed forward; distance from posterior nostril to eye equaling one-third the interval between nostrils; mandibular teeth minute posteriorly, in a narrow band which narrows anteriorly to a single series of slightly enlarged teeth; maxillary teeth similar, in a wider band, which narrows anteriorly, but not to a single series, the inner row of teeth becoming anteriorly

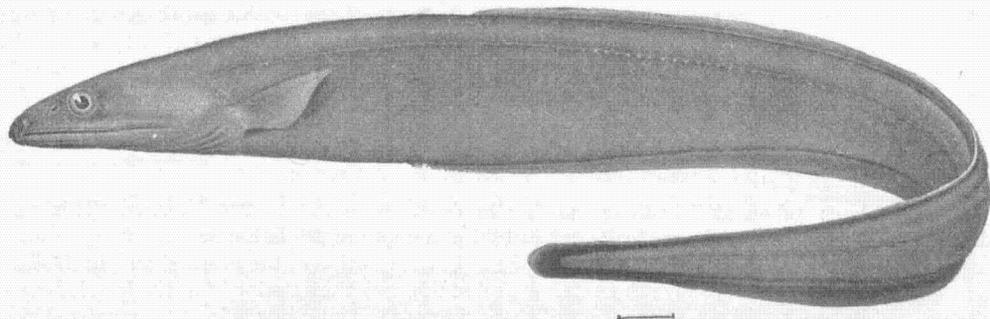


FIG. 232.—*Synaphobranchus brachysomus* Gilbert, new species. Type.

somewhat larger than the others; a prominent elliptical patch of teeth on head of vomer, those on median line a little larger than any other teeth in mouth; a single series of small conical teeth along shaft of vomer.

Scales narrowly elliptical, arranged in groups with their axes at right angles to each other, absent on fins, snout, and under side of head; lateral line prominent, opening by small pores arranged principally along its lower margin, each pore with raised margins; lateral line nearer the dorsal than the ventral outline, until it approaches within less than a head's length of the tip of tail.

Color, warm brown, darker on fins and under side of head; fins all distinctly white-margined; buccal and gill-cavities, and body cavity lined with blackish membrane.

In the 2 smallest specimens, 19 and 36 cm. long, the body and fins are much lighter in color, the fins almost perfectly translucent in the smallest. In both, the caudal and the posterior part of dorsal and anal are jet-black, without white edging. The origin of the dorsal varies somewhat in position, but is a little in advance of the anal in only one specimen.

Most nearly related to *S. pinnatus* (Gronow) and *S. affinis* Günther, differing in the much shorter trunk, and in the white margins of the fins. Examples were taken at the following stations: Nos. 3979, vicinity of Bird Island, 222 to 387 fathoms; 4019, vicinity of Kanai, 409 to 550 fathoms; 4123, off the southwest coast of Oahu, 352 to 357 fathoms; 4137, off the southwest coast of Oahu, 411 to 476 fathoms; 4166, vicinity of Bird Island, 293 to 800 fathoms.

Family LEPTOCEPHALIDÆ.

Leptocephalus æquoreus (Gilbert & Cramer).

It seems at present impossible to recognize *Congrellus* as distinct from *Leptocephalus*. The position of the front of the dorsal, whether over the basal portion or the distal portion of the pectoral fin, can not be considered a useful generic character. The species which have been included in *Congrellus* are supposed to live in somewhat deeper water and to have the system of sensory canals more largely developed, but the species differ widely in this respect also. It is best to unite these genera until a review of all the species has discovered some basis for separation.

In the original description of *L. æquorea*, the snout is said to be contained 3 to 3.25 times in the head. This should read 3.5 in adults, 3.7 or 3.8 in young. The projection of the soft tip of the snout is variable; it usually extends beyond the mandible for a distance less than two-thirds diameter of eye; the longitudinal diameter of eye is contained 6.3 times in the head; the teeth on the head of the vomer form a broad transverse patch, the outer posterior tooth on each side sometimes a little enlarged; those on the shaft of the vomer are separated from the anterior teeth by a short interspace, and are in a short narrow patch, the central tooth enlarged, canine-like, and sometimes preceded or followed by 1 or 2 smaller canines on the median line; the maxillary and mandibular teeth are similar, all slender and sharp, arranged in bands, within which no rows are visible; at the angle of the mouth the teeth are very small, those in the outer portion of the band becoming larger anteriorly. A single short and thick pyloric cæcum.

The species was taken at the following stations: Nos. 3813, off the south coast of Oahu, 183 to 264 fathoms; 3984, vicinity of Kauai, 164 to 237 fathoms; 3988, vicinity of Kauai, 165 to 469 fathoms; 4122, off the southwest coast of Oahu, 192 to 352 fathoms; 4123, off the southwest coast of Oahu, 352 to 357 fathoms; 4136, vicinity of Kauai, 294 to 352 fathoms.

Congermurena æquorea Gilbert & Cramer, Proc. U. S. Nat. Mus., XIX, 1897, 406, pl. xxxvii.

Promyllantor alcocki Gilbert & Cramer.

Not abundant; taken at 7 stations, ranging in depth from 238 to 334 fathoms. This range embraces that of the type specimens, collected in 1891 at a depth of 295 fathoms.

The genus *Promyllantor* differs from *Leptocephalus* in the position of the nostrils, and in the dentition. The posterior nostril is above the anterior part of the eye; the anterior is on the inferior surface of the projecting snout. The teeth are all villiform, in very broad bands. In *P. purpureus* Alcock, the type and only other species of the genus, the teeth are described as occurring "in broad bands in the jaws, and in a broad confluent triangular patch covering the palate." From this description, Goode and Bean (*Oceanic Ichthyology* 1896, p. 138) have inferred that the genus lacks vomerine teeth. In *P. alcocki*, the roof of the mouth is largely covered by a broad patch of villiform teeth, which are placed on the shaft of the vomer and are continuous with the narrower band on the head of the vomer. The latter does not project beyond the broad maxillary bands, which are continuous with it laterally. It is very probable that Alcock's description of *P. purpureus*, quoted above, refers to a condition similar to that found in *P. alcocki*. The teeth are narrowly conical, but not acutely pointed, those on the posterior portion of the vomer blunter than the others. There is no pyloric cæcum. The soft tip of the snout is much longer in some specimens than in others, sometimes scarcely protruding beyond the jaws. *Congrosoma* Garman (Mem. Mus. Comp. Zool., XXIV, 1899, p. 308), seems to differ from *Promyllantor* only in the position of the posterior nostril, which is in advance of the eye.

Examples were taken at the following stations: Nos. 3836, off the south coast of Molokai, 238 to 255 fathoms; 3867, Pailolo Channel, 284 to 290 fathoms; 3883, Pailolo Channel, 277 to 284 fathoms; 3900, Pailolo Channel, 280 to 283 fathoms; 3912, off the south coast of Oahu, 310 to 334 fathoms; 4090, Pailolo Channel, 304 to 308 fathoms.

Promyllantor alcocki Gilbert & Cramer, Proc. U. S. Nat. Mus., XIX, 1897, 406, pl. xxxvi, fig. 1.

Family NETTASTOMIDÆ.

Metopomycter, new genus.

Like *Nettastoma* in all respects, except the position and shape of the posterior nasal openings, which are long slits, beginning above the middle of the eyes and extending backward, converging toward the middle line. The genus includes the type species and *Nettastoma parviceps* Günther. In the type of *Nettastoma*, *N. melanurum*, the posterior nostril is located in front of the eye, on a level with its upper margin.

Metopomycter Gilbert, new genus of *Nettastomidae* (*denticulatus*).

Metopomycter denticulatus, new species. Fig. 233.

Type, 778 mm. long, from station 4019, vicinity of Kauai, depth 409 to 550 fathoms; type, No. 52191, U. S. Nat. Mus.

Length of head and body 38 hundredths of the total. Length of head 34 hundredths of total length without tail; snout 13; eye 3; interorbital width 3; preoral length of vomer 1; tip of vomer to angle of mouth 17; tip of vomer to front of posterior nostril 15; length of gill-slit 2.5; distance between gill-slits 3.8; greatest depth of head 8; greatest width of head 7; distance from occiput to front of dorsal 9.

Head and body slender; tail tapering posteriorly, but ending squarely at base of caudal; snout depressed, flattened above, its depth everywhere equaling or slightly exceeding its width; vomer pro-

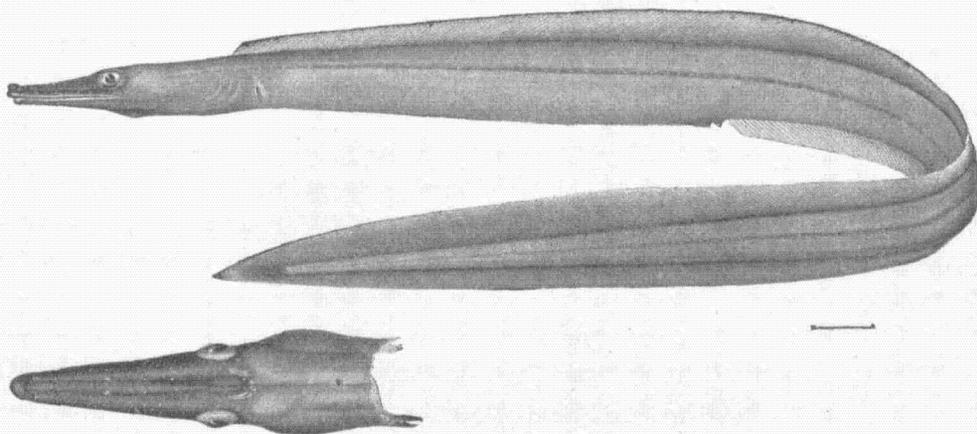


FIG. 233.—*Metopomycter denticulatus* Gilbert, new species. Type.

truding beyond mandible a distance equaling one-third the diameter of eye; soft tip of snout scarcely projecting beyond vomer; anterior nostril, on upper aspect of snout near its tip, a large round opening, directed forward, each in a very short tube; posterior nostril a long slit beginning above middle of eye, the two converging backward; sides of snout very soft, thickly beset with minute pores, a few larger pores in pairs on top of snout; diameter of eye equal to interorbital width; teeth very small, in wide bands, forming a shagreen-like surface, the inner series slightly larger, but still very small; band on vomer extending five-sixths the length of buccal cleft; maxillary extending beyond the eye a distance slightly exceeding half its diameter; tongue absent.

Dorsal fin beginning two-thirds diameter of eye in advance of gill-opening.

General color olive-brown, growing darker toward tip of tail, and on head; snout, mandible, opercles, and area surrounding the vent, blue-black; a bluish tinge on abdomen and along base of anal fin; vertical fins translucent anteriorly with a light bluish tinge, becoming blue-black posteriorly with a white edge; abdominal cavity lined with blackish.

The type only is known. The species differs from *M. parviceps*, from the Japanese region, in its larger head and different color. It has much smaller teeth than *Nettastoma melanurum*.

Gavialiceps tenuiola Wood-Mason, from the Bay of Bengal, has been subsequently referred by Alcock to the genus *Nettastoma*. But as the posterior nostril is "situated laterally nearly midway between the eye and the tip of the snout," the gill-openings are "of moderate size, almost meeting in the mid-ventral line;" there is present a fleshy tongue, and the mandible and vomer are abruptly expanded at tip, the species would seem to belong to a genus distinct from *Nettastoma*, for which the name *Gavialiceps* must be retained. *Gavialiceps* Wood-Mason, first appears in a paper by Alcock "On the Bathybial Fishes of the Bay of Bengal" in Ann. Mag. Nat. Hist. (6) vol. 4, 1889, p. 460. Two species are described: *G. tenuiola* Wood-Mason and *G. microps* Alcock. There can be no doubt that *G. tenuiola* must be considered the type of the genus, and this would become a synonym of *Nettastoma* if Alcock's later views are correct, and the characters indicated above are not of sufficient importance to warrant generic separation. The immature types of *G. tenuiola* are said to have no pectoral fins. In later papers, in describing the adults of *G. tenuiola*, Alcock neglects to call attention to the presence of pectoral fins, though their presence would be inferred from his reference of the species to *Nettastoma*. If they were absent in the types of the species, but were present in the adult specimens subsequently acquired, an error must have been made in the identification of the adults, as pectorals are present even in the larval stages of eels which possess pectorals in the adult condition.

For the nemichthyoid genus, without pectoral fins, typified by *Gavialiceps microps*, to which Alcock erroneously restricts the genus *Gavialiceps*, I would propose the name *Alcockidia*, in honor of its distinguished discoverer.

Family NEMICHTHYIDÆ.

Serrivomer beanii Gill & Ryder.

Three specimens were obtained, which I am unable to distinguish from Garman's figure and description of *S. sector* from the Pacific coast of Mexico and Central America. Garman fails to point out any characters by which *S. sector* differs from *S. beanii* of the Atlantic. *S. beanii* has received no description beyond a few trivial remarks, but the figure of the type presented by Goode and Bean (Oceanic Ichthyology, 1896, fig. 175) agrees so closely with the Pacific form that I do not venture to separate them. Differences may appear when it is possible to compare material from the various localities.

The specimens were taken at the following stations: 3910, off the south coast of Oahu, 311 to 337 fathoms; 4157, vicinity of Bird Island, 762 to 1,000 fathoms; 4183, vicinity of Kauai, 957 to 1,067 fathoms.

Stemonidium, new genus.

Intermediate in the respects between the groups typified by *Nemichthys* and *Serrivomer*, having the dentition of the former, and the short straight jaws, small eyes, long postorbital region, and wide, partly confluent gill-openings of the latter; it agrees with *Serrivomer* also in the position of the nostrils and the absence of the lateral line pores. The pectorals are reduced in size, with few rays, and are very slender. The dorsal originates behind the occiput a distance equal to half the length of the head, and the vent is remote from the head. Not closely related to any known genus, but nearer *Serrivomer* than *Nemichthys*, in spite of its reduced dentition.

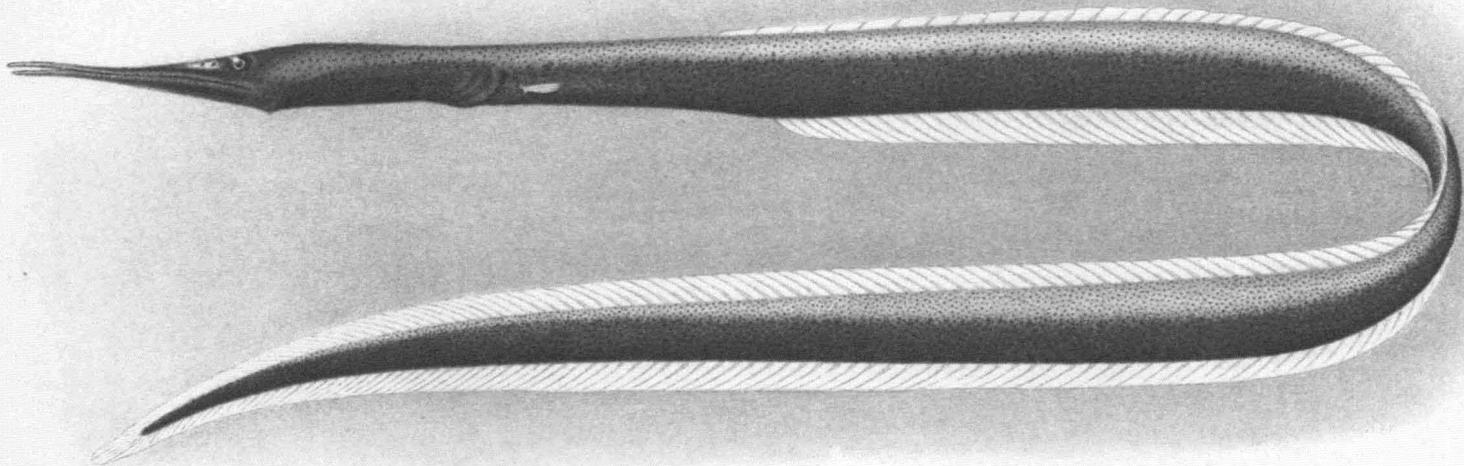
Stemonidium Gilbert, new genus of *Nemichthyidæ* (*hypomelas*).

Stemonidium hypomelas, new species. Plate 67.

Type, 171 mm. long, from station 4176, vicinity of Niihau Island, depth 537 to 672 fathoms; type, No. 51550, U. S. Nat. Mus.

Head 17 hundredths of the total length; distance from tip of snout to front of anal 26; from tip of snout to front of dorsal 25; from tip of snout to front of eye 8; diameter of eye 1; length of pectoral 1.5; greatest depth of body 3; interorbital width two-thirds diameter of eye.

Body narrowly band-shaped, of nearly uniform depth in its middle half, tapering to the narrower neck, and rather rapidly to the pointed but short and not filamentous tail; eye very small, in the middle of length of head, one-eighth the postorbital length of head, a little longer than interorbital width; head and beak shaped much as in *Serrivomer*; upper profile descending in a straight line from occiput



STEMONIDIUM HYPOMELAS GILBERT. TYPE.

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to the basal half of the rostrum, which is more robust than in *Nemichthys*, and wholly lacks the characteristic snipe-like aspect of the latter; jaws tapering to very delicate slender tips, and closely apposed for their entire length; lower jaw slightly longer than upper; gape extending to below posterior border of eye; maxillaries terminating anteriorly at a point midway between tip of snout and front of eye, the anterior half of beak composed of the elongate vomer alone; teeth as in *Nemichthys*, all reduced to small granular plates, arranged in quincunx on the jaws and vomer, each ending in a short acute tip directed posteriorly; vomerine band wide posteriorly, then tapering to a point opposite the nostrils; maxillary and mandibular bands narrower than in *Nemichthys*, none of upper band and only a narrow strip of the lower inserted on the lateral aspect of the jaw; nostrils as in *Serrivomer*, consisting of 2 short slits, in front of the middle of eye, the anterior shorter than the posterior; gill-slits long, very oblique, confluent below, the membranes united inferiorly and free from the isthmus; gills 4. As in *Serrivomer*, no lateral line can be detected.

Dorsal and anal beginning at nearly the same vertical, which is half the length of head behind gill-opening; anterior dorsal rays extremely delicate and difficult to detect, none shortened or spine-like; anal somewhat higher than dorsal, the rays longer and more crowded in the posterior portions of both fins.

Upper half of body light grayish, covered with fine black pigment specks; the lower half of side abruptly jet-black; head all black save tips of jaws and the occiput, which are a little lighter; posterior sixth of tail wholly black; all the fins light-colored.

A single specimen known.

Nematoprora, new genus.

Like *Nemichthys*, but without pores along the lateral line, and with pavement-like teeth which do not bear backwardly-directed spinous tips, like those present in *Nemichthys* and related genera.

Tail ending in a long filament; dorsal beginning on nape and without differentiated spinous portion; anal origin immediately behind tips of pectorals; jaws exceedingly attenuate, recurved; the nostrils are round pores, the posterior behind and above the anterior; branchial membranes are torn anteriorly in the type specimen, but the branchial clefts were apparently wide.

Nematoprora Gilbert, new genus of *Nemichthyidae* (*polygonifera*).

Nematoprora polygonifera, new species. Fig. 234.

Type, 315 mm. long, from station 4151, vicinity of Bird Island, depth 313 to 800 fathoms; No. 51589, U. S. Nat. Mus.

Head 7.5 hundredths of total length; greatest depth 2.2; least depth at nape 1; distance from tip of snout to front of dorsal 7; from tip of snout to vent 8.5; length of snout 5.5.

Greatest depth of body near middle of its total length; contours not approximately parallel for a considerable portion of its length as in *Nemichthys*, but converging gradually to the filiform tail, and forward to the very narrow "neck;" head extremely slender, little deeper than the neck, about three-

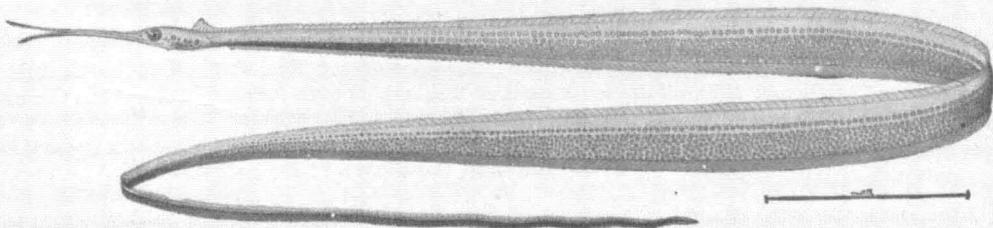


FIG. 234.—*Nematoprora polygonifera* Gilbert, new species. Type.

fifths the greatest depth of body; eye small, in the posterior two-sevenths of head, its diameter twice the width of the flat interorbital space, a little more than one-third the postorbital length of head; upper jaw a little longer than the lower, with no indication of mutilation; teeth pavement-like, with slightly rounded surfaces, and arranged in oblique series.

Dorsal rays extremely delicate, the anterior very short and slender throughout, the median and posterior rays longer, with a thicker base and a very attenuate tip. In a poorly preserved specimen,

the delicate tips of the rays would be easily detached and the short stiff bases might then appear as a series of differentiated spines. It is certain that this occurrence has been responsible for the ascription of spines to at least one species of *Nemichthys* (*N. avocetta*). This may also be the case in *N. acanthonotus* Alcock and *N. fronto* Garman. The dorsal originates at a point midway between the occiput and the vertical from the base of the pectorals. The pectoral fins are short and broad. The course of the lateral line is definitely marked, but no pores are visible under high magnification.

Upper half of body whitish, unmarked, lower half covered with thickly crowded polygonal spots of blackish, about as large as the pupil; most of these are pentagonal or squarish in outline, and each consists of a whitish center, from which radiate very numerous fine black hair-lines; a single series of these spots runs along the entire upper margin of the lateral line, which is whitish, of the color of the back, and very conspicuous; the abdomen and lower side of tail posteriorly develop additional black pigment and are much darker; lower half of head, including basal portion of mandibles, irregularly blotched or spotted with blackish.

But one specimen known, probably from much nearer the surface than the depth of the dredge-haul would indicate.

Family OPHICHTHYIDÆ.

Sphagebranchus flavicaudus Snyder.

Taken at the following stations: No. 3874, channel between Maui and Lanai, in 21 to 28 fathoms; 4055, off the northeast coast of Hawaii, 50 to 62 fathoms; 4061, off the northeast coast of Hawaii, 24 to 83 fathoms.

Family MURENIDÆ.

Uropterygius marmoratus (Lacépède).

Taken at the following stations: No. 3847, off the south coast of Molokai, in 23 to 24 fathoms; 3850, off the south coast of Molokai, in 43 to 66 fathoms; 3872, channel between Maui and Lanai, in 32 to 43 fathoms; 3876, channel between Maui and Lanai, in 28 to 43 fathoms.

Gymnothorax undulatus (Lacépède) and *Melichthys radula* Solander have been listed by Snyder (Bull. U. S. Fish Comm., 1902, 518) from station 3824, off the south coast of Molokai, at a depth of 222 to 498 fathoms. These are both common reef-forms and were not taken at the station given, but probably from 3874, tangles, 21 to 28 fathoms, between Maui and Lanai.

Uropterygius leucurus Snyder.

Taken at station 3874, channel between Maui and Lanai, 21 to 28 fathoms.

Family SYNODONTIDÆ.

Synodus varius (Lacépède).

This common shore form was dredged at the following stations: Nos. 3849, off the south coast of Molokai, 43 to 73 fathoms; 3850, off the south coast of Molokai, 43 to 66 fathoms; 3875, Avau Channel, 34 to 65 fathoms; 4158, vicinity Bird Island, 20 to 30 fathoms.

Synodus kaianus (Günther).

Nine specimens were secured of a species of *Synodus*, which we are unable to distinguish from *S. kaianus* Günther, known only from Günther's figure and brief description, cited below.

Head 3.3 to 3.7 in length (without caudal), depth about 7. Length of snout 7 to 8 hundredths of total length without caudal; diameter of eye 6.5 to 7; length of maxillary 17 to 18; length of pectoral 15; length of ventrals 20 to 21; distance from tip of snout to front of dorsal 42 to 44; from front of dorsal to adipose dorsal 42 to 44; from front of adipose dorsal to middle of caudal base 16 to 17; from base of ventrals to front of anal 44. D. rays 10 to 13; A. 10 to 11; P. 12; V. 8; branchiostegal rays 11 or 12; scales in the lateral line 61-64; 17 or 18 scales in the median series from occiput to front of dorsal.

Our specimens have a very slender form, and a narrow slightly upturned snout, which protrudes beyond the tip of the mandible, though to a less extent than is indicated in the figure of the type; maxillary reaching to or beyond middle of cheek; the narrow tip of the mandible soft and flexible, fitting behind the premaxillary teeth; teeth slender and showing the usual arrangement; an inner longer series and an outer shorter series of teeth in the jaws and on the palatines, both depressible; tongue and basibranchials covered with large teeth, which, in the closed mouth, occupy the medial depression between the palatines; eye surrounded by a narrow but heavy adipose ring, of very irregular contour, containing a small sharp notch above the middle of the posterior side, and an abrupt notch and angle postero-inferiorly; the superior margin deeply incised; position and proportions of fins as represented in the figure of the type cited below.

Color, lower half of side bright silvery, marked with alternately wide and narrow cross-bars. In some specimens still narrower bars divide the intervals between the primary and secondary bars. Dorsal fin translucent, the rays occasionally with dusky cross-bars.

Taken at the following stations: Nos. 4079, off the north coast of Maui, 143 to 178 fathoms; 4101, Pailolo Channel, 122 to 143 fathoms; 4102, Pailolo Channel, 122 to 132 fathoms; 4104, Pailolo Channel, 123 to 141 fathoms.

Saurus kaianus Günther, Shore Fishes, Challenger, 1880, 50, pl. XXIII, fig. C. Ki Islands; in 129 fathoms.

***Saurida gracilis* (Quoy & Gaimard).**

Taken at station 4068, off the north coast of Maui, 14 to 18 fathoms.

***Trachinocephalus myops* (Forster).**

Taken at the following stations: Nos. 3850, off the south coast of Molokai, 43 to 66 fathoms; 4067, off the north coast of Maui, 10 to 14 fathoms.

Family AULOPIDÆ.

***Chlorophthalmus proridens* Gilbert & Cramer.**

In the light of our abundant material the following notes are added to the original account of the species:

Distance from tip of snout to tip of ventrals 2.4 in length of head and body; base of anal 4.3 to 4.5 in head. Pectorals extending well behind vent, 1.2 in head; ventrals shorter than in the type, 1.7 to 1.8 in head; anal with 9 rays, the last ray cleft to base; body as wide as deep immediately in front of pectoral fin, much narrower than deep at all points posterior to this; head wider than deep immediately behind eyes. Maxillary gradually widened behind (not "abruptly expanded"); with a narrow rod-shaped supernumerary bone, movably attached by membrane, along the distal two-thirds of its posterior edge. Sides of mandible with a narrow band (about 2 series) of small teeth, those of the inner series larger than the others; the symphyseal continuation of this band consists of a single series of somewhat larger teeth, directed almost horizontally backward; in front of this series, occupying the upper surface of the protruding symphyseal knob, are 2 series of teeth, laterally in contact, separated mesially by a wide space; the anterior series consisting of strong conical teeth, directed horizontally forward, the inner series much smaller, directed posteriorly; premaxillary with a narrow band of teeth occupying its entire length; head of vomer with a projecting lobe on each side, each lobe with a single series of 5 or 6 strong teeth; palatines with a single series occupying the anterior three-fifths of their length, the series abruptly widening at anterior end to form a knob; a few minute teeth scattered over surface of tongue can be made out with difficulty; vertical limb of anterior branchial arch adnate to gill-cover by a fold of membrane, as in *Macrourus*.

Scales strongly ctenoid on back and sides (not cycloid, as described); cycloid on breast, belly, and under side of tail; opercles completely scaled; a few of the scales on cheeks and opercles with short spinous points.

Color grayish silvery, the upper parts coarsely black-punctate; a narrow blackish vertebral streak; margins of snout and of mandible blackish; a dusky patch on cheeks, below eye; interorbitals and occiput blackish, the opercles black; anterior 2 or 3 dorsal rays black on basal third; a blackish bar

encircling body below dorsal fin, expanding below to include the breast, and becoming intensely black about base of ventrals; inner 3 or 4 ventral rays intensely black; upper half of axil dusky; a blackish streak at base of caudal, including the upper rudimentary rays; gullet, gill cavity and peritoneum black.

Taken at the following stations: Nos. 3867, Pailolo Channel, 284 to 290 fathoms; 3900, Pailolo Channel, 283 to 280 fathoms; 3920, off south coast of Oahu Island, 280 to 265 fathoms; 3952, vicinity of Laysan Island, 351 to 347 fathoms; 4081, off north coast of Maui Island, 202 to 220 fathoms; 4082, off north coast of Maui Island, 220 to 238 fathoms; 4096, Pailolo Channel, 272 to 286 fathoms; 4115, off northwest coast of Oahu Island, 195 to 241 fathoms; 4117, off northwest coast of Oahu Island, 282 to 253 fathoms; 4122, off southwest coast of Oahu Island, 192 to 352 fathoms; 4132, vicinity of Kauai Island, 257 to 312 fathoms.

Chlorophthalmus pravidens Gilbert & Cramer, Proc. U. S. Nat. Mus., XIX, 1897, 406, pl. 36, fig. 2.

Family BATHYPTEROIDÆ.

Bathypterois antennatus, new species. Fig. 235.

Type, 165 mm. long, from station 4151, vicinity of Bird Island, depth 313 to 800 fathoms; No. 5160, U. S. Nat. Mus.

Head 22 hundredths of total length without caudal; depth 14; depth of caudal peduncle 7.5; interorbital width 7.5; eye 2; snout 7; maxillary 14; length of ventrals 33; length of pectoral filament 100; D. 15; A. 9; P. 2-10 or 11; V. 9; branchiostegals 13 or 14; scales 5-56 or 57-8.

Anterior nostril midway between tip of snout and middle of eye, the 2 nostrils separated only by the elevated membranous rim of anterior nostrils; posterior nostril elliptical in shape, twice the diameter of the anterior; eye minute; maxillary comparatively broad, its greatest width approximately equaling the length of the tapering posterior portion; teeth minute, in a narrow band on premax-

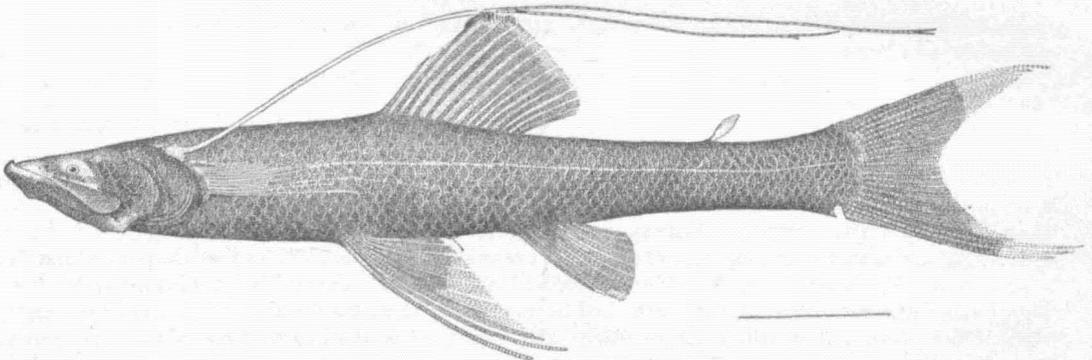


FIG. 235.—*Bathypterois antennatus* Gilbert, new species. Type.

illaries and a wider band in the mandibles, the premaxillary band confined to anterior half or three-fifths of the bone; a few minute asperities in a patch on each side of the head of the vomer and on the front of each palatine; gill-rakers very long, slender, toothed, 14+34 on the outer arch.

Origin of dorsal midway between tip of mandible and middle of interspace from adipose dorsal to caudal, or a short distance behind axil of ventral, its base very slightly overlapping front of anal and its length 1.5 in head; about one-fourth of dorsal fin in the anterior half of body; distance from adipose fin to base of upper caudal rays one-third its distance from origin of dorsal, or two-thirds its distance from last dorsal ray; origin of anal midway between head and base of caudal fin; lower caudal lobe longer than the upper, 3.4 in total length without caudal; upper pectoral ray injured in both our specimens, but extending beyond caudal; it is forked as far forward as a point between vent and front of anal, and the coalesced halves of the ray can be traced to the base; second ray joined to first by membrane, and very short, about 0.2 length of head; below this 10 or 11 very slender disconnected rays, some of the lower ones at least forked near tip, and extending beyond origin of anal fin; the 2 outer ventral rays wholly distinct, simple, elongated and flattened, and with a soft white pad near their tips; in the type

they extend well beyond the anal base; in the cotype, to the base of the last ray; third ventral ray divided, its outer half produced and modified much as in the outer rays; distance from vent to anal fin 1.7 in distance from insertion of ventrals.

Color brownish black, the pectoral filaments and tips of outer ventral rays white; mouth and gill-cavities and the peritoneum blackish.

The cotype is 200 mm. long, and was taken at station 4181, vicinity of Kauai, depth 1,000 to 1,314 fathoms.

Family MYCTOPHIDÆ.

Nannobrachium nigrum Günther.

Three small specimens in rather poor condition, having lost much of the integument, agree closely with Günther's description and figure. Dorsal 14; anal 16 or 17; gill-rakers 18 on outer arch; eye somewhat larger in our specimens, a trifle less than 5 rather than 4 in head, longer than snout, and exceeding also the longest gill-raker. While we do not venture to distinguish the Hawaiian form on the basis of the larger eye, there may exist other characters not given by Günther. The number and distribution of the luminous spots in the type of *N. nigrum* remain wholly unknown. In the Hawaiian specimens these are arranged as follows: Mandibulars, 3 pairs, very inconspicuous; operculars, but 1 pair evident, poorly developed; pectorals, 4 pairs, 1 immediately below lateral line, 1 on pectoral base, 1 vertically below pectoral base and halfway to median line, 1 on line between pectoral base and first thoracic pair; thoracics, 5 pairs, the fourth pair high up on sides, over interspace between third and fifth pairs, the lower pairs evenly spaced; supraventrals, 1 pair, immediately below lateral line; ventrals, 4 pairs, evenly spaced; supra-anals, 3 pairs, 2 forming an oblique line upward and backward from vent, the uppermost on the lateral line, the third well forward, over the interspace between second and third ventrals, on a level with the fourth pair of thoracics; anals in 2 well-separated series, the anterior group with 6 pairs, of which the first 5 are in parallel lines, the sixth placed high, in a line joining the fifth anal and the posterolateral; posterior series also with 6 pairs; posterolaterals, 1 pair, on the lateral line; caudals 4, the anterior 3 forming a right-angled or obtuse-angled triangle at base of lower lobe, the fourth separated from the third by a wide interspace, placed on, or even a little above, the end of the lateral line; a luminous streak above and one below on caudal peduncle.

In size and position of fins and in the arrangement of the photophores *N. nigrum* shows great resemblance to the type of *Lampanyctus*, *L. crocodilus* (Risso). The 2 genera are distinguished only by the reduction of the pectorals in *Nannobrachium*, a character of doubtful value. The pectorals are narrow in our specimens, and consist of a few (3 to 6) short rays. The body is uniformly black, the fins black on basal portions.

The species was taken at the following stations: No. 4108, Kaiwi Channel, 411 to 442 fathoms; 4110, Kaiwi Channel, 449 to 460 fathoms. The type of *N. nigrum* was taken south of the Philippine Islands, at a depth of 500 fathoms.

Nannobrachium nigrum Günther, Deep-sea Fishes, Challenger, 1887, 199, pl. 52, fig. B, south of the Philippines.

KEY TO HAWAIIAN SPECIES OF DIAPHUS.

- a. No luminous areas about eye..... *urolampus*, p. 591
 aa. Luminous area covering entire snout..... *chrysohynchus*, p. 592
 aaa. A narrow luminous streak above eye and one below it..... *adenomus*, p. 592

Diaphus urolampus Gilbert & Cramer.

One specimen from station 4016, vicinity of Kauai Island, depth 305 to 318 fathoms. The types were from 295 and 310 fathoms.

The species has the following characteristic disposition of the photophores: Upper pectorals immediately below lateral line, the supraventrals, upper supra-anals, and posterolaterals in contact with the lateral line; the fourth thoracics high on sides, on a level with pectoral base; second and third ventrals elevated, on the same level, a little above ventral base; supra-anals 2, forming a slightly oblique line which traverses the fifth ventrals; first anal (interpreted as one of the supra-anals in the description cited below) elevated, nearly vertically above the second; the second to sixth anals forming

a line parallel with base of anal fin, the seventh elevated, on a line joining sixth with posterolateral; 6 posterior anals. The distinguishing features are especially the elevated second ventral, the presence of but 2 (instead of 3) supra-anals, and the very high position of the uppermost series.

The differentiation of the upper half of each photophore and its superficial separation from the lower half by a pigment band can be made out only when the photophores are uninjured and are still protected by the scales. It is possible that all species heretofore grouped in *Collettia* and *Aethoprora* possess the character of divided photophore. In this case we should range them under the oldest name, *Diaphus*, as we do not consider the presence or the extent of the preocular photophore of generic importance. If the current system of minute subdivision be followed to its logical extreme, *D. urolampus* must be considered the type of a new genus, distinguished by the absence of preocular photophores, and *D. chryisorhynchus* the type of another characterized by the large preocular photophore, which covers the entire snout (as in *Aethoprora*).

Diaphus urolampus Gilbert & Cramer, Proc. U. S. Nat. Mus., xix, 1897, p. 408, pl. 38, fig. 1.

Diaphus chryisorhynchus Gilbert & Cramer.

Four specimens were taken at the following stations: No. 3834, off Kaunakakai, Molokai, surface; 3921, off Honolulu, surface; 4117, off northwest coast Oahu, 253 to 282 fathoms.

The specimen from station 4117 came to hand in perfect condition and must have entered the trawl near the surface. All other specimens known, including type and cotypes, were obtained in the surface tow net.

The bluntly rounded snout, covered by the preocular photophore, gives a strong resemblance to the species of *Aethoprora*, which differ only in their simple photophores. It is not improbable that perfect specimens of *Aethoprora* and *Collettia*, with scales still in place, will show their photophores also to be divided by a black pigment line, in which case the species may be united under the oldest name, *Diaphus*. *Nyctophus*, Cocco, used by Brauer for this group, was proposed solely as an amended form of *Myctophum*, and is therefore not available.

The photophores of *D. chryisorhynchus* show the following characteristic arrangement: Two lower pectorals on each side forming diverging lines extending from first thoracics to middle of pectoral base, third pectorals high on sides, nearer lateral line than pectoral fins; fourth thoracics elevated, on a level with ventral base, vertically over the third thoracics; five ventrals, the first, second, and third pairs forming oblique diverging lines, the third a little above level of ventral base; supra-anals 3, forming a nearly vertical line from vent, the uppermost more widely spaced, and in contact with the lateral line; the first anal (interpreted as supra-anal in description cited below) elevated, in a line joining second anal and upper supra-anal; second to fifth anals in a straight or gently curved line, the sixth strongly diverging, in a line which includes the posterolateral; the posterolateral in contact with the lateral line; five anals in the posterior series.

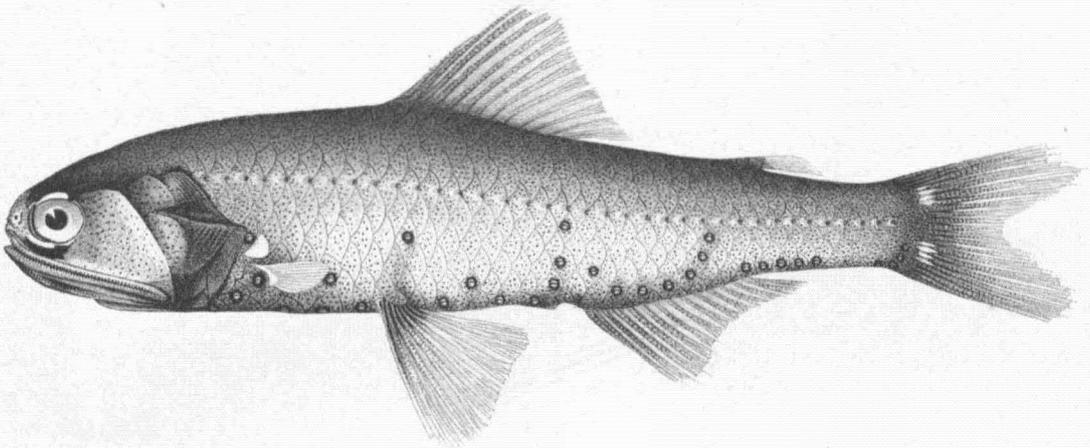
In the arrangement of its photophores this species agrees very closely with *D. theta* Eigenmann & Eigenmann and *D. adenomus*, but *theta* has the upper lateral spots much less elevated and the first anal on a level with the others, while *adenomus* has the upper pectoral much less elevated, and those of the anterior anal group describe a wide curve. *D. chryisorhynchus* shows no variation in the number or arrangement of its photophores (except that in one specimen there are on one side 6 instead of 5 posterior anals) nor in the size of its preocular luminous area.

Diaphus chryisorhynchus Gilbert & Cramer, Proc. U. S. Nat. Mus., xix, 1897, 409, pl. 38, fig. 3 (not fig. 2, as erroneously indicated on the plate and in the description).

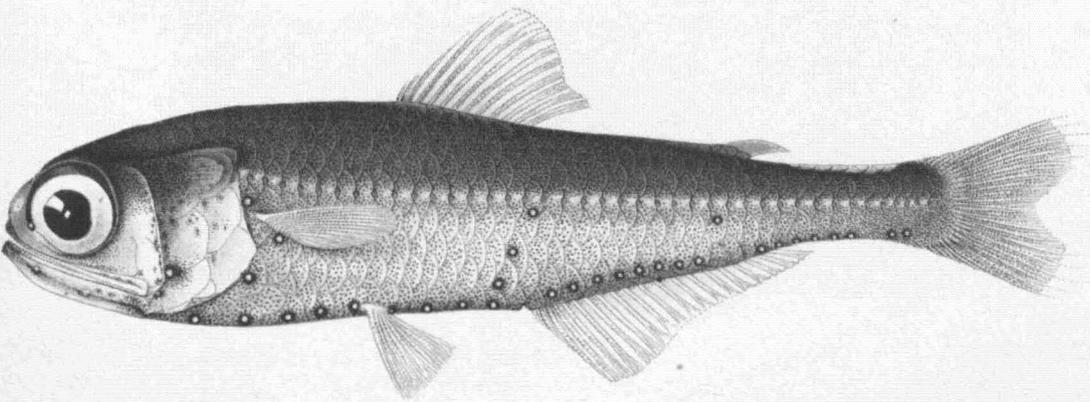
Diaphus adenomus, new species. Plate 68.

Type, a female with developed spawn, 16 cm. long, from Albatross station 4106, the Kaiwi Channel between Oahu and Molokai, depth 335 to 350 fathoms; type, No. 51588, U.S.Nat.Mus.

Head 28 hundredths of total length, excluding caudal; greatest depth of body 23; least depth of caudal peduncle 10; distance from last anal ray to first caudal ray 18; length of pectoral 10; length of inner ventral rays 17; base of anal 19; base of dorsal 21; diameter of eye 6; width of middle of inter-orbital space 8.5; length of snout 4.5; length of maxillary 20.5. D. 15; A. 15; P. 12; V. 9; scales in lateral line 36.



1. *DIAPHUS ADENOMUS* GILBERT. TYPE.



2. *MYCTOPHUM MARGARITATUM* GILBERT. TYPE.

Diameter of eye longer than snout, but shorter than interorbital width; maxillary very long and narrow, extending far behind middle of head, its posterior portion not at all widened; both premaxillary and mandible armed with broad bands of fine depressible teeth, which extend over the outer as well as the inner margins of the jaws; two small separate vomerine patches, one on each side of median line, a long narrow palatine band, and a longer broader pterygoid band, parallel to palatine band and extending farther backward; gill-rakers long and slender, 5+13 in number, toothed along their inner margins, the longest two-thirds the diameter of orbit.

Insertion of first dorsal and the outer ventral rays in the same vertical; base of last dorsal ray vertically above vent; front of adipose fin over last anal ray; pectoral reaching fourth thoracic photophore, the inner ventral rays barely reaching vent.

Scales caducous, all having fallen in the type. In one of the cotypes a few scales remain, which show that those of the lateral line are not enlarged, and that all have entire edges.

As in other species of *Diaphus*, the fourth thoracic photophore is elevated laterally to a point on a level with the base of the pectoral fin; the third ventral photophore is on the same level, the second ventral forming with the first and third an oblique line extending upward and backward; supra-ventral high, slightly nearer lateral line than base of ventral; supra-anals 3 in number, forming an oblique line from just before vent to lateral line, the upper supra-anal immediately below the lateral line, widely separated from second supra-anal; first anal remote from anal base, on a line joining second anal with upper supra-anal; second, third, and fourth anals lie near base of anal fin, the fifth and sixth diverging in a curved line which includes the single posterolateral; the latter is separated from the lateral line by one-fourth its distance from the anal base; five posterior anals in a straight line along anterior half of caudal peduncle; caudals 4 in number, equidistant in a curve at base of lower caudal lobe, the upper spot well below middle of caudal base; pectorals 3 in number, the upper at tip of opercular flap, the lower intermediate between the first thoracic and the spot at base of pectoral; a narrow luminous (golden) streak on upper orbital rim, and one along anterior half of lower margin, both of them conspicuously margined with black; no luminous patches on tail; a semi-circular white glandular body between pectoral base and upper pectoral spot, similar to the one occupying the same position in *D. theta*. The division of the photophores can be made out only where they still lie protected beneath the scales.

General color dusky, the bases of all the fins except the pectoral black; anterior dorsal and anal fin blackish; opercle black, cheek silvery, snout whitish; interorbital space black, except a small whitish median area; a broad black subocular bar, from which a narrow black ring encircles anterior half of orbit; gular membrane black, its anterior portion violet; a black bar near tip of mandible, and one across mandible below eye; lining of buccal and gill-cavities and the peritoneum black.

The condition of all the specimens indicated that they entered the dredge near the bottom. They were taken at the following stations: No. 3920, off south coast of Oahu, 265 to 280 fathoms; 4015, vicinity of Kauai, 318 to 362 fathoms; 4106, Kaiwi Channel, 335 to 350 fathoms.

This species resembles *D. engraulis* Günther, from the Philippines, but differs in the darker coloration, the different shape of the circumocular luminous patches, and the higher position of the upper supra-anal and the posterolateral photophores.

Centrobranchus Fowler.

Allied to *Rhinoscopelus*, but without lateral line and with the gill-rakers obsolescent. The slender snout protrudes far beyond the premaxillaries, and is hollowed out on each side to form a conspicuous nasal cavity, which is entirely roofed over by the expanded preorbitals; these are strongly convex outwards and cover the entire lateral portions of the snout, joining superiorly and anteriorly the mid-rostral ridge, and in contact below with the premaxillaries; their posterior margin is notched to give passage to the nasal openings; gill-rakers reduced to a few rudiments near angle of arch; photophores arranged as in *Rhinoscopelus* and *Myctophum*, all those of the lower series forming parallel rows, none of them elevated on the sides, and the caudal photophores but 2 in number.

Centrobranchus Fowler, Proc. Ac. Nat. Sci. Phila., 1908 (Jan. 13, 1904), 764 (*churocephalus*).

Centrobranchus chærocephalus^a Fowler. Plate 69, Fig. 1.

Dorsal 11; anal 18; pectoral 13; ventral 8; scales in a longitudinal series 39; in a transverse series 10, excluding the median row above and below.

Greatest depth of body 20 hundredths of total length without caudal; least depth of caudal peduncle 4; length of head 26; diameter of orbit 7; interorbital width 8; length of snout 7.5; projection of snout beyond premaxillaries 4.5; length of maxillary 14; distance from tip of snout to front of dorsal 45, from front of dorsal to adipose dorsal 29, from front of adipose dorsal to rudimentary caudal rays 27, from tip of snout to ventrals 37, from tip of snout to origin of anal 53; base of anal 24; distance from last anal ray to base of median caudal ray 26; length of pectoral 12; length of ventral 10.

Body very slender, ventral outline a little more strongly curved than dorsal; behind the vent the form tapers rapidly to the very long and slender caudal peduncle; eyes small, the diameter a trifle shorter than length of snout; cleft of mouth strongly convex upward, extending well behind the orbits, and overpassed anteriorly by the strongly protruding conical snout; maxillary a very slender rod, not at all widened toward tip; premaxillary teeth in a single series; mandibular and palatine teeth in narrow bands; head of vomer with a pair of small round prominences covered with teeth; inside the palatine band is a shorter wider patch of teeth on each side median line of roof of mouth; preopercular margin entire, but little oblique; gill-rakers nearly obsolete, represented only by 2 to 4 small protuberances on each limb near the angle, each rudiment bearing minute spines.

The first dorsal ray is over the fourteenth scale of the mid-lateral series, and over the tips of the ventrals; base of ventrals vertically below the ninth scale of this series, first anal ray below the eighteenth; the pectorals fail to reach the middle of ventrals, and the ventrals do not reach the vent.

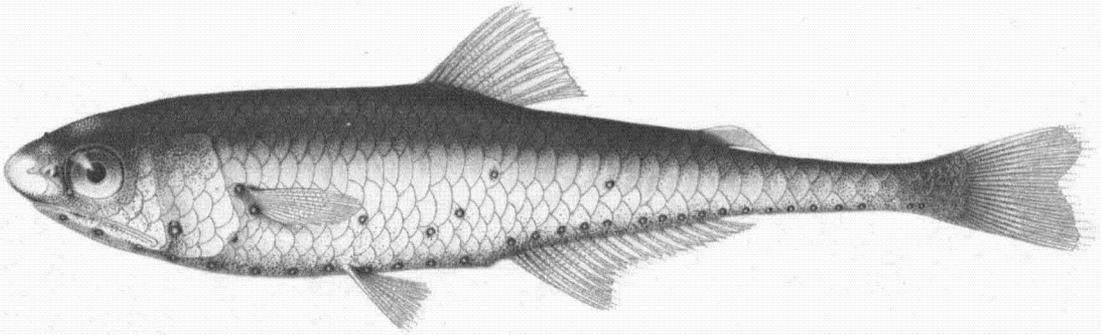
Scales thin, with entire edges, rather firmly adherent, those of the mid-lateral series larger than the others, but largely concealed anteriorly by the series above and below them; they bear no tubes; head entirely invested with scales, which cover mandibles and snout; 2 to 4 series of scales cover the basal half of the anterior portions of dorsal and anal fins.

Photophores arranged as follows: Preoculars 2, one at the upper, the other at the lower end of a narrow vertical pigment band on the anterior orbital rim, both minute, but the lower easily visible, the upper usually concealed beneath the protruding margin of the frontal in alcoholic specimens and made out only on dissection; mandibulars 3; operculars 2, the upper large, the lower minute and rudimentary beneath the preopercular margin, visible only on dissection; pectorals 3, the upper very slightly above and in front of the base of the upper pectoral ray, the middle immediately below base of lower ray, the lower concealed beneath the opercular margin, nearly midway between base of pectoral and the second thoracic photophore; thoracics 5, forming with their fellows 2 gently diverging series, the first, second, and third pairs usually a little more widely spaced than the others, the third and fourth pairs usually less widely spaced than the fourth and fifth; ventrals 4, evenly spaced, the lines parallel; anals 5+11, the break in the series over the middle of the anal fin; the second and third antero-anals often more widely spaced than the others; caudals 2, in a horizontal line immediately in front of the rudimentary caudal rays, more closely approximated than those forming the anal series; supraventrals 1, halfway between base of ventrals and middle of sides; supra-anals 3, forming a very oblique gently curved line, the upper encroaching on the mid-lateral row of scales and vertically above the vent, the middle one halfway between middle of sides and the fourth of the ventral series and slightly in front of the latter, the lowermost occupying a similar position with reference to the third of the ventral series, which it more closely approximates; posterolateral 1, over the break in the anal series and just below the mid-lateral line; the antero-anals vary from 4 to 7, in the following proportions, each side of each specimen separately enumerated: 4 in 2 cases, 5 in 64 cases, 6 in 68 cases, 7 in 8 cases; the postero-anals vary from 9 to 12: 9 in 15 cases, 10 in 84 cases, 11 in 42 cases, 12 on but one side of one specimen.

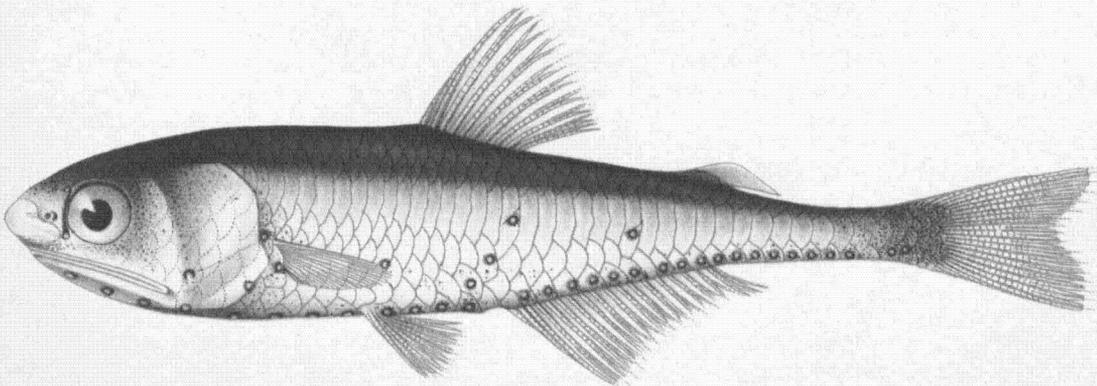
The combinations 5+10, 5+11, 5+12, 6+9, 6+10, 6+11, and 7+9 are found, those occurring most frequently being 6+10, 5+11, and 5+10, in the order named.

The sum of the anals varies from 14 to 17, as follows: 14 in 3 cases, 15 in 37 cases, 16 in 90 cases, 17 in 12 cases.

^aThis species was recognized by me as new and as representing a new generic type, and the descriptions here given had been prepared before the receipt of the paper by Mr. Fowler.



1. *CENTROBRANCHUS CHÆROCEPHALUS* FOWLER.



2. *CENTROBRANCHUS GRACILICAUDUS* GILBERT. TYPE.

In some specimens examined, a row of 5 to 7 luminous spots occupies the median line on the lower side of the caudal peduncle, one under each scale. Others have a row of similar but stronger spots on the back of the caudal peduncle. In either series the spots vary from 5 to 7 in number. Similar arrangements are found in *Rhinoscopelus coccoi* and *andrew* (Lütken, *Spolia Atlantica*, Scopelini, pp. 243 and 245). From the fact that no individual possesses both the dorsal and the ventral series, Lütken suggests that the position of these spots may be a sexual character. Dissection of three specimens of each kind of *C. cherocephalus* has shown that such is the case, the males having the dorsal series of stronger spots. The smallest specimen showing a trace of these spots is 25 mm. long, and the longest specimen in which none are apparent is 28 mm. Males are somewhat more abundant than females.

General color dark on back, silvery on lower half of sides, with bluish and reddish reflections; dorsal and caudal dusky, base of caudal blackish.

Specimens were taken at the following stations: No. 3912, south of Oahu, surface; 3926, west of Oahu, surface; 3927, west of Niihau, surface; 3929, south of French Frigate Shoals, surface; 3930 near Laysan Island, surface; 3932, near Laysan Island, surface; 3980, south of Oahu, surface; 4009, east of Kauai, surface; 4011, west of Oahu, surface; 4145, west of Niihau, surface; 4188, between Honolulu and San Francisco, lat. N. 28° 13' 42'', long. W. 145° 44', surface.

Centrobranchus cherocephalus Fowler, Proc. Ac. Nat. Sci. Phila., 1903 (Jan. 13, 1904), 754, near the Sandwich [Hawaiian] Islands. (Type, No. 7972, A. N. S. P., Coll. Dr. Wm. H. Jones.)

***Centrobranchus gracilicaudus*, new species. Plate 69, Fig. 2.**

Type 33 mm. long, from the surface at station 4145, west of Niihau Island; type, No. 51518, U. S. Nat. Mus.

Closely related to *C. cherocephalus*, with which it agrees in all essential features except the following: (1) Supra-anals arranged in an oblique line, the middle spot vertically above the vent, the lowest vertically above the fourth of the ventral series. The species differs from *C. cherocephalus*, therefore, very much as *Rhinoscopelus andrew* (Lütken) differs from *Rhinoscopelus coccoi* (Cocco). (2) Anals averaging a little more numerous, in the 11 specimens collected, the sum of the two groups being 16 in 8 cases, 17 in 12 cases, 18 in 2 cases. The anterior group consists always of 6 or 7 spots (6 in 15 cases, 7 in 7 cases), while in *cherocephalus* 5 and 6 are equally abundant and 7 is rare. Of postero-anals, there are 9 in 3 cases, 10 in 7 cases, 11 in 12 cases. In *cherocephalus* 10 is much more abundantly represented than 11. The limited number of specimens in the species here described renders the averages not wholly reliable, but they are obviously different from the averages in *cherocephalus*. (3) Scales of mid-lateral series more persistent, and deeper in proportion to their width. (4) Body deeper and snout somewhat less projecting.

Dorsal 12; anal 19; scales in mid-lateral series 38 or 39. Greatest depth of body 23 hundredths of the total length without caudal; least depth of caudal peduncle 5; length of head 28; diameter of orbit 7; interorbital width 7.5; length of snout 7; projection of snout beyond maxillaries 4; length of maxillary 17; distance from tip of snout to front of dorsal 47, from front of dorsal to adipose dorsal 29, from front of adipose dorsal to rudimentary caudal rays 26, from tip of snout to origin of anal 56; length of pectoral 14; length of ventral 10.

With the exceptions noted, the shape of the body, size and relative position of fins, character of scales, and the number and arrangement of the photophores are as in *C. cherocephalus*.

Specimens were taken at the following stations: No. 3926, west of Oahu, surface; No. 3927, west of Niihau, surface; No. 3929, southwest of French Frigate Shoals, surface; No. 3930, near Laysan Island, surface; No. 4011, west of Oahu, surface; No. 4145, west of Niihau, surface.

KEY TO HAWAIIAN SPECIES OF MYCTOPHUM.

- a. Three pairs of ventral photophores along the median line..... *fbulatum*, p. 596
- aa. Four pairs of ventral photophores along median line.
 - b. Posterolateral single.
 - c. Supra-anals forming a straight line rising obliquely from near the last ventral..... *margaritatum*, p. 596
 - cc. Supra-anals forming an obtuse-angled triangle, the middle and lower photophores at about the same level, the lower much in advance..... *evermanni*, p. 597
 - bb. Posterolaterals two.
 - d. Supra-anals forming an obtuse-angled triangle..... *braveri*, p. 598

Myctophum fibulatum Gilbert & Cramer.

Two specimens, dredged at depths of 220 to 284 fathoms, do not differ from the type in number and distribution of the photophores. The species is peculiar in having but 3 equally spaced pairs of ventral photophores along median line, the second pair being displaced laterally, almost vertically above the first pair. The anterior pair of the supra-anals lies over the interspace between the third and fourth ventrals. A small black-ringed photophore on the anterior orbital rim escaped notice in the type. One small specimen was taken in the surface tow-net, at station 3889, north of Molokai; others were obtained at stations 3899, Pailolo Channel, 283 to 284 fathoms, and 4082, off the north coast of Maui, 220 to 238 fathoms.

Myctophum fibulatum Gilbert & Cramer, Proc. U. S. Nat. Mus., xix, 1897, 411, pl. 38, fig. 2 (not fig. 3, as erroneously indicated on plate 38 and in the description).

Myctophum margaritatum, new species. Plate 68, Fig. 2.

Type 80 mm. long, from the surface at station 3930, off the south coast of Molokai; type, No. 51536, U. S. Nat. Mus.

Closely related to *M. affine* Lütken and *M. opalinum* Goode & Bean, from the Atlantic. These two species are insufficiently described, and may even prove to be identical with each other and with the species here described. Certain differences are, however, indicated in the descriptions as they stand.

Greatest depth of body 24 hundredths of total length without caudal; least depth of caudal peduncle 8; length of head 27; diameter of orbit 9; interorbital width 10; length of snout 4; length of maxillary 17; distance from tip of snout to front of dorsal 44, from front of dorsal to adipose dorsal 37, from front of adipose dorsal to rudimentary caudal rays 21, from tip of snout to ventrals 41, from tip of snout to origin of anal 57; base of anal 27; length of pectoral 15; length of ventral 12. D. 13; A. 20; P. 15; V. 9, the outermost ray minute; scales in the lateral line 40, the 41st on the base of the caudal fin and without tube; 9 scales in a cross-series excluding median rows on back and belly.

Body rather slender, heavy forward, snout very short and bluntly rounded, the profile descending in a strong, nearly uniform curve from occiput to front of nostrils; eyes very large, one-third length of head, slightly less than frontal width above their middle; snout and frontal region with low concealed median crests; mouth oblique, maxillary gradually widening posteriorly, extending well behind the orbit, its length slightly less than two-thirds that of head; teeth minute, in narrow bands in each jaw, those on vomer in 2 small, widely separated clusters, those on palatines larger than the others, in single series; in addition to these, all the roof of the mouth, except its middle line, is covered with minute asperities; preopercle nearly vertical, its margin entire; opercle entire and unstriated, except for a short space below the upper posterior angle, where the margin is weakly ribbed and toothed; gill-rakers long and slender, 5+16 on outer arch, the longest slightly more than half the diameter of orbit.

First dorsal ray over the eleventh scale of lateral line; root of ventrals opposite the ninth or tenth; first anal ray under the eighteenth, last under the thirty-first; origin of adipose dorsal over the twenty-ninth; pectorals not reaching middle of ventrals; ventrals not reaching vent.

Scales all thin, not spinous, the margins entire or only gently notched or sinuate, those of the lateral line not enlarged.

Photophores arranged as in *M. affine* Günther and *M. opalinum* Goode & Bean; preoculars 1, minute, similar to those on body, on the lower anterior orbital rim; mandibulars 3; operculars 2, the one behind the tip of maxillary concealed beneath the margin of the preopercle; pectorals 3, forming a right angled triangle, the middle spot on lower edge of pectoral base, the upper encroaching on third scale of lateral line, the lower on line between pectoral base and the first thoracic spot; thoracics 5, the third and fourth less widely separated than the others, the 5 pairs arranged in 2 nearly straight gently diverging lines; supra-ventrals 1, nearly midway between the axil of the ventrals and the lateral line; ventrals 4, equally spaced; supra-anals 3, in an oblique line directed toward interspace between third and fourth ventrals; anals 13 to 17 (usually 14 or 15), in 2 well-separated groups, 8-10+5-7, the usual formula being 9+6, 9+5, or 10+5, the series throughout parallel with the lower outline; posterolateral 1, over the last antero-anal; caudals 2, closely approximated, the posterior little higher than the anterior; the third supra-anals and the posterolaterals encroach upon the series of scales which bear the lateral line, the former below the eighteenth, the latter below the twenty-eighth

scale of the series; each of these scales is greatly shortened in its lower half to make room for the special scale of the photophore, and is but little more than half the height of the other scales; the posterolateral is over, or very slightly in advance of the last antero-anal, the latter vertically over the fourth anal ray before the last and below the front of the adipose fin.

The photophores are invariable in number and position, except those of the anal series. Our material includes 63 specimens. As each side must be tabulated separately, we have for consideration 126 cases:

The antero-anals are 8 in number in 7 cases, 9 in number in 88 cases, 10 in number in 31 cases. The postero-anals are 5 in number in 62 cases, 6 in number in 55 cases, 7 in number in 9 cases. Combining these gives a total range of 13 to 17, distributed as follows: 13 in 3 cases, of which 2 occur bilaterally, 1 unilaterally; 14 in 37 cases, of which 24 occur bilaterally, 13 unilaterally; 15 in 74 cases, of which 60 occur bilaterally, 14 unilaterally; 16 in 10 cases, of which 6 occur bilaterally, 4 unilaterally; 17 in 2 cases, of which none occur bilaterally, 2 unilaterally.

The usual combinations are 9+5 (32 cases) 9+6 (48 cases) and 10+5 (23 cases), one or another of these combinations occurring on one or both sides of 56 out of the 63 specimens at hand. The 2 sides do not vary independently in this species. Perfect bilateral symmetry occurs in 46 specimens, and in 6 others the lack of symmetry is plainly due to the dropping out of the second or the penultimate member of the anterior group. In no case does the difference in number of anals on the 2 sides exceed 1.

General color dusky brown on upper half of head and body; sides of head and lower half of sides silvery, the latter everywhere coarsely specked with brown; anterior dorsal dusky, base of caudal blackish, other fins translucent. In the type, 7 scales on the back of the caudal peduncle are underlaid by pearly (luminous) spots, agreeing in this respect with *M. opalinum*. None of the smaller specimens (47 mm. and less) shows any trace of this luminous area.

M. margaritatum agrees in outline very closely with Lütken's figure of *M. affine* (Spolia Atlantica, II, Scopelini, 1892, p. 252). It seems to differ in the more numerous scales of the lateral line, in the more anteriorly placed break in the anal series, the more elevated posterolateral, and in the somewhat different range of variation in the number of anal spots. In *M. affine*, the antero-anals vary from 7 to 10 (frequently 8 or 9); in *M. margaritatum*, the number 7 does not occur, and 8 very rarely, 9 and 10 prevailing. In *M. affine*, the postero-anals vary from 4 to 6 (frequently 5 or 6); in *M. margaritatum*, no specimens have 4, but a few have 7.

The species was taken at the following stations: Nos. 3878, south of Lanai; 3926, west of Oahu; 3927, west of Niihau; 3929, southwest of French Frigate Shoals; 3930, near Laysan Island; 3931, near Laysan Island; 3932, near Laysan Island; 3980, south of Oahu; 4010, west of Oahu; 4011, west of Oahu; 4145, west of Niihau, and 4188, between Honolulu and San Francisco, lat. N. 28° 13' 42", long. W. 145° 44' 00"; all at the surface.

***Myctophum evermanni*, new species. Plate 70, Fig. 2.**

Type, 29 mm. long, from station 3980, south of Oahu, taken at the surface; type, No. 51521, U. S. Nat. Mus.

Related to *M. boops* and *M. humboldti*, but with a short postero-anal series of photophores (4 to 6), the first of the series much farther back than in related species, a little behind the last anal ray. In *M. boops*, Richardson, and *M. humboldti* (Risso), the break in the anal series is but little behind the middle of the fin.

Total length, excluding caudal, 22 mm.; greatest depth of body 22 hundredths of this length; least depth of caudal peduncle 7; length of head 33; diameter of orbit 8; frontal width over middle of eye 9; length of snout 7; length of maxillary 23; distance from tip of snout to front of dorsal 51; from front of dorsal to adipose dorsal 36; from tip of snout to front of anal 50; base of anal 26; ventrals 16; pectoral broken. D. 15, the 4 anterior rays much shortened; A. 20; lateral line with 39 tubes; 9 longitudinal series of scales where body is widest, not including the median series above and below.

Head and body very slender, the caudal peduncle deeper in proportion; head tapering forward, the snout not bluntly rounded; maxillary very long, little widened posteriorly, half its length behind middle of eye; eye little longer than snout; preopercular margin not very oblique.

Origin of the dorsal slightly behind insertion of ventrals, its posterior rays slightly overlapping the anal; vertical from front of adipose dorsal passing through the posterolateral photophore and the

base of the fourth anal ray before the last; ventrals reaching front of anal; the pectorals are broken in the type; in some of the cotypes they are intact and are comparatively short, not reaching the middle of the ventrals, and falling a little short of the anterior supra-anal.

Scales thin, entire, caducous, those of the lateral line very little larger than the others.

Arrangement of photophores: As in *M. boops* and *M. humboldti*, the 3 supra-anals are so disposed as to form an obtuse-angled triangle, the uppermost in contact with the lateral line vertically above origin of anal fin, the second midway between the upper supra-anal and the last ventral photophore, the third anterior to the second and on a level with it, a little behind second ventral pair; supra-ventral on a level with base of pectoral, a little higher than third supra-anal, somewhat nearer lateral line than ventral base; pectorals forming the usual right-angled triangle, the lower vertically above the second thoracic pair, the upper somewhat nearer lateral line than pectoral base; posterolateral in contact with lateral line, slightly behind last antero-anal; two opercular spots, upper the largest and lower the smallest of all the photophores; mandibulars 3 as usual; no preocular photophore can be detected in these young specimens. The first and second pairs of thoracics are more widely separated than the other pairs, which are evenly spaced, the 2 lines diverging posteriorly. The 4 ventral pairs are evenly spaced and form parallel lines.

The anals vary from 12 to 14, the antero-anals from 7 to 9, the postero-anals from 4 to 6. They are distributed as follows in the 70 cases (35 specimens): Antero-anals 7 in 6 cases, 8 in 58 cases, 9 in 6 cases; postero-anals 4 in 6 cases, 5 in 57 cases, 6 in 7 cases; totals, 12 in 6 cases, 13 in 57 cases, 14 in 21 cases. Combinations found bilaterally are 7 + 5, 7 + 6, 8 + 5, 9 + 4; 8 + 5 occurs on one or both sides of 30 of the 35 specimens in the collection. As *M. humboldti* has typically 8 + 8 anals, and *M. boops* 8 + 10, it would be entirely inadmissible to identify *M. evermanni* with either of these species. In one of the cotypes of *M. californiense* Eigenmann, I find the anals 6 + 11. The 2 caudal photophores in *M. evermanni* are arranged a little obliquely and are separated by an interspace a trifle wider than that between the pairs of postero-anals.

General color blackish, except cheeks, nostrils, and a part of the opercles, which are whitish; base of caudal lobes black.

The species was taken at the following stations: Nos. 3878, south of Lanai; 3926, west of Oahu; 3927, west of Niihau; 3931, near Laysan Island; 3932, near Laysan Island; 3980, south of Oahu, and 4145, west of Niihau; all at the surface.

Named for Dr. Barton Warren Evermann.

***Myctophum braueri*, new species. Plate 70, Fig. 1.^a**

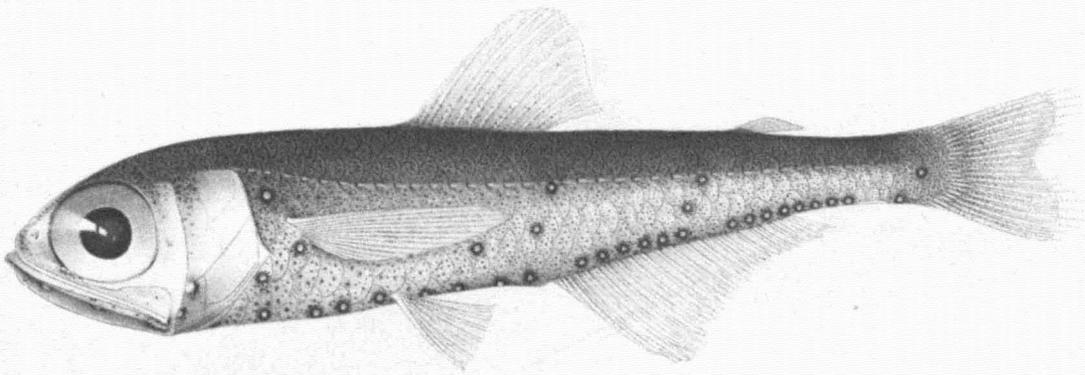
Type, 57 mm. long, from station 3980, south of Oahu, surface tow; type, No. 51527, U. S. Nat. Mus.

Closely related to *M. reinhardtii* Lütken, from the Mediterranean, differing, in so far as appears from Lütken's figure and very brief description (*Spolia Atlantica*, II, Scopelini, 1892, 257), in the slightly lower position of the anterior supra-anal photophore, the slightly higher insertion of the supra-ventral, and the much longer dorsal and anal fins (with 11 and 16 rays, respectively, in *M. reinhardtii*).

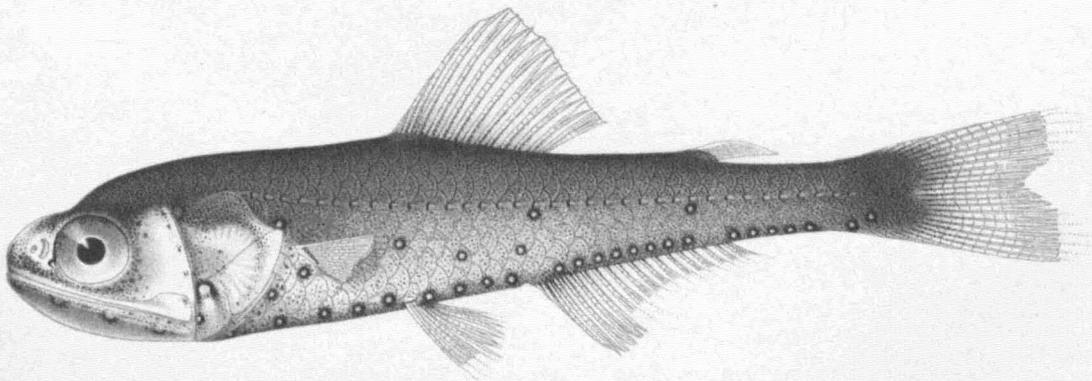
Greatest depth of body 21 hundredths of total length without caudal; least depth of caudal peduncle 7; length of head 28; diameter of orbit 13; frontal width over middle of eye 8; length of snout 5; length of maxillary 19; distance from front of snout to tip of dorsal 45; from front of dorsal to adipose dorsal 37; from front of adipose dorsal to rudimentary caudal rays 18; from tip of snout to ventrals 41; to origin of anal 58; base of anal 28; length of pectoral 30; of ventrals 12. D. 14; A. 22 (23 in other specimens); P. 14; V. 8; scales in lateral line 40 or 41, 9 in a cross-series, excluding median rows along dorsal and ventral outlines.

Body very slender, eye remarkably large, mouth oblique, snout short but pointed, upper profile not abruptly decurved; orbital diameter little less than half length of head; interorbital width a little less than three-sevenths; maxillary reaching the vertical from posterior border of eye, greatly widened posteriorly and bearing a lengthwise ridge parallel with its dorsal margin; a narrow strip of its ventral portion protrudes below premaxillary near its tip; gape of mouth showing a double curve, convex upward in its posterior portion, concave upward anteriorly; mandible upturned toward symphysis, its tip acute, protruding a little beyond premaxillaries.

^a*Myctophum lutkeni* on plate, by error.



1. MYCTOPHUM LUTKENI GILBERT, TYPE.



2. MYCTOPHUM EVERMANNI GILBERT, TYPE.

Teeth on jaws and palatines in very narrow bands; broad bands investing the mesopterygoids; head of vomer bearing on each side a strongly protruding lobe, devoid of teeth, the concave interspace bearing minute asperities; gill-rakers long and slender, 4+14 in number on outer arch; preopercular margin vertically placed and evenly rounded.

Insertion of first dorsal ray slightly behind the vertical from base of ventrals, the last dorsal ray vertically over the first anal ray; adipose dorsal over second postero-anal photophore, well in advance of last anal ray; pectorals very long and pointed, their tips reaching vent and extending beyond tips of ventrals.

Scales thin, with entire edges, and caducous; occasional scales only being preserved in our material.

Arrangement of photophores: Agreeing with *M. reinhardtii* in the obtuse-angled triangle formed by the 3 supra-anals, in the presence of 2 posterolaterals, in the wide separation of the 2 caudals, and in the normal position of the supra-ventral. A minute preocular present on lower anterior orbital rim, similar to other photophores, but much smaller; first and second, and second and third pairs of thoracic photophores more widely separated than the others, the third and fourth pairs nearer together than the others; upper pectoral spot immediately below third scale of lateral line; supra-ventral on a level with middle pectoral and middle supra-anal spots, and constantly a little above anterior supra-anal; upper supra-anal, upper posterolateral and upper caudal spots in contact with lateral line at 18th, 26th, and 40th scales, respectively; lower posterolateral in advance of upper, and very slightly in advance of last antero-anal.

The number of photophores is as follows: Preoculars 1; mandibulars 3; operculars 2, the lower not concealed; pectorals 3, the middle one immediately below the base of lowest pectoral ray, the lower one on a line joining the middle pectoral and the lower opercular spots; thoracics 5, those of the last pair more widely separated; ventrals 4, the third and fourth pairs less widely spaced than the others; anals 6 to 8+6 to 8 (13 to 15); caudals 2; supraventrals 1; supra-anals 3; posterolaterals 2.

The anals form the only variable groups. In the 17 specimens (giving 34 cases) of the collection, we find them distributed as follows: Antero-anals 6 in 14 cases, 7 in 18 cases, 8 in 2 cases; postero-anals 6 in 2 cases, 7 in 23 cases, 8 in 9 cases. In both groups then, the mode is 7, the anterior group varying principally toward 6, the posterior group toward 8. The totals of the 2 groups, in the 34 cases, are as follows: 13 in 7 cases, 14 in 25 cases, 15 in 2 cases. In the type there is a well-developed luminous patch on the lower side of the caudal peduncle, and an incipient patch on the dorsal surface.

General color dark, with bluish reflections from opercles and scales on sides; caudal with a dusky patch at base of each lobe; other fins translucent.

Specimens were taken at the following stations: Nos. 3878, south of Lanai; 3927, west of Niihau; 3980, south of Oahu; and 4145, west of Niihau; all at the surface.

Named for Dr. August Brauer, the author of a most useful review of the genus *Myctophum*.

***Dasyscopelus spinosus* (Steindachner).**

Forty-nine specimens, the longest 69 mm., were taken at the surface about the Hawaiian Islands, and in the vicinity of Laysan Island. They agree in all essential features with the excellent descriptions and figures cited below. The pectoral fins are a little longer and more pointed than previously represented, reaching with their tips a little beyond the ventrals, but not quite to vent. The scales of the lateral line are little longer than the neighboring scales. They are almost wholly concealed by the overlapping series above and below, the scales of which are arranged vertically with reference to them.

Dorsal with 13 or 14 rays, anal 19; 40 scales in lateral line, 9 in a cross-series, excluding the mid-dorsal and the mid-ventral rows.

Variation in number and disposition of photophores is confined to the anal series. The total number of these varies from 13 to 15 (abnormally 12 in the anterior group on one side of one specimen), the prevailing number being 14 (7+7). The following combinations occur: 7+7 and 7+7 in 26 specimens; 7+7 and 7+6 in 3; 7+7 and 6+7 in 1; 7+7 and 7+5 in 1; 7+6 and 7+6 in 6; 7+8 and 7+8 in 1; 7+8 and 7+7 in 1; 7+8 and 8+7 in 1; 7+8 and 6+7 in 1; 8+6 and 8+6 in 5; 8+6 and 8+7 in 2; 8+7 and 8+7 in 1. From this it appears that the predominating combinations are 7+7, 7+6, and 8+6. In the anterior group, 8 occurs in 17 cases, 7 in 79, and 6 in 2; in the posterior group, 8 occurs in 5 cases, 7 in 65, 6 in 27, and 5 in 1. Thus, while 7 is the prevailing number in each group, the anterior group varies most frequently toward 8, the posterior group in the

opposite direction. This compensatory variation is not due solely to the shifting of the photophore from the anterior to the posterior group, or in the opposite direction, for the supra-anals maintain a constant relation to the last antero-anal, whatever the number.

Specimens were taken at the following stations: Nos. 3878, south of Lanai; 3926, west of Oahu; 3927, west of Niuhau; 3930, near Laysan Island; 3980, south of Oahu; 4009, west of Oahu; 4011, west of Oahu, and 4145, west of Niuhau; all at the surface.

Scopelus spinosus Steindachner, Ichthy. Notizen, V, 1867, 11 (author's reprint), pl. 3, figs. 4-4a. China.

Scopelus (Dasyscopelus) spinosus Lütken, Spolia Atlantica, Scopelini, 1892, p. 239, pl. 1, figs. 1-2. Tropical Atlantic; Maldon Island, S. Pacific.

***Dasyscopelus pristilepis* Gilbert & Cramer.**

One of the most abundant species at the surface, where young and half-grown specimens were frequently taken in the tow-net. One adult was found in the stomach of a dolphin, in the Honolulu market.

D. pristilepis agrees with *D. asper* (Richardson), the type of the genus, and differs from *D. spinosus* in the greatly enlarged thickened scales of the lateral line. The depth of these scales, when fully exposed, exceeds their distance from the base of the dorsal fin. In *spinosus*, the scales of the lateral line are very little if at all enlarged. In both species, the scales of the lateral line are overlapped and almost wholly concealed by the series above and below them, and the tubes of the lateral line are strongly developed, forming keel-like projections. *D. asper* differs from *pristilepis* in the presence of a large preocular photophore, extending from middle of eye forward to around nostrils; furthermore, the anal spots are 10+4, and the 2 caudal photophores are widely separated.

The number and distribution of the luminous spots in *D. pristilepis* have been tabulated in the 94 specimens of the collection. No variation was found, except in the anterior and posterior anals. These have for their normal formula 7 for the anterior group and 4 for the posterior, but the anterior may vary from 6 to 8 and the posterior from 3 to 5. A plus variation in the anterior group is more frequently connected with a minus variation in the associated posterior group, the 2 varying in a compensatory manner. For this reason, the variation in the total number of the anal spots found on one side of any individual is no greater than the total variation found in each group separately, and comprises only the numbers 10, 11, and 12. The combinations 6+3 and 8+5, although within the ascertained range of variation of anterior and posterior groups taken separately, do not occur in our material.

The 2 sides of a fish do not always agree in the number and arrangement of the spots. We must therefore tabulate each side separately, giving thus for consideration, with our material, 188 cases. Of these, we find in the anterior group: 6 photophores in 11 cases, 7 photophores in 160 cases, 8 photophores in 17 cases. In the posterior group: 3 photophores in 21 cases, 4 photophores in 157 cases, 5 photophores in 10 cases.

As already stated, the size of the 2 associated groups is not purely a matter of chance. Thus when the anterior group contains 6 photophores, only the combinations 6+4 and 6+5 are found, as follows: 6+4 in 5 cases, 6+5 in 6 cases. When the anterior series contains 7, it may be associated with 3, 4 or 5 in the posterior series, as follows: 7+3 in 9 cases, 7+4 in 147 cases, 7+5 in 4 cases. When the anterior series contains 8, only the combinations 8+3 and 8+4 are found, as follows: 8+3 in 12 cases, 8+4 in 5 cases.

Opposite sides of the same fish may vary independently, as appears from the occurrence of the following combinations: 7+3 occurs bilaterally in 2 specimens, unilaterally in 5; 7+4 occurs bilaterally in 66 specimens, unilaterally in 15; 7+5 occurs bilaterally in 1 specimen, unilaterally in 2; 6+4 occurs bilaterally in 1 specimen, unilaterally in 3; 6+5 occurs bilaterally in 2 specimens, unilaterally in 2; 8+3 occurs bilaterally in 4 specimens, unilaterally in 4; 8+4 occurs bilaterally in 1 specimen, unilaterally in 3. In deviations from the mode (7+4) there thus appears a distinct tendency toward a symmetrical variation. The chance nature of the association of groups on opposite sides of the same individual is evident from a consideration of the 15 specimens, noted above, in which 7+4 occurs unilaterally: the combination 7+4 and 7+3 occurs in 5 specimens; 7+4 and 7+5 in 1 specimen; 7+4 and 6+4 in 3 specimens; 7+4 and 6+5 in 2 specimens; 7+4 and 8+3 in 2 specimens; 7+4 and 8+4 in 2 specimens.

A minute photophore surrounded by a black ring is present on the lower anterior orbital margin. In the adult specimen only, 2 scales on lower edge of caudal peduncle cover luminous spots.