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DESCRIPTIONS OF FIVE NEW SPECIES OF MYCTOPHID FISHES FROM THE PACIFIC, INDIAN, AND ATLANTIC OCEANS

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ABSTRACT: Five new species of myctophid fishes are described and are compared with closely related forms. Three of the new species, two in the genus *Diaphus* and one in the genus *Lampanyctus*, occur in warm waters of the eastern and central North Pacific Ocean; of the remaining two species, both in the genus *Lampanyctus*, one occurs in the eastern tropical Atlantic Ocean, and one in both the western tropical Pacific and the Indian oceans.

INTRODUCTION

The five new species described below are referable to three distinct species groups and are treated under three sections; related species are discussed.

In the first section, two of the new species, *Diaphus trachops* and *D. similis*, are referred to a small group of *Diaphus*, formerly comprised of six nominal species, characterized in part by having the preorbital organs, Dn and Vn, small and widely separated. Most specimens of these two new species from the central and eastern tropical Pacific Ocean have been erroneously identified as the infrequently reported species *Diaphus termophilus*.

In the second section, two other new species, *Lampanyctus basili* and *L. isaacsi*, are referred to a group of the genus characterized by having the VO_2 photophore highly elevated and displaced forward to a position approximately above VO_1. This group has also been defined in part by having the pectoral fin long and broad-based, but in *L. isaacsi* this fin is short and narrow-based. The species to be described as *Lampanyctus basili* has been previously recognized as probably new and briefly described and figured, but not named, on the basis of a single young specimen from the western Indian Ocean (Nafpaktitis and Nafpaktitis, 1969); specimens of *L. isaacsi* have not before been recognized.

In the third section, the fifth new species, *Lampanyctus acanthurus*, is compared with the closely related species complex comprising *L. tenuiformis* and *L. festivus*; it has been variously misidentified as each of these species. This new species differs strikingly from all other species currently recognized in the genus in having a notably increased number of procurrent caudal rays.

Holotypes of the five new species, and paratypes bearing SIO collection numbers, are deposited in the Marine Vertebrate Collection of the Scripps Institution of Oceanography. Paratypes to be deposited in other museums bear numbers assigned by those museums.

Acknowledgments

I am deeply indebted to the following persons and agencies for their kindness in making specimens available to me. Thomas A. Clarke, University of Hawaii, donated specimens of *Diaphus trachops* to the Scripps Institution collection. Basil Nafpaktitis, University of Southern California, and John E. Fitch, California Department of Fish and Game, kindly permitted me to report a far eastern occurrence, off California, of *D. trachops*. E. H. Ahlstrom, National Marine Fisheries Service, Southwest Fisheries Center, provided the Scripps collection with specimens of *Diaphus similis* taken during the joint Eastropac Expedition. M. Boeseman, Reijksmuseum, Leiden, and H. Nijssen, Zoological Museum, Amsterdam, provided specimens on which the original description of *Diaphus suborbitalis* was based. Paratypes of *Diaphus glandulifer* were provided by the U. S. National Museum of Natural History, and additional material of that species was loaned by the Field Museum of Natural History.

Material of *Lampanyctus basili* and *L. macropterus* was taken primarily on the Scripps Antipode, Circe, Naga, and

Monsoon expeditions to the western Pacific and Indian oceans. Further material of these species was made available from the *Galathea* collection by Jørgen Nielsen, Copenhagen, and by Basil Nafpaktitis from the International Indian Ocean Expedition, Cruises 3 and 6 of the R/V *Anton Bruun*. Specimens of *Lampanyctus isaacsi* were taken on the Lusiad Expedition of Scripps Institution. In addition, five paratypes taken on the Guinean Trawling Survey were made available by Bruce B. Collette of the National Marine Fisheries Service.

Specimens of *Lampanyctus acanthurus* were mostly taken by the Scripps expeditions Aries-9, Climax I, and Cato I in the North Central Gyre of the Pacific Ocean, north of Hawaii. Two other specimens were taken farther east, during the 1961-1963 survey of pelagic fishes of the California Current area conducted by the National Marine Fisheries Service.

E. Bertelsen kindly provided counts of procurrent caudal rays of the holotype of *L. festivus*.

Carl L. Hubbs of Scripps Institution of Oceanography has critically read the manuscript.

METHODS

The conventional names and the approximate locations of the photophores of myctophids are shown schematically (fig. 1). In the dorsal and anal fins all rays were counted, including the anteriormost rudimentary rays, and the last ray was treated as being bifurcate through the base. In counting the gill rakers on the outer arch, the raker at the angle was included in the count for the lower limb. The urostyle was included in the count for vertebrae. Body proportions, unless otherwise stated, are expressed as thousandths of standard length (SL). Usually the maximum depth of trawls was estimated from meters of wire out, and the nets were fished open.

The holotypes of *Lampanyctus basili* and *L. isaacsi* are portrayed by drawings only, because their photophores did not register satisfactorily on film. The other species are illustrated both by photographs and diagrams showing particularly the position of the photophores.

Abbreviations for collections are as follows: USNM--United States National Museum of Natural History; CAS--California Academy of Sciences; LACM--Los Angeles County Museum of Natural History; BPBM--Bernice P. Bishop Museum.

SECTION I. *Diaphus trachops* and *D. similis*

These two new species belong to a small group of the genus *Diaphus* characterized principally by having only two small and widely separated principal luminous organs of the head, the Dn and Vn. Dn is located close above the nasal apparatus and before the orbital rim, and Vn is well back on the ventral rim of the orbit under the posterior half of the pupil. Most species of this group also have the first SAO on or very slightly above level of last VO. Six nominal species have been described as having Dn and Vn widely separated: *D. suborbitalis* Weber, 1913; *D. glandulifer* Gilbert, 1913 (as discussed below, *D. glandulifer* is a synonym of *D. suborbitalis); D. termophilus* Tåning, 1928; *D. dumerili* (Bleeker, 1856); *D. lutkeni* (Brauer, 1904); and *D. diadematus* Tåning, 1932. The two new species are less closely related to the last three named above than to the others. They differ from the first three named above primarily in the shape of Vn. *D. dumerili* is readily separable by the very minute size of Vn and its location on the anterior portion of the ventral margin of orbit; also, this is the only species of the group having the first SAO well above the level of the last two VO. In *D. lutkeni* (both sexes) and *D. diadematus* (males only) the Vn is much elongated, and occupies most of the ventral margin of the orbit. The Vn of *D. diadematus* is highly sexually dimorphic in that the Vn of females is small and oblong and somewhat similar in position to the Vn of each of the new species being described and of the first three species named above, whereas the Vn of males is greatly enlarged and broadened posteriorly, filling most of the space between orbital rim and upper jaw. The patterns of photophores of these two species are similar, but the gill rakers of *D. lutkeni* are more numerous, 6-7+1+14 (13-15), total 22(20-23) *versus* 5(4)+1+(9)10, total (15)16, for *D. diadematus*. The Vn of *D. lutkeni* is less sexually dimorphic than that of *D. diadematus;* that of the male is more robust than that of the female and extends vertically to approach, or contact, the upper jaw.

Direct comparison of syntypes of *Diaphus suborbitalis* with the holotype and paratypes of *D. glandulifer* discloses no differences that warrant their separation. As Weber's description predates that of Gilbert by about three months (May and August, respectively), I hereby synonymize *Diaphus glandulifer* Gilbert (1913, p. 90, pl. 11, fig. 2) with *Diaphus suborbitalis* Weber (1913, p. 30, fig. 31). Study material of *D. suborbitalis* included two syntypes from Bali Sea, Siboga Station 38 (07°35.4' S., 117°28.6' E.). Accompanying one syntype was the following pencilled note: "This specimen selected as the LECTOTYPE. Rolf L. Bolin, 10/31/47." As Bolin's action has not been published, I hereby designate this specimen, deposited in the Zoologisch Museum, Amsterdam, ZMA 109.968, a male, 68.0 mm. standard length, as the lectotype of *Diaphus suborbitalis* Weber, 1913. Also, I designate as paralectotype of *D. suborbitalis* the other syntype from Siboga Station 38, deposited in the Rijksmuseum, Leiden, reg. no. 9942, 71.5 mm. standard length, sex indeterminate (body cavity open and empty).

Diaphus trachops Wisner, new species.
(Figures 2, 3A; tables 1, 2.)

MATERIAL EXAMINED. The holotype and the paratypes, except as otherwise stated, were taken near the island of Oahu, Hawaii, with a 10-foot Isaacs-Kidd midwater trawl, by Thomas A. Clarke in his work at the Institute of Marine Biology, University of Hawaii. Holotype: SIO 71-172, a male, 63.5 mm. in standard length, taken between 200 and 225 m. on 11 November 1969, 2050 to 0020 hours. Paratypes: SIO 71-172 (1 specimen, 55.5 mm. in standard length), taken with the holotype. SIO 71-175 (1, 55.1), 220 m., 12 November 1969, 0453-0745 hrs. SIO 71-176 (2, 15-20), 100 m., 28 October 1969, 2020-2340 hrs. USNM 208457 (1, 38.7 mm.), R/V *Townsend Cromwell*, Cruise 7, Station 25, off Kailua, Kona, Hawaii, 0-686 m., 22 August 1968, 0912-1203 hrs. USNM 208458 (5, 41.5-53.3), R/V *Hugh M. Smith*, Cruise 35, Station 1, 21°21.5' N., 158°15.0' W., 0-176 m., 1 August 1955, start of tow 1930 hr. CAS 15988 (2, 43.1-45.8 mm.), 180-200 m., 30 October 1969, 0050-0415 hrs. (formerly SIO 71-174). LACM 6880-4 (1, 58.0 mm.), 36°40' N., 122°06' W., about 360 m., 23 November 1965, 1853-1923 hrs., taken by California Department of Fish and Game. BPBM 14310 (2, 50.7-53.6 mm.), 0-180 m., 12 November 1969, 0052-0400 hrs. (formerly SIO 71-173).

DESCRIPTION. Body elongate, moderately slender and laterally compressed, deepest at pectoral origin; greatest depth 4.5 in standard length, greatest width about 1.6 in depth. Head long, 3 in standard length; depth 1.4 in length. Upper jaw long, 1.4 in head length; orbit large, 3.3 in head, 2.4 in upper jaw. Snout short, 2 in orbit. Bases of dorsal and anal fins equal in length. Origin of anal base slightly behind a vertical from end of dorsal base; end of adipose base slightly before a vertical from end of anal base. Pelvic fin reaches to about fourth anal ray; pectoral fin reaches slightly past pelvic base. Gill rakers long and slender; the longest about 1.4 in orbit and about 3.6 in upper jaw.

Dorsal rays 14, anal rays 15 (14-16), pectoral rays 12 (11-13). AO 6 (5+7) + 5(6), total 11 (10-12). Gill rakers 8 (7-9) + 1 + 15-16 (14-17), total 24 (22-26). Vertebrae 34-35. Numbers of anal photophores (AO) and of gill rakers (table 1) and body proportions (table 2) are compared with similar data for related species. Counts of AO and gill rakers for the holotype of *D. trachops* are indicated by an asterisk in table 1.

Dentition. The small cardiform teeth of the jaws form a rounded band. In the upper jaw a median row of somewhat elongate and curved teeth, somewhat more widely spaced than the rest, project downward. The tooth band of the lower jaw is twice as wide as that of the upper jaw. Palatines and mesopterygoids are thickly beset with minute teeth. The vomer heads bear a very few minute teeth posteriorly.

Luminous organs. Dn is small and round, is located slightly below level of upper margin of pupil, and is deeply recessed; the recess is filled with a transparent substance that extends forward to ethmoidal crest and forms a smooth, rounded rostral contour. Vn is prominent, triangular, and about twice as large as Dn, and protrudes into ventral margin of orbit under posterior third of pupil; the luminous tissue is vertically striated. Vn of males is slightly larger and more robust than that of females. Anterior to Vn, and embedded in a band of dark tissue, are five minute dots of whitish tissue (probably luminous); the pigmented tissue above these dots bulges upward in small domes that protrude slightly above orbital rim (fig. 3A), and are evident in specimens as small as 22 mm., but not in one 15 mm. in standard length. These protrusions, although much less prominent, resemble those that project notably from the Vn into the orbital rim of *Diaphus lutkeni*.

OP_1 is minute, directly behind end of upper jaw. OP_2 is slightly larger than body photophores, and is located about on level of lower margin of orbit with its rear edge approximately on a vertical from front of OP_1. PLO lies directly over pectoral origin and slightly below midway between that point and lateral line. Luminous scale at PLO (missing on right side of holotype) is roughly ovoid; its length equals or slightly exceeds half the pupil diameter; the luminous tissue is finely convoluted. PO_1, PVO_1, and PVO_2 are equally spaced in an oblique straight line; PVO_2 lies close before lowest pectoral rays. Five PO; PO_{1-2} interspace is about twice that of PO_{2-3} and of PO_{3-5}; the PO_{2-3} and PO_{3-5} interspaces are about equal; PO_4 is elevated to about level of lower end of pectoral base, and is on (seldom behind) vertical from center of PO_3. The PO series gradually diverges posteriorly, with PO_5 abruptly raised to about one diameter below and before outer pelvic ray. VLO is slightly behind pelvic origin and above a midpoint between there and lateral line. First three of the five VO are equally spaced in an oblique line; VO_3 lies two of its diameters before vertical from VO_4 and about on a line through SAO_2 and AOa_1. The three SAO form a steeply ascending, nearly straight line; SAO_3 may be on, or close before or behind, a line through the first two. SAO_1 is located about two of its diameters behind and one above VO_5. SAO_{2-3} interspace is twice that of SAO_{1-2}. SAO_3 located its diameter below lateral line and over or slightly before anal-fin origin. Five AOa; the first and last are markedly elevated, so that a straight line through them passes through SAO_1 and VO_3 (AOa_1 is rarely slightly below this line). Pol is about its diameter below lateral line, forms a straight or very slightly curved line with last two AOa, and lies over midpoint between penultimate AOa and first AOp. Of the four Prc, the first three are evenly spaced in a gentle curve, and the last one is abruptly elevated to about three of its diameters below lateral line and is separated from the nearest Prc by a space about equal to that between the first and the third. The AOp-Prc and the AOa-AOp interspaces are about equal.

In addition to the large scale of luminous tissue at PLO, similar but much smaller scales occur posteroventrally to VLO, SAO_3, Pol, and upper Prc. These scales vary in size (in preserved material) but are generally two to four times the size of adjacent photophores. Caudal luminous glands are absent.

DISTRIBUTION. All but one of the study specimens of *D. trachops* is from near Hawaii. The single exception, paratype LACM 6880-4, a male with moderately developed testes, was taken about 8 miles west-northwest of Point Pinos, Monterey County, California. This specimen may be regarded as a stray, for a moderate amount of collecting effort in waters adjacent to Monterey and between there and Hawaii has yielded no material of the species. No other has been taken away from the Hawaiian area.

ETYMOLOGY. The name '*trachops*', from the latinized Greek words *trachos* (rough) plus *ops* (eye), refers to the uneven surface of the lower orbital margin caused by the small domed intrusions of pigmented tissue covering the minute, probably luminous, dots anterior to Vn.

Diaphus similis Wisner, new species.
(Figures 4, 3b; tables 1, 2.)

MATERIAL EXAMINED. The holotype and paratypes, SIO 71-177 through 71-180, were taken with a 5-ft. nekton net during the Eastropac Expedition and were made available to the Scripps Institution of Oceanography by E. H. Ahlstrom. Holotype: SIO 71-177, a ripe female, 72.2 mm. in standard length. It was taken between the surface and 200 m. on 14 August 1967, start of tow at 0030 hrs. Paratypes: SIO 71-179 (3 specimens, 36.8-39.3 mm. in standard length), 08°22.0' N., 97°52.0' W., 0-200 m., 26-27 January 1968, start of tow 2203 hrs.; SIO 71-180 (4, 36.5-63.4), 08°53.0' N., 119°00.0' W., 0-200 m., 2 February 1967, start of tow 2228 hrs.; SIO 63-841 (2, 33.0-44.0), 05°55.5' N., 87°16.0' W., 450 meters wire out, 15 May 1958, 0013-0122 hrs. USNM 208459 (3, 22.0-53.0 mm.), R/V *Hugh M. Smith* Cruise 31, Station 64, 07°06.0' N., 108°36.0' W., 0-337 m., 27 October 1955, start of tow 2025 hr. USNM 208460 (1, 68.4), R/V *Hugh M. Smith* Cruise 31, Station 67, 04°39.0' N., 109°24.0' W., 0-631 m., 28 October 1955, start of tow 2002 hr. CAS 15989 (2, 51.1-68.4), 08°01.0' N., 119°02.0' W., 0-200 m., 24 October 1967, start of tow 2230 hr. (formerly SIO 71-178). Remaining nontype study material, rather badly damaged: SIO 63-838 (6, 32-48), 07°22.0' N., 92°47.0' W.; SIO 63-840 (2, 42-46), 09°48.5' N., 89°14.5' W.

DESCRIPTION. Dorsal rays 14, anal rays 15-16, pectoral rays 12-13 (14). AO 6 (5-7) + (4)5, total 11(10-12). Gill rakers 7 (6-8) + 1 + 14 (13-15), total 22 (21-23). Vertebrae 35 (34-36). Numbers of anal photophores (AO) and of gill rakers (table 1) and body proportions (table 2) are compared with similar data for the related species *D. trachops*, *D. suborbitalis*, and *D. termophilus*. Counts of AO photophores and gill rakers for the holotype of *D. similis* are indicated by an asterisk in table 1.

DISCUSSION. *Diaphus similis* is closely related and superficially similar to *D. trachops*. The photophore pattern is essentially similar, differing slightly in that the elevated AOa_1 of *D. similis* is most often slightly below level of SAO_2 rather than almost always on that level as in *D. trachops*. Similarities are also evident in both the counts (table 1), *D. similis* averaging about two fewer total rakers, and in body proportions (table 2). The two species are most readily separable by the differences in structure of Vn. In *D. similis*, this organ is usually more rounded or vertically elliptical, and the luminous tissue is vertically ovoid or pear shaped (fig. 3B) and usually does not fill the entire organ; it is bordered by a silvery, probably reflective area. This contrasts with the rather triangular luminous tissue that nearly fills the Vn of *D. trachops* (fig. 3A) and *D. suborbitalis* (fig. 3C). This structural difference of Vn is evident in the smallest specimens examined, 15 to 20 mm. long. Also, in *D. similis*, the small protuberances over the tiny luminous dots anterior to Vn are lacking or are extremely minute, at least very difficult to perceive, whereas they are very easily seen in *D. trachops*. Another difference is that in *D. similis* the small scales of luminous tissue are absent at photophores other than PLO, even on specimens in excellent condition, whereas they are evident in *D. trachops*, even on rather badly eroded specimens, posteroventrally to VLO, SAO_3, Pol, and upper Prc. Also, the anterior margin of PO_4 is on or slightly behind a vertical from posterior margin of PO_3.

Diaphus trachops and *D. similis* may be confused with *D. suborbitalis* and *D. termophilus* because of very similar arrangements of Dn and Vn, and of many other body photophores. Also, all four species have from three to four minute luminous dots embedded in, or covered by, a streak of dark tissue overlying the ventral rim of the orbit, but only in *D. trachops* does this overlying pigment bulge upward significantly as a small dome over each tiny dot.

This streak of dark tissue is considerably less well developed in *D. termophilus* and the minute dots are more readily visible than in the other three species. Another point of similarity and confusion in these four species is the very low position of SAO_1, on or slightly above the level of the last VO. On the basis of photophores, *D. termophilus* is usually separable from the other three species in that PLO is much nearer to the pectoral origin than to the lateral line, rather than slightly nearer the latter or midway between. Also, in *D. termophilus* the SAO spacing is more nearly equal, with the SAO_{1-2} interspace only slightly smaller than that between SAO_{2-3}; in the other three species the SAO_{2-3} interspace is from 1.5 to 2 times greater than that of SAO_{1-2}.

Body proportions (table 2) of the four species are also very similar, although *D. termophilus* differs in having a longer and deeper head, a longer upper jaw, a greater predorsal length, and a greater distance between origins of dorsal and pelvic fins. The numbers of AO photophores, fin rays, and vertebrae of the four species are very similar, but the more numerous gill rakers (table 1), especially in total count, appear to be useful in separating *D. suborbitalis*.

The most useful additional characters appear to be the small patches (scales) of luminous tissue at certain photophores in addition to that at PLO. Although subject to erosion, these luminous scales are quite persistent and are evident on specimens that have lost all body scales and most scale pockets. *Diaphus trachops* is separable from *D. similis* by having luminous scales at VLO, SAO_3, Pol, and Prc_4; *D. similis* has only one such scale (at PLO). *D. suborbitalis* is readily separable from the others by having luminous scales at many more photophores.

In *D. suborbitalis*, these luminous scales appear to be erratic in occurrence. In six paratypes of *D. glandulifer* in good condition (USNM 74501, Suruga Bay, Japan) these scales were present on all specimens at PO_4, VLO, VO_2, VO_3, SAO_3, Pol and Prc_4; in addition, on from 20 to 83 percent of the specimens, scales were variously present at PVO_1, PVO_2, PO_3, $VO_{1, 3, 4,}$ and 5, SAO_2, first and last AOa, last AOp, and Prc_3. On two syntypes of *D. suborbitalis*, from Bali Sea, these scales were present at PO_4, VO_2, SAO_3, AOa_1, Pol, Prc_3, and Prc_4. The rather poor condition of these two specimens prevents conjecture as to the presence of luminous scales at most other photophores as found in the paratypes of *D. glandulifer*.

DISTRIBUTION. *Diaphus similis* is thus far known only from a rather small area of the northeastern tropical Pacific Ocean bounded by about 04°-10°N., 87°-119°W.

ETYMOLOGY. The name *similis* refers to its similarity to *D. trachops* and, to a lesser degree, to *D. suborbitalis*.

SECTION II. *Lampanyctus basili* and *L. isaacsi*

These two new species are referable to a group within the genus *Lampanyctus* that is characterized principally by having the VO_2 photophore elevated and displaced forward to a position very near VO_1, and the AOa series more or less curved. *Lampanyctus basili* has the AOa series of photophores strongly curved, the pectoral fins long, strong, and broad-based, and the base of the anal fin overlapping about 38 percent of the length of the dorsal base. *Lampanyctus isaacsi* differs from *L. basili* principally in that the AOa series is very slightly curved, the pectoral fins are short and weak, and the base of the anal fin overlaps nearly 60 percent of the length of the dorsal base.

Nafpaktitis and Nafpaktitis (1969, p. 52, figs. 63, 64) illustrated and briefly diagnosed two small specimens from the western Indian Ocean, each having the VO_2 elevated and displaced forward to near VO_1, one having a Prc configuration similar to that of *L. hubbsi*, an unusual arrangement in that Prc_2 is offset behind a straight line through Prc_1, Prc_3, and Prc_4. With only one specimen of each form available, these authors designated them only as *Lampanyctus* "A" and "B." However, enough specimens of each form have now become available to permit adequate characterization. Species "A" is referable to *L. macropterus*, but species "B" represents the new species, *Lampanyctus basili*, described below.

Only four species within the genus *Lampanyctus*, as presently constituted, have been known to have the VO_2 both elevated and displaced forward to near VO_1. These species are *L. macropterus* Brauer (1904, 1906), as defined by Nafpaktitis and Nafpaktitis (1969), *L. hubbsi* Wisner (1963), *L. omostigma* Gilbert (1908), and *L. parvicauda* Parr (1931). The last three species have been discussed by Wisner (1963).

The following key to identification will serve to separate these four species and the two new ones being described.

Key to Species of *Lampanyctus* That Have VO_2 Both Elevated and Displaced Forward to Near VO_1

1a. Pectoral fin short and weak, with basal width less than distance between orbit and ventral margin of upper jaw. AOa series very slightly curved. Origin of anal base somewhat before a vertical from beginning of last third of dorsal base. VLO very near lateral line. VO_2 before vertical from VO_1..............*L. isaacsi*, new species.

1b. Pectoral fin long and strong, with basal width greater than distance between orbit and ventral margins of upper jaw.................... 2

2a. VO_2 distinctly before vertical from VO_1............ 3
2b. VO_2 distinctly behind vertical from VO_1............ 5

3a. VLO several diameters below lateral line. Prc_2, Prc_3, and Prc_4 form a straight, steeply oblique line. PLO, PVO_{1-2}, and PO_2 form a straight, somewhat posteriorly slanting line.....*L. omostigma*
3b. VLO in contact with lateral line (or very nearly so).. 4

4a. Prc_2 about under Prc_3, forming with Prc_4 a pronounced curve, the concavity facing posteriorly. AO 4 (3-5) + 9 (7-10), total 13 (12-14). 2 AOp over anal base. PO_2 in line with PVO_{1-2}. Gill rakers 3 (2-4) + 9 (7-10), total 13 (11-15) .. ..*L. basili*, new species
4b. Prc_2 well behind a vertical from Prc_3; Prc_1, Prc_3, and Prc_4 forming a straight, steeply oblique line. AO 5 (4-6) + 11 (9-12), total 15-16 (14-17). 4 (3) AOp over anal base. PO_2 behind a line through PVO_{1-2}. Gill rakers 4 +1+11 (10-12), total 16 (15-17)..................*L. hubbsi*

5a. PVO_1 well before a vertical from PVO_2; the two usually forming a straight line with PO_1. Prc_2, Prc_3, and Prc_4 forming a straight, steeply oblique line that passes far behind Prc_1........ ....*L. parvicauda*
5b. PVO_1 about under PVO_2, a line through them passing far behind PO_1. Prc_2, Prc_3, and Prc_4 forming a variably pronounced curve, the last two Prc forming a nearly straight line with Prc_1 ....*L. macropterus*

Lampanyctus basili Wisner, new species.
(Figures 5, 6; tables 3, 4, 5.)

MATERIAL EXAMINED. Holotype: SIO 69-20, sex undetermined, 55.7 mm. in standard length, taken with an Isaacs-Kidd 10-foot midwater trawl at 06°32.5' N., 114°16.0' E., between surface and 1100 m. (estimated depth), 24 April 1968, 1605-2105 hours, by the Scripps Circe Expedition. Paratypes: SIO 69-20 (9 specimens, 16-45 mm. in standard length, taken with the holotype); SIO 70-341 (21, 17-54), 18°14.4' N., 119°45.2 E., 0-1850 m., 17 November 1970, 0455-1240 hrs. SIO 70-343 (78, 18-51), 18°06.2' N., 119°07.9' E., 0-1850 m., 17-18 November 1970, 1600-0045 hrs. SIO 70-346 (78, 18-55), 14°48.9' N., 119°32.2' E., 0-1500 m., 19 November 1970, 0525-1410 hrs. SIO 70-347 (34, 27-54), 14°19.0' N., 119°35.0' E., 0-1750 m., 19 November 1970, 1505-2320 hrs. USNM 208461 (1, 54.0), 05°10' S., 153°41' E., 6 March 1965, time and depth of tow unknown to me (formerly *Te Vega* IIOE Station 239). USNM 208462 (1, 36.0), 17°34' S., 42°43' E., 0-±70 m., 13 October 1964, 0359-0402 hrs. (formerly R/V *Anton Bruun*, IIOE Cruise 8, station 407B). USNM 208463 (5, 24-56), 10°26' S., 115°16' E., 0-1500 m., 3 November 1960, 0121-0451 hrs. (formerly SIO 61-32). CAS 15990 (11, 20-24), 06°00.5' N., 122°35.6' E., 0-1120 m., 2 April 1968, 1200-1655 hrs. (formerly SIO 69-19). CAS 15991 (5, 36-49), selected from SIO 70-347 (see above). LACM 31396-7 (1, 45.0), 09°57' S., 64°55' E., 200-525 m., 2 June 1964, 1755-2250 hrs. LACM 33362-1 (1, 55.0), 19°08' N., 126°29' E., 0-2000 m., 13 September 1970, 0645-1535 hrs. (formerly SIO 70-333). LACM 33363-1 (5, 42-53), selected from SIO 70-346 (see above). BPBM 14311 (5, 17-43), 16°51' N., 119°24' E., 0-1550 m., 18 September 1970, 1030-1830 hrs. (formerly SIO 70-345). BPBM 14312 (5, 18-36), 08°33' N., 111°45' E., 0-800 m., 7 March 1960, 2205-2250 hrs. (formerly SIO 61-588). BPBM 14313 (5, 39-50), selected from SIO 70-343 (see above).

DESCRIPTION. Body elongate, slender, moderately compressed. Head long, about 3.4 in standard length, its depth 1.7 (1.6-1.8) in its length. Upper jaw long, 1.5 (1.4-1.6) in head; eye small, 3.0 (2.5-3.5) in upper jaw. Snout long, 1.3 in orbit; mouth terminal. Dorsal origin well behind that of pelvic; dorsal base 1.5 (1.4-1.6) in anal base. Origin of anal base under about beginning of last fourth of dorsal base. Pelvic fin short, usually reaching slightly beyond anus but seldom to anal origin. Pectoral fins long, reaching to Pol, filamentous at tips; pectoral base considerably longer than distance from orbit to ventral margin of upper jaw.

Numbers of fin rays, anal photophores (AO), gill rakers, and vertebrae (table 3) are compared with similar counts for related species. Counts for the holotype of *L. basili* are indicated by an asterisk. Body proportions for holotype and paratypes of *L. basili* are compared with similar data for related species (table 4).

Dentition. The small, villiform teeth of upper jaw form a narrow rounded band, with none enlarged; similar teeth on lower jaw form a more broadly rounded band, in which a few of the posteriormost inner teeth are somewhat enlarged and flattened, and slant forward. Tiny rounded teeth are thickly set on the slender palatines and the broad, oval mesopterygoids. There is a small patch of minute teeth on the posterior face of each vomer head.

Luminous organs. Dn is absent. The small but prominent Vn is located at anterior margin of orbit, well above ventral margin of pupil. A prominent Ce, as large as body photophores, lies just above dorsal insertion of opercle and slightly before a vertical from end of upper jaw. OP_2 is notably larger than other body photophores and is about on a line from lower margin of orbit to middle of pectoral base. PLO lies about two of its diameters below lateral line, before a vertical from pectoral origin. PVO_2 is located its diameter below and before pectoral origin; PVO_1, very slightly behind a vertical from PVO_2. Of the five PO, the fourth is elevated nearly to level of pectoral origin (to middle of base in some paratypes). The PO_{1-2} interspace is about 1.5 times those of PO_{2-3} and PO_{3-5}, which are about equal. PO_5 lies its diameter before and slightly below level of outer pelvic ray. VLO nearly touches lateral line (does touch in some paratypes) about over a midpoint between base of inner pelvic ray and VO_1. VO_2 is highly elevated (often to slightly below level of PO_4), and is displaced forward to at least its diameter before a vertical from VO_1; VO_3 is also elevated by at least its diameter above a line through dorsal margins of VO_1 and VO_4; the VO_{1-3} and VO_{3-4} interspaces are about equal.

SAO series is markedly angulate; SAO_1 lies slightly above level of SAO_2; SAO_{1-2} interspace slightly greater than that of SAO_{2-3}; SAO_1 is about midway between lateral line and ventral profile and is usually nearer VO_3 than VO_4; SAO_2 is about over anal origin; SAO_3 touches lateral line slightly before a vertical from anterior margin of first AOa. The four AOa form a notably curved series; AOa_2 is much elevated; the succeeding ones descend toward anal base; the AOa_{1-2} interspace is usually somewhat greater than the space between any remaining adjacent AOa. The two Pol form with the last AOa a notably oblique line, in which the spacing is equal; the upper POl is at lateral line. There are nine AOp, of which the first two lie over end of anal base; the first is always, the second is usually, depressed below level of the others; the series is evenly spaced and continuous with Prc_1. The AOa-AOp interspace is about three-fourths the least depth of caudal peduncle.

The number of Prc is herein interpreted as four; however, the series could reasonably be assumed to contain only three, because Prc_1 is much nearer to the last AOp than to Prc_2, so that the last three Prc are well isolated as a group (fig. 5). The Prc_{1-2} interspace is at least a photophore diameter greater than the Prc_{2-3} and Prc_{3-4} interspaces, and twice the interspace between photophores of the AOp series and between last AOp and Prc_1. Prc_2 is offset posteriorly to approximately below, or slightly before, a vertical from Prc_3, and forms a marked curve with Prc_3 and Prc_4. A line through Prc_1 and Prc_4 forms an angle of from 50 to 55 degrees from the vertical; Prc_3 lies at least its diameter below this line.

Supra- and infracaudal luminous glands respectively with 3 to 4 and 7 to 9 overlapping, seemingly coalesced scales, not margined with dark pigment.

DISTRIBUTION. *Lampanyctus basili* is known from below South Africa, across the tropical Indian Ocean, into the Indo-Pacific region, and eastward to the Bismarck Archipelago (fig. 6). In the South China Sea area it appears to be common and gregarious (encircled area, fig. 6); two hauls took 78 specimens each, and two other hauls 21 and 34 respectively. In comparable hauls from other localities throughout the range, no more than 9 (usually 1 to 5) were taken in any one.

ETYMOLOGY. I am pleased to name this species for Basil G. Nafpaktitis in recognition of his extensive work on myctophid fishes of the North Atlantic and western Indian oceans.

Lampanyctus isaacsi Wisner, new species.
(Figures 6, 7; tables 3, 4, 5, 6.)

MATERIAL EXAMINED. *Lampanyctus isaacsi* is represented by 8 specimens from two collections: one of 3 specimens from the eastern Atlantic Ocean off Freetown, Sierra Leone, and one of 5 specimens from the Guinea Basin, south of Liberia. The new species is of considerable interest in that its characters are those considered to be diagnostic of rather widely divergent species groups of the genus; these relationships are discussed below. Holotype: SIO 63-560, sex unknown, 52.0 mm. in standard length, taken by a 10-ft. Isaacs-Kidd midwater trawl at 01°10' N., 11°36.0' W., between surface and 2300 m., 6 July 1963, 0250-0745 hrs. Paratypes: SIO 63-560 (3 specimens, 27-64 mm. in standard length), taken with the holotype. USNM 206795 (5, 79-126), taken at 09°10' N., 15°39' W., in a bottom trawl fished to 600-610 m., 28 November 1963, 0648 hr. Galathea Expedition Station 99 (1, 51.2), 08°40' S., 11°10' E., 5200 meters of wire out, 11 December 1950, start of tow 1110 hrs.

DESCRIPTION. Body slender, elongate, somewhat flaccid and laterally compressed. Head long, 3.5 in standard length, its depth about 1.8 in its length. Upper jaw about 1.4 in head, 5.6 in standard length. Orbit small, 5.5 in head, 3.5 in upper jaw. Snout about as long as orbit. The lens is very small, about half the diameter of pupil. The mouth is essentially terminal; tip of lower jaw protruding very slightly. Dorsal origin well before midpoint of body; pelvic origin well before a vertical from that of dorsal. Anal origin a little before midpoint of body and somewhat before a vertical from middle of dorsal base. Anal and dorsal bases long, the anal 4, the dorsal 5 times in standard length; dorsal base 1.2 in anal base. Base of adipose fin slightly behind a vertical from end of anal base.

Frequency distributions of fin rays, vertebrae (table 3), anal photophores, and gill rakers (table 4), and body proportions (table 5), are compared with similar data for related species. Counts for the holotype of *L. isaacsi* are indicated by an asterisk in tables 3 and 4.

Dentition. Teeth of both jaws are cardiform, with none enlarged. Those of upper jaw form a narrow, flatly rounded band along outer margin of premaxillary; those of the lower jaw are in a more rounded band, about twice the width of the upper band. A few teeth at the extreme posterior end of the dentary are broadened and somewhat enlarged. Teeth on palatines and mesopterygoids and in a small patch on the posterior surfaces of vomer heads are conical, sharp, and much smaller than those of jaws.

Luminous organs. The following description of photophores is taken primarily from the holotype, which is in rather good condition, because all paratypes are partially denuded and lack some photophores. Pits in the flesh and traces of missing photophores indicate patterns that agree well with those of the holotype.

The body photophores are not notably small, but are flattened ventrally to a somewhat semilunate configuration. Dn is absent. The small but prominent Vn lies a little below center of anterior border of orbital rim, level with ventral margin of nasal rosette. OP_1, nearly as large as body photophores, lies well below end of upper jaw; OP_2, about twice larger than body photophores, is a little behind a vertical from OP_1 and about level with ventral margin of orbit. The small Ce is just above dorsal insertion of opercle and about vertically over end of upper jaw. PLO nearly touches lateral line, well before the PVO group. PVO_1 lies almost directly below PVO_2; PVO_2 is close to, and one diameter below, pectoral origin. The five PO are unequally spaced: the PO_{1-2} interspace is 1.5 to 2.0 times that of PO_{2-3}; the PO_{3-5} interspace about equals, or sometimes slightly exceeds, the PO_{2-3} interval. PO_4 lies one diameter behind a vertical from PO_3, and is elevated to about level of pectoral origin. PO_5 is located just above outer ray of pelvic fin. VLO nearly touches lateral line about over base of inner pelvic ray and before a vertical from VO_1. The second of the four VO organs is elevated nearly to level of PO_4 and is displaced one diameter forward of VO_1; the first, third, and fourth are about equally spaced.

The SAO series is broadly angulate, with SAO_1 slightly below level of SAO_2 and somewhat nearer ventral profile than lateral line, and much nearer VO_4 than VO_3. The SAO_{1-2} interspace is a photophore diameter or more greater than that of SAO_{2-3}. SAO_2 lies behind a vertical from anal origin and a little more than one-third nearer lateral line than anal origin. SAO_3 touches lateral line about over AOa_1. AO 6 + 7-8; the AOa series is slightly but distinctly curved; the AOa_{1-2} interspace is usually somewhat greater than the space between any adjacent AOa. The two Pol form a flatly oblique line with the last AOa and front of base of adipose fin. AOp is continuous with Prc; not more than one AOp overlies anal base. AOa-AOp interspace is about 75 percent of least depth of caudal peduncle. Upper Prc is level with and just behind end of lateral line. The last three Prc form a straight, strongly oblique line; the three Prc and the last AOp are equally spaced.

The short supracaudal luminous gland comprises three or four small, weakly developed, overlapping scales. The long infracaudal gland comprises eight or nine similar scales, which reach to about the third or fourth AOp.

DISCUSSION. The placement of *Lampanyctus isaacsi* within the genus is necessarily somewhat arbitrary and dependent upon the phylogenetic importance accredited to several characters. Because of the elevated and far-forward position of VO_2, *L. isaacsi* is referable to that group discussed above in relation to *L. basili* -- a group further characterized by having long, broad-based pectoral fins and markedly curved AOa series of photophores. However, the position of VO_2, and the slightly curved AOa series appear to be the only characters linking *L. isaacsi* to that group. In most other respects, particularly the narrow-based and weak pectoral fins, and the considerable overlap of the dorsal and anal fin bases, *L. isaacsi* appears to be more closely allied to other species of the genus having similar characters: the species complex of *L. niger* (Günther, 1887), *L. ater* Tåning, 1928, and *L. achirus* Andriashev, 1962, and two additional species, *L. lineatus* and *L. cuprarius*, both described by Tåning, 1928. The first three species are separable from the last two primarily in having SAO_1 over the VO_{2-3} interspace; in the last two species, and in *L. isaacsi*, SAO_1 lies over the VO_{3-4} interspace. *L. isaacsi* is separable from *L. lineatus* and *L. cuprarius* principally by reason of the elevated and far-forward position of VO_2. Additional characters (table 6) distinguish these three species.

It should be noted that the configuration of the VO series in *L. lineatus* and *L. cuprarius* has been variously presented. Nafpaktitis and Nafpaktitis (1969, pp. 41-42, figs. 49-50) described and figured the VO series as curved, with VO_2 elevated but not displaced forward, for the holotype of *L. cuprarius* (63.0 mm.) and for a specimen (97.0 mm.) of *L. lineatus*. These authors also stated that the SAO_1 is over the VO_{3-4} interspace in each species and so figured *L. lineatus*; however, perhaps by error, SAO_1 was shown to be behind VO_4 for *L. cuprarius*. Rolf L. Bolin has kindly provided me with an unpublished drawing of a specimen of *L. cuprarius* (49.2 mm.), from the northwestern Atlantic Ocean, in which the VO series is shown to be level and SAO_1 to be nearer VO_3 than VO_4. Bolin (1959) did not describe the

VO series for either *L. lineatus* or *L. cuprarius*. Parr (1928, p. 107, fig. 18) described and figured the VO series as level and SAO_1 over the VO_{3-4} interspace for both these species.

DISTRIBUTION. *Lampanyctus isaacsi* is known only from the eastern tropical Atlantic Ocean at the western boundary of the Gulf of Guinea (fig. 6).

ETYMOLOGY. I take pleasure in dedicating this interesting species to Professor John D. Isaacs, in honor of his development of the Isaacs-Kidd midwater trawl and his many other contributions to the marine sciences.

SECTION III. *Lampanyctus acanthurus*

Lampanyctus acanthurus Wisner, new species.
(Figure 8.)

MATERIAL EXAMINED. Holotype: SIO 71-305, a male, 93.3 mm. in standard length, taken at 27°25' N., 155°32'W., on 1 October 1971, in an Isaacs-Kidd midwater trawl fished open from surface to estimated depth of 560 m. during 0430-0616 hours. Paratypes: SIO 71-309 (3 specimens, 79-94 mm. in standard length), 27°27' N., 155°38' W., 0-1100 m., 29-30 July 1972, 2229-0335 hrs. SIO 72-373 (6, 26-31), 30°39' N., 155°20' W., 0-1100 m., 24 June 1972, 1805-2136 hrs. SIO 70-102 (1, 33), 27°52' N., 155°14' W., 0-1620 m., 31 August 1969, 1824-2040 hrs. SIO 63-405 (1, 50), 34°57' N., 129°19' W., 0-1863 m., 29 March 1962, 1022-1511 hrs. SIO 63-406 (1, 75), 34°16' N., 130°41' W., 0-800 m., 29-30 March 1962, 2330-0110 hrs. USNM 208465 (2, 69-112), 27°26' N., 155°25' W., 0-1100 m., 1 October 1971, 1047-1547 hrs. (formerly SIO 71-307). CAS 15992 (1, 94), 27°17' N., 155°02' W., 0-1350 m., 24 September 1971, 1917-2230 hrs. (formerly SIO 72-11). CAS 15993 (2, 30-38), 31°06' N., 155°20' W., 0-1350 m., 21-22 June 1972, 2342-0325 hrs. (formerly SIO 72-372). LACM 33364-1 (1, 93), 27°27' N., 155°25' W., 0-1350 m., 30 October 1971, 1853-2230 hrs. (formerly SIO 71-303). LACM 33365-1 (1, 92), 27°36' N., 155°27' W., 0-1800 m., 5-6 October 1971, 2335-0505 hrs. (formerly SIO 72-25). BPBM: 14314 (1, 94), 27°23' N., 155°25' W., 0-1350 m., 23 September 1971, 2050-2345 hrs. (formerly SIO 72-9). All specimens known to me are designated as types.

DESCRIPTION. Body elongate, moderately robust, its greatest depth about 20 percent of its length. Head long, about 30 percent of standard length, and deep, about 63 percent of its length. Mouth terminal, both jaws slightly curved upward near symphysis. Upper jaw long, 74 (72-76 percent of head length. Orbit moderately large, about 3 in length of upper jaw. Gill rakers of outer arch long and slender, those at the angle slightly shorter than orbit. Origin of base of anal fin directly below end of dorsal base. Origin of pelvic fin well before that of dorsal. Pectoral fin very long, reaching to third AOa in holotype (to fifth AOa in one paratype). Base of adipose fin over or very slightly behind a vertical from end of anal base. Caudal peduncle moderately deep, about 2.2 (2.0-2.4) in length of peduncle.

Teeth of both jaws villiform, none enlarged. Minute teeth are thickly set on palatines and on the broadly ovate mesopterygoids. The posterior faces of vomer heads bear a few very small teeth.

Dorsal rays 13 (14); anal rays 17 (16-18); pectoral rays 14-15. AO (5) 6 + 7 (8), total 13 (12-14); gill rakers 5 (6) + 1 + 10 (9-11), total 16 (15-18); vertebrae 36 (12 specimens). Particularly diagnostic is the high number of procurrent caudal rays: 9 (8-10) above and 10 (11) below. In this unusually high number of procurrent caudal rays *L. acanthurus* lines up with species of certain other myctophid genera: *Lampanyctodes*, *Gymnoscopelus*, *Notoscopelus*, *Lampichthys*, *Hintonia*, and *Scopelopsis*.

Body proportions. Data are given for the holotype first and are followed by the average and range for paratypes (11, unless otherwise noted). Head length 291, 294 (284-306); head depth 182, 185 (174-196); upper-jaw length 214, 215 (209-229); orbit length 67, 63 (55-69); prepectoral length 304, 310 (303-326); prepelvic length 422, 430 (423-440); predorsal length 467, 463 (457-478); preanal length 587, 586 (575-600); preadipose length 802, 803 (790-812); dorsal to anal origins 234, 245 (232-255); dorsal to pelvic origins 212, 203 (191-214); dorsal-base length 155, 160 (153-170); anal-base length 210, 209 (202-217); caudal-peduncle length 231, 220 (211-228); caudal-peduncle depth 103, 99 (90-109); pectoral-fin length 394, 387 (340-414 in 10 specimens); pelvic-fin length 171, 168 (160-184 in 6 specimens); infracaudal-gland length 151, 163 (147-199).

Luminous organs. All photophores are reniform and are bordered dorsally and laterally with dark pigment; ventrally, a rather narrow downwardly directed channel is unpigmented. There is no evidence of minute secondary photophores on head or back. Dn is absent. Vn is small, is heavily masked dorsally by a thick streak of dark pigment that covers anteroventral margin of orbit, and is located just below confluence of orbital rim and posterodorsal aspect of nasal apparatus. Cheek and Bu photophores are absent. A prominent Ce lies at dorsal margin of opercle, well before a vertical from end of upper jaw. OP_1, somewhat larger than other photophores, is about on level of middle of base of pectoral fin; OP_2 lies directly below OP_1, about in line with the gape. PLO is located about two of its diameters below lateral line and about three diameters before origin of pectoral fin. PVO_1 is about its diameter before bases of fourth or fifth pectoral ray; PVO_2, about three diameters below and two before base of lower pectoral ray. PLO, PVO_{1-2}, and PO_2 form a nearly straight, posteriorly slanting line.

Five PO; PO_4 highly elevated to on or slightly above level of middle of base of pectoral fin and lies just behind a vertical from PO_3. PO_{2-3} interspace slightly less than those between PO_{1-2} and between PO_{3-5}, which are about equal. VLO lies about its diameter nearer to lateral line than to base of pelvic fin, and about over base of inner ray of that fin, and on or very near a line from PLO to SAO_1. The four VO form a curved line, along which VO_2 is elevated by at least its diameter above VO_1 and VO_3 is on a descending line between VO_2 and VO_4, which is close to vent.

SAO series forms an angle of about 110°-115°. SAO_{1-2} interspace slightly exceeds that of SAO_{2-3}. SAO_1 lies about its diameter before a vertical from VO_3, on or slightly above level of SAO_2. SAO_3 touches lateral line; a line through SAO_{2-3} passes through or slightly behind VO_4. The AO series, numbering 6 + 7, is slightly curved, with AO_1 depressed about its diameter below AO_2. All AOp lie behind end of anal base. AOa-AOp interspace equals about half the least depth of caudal peduncle. The two Pol lie on a line from last AOa to end of adipose base. The AOp and Prc series are continuous. First three of the four Prc are closely spaced, near bases of procurrent caudal rays; Prc_4 is widely distant, at lateral line about one or two of its diameters behind a vertical from Prc_3.

The very short supracaudal luminous gland apparently comprises only two coalesced scales. The long infracaudal gland is formed by seven overlapping scales that extend to base of last anal ray.

COMPARISONS. *Lampanyctus acanthurus* is closely related to the poorly understood nominal species *L. tenuiformis* Brauer, 1906, and *L. festivus* Tåning, 1928, which may be conspecific. They were considered as distinct in the brief discussion by Nafpaktitis and Nafpaktitis (1969, p. 46, figs. 57, 58). These authors stated that *L. tenuiformis* has 6 infracaudal luminous scales that occupy about four-fifths of the ventral surface of the caudal peduncle and that *L. festivus* has 8 scales that fill the entire surface. Other differences indicated were, respectively, 18 versus 20 anal rays, 14 versus 17 pectoral rays, and 6 + 7 versus 7 + 8 AO photophores. The AO_2 series of photophores was illustrated as being straight in *L. tenuiformis*, but curved in *L. festivus*. The gill rakers were stated to number 4 + 1 + 9 for *L. tenuiformis*; no count was given for *L. festivus*, but for that species Bolin (1959) listed 4 + 1 + 9 (8-9) rakers. Nafpaktitis and Nafpaktitis (1969) also stated: "In addition, the VO series in *L. festivus* formed a pronounced arc, with the second VO well above the level of the first VO. The same organs were on the same or almost the same level in *L. tenuiformis.* The SAO_1 was on the same level with the SAO_2 and distinctly in advance of the VO_3 in *L. festivus,* whereas in *L. tenuiformis* this organ was somewhat lower than the SAO_2 and directly above the VO_3." These authors did not mention cheek photophores, but Bolin (1959) stated that a poorly developed Bu was detectable over the posterior part of the maxillary in good specimens of *L. festivus.*

Based on the above criteria, *L. acanthurus* is most closely related to *L. festivus* in that it has a long infracaudal gland and a distinctly curved VO and AO series of photophores. The sharpest distinction seems to lie in the higher number of procurrent caudal rays (a character heretofore largely ignored). Dr. E. Bertelsen (personal communication, 1972) has found that the holotype of *L. festivus* has six procurrent rays in each lobe of the caudal fin.

DISTRIBUTION. *Lampanyctus acanthurus* is known only from two areas of the North Pacific Ocean, as indicated by the capture data listed for the study material (all known specimens). Most specimens were taken about 600 miles north of Hawaii (about 27-31° N., 155°W.). Two specimens were taken about 350 miles west of Pt. Conception, California.

ETYMOLOGY. The name *acanthurus* is based on the latinized Greek words *acanthos,* spiny, and *ura,* tail, in reference to the unusually high number of spiny procurrent rays in the caudal fin.

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TABLE 1. *Numbers of anal photophores (AO) and gill rakers for* Diaphus trachops[1], D. similis[1], D. suborbitalis *and* D. termophilus.

	Anal Photophores									
	AOa			AOp			Total AO			
	5	6	7	4	5	6	9	10	11	12
D. trachops[1]	2*	19	2	--	16*	7	--	2	12	9
D. similis[1]	2	37*	4	8	35*	--	--	8	33	2
D. suborbitalis	2	20	--	--	21	1	--	1	20	1
D. termophilus	14	52	--	48	18	--	4	54	8	--

	Upper Gill Rakers						
	6	7	8	9	10	11	12
D. trachops[1]	--	5*	25	2	--	--	--
D. similis[1]	1	36*	5	--	--	--	--
D. suborbitalis	--	--	--	7	15	10	4
D. termophilus	16	50	3	--	--	--	--

[1] Asterisks indicate counts for the holotypes of *Diaphus trachops* and *D. similis*.

TABLE 1. (Continued)

	Lower Gill Rakers (including central raker)							
	13	14	15	16	17	18	19	20
D. trachops[1]	--	--	4*	14	12	2	--	--
D. similis[1]	--	5	31*	6	--	--	--	--
D. suborbitalis	--	--	--	--	--	14	17	5
D. termophilus	11	51	7	--	--	--	--	--

	Total Gill Rakers												
	19	20	21	22	23	24	25	26	27	28	29	30	31
D. trachops[1]	--	--	--	3*	3	12	10	4	--	--	--	--	--
D. similis[1]	--	--	5	27*	10	--	--	--	--	--	--	--	--
D. suborbitalis	--	--	--	--	--	--	--	--	7	6	9	6	8
D. termophilus	7	13	39	10	--	--	--	--	--	--	--	--	--

1 Asterisks indicate counts for the holotypes of *Diaphus trachops* and *D. similis*.

TABLE 2. *Body proportions, expressed as thousandths of standard length, for* Diaphus trachops, D. similis, D. suborbitalis, *and* D. termophilus.

	D. trachops		*D. similis*		*D. suborbitalis*		*D. termophilus*	
	16(32.1-63.5 mm.)		17(36.6-72.2 mm.)		9(52.5-71.5 mm.)		11(30.2-48.2 mm.)	
	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range
Head length	314	304-320	329	317-340	299	286-312	351	341-361
Head depth	220	210-233	218	208-233	201	193-207	245	227-266
Upper-jaw length	240	230-248	233	223-243	226	220-235	262	252-271
Orbit length	94	88-100	86	79-92	83	80-91	95	90-100
Prepectoral length	313	301-328	333	320-346	302	289-312	337	323-352
Prepelvic length	447	428-464	450	439-463	446	435-462	475	450-495
Preanal length	644	625-660	638	627-653	640	622-663	655	641-671
Predorsal length	464	450-477	461	451-469	453	446-465	513	504-528
Preadipose length	829	813-846	823	810-839	817	800-849	844	827-866
Dorsal to pelvic origins	212	198-223	207	191-222	198	187-207	246	227-266
Dorsal to anal origins	293	280-308	297	288-308	278	268-291	288	276-301
Caudal-peduncle length	200	181-208	185	170-202	197	183-215	182	173-192
Caudal-peduncle depth	93	86-100	96	86-108	96	92-100	102	93-112
Dorsal-base length	186	181-197	192	181-206	198	193-211	179	166-187
Anal-base length	185	174-197	192	182-209	176	179-181	188	182-203

TABLE 3. *Numbers of fin rays and vertebrae for species of* Lampanyctus *having the* VO_2 *photophore markedly elevated and displaced forward to near* VO_1.

	Dorsal rays							Pectoral rays					
	11	12	13	14	15	16		11	12	13	14	15	16
L. basili [1]	--	--	20	32*	1	--	*L. basili* [1]	2	27*	26	--	--	--
L. hubbsi	--	1	6	24	1	--	*L. hubbsi*	--	2	24	28	4	--
L. macropterus	--	--	5	4	--	--	*L. macropterus*	1	4	12	4	--	--
L. omostigma	--	--	14	37	3	--	*L. omostigma*	--	18	58	19	--	--
L. parvicauda	--	--	4	49	2	--	*L. parvicauda*	--	20	52	22	1	--
L. isaacsi [1]	--	--	--	--	5*	1	*L. isaacsi* [1]	1	2*	2	--	--	--

	Anal rays							Vertebrae					
	16	17	18	19	20	21		34	35	36	37	38	39
L. basili [1]	1	2	30*	17	2	--	*L. basili* [1]	--	16	35*	1	--	--
L. hubbsi	--	--	1	5	20	6	*L. hubbsi*	--	--	--	16	19	2
L. macropterus	--	--	3	5	1	--	*L. macropterus*	14	13	--	--	--	--
L. omostigma	3	7	36	10	1	--	*L. omostigma*	--	17	82	33	2	--
L. parvicauda	--	6	37	9	1	--	*L. parvicauda*	--	27	78	23	5	--
L. isaacsi [1]	--	1	4	1*	--	--	*L. isaacsi* [1]	2	5*	--	--	--	--

[1] Asterisks indicate the counts for the holotypes of *Lampanyctus basili* and *L. isaacsi*.

TABLE 4. *Numbers of gill rakers and anal photophores for species of* Lampanyctus *having the* VO_2 *photophore (AO) markedly elevated and displaced forward to near* VO_1.

	Upper Rakers				Lower Rakers (including central raker)						
	2	3	4	5	8	9	10	11	12	13	14
L. basili [1]	2	80*	5	--	1	5	76*	5	--	--	--
L. hubbsi	--	66	--	--	--	--	--	5	54	7	--
L. macropterus	--	31	2	--	--	1	27	2	--	--	--
L. omostigma	--	6	297	6	--	--	11	130	162	6	--
L. parvicauda	--	198	3	--	--	17	178	6	--	--	--
L. isaacsi [1]	--	--	--	12*	--	--	--	--	--	2	10*

	Total Gill Rakers									
	10	11	12	13	14	15	16	17	18	19
L. basili [1]	3	3	74	4*	3	--	--	--	--	--
L. hubbsi	--	--	--	--	--	5	54	7	--	--
L. macropterus	--	--	2	37	4	--	--	--	--	--
L. omostigma	--	--	--	--	15	128	154	12	--	--
L. parvicauda	--	--	16	177	8	--	--	--	--	--
L. isaacsi [1]	--	--	--	--	--	--	--	--	2	10*

[1] Asterisks indicate the counts for the holotypes of *Lampanyctus basili* and *L. isaacsi*.

TABLE 4. (Continued)

	AOa				AOp					
	3	4	5	6	7	8	9	10	11	12
L. basili [1]	10	145*	61	--	2	63	137*	14	--	--
L. hubbsi	--	3	46	15	--	--	4	35	23	2
L. macropterus	--	5	23	15	2	22	12	--	--	--
L. omostigma	--	19	115	21	10	69	61	8	--	--
L. parvicauda	--	32	101	4	2	40	76	9	2	--
L. isaacsi [1]	--	--	--	10*	2	3*	--	--	--	--

	Total AO					
	12	13	14	15	16	17
L. basili [1]	33	152*	31	--	--	--
L. hubbsi	--	--	3	27	30	4
L. macropterus	3	19	12	2	--	--
L. omostigma	5	78	57	8	--	--
L. parvicauda	2	61	61	3	2	--
L. isaacsi [1]	--	2	3*	--	--	--

[1] Asterisks indicate the counts for the holotypes of *Lampanyctus basili* and *L. isaacsi*.

TABLE 5. *Body proportions, expressed as thousandths of standard length, for* Lampanyctus basili, L. isaacsi, *and* L. macropterus.

	L. basili			*L. isaacsi*			*L. macropterus*	
		Paratypes 19 (29-57 mm.)			Paratypes 5 (90-125 mm.)		15 (27-65 mm.)	
	Holotype 55.7 mm.	Avg.	Range	Holotype 52.0 mm.	Avg.	Range	Avg.	Range
Head length	273	289	269-310	292	273	261-292	304	288-317
Head depth	162	173	160-182	167	153	141-168	171	159-180
Upper-jaw length	194	199	188-210	204	182	165-207	202	196-211
Orbit length	66	66	59-75	54	52	42-58	72	64-81
Prepectoral length	296	301	285-323	292	272	269-298	314	295-323
Prepelvic length	415	408	391-419	400	382	370-402	411	401-420
Preanal length	553	562	546-579	524	521	507-526	555	543-563
Predorsal length	454	466	451-482	449	448	434-451	480	468-496
Preadipose length	777	791	770-807	779	781	778-785	808	799-819
Dorsal to pelvic origins	192	186	170-202	160	157	150-168	184	172-196
Dorsal to anal origins	210	211	198-221	183	183	177-187	197	184-211
Caudal-peduncle length	226	224	210-240	250	243	239-249	207	192-221
Caudal-peduncle depth	83	83	72-95	73	81	72-91	78	70-85
Dorsal-base length	158	157	143-169	201	207	194-220	150	141-155
Anal-base length	226	231	218-247	240	245	237-253	246	234-262
Supracaudal-gland length	90	76	55-103	50	53	50-59	69	57-82
Infracaudal-gland length	180	169	148-188	138	139	130-149	150	124-180

TABLE 6. *Characters other than position of* VO_2 *useful in separating* Lampanyctus isaacsi, L. lineatus, *and* L. cuprarius.

Characters	*L. isaacsi*	*L. lineatus* [1]	*L. cuprarius* [1]
Luminous scales in infracaudal gland	8-9	3-8 [2]	3-4
Distance from end of anal base to Prc_4	Much greater than length of upper jaw	Equal to or slightly greater than length of upper jaw	Much less than length of upper jaw
Last three Prc	In a straight line	In a curved line	In a straight line
AO photophores	6+7-8, total 13-14	7-8+7-9, total 15-16	6(5-7)+ 5(5-6), total 11-12
Dorsal rays	15(16)	16-17(18)	(16)17
Anal rays	18(17-19)	20-21	18(19)
Pectoral rays	12(11-13)	12	11(10-13)
Gill rakers	5+1+13(12)	5+1+11(12)	5+1+11(12)

[1] Data taken from Nafpaktitis and Nafpaktitis (1969) and from Bolin (1959).

[2] Bolin (1959) reported 3 to 5 luminous scales for *L. lineatus* from the northwestern Atlantic; Nafpaktitis and Nafpaktitis (1969) reported 6 to 8 scales for western Indian Ocean specimens.

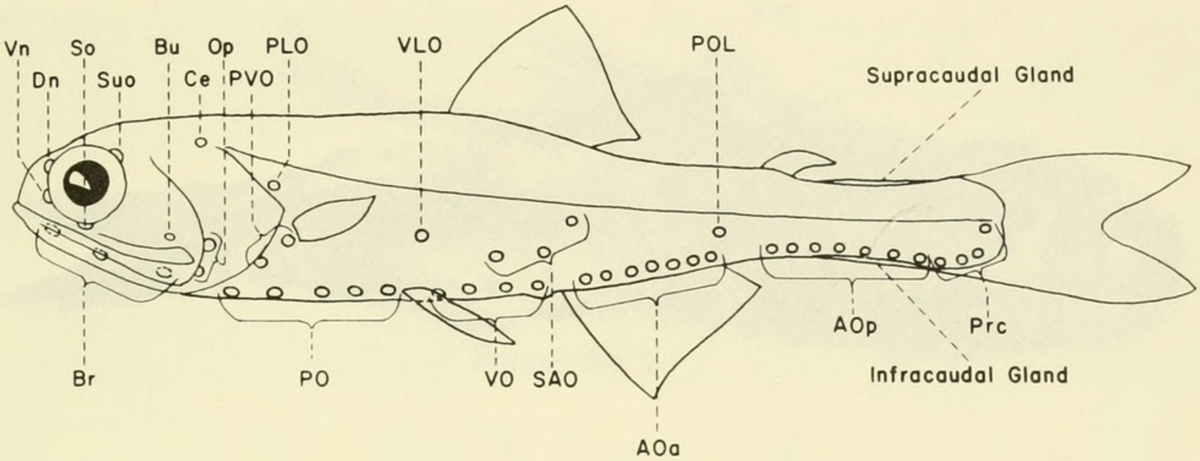
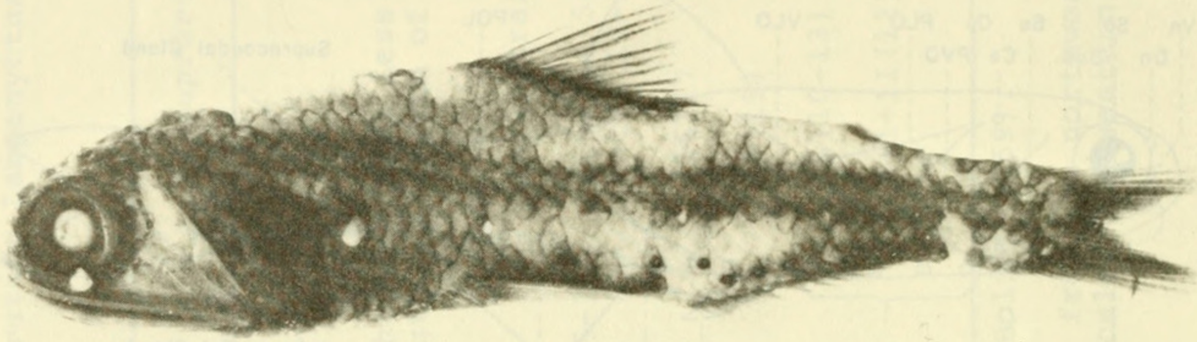


FIGURE 1. General distribution of photophores of body and luminous organs of head of a hypothetical myctophid fish and their abbreviated terminology.



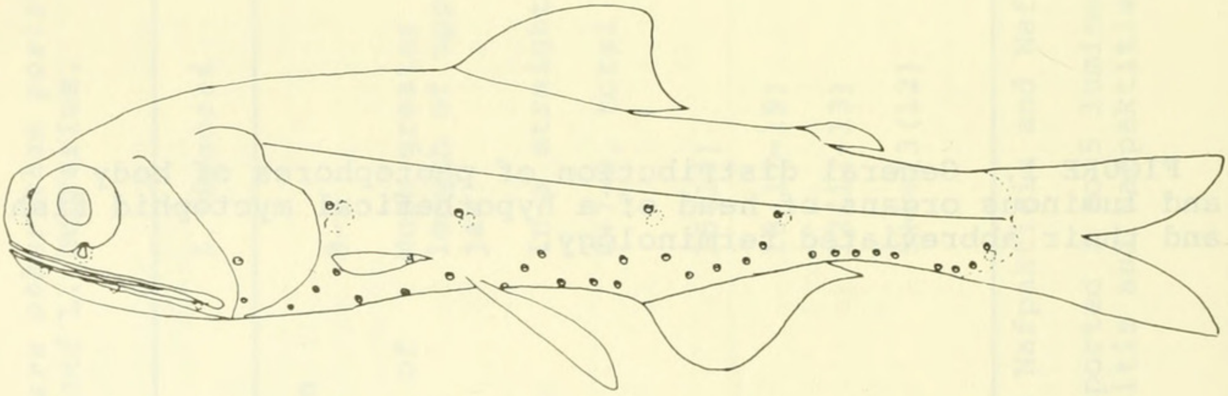


FIGURE 2. *Diaphus trachops*. Holotype, SIO 71-172, male, 63.5 mm. S.L., photograph and schematic drawing, the latter to show particularly the photophore patterns.

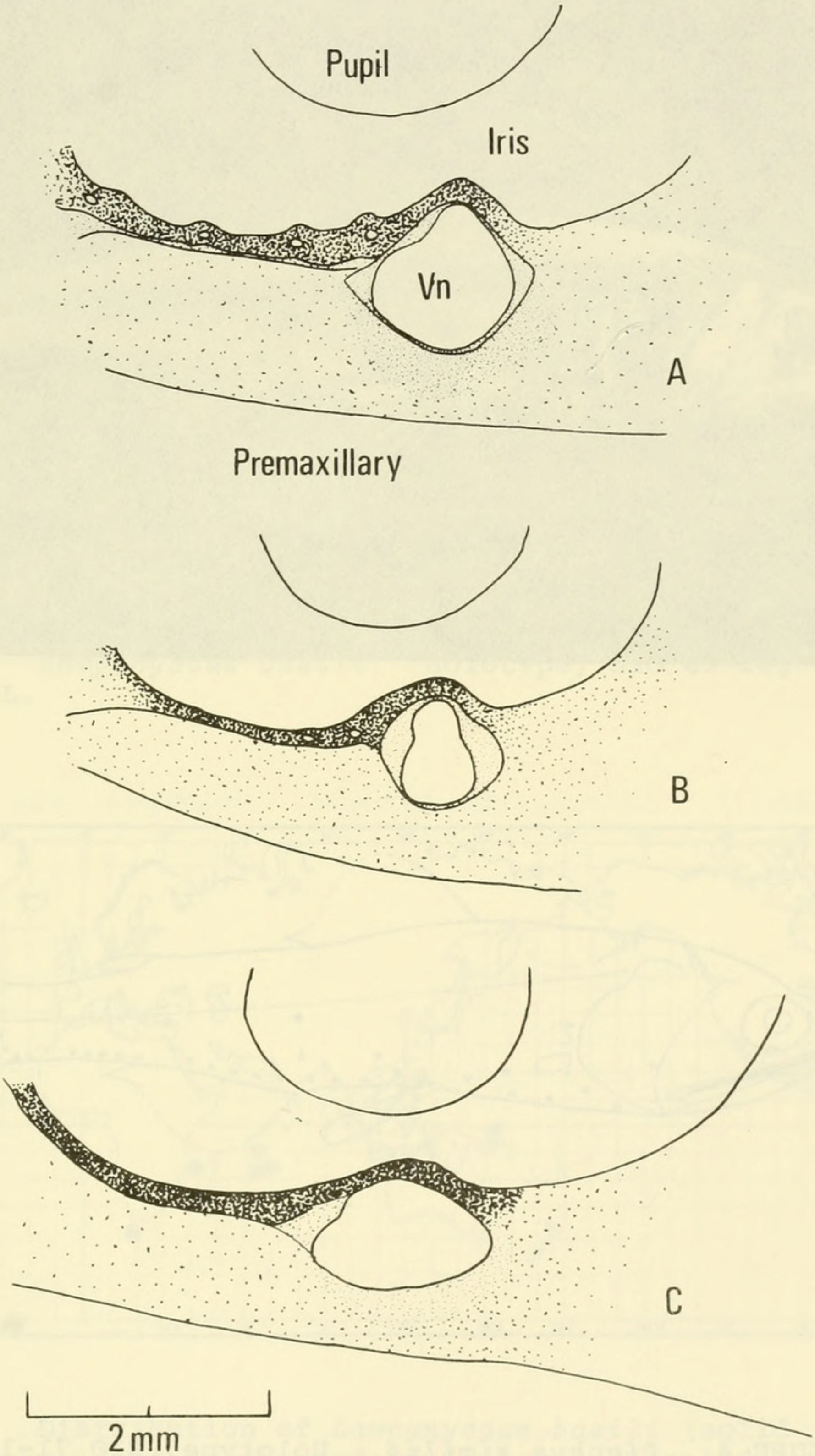


FIGURE 3. Vn and associated ventral margin of orbit of *Diaphus trachops* (A), *D. similis* (B), and *D. termophilus* (C).

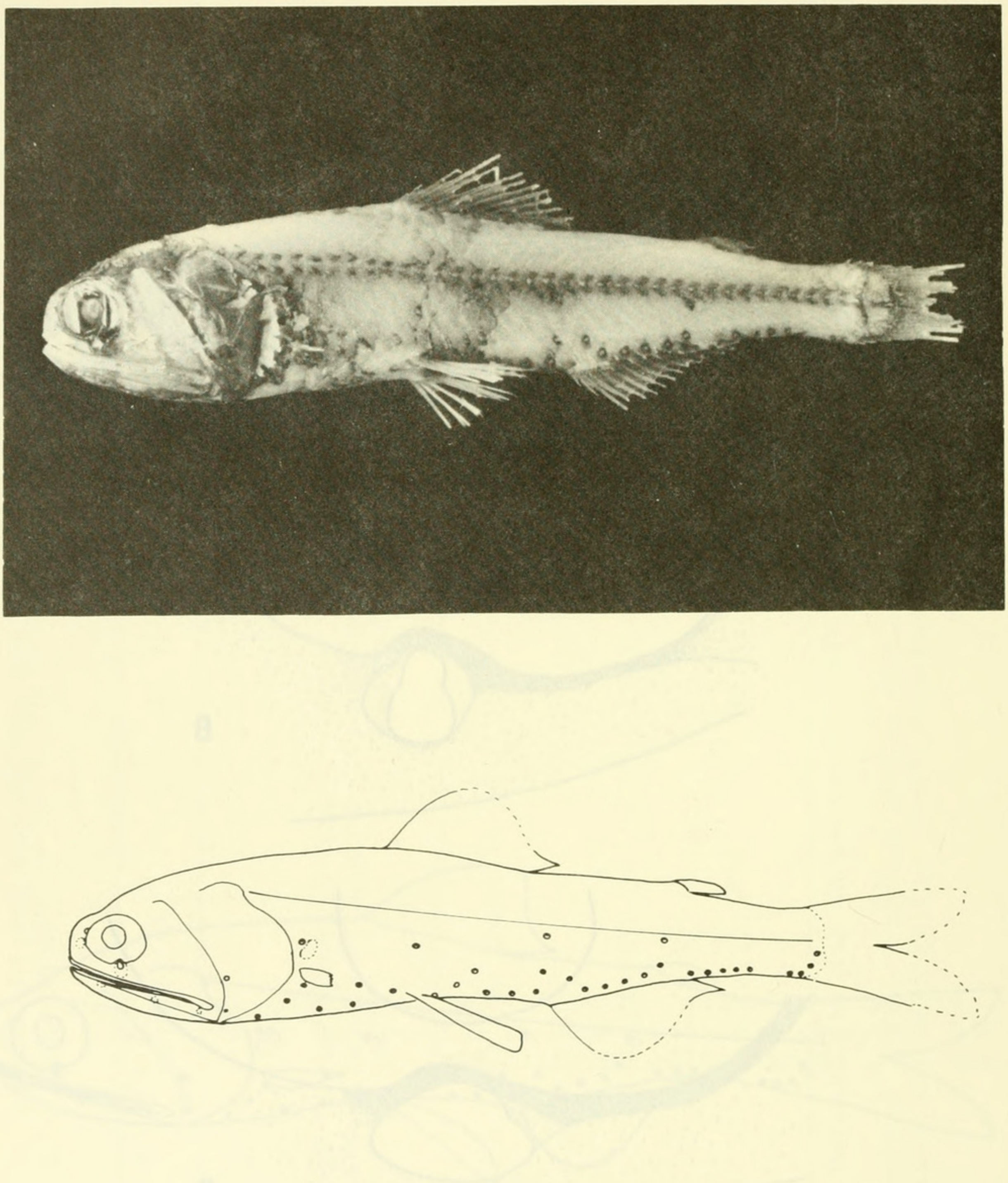


FIGURE 4. *Diaphus similis*. Holotype, SIO 71-177, female, 72.2 mm. S.L., photograph and schematic drawing, the latter to show particularly the photophore patterns.

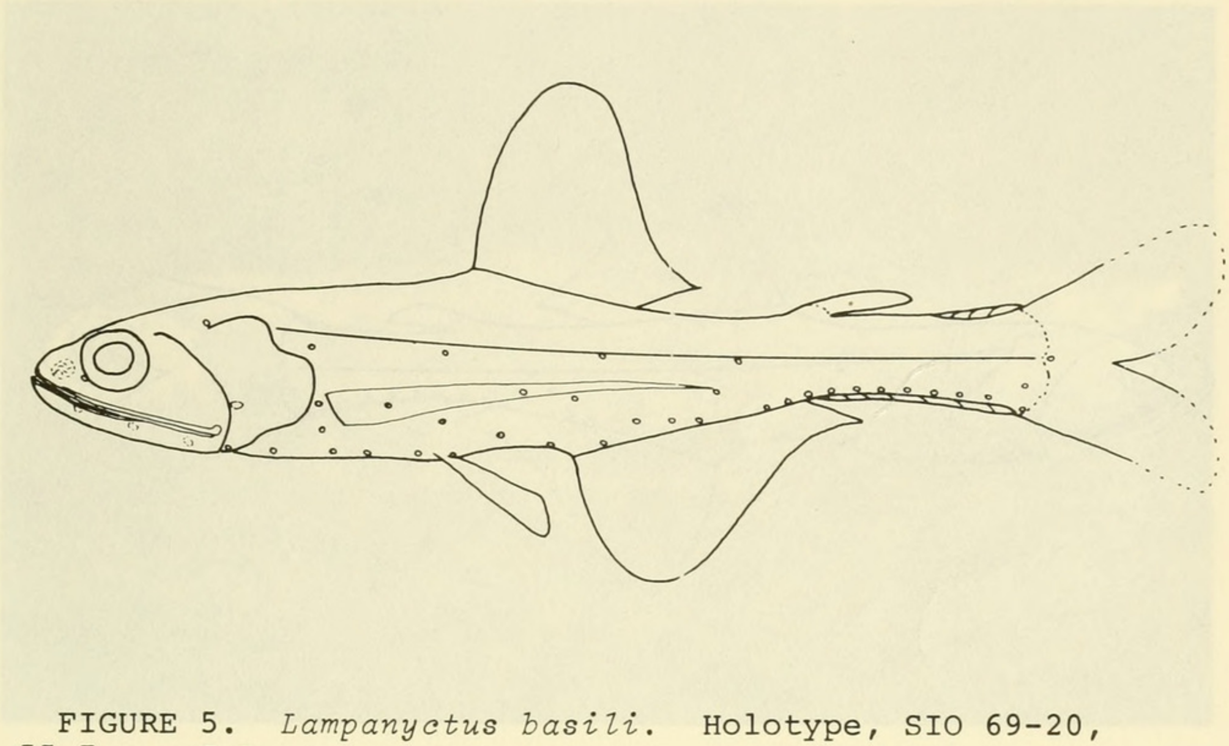


FIGURE 5. *Lampanyctus basili.* Holotype, SIO 69-20, 55.7 mm. S.L.

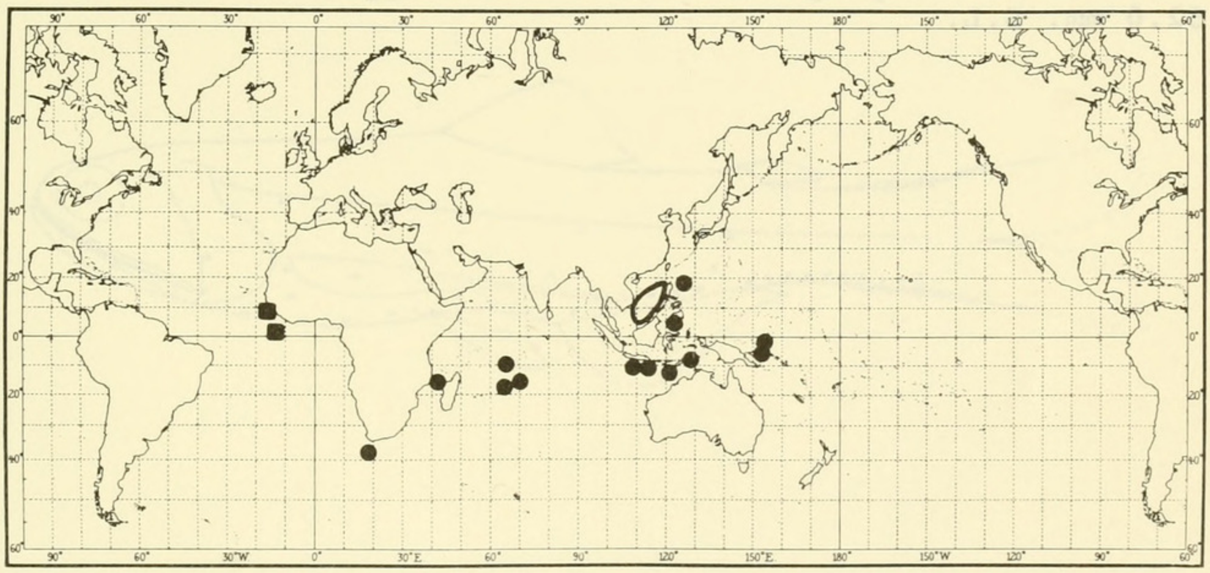


FIGURE 6. Distribution of *Lampanyctus basili* (solid circles and outlined area), and of *L. isaacsi* (solid squares).

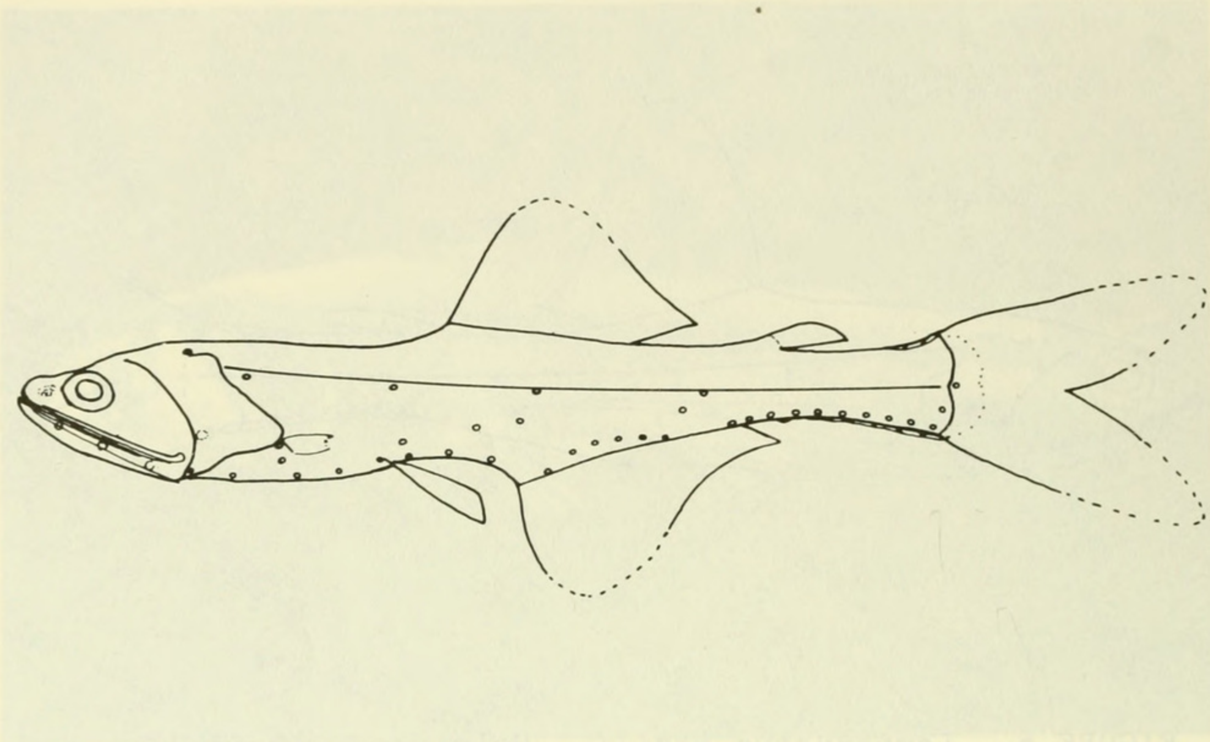


FIGURE 7. *Lampanyctus isaacsi*. Holotype, SIO 63-560, 52.0 mm. S.L.

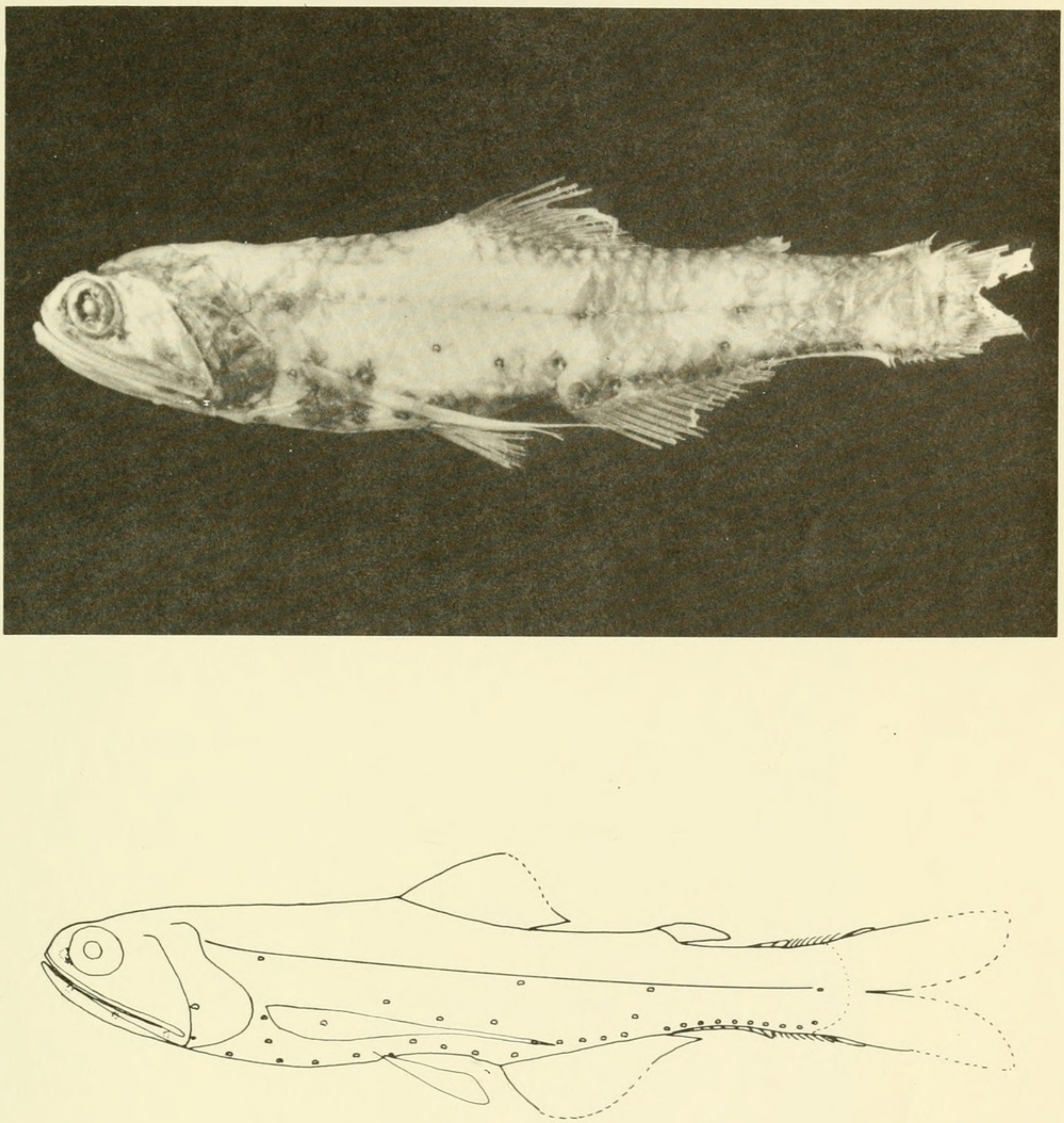


FIGURE 8. *Lampanyctus acanthurus*. Holotype, SIO 71-305, male, 93.3 mm. S.L., photograph and schematic drawing, the latter to show particularly the photophore patterns.