A REVIEW OF THE LANTERNFISH GENUS *Taaningichthys* (FAMILY MYCTOPHIDAE) WITH THE DESCRIPTION OF A NEW SPECIES

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ABSTRACT

The genus *Taaningichthys* includes three known species, one of which is here described as new.

The species of the genus *Taaningichthys* do not appear to perform daily vertical migrations. Evidence indicates vertical stratification of juveniles and adults.

Although photophores and lateral line are reduced, the species of *Taaningichthys* possess very large eyes which may be related to capture of luminescent prey.

Otoliths of all three species have been examined and found to be taxonomically important.

Bolin (1959) erected the genus *Taaningichthys* to include two species, *T. bathyphilus* and *T. minimus*, previously placed in the genus *Lampadena* by Tåning (1928). The main characters which distinguish *Taaningichthys* from *Lampadena* are: (1) the origin of the dorsal fin in *Taaningichthys* is clearly behind the base of the pelvic fins; (2) the development in *Taaningichthys* of a crescent of white tissue[2] on the posterior half of the iris, although a similar white (luminous?) crescent is present on the dorsal portion of the iris in *Lampadena chavesi* (Nafpaktitis and Paxton, 1968); (3) the presence of a single SAO, or none, in *Taaningichthys* (always three SAO in *Lampadena*); (4) reduced dentition and lateral line in *Taaningichthys*.

Taaningichthys may be distinguished from all other myctophid genera by the combination of the white crescent of tissue on the posterior half of the iris, the undivided luminescent caudal glands, and the single or altogether absent SAO.

Berry and Perkins (1966) reported what they thought to be a third form of *Taaningichthys* apparently without photophores. Following the capture of a number of specimens of this form by the RV *Velero IV* of the University of Southern California and the examination of considerable material made available to me by numerous institutions around the world, I felt that a review of the genus was appropriate.

MATERIALS AND METHODS

Members of the genus *Taaningichthys* are deep-dwelling, fragile myctophids, easily damaged by the net. Scales are readily lost, and damage to the bones of the snout, upper jaw, and operculum is very common. Consequently, measurement of jaw, head, and snout length is often very difficult if at all possible. The following measurements were taken on the best preserved specimens: Eye diameter (ED)—horizontal distance across the orbit; jaw length (JL)—length of premaxillary; predorsal (Pre D)—anterior tip of premaxillary to base of anteriormost ray of dorsal fin; preventral (Pre V)—anterior tip of premaxillary to base of anteriormost ray of ventral fin; preanal (Pre A)—anterior tip of premaxillary to base of anteriormost ray of anal fin; prepectoral (Pre P)—anterior tip of premaxillary to base of anteriormost ray of pectoral fin; preadipose (Pre Ad)—anterior tip of premaxillary to posterior end of base of adipose fin; length of supra- and infracaudal luminous glands—length of exposed luminous tissue only; anal-infracaudal distance—anterior tip of

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[2] This tissue is not visible until some time after preservation and is hardly distinguishable in specimens initially frozen and then preserved.

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infracaudal gland to end of base of anal fin. Sizes of specimens are given in standard lengths (SL) only.

Terminology of body photophores follows that of Bolin (1939). Unless otherwise specified, the term photophore refers to the primary body photophore.

Otoliths were measured with an eyepiece micrometer as follows: Length (OL)—the greatest length parallel to the sulcus; height (OH)—greatest height perpendicular to the sulcus. Following measurements, otoliths were lightly smeared with graphite to bring out detail and then photographed. Otolith terminology follows that of Frizzell and Dante (1965).

Female specimens were considered gravid when eggs included oil globules and completely filled the oviduct.

Most specimens examined were captured with open nets and depth sampled is here considered as the maximum depth reached by the net (appendix).

Counts of procurrent caudal rays are given as dorsal + ventral.

KEY TO THE SPECIES OF THE GENUS *Taaningichthys*

1a. VO 8-10; AO 5-7 + 4-6, total 9-13; Pol directly below or anterior to base of adipose fin; Prc_1-Prc_2 interspace equal to or greater than two photophore diameters; as many as five pairs of broad-based, hooklike teeth on dentary near symphysis .... *T. minimus* (Tåning, 1928)

1b. VO, if present, 3-5; AO, if present, 1-4 + 1-2, total 2-5; Pol, if present, clearly behind base of adipose fin; Prc_1-Prc_2, if present, interspace equal to, or less than, one photophore diameter; no broad-based, hooklike teeth on dentary near symphysis 2

2a. Photophores present as in 1b above; anal-infracaudal distance half as long as length of infracaudal gland, or longer .... *T. bathyphilus* (Tåning, 1928)

2b. Photophores absent; anal-infracaudal distance less than half length of infracaudal gland .... *T. paurolychnus* n. sp.

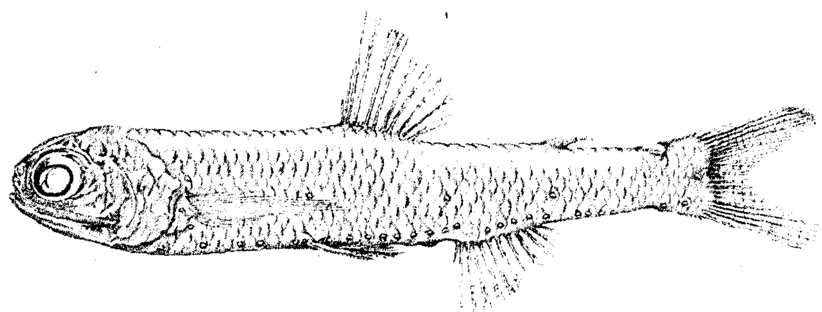

FIGURE 1.—*Taaningichthys minimus* (Tåning); 46 mm, Ocean Acre stn. 7-21.

GENUS *Taaningichthys* Bolin

Taaningichthys minimus (Tåning, 1928)

Figures 1 and 2

Lampadena minima Tåning, 1928: 63; Parr, 1928: 154, Figure 37.

Lampadena (*Lampadena*) *minima* Fraser-Brunner, 1949: 1078, Figure.

Taaningichthys minimus Bolin, 1959: 26.

D 11-13; A 12-13 (11-14); P 15-17; V 8; gill rakers 4-5+1+11 (10-13), total 16-17 (15-18); VO 8-10; AO 5-7+4-6, total 9-13; Prc 2+1; vertebrae 40-41; procurrent caudal rays 8-10+8.

Mouth terminal, moderately large, JL about 1.5 in Pre P; maxillary slightly expanded posteriorly. Eye large, ED 2.2-3.4 in Pre P. Pterotic spine long and directed posteriorly. Opercular margin concave posterodorsally, slightly convex posteriorly. Pectoral fin long, reaching VO_6 or VO_7; its base about midway between ventral body margin and horizontal septum. Pre V 2-2.4 in SL. Pre D 1.9-2.3 in SL; end of base of dorsal fin clearly in advance of vent. Pre A 1.4-1.6 in SL. Anterior end of base of adipose fin on vertical through posterior end of base of anal fin; Pre Ad 1.2-1.3 in SL.

A band of dark pigment along anteroventral margin of orbit containing a series of light gray, triangular patches of tissue not present in the other two species.

Dn absent; Vn present between anterior margin of orbit and posteroventral margin of nasal rosette. PVO_1 on or behind vertical through upper end of base of pectoral fin and about midway between it and ventral margin of body; PVO_2 in front of middle of base of pectoral fin; a straight line through PVO_1 and PVO_2 passing in front of PLO. PLO about halfway between upper end of base of pectoral fin and horizontal septum. Five PO. VLO above base of pelvic fin, usually closer to horizontal septum than to ventral margin of body. Last VO usually slightly elevated. SAO 1-2 photophore diameters below horizontal septum, directly above vent. AO level. AO series overlaps anterior end of infracaudal gland. Pol directly below or in advance of base of adipose fin, 1-2 photophore

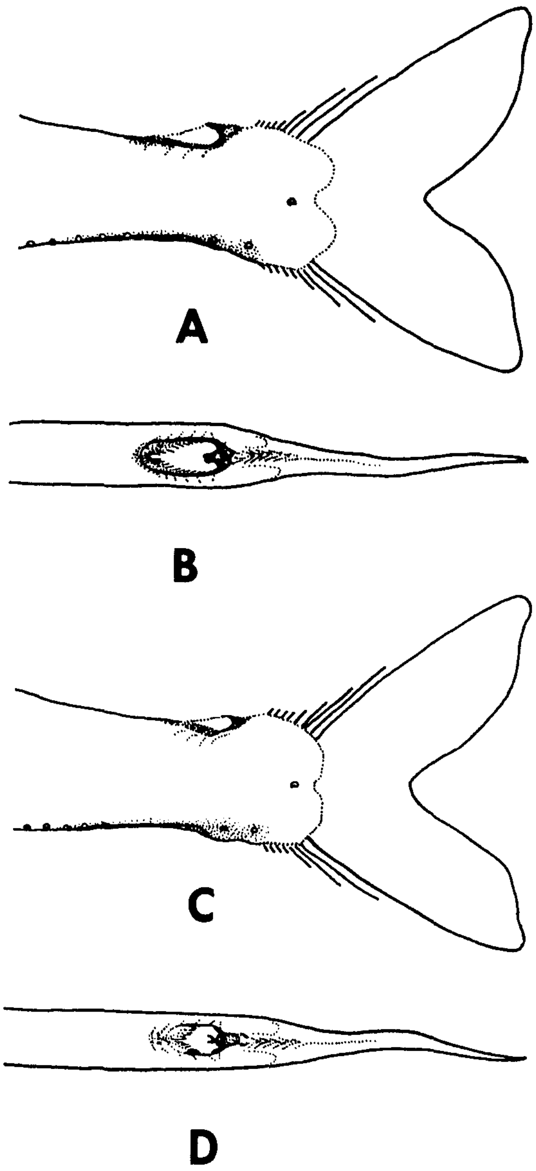

FIGURE 2.—*Taaningichthys minimus*. A. Side view, sexually dimorphic supracaudal gland of male, 53 mm. B. Top view, sexually dimorphic supracaudal gland of same male. C. Side view, sexually dimorphic supracaudal gland of female, 54 mm. D. Top view, sexually dimorphic supracaudal gland of same female.

diameters below horizontal septum. Prc_1 and Prc_2 level, behind infracaudal gland; Prc_3 at horizontal septum.

Caudal luminous glands undivided, the infracaudal larger than the supracaudal and both covered by scales. Sexual dimorphism is evident in supracaudal gland of adults (specimens about 40 mm and larger); in males this gland is about twice as large as in females (Figure 2).

Mesopterygoid teeth in narrow oval patches. Narrow band of needlelike teeth on palatine. No vomerine teeth. Both jaws with needlelike teeth which bend medially. A single row of broad-based, anteriorly hooked teeth occupying posterior two-thirds of medial surface of dentary. As many as five pairs of similar teeth, most often directed posteriorly, on medial surface of dentary near symphysis, and another two to three pairs projecting forward and laterally on symphysial area of premaxillary; below these, on anterior part of premaxillary, several posteriorly curved teeth (longer than rest of premaxillary teeth).

Taaningichthys minimus is the shallowest dwelling, most firm-bodied, and smallest of the three species, the largest examined specimen measuring 65 mm.

Gravid females (about 40 mm and larger) were captured in August-September.

Horizontal distribution—*T. minimus* occurs circumglobally between about lat 35° N and 30° S (Figure 5). It has been taken less frequently than *T. bathyphilus*.

Vertical distribution—Closing-net data from the Project "Ocean Acre" in the north Atlantic Ocean suggest vertical stratification of juveniles and adults. Juveniles appear to inhabit depths of 140 to 250 m, the smallest specimen (21 mm) having been captured at 140 m. Adults occur predominantly in depths between 450 and 500 m. *T. minimus* does not appear to perform daily vertical migrations.

Taaningichthys bathyphilus (Tåning, 1928)

Figure 3

Lampadena bathyphila Tåning, 1928: 63; Parr, 1928: 151, Figure 36.

Lampadena (Lampadena) bathyphila Fraser-Brunner, 1949: 1078, Figure.

Taaningichthys bathyphilus Bolin, 1959: 26, Figure 6.

D 12-13 (11-14); A 13 (12-14); P 12-14; V 8; gill rakers 3+1+7-8 (5-9), total 11-12 (9-13); VO 4 (3-5); AO 3 (1-4)+1(2), total 4(2-5); Prc 2+1; vertebrae 34-36; procurrent caudal rays 7+6.

Mouth terminal, moderately large, JL about 1.5 in Pre P; maxillary slightly expanded posteriorly. Eye large, ED about 2.5 in Pre P. Pterotic spine inconspicuous. Opercular margin as in *T. minimus*. Pectoral rays reaching VO_1; base of pectoral fin nearer to horizontal septum than to ventral margin of body. Pre V 2.1-2.5 in SL. Pre D 1.9-2.2 in SL; end of base of dorsal fin on, or slightly in advance of, vertical through SAO. Pre A 1.5-1.7 in SL. Base of adipose fin above end of base of anal fin; Pre Ad 1.2-1.4 in SL.

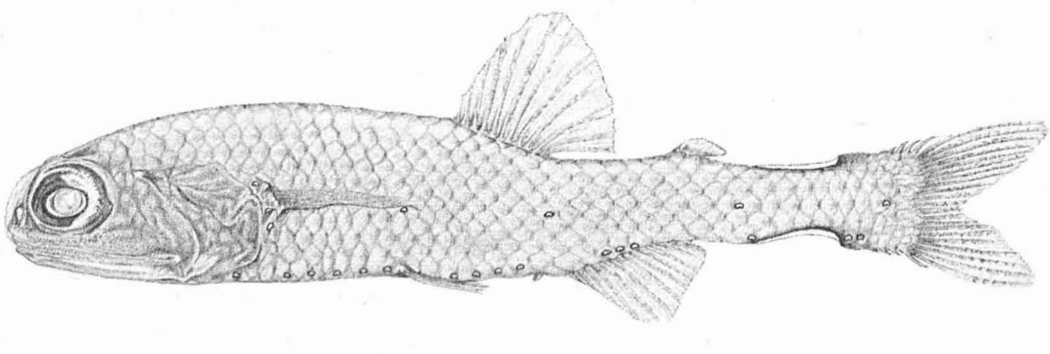

FIGURE 3.—*Taaningichthys bathyphilus* (Tåning); 62 mm, RV *Velero* stn. 11733, LACM 30034-1.

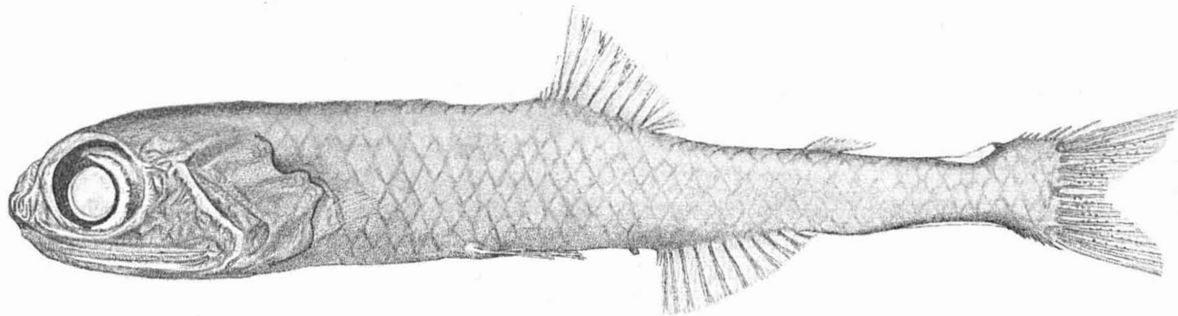

FIGURE 4.—*Taaningichthys paurolychnus*, new species, holotype, 67 mm, SIO 70-19.

Dn absent; a very small oval Vn, visible in young individuals and masked by darkly pigmented tissue in adults. Position of PVO_1 farther forward than in *T. minimus*, a line through PVO_1 and PVO_2 passing behind PLO; PVO_1 midway between upper end of base of pectoral fin and ventral margin of body; PVO_2 midway between PVO_1 and upper end of base of pectoral fin. PLO varying in position, usually closer to horizontal septum than upper end of base of pectoral fin. PO 5-6. VLO above base of pelvic fins, closer to horizontal septum than ventral margin of body. VO level. SAO 1-2 photophore diameters below horizontal septum, directly above or slightly behind urogenital papilla. AO level; AOp over anterior end of infracaudal gland. Pol position variable, generally midway between anterior end of infracaudal gland and end of base of anal fin (always well behind base of adipose fin), and one photophore diameter or less below horizontal septum. Prc_1 and Prc_2 level; Prc_3 at horizontal septum. Secondary photophores present on snout and rays of caudal fin.

Length of supracaudal luminous gland 1.5-2 in length of infracaudal; sexual dimorphism not apparent; both glands undivided and surrounded by dark pigment.

Mesopterygoid teeth rather sparsely distributed. Single row of needlelike teeth on palatines. No vomerine teeth. Both jaws with needlelike teeth which bend medially (those on the anteriormost premaxillary somewhat longer). Several broad-based, anteriorly hooked teeth on posterior medial surface of dentary (not as many as in *T. minimus*). Two to three pairs of similar teeth projecting forward and laterally on symphysial area of premaxillary.

Taaningichthys bathyphilus is the intermediate of the three species in terms of depth of occurrence, photophore development and size. It does not seem to grow larger than about 80 mm.

Of the specimens examined, only one gravid female (57 mm) was found which had been captured in late June.

Horizontal distribution—*T. bathyphilus* occurs circumglobally within a broad zone between lat 41° N and 67°31′ S (Figure 5). It appears to be more common or, perhaps, more easily captured than its two congeners.

Vertical distribution—The shallowest depth of capture for *T. bathyphilus* is 580 m (a juvenile male, 32 mm). An adult female, 65-mm long, was captured at a depth of 675 m. Members of this species have not been taken above these depths. The maximum depth of occurrence is not yet known. *T. bathyphilus* does not appear to perform daily vertical migrations.

Taaningichthys paurolychnus, NEW SPECIES

Figure 4

Holotype: 1 (67 mm), 17 Dec. 1969, 31° N, 119° W, Scripps Institution of Oceanography.

Paratypes: 1 (68 mm), 22 Nov. 1969, 17° 47′ N, 25°22′ W, National Institute of Oceanography; 1 (87 mm), 13 Sept. 1968, 17° S, 86° W, Institute of Oceanology, Academy of Sciences of the USSR, Moscow; 1 (49 mm), 20 Sept. 1961, 33° N, 17° W, Museu Municipal do Funchal; 1 (57 mm), 29 Jan. 1922, 19° N, 79° W, Zoological Museum, University of Copenhagen; 2 (79-95 mm), 17 Dec. 1969, 31° N, 119° W, 2 (65-71 mm), 10 June 1967, 35° N, 123° W, Scripps Institution of Oceanography; 1 (75 mm), 17 Sept. 1966, 1° N, 81° W, 1 (80 mm), 15 Jan. 1969, 32° N, 120° W, Smithsonian Oceanographic Sorting Center; 1 (82 mm), 13 Apr. 1962, 30° N, 120° W, 1 (77 mm), 29 Mar. 1962, 35° N, 129° W, National Marine Fisheries Service.

D 12-13 (11); A 13 (11-14); P 14 (13-15); V 8; gill rakers 3-4 + 1 + 9-10 (8-11), total 13-15 (12-16); vertebrae 35-36; procurrent caudal rays 7 + 6-7.

Mouth terminal, moderately large, JL about 1.5 in Pre P. Eye large, ED 2.2-3.2 in Pre P. A short pterotic spine directed posterolaterally. Opercular margin slightly concave posterodorsally to a level above upper end of base of pectoral fin, slightly convex posteriorly. Pectoral rays reaching base of pelvic fins; base of pectoral fin midway between ventral margin of body and horizontal septum. Pre V 2.1-2.3 in SL. Pre D 1.9-2.1 in SL; end of base of dorsal fin in advance of origin of anal fin. Pre A 1.5-1.7 in SL. Base of adipose fin directly above, or somewhat behind end of base of anal fin; Pre Ad 1.2-1.4 in SL.

Vn apparently absent. Head and body photophores absent. Secondary photophores present on snout and interradial membranes of caudal fin.

Length of supracaudal luminous gland 1.5-2 in length of infracaudal gland; sexual dimorphism not apparent; both glands undivided and surrounded by dark pigment.

Mesopterygoid teeth rather sparsely distributed. Single row of needlelike teeth on palatine. No vomerine teeth. Both jaws with needlelike teeth which bend medially (those on the anterior part of premaxillary somewhat longer). Several broad-based, anteriorly hooked teeth on posterior medial surface of dentary as in *T. bathyphilus*. Two to three pairs of similar teeth projecting forward and laterally on symphysial area of premaxillary.

Taaningichthys paurolychnus is the largest of the three species, the longest specimen examined measuring 95 mm. It has apparently lost its

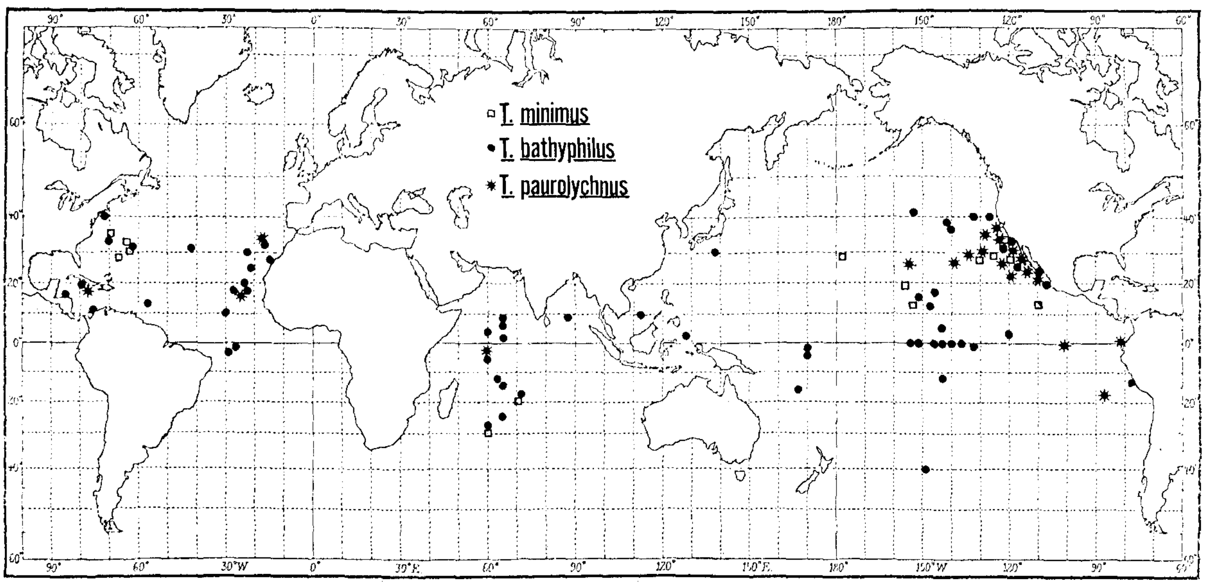

FIGURE 5.—Catch localities of *Taaningichthys minimus*, *T. bathyphilus*, and *T. paurolychnus*. Capture locality for specimen taken from 67°31′ S/90°26′ W not shown.

primary photophores, retaining only the caudal glands and the simple, presumably secondary, photophores, on the head and caudal fin. It is also the deepest dwelling of the three species.

Gravid females have been captured in March-April and August-September. The smallest gravid female examined was 65 mm.

Horizontal distribution—*T. paurolychnus* is distributed circumglobally between about lat 40° N and 20° S (Figure 5). It does not appear to be as common as *T. bathyphilus*.

Vertical distribution—*T. paurolychnus* has not been taken above 900 m (an adult female, 77 mm). The lower limits of its distribution are not yet known. *T. paurolychnus* does not appear to perform daily vertical migrations.

Etymology—The name *paurolychnus* refers to the absence of primary photophores and the presence of limited, presumably secondary photophores. It is derived from the Greek *pauros* meaning few, small, and *lychnus* meaning light.

OTOLITHS

OL as a percentage of SL ranges from 4.4 to 5.5% in *T. minimus*, 3.9 to 4.6% in *T. bathyphilus*, and 2.8 to 3.6% in *T. paurolychnus*. OH as a percentage of OL ranges from 66.7 to 77.7% in *T. minimus*, 72.1 to 77.9% in *T. bathyphilus*, and 78.3 to 91.7% in *T. paurolychnus*.

The sulcus is more pronounced in the otolith of *T. bathyphilus* than it is that of *T. paurolychnus*, but less so than in that of *T. minimus* (Figure 6). The otolith of *T. paurolychnus* has almost no antirostrum, and the antirostrum in *T. bathyphilus* is less pronounced than that in *T. minimus*. The posterior margin of the otolith in *T. paurolychnus* is nearly straight vertically, making the general outline almost square, whereas the otoliths of its two congeners are smoothly rounded posteroventrally, so that the general outline is oval. The otolith (Figure 6) of a single specimen of *T. bathyphilus* from the north Atlantic is differently shaped and very large for a specimen of its size (60 mm). However, no other differences in the fish were found and more material from the north Atlantic must be examined before anything further can be stated.

DISCUSSION

The various hypotheses and ideas regarding the function, or functions, of luminous organs of midwater fish are reviewed by Nicol (1969). The photophores within the genus *Taaningichthys* show drastic reduction in terms of numbers and development. *T. minimus* has, relatively, the best developed photophores as well as the greatest number; these organs are seldom rubbed off unless the specimen is damaged. *T. bathyphilus* has fewer and less well-developed photophores which are easily rubbed off. *T. paurolychnus* has lost all primary photophores but retains simple, presumably secondary, photophores on the snout and caudal fin. As already mentioned, there are no indications that the members of the genus *Taaningichthys* undertake diel vertical migrations as most myctophids do. It may therefore be that photophores of the myctophid type are not selected for in a deep-water, nonmigratory fish, which would account for the reduction of these organs and, eventually, their loss. Unlike photophores, eyes are very well developed in *Taaningichthys*, regardless of depth of occurrence. Even the deepest of the species has large, nearly binocular eyes. This may be correlated with the food habits of these fish. Myctophids, in general, feed on zooplankters, many, if not most, of which are bioluminescent. It is possible therefore that *Taaningichthys* strongly depends on large, presumably highly effective eyes for locating and capturing its prey, which is probably not very abundant in those dark midwater depths. Furthermore, retention of this energetically expensive visual equipment may account for the very poorly developed lateral line system.

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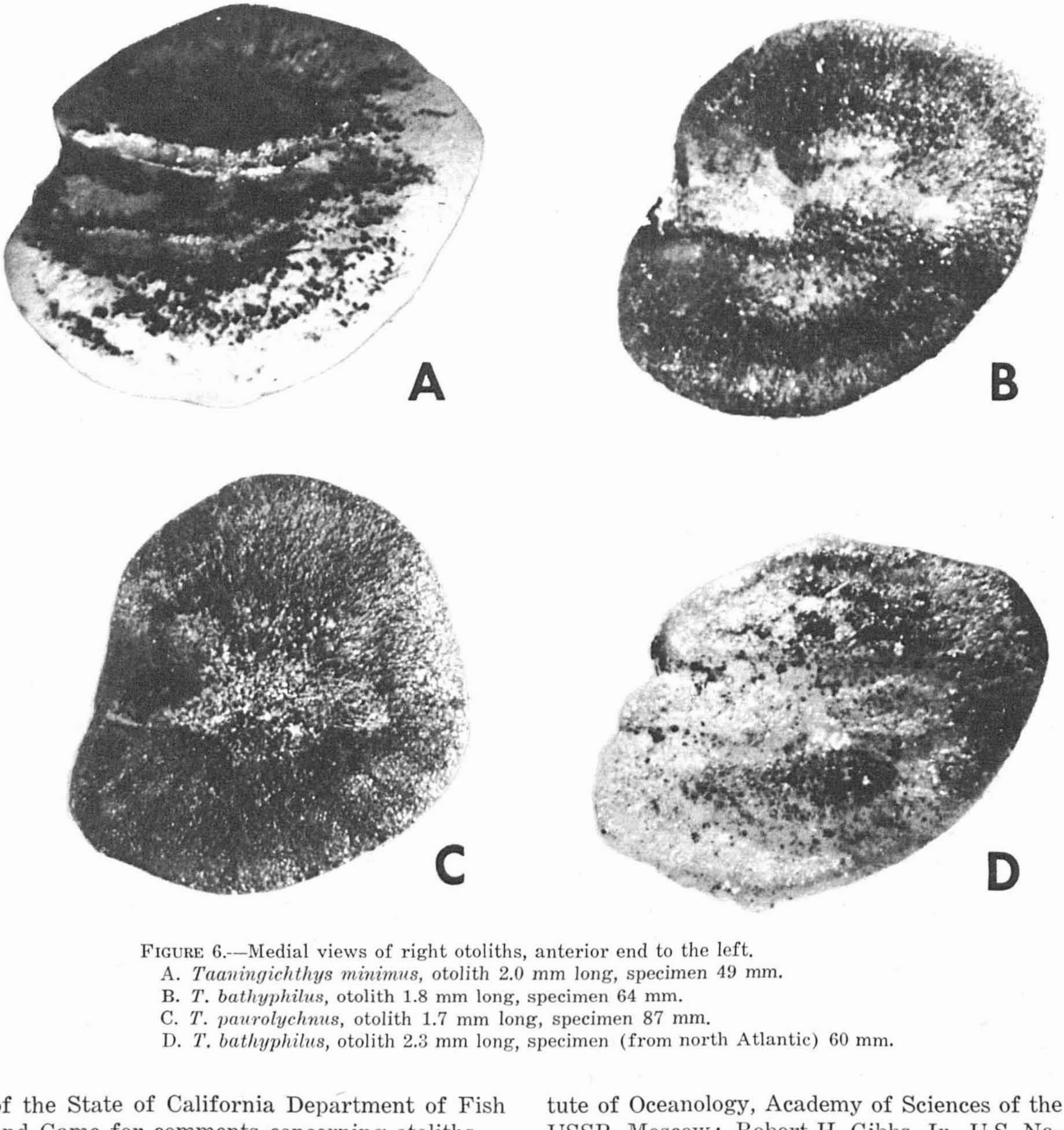

FIGURE 6.—Medial views of right otoliths, anterior end to the left.
A. *Taaningichthys minimus*, otolith 2.0 mm long, specimen 49 mm.
B. *T. bathyphilus*, otolith 1.8 mm long, specimen 64 mm.
C. *T. paurolychnus*, otolith 1.7 mm long, specimen 87 mm.
D. *T. bathyphilus*, otolith 2.3 mm long, specimen (from north Atlantic) 60 mm.

of the State of California Department of Fish and Game for comments concerning otoliths.

I am indebted to several people and their institutions for making specimens available: Robert L. Wisner, Scripps Institution of Oceanography (SIO); Julian Badcock, National Institute of Oceanography, Surrey, England; Robert J. Lavenberg; Jørgen Nielsen, Zoological Museum, University of Copenhagen; V. E. Becker, Institute of Oceanology, Academy of Sciences of the USSR, Moscow; Robert H. Gibbs, Jr., U.S. National Museum; Leslie W. Knapp, Smithsonian Oceanographic Sorting Center; G. E. Maul, Museu Municipal do Funchal, Madeira; Thomas Clarke, University of Hawaii; E. H. Ahlstrom and H. Geoffrey Moser, National Marine Fisheries Service; Richard H. Backus and James E. Craddock, Woods Hole Oceanographic Institution; G. Palmer, British Museum (Natural History); Michel Le Gand, Office de la Recherche Scientifique et Technique Outre-Mer, Nouméa, New Caledonia (material presented to the Los Angeles County Museum of Natural History).

Illustrations were made by Sharon Calloway, Los Angeles County Museum of Natural History, and otoliths were photographed by the Photography Department, Los Angeles County Museum of Natural History.

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APPENDIX

Material examined

Taaningichthys minimus

University of Southern California, RV *Velero IV:*
Stn. 11168, 31 July 1966, 32° N/120° W, 350 m, 10-ft IKMT, 1 (36 mm), LACM 9705.
Stn. 11185, 2 Aug. 1966, 29° N/118° W, 375 m, 10-ft IKMT, 1 (47 mm), LACM 9650.

International Indian Ocean Expedition, RV *Anton Bruun*, Cruise III:
Stn. 156, 6 Sept. 1963, 29° S/60° E, 122 m, 10-ft IKMT, 1 (45 mm), LACM 31320.

University of Hawaii, Institute of Marine Biology:
LACM 31574, 11 Sept. 1969, Hawaiian waters, 380 m, 6-ft IKMT, 2 (55-57 mm).
LACM 31575, 30 Oct. 1969, Hawaiian waters, 780 m, 6-ft IKMT, 2 (63-65 mm).
LACM 31576, 13 Nov. 1969, Hawaiian waters, 575 m, 10-ft IKMT, 2 (50-60 mm).

Scripps Institution of Oceanography:
SIO 57-86, 12 May 1955, 29° N/125° W, 700 m, 10-ft IKMT, 1 (42 mm).
SIO 62-430, 24 Aug. 1962, 29° N/130° W, 600 m, 10-ft IKMT, 1 (52 mm).
SIO 68-490, 22 Sept. 1968, 29° N/178° W, no depth, 10-ft IKMT, 1 (46 mm).
SIO 69-341, 27 Mar. 1969, 13° N/110° W, 1,100 m, 10-ft IKMT, 1 (42 mm).

Woods Hole Oceanographic Institution:
RHB stn. 1112, 17 June 1965, 22° N/70° W, 200 m, 10-ft IKMT, 1 (28 mm).
RHB stn. 1735, 8 July 1968, 28° N/67° W, 870 m, 10-ft IKMT, 1 (40 mm).

Zoological Institute, Academy of Sciences of the USSR, Leningrad:
RV *Vitiaz* stn. 4885, 20 Dec. 1960, 17° S/71° E, 2,700 m, RT, 1 (27 mm).
RV *Vitiaz* stn. 5127, 28 Oct. 1961, 13° N/154° W, 1,000 m, CN, 1 (48 mm).

National Marine Fisheries Service, RV *Horizon*:
Cruise H6204, stn. 100·140, 15 Apr. 1962, 28° N/124° W, 1,676 m, 10-ft IKMT, 1 (53.5 mm).
Cruise H6204, stn. 110·160, 17 Apr. 1962, 35° N/124° W, 1,676 m, 10-ft IKMT, 1 (50 mm).

U.S. National Museum, Ocean Acre material:
Stn. 2-2N, 6 Mar. 1967, 32°26′ N/63°44′ W, 140 m, 6-ft IKMT, 1 (21 mm).
Stn. 3-3N, 4 July 1967, 33°4′ N/64°37′ W, 1,060 m, 10-ft IKMT, 1 (52.5 mm).
Stn. 3-4N, 4 July 1967, 33°10′ N/64°45′ W, 480 m, 10-ft IKMT, 1 (37 mm).
Stn. 3-6N, 5 July 1967, 33°9′ N/64°33′W, 250 m, 10-ft IKMT, 3 (36-45.2 mm).
Stn. 3-13N, 6 July 1967, 32°54′ N/64°45′ W, 161 m, 10-ft IKMT, 1 (20.5 mm).
Stn. 4-9A, 4 Sept. 1967, 31°52′ N/63°58′ W, 479 m, 10-ft IKMT, 1 (49 mm).
Stn. 4-9B, 4 Sept. 1967, 31°52′ N/63°58′ W, 479 m, 10-ft IKMT, 1 (42 mm).
Stn. 4-16C, 6 Sept. 1967, 32° N/64° 17′ W, 500 m, 10-ft IKMT, 1 (41 mm).
Stn. 6-7B, 26 Apr. 1967, 31°47′ N/63°53′ W, 155 m, 10-ft IKMT, 1 (33.5 mm).

Stn. 6-15B, 28 Apr. 1967, 32°13′ N/63°51′ W, 160 m, 10-ft IKMT, 1 (33 mm).
Stn. 6-15P, 28 Apr. 1967, 32°13′ N/63°51′ W, 160 m, 10-ft IKMT, 1 (34.5 mm).
Stn. 6-18P, 29 Apr. 1967, 32°14′ N/63°46′ W, 750 m, 10-ft IKMT, 1 (30 mm).
Stn. 6-26N, 30 Apr. 1967, 32°18′ N/63°55′ W, 200 m, 10-ft IKMT, 1 (29 mm).
Stn. 7-14N, 8 Sept. 1967, 32°12′ N/63°25′ W, 250 m, 10-ft IKMT, 1 (45 mm).
Stn. 7-15N, 8 Sept. 1967, 32°21′ N/63°29′ W, 450 m, 10-ft IKMT, 1 (42 mm).

Taaningichthys bathyphilus

University of Southern California, RV *Eltanin*:
Stn. 947, 27 Jan. 1964, 67°31′ S/90°26′ W, 2,690 m, 3-m IKMT, 1 (67 mm), LACM 10424.
Stn. 1724, 18 July 1966, 40°06′ S/149°55′ W, 1,180 m, 3-m IKMT, 1 (60 mm), LACM 11247.

University of Southern California, RV *Velero IV*:
Stn. 8959, 17 Oct. 1963, 33° N/119° W, 900 m, 10-ft IKMT, 1 (69 mm), LACM 6435.
Stn. 10607, 10 June 1965, 33° N/119° W, 900 m, 10-ft IKMT, 1 (61 mm), LACM 6723.
Stn. 966, 15 May 1964, 33° N/118° W, 750 m, 10-ft IKMT, 1 (72 mm), LACM 8525.
Stn. 8238, 25 Oct. 1962, 33° N/118° W, 10-ft IKMT, 1 (64 mm), LACM 9036.
Stn. 9860, 25 June 1964, 33° N/118° W, 750 m, 10-ft IKMT, 1 (60 mm), LACM 9089.
Stn. 11538, 21 June 1967, 32° N/118° W, 1,300 m, 10-ft IKMT, 1 (66 mm), LACM 9676.
Stn. 11539, 21 June 1967, 33° N/118° W, 950 m, 10-ft IKMT, 1 (63 mm), LACM 9677.
Stn. 11617, 16 Aug. 1967, 31° N/118° W, 1,130 m, 10-ft IKMT, 1 (68 mm), LACM 9682.
Stn. 11312, 25 Jan. 1967, 28° N/116° W, 1,325 m, 10-ft IKMT, 1 (58 mm), LACM 9708.
Stn. 10373, 23 Feb. 1965, 33° N/118° W, 10-ft IKMT, 2 (61-68 mm), LACM 9764.
Stn. 11696, 12 Oct. 1967, 32° N/118° W, 860 m, 10-ft IKMT, 1 (67 mm), LACM 9796.
Stn. 11733, 8 Nov. 1967, 20° N/106° W, 1,400 m, 10-ft IKMT, 1 (62 mm), LACM 30034.
Stn. 11767, 16 Nov. 1967, 24° N/109° W, 1,500 m, 10-ft IKMT, 1 (57 mm), LACM 30045.
Stn. 12066, 12 Apr. 1968, 26° N/114° W, 1,300 m, 10-ft IKMT, 1 (61 mm), LACM 30075.
Stn. 12072, 14 Apr. 1968, 29° N/118° W, 750 m, 10-ft IKMT, 1 (65 mm), LACM 30079.
Stn. 12184, 24 July 1968, 31° N/119° W, 820 m, 10-ft IKMT, 1 (50 mm), LACM 30271.
Stn. 12597, 17 Jan. 1969, 32° N/120° W, 770 m, 10-ft IKMT, 1 (67 mm), LACM 30348.
Stn. 12392, 11 Oct. 1968, 32° N/118° W, 1,110 m, 10-ft IKMT, 1 (61 mm), LACM 30403.
Stn. 12349, 12 Sept. 1968, 32° N/118° W, 1,400 m, 10-ft IKMT, 1 (67 mm), LACM 20598.
Stn. 12491, 20 Nov. 1968, 29° N/118° W, 910 m, 10-ft IKMT, 2 (61-65 mm), LACM 30609.
Stn. 13385, 28 Oct. 1969, 28° N/118° W, 780 m, 10-ft IKMT, 1 (68 mm), LACM 30886.

Smithsonian Oceanographic Sorting Center, RV *Anton Bruun*, Cruise III and VI:
Label no. 7033, 18 Aug. 1963, 4° N/60° E, 2,120 m, 10-ft IKMT, 1 (34 mm), LACM 31292.
Label no. 7057, 23 Aug. 1963, 5° S/60° E, 2,030 m, 10-ft IKMT, 1 (26 mm), LACM 31303.
Label no. 7083, 6 Sept. 1963, 29° S/60° E, 1,150 m, 10-ft IKMT, 7 (44-55 mm), LACM 31320.
Label no. 7173, 23 May 1964, 8° N/65° E, 2,850 m, 10-ft IKMT, 1 (44 mm), LACM 31344.
Label no. 7177, 23 May 1964, 7° N/65° E, 940 m, 10-ft IKMT, 1 (36 mm), LACM 31345.
Label no. 7204, 27 May 1964, 2° N/65° E, 1,250 m, 10-ft IKMT, 1 (46 mm), LACM 31358.
Label no. 7217, 28 May 1964, 14° S/65° E, 2,250 m, 10-ft IKMT, 1 (53 mm), LACM 31361.
Label no. 7265, 4 June 1964, 12° S/64° E, 1,930 m, 10-ft IKMT, 1 (38 mm), LACM 31375.
Label no. 7273, 6 May 1964, 14° S/65° E, 880 m, 10-ft IKMT, 1 (47 mm), LACM 31376.
Label no. 7305, 24 June 1964, 24° S/65° E, 3,500 m, 10-ft IKMT, 1 (57 mm), LACM 31401.
Label no. 7312, 25 June 1964, 24° S/65° E, 1,100 m, 10-ft IKMT, 1 (56 mm), LACM 31404.

Office de la Recherche Scientifique et Technique Outre-Mer, Nouméa, New Caledonia:
RV *Caride*, Cruise I, stn. 36A, 23 Sept. 1968, 0°2′ N/137°51′ W, 950 m, 10-ft IKMT, 3 (51-60 mm), LACM 31439.
RV *Caride*, Cruise I, stn. 39A, 24 Sept. 1968, 0°14′ N/138°17′ W, 1,130 m, 10-ft IKMT, 1 (46 mm), LACM 31440.
RV *Caride*, Cruise I, stn. 69A, 29 Sept. 1968, 0°5′ N/144°41′ W, 580 m, 10-ft IKMT, 1 (32 mm), LACM 31446.
RV *Caride*, Cruise I, stn. 74A, 29 Sept. 1968, 0°/145°41′ W, 820 m, 10-ft IKMT, 1 (58 mm), LACM 31448.
RV *Caride*, Cruise I, stn. 77A, 30 Sept. 1968, 0°25′ N/146°17′ W, 1,110 m, 10-ft IKMT, 1 (48 mm), LACM 31450.
RV *Caride*, Cruise I, stn. 78A, 30 Sept. 1968, 0°2′ S/146°29′ W, 1,280 m, 10-ft IKMT, 1 (42 mm), LACM 31451.
RV *Caride*, Cruise III, stn. 17, 7 Feb. 1969, 11°17′ S/142°47′ W, 1,050 m, 10-ft IKMT, 1 (60 mm), LACM 31459.
RV *Caride*, Cruise III, stn. 18, 8 Feb. 1969, 11°7′ S/142°35′ W, 1,050 m, 10-ft IKMT, 1 (53 mm), LACM 31460.
RV *Caride*, Cruise III, stn. 60, 18 Feb. 1968, 0°12′ S/139°19′ W, 850 m, 10-ft IKMT, 1 (55 mm), LACM 31464.
RV *Caride*, Cruise III, stn. 64, 19 Feb. 1969, 0°/140°9′ W, 900 m, 10-ft IKMT, 1 (48 mm), LACM 31467.
RC *Caride*, Cruise III, stn. 68, 10 Feb. 1969, 0°/140°42′ W, 1,080 m, 10-ft IKMT, 1 (29 mm), LACM 31469.
RV *Caride*, Cruise III, stn. 122, 24 Feb. 1970, 0°3′N/147°2′ W, 1,100 m, 10-ft IKMT, 2 (45-51 mm), LACM 31478.
RV *Caride*, Cruise III, stn. 200, 2 March 1970, 0°1′ N/154°14′ W, 930 m, 10-ft IKMT, 1 (46 mm), LACM 31491.
RV *Caride*, Cruise III, stn. 204, 2 March 1970, 0°/154°25′ W, 1,160 m, 10-ft IKMT, 1 (34 mm), LACM 31492.
RV *Cyclone*, Cruise III, stn. 8, 4 May 1967, 2°13′ S/169°47′ E, 1,125 m, 10-ft IKMT, 1 (37 mm), LACM 31501.
RV *Cyclone*, Cruise III, stn. 17, 5 May 1967, 4°23′ S/169°52′ E, 1,090 m, 10-ft IKMT, 1 (51 mm), LACM 31505.
RV *Santo*, Cruise 68, stn. 6, 20 July 1968, 16°17′ S/166°40′ E, 1,395 m, 10-ft IKMT, 1 (52 mm), LACM 31528.

U.S. National Museum: Ocean Acre material:
Stn. 3-2N, 4 July 1967, 33° N/64°45′ W, 1,425 m, 10-ft IKMT, 1 (44 mm).
Stn. 3-11N, 5 July 1967, 33° N/64°40′ W, 1,920 m, 10-ft IKMT, 2 (53-58 mm).
Stn. 6-10B, 27 Apr. 1967, 31°59′ N/63°43′ W, 900 m, 10-ft IKMT, 1 (55 mm).
Stn. 6-24N, 30 Apr. 1967, 32°13′ N, 63°40′ W, 750 m, 10-ft IKMT, 1 (67 mm).
Stn. 7-13N, 8 Sept. 1967, 32°18′ N/63°30′ W, 1,500 m, 10-ft IKMT, 1 (36 mm).

Carlsberg Foundation, *Dana* collections:
Dana stn. 1156 VII, 25 Oct. 1921, 25° N/21° W, 2,000 m, S 150, 1 (37 mm).
Dana stn. 1159 II, 29 Oct. 1921, 18° N/24° W, 2,000 m, S 150, 1 (43 mm).
Dana stn. 1159 III, 29 Oct. 1921, 18° N/24° W, 1,500 m, S 150, 1 (35 mm).
Dana stn. 1181 III, 21 Nov. 1921, 13° N/57° W, 1,500 m, S 150, 1 (28 mm).
Dana stn. 1217 III, 29 Jan. 1922, 19° N/79° W, 1,500 m, S 150, 1 (45 mm).
Dana stn. 1342 I, 15 May 1922, 34° N/70° W, 2,250 m, E 300, 1 (43 mm).
Dana stn. 1365 IX, 8 June 1922, 32° N/42° W, 2,500 m, E 300, 1 (55 mm).

Zoological Institute, Academy of Sciences of the USSR, Leningrad:
RV *Lyra* stn. 50, 25 Mar. 1966, 3° N/120° W, 1,000 m, CN, 1 (43 mm).
RV *Lyra* stn. 3717, 9 Jan. 1957, 3° N/128° E, 1,250 m, CN, 1 (35 mm).
RV *Vitiaz* stn. 4183, 6 Dec. 1958, 40° N/127° W, 675 m, CN, 1 (65 mm).
RV *Vitiaz* stn. 4189, 7 Dec. 1958, 40° N/133° W, 1,000 m, CN, 1 (49 mm).
RV *Vitiaz* stn. 4939, 4 Feb. 1961, 9° N/87° E, 1,000 m, CN, 1 (39 mm).

National Institute of Oceanography, Surrey, England:
NIO stn. 4687, 30 Aug. 1961, 29°57′ N/32°3′ W, 800 m, IKMT, 1 (50 mm).
NIO stn. 4746, 30 Sept. 1961, 29°59′ N/22°56′ W, 1,100 m, IKMT, 2 (38-44 mm).
NIO stn. 5799, 19 Oct. 1965, 28°9′ N/14°9′ W, 675 m, IKMT, 1 (48 mm).
NIO stn. 5810, 7 Nov. 1965, 28°4′ N/13°51′ W, 800 m, IKMT, 1 (28 mm).
NIO stn. 5813, 10 Nov. 1965, 28°5′ N/14°11′ W, 950 m, IKMT, 1 (56 mm).
NIO stn. 6687, 7 Mar. 1968, 20°37′ N/22°56′ W, 1,000 m, RMT8, 1 (56 mm).
NIO stn. 7072, 30 Oct. 1969, 20°27′ N/25°32′ W, 1,000 m, RMT8, 2 (32-55 mm).
NIO stn. 7079, 3 Nov. 1969, 17°40′ N/27°6′ W, 1,000 m, RMT8, 1 (24 mm).
NIO stn. 7089 #54, 22 Nov. 1969, 17°47′ N/25°22′ W, 1,000 m, RMT8, 2 (54-77 mm).
NIO stn. 7089 #55, 22 Nov. 1969, 17°47′N/25°22′ W, 2,000 m, RMT8, 1 (46 mm).

British Museum of Natural History:
Rosaura collection, 26 June 1969, 17° N/86° W, 1,100 m, S 200, 1 (57 mm).
Rosaura collection, 26 June 1969, 11° N/76° W, 1,200 m, S 200, 1 (46 mm).

National Marine Fisheries Service, RV *Horizon*:
Cruise H6204 stn. 120·70, 23 Apr. 1962, 26° N/117° W, 1,676 m, 10-ft IKMT, 1 (65 mm).

Woods Hole Oceanographic Institution:
RHB stn. 977, 26 Feb. 1963, 1° S/27° W, 10-ft IKMT, 1,100 m, 1 (65 mm).
RHB stn. 979, 28 Feb. 1963, 3° S/29° W, 10-ft IKMT, 1,100 m, 1 (57 mm).
RHB stn. 1603, 6 Oct. 1967, 39°46′ N/70°30′ W, 10-ft IKMT, 1,000 m, 1 (65 mm).

Taaningichthys paurolychnus

University of Southern California, RV *Velero IV*:
Stn. 10675, 28 Aug. 1965, 29° N/118° W, 1,625 m, 10-ft IKMT, 1 (44 mm), LACM 9350.
Stn. 11187, 2 Aug. 1966, 29° N/118° W, 1,720 m, 10-ft IKMT, 1 (87 mm), LACM 9567.
Stn. 11257, 21 Oct. 1966, 29° N/118° W, 940 m, 10-ft IKMT, 1 (77 mm), LACM 9408.
Stn. 11628, 18 Aug. 1967, 32° N/119° W, 1,300 m, 10-ft IKMT, 1 (33 mm), LACM 9693.
Stn. 12331, 24 Aug. 1968, 29° N/118° W, 1,100 m, 10-ft IKMT, 1 (55 mm), LACM 30284.
Stn. 12340, 26 Aug. 1968, 32° N/118° W, 1,130 m, 10-ft IKMT, 1 (17 mm), LACM 30591.
Stn. 12475, 18 Nov. 1968, 28° N/119° W, 900 m, 10-ft IKMT, 1 (42 mm), LACM 30606.
Stn. 12483, 19 Nov. 1968, 28° N/119° W, 2,080 m, 10-ft IKMT, 3 (52-81 mm), LACM 30382.
Stn. 12592, 15 Jan. 1969, 32° N/120° W, 1,950 m, 10-ft IKMT, 3 (23-82 mm), LACM 30429.
Stn. 12593, 16 Jan. 1969, 32° N/120° W, 1,920 m, 10-ft IKMT, 1 (91 mm), LACM 30430.
Stn. 12594, 16 Jan. 1969, 32° N/120° W, 1,250 m, 10-ft IKMT, 1 (79 mm), LACM 30431.
Stn. 12786, 16 Mar. 1969, 32° N/118° W, 1,350 m, 10-ft IKMT, 1 (66 mm), LACM 30423.
Stn. 12791, 17 Mar. 1969, 32° N/118° W, 1,200 m, 10-ft IKMT, 1 (64 mm), LACM 30428.

Smithsonian Oceanographic Sorting Center, RV *Anton Bruun*, Cruise III and VI:
Label no. 7057, 23 Aug. 1963, 4° S/60° E, 2,030 m, 10-ft IKMT, 1 (51 mm), LACM 31303.

National Marine Fisheries Service, RV *Horizon*:
Cruise H6204 stn. 60.60, 26 Mar. 1962, 37° N/123° W, 1,863 m, IKMT, 1 (86 mm).
Cruise H6204 stn. 60.140, 29 Mar. 1962, 35° N/129° W, 1,863 m, IKMT, 1 (77 mm).
Cruise H6204 stn. 80.90, 18 Mar. 1962, 33° N/123° W, 2,234 m, IKMT, 1 (29 mm).
Cruise H6204 stn. 100.60, 13 Apr. 1962, 31° N/119° W, 1,676 m, IKMT, 1 (68 mm).
Cruise H6204 stn. 100.80, 13 Apr. 1962, 30° N/120° W, 1,676 m, IKMT, 1 (82 mm).

Scripps Institution of Oceanography:
SIO 54-95, 23 June 1954, 23° N/119° W, 2,500 m, 10-ft IKMT, 1 (49 mm).
SIO 60-283, 12 Aug. 1960, 28° N/135° W, 3,000 m, 10-ft IKMT, 1 (44 mm).
SIO 60-284, 13 Aug. 1960, 29° N/132° W, 3,000 m, 10-ft IKMT, 1 (71 mm).
SIO 64-11, 30 Jan. 1964, 24° N/113° W, 5,300 m, 10-ft IKMT, 1 (78 mm).
SIO 66-31, 5 Apr. 1966, 29° N/117° W, 4,000 m, 10-ft IKMT, 1 (84 mm).
SIO 67-52, 22 Apr. 1967, 30° N/117° W, 4,000 m, 10-ft IKMT, 1 (80 mm).

SIO 67-102, 10 June 1967, 35° N/123° W, 2,200 m, 10-ft IKMT, 2 (65-71 mm).
SIO 70-19, 17 Dec. 1969, 31° N/119° W, 4,000 m, 10-ft IKMT, 1 (67 mm).
SIO 70-20, 17 Dec. 1969, 31° N/119° W, 4,000 m, 10-ft IKMT, 2 (79-95 mm).

National Institute of Oceanography, Surrey, England:
NIO sta. 7089 #55, 22 Nov. 1969, 17°47′ N/25°22′ W, RMT8, 3 (45-73).

Zoological Institute, Academy of Sciences of the USSR, Leningrad:
RV *Akademik Kurchatov* stn. 233, 13 Sept. 1968, 17° S/86° W, 2,000 m, CN, 1 (87 mm), 39908.

Zoological Museum, University of Copenhagen:
Dana stn. 1217 I, 29 Jan. 1922, 19° N/79° W, 2,000 m, E 300, 1 (57 mm), P2330669.

Museu Municipal do Funchal, Madeira:
RV *Discovery* 4742, 20 Sept. 1961, 32°42′ N/16°32′ W, 1,700 m, IKMT, 1 (49 mm), MMF 22115.