



Title	Deep-sea Fishes Collected from the North Pacific by the T/S OSHORO-MARU
Author(s)	Shinohara, Gento; Yabe, Mamoru; Nakaya, Kazuhiro; Anma, Gen; Yamaguchi, Shuichi; Amaoka, Kunio
Citation	北海道大學水産學部研究彙報, 45(2), 48-80
Issue Date	1994-06
Doc URL	http://hdl.handle.net/2115/24137
Type	bulletin (article)
File Information	45(2)_P48-80.pdf



[Instructions for use](#)

Deep-sea Fishes Collected from the North Pacific by the T/S OSHORO-MARU

Gento SHINOHARA*, Mamoru YABE*, Kazuhiro NAKAYA*,
Gen ANMA**, Shuichi YAMAGUCHI**
and Kunio AMAOKA*

Abstract

Mesopelagic deep-sea fishes were collected by larval net and beam trawl in the North Pacific by the T/S Oshoro-MarU of Hokkaido University and they were studied from the taxonomic point of view. The following forty species were identified and described: *Nemichthys scolopaceus*, *Avocettina infans*, *Bathylagus milleri*, *B. ochotensis*, *B. pacificus*, *B. schmidtii*, *Gonostoma gracile*, *Ichthyococcus elongatus*, *Cyclothone alba*, *C. pseudopallida*, *C. atraria*, *Argyropelecus hemigymnus*, *A. sladeni*, *Danaphos oculatus*, *Chauliodus macouni*, *C. sloani*, *Tactostoma macropus*, *Benthalbella linguoidens*, *Protomyctophum crockeri*, *P. beckeri*, *P. thompsoni*, *Symbolophorus californiensis*, *Myctophum nitidulum*, *M. obtusirostre*, *M. lychnobium*, *Hygophum proximum*, *Tarletonbeania crenularis*, *T. taylori*, *Diaphus theta*, *D. kuroshio*, *Ceratoscopelus warmingii*, *Electrona risso*, *Stenobranchius nannochir*, *S. leucopsarus*, *Lampanyctus ritteri*, *L. fernae*, *L. jordani*, *L. regalis*, *Melamphaes lugubris* and *Zaprora silenus*.

Introduction

The taxonomy and zoogeography of mesopelagic deep-sea fishes in the North Pacific, have been studied by many authors (e.g., Taylor, 1967; Kawaguchi, 1971; Haruta, 1975; Wisner, 1976; Peden et al., 1985). In addition, Willis et al. (1988) set out to clarify the zoogeography of such fishes in the subarctic region. However, there is poor light for understanding the species composition in mesopelagic areas in the whole North Pacific Ocean because the above studies were restricted to special taxonomic groups and/or areas. Accordingly, further documents regarding mesopelagic ichthyofauna are necessary in order to gain a sound understanding of them and in turn consider the ecosystem and biodiversity of the North Pacific Ocean.

Since 1984 the T/S Oshoro-MarU of Hokkaido University has continued beam trawl researches together with larval net surveys in order to clarify the ichthyofauna of the North Pacific Ocean. The purpose of this paper is to describe the deep-sea fishes, captured by beam trawl and larval nets in the North Pacific from early to middle summer for four years (1984-1986 and 1988).

* *Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University*
(北海道大学水産学部水産動物学講座)

** *Training Ship "Oshoro-MarU", Faculty of Fisheries, Hokkaido University*
(北海道大学水産学部練習船おしよる丸)

Materials and Methods

Sampling stations (OL and OBT) and data are as shown in Tables 1 and 2. Specimens, excepting larvae, were collected by the T/S Oshoro-Marui in the North Pacific in 1984, 1985, 1986 and 1988 (Fig. 1), and were fixed by 10% formalin on the ship. The larval net (1.3 m in ring diameter), being operated in 1984, was towed near surface at a speed of about three knots. The midwater beam trawl net surveys, using a non-closing net, were made in 1985, 1986 and 1988. All the specimens were preserved in 50% isopropyl alcohol and deposited in the Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University (HUMZ).

Measurements and counts follow Hubbs and Lagler (1958) in principle. The following abbreviations are used in this paper: total length (TL), standard length

Table 1. Sampling data of larval net surveys (OL) made by the T/S Oshoro-Marui in 1984. Sunset or sunrise is shown in parentheses.

Sampling station	Date	Position	Local time	Temp.* [°C]
OL-8401	June 7	41°17.8'N, 150°19.6'E	1927-1937 (1830)	13.1
OL-8403	9	40°24.6'N, 163°26.8'E	1933-1943 (1905)	12.5
OL-8406	11	39°25.0'N, 179°57.5'W	2010-2020 (1937)	11.2
OL-8407	12	40°55.6'N, 179°57.7'W	2119-2129 (1929)	10.4
OL-8409	14	43°42.3'N, 179°58.2'W	2047-2057 (1941)	7.8
OL-8416	24	56°58.6'N, 164°59.9'W	2059-2109 (1959)	6.8
OL-8432	July 19	50°59.5'N, 154°53.7'W	2153-2203 (2025)	10.9
OL-8434	21	49°02.7'N, 154°53.1'W	2113-2123 (2014)	10.2
OL-8435	22	47°58.4'N, 154°54.3'W	2114-2124 (2008)	10.6
OL-8436	23	46°57.0'N, 154°55.0'W	2102-2112 (2004)	10.9
OL-8437	24	45°26.2'N, 154°58.9'W	2103-2113 (2000)	12.3
OL-8438	25	44°02.7'N, 154°54.9'W	2105-2115 (1952)	13.5
OL-8439	26	42°28.9'N, 154°54.6'W	2110-2120 (1946)	15.1
OL-8440	27	40°57.0'N, 154°57.9'W	2046-2056 (1942)	16.4
OL-8443	30	36°32.8'N, 155°03.7'W	2033-2043 (1928)	22.8
OL-8444	31	34°17.6'N, 150°01.0'W	2023-2034 (1923)	23.9
OL-8445	Aug. 1	30°48.1'N, 154°58.9'W	2114-2124 (2014)	25.5
OL-8446	2	26°38.2'N, 155°00.2'W	2106-2116 (2008)	25.5
OL-8447	3	23°09.4'N, 156°17.5'W	2005-2015 (1907)	26.0
OL-8448	10	22°40.2'N, 159°43.5'W	2013-2023 (1913)	26.3
OL-8449	11	25°48.2'N, 164°37.4'W	1937-1947 (1837)	26.9
OL-8450	12	28°46.8'N, 169°27.1'W	1857-1903 (1759)	27.3
OL-8451	13	31°19.5'N, 174°44.4'W	1918-1928 (1823)	25.4
OL-8453	14	33°46.9'N, 179°51.6'E	1947-1957 (1847)	25.7
OL-8454	16	34°26.7'N, 177°58.5'E	0322-0332 (0430)	24.6
OL-8455	16	35°48.4'N, 174°14.9'E	1909-1919 (1811)	23.2
OL-8458	18	39°08.9'N, 161°15.2'E	2017-2027 (1903)	22.0

* Surface temperature.

Table 2. Sampling data of beam trawl surveys (OBT) made by the T/S Oshoro-Maru in 1985, 1986 and 1988.

Sampling station	Date	Position	Depth (Wire out) [m]	Local time
1985				
OBT-8502	Aug. 1	42°24.6'N, 132°36.9'W	150 (400)	2130-2213
OBT-8503	2	43°01.2'N, 138°45.1'W	150 (400)	2031-2127
OBT-8504	3	43°36.7'N, 145°07.8'W	150 (400)	2016-2039
OBT-8505	4	44°17.6'N, 151°36.8'W	150 (400)	2024-2106
OBT-8506	5	43°36.0'N, 157°00.5'W	150 (400)	1946-2025
OBT-8507	6	44°43.3'N, 163°27.1'W	150 (400)	2012-2054
OBT-8508	7	45°18.4'N, 170°08.7'W	270 (1000)	1939-2024
1986				
OBT-8601	Aug. 10	53°20.1'N, 169°31.2'W	600	2316-2350
OBT-8602	11	50°44.8'N, 175°31.6'W	600	2313-2344
OBT-8603	12	48°50.2'N, 178°17.1'E	600	2230-2300
1988				
OBT-8801	June 13	37°53.8'N, 179°59.3'W	— (1000)	1854-1931
OBT-8802	15	40°00.6'N, 179°59.8'W	390 (1200)	1915-2008
OBT-8803	16	41°04.8'N, 179°59.0'W	340 (1450)	1853-1946
OBT-8804	17	41°56.8'N, 179°59.2'W	400 (1300)	1900-1952
OBT-8805	24	55°01.1'N, 169°59.8'W	— (400)	1850-1912
OBT-8806	25	55°31.0'N, 166°59.7'W	130 (520)	1857-1924
OBT-8807	27	55°56.2'N, 166°58.6'W	117 (600)	1849-1914
OBT-8808	28	54°39.7'N, 166°28.3'W	326 (995)	1847-1925
OBT-8809	July 6	54°01.3'N, 160°03.9'W	— (1300)	1852-1947
OBT-8810	7	54°01.0'N, 157°01.1'W	— (1300)	1852-1946
OBT-8811	9	54°29.9'N, 151°56.7'W	— (1310)	2036-2131
OBT-8812	10	54°59.4'N, 149°59.1'W	— (1300)	1848-1938
OBT-8813	11	55°00.9'N, 148°56.5'W	— (1300)	2031-2128
OBT-8814	13	55°01.8'N, 144°03.5'W	— (1500)	2057-2153
OBT-8815	14	54°59.5'N, 141°59.8'W	— (1300)	2059-2152
OBT-8816	15	55°01.0'N, 139°57.9'W	— (1500)	2053-2150
OBT-8817	17	55°59.0'N, 137°12.6'W	— (1300)	1909-1955
OBT-8818	18	54°00.2'N, 136°21.8'W	— (1500)	1911-2008
OBT-8819	19	53°57.6'N, 135°31.3'W	— (1300)	1913-2009
OBT-8820	30	52°00.9'N, 148°04.3'W	— (1500)	2106-2158
OBT-8821	31	52°02.5'N, 154°37.4'W	— (1500)	2202-2306
OBT-8822	Aug. 4	49°58.1'N, 176°57.5'W	— (1200)	2108-2212
OBT-8823	6	47°26.3'N, 174°56.6'W	— (1500)	2003-2058
OBT-8824	7	43°45.5'N, 174°59.8'W	— (1700)	1952-2049
OBT-8825	8	40°00.3'N, 175°01.9'W	— (1600)	2028-2127

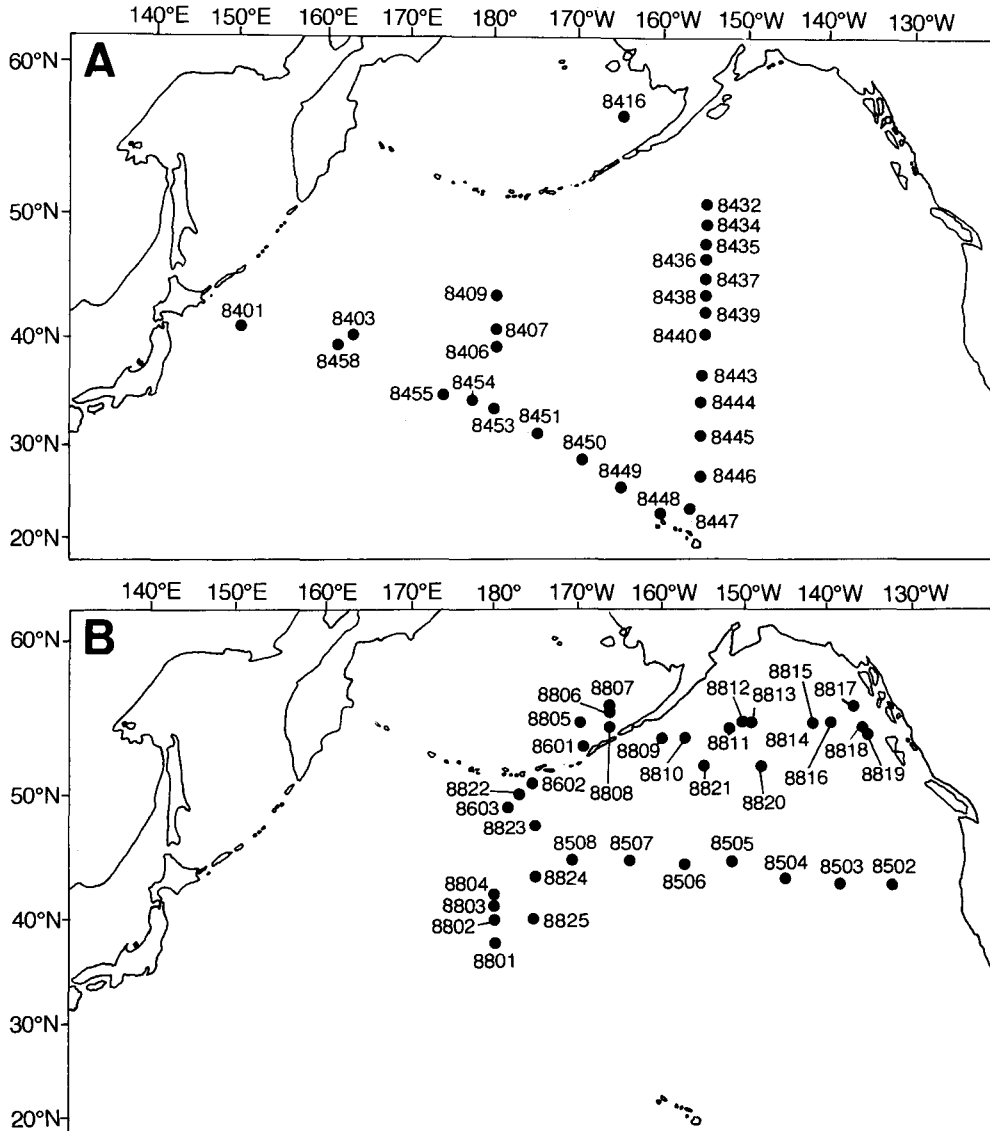


Fig. 1. Sampling stations of larval net (A) and beam trawl net surveys (B). Number corresponds with that of Tables 1 and 2.

(SL), dorsal fin ray count (D), anal (A), pectoral (P_1), pelvic (P_2), gill raker (GR, upper+middle+lower), lateral line scale or pore (LL) and vertebra (VB). Vertebrae were examined from radiographs. Measurements for nemichthyid eels follow Nielsen and Smith (1978) (e.g., SL_{100} shows distance from posterior edge of orbit to 101st vertebra). The terminology of photophores in the stomiiforms and myctophids follows Fujii (1984a, c) (Figs. 2-4), and higher classification Nelson (1984).

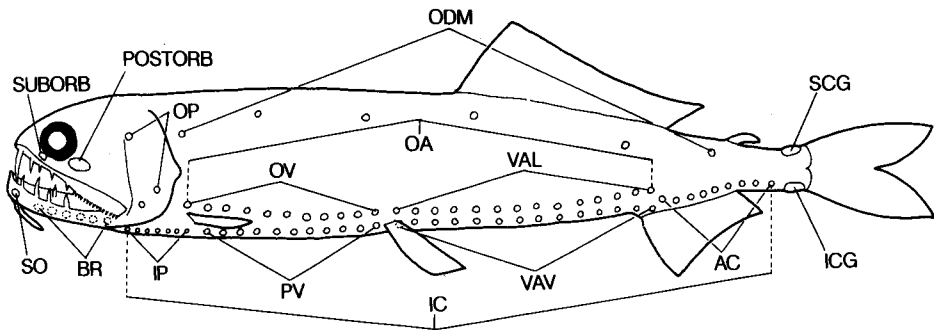


Fig. 2. Terms and locations of luminous organs. AC, posterior part of IC series between a vertical line at anal-fin origin to posterior termination of IC photophore row on caudal peduncle; BR, branchiostegal photophore; IC, all photophores of ventral series; ICG, infraluminous gland; IP, ventral series between isthmus and pectoral insertion; OA, lateral series of photophores; ODM, photophore series near dorsal margin; OP, opercular series; OV, lateral series behind opercle to above pelvic insertion; POSTORB, postorbital luminous organ; PV, ventral series, pectoral-pelvic insertion; SCG, supracaudal luminous gland; SO, symphyseal series; SUBORB, suborbital luminous organ; VAL, lateral series from above pelvic insertion to end of the row above anal fin; VAV, ventral series, pelvic insertion to anal origin if the row is continuous with AC, of end if AC row is separate.

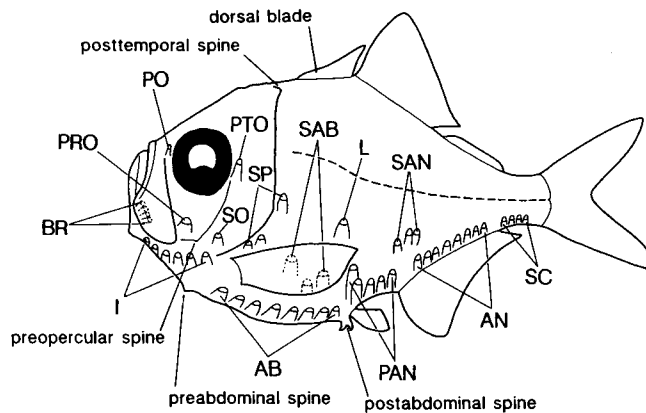


Fig. 3. Terminology of Sternoptychidae. AB, abdominal photophores; AN, anal photophores; BR, branchiostegal photophores; I, isthmus photophores; L, lateral photophore; PAN, preanal photophores; PO, preorbital photophore; PRO, preopercular photophore; PTO, postorbital photophore; SAB, supraabdominal photophores; SAN, supraanal photophores; SC, subcaudal photophores; SO, subopercular photophore; SP, suprapectoral photophores.

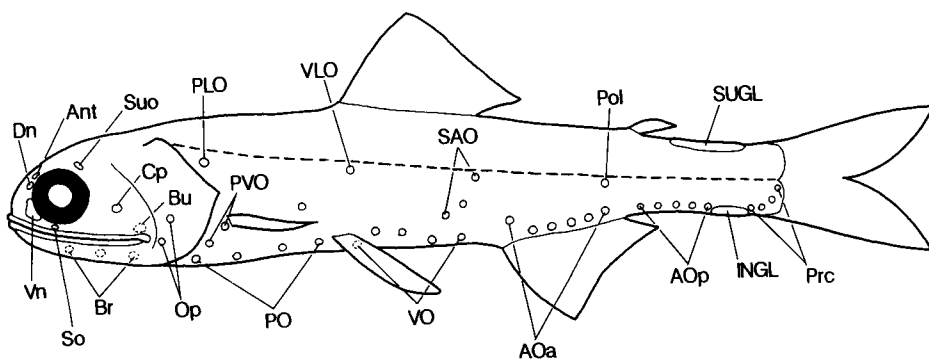


Fig. 4. Terminology of myctophid photophores. Ant, antorbital organ; AO, anal organs; AOa, anterior anal organs; AOp, posterior anal organs; Br, branchiostegal organs; Bu, buccal organ; Cp, cheek photophores; Dn, dorsonasal organ; INGL, infracaudal luminous gland; Op, opercular organs; PLO, suprapectoral organ; PO, thoracic organ or pectoral organ; Pol, posterolateral organ; Prc, precaudal organs; PVO, subpectoral organs; SAO, supraanal organs; So, suborbital organ; Suo, supraorbital organ; SUGL, supracaudal luminous gland; VLO, supraventral organ; Vn, ventronasal organ; VO, ventral organs.

Result

Order Anguilliformes Family Nemichthyidae

1. *Nemichthys scolopaceus* Richardson, 1848 (Japanese name : Shigi-unagi) (Fig. 5A)

Three specimens, 283.0–385.0 mm SL_{200} : HUMZ 108294, OBT-8504; HUMZ 108242, 108243, OBT-8505.

D_{200} 185; A_{200} 189–192; P_1 9–10. Predorsal length 2.3–2.5% of SL_{200} ; preanal length 4.8–5.4%; prepectoral length 3.2–3.4%; eye diameter 1.1–1.2%; interorbital width 0.8–0.9%. Five pores per segment, arranged in three rows. Postorbital pores 3–4; preopercular ones 3–4. Teeth small. Body somewhat pigmented.

Remarks. Identification follows Nielsen and Smith (1978). This species is known to be distributed in various oceans in the tropical and temperate regions, from ca. 55°N to 42°S (Hart, 1973; Asano, 1984).

2. *Avocettina infans* (Günther, 1878) (Kuro-shigi-unagi) (Fig. 5B)

Two specimens, 209.9–247.7 mm SL_{100} : HUMZ 114040, 114041, OBT-8819.

D_{100} 160–161; A_{100} 123–128; P_1 15; LL 184–195. Predorsal 5.5–6.3% of SL_{100} ; preanal 21.7–23.0%; prepectoral 4.3–4.6%; eye diameter 1.3–1.5%; interorbital width 0.7%. Sensory ridges behind eye elongate. Anus well posterior to pectoral fin. One rather large lateral line pore per segment, arranged in one row.

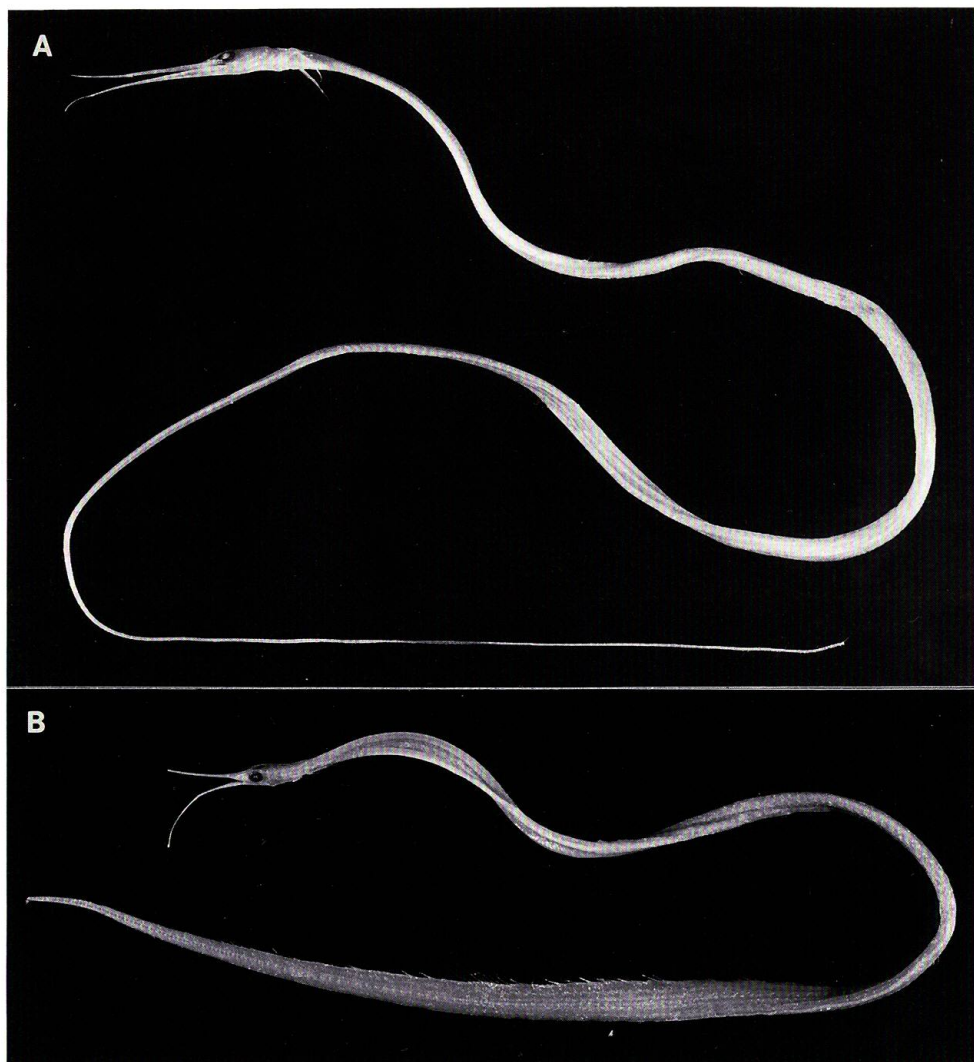


Fig. 5. Two species of family Nemichthyidae. A, *Nemichthys scolopaceus* (HUMZ 108242, 283.0 mm SL₂₀₀); B, *Avocettina infans* (HUMZ 114040, 209.9 mm SL₁₀₀).

Remarks. Identification follows Nielsen and Smith (1978). This species is known to be distributed in all oceans from 50°N to 10°S at depths of 50–4,571 m (Sakamoto, 1983).

Order Salmoniformes
Family Bathylagidae

3. *Bathylagus milleri* Jordan and Gilbert, 1898
(Kuro-soko-iwashi)
(Fig. 6A)

Six specimens, 62.4-147.4 mm SL : HUMZ 114029, 114030, OBT-8823 ; HUMZ 114024, OBT-8821 ; HUMZ 114028, OBT-8822 ; HUMZ 114022, OBT-8816 ; HUMZ 114023, OBT-8819.

D 7 ; A 23-24 ; P₁ 12-15 ; P₂ 7-8. Body deep and compressed. Anal fin base longer than dorsal one. Eye diameter about twice snout length. Upper and lower jaws almost equal in length. Teeth present on both jaws, prevomer and palatine.

Remarks. Identification follows Hart (1973). This species is known to be distributed in the Pacific Ocean off northern Japan, the northern North Pacific, the southern Okhotsk Sea, and the Bering Sea, at depths of 6,600 m or less (Kanayama, 1983).

4. *Bathylagus ochotensis* Schmidt, 1938
(Soko-iwashi)
(Fig. 6B)

Ten specimens, 27.0-81.3 mm SL : HUMZ 108240, OBT-8504 ; HUMZ 108210-108213, 108215-108217, 108219, OBT-8505 ; HUMZ 108002, OBT-8507.

D 11 ; A 14-15 ; P₁ 10. Body slender and compressed. Anal fin base slightly shorter than dorsal one. Snout blunt. Eye diameter longer than snout length. Teeth present on lower jaw, prevomer and palatine.

Remarks. Identification follows Hart (1973) and Uyeno (1984). This species is known to be distributed in the Pacific Ocean off northern Japan, the northern North Pacific, the Okhotsk Sea, and the Bering Sea at 6,000 m or less (Kanayama, 1983).

5. *Bathylagus pacificus* Gilbert, 1890
(Yase-soko-iwashi)
(Fig. 6C)

Four specimens, 44.3-55.5 mm SL : HUMZ 114021, 114025, 114026, 114286, OBT-8821.

D 9-10 ; A 17-18 ; P₁ 7-10 ; GR 9-10+1+18=28-29. Body slender and compressed. Anal fin base about twice the size of dorsal one. Eye diameter about twice as long as snout length. Posterodorsal margin of opercle not curved inward.

Remarks. Identification follows Hart (1973), Kanayama (1983) and Uyeno (1984). This species is known to be distributed in the Pacific Ocean off northern Japan, northern North Pacific, Okhotsk Sea, Bering Sea at 7,700 m or less (Kanayama, 1983). According to Peden et al. (1985), this species inhabits abundantly at depths of 600-800 m, and large individuals (>100 mm SL) usually at depths of 800 m or more.

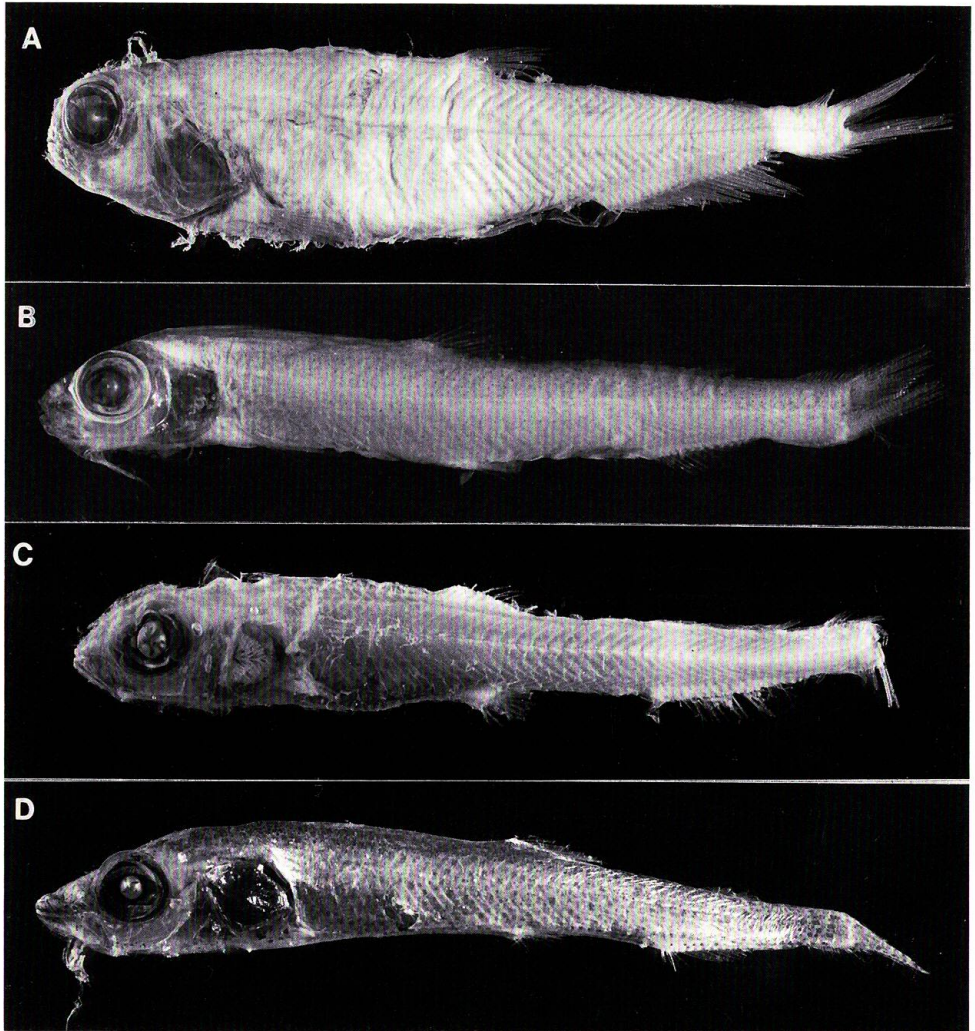


Fig. 6. Four species of genus *Bathylagus*. A, *B. milleri* (HUMZ 114029, 93.6 mm SL); B, *B. ochotensis* (HUMZ 108002, 78.3 mm SL); C, *B. pacificus* (HUMZ 114025, 51.4 mm SL); D, *B. schmidti* (HUMZ 111399, 50.5 mm SL).

6. *Bathylagus schmidti* (Rass, 1955)
(Togari-ichimonji-iwashi)
(Fig. 6D)

Four specimens, 25.2-101.3 mm SL : HUMZ 111398, 111399, OBT-8601 ; HUMZ 114292, 114293, OBT-8825.

D 11 ; A 12-13 ; P₁ 9 ; P₂ 8-9 ; VB 48-50. Body slender and compressed. Anal fin base short, equal to dorsal one. Snout pointed. Eye diameter slightly shorter than snout length. Upper jaw shorter than lower jaw. Teeth present on

lower jaw, prevomer and palatine.

Remarks. Identification follows Peden (1981) and Uyeno (1984). This species is distributed in the Okhotsk Sea, the Bering Sea, and the eastern North Pacific at depths of 1,400 m or less (Kanayama, 1983).

Order Stomiiformes
Family Gonostomatidae

7. *Gonostoma gracile* Günther, 1878
(Yoko-eso)
(Fig. 7A)

Forty-four specimens, 65.0-113.6 mm SL : HUMZ 108069-108071, OBT-8506 ; HUMZ 108167-108182, OBT-8508 ; HUMZ 113978-113992, OBT-8824 ; HUMZ 113994-113997, 113999, 114000, 114008, 114009, 114014, 114016, OBT-8825.

D 11-12 ; A 27-29 ; P₁ 9-10 ; GR 6-9+2+11-12=20-21. BR 9 ; IP 5 ; ODM 6 ; PV 10 ; VAV 5 ; AC 17-19 ; IC 37-39. OA series not in a straight line. ODM widely separated each other. Adipose fin absent. Anus before anal origin.

Remarks. Identification follows Fujii (1984a). This species is widely found from the subtropical to the subarctic North Pacific (Mead and Taylor, 1953 ; Fujii, 1984a). Vertically, it inhabits at depths of 800 m or less (Peden et al., 1985).

8. *Ichthyococcus elongatus* Imai, 1941
(Shinju-eso)
(Fig. 7B)

Eleven specimens, 31.2-84.3 mm SL : HUMZ 114031-114035, 114268, 114269, OBT-8803 ; HUMZ 114037, OBT-8802 ; HUMZ 114036, OBT-8804 ; HUMZ 114270, 114271, OBT-8824.

D 15 ; A 15-17 ; P₁ 7-8 ; P₂ 7-8 ; GR 10-11+1+18-26=30-37. IP 10 ; PV 17 ; VAV 13-14 ; AC 13-15 ; IC 54-56 ; OA 30-31. Eye semitubular and directed upward. Mouth small. Teeth of both jaws minute. Dorsal origin in advance of pelvic one.

Remarks. Identification follows Grey (1964) and Kawaguchi (1971). This species is widely found in the mesopelagic zone of the temperate North Pacific (Fujii, 1984a).

9. *Cyclothone alba* Brauer, 1906
(Yuki-oni-hadaka)
(Fig. 7C)

Three specimens, 20.9-24.9 mm SL : HUMZ 114315-114317, OBT-8825.

D 12-13 ; A 17-19 ; P₁ 9 ; P₂ 6-7 ; GR 4+1+9=14. BR 8 ; OV 6 ; IV 13 ; VAV 4 ; AC 11 ; IC 28. One gill raker in angle between epibranchial and ceratobranchial. Abdominal cavity ending above VAV₁. Photophores on body large. Gill lamellae fused along hypobranchial.

Remarks. Identification follows Kawaguchi (1971) and Mukhacheva (1974). This species is known to be found in all oceans (Mukhacheva, 1974). Vertically, it inhabits at depths of 300-600 m at daytime and night (Miya and Nemoto, 1986).

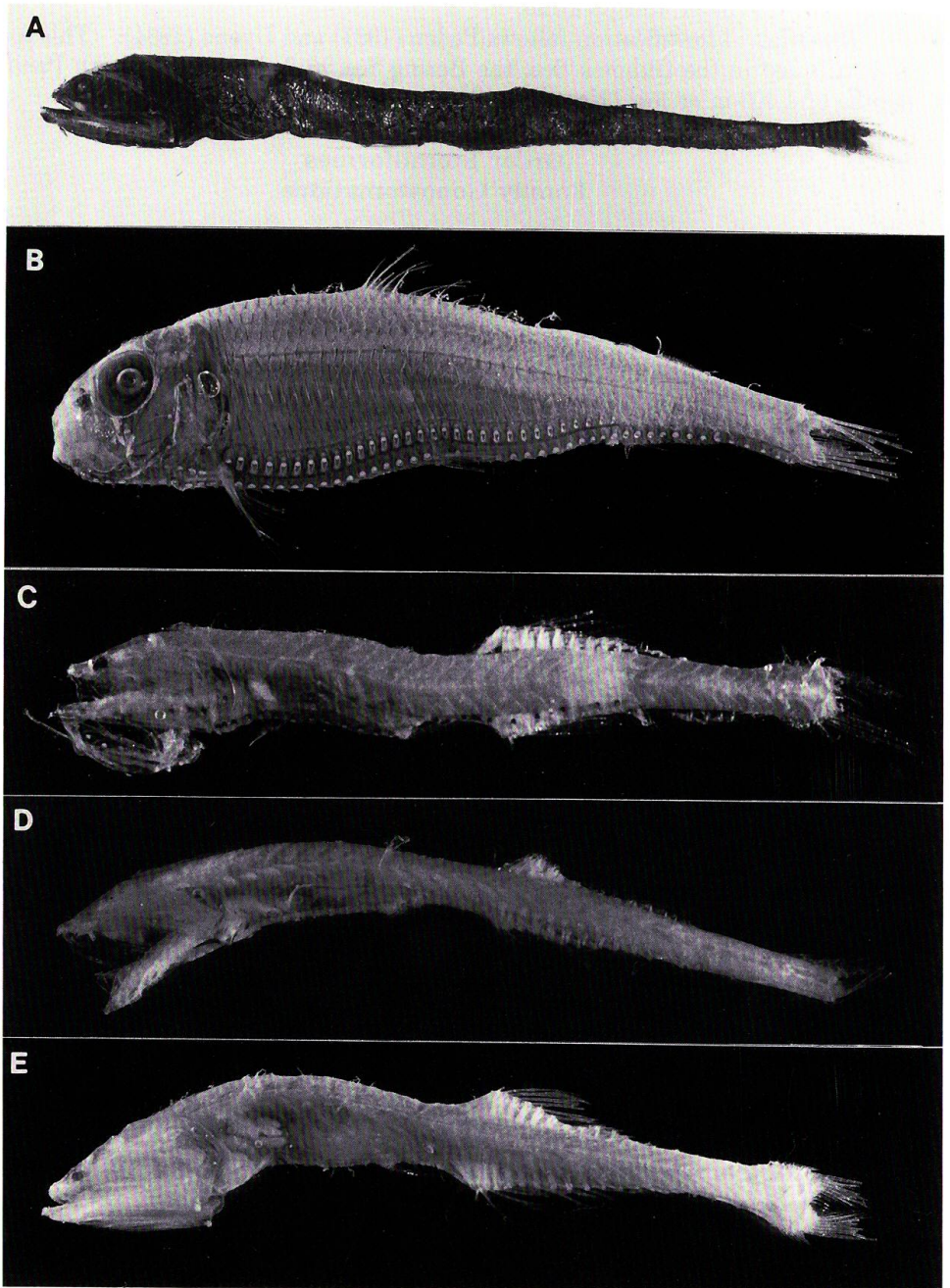


Fig. 7. Five species of family Gonostomatidae. A, *Gonostoma gracile* (HUMZ 108180, 88.4 mm SL); B, *Ichthyococcus elongatus* (HUMZ 114032, 70.0 mm SL); C, *Cyclothone alba* (HUMZ 114315, 24.9 mm SL); D, *C. pseudopallida* (HUMZ 114311, 44.3 mm SL); E, *C. atraria* (HUMZ 114017, 49.0 mm SL).

10. *Cyclothone pseudopallida* Mukhacheva, 1964
(Haiiro-oni-hadaka)
(Fig. 7D)

Four specimens, 40.2–46.0 mm SL : HUMZ 114311, OBT-8819 ; HUMZ 114312, 114313, OBT-8822 ; HUMZ 114314, OBT-8824.

D 13 ; A 19–21 ; P₁ 9–10 ; GR 5+2+11–12=18–19. BR 11 ; OV 7 ; IV 13 ; VAV 5 ; AC 15 ; IC 33. Two gill rakers in angle between epibranchial and ceratobranchial. Abdominal cavity ending above VAV₂. Photophores on body small. Gill lamellae fused to along hypobranchial.

Remarks. Identification follows Kawaguchi (1971) and Mukhacheva (1974). This species is distributed from the subarctic to subantarctic regions of the Pacific, the Indian, and the Atlantic Oceans (Fujii, 1984a). It is found at depths of 300–900 m (Badcock, 1984).

11. *Cyclothone atraria* Gilbert, 1905
(Oni-hadaka)
(Fig. 7E)

Five specimens, 42.3–51.8 mm SL : HUMZ 114017–114020, 114291, OBT-8825.

D 14 ; A 17–19 ; P₁ 9–10 ; P₂ 6 ; GR 7–8+2+12=21–22. BR 9 ; OV 7 ; IV 13–14 ; VAV 5 ; AC 14–15 ; IC 32–34. Body color dark brown or black. Margin of scale pockets especially dark. Area immediately anterior to anal origin densely pigmented and not transparent. Abdominal cavity ending above area between VAV₃ and VAV₄, usually invisible from the outside. Gill lamellae free and reduced.

Remarks. Identification follows Kawaguchi (1971) and Mukhacheva (1974). This species is known to be distributed in the subtropical and subarctic regions of the North Pacific excluding the waters of California, and in the Okhotsk Sea and the Bering Sea (Fujii, 1984a).

Family Sternoptychidae

12. *Argyropelecus hemigymnus* Cocco, 1829
(Tengan-mune-eso)
(Fig. 8A)

One specimen, 18.8 mm SL : HUMZ 108262, OBT-8503.

D 8 ; A 11 ; P₁ 10 ; P₂ 6. SAB, PAN, AN and SC not in a continuous straight line. Each SC closely spaced. Two posteriorly directed postabdominal spines and the lower spine much larger and serrated.

Remarks. Identification follows Baird (1971) and Fujii (1984a). According to Badcock (1984) the number of PAN photophore is constantly four in this species. But the present specimen possesses five photophores on the left side and four on the right side. This specimen agrees with *Argyropelecus hemigymnus* in other characters. This species is found in all oceans (Baird, 1971, 1986). It inhabits at depths of 100–700 m (Baird, 1971).

13. *Argyropelecus sladeni* Regan, 1908
(Teono-eso)
(Fig. 8B)

Fourteen specimens, 16.4–53.1 mm SL: HUMZ 108003–108005, OBT-8507;
HUMZ 108065–108068, OBT-8506; HUMZ 108200–108203, OBT-8505; HUMZ

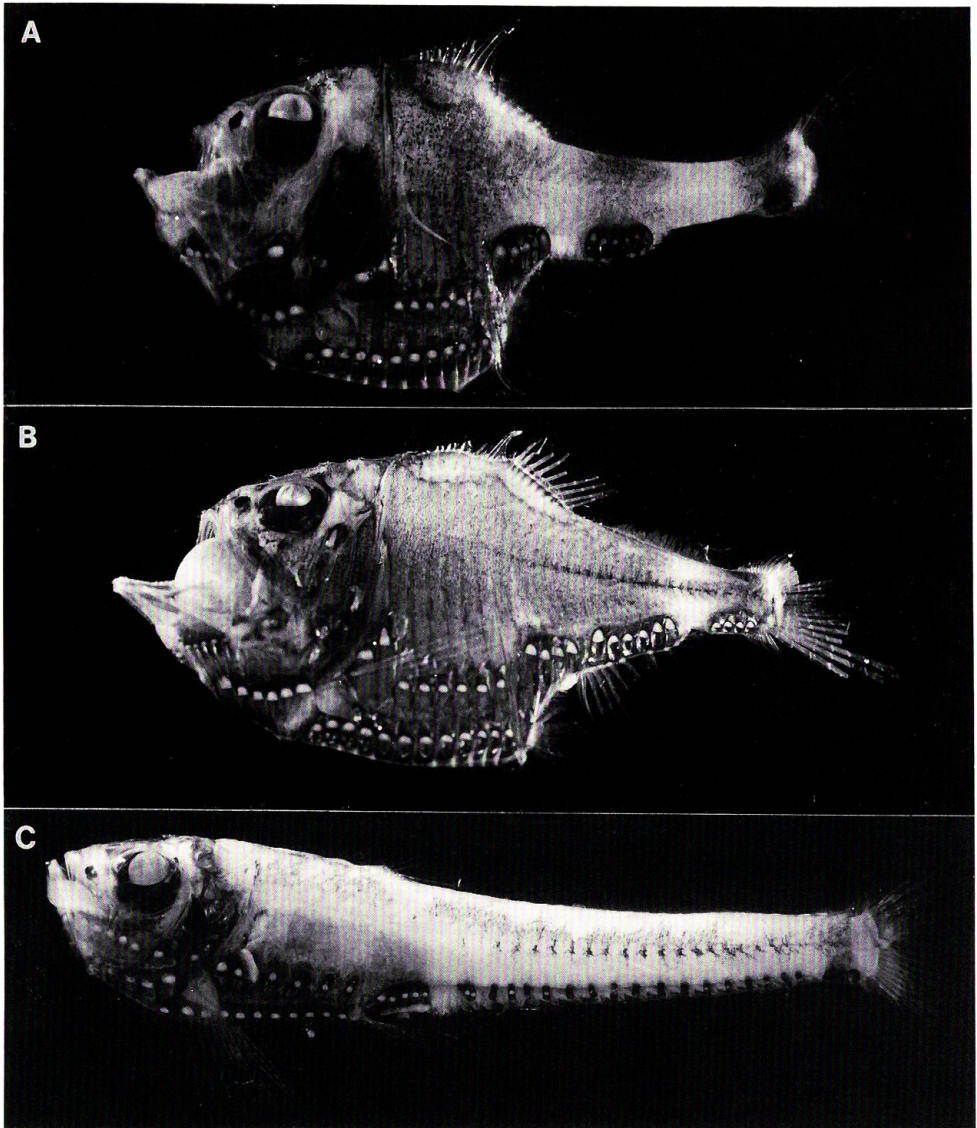


Fig. 8. Three species of family Sternoptychidae. A, *Argyropelecus hemigymnus* (HUMZ 108262, 18.8 mm SL); B, *A. sladeni* (HUMZ 108201, 31.7 mm SL); C, *Danaphos oculatus* (HUMZ 108260, 33.2 mm SL).

108249, 108251, OBT-8504; HUMZ 113971, OBT-8825.

D 9; A 12; P₁ 10-11; P₂ 6; GR 7-8+2+9-10=19-20; VB 33. SAB, PAN, AN and SC photophores not in a continuous straight line. Each SC closely spaced. Dorsal blade low, its height less than one-third of its length. Upper preopercular spine curved dorsally. No spines on scales below SC photophores. Dark well-developed pigment spots form a line along posterior midline.

Remarks. Identification follows Baird (1971). This species shows worldwide distribution (Baird, 1971, 1986).

14. *Danaphos oculatus* (Garman, 1899)

(No Japanese name)

(Fig. 8C)

Two specimens, 33.2-34.1 mm SL: HUMZ 108258, 108260, OBT-8503.

D 6; A 23-24; P₁ 13; P₂ 6; GR 2+0+11-13=13-15. BR 5; PV 11; VAV 5; AC (3)+15-16+(4)+1=23-24; IC 45-46; OA 6-7. SO absent. Eye tubular, directed obliquely upward. Interorbital width (at center of eye) less than orbit length. Mouth nearly vertical. Teeth of upper jaw minute and uniserial. Dorsal origin located in middle of body, and in advance of anal one. Pelvic base beneath dorsal one.

Remarks. Identification follows Grey (1964). This species is known to be found in the Pacific and the Indian Oceans at depths of 183-914 m (Eschmeyer et al., 1983).

Family Chauliodontidae

15. *Chauliodus macouni* Bean, 1890

(Higashi-hourai-eso)

(Fig. 9A)

Thirty-seven specimens, 61.0-133.2 mm SL: HUMZ 108154, OBT-8508; HUMZ 113940, 113941, OBT-8809; HUMZ 113933, 113934, OBT-8810; HUMZ 113936, OBT-8811; HUMZ 113955, OBT-8813; HUMZ 113937-113939, OBT-8814; HUMZ 113942, OBT-8815; HUMZ 113943-113946, OBT-8816; HUMZ 113947-113952, OBT-8817; HUMZ 113953-113957, OBT-8818; HUMZ 113958-113962, OBT-8819; HUMZ 113963-113966, OBT-8820; HUMZ 113967, OBT-8822; HUMZ 113968, OBT-8823.

D 7; A 10-13; P₁ 11-12; P₂ 7. IP 10-11; PV 17-20; VAV 26-28; AC 9-12; IC 65-68; OV 18-20; VAL 24-27; OA 44-46. POSTORB elongate, triangular, located behind a vertical through posterior margin of orbit. Third tooth longer than the fourth one on premaxillary.

Remarks. Identification follows Morrow (1964). This species is known to be found in the northern and southern California through Oregon, Washington, Alaska, the Bering Sea, the Kuril Isls. and Japan at depths of 75-1,600 m (Taylor, 1967; Hart, 1973; Yamamoto, 1983; Fujii, 1984a; Peden et al., 1985).

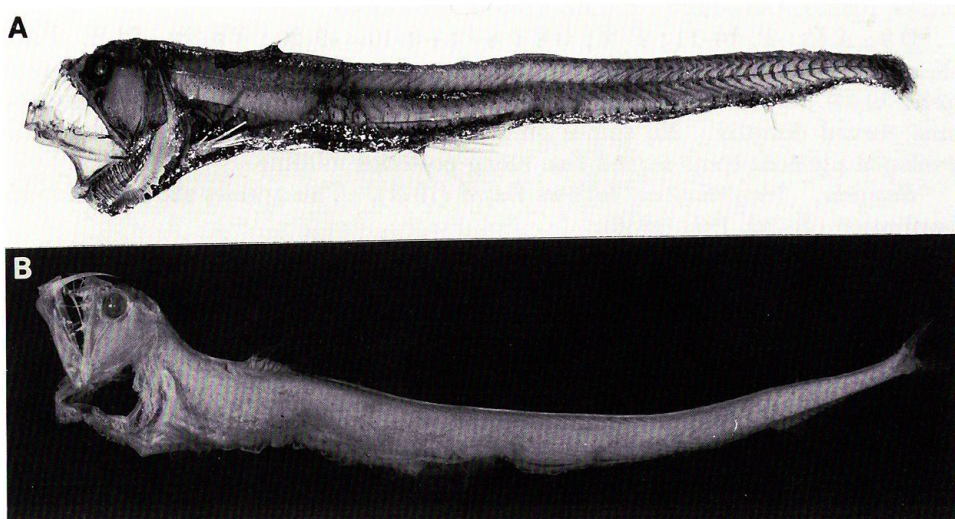


Fig. 9. Two species of genus *Chauliodus*. A, *C. macouni* (HUNZ 108154, 131.8 mm SL); B, *C. sloani* (HUMZ 113969, 174.1 mm SL).

16. *Chauliodus sloani* Block and Schneider, 1801
(Hourai-eso)
(Fig. 9B)

One specimen, 174.1 mm SL : HUMZ 113969, OBT-8825.

D 6 ; A 13 ; P₁ 14 ; P₂ 7. IP 10 ; PV 20 ; VAV 25 ; AC 9 ; IC 64 ; OV 20 ; VAL 23 ; OA 42. Third tooth shorter than the fourth one on premaxillary. POSTORB round, located below or in front of the vertical through posterior margin of orbit.

Remarks. Identification follows Morrow (1964). This species is known to be found in the warm regions of the Pacific, the Indian and the Atlantic Oceans and the Mediterranean Sea at depths of 1,000 m or more (Fujii, 1984a ; Gibbs, 1984).

Family Melanostomiidae

17. *Tactostoma macropus* Bolin, 1939
(Hadaka-hotei-eso)
(Fig. 10)

Sixteen specimens, 114.0-175.8 mm SL : HUMZ 108205-108209, OBT-8505 ; HUMZ 108057-108063, OBT-8506 ; HUMZ 108006, OBT-8507 ; HUMZ 111442, OBT-8603 ; HUMZ 114267, OBT-8823 ; HUMZ 113993, OBT-8824.

D 12-18 ; A 15-20 ; P₂ 9-10. Pectoral fin absent. Anal origin situated below dorsal origin. Teeth on both jaws in several clusters. No teeth on prevomer.

Remarks. Identification follows Hart (1973). This species is found in the temperate and subarctic North Pacific, at depths of 30-2,000 m (Yamamoto, 1983).



Fig. 10. *Tactostoma macropus* (HUMZ 108061, 112.4 mm SL).

Order Aulopiformes
Family Scopelarchidae

18. *Benthalbella linguicens* (Mead and Böhlke, 1953)
(Deme-eso)
(Fig. 11)

One specimen, 78.2 mm SL: HUMZ 108162, OBT-8508.

D 9; A 27; P₁ 24; P₂ 8; VB 64. Adipose fin distinctly posterior to end of anal fin base. Pelvic origin in advance of dorsal one. No pigments on body and head except eye.

Remarks. Identification follows Johnson (1974). This specimen was regarded as a juvenile of *Benthalbella linguicens* because it has no pigments on body. This species is known to be found in the subarctic waters of the North Pacific (Fujii, 1984b).



Fig. 11. *Benthalbella linguicens* (HUMZ 108162, 78.2 mm SL).

Order Myctophiformes
Family Myctophidae

19. *Protomyctophum crockeri* (Bolin, 1939)
(Mukashi-hadaka)
(Fig. 12A)

Nine specimens, 27.3–37.0 mm SL: HUMZ 108111, 108112, 108115, 108120, 108124, OBT-8508; HUMZ 114285, 114306, OBT-8802; HUMZ 114307, 114308, OBT-8804.

D 11–13; A 20–22; P₁ 14–16; P₂ 8; GR 4–5+1+14–15=19–21. VO 4; SAO 3; AO 13–14; Prc 2. Head length about 30–33% of SL. Interorbital width half or less than width of posterior end of maxillary. SAO series equally spaced in a nearly straight line. SAO₁ over or slightly in advance of VO₄. Last two or three AO behind end of anal base.

Remarks. Identification follows Wisner (1976). This species is found in the North Pacific, primarily within the subarctic and California Current systems, and



Fig. 12. Three species of genus *Protomyctophum*. A, *P. crockeri* (HUMZ 108112, 32.0 mm SL); B, *P. beckeri* (HUMZ 108025, 29.5 mm SL); C, *P. thompsoni* (HUMZ 108114, 47.2 mm SL).

inhabits at depths above 100 m at night (Wisner, 1976).

20. *Protomyctophum beckeri* Wisner, 1971
(No Japanese name)
(Fig. 12B)

Ten specimens, 27.0–34.7 mm SL : HUMZ 108053, OBT-8506 ; HUMZ 108019–108022, 108025, 108027, 108029, 108036, OBT-8507 ; HUMZ 108119, OBT-8508.

D 11–13 ; A 20–23 ; P₁ 13–15 ; P₂ 7–9 ; GR 4 + 1 + 11–13 = 16–18. SAO series evenly spaced in a straight line. SAO₁ over or slightly before VO₄. Posterior two or three AO behind end of anal base.

Remarks. *Protomyctophum beckeri* is very similar to *P. crockeri*. According to Wisner (1976), it is distinguished from the latter by having lower numbers of total gill raker count (16–18 vs. 20–23 in *P. crockeri*). This species is distributed in the central North Pacific south to 20°N and inhabits from the surface to 326 m depth at night (Wisner, 1976).

21. *Protomyctophum thompsoni* (Chapman, 1944)
(Oome-hadaka)
(Fig. 12C)

Sixty-four specimens, 22.0–49.3 mm SL : HUMZ 108018, 108023, 108024, 108028, 108030–108035, 108037, 108038, OBT-8507 ; HUMZ 108113, 108114, 108116–108118, 108121–108123, 108125–108144, OBT-8508 ; HUMZ 113931, OBT-8802 ; HUMZ 114281, OBT-8803 ; HUMZ 113932, OBT-8804 ; HUMZ 114284, OBT-8810 ; HUMZ 114279, 114280, OBT-8811 ; HUMZ 113929, 113930, OBT-8813 ; HUMZ 114111, 114112, OBT-8814 ; HUMZ 114282, OBT-8815 ; HUMZ 114275, OBT-8816 ; HUMZ 114276–114278, OBT-8817 ; HUMZ 114272, OBT-8819 ; HUMZ 114273, 114274, OBT-8820 ; HUMZ 114283, OBT-8822 ; HUMZ 114113–114115, OBT-8824 ; HUMZ 113927, 113928, OBT-8825.

D 11 ; A 21–24 ; P₁ 14–16 ; GR 4 + 1 + 12–13 = 17–18. VO 4 ; SAO 3 ; AO 16–17 ; Prc 2. Interorbital space narrower than width of posterior end of maxillary. SAO series angulated. SAO₂ nearer to SAO₃ than SAO₁. SAO₁ over or slightly in advance of VO₃. Distance between Prc₁ and Prc₂ less than a photophore diameter.

Remarks. Identification follows Wisner (1976). This species is known to be distributed in the North Pacific north to 40°N, and also can be found in the Bering Sea near the central Aleutian Isls., from surface to 500 m depth at night (Wisner, 1976).

22. *Symbolophorus californiensis* (Eigenmann and Eigenmann, 1889)
(Naga-hadaka)
(Fig. 13)

Nine specimens, 70.2–108.1 mm SL : HUMZ 111455, 111456, OL-8403 ; HUMZ 111457, OL-8406 ; HUMZ 111461, OL-8407 ; HUMZ 107909–107911, OBT-8057 ; HUMZ 108110, OBT-8508 ; HUMZ 113503, OBT-8802.

D 14–15 ; A 20–21 ; P 15–17 ; GR 6–7 + 1 + 14–16 = 21–24. PO 5 ; PVO 2 ; VO 4 ; SAO 3 ; AOa 7–8 ; AOp 8–10 ; Pol 1 ; Prc 2. First 4 AOp over anal base. Pol well in advance of adipose origin. SAO₁ over or slightly behind VO₂. AOa series straight. Villiform teeth on palatine.



Fig. 13. *Symbolophorus californiensis* (HUMZ 113503, 71.5 mm SL).

Remarks. Identification follows Becker (1965) and Wisner (1976). This species is confined to the California Current from 27°N to British Columbia, in the surface layer at night (Wisner, 1976).

23. *Myctophum nitidulum* Garman, 1899
(Susuki-hadaka)
(Fig. 14A)

Sixty-six specimens, 16.3–40.8 mm SL: HUMZ 111813–111819, OL-8445; HUMZ 111823, 111824, OL-8446; HUMZ 111639, 111644, 111645, OL-8447; HUMZ 111652, 111654, 111656, 111657, OL-8448; HUMZ 111661–111663, OL-8449; HUMZ 111668, OL-8450; HUMZ 111673–111696, OL-8451; HUMZ 111698–111712, OL-8453; HUMZ 111716, OL-8454; HUMZ 111717–111719, OL-8455; HUMZ 111720–111722, OL-8458.

D 12–14; A 20; P₁ 13–15; GR 5–7+1+13–15=20–23. PO 5; PVO 2; VO 4; SAO 3; AO 13–16; Pol 1; Prc 2. Posterodorsal margin of opercle markedly angulate and not serrated. Scales cycloid. SAO series in a straight line.

Remarks. Identification follows Wisner (1976) and Fujii (1984c). This species is widely distributed in the warm waters of the Pacific, the Indian and the Atlantic Oceans (Wisner, 1976).

24. *Myctophum obtusirostre* Tanning, 1928
(Hisa-hadaka)
(Fig. 14B)

Thirteen specimens, 13.0–33.1 mm SL: HUMZ 111638, OL-8445; HUMZ 111640–111643, OL-8447; HUMZ 111650, 111651, OL-8448; HUMZ 111664–111666, OL-8449; HUMZ 111667, 111669, OL-8450; HUMZ 111722, OL-8458.

D 12–13; A 17–18; P₁ 17–19; GR 6–7+1+15–16=22–23. PO 5; PVO 2; VO 4; SAO 3; AO 13; Pol 1; Prc 2. Scales cycloid or feebly ctenoid. Posterodorsal margin of opercle weakly serrated. SAO series slightly angulate.

Remarks. Identification follows Wisner (1976) and Nafpaktitis et al. (1977). This species is widely found in the tropical waters of the world oceans (Fujii, 1984c).

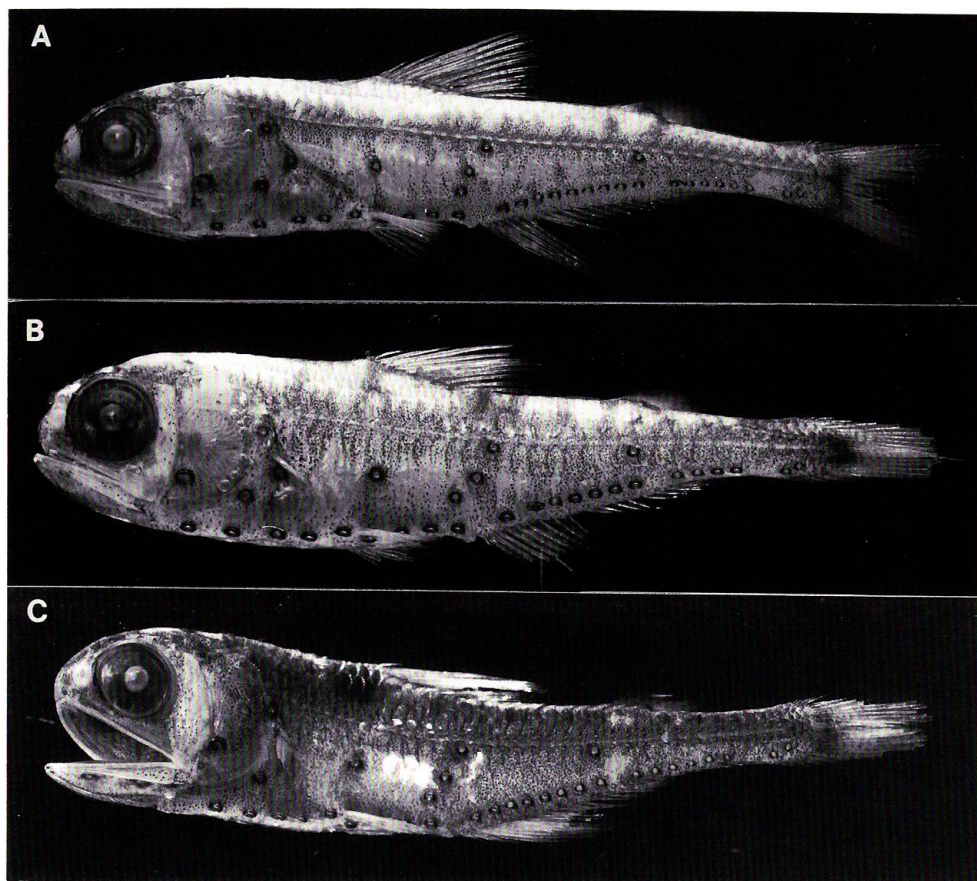


Fig. 14. Three species of genus *Myctophum*. A, *M. nitidulum* (HUMZ 111656, 38.4 mm SL); B, *M. obtusirostre* (HUMZ 111669, 34.0 mm SL); C, *M. lychnobium* (HUMZ 111646, 38.2 mm SL).

25. *Myctophum lychnobium* Bolin, 1946

(No Japanese name)

(Fig. 14C)

One specimen, 38.2 mm SL: HUMZ 111646, OL-8447.

D 13; A 18; P₁ 14; 7+1+14=22. PO 5; PVO 2; VO 4; SAO 3; AO 14; Pol 1; Prc 2. Scales ctenoid. SAO series in a straight line, and a line through them passing through VO₃. Greatest depth of body about 4.0 in SL. Least depth of caudal peduncle about 3.2 in the length. Scales over AO series with 1 to 3 elongate, sharp spines projecting posteriorly. Prc₂ below lateral line, and near Prc₁. Pol just below origin of adipose fin base.

Remarks. Identification follows Wisner (1976). This species is known to be distributed from the tropical waters of the eastern Pacific to the Mozambique Channel in the Indian Ocean, and at surface at night (Wisner, 1976).

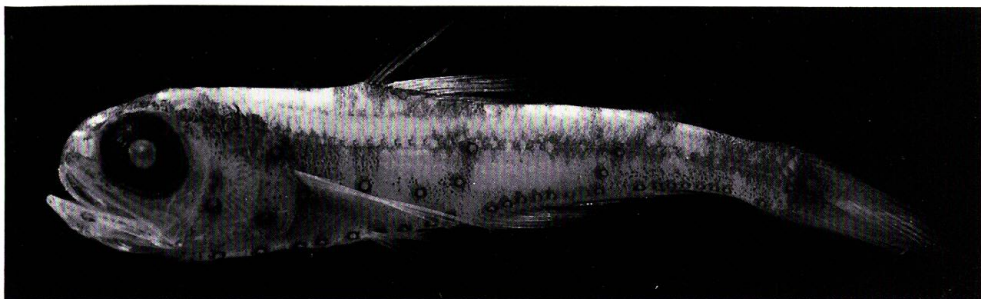


Fig. 15. *Hygophum proximum* (HUMZ 111820, 27.1 mm SL).

26. *Hygophum proximum* Becker, 1965
(Tsumari-donguri-hadaka)
(Fig. 15)

Eight specimens, 17.0-27.1 mm SL: HUMZ 111820-111822, OL-8445; HUMZ 111825, OL-8446; HUMZ 111653, OL-8448; HUMZ 111658-111660, OL-8449.

D 12; A 18-21; P 13-14; GR 4-5+1+12-14. PO 5; PVO 2; VO 4; SAO 3; AOa 6-7; AOp 7-8; Pol 2; Pre 2. Body depth about 4.0 in SL. Upper end of base of pectoral fin below level of center of eye. Pol₂ well in advance of adipose fin. AOa series in a straight line. A line through SAO₁ and SAO₂ passes below PVO₁. Upper jaw barely extends posterior margin of orbit.

Remarks. Identification follows Wisner (1976). This species is widely found in the warm waters of the Pacific and the Indian Oceans (Wisner, 1976).

27. *Tarletonbeania crenularis* (Jordan and Gilbert, 1880)
(No Japanese name)
(Fig. 16A)

Four specimens, 34.2-37.8 mm SL: HUMZ 111504, OL-8432; HUMZ 114298, OBT-8815; HUMZ 114300, OBT-8816; HUMZ 114303, OBT-8818.

D 12; A 17-18; P₁ 12; GR 4-5+1+9-10=14-16. Snout slightly projecting. Caudal peduncle narrow, and its depth less than eye diameter. Lateral line incomplete. PLO lower than upper end of pectoral base. SUGL filling supracaudal space, and INGL short and hidden under body scales.

Remarks. All specimens used in this paper are males because of the presence of SUGL and INGL. According to Wisner (1976) and Peden et al. (1985), only male specimens are distinguishable from its close relative, *T. taylori*, by the condition of SUGL and INGL. This species is known to be found in the coastal waters of North America in the Pacific Ocean (Wisner, 1976).

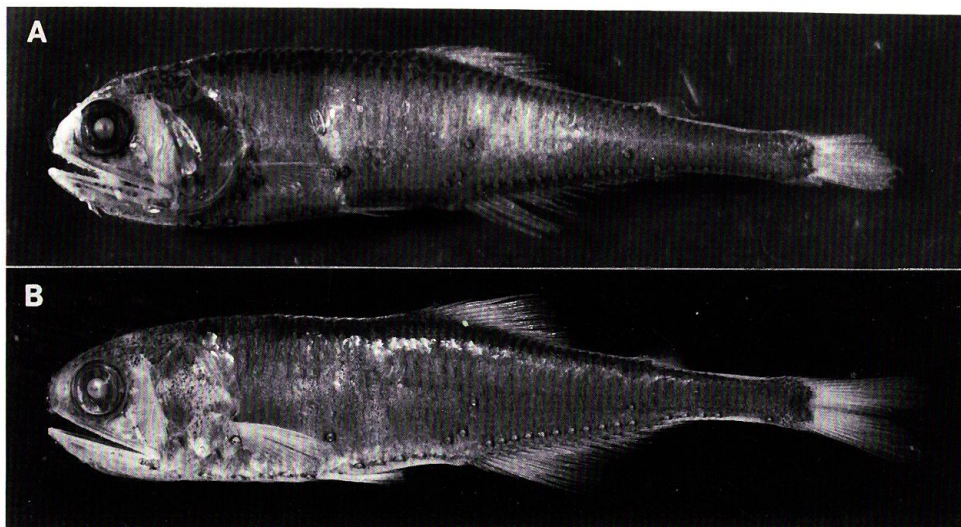


Fig. 16. Two species of genus *Tarletonbeania*. A, *T. crenularis* (HUMZ 114300, 37.8 mm SL); B, *T. taylori* (HUMZ 111471, 44.4 mm SL).

28. *Tarletonbeania taylori* Mead, 1953
(Hokuyou-hadaka)
(Fig. 16B)

A total of 169 specimens, 22.8–53.0 mm SL: HUMZ 111453, 111454, OL-8401; HUMZ 111458, 111460, OL-8406; HUMZ 111462–111470, OL-8407; HUMZ 111471–111502, OL-8409; HUMZ 111503, OL-8416; HUMZ 111505–111507, OL-8432; HUMZ 111508, 111509, OL-8434; HUMZ 111510–111523, OL-8435; HUMZ 111524–111545, OL-8436; HUMZ 111546–111572, OL-8437; HUMZ 111772–111784, OL-8438; HUMZ 111785–111802, OL-8439; HUMZ 111803–111810, OL-8440; HUMZ 108007–108016, OBT-8507; HUMZ 108155, 108156, OBT-8508; HUMZ 113924–113926, 114299, OBT-8823.

D 12–14; A 17–19; P₁ 11–13; GR 5+1+9–10=15–16. PO 6; PVO 2; VO 6; SAO 3; AOa 10–12; AOp 4–6; Pol 1; Pre 1. Snout slightly projecting. Caudal peduncle narrow and its depth less than eye diameter. Lateral line incomplete. PLO lower than upper end of pectoral base. SUGL and INGL present in males.

Remarks. This species is very similar to *Tarletonbeania crenularis*, and only male specimens can be identified by the condition of SUGL and INGL (Wisner, 1976). Female specimens were identified as this species because they were collected with the males in the same trawl net. This species is distributed in the North Pacific from northern Japan to northern coast of North America at surface at night (Wisner, 1976).

29. *Diaphus theta* Eigenmann and Eigenmann, 1890
(Todo-hadaka)
(Fig. 17A)

A total of 236 specimens, 29.9–81.0 mm SL : HUMZ 108263–108265, OBT-8502 ; HUMZ 108236–108239, OBT-8504 ; HUMZ 108184–108188, OBT-8505 ; HUMZ 108042–108045, OBT-8506 ; HUMZ 107972–108001, OBT-8507 ; HUMZ 108095–108109, OBT-8508 ; HUMZ 110025–110050, 111421–111429, OBT-8602 ; HUMZ 111421–111429, OBT-8603 ; HUMZ 113556–113568, 113720–113727, OBT-8802 ; HUMZ 113551–113554, 113920, OBT-8804 ; HUMZ 113728–113731, OBT-8814 ; HUMZ 113732–113741, OBT-8815 ; HUMZ 113742–113745, OBT-8816 ; HUMZ 113746–113768, OBT-8817 ; HUMZ 113769–113774, OBT-8818 ; HUMZ 113775–113781, OBT-8819 ; HUMZ 113782–113787, OBT-8820 ; HUMZ 113788–113792, OBT-8821 ; HUMZ 113793–113828, 113830–113833, OBT-8823.

D 12–14 ; A 13–14 ; P₁ 10–11 ; GR 6–7+1+13–14 = 20–22. Dn 1 ; Vn 1 ; So 1 ; PO 5 ; PVO 2 ; VO 5 ; SAO 3 ; AOa 5 ; AOp 6 ; Pol 1 ; Prc 4. Pupil elongate horizontally. Vn and So connected by black tissue. So small, anterior to a vertical line of posterior end of pupil. A straight line through AOa₁ and AOa₂ passing below SAO₁. A large luminous scale at PLO.

Remarks. Identification follows Wisner (1976) and Kawaguchi and Shimizu (1978). This species is restricted to the subarctic waters of the North Pacific (Kawaguchi and Shimizu, 1978). They can be found at about 10 m depth at night, and at 400 m depth in daytime (Wisner, 1976).

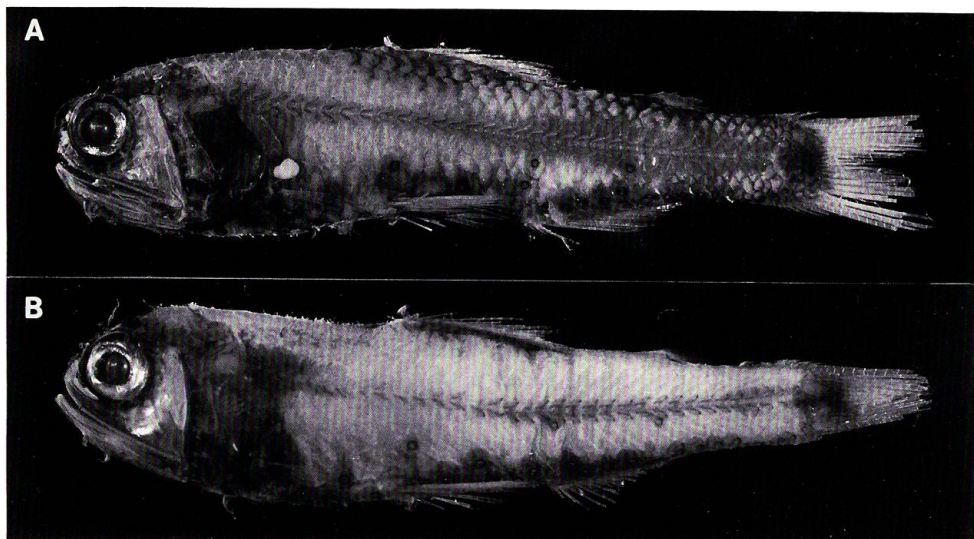


Fig. 17. Two species of genus *Diaphus*. A, *D. theta* (HUMZ 113784, 63.4 mm SL) ; B, *D. kuroshio* (HUMZ 113923, 49.4 mm SL).

30. *Diaphus kuroshio* Kawaguchi and Nafpaktitis, 1978
(Kuroshio-hadaka)
(Fig. 17B)

Five specimens, 30.8-49.4 mm SL: HUMZ 113923, 114295, 114296, 114304, 114305, OBT-8825.

D 13-14; A 13; P₁ 11; GR 7-8+1+15-16=23-24. PO 5; PVO 2; VO 5; AOa₁ 5; AOp 4-5; Pol 1; Prc 5. Pupil elongate horizontally. No Suo and Ant. Vn elongate horizontally and its length more than two times the distance between So and itself. So small, below center of orbit. A straight line through AOa₁ and AOa₂ passing above SAO₂. A small luminous scale at PLO.

Remarks. Identification follows Kawaguchi and Shimizu (1978). This species is found in the Kuroshio waters off Japan, and can be found at a depth of 100 m at night, and depths of 200-300 m in daytime (Kawaguchi and Shimizu, 1978).

31. *Ceratoscopelus warmingii* (Lütken, 1892)
(Gokou-hadaka)
(Fig. 18)

One specimen, 44.0 mm SL: HUMZ 113921, OBT-8825.

D 14; A 14; P₁ 15; P₂ 8; GR 4+1+10=15. PO 5; PVO 2; VO 5; SAO 3; AOa₁ 6; AOp 6; Pol 1; Prc 4. Pectoral fin long. No supraorbital luminous gland. Luminous tissues below PVO₁, VO and AO series. INGL elongate, reaching below Prc₄.

Remarks. Identification follows Wisner (1976). This species is known to be distributed in the warm waters of the Pacific, the Indian and the Atlantic Oceans at a depth of 100 m at night (Wisner, 1976; Fujii, 1984c).

32. *Electrona risso* (Cocco, 1829)
(Daruma-hadaka)
(Fig. 19)

One specimen, 62.7 mm SL: HUMZ 113970, OBT-8825.

D 13; A 20; P 16; P 8; GR 9+1+19=29; VB 33. PO 5; PVO 2; VO 4; SAO 3; AO 11; Prc 2. No Pol. Body deep, and its depth about three times in its length. Upper jaw short, not reaching below the posterior end of orbit. SAO series about equally spaced and slightly angulate. AO series undulating near end of anal

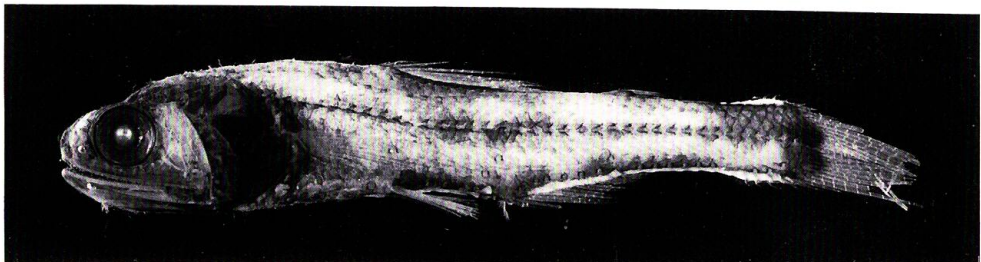


Fig. 18. *Ceratoscopelus warmingii* (HUMZ 113921, 44.0 mm SL).

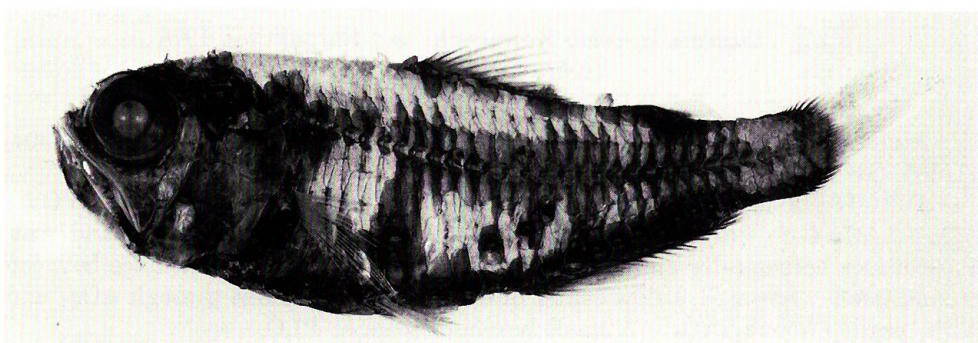


Fig. 19. *Electrona risso* (HUMZ 113970, 62.7 mm SL).

fin base.

Remarks. Identification follows Wisner (1976). This species is widely found in the North Pacific, the Mediterranean Sea, the western North Atlantic, Gulf of Guinea, South Africa, the tropical Indian Ocean, and near New Zealand (Kubota and Uyeno, 1972; Wisner, 1976). It inhabits at a depth of 170 m at night in the eastern North Pacific (Wisner, 1976).

33. *Stenobranchius nannochir* (Gilbert, 1890)
(Sekki-hadaka)
(Fig. 20A)

Eighteen specimens, 42.0–107.3 mm SL: HUMZ 113505, OBT-8809; HUMZ 114309, 114310, OBT-8810; HUMZ 113477, OBT-8818; HUMZ 113462, 113467, OBT-8819; HUMZ 113492, 113665, 113666, 114051–114056, OBT-8821; HUMZ 113662–113664, OBT-8822.

D 13–15; A 14–16; P₁ 9–10; GR 5–6+1+12–13=18–20. PO 5; PVO 2; VO 4–5; SAO 3; AOa 4–6; AOp 6–8; Pol 1; Prc 3–4. Body slender and elongate. Pectoral fin small. SAO series nearly straight. SUGL with 3–5 luminous scales. INGL with 5–7 scales, filling only about three-fourths of infra-caudal space.

Remarks. Identification follows Wisner (1976). This species is widely found in the subarctic waters of the North Pacific at depths of 300–600 m (Wisner, 1976; Fujii, 1984c; Furuhashi and Shimazaki, 1989).

34. *Stenobranchius leucopsarus* (Eigenmann and Eigenmann, 1890)
(Kohire-hadaka)
(Fig. 20B)

A total of 382 specimens, 21.4–102.6 mm SL: HUMZ 108266–108271, 108274, OBT-8502; HUMZ 108228, 108229, OBT-8504; HUMZ 108195–108199, OBT-8505; HUMZ 107912–107949, 107952–107971, OBT-8507; HUMZ 108079–108085, 108087–108094, 108160, OBT-8508; HUMZ 111229–111397, OBT-8601; HUMZ 111400–111409, 111411–111420, 111447–111451, OBT-8602; HUMZ 111430–111440, OBT-8603; HUMZ 113449, 113450, 113506, OBT-8809; HUMZ 113451, 113452, 113507–113509, OBT-8810; HUMZ 113453–113459, OBT-8811; HUMZ 113480–113483, 113513, 113514, OBT-8813; HUMZ 113460, OBT-8814; HUMZ 113717, OBT-8815;

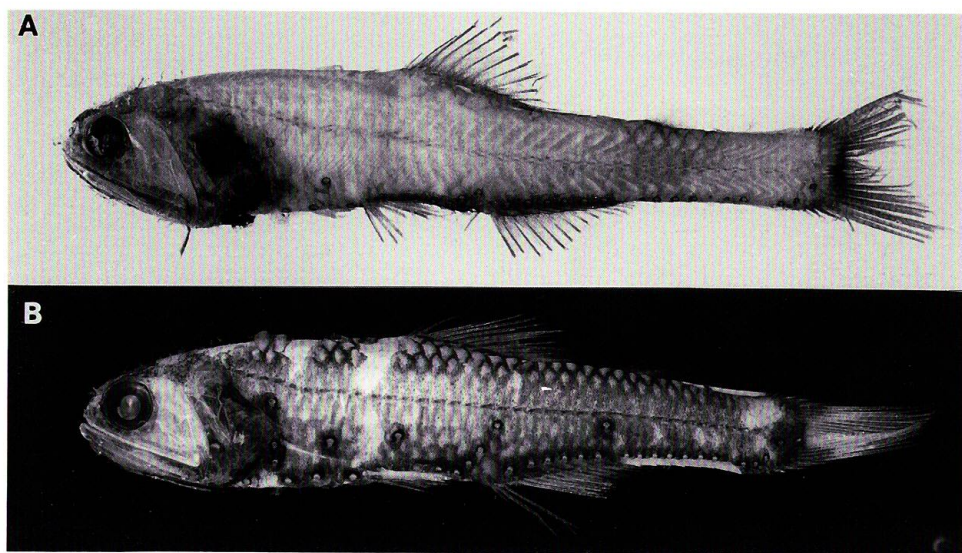


Fig. 20. Two species of genus *Stenobranchius*. A, *S. nannochir* (HUMZ 113492, 98.7 mm SL); B, *S. leucopsarus* (HUMZ 107912, 79.4 mm SL).

HUMZ 113468-113474, OBT-8816; HUMZ 113718, OBT-8817; HUMZ 113475, 113476, 113478, 113479, OBT-8818; HUMZ 113461, 113463-113466, 113719, OBT-8819; HUMZ 113484-113489, 113518-113523, OBT-8820; HUMZ 113490, 113491, 113493, 113524-113530, OBT-8821; HUMZ 113494-113497, 113531-113535, OBT-8822; HUMZ 113498-113500, 113536-113547, OBT-8823; HUMZ 113548, 113549, OBT-8824.

D 13-14; A 14-15; P₁ 9; GR 5-6+1+12-13=18-20. Vn 1; Op 2; PO 5; PVO 2; VO 4; SAO 3; AOa 6; AOp 7-8; Pol 1; Prc 4. Body moderately robust. Pectoral fin small. SAO series almost in a straight line. SUGL with 6-8 luminous scales. INGL with 7-9 luminous scales, filling entire infra-caudal space.

Remarks. Identification follows Wisner (1976). This species is widely found in the subarctic waters of the North Pacific, including the Bering Sea (Fujii, 1984c). It inhabits at depths of 30 m or less at night (Wisner, 1976).

35. *Lampanyctus ritteri* Gilbert, 1915
(No Japanese name)
(Fig. 21A)

Twelve specimens, 36.6-100.8 mm SL: HUMZ 108272, 108273, 108275, OBT-8502; HUMZ 108253, 108256, OBT-8503; HUMZ 108231, 108232, 108234, 108235, OBT-8504; HUMZ 108047, OBT-8506; HUMZ 113501, 113502, OBT-8815.

D 13-14; A 17-19; P₁ 11-13; VB 4-5+1+9-10=14-15. PO 5; PVO 2; VO 4; SAO 3; AOa 6-8; AOp 6-10; Pol 2; Prc 4. Body robust. Pectoral fin short and its base narrow. No prominent photophores except Bu on cheek. VLO on a line through SAO₁ and SAO₂. SAO₂ about over, SAO₃ slightly behind anal origin.

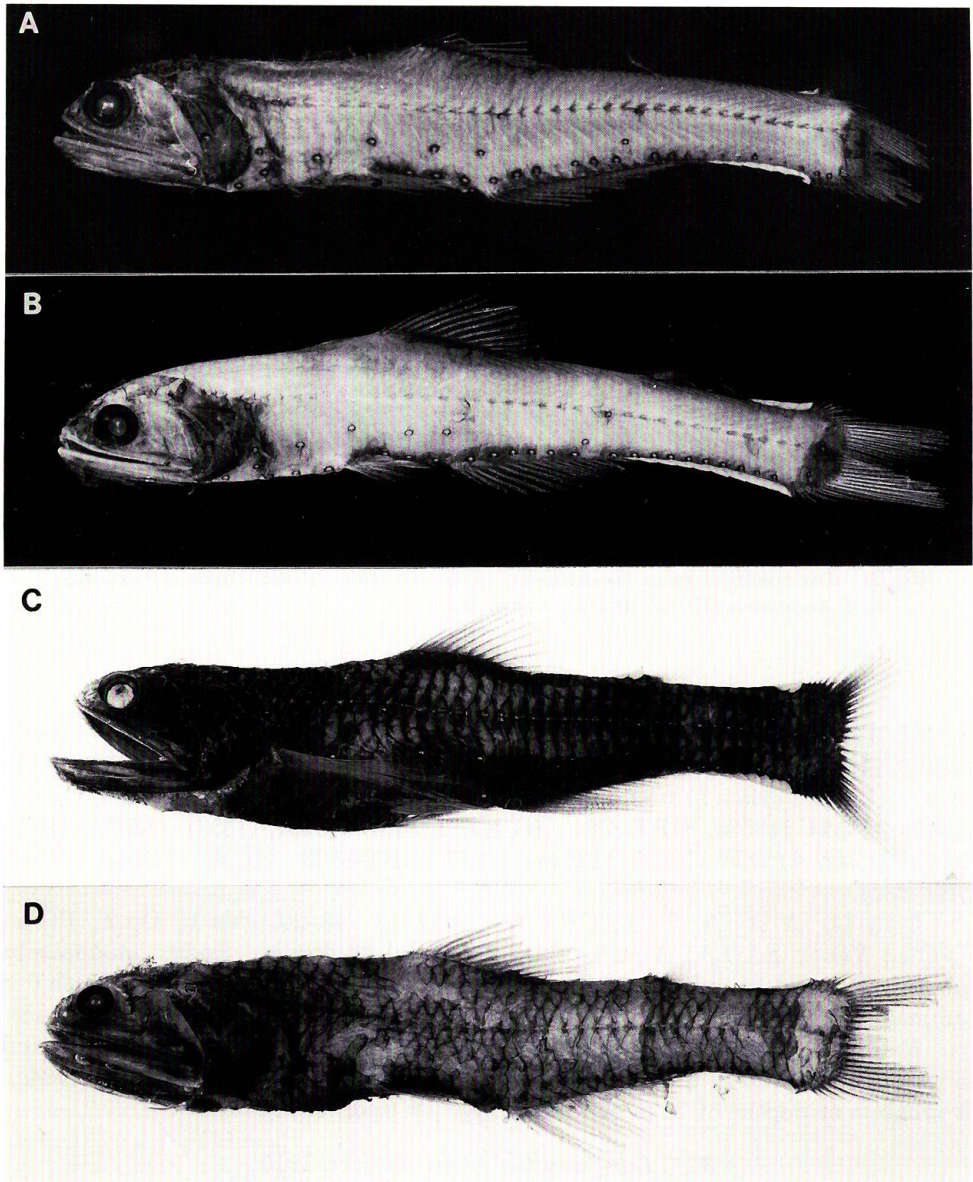


Fig. 21. Four species of genus *Lampanyctus*. A, *L. ritteri* (HUMZ 113502, 85.8 mm SL); B, *L. fernae* (HUMZ 108064, 61.4 mm SL); C, *L. jordani* (HUMZ 113915, 60.5 mm SL); D, *L. regalis* (HUMZ 113907, 101.0 mm SL).

VO₂ not elevated. INGL with 6 luminous scales filling three-fourths or less of infra-caudal space.

Remarks. Identification follows Wisner (1976). This species is found in the cold water areas of the eastern North Pacific between about 25°N and 46°N, and at

above 20 m depth at night (Wisner, 1976).

36. *Lampanyctus fernae* Wisner, 1971

(No Japanese name)

(Figs. 21B and 22)

Seven specimens, 40.3–66.9 mm SL : HUMZ 108254, 108255, OBT-8503 ; HUMZ 108230, OBT-8504 ; HUMZ 108191, 108194, OBT-8505 ; HUMZ 108064, OBT-8506 ; HUMZ 114294, OBT-8804.

D 13–14 ; A 16–18 ; P₁ 12–13 ; GR 4–5+1+10–11=15–17. Body slender. Pectoral fin short and its base narrow. No prominent photophores except Bu on cheek. No luminous tissue on adipose fin base. Pectoral fin small, and its basal length 0.7–1.0 times infraorbital width. SAO₂ well before, SAO₃ well behind anal origin. VLO, well below lateral line, at or slightly above a line through SAO₁ and SAO₂. VO₂ slightly elevated. INGL with 8–9 luminous scales filling infra-caudal space.

Table 3. Comparison of proportional measurements (% of SL) in present specimens with those of *Lampanyctus fernae* and *L. ritteri*.

	Present specimens N=3	<i>L. fernae</i> N=21*	<i>L. ritteri</i> N=18*
Head length	23.6–25.8	23.5–26.4	27.2–30.0
Head depth	13.9–15.2	13.0–15.6	16.2–18.0
Upper jaw length	16.1–18.2	15.4–18.7	19.4–21.2
Prepectoral length	26.0–27.3	25.4–27.5	28.0–31.2
Length of INGL	20.4–21.0	18.2–23.2	7.7–14.5

* Data from Wisner (1976).

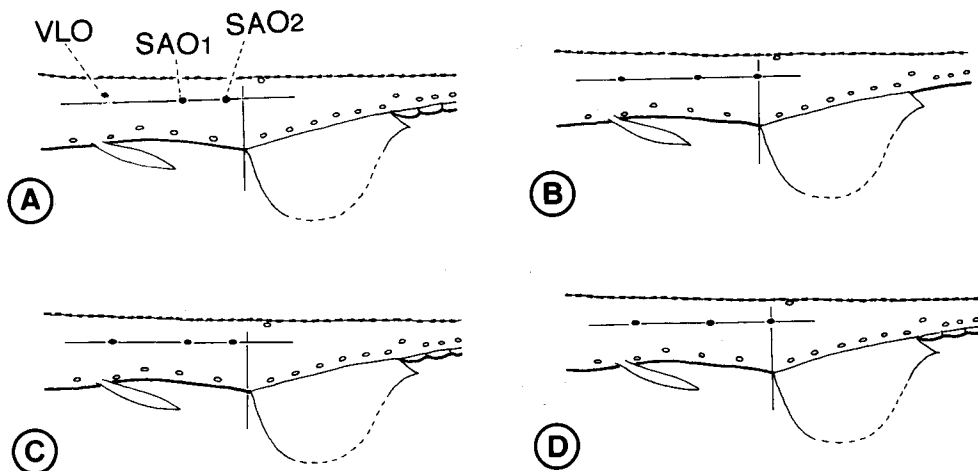


Fig. 22. Arrangements of photophores in *Lampanyctus fernae* (A, C and D) and *L. ritteri* (B). A, typical arrangements in *L. fernae* ; B, those of *L. ritteri* ; C and D, conditions of present specimens.

Remarks. According to Wisner (1976), this species is distinguished from its close relative, *L. ritteri*, by two characters: (1) SAO₂ well before the anal origin, and (2) VLO slightly above a line through SAO₁ and SAO₂ (Fig. 22A). Three specimens (HUMZ 108191, 108230 and 108254) partly or completely lack the characters above (Fig. 22C, D). Because these proportional measurements are included in those of *L. fernae* (Table 3), three specimens were identified as the latter. It is, therefore, considered that the above two characters show the infraspecific variations. This species is known to be found in restricted areas of the North Pacific Ocean, from 40°N to 45°N, and from 135°W to 165°W, at a depth of 200 m at night (Wisner, 1976).

37. *Lampanyctus jordani* Gilbert, 1913
(Mame-hadaka)
(Fig. 21C)

Twenty-eight specimens, 59.7–103.8 mm SL: HUMZ 108252, OBT-8503; HUMZ 108189–108193, OBT-8505; HUMZ 108046, 108049–108052, OBT-8506; HUMZ 107904–107908, OBT-8507; HUMZ 111441, OBT-8603; HUMZ 113908, OBT-8822; HUMZ 113910–113914, OBT-8823; HUMZ 113915, 113916, OBT-8824; HUMZ 113917–113919, OBT-8825.

D 13–14; A 17–19; P₁ 13–15; GR 6–7+1+13–15=20–22. PLO 2; PO 5; PVO 2; VO 4; SAO 3; AOa 7; AOp 9–10; Pol 2; Prc 4. Pectoral fin long and its base broad. VLO near lateral line. AOa_{1–4} variously highly elevated. INGL short. Extra PLO developed near pectoral origin. Secondary photophores on body weakly developed, persistent only near lateral line. Luminous scales at base of adipose fin.

Remarks. Identification follows Wisner (1976). This species is widely found in the subarctic waters of the North Pacific, including the Okhotsk Sea and the Bering Sea (Fujii, 1984c). It inhabits from the surface to 200 m depth at night (Wisner, 1976).

38. *Lampanyctus regalis* (Gilbert, 1891)
(Mikado-hadaka)
(Fig. 21D)

Three specimens, 73.6–105.4 mm SL: HUMZ 113907, OBT-8809; HUMZ 113829, OBT-8819; HUMZ 113909, OBT-8822.

D 15–16; A 18; P₁ 14; GR 4–5+1+9–10=14–16. Bu 1; PO 5; VO 4; SAO 3; AOa 7; AOp 7–8; Pol 2; Prc 4. Pectoral fin short and its base narrow. SUGL and INGL consist of 3–4 and 7–8 luminous scales respectively. No luminous gland at base of adipose fin. Body photophores notably small. Both SAO₁ and SAO₂ before anal origin. VLO well above a line through SAO₁ and SAO₂.

Remarks. Identification follows Wisner (1976). This species is found in the cold waters of the eastern North Pacific as off Baja California to Japan, and inhabits at a depth of about 50 m at night (Wisner, 1976).



Fig. 23. *Melamphaes lugubris* (HUMZ 108257, 85.0 mm SL).

Order Beryciformes
Family Melamphaidae

39. *Melamphaes lugubris* Gilbert, 1890
(Hon-kabuto-u)
(Fig. 23)

Six specimens, 38.0–85.0 mm SL: HUMZ 108257, OBT-8503; HUMZ 108145–108148, OBT-8508; HUMZ 114039, OBT-8821.

D III, 15; A I, 7–9; P₁ 15–16; P₂ I, 7; GR 20–21; VB 12+16–18=28–30; LL 32–34. No posttemporal spine. Anal origin below or slightly behind posterior end of dorsal fin base. Gill raker flat, and its width about equal to the distance between each raker.

Remarks. Identification follows Ebeling (1962). This species is widely found in the subarctic waters of the northern North Pacific at depths of 150–1,200 m (Fujii, 1984d).

Order Perciformes
Family Zaproridae

40. *Zaprora silenus* Jordan, 1896
(Bouzu-ginpo)
(Fig. 24)

Three specimens, 34.4–93.9 mm SL: HUMZ 111443–111445, OBT-8603.

D LIV–LV; A 29; P₁ 23–25; VB 62. Body deep and compressed. Dorsal and anal fins completely separated from caudal fin. Pelvic fin absent. Many large sensory pores with white margins scattered on head.

Remarks. Identification follows Hart (1973). These specimens are all juveniles. This species is known to be distributed in the Pacific coast of Hokkaido, Japan to Kamchatka, Gulf of Alaska to California (Hart, 1973). It inhabits at depths of 0–500 m (Haryu and Nishiyama, 1981; Amaoka, 1984).

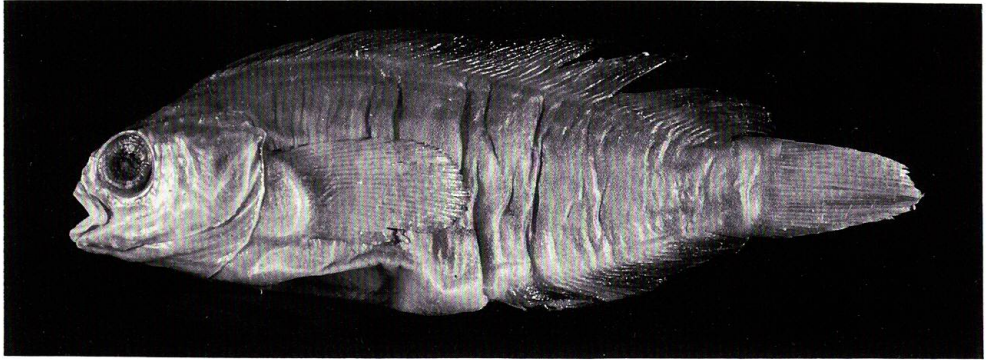


Fig. 24. *Zaprora silenus* (HUMZ 111443, 71.6 mm SL).

Acknowledgments

We wish to express our thanks to the former Captain Kiyoshi Masuda and all officers and crew of the T/S Oshoro-Maruo of Hokkaido University for supporting both larval and mid-water trawl net surveys; and to Mr. Hidenori Hioki (HUMZ) for preliminary identification of 1988 samples and Mr. Eiji Mihara (HUMZ) for photographs.

References

- Amaoka, K. (1984). Zaproridae. p. 304. In Masuda, H., Amaoka, K., Araga, C., Uyeno T. and Yoshino, T. (eds.), *The Fishes of the Japanese Archipelago*. English text. xxii+437 p. Tokai Univ. Press, Tokyo.
- Asano, H. (1984). Nemichthyidae. p. 22. *Ibid.*
- Badcock, J. (1984). Gonostomatidae, Sternoptychidae. p. 284-317. In Whitehead, P.J.P., Bauchot, M.-L., Hureau, J.-C., Nielsen, J. and Tortonese, E. (eds.), *Fishes of the North-eastern Atlantic and the Mediterranean* 1. 510 p. Unesco, Paris.
- Baird, R.C. (1971). The systematics, distribution, and zoogeography of the marine hatchetfishes (family Sternoptychidae). *Bull. Mus. Comp. Zool. Harvard Univ.* 142, 1-128.
- Baird, R.C. (1986). Tribe Sternoptychini. p. 255-259. In Smith, M. and Heemstra, P.C. (eds.), *Smiths' Sea Fishes*. xix+1047 p. Springer-Verlag, Berlin.
- Becker, V.E. (1965). The lantern fishes of the genus *Hygophum* (Myctophidae, Pisces): systematics and distribution. *Trudy Inst. Okeanol. Acad. Sci. USSR* 80, 60-103. (In Russian).
- Ebeling, A.W. (1962). Melamphaidae I: systematics and zoogeography of the species in the bathypelagic fish genus *Melamphaes* GÜNTHER. *Dana-Rep. Carlsberg Found.* (58), 1-164.
- Eschmeyer, W.N., Herald, E.S. and Hammann, H. (1983). *A Field Guide to Pacific Coast Fishes of North Pacific of North America*. xii+336 p. Houghton Mifflin Company, Boston.
- Fujii, E. (1984a). Stomiiformes. p. 44-54. In Masuda, H., Amaoka, K., Araga, C., Uyeno, T. and Yoshino, T. (eds.), *The Fishes of the Japanese Archipelago*. English text. xxii+437 p. Tokai Univ. Press, Tokyo.
- Fujii, E. (1984b). Scopelarchidae. p. 63. *Ibid.*
- Fujii, E. (1984c). Myctophidae. p. 64-75. *Ibid.*
- Fujii, E. (1984d). Melamphaidae. p. 110-111. *Ibid.*
- Furuhashi, M. and Shimazaki, K. (1989). Vertical distribution and diet of *Stenobranchius nannochir* (Myctophidae) in the southern Bering Sea, summer, 1987. *Proc. NIPR Symp. Polar Biol.*

- 2, 94-104.
- Gibbs, R.H., Jr. (1984). Chauliodontidae. p. 336-337. In Whitehead, P.J.P., Bauchot, M.-L., Hureau, J.-C., Nielsen, J. and Tortonese, E. (eds.), *Fishes of the North-eastern Atlantic and the Mediterranean* 1. 510 p. Unesco, Paris.
- Grey, M. (1964). A preliminary review of the family Gonostomatidae, with a key to genera and the description of a new species from the tropical Pacific. *Bull. Mus. Comp. Zool. Harvard Univ.* **122**, 57-125.
- Hart, J.L. (1973). Pacific Fishes of Canada. *Bull. Fish. Res. Bd. Can.* **180**, i-ix+1-740.
- Haruta, C. (1975). Taxonomy and geographical distribution of the genus *Argyropolecus* (family Sternoptychidae) from the western North Pacific Ocean. *Japan. J. Ichthyol.* **22**, 83-96. (In Japanese with English abstract).
- Haryu, T. and Nishiyama, T. (1981). Larval form of zaprorid fish *Zaprora silenus* from the Bering Sea and the northern North Pacific. *Japan. J. Ichthyol.* **28**, 313-318. (In Japanese with English abstract).
- Hubbs, C.L. and Lagler, K.F. (1958). *Fishes of the Great Lakes Region*. vii+213 p. Cranbrook Inst. Sci., Bloomfield.
- Johnson, R.K. (1974). A review of the aleposauroid family Scopelarchidae (Pisces: Myctophiformes). *Fieldiana Zool.* **66**, 1-269.
- Kanayama, T. (1983). Bathylagidae. p. 80-83, 179, 180. In Amaoka, K., Nakaya, K., Araya, H. and Yasui, T. (eds.), *Fishes from the North-western Sea of Japan and the Okhotsk Sea off Hokkaido*. 371 p. Japan Fish. Res. Conserv. Assoc., Tokyo. (In Japanese and English).
- Kawaguchi, K. (1971). Gonostomatid fishes of the western North Pacific. *Japan. J. Ichthyol.* **18**, 1-19.
- Kawaguchi, K. and Shimizu, H. (1978). Taxonomy and distribution of the lanternfishes, genus *Diaphus* (Pisces, Myctophidae) in the western Pacific, eastern Indian Oceans and the southeast Asian Seas. *Bull. Ocean Res. Inst. Univ. Tokyo* (**10**), 1-145.
- Kubota, T. and Uyeno, T. (1972). On the occurrences of the lanternfish *Electrona risso* in Japan. *Japan. J. Ichthyol.* **19**, 125-128.
- Mead, G.W. and Taylor, F.H.C. (1953). A collection of oceanic fishes from off northeastern Japan. *J. Fish. Res. Bd. Can.* **10**, 560-582.
- Miya, M. and Nemoto, T. (1986). Reproduction, growth and vertical distribution of the mesopelagic fish *Cyclothone pseudopallida* (family Gonostomatidae). p. 830-837. In Uyeno, T., Arai, R., Taniuchi, T. and Matsuura, K. (eds.), *Indo-Pacific Fish Biology: proceeding of the second international conference on Indo-Pacific fishes*. xii+985 p. Ichthyol. Soc. Japan, Tokyo.
- Morrow, J.E., Jr. (1964). Family Chauliodontidae. p. 274-289. In Bigelow, H.B., Breder, C.M., Olsen, Y.H., Cohen, D.M., Schroeder, W.C., Mead, G.W., Schultz, L.P., Merriman, D. and Tee-Van, J. (eds.), *Fishes of the Western North Atlantic*. Part 4. xix+599 p. Mem. Sears Found. Mar. Res., New Haven.
- Mukhacheva, V.A. (1974). Cyclothones (gen. *Cyclothone*, fam. Gonostomatidae) of the world ocean and their distribution. *Trudy Inst. Okeanol.* **96**, 189-254. (In Russian).
- Nafpaktitis, B.G., Backus, R.H., Craddock, J.E., Headrich, R.L., Robison, B.H. and Karnella, C. (1977). Family Myctophidae. p. 13-265. In Gibbs, R.H., Jr., Berry, F.H., Eschmeyer, W.N., Böhlke, J.E., Mead, G.W., Cohen, D.M., Merriman, D., Collette, B.B., Pietsch, T.W. and Parr, A.E. (eds.), *Fishes of the Western North Atlantic*. Part 7. xv+299 p. Mem. Sears Found. Mar. Res. Yale Univ., New Haven.
- Nelson, J.S. (1984). *Fishes of the World*. 2nd Ed. xv+523 p. John Wiley & Sons, Inc., New York.
- Nielsen, J.G. and Smith, D.G. (1978). The eel family Nemichthyidae (Pisces, Anguilliformes). *Dana-Rep. Carlsberg Found.* (**88**), 1-71, pls. 1-2.
- Peden, A.E. (1981). Recognition of *Leuroglossus schmidti* and *L. stilbius* (Bathylagidae, Pisces) as distinct species in the North Pacific Ocean. *Can. J. Zool.* **59**, 2396-2398.
- Peden, A.E., Ostermann, W. and Pozar, L.J. (1985). *Fishes Observed at Canadian WeatherShip Ocean Station Papa [50°N, 145°W] with Notes on the Trans-Pacific Cruise of the CSS Endeavor*. vi+50 p. British Columbia Provincial Mus., Victoria.
- Sakamoto, K. (1983). Nemichthyidae. p. 68, 69, 175. In Amaoka, K., Nakaya, K., Araya, H. and Yasui, T. (eds.), *Fishes from the North-western Sea of Japan and the Okhotsk Sea off*

- Hokkaido*. 371 p. Japan Fish. Res. Conserv. Assoc., Tokyo. (In Japanese and English).
- Taylor, F.H.C. (1967). Midwater trawl catches from Queen Charlotte Sound and the open ocean adjacent to the Queen Charlotte Islands. *Fish. Res. Bd. Canada Tech. Rep.* (11), 1-44.
- Uyeno, T. (1984). Bathylagidae. p. 41. In Masuda, H., Amaoka, K., Araga, C., Uyeno T. and Yoshino, T. (eds.), *The Fishes of the Japanese Archipelago*. English text. xxii+437 p. Tokai Univ. Press, Tokyo.
- Willis, J.M., Percy, W.G. and Parin, N.V. (1988). Zoogeography of midwater fishes in the Subarctic Pacific. *Bull. Ocean Res. Inst. Univ. Tokyo* (26), 79-142.
- Wisner, R.L. (1976). *The Taxonomy and Distribution of Lanternfishes (Family Myctophidae) of the Eastern Pacific Ocean*. 299 p. Navy Oceanographic Research Development Activity, Washington, D.C.
- Yamamoto, E. (1983). Melanostomiidae. p. 86, 87, 182. In Amaoka, K., Nakaya, K., Araya H. and Yasui, T. (eds.), *Fishes from the North-western Sea of Japan and the Okhotsk Sea off Hokkaido*. 371 p. Japan Fish. Res. Conserv. Assoc., Tokyo. (In Japanese and English).