TAXONOMY OF THE SUBFAMILY LYCODINAE (FAMILY ZOARCIDAE) IN JAPAN AND ADJACENT WATERS

BY

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Contents

The present work is a portion of a dissertation that was submitted as a partial fulfillment of the requirements for Doctor's degree in Fisheries Science at Hokkaido University in 1983.

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I. Introduction

The family Zoarcidae is comprised of three subfamilies, Zoarcinae (including Hadropareinae and Gymnelinae), Lycodinae, and Bothrocarinae (including Lycogramminae, Melanostigmatinae and Lycodapodinae).

The Lycodinae is the largest subfamily of zoarcids, and known predominantly from the temperate to polar seas of the Hemisphere. The fishes of the subfamily are bottom dwellers usually captured from the continental shelves and slopes.

The taxonomic study of the lycodine fishes from the waters north of Okhotsk Sea has been carried out mainly by the Russian and American ichthyologists (Collett, 1880; Jordan and Evermann, 1898; Jensen, 1904; Knipowitschi, 1906; Taranetz, 1937; Schmidt, 1950; Andriashev, 1954, 1958, 1959). However, their studies were not always satisfactory because they examined small samples with limited geographic representation and because they established many subspecies based on modest differences.

On the other hand, the Japanese species had been studied mainly by American ichthyologists (Jordan and Fowler, 1902; Jordan and Hubbs, 1925, etc.). On the bases of these studies, Okada and Matsubara (1938), without using subfamilies, grouped the 24 known Japanese species, including the Okhotsk species described by the Russian ichthyologists (Schmidt, 1904; Soldatov, 1917; Soldatov and Lindberg, 1930, etc.), in 13 genera. Matsubara (1955), also without adopting subfamilies, presented an analytical key to 48 species of 17 genera hitherto known from the Sea of Japan, Okhotsk Sea and the Pacific coast of Japan. However, his key can not be easily used for identification of Japanese zoarcids because they were mixed with many Russian species that he was unable to study.

These circumstances have resulted in considerable confusion in the taxonomy of the Lycodinae as well as in other subfamilies of Zoarcidae. It is the principal aim of this paper to resolve these problems and clarify the relationships amongst species and genera. This paper discusses all lycodine genera from the Northern Hemisphere and all species known from the Sea of Japan, Okhotsk Sea, western Pacific Ocean and Bering Sea.

II. Materials and methods

The specimens used in the present study are deposited at the Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University (HUMZ), Aquiculture Center of Aomori Prefecture (ACAP), Faculty of Agriculture, Kyoto University (FAKU), Los Angeles County Museum (LACM), National Museum of Natural Sciences, National Museums of Canada (NMC), National Science Museum, Tokyo (NSMT), and Department of Zoology, University Museum of Tokyo (ZUMT).

Measurements were made with calipers to the nearest mm and defined as follows (Fig. 1).

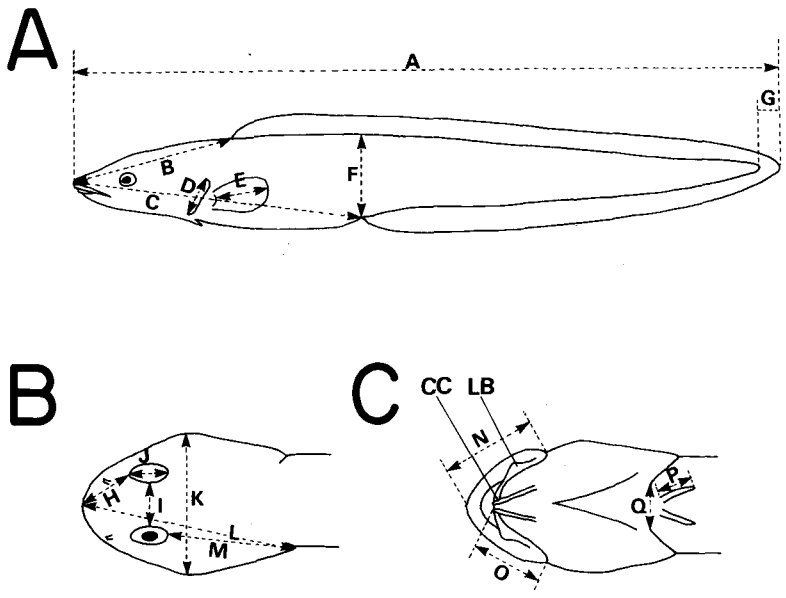

Fig. 1. Schematic eelpout to show how various measurements were made. A, total length; B, predorsal length; C, preanal length; CC, chin crest; D, gill opening length; E, pectoral fin length; F, depth of body; G, caudal fin length; H, snout length; I, interorbital width; J, eye diameter; K, head width; L, head length; LB, labial lobe; M, postorbital head length; N, upper jaw length; O, lower jaw length; P, pelvic fin length; Q, isthmus width.

Total length. From the tip of snout to the tip of caudal fin.
Standard length. From the tip of snout to the base of caudal fin.
Predorsal length. From the tip of snout to the origin of dorsal fin.
Preanal length. From the tip of snout to the origin of anal fin.
Head length. From the tip of snout to the tip of opercle.
Head width. The greatest width at the cheek region.
Postorbital head length. From the posterior margin of eye to the tip of opercle.
Depth of body. The vertical measurement at the origin of anal fin.

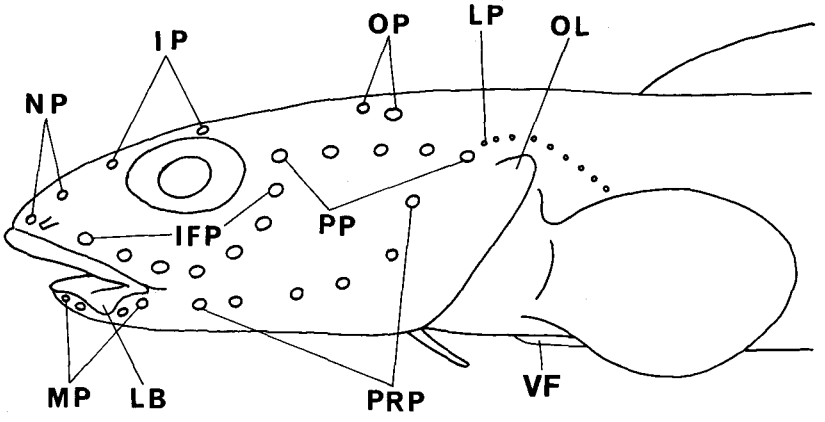

Fig. 2. Schematic representative of eelpout to show the nomenclature of head pores and the other important characters. IFP, infraorbital pores; IP, interorbital pores; LB, labial lobe; LP, lateral line pore; MP, mandibular pores; NP, nasal pores; OL, opercular lobe; OP, occipital pores; PP, postorbital pores; PRP, preopercular pores; VF, ventral fold.

Snout length. From the tip of snout to the anterior end of eye.

Eye diameter. The horizontal length of eye.

Interorbital width. The narrowest distance of the fleshy part between eyes without pressure of the caliper jaws.

Gill opening length. The distance between upper and lower ends of gill opening.

Isthmus width. The distance between lower ends of gill opening on each side.

Upper jaw length. From the tip of upper jaw to its posterior end.

Lower jaw length. From the tip of lower jaw to posterior end of mandible.

Fin ray length. Pectoral, pelvic and caudal fin lengths were represented by the longest ray respectively.

The nomenclature of the lateral line head pores is shown in Fig. 2. The nasal, infraorbital, postorbital, preopercular and the mandibular pores were counted on the left side. The interorbital and occipital pores were represented by the total number.

Fin rays and vertebrae were counted using radiographs and actual specimens. Dorsal and anal fin ray counts did not include half caudal rays. Vertebral counts include the urostyle.

Concerning the species that could not be examined, the diagnostic characters, counts and measurements, and distribution are taken from the literatures.

III. Acknowledgments

I express my sincere thanks to the late Dr. Takao Igarashi, a former Professor of Hokkaido University, for his guidance in the present study and for critically reading the manuscript. My special thanks go to Dr. Kunio Amaoka, Professor of the same University, who gave me valuable advice and critically read the manuscript. My thanks also go to Dr. Keikichi Hamada, Professor of the same Univer-

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IV. Taxonomy of the subfamily Lycodinae

The Lycodinae forms the largest subfamily among the zoarcids and defined as follows.

The dermis of the body is firm and not gelatinous except in *Taranetzella*. Skin is solidly attached to body. The head pores are well developed in several genera. The lateral line is present in most genera. The gill opening is moderately large, its lower end extends downward beyond the lower base of pectoral fin. The dorsal fin consists of soft rays. Pelvic fins are usually present except in *Maynea* and *Pachycara*. Osteologically, the present subfamily is characterized by the fusion of the right and left frontals with one another.

As a result of the present study, 13 genera were recognized in the Northern Hemisphere and 67 species including 12 new species were described from the Sea of Japan, Okhotsk Sea, western Pacific Ocean, and Bering Sea.

The lycodine genera are characterized by the presence or absence of pelvic fins, barbels, head pores, bony plates, and the dentition of prevomer and palatines as shown in the following key. In addition, the following characters are especially useful in distinguishing species as suggested in the remarks under *Lycodes*: the meristic counts, proportional measurements, lateral-line pattern, and coloration.

1. Key to genera of Lycodinae

A1. Pelvic fins consisting of one spine and 2 soft rays.
..... *Petroschmidtia* Taranetz et Andriashev, 1934, p. 137

A2. Pelvic fins absent or consisting of 3 soft rays.

B1. Barbels on ventral surface of head.
  C1. Pelvic fins bifurcated at tips.
    ..... *Hadropogonichthys* Fedorov, 1982, p. 142
  C2. Pelvic fins not bifurcated.
    ..... *Lyconema* Gilbert, 1895, p. 142
B2. Barbels absent.
  D1. Bony plates present along base of dorsal fin.
    ..... *Lycodonus* Goode et Bean, 1883, p. 143
  D2. Bony plates absent.
    E1. Head pores usually large.
      F1. Pelvic fins absent.
        G1. Lateral line midlateral.
          ..... *Maynea* Cunningham, 1871, p. 143
        G2. Lateral line absent.
          ..... *Pachycara* Zugmayer, 1911, p. 144
      F2. Pelvic fins present.
        H1. Pelvic fins situated below eye, extending beyond lower jaw when bent anteriorly.
          ..... *Derepodichthys* Gilbert, 1895, p. 144
        H2. Pelvic fins situated near isthmus, not extending beyond lower jaw when bent anteriorly.
          I1. Skin very loosely attached to body. Scales developed only in caudal region.
            ..... *Taranetzella* Andriashev, 1952, p. 144
          I2. Skin tightly attached to body. Scales covering abdominal and caudal regions.
            J1. Prevomer and palatines toothed.
              ..... *Lycenchelys* Gill, 1884, p. 145
            J2. Prevomer and palatines toothless.
              ..... *Embryx* Jordan et Gilbert, 1898, p. 176
    E2. Head pores usually absent or very small.
      K1. Palatines toothed.
        L1. Prevomer toothed.
          ..... *Lycodes* Reinhardt, 1831, p. 180
        L2. Prevomer toothless.
          ..... *Aprodon* Gilbert, 1891, p. 237
      K2. Palatines toothless.
        ..... *Lycodopsis* Collett, 1879, p. 238

2. Genus *Petroschmidtia* Taranetz et Andriashev, 1934
(Japanese name: agogenge-zoku)

Petroschmidtia Taranetz et Andriashev, 1934: 506, type species by monotypy, *Petroschmidtia albonotata* Taranetz et Andriashev, 1934; Taranetz, 1937: 161; Schmidt, 1950: 107; Matsubara, 1955: 774; Fowler, 1958: 303; Lindberg and Krasyukova, 1975: 165.

Diagnosis. Chin crests well developed and united anteriorly. Pelvic fins with a strong spine and 2 soft rays. Prevomer and palatines toothless.

Description. Body elongate and compressed especially in its posterior half. Eye high in position. Chin crests well developed, thick, high, and united anteriorly. Branchiostegal membranes united to isthmus. Gill opening large, nearly reaching base of pelvic fin. Small pores on head. Feebly developed seismosensory cavities along jaws. Prevomer and palatines toothless. Scales developed. Lateral line midlateral. Pectoral fins not emerginate. Pelvic fins with a strong, irregular-shaped spine and 2 soft rays.

Remarks. This genus is highly characteristic amongst zoarcids in having a strong spine in the pelvic fin. Two species are known from the Sea of Japan and Okhotsk Sea.

3. Key to species of *Petroschmidtia*

A1. Dorsal fin with 3~10 blackish blotches; blotches surrounded by broad white areas in young; such blotches absent in adults.
.....*P. toyamensis* Katayama, 1941, p. 138

A2. Dorsal fin with 4 or more white blotches extending onto body both in young and adults.
.....*P. albonotata* Taranetz et Andriashev, 1934, p. 140

Petroschmidtia toyamensis Katayama, 1941
(Japanese name: agogenge)
Fig. 3.

Petroschmidtia toyamensis Katayama, 1941: 593 (Toyama Bay, Sea of Japan); Katayama, 1943: 380 (Sea of Japan); Katayama, 1949: 73 (Sea of Japan); Hikita and Misu, 1951: 49 (western coast of Hokkaido); Matsubara and Iwai, 1951: 105 (Sea of Japan); Matsubara, 1955: 774, fig. 290 (Sea of Japan); Mori, 1956: 21 (San-in District, Sea of Japan); Fowler, 1958: 303; Honma, 1963: 21 (near Sado Island, Sea of Japan); Honma and Sugihara, 1963: 7 (near Sado Island); Takegawa and Morino, 1970: 383 (Wakasa Bay, Sea of Japan); Ogata, Okiyama and Tanino, 1973: 25 (Sea of Japan); Lindberg and Krasyukova, 1975: 165, fig. 130 (Okhotsk Sea).

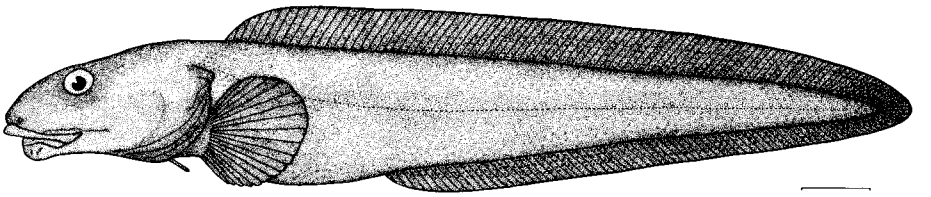

Fig. 3. —*Petroschmidtia toyamensis* from the Sea of Japan. HUMZ 53719 (247.6 mm TL, male). Scale indicates 20 mm.

Material examined. HUMZ 41097 (320.0 mm TL, male), HUMZ 41099 (310.0 mm TL, female), off Kasumi, Hyogo Prefecture, Sea of Japan, December 20, 1963; HUMZ 41114 (220.0 mm TL, female), HUMZ 41115 (294.0 mm TL, male), HUMZ 41116 (172.0 mm TL, male), HUMZ 41261 (354.0 mm TL, female), HUMZ 41262 (317.0 mm TL, male), HUMZ 41264 (370.0 mm TL, male), Wakasa Bay, Sea of Japan, March 27, 1975; HUMZ 41123 (338.0 mm TL, male), HUMZ 41124 (332.0 mm TL, male), 35°41′N, 132°11′E, off Shimane Prefecture, Sea of Japan, 482~650 m, March 27, 1972; HUMZ 41159 (191.0 mm TL, male), HUMZ 41160 (268.0

mm TL, female), HUMZ 41161 (187.0 mm TL, female), HUMZ 41162 (254.0 mm TL, female), HUMZ 41163 (338.0 mm TL, male), HUMZ 41164 (183.0 mm TL, female), HUMZ 41165 (236.0 mm TL, male), HUMZ 41166 (210.0 mm TL, male), HUMZ 41167 (343.0 mm TL, female), HUMZ 41168 (329.0 mm TL, female), HUMZ 41169 (213.0 mm TL, female), HUMZ 41170 (233.0 mm TL, male), HUMZ 41171 (372.0 mm TL, male), HUMZ 41172 (241.0 mm TL, female), HUMZ 41173 (223.0 mm TL, male), HUMZ 41174 (196.0 mm TL, male), HUMZ 41175 (330.0 mm TL, female), HUMZ 41176 (215.0 mm TL, female), HUMZ 41178 (212.0 mm TL, male), HUMZ 41179 (378.0 mm TL, male), HUMZ 41180 (303.0 mm TL, female), HUMZ 41181 (198.0 mm TL, male), HUMZ 41182 (202.0 mm TL, male), HUMZ 41183 (334.0 mm TL, male), HUMZ 41184 (281.0 mm TL, female), HUMZ 41185 (319.0 mm TL, female), HUMZ 41186 (186.0 mm TL, male), HUMZ 41187 (259.0 mm TL, female), HUMZ 41188 (258.0 mm TL, female), HUMZ 41189 (290.0 mm TL, male), HUMZ 41190 (244.0 mm TL, male), HUMZ 41191 (301.0 mm TL, female), HUMZ 41192 (279.0 mm TL, male), Wakasa Bay, March 30, 1975; HUMZ 53179 (249.6 mm TL, male), 38°23.4′N, 137°23.1′E, Sea of Japan, 560 m, June 4, 1976.

Diagnosis. Black blotches, when present, 3~10 in number, surrounded by white areas.

Counts and proportions. Dorsal 90~100, anal 75~84, pectoral 19~20, gill rakers on 1st arch 2~3+12~14=14~17, vertebrae 21~23+76~85=97~108. Head length 5.5~7.1 in total length, depth of body 7.6~13.5, pectoral fin 8.6~12.3, preanal length 2.4~3.3, predorsal length 3.9~5.8. Head width 1.6~2.6 in head length, snout 2.6~5.1, upper jaw 2.2~3.0, eye diameter 4.7~8.9, isthmus width 6.2~9.5, interorbital width 3.6~4.8, gill opening 1.9~2.3. Eye diameter 1.2~2.6 in snout. Pelvic fin 0.8~1.3 in eye.

Description. Body elongate, compressed posteriorly. Head large, moderately wide, and gelatinous; its length about 1/6~1/7 of total length and its width about half of head length. Eye small and high in position, its diameter longer than snout. Interorbital region convex and wide, its width about 4~5 in head. Chin crest well developed, very thick and united anteriorly. Branchiostegal membranes narrowly united to isthmus, isthmus width more than 6 in head. Posterior end of upper jaw below anterior half of eye in smaller specimens, below middle or posterior half of it in the larger. Palatine membrane well developed. Teeth small and conical; those on upper jaw in 2 rows anteriorly, in a single row posterolaterally; those on lower jaw in 2 or 3 rows anterolaterally, in a single row posteriorly. Body covered with small cycloid scales; head completely scaleless; belly and vertical fins scaled. In smaller specimens, scales absent or fewer on back before dorsal fin, but denser in the larger. Vertical fins gelatinous. Dorsal fin originating above anterior half of pectoral fin. Pectoral fin gelatinous and thickened, about half of head. Pelvic fin usually arch-like in shape.

Color in alcohol and fresh specimens brownish or blackish brown. Head and belly darker than side of body. No blotches or bars on body. Black blotches present or absent on dorsal fin; when present 3~10 blotches surrounded by white areas or not. Margin of vertical fins blackish. Pectoral fins also blackish.

Distribution. Sea of Japan, Okhotsk Sea.

Remarks. Matsubara and Iwai (1951) described the color variation of the present species based on many specimens (100.5~357.0 mm in total length). The following characters were added to their description based on the adult specimens (more than 150.0 mm in total length).

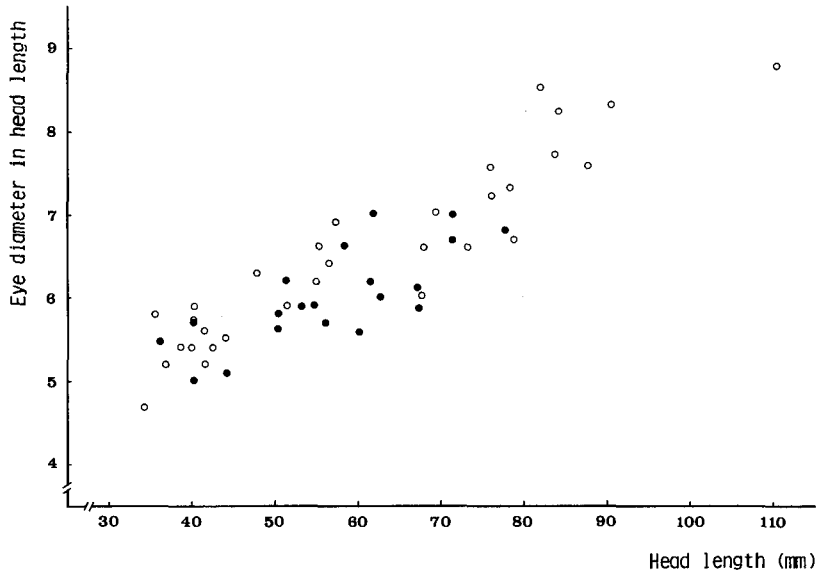

Fig. 4. Relationship between head length and eye diameter in male (open circle) and female (closed circle) of *Petroschmidtia toyamensis*.

In many specimens, less than 350 mm in total length, the blotches on dorsal fin are surrounded by white areas. The blotches gradually diminish in number, and white broad areas disappear with growth. Thus, in larger specimens more than 400 mm in total length, these blotches are completely absent.

Further, with growth, the eyes become smaller proportionally (Fig. 4).

Petroschmidtia albonotata Taranetz et Andriashev, 1934
(Japanese name: hanagenge)
Fig. 5.

Petroschmidtia albonotata Taranetz et Andriashev, 1934: 507, figs. 1, 2 (Okhotsk Sea); Taranetz, 1937: 161; Okada and Matsubara, 1938: 406; Schmidt, 1950: 107; Matsubara, 1955: 774; Fowler, 1958: 303; Lindberg and Krasyukova, 1975: 166, fig. 132 (Okhotsk Sea); Amaoka and Nakaya, 1983: 76 (Okhotsk Sea); Toyoshima, 1983: 295, pl. 149 (Okhotsk Sea).

Material examined. HUMZ 44963 (320.0 mm TL, sex unknown), HUMZ 44964 (303.0

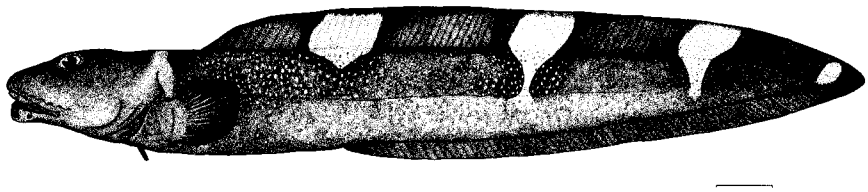

Fig. 5. *Petroschmidtia albonotata* from the southern Okhotsk Sea. HUMZ 44946 (303.0 mm TL, male). Scale indicates 20 mm.

mm TL, male), 44°25′N, 144°17.5′E, Kitami-yamato Bank, southern Okhotsk Sea, 385～400 m, July 3, 1975; HUMZ 55528 (402.4 mm TL, female), 45°56′N, 144°14′E, Kitami-yamato Bank, 250～270 m, July 17, 1976; HUMZ 57703 (361.5 mm TL, male), 57°26′N, 149°16′E, southwestern Okhotsk Sea, 220 m, September 11, 1976; HUMZ 57826 (310.6 mm TL, male), 57°16′N, 145°11′E, southwestern Okhotsk Sea, 208 m, September 16, 1976; HUMZ 75929 (403.0 mm TL, female), HUMZ 75930 (359.6 mm TL, female), 44°57.2′N, 144°24′E, Kitami-yamato Bank, 440～450 m, June 28, 1978; HUMZ 77621 (205.4 mm TL, male), HUMZ 77622 (260.5 mm TL, female), HUMZ 77623 (363.3 mm TL, male), HUMZ 77624 (349.0 mm TL, male), HUMZ 77625 (346.8 mm TL, male), HUMZ 77626 (370.3 mm TL, female), 44°46′N, 144°28′E, Kitami-yamato Bank, 700～790 m, September 21, 1978; HUMZ 77650 (251.3 mm TL, male), 44°48′N, 144°26′E, Kitami-yamato Bank, 680～800 m, September 21, 1978; HUMZ 78684 (382.6 mm TL, male), HUMZ 78685 (382.5 mm TL, male), HUMZ 78686 (448.3 mm TL, male), HUMZ 78687 (353.6 mm TL, female), HUMZ 78688 (353.5 mm TL, sex unknown), 44°49′N, 144°28′E, September 20, 1978; HUMZ 78873 (438.4 mm TL, male), HUMZ 78874 (373.0 mm TL, male), HUMZ 78876 (398.8 mm TL, male), HUMZ 78877 (294.4 mm TL, male), HUMZ 78878 (245.4 mm TL, male), 44°47.5′N, 144°26.5′E, Kitami-yamato Bank, September 20, 1978; HUMZ 81267 (421.8 mm TL, male), 44°58′N, 144°23.3′E, Kitami-yamato Bank, 488～512 m, June 28, 1979.

Diagnosis. Dorsal fin with 4 or more white blotches.

Counts and proportions. Dorsal 89～94, anal 76～80, pectoral 18～19, gill rakers on lst arch 2～3+11～12=13～15, vertebrae 21～24+76～82=97～106. Head length 4.3～5.9 in total length, predorsal length 3.5～4.9, preanal length 2.3～2.8, deph of body 7.7～9.6, pectoral fin 9.1～13.3. Head width 1.8～2.6 in head length, snout 2.5～3.0, upper jaw 2.1～2.8, lower jaw 2.3～3.5, eye diameter 4.8～8.3, interorbital width 3.6～5.7, depth of body 1.5～2.2, pectoral fin 1.7～2.3, pelvic fin 4.3～8.0, gill opening 1.9～2.3, isthmus width 6.1～11.2.

Description. Body elongate and compressed. Head moderately large, somewhat gelatinous and wide, its length about 4～5 in total length. Eye moderately large, about equal to or shorter than pelvic fin. Interorbital region narrow and convex, its width somewhat longer than eye. Chin crests well developed, very thick and united anteriorly. Branchiostegal membranes narrowly united to isthmus, isthmus width more than 6 in head. Mouth moderately large, posterior end of upper jaw below anterior half of eye. Teeth small and conical; those on upper jaw in 2 rows, outer 14～15 and inner 7～8 in number; those on lower jaw in irregular 3 rows anteriorly, in 2 rows laterally, and in a single row posteriorly. Body covered with small scales; belly, vertical fins, base of pectoral fin, and predorsal region also scaled; head scaleless. Scales denser and smaller on belly and vertical fins than those on side of body. Dorsal fin originating above anterior half of pectoral fin. Pectoral fin rounded, about half of head, its lower rays slightly thickened. Pelvic fin about equal to eye.

Color in alcohol and fresh specimens blackish brown. Head, vertical fins, paired fins, and belly darker than side of body. Four or more white blotches on dorsal fin. Blotches sometimes provided with dark spots in their centers. Peritoneum brownish. Branchial cavity blackish.

Distribution. Okhotsk Sea.

Remarks. The white blotches of present species easily separate it from *P. toyamensis*.

4. Genus *Hadropogonichthys* Fedorov, 1982

Hadropogonichthys Fedorov, 1982: 722, type species by original designation, *Hadropogonichthys lindbergi* Fedorov, 1982.

The following characters are taken from Fedorov (1982).

Diagnosis. Body rather elongate. Coriaceous appendages (barbels) on snout, around mouth openings, on lips and branchiostegal membranes. Pelvic fins with ends divided into 2 thickenings. Pyloric caeca absent. Head pores developed. Prevomer and palatines toothed.

Remarks. This genus resembles *Lycenchelys* in having the head pores, elongate body, and toothed prevomer and palatines. It also resembles *Lyconema* in having the barbels on head region. However, it clearly differs from *Lycenchelys* in the presence of coriaceous appendages on head region and in having the pelvic fins with ends divided into two projecting thickenings. Further, such a condition of the pelvic fins also separates *Hadropogonichthys* from *Lyconema*.

Only one species, *H. lindbergi*, is known from the northern Kuril Islands.

Hadropogonichthys lindbergi Fedorov, 1982

Hadropogonichthys lindbergi Fedorov, 1982: 724, figs. 1, 2 (Fourth Kuril Strait).

This species is represented by the holotype (367 mm TL, female) and paratype (290 mm TL, female). The following description is based on Fedorov (1982).

Diagnosis. Lateral line ventral. Scales densely covering body except for head, dorsum before dorsal-fin origin and paired fins. Body and fins brownish-cinnamon brown. Ventral surface of head and belly with a blue metalic hue.

Counts and proportions. Dorsal 132~134 (including half caudal rays), anal 117~119 (including half caudal rays), pectoral 19, vertebrae 23~24+109~110=132~134. Head legth 23.9~24.1% of total length, preanal length 27.8~27.9, predorsal length 16.7~17.7, depth of body at anal-fin origin 5.3~5.4, greatest depth of body 5.7~6.3, pectoral fin 7.0~7.9, pelvic fin 2.0~2.7. Head width 45.2~58.4% of head length, head depth 37.8~39.6, snout 31.4~35.6, eye diameter 17.1~17.2, upper jaw 36.4~40.0, lower jaw 42.3~48.2, gill opening 36.9~41.6, pectoral fin 50.2~56.2, pelvic fin 14.1~18.9.

Distribution. Known from the Fourth Kuril Strait at a depth of about 600 m.

5. Genus *Lyconema* Gilbert, 1895

Lyconema Gilbert, 1895: 471, type species by original designation, *Lyconema barbatum* Gilbert, 1895; Jordan and Evermann, 1898: 2427.

Diagnosis. Numerous barbels on lower surface of head. Body covered with scales. Head pores developed. Teeth on jaws, prevomer and palatines. Pelvic fin consisting of 3 soft rays.

Remarks. This genus differs from the related *Hadropogonichthys* in having the pelvic fins which are not bifurcated. Only one species, *L. barbatum* Gilbert, 1895, is reported from the eastern Pacific Ocean.

6. Genus *Lycodonus* Goode et Bean, 1883
(Japanese name: hosonagagenge-zoku)

Lycodonus Goode and Bean, 1883: 28, type species by monotypy, *Lycodonus mirabilis* Goode et Bean, 1883; Jordan and Evermann, 1898: 2473; Jensen, 1904: 93; Andriashev, 1958: 379

Diagnosis. Body strongly elongate. Nostril-like head pores around mouth. A series of bony plates along base of dorsal fin. Branchiostegal rays 5. Pelvic fin with 3 soft rays.

Remarks. The present genus is related to *Lycenchelys* in having a strongly elongate body and nostril-like head pores. However, it is easily separable from the latter in having small bony plates along the base of the vertical fins. Only one species is known from the Japanese waters. In addition to this, four species are reported from the Arctic and Atlantic Oceans; *L. mirabilis*, *L. ophidium*, *L. vermiformis*, and *L. flagellicauda*. An account of the Japanese species, *L. dorsoscutatus*, is quoted below.

Lycodonus dorsoscutatus Oshima, 1957
(Japanese name: hosonagagenge)

Lycodonus dorsoscutatus Oshima, 1957: 7, fig. 5 (Sea of Japan).

The following description is based on Oshima (1957) who established the present species by a single specimen (346 mm in total length).

Diagnosis. No bony plates along base of anal fin.

Counts and proportions. Dorsal ca. 77, anal ca. 48, pectoral 18. Head length 9.40 in total length, depth of body 13.00. Snout 6.00 in head length, eye diameter 3.26, interorbital width 4.50.

Distribution. Off Kamo, Yamagata Prefecture, Sea of Japan.

Remarks. The present species has been represented by a single specimen. It is easily separable from the other species of *Lycodonus* by the absence of bony plates along the base of anal fin.

Although Oshima (1957) described the present species more or less in detail, his description was not detailed enough and is thought to include some errors (pelvic fin I, 5; branchiostegal rays 4, etc.). Therefore, a more detailed description is needed based on the new materials because the single specimen hitherto known has been lost.

7. Genus *Maynea* Cunningham, 1871

Maynea Cunningham, 1871: 471, type species by original designation, *Maynea patagonica* Cunningham, 1871; McAllister and Rees, 1964: 105.

Diagnosis. Body considerably elongate and scaled. Head pores well developed. Pelvic fins absent. Lateral line present. Jaws about equal. Teeth on jaws, prevomer and palatines. Abdominal vertebrae more than 25.

Remarks. The present genus is clearly separable from the related genera by the absence of pelvic fins. Only one species, *M. californica*, is known from the Monterey Bay of California in the Northern Hemisphere.

8. Genus *Pachycara* Zugmayer, 1911

Pachycara Zugmayer, 1911 : 12, type species by monotypy, *Pachycara obesa* Zugmayer, 1911 ; Markle and Sedberry, 1978 : 22.

The following description is taken from Markle and Sedberry (1978).

Diagnosis. Body elongate, compressed and scaled. Head with large pores. Jaws, prevomer and palatines toothed. Lateral line absent. Gill openings large, extending beyond lower base of pectoral fin. Pelvic fins absent.

Remarks. The present genus is related to *Lycenchelys* and *Lycodes*. However, it differs from them in the absence of pelvic fins. Only one species, *P. obesa* that has been represented by two specimens, is known from the Atlantic Ocean.

9. Genus *Derepodichthys* Gilbert, 1895

Derepodichthys Gilbert, 1895 : 456, type species by original designation, *Derepodichthys alepidotus* Gilbert, 1895 ; Jordan and Evermann, 1898 : 2480 ; Anderson and Hubbs, 1981 : 341.

The following characters are taken from Anderson and Hubbs (1981).

Diagnosis. Pelvic fins situated under eyes, with erectile base, extending anteriorly beyond lower jaw when bent forward, and rays segmented only in their distal half. Fang-like teeth in jaws. Prevomer with a few conical teeth. Palatine teeth recurved medially. Head pores prominent. Gill opening relatively small, its ventral end extending to lower base of pectoral fin. Branchiostegal rays 6.

Remarks. The present genus has been included in Zoarcidae (Gilbert, 1895 ; Boulenger, 1904 ; Greenwood et al., 1966 ; McAllister, 1968 ; Nelson, 1976), Lycodinae (Günther, 1862), and Derepodichthyidae (Jordan and Evermann, 1896, 1898). Recently, Anderson and Hubbs (1981) concluded that *Derepodichthys* should be placed in the family Zoarcidae based on many osteological characters. Their conclusion is accepted and I tentatively include the single eastern North Pacific species, *D. alepidotus* Gilbert, 1895, in the Lycodinae.

10. Genus *Taranetzella* Andriashev, 1952

Taranetzella Andriashev, 1952 : 415, type species by original designation, *Taranetzella lycoderma* Andriashev, 1952 ; Andriashev, 1955 : 381.

The following characters are taken from Andriashev (1952, 1955).

Diagnosis. Body covered with very thin transparent mobile skin. Scale cover reduced and some scales present only in posterior region of body. Lateral line midlateral, weakly developed. Nostril-like pores around mouth. Teeth on jaws, prevomer and palatines strong and sharp ; those on jaws and palatines in a single row ; those on prevomer in a group : a pair of anterior teeth on upper jaw enlarged and canine-like. Gill opening quite reaching lower end of pectoral base. Pelvic fins with 3 rays.

Remarks. The present genus is most allied to *Lycenchelys* in having well developed nostril-like pores around mouth. However, it is distinguished from the genus by the uniserial teeth on jaws, peculiar mobile "liparid-like" skin, and poor development of scale cover. Only one species, *T. lycoderma*, is known from the Bering Sea.

Taranetzella lycoderma Andriashev, 1952

Taranetzella lycoderma Andriashev, 1952: 416, two unnumbered figs. (Olutorsky Bay, western Bering Sea); Andriashev, 1955: 382, figs. 22, 23.

The present species is represented only by the holotype (105 mm in total length). The following description is based on Andriashev (1952, 1955).

Diagnosis. A series of 7 large, nostril-like pores above upper jaw, 8 pores in mandibular series (including mandibular and preopercular pores). A pair of canine-like teeth exposed when mouth closed. Lateral line midlateral and visible only on anterior portion of body. Body pinkish grey in alcohol, thin skin transparent and without pigment.

Counts and proportions. Vertebrae 20+69=89, pectoral 15. Head length 18% of total length, depth of body 7.0, predorsal length 20.5, length from snout to anus 32.1, pectoral fin 11.2. Head depth about 43% of head length, head width about 34, eye diameter 16.4, snout 20.7, interorbital width 7.4, upper jaw 37.1, lower jaw 51.0, gill opening 32.0, pectoral fin 62.0.

Distribution. Known from Olutorsky Bay, the western Bering Sea at a depth of 986 m.

11. Genus *Lycenchelys* Gill, 1884

(Japanese name: hebigenge-zoku)

Lycenchelys Gill, 1884: 180, type species by original designation, *Lycodes muraena* Collett, 1879: Goode and Bean, 1896: 309; Jordan and Evermann, 1898: 2470; Jensen, 1904: 82; Matsubara, 1955: 775; Schmidt, 1950: 106; Andriashev, 1955: 350.

Diagnosis. Body considerably elongate, its depth 4~14% (usually less than 10%)of total length. Head pores always prominent, pores around mouth especially well developed and frequently becoming nostril-like. Jaws, prevomer and palatines toothed. Pelvic fins with 3 rays.

Description. Body very elongate, its depth 4~14% (usually less than 10%) of total length. Head pores prominent; nasal, infraorbital, preopercular, and mandibular pores always present; interorbital and occipital pores sometimes absent. Labial lobes of lower lip well developed. Jaws, prevomer, and palatines toothed. Chin crests well developed. Lateral line usually single and ventral in position, except for some species with a dorsal one or both dorsal and ventral ones.

Remarks. The fishes of the present genus are usually found in depths of 600 ~4000 m, and are characterized by the prominent head pores and considerably elongate body. More than 30 species have been reported from the various regions of the world.

Although a taxonomic study of the Far Eastern *Lycenchelys* was made by Andriashev (1955, 1958), the Japanese species have never been investigated except for Matsubara (1955) who listed one species as Japanese from the Okhotsk Sea based on Scmidt (1950).

Here, nineteen species including five species new to science from Japan and adjacent waters are described.

In most species of *Lycenchelys* head-pore patterns and number of vertebrae (which show the relative elongation of body) have played important roles in

Table 1. Meristic Characters.

Species	Vertebrae		
	Abdominal	Caudal	Total
L. maculatus	27～28	111～120	138～147
L. microporus	29	94	123
L. volki	30	96	126
L. roseus	28	118～119	146～147
L. albeolus	27	106	133
L. uschakovi	28	94	122
L. pliciferus	28～29	96～97	124～128
L. bersteini	30	92	122
L. albomaculatus	22～24	102～106	124～130
L. camchaticus	21～24	97～103	119～127
L. vitiazi	25	89～91	114～116
L. ratmanovi	22～23	88～89	111
L. longirostris	21～22	92～93	113～115
L. hippopotamus	22～23	114～115	136～138
L. melanostomias	22	99	121
L. rassi	22～23	102～105	125～129
L. brevimaxillaris	22～23	95～100	118～122
L. squamosus	19～20	72～73	91～93
L. altus	21	67	88

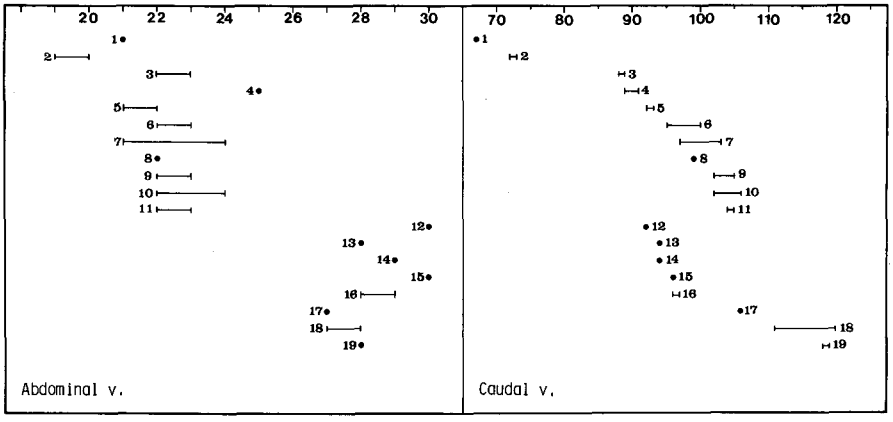

Fig. 6. Number of abdominal and caudal vertebrae in the species of *Lycenchelys*. 1, *L. altus*; 2, *L. squamosus*; 3, *L. ratmanovi*; 4, *L. vitiazi*; 5, *L. longirostris*; 6, *L. brevimaxillaris*; 7, *L. camchaticus*; 8, *L. melanostomias*; 9, *L. rassi*; 10, *L. albomaculatus*; 11, *L. hippopotamus*; 12, *L. bersteini*; 13, *L. uschakovi*; 14, *L. microporus*; 15, *L. volki*; 16, *L. pliciferus*; 17, *L. albeorus*; 18, *L. maculatus*; 19, *L. roseus*.

in the species of *Lycenchelys*.

Dorsal rays	Anal rays	Head pores				
		OP	IP	PP	IFP	PRP
131～138	114～120	3	1	4	9	3
—	—	0	0	2	—	—
—	—	0	1	2	—	—
130～133	114～115	0	1	4	8	4
—	—	0	0	2	—	—
—	—	0	0	2	—	—
—	—	0	0	2	—	—
—	—	0	0	1	—	—
117～120	100～105	0	1	4	8～10	5
113～116	100～103	0	0	2	7～9	4
—	—	4	1	—	—	—
—	—	4	1	5	8	4
108～109	93～95	4	1	5	9	4
129～131	116～118	2	2	3	9	6
117	100	2	1	5	9	5
122	109	1～2	1	3～4	7～9	3
121～122	98～102	2	1	4	7～8	5
86～88	72	0	1	4	5	4
83	68	2	1	5	5	4

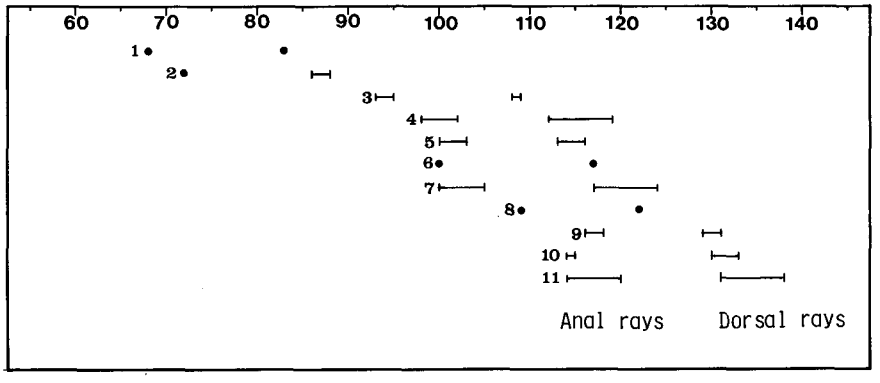

Fig. 7. Number of dorsal and anal rays in the species of *Lycenchelys*. 1, *L. altus*; 2, *L. squamosus*; 3, *L. longirostris*; 4, *L. brevimaxillaris*; 5, *L. camchaticus*; 6, *L. melanostomias*; 7, *L. albomaculatus*; 8, *L. rassi*; 9, *L. hippopotamus*; 10, *L. roseus*; 11, *L. maculatus*.

taxonomy. As a result of the present study, the species of the present genus can be divided into three major groups based on the combination of vertebral and vertical fin-ray counts (Table 1, Figs. 6, 7) although the counts are not always complete because of the lack of data concerning the species described by Russian ichthyologists. Further, the arrangements of head pores, scale cover, coloration, and lateral-line patterns are very useful for distinguishing species.

On the bases of these features, the following key was presented.

12. Key to species of *Lycenchelys*

A1. Abdominal vertebrae more than 27.
  B1. Body with dark blotches.
    ..... *L. maculatus* sp. nov., p. 149
  B2. Body without blotches.
    C1. Palatine teeth in 2 or 3 rows.
      ..... *L. microporus* Andriashev, 1955, p. 152
    C2. Palatine teeth in a single row.
      D1. Interorbital pore present.
        E1. Postorbital pores 2.
          ..... *L. volki* Andriashev, 1955, p. 152
        E2. Postorbital pores 4.
          ..... *L. roseus* sp. nov., p. 152
      D2. Interorbital pores absent.
        F1. Body whitish.
          ..... *L. albeolus* Andriashev, 1958, p. 154
        F2. Body dark.
          G1. Ventral fold on midventral region. Dorsal-fin origin above middle of pectoral fin.
            ..... *L. pliciferus* Andriashev, 1955, p. 155
          G2. Ventral fold absent. Dorsal-fin origin above pectoral tip.
            H1. Postorbital pores 2.
              ..... *L. uschakovi* Andriashev, 1958, p. 155
            H2. Postorbital pore 1.
              ..... *L. bersteini* Andriashev, 1958, p. 155
A2. Abdominal vertebrae less than 25.
  I1. Total vertebrae less than 100.
    J1. Medial basal half of pectoral fin densely scaled. Occipital pores absent. Postorbital pores 4.
      ..... *L. squamosus* Toyoshima, 1983, p. 156
    J2. Pectoral fin scaleless. Occipital pores 2. Postorbital pores 5.
      ..... *L. altus* sp. nov., p. 158
  I2. Total vertebrae more than 100.
    K1. Body with light blotches.
      ..... *L. albomaculatus* Toyoshima, 1983, p. 159
    K2. Body without blotches.
      L1. Ventral fold on midventral region.
        ..... *L. vitiazi* Andriashev, 1955, p. 164

L2. Ventral fold absent.
M1. Head anterior to line connecting upper ends of gill openings densely scaled.
.....*L. camchaticus* (Gilbert et Burke, 1912) p. 164
M2. Head completely scaleless.
N1. Pectoral fin with a greenish spot which is light-colored in alcohol.
.....*L. ratmanovi* Andriashev, 1955, p. 166
N2. Pectoral fin without a greenish spot.
O1. Occipital pores 4.
.....*L. longirostris* sp. nov., p. 166
O2. Occipital pores 1~2.
P1. Interorbital pores 2.
.....*L. hippopotamus* Schmidt, 1950, p. 169
P2. Interorbital pore 1.
Q1. Stomach black.
.....*L. melanostomias* Toyoshima, 1983, p. 170
Q2. Stomach light.
R1. Preopercular pores 3. Head 15.0~16.1% of total length.
.....*L. rassi* Andriashev, 1955, p. 173
R2. Preopercular pores 5. Head 13.0~13.8% of total length.
.....*L. brevimaxillaris* sp. nov., p. 174

Lycenchelys maculatus sp. nov.
(New Japanese name: kurobuchihebigenge)
Figs. 8, 9.

Holotype. HUMZ 71361 (198.0 mm TL, male), off Onahama, Pacific coast of Fukushima Prefecture, 200~300 m, November 10, 1977.

Paratypes. All specimens were captured at the same locality and depth with the holotype. HUMZ 71217 (288.3 mm TL, male), November 18, 1977; HUMZ 71362 (288.7 mm TL, male), HUMZ 71363 (283.0 mm TL, female), HUMZ 71364 (279.4 mm TL, male), November 10, 1977; HUMZ 71391 (282.6 mm TL, female), HUMZ 71392 (285.5 mm TL, male), November 11, 1977; HUMZ 71537 (298.4 mm TL, female), November 13, 1977.

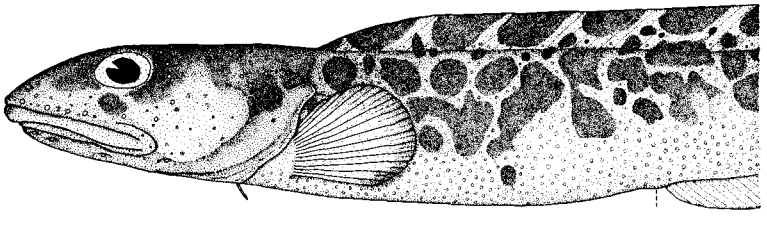

Fig. 8. Holotype of *Lycenchelys maculatus* from off Onahama, the Pacific coast of Fukushima Prefecture. HUMZ 71361 (198.0 mm TL, male). Scale indicates 20 mm.

Diagnosis. Body and dorsal fin with many clear dark blotches. Vertical-fin rays and vertebrae numerous; dorsal 131~138, anal 114~120, abdominal vertebrae

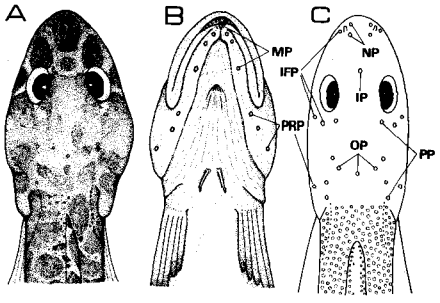

Fig. 9. Illustrations to show the shape of head and distribution of head pores in male (A, B) and female (C) of *Lycenchelys maculatus*. A, B, holotype, HUMZ 71361 (198.0 mm TL, male); C, paratype, HUMZ 71537 (298.4 mm TL, female).

27 or 28, and caudal ones 111～120.

Counts and proportions. Shown in Table 2.

Description of holotype and paratypes. Body moderately elongate (Fig. 31A), its depth about equal to pectoral fin. Caudal region moderately long. Head large and wide (or not conspicuously wide in paratypes), with swollen cheeks. Eye oval, moderately large, and about equal to interorbital width (sometimes longer). Snout somewhat pointed and long, clearly longer than eye. Interorbital region slightly elevated, and moderately wide, nearly equal to (or sometimes longer) than eye. Posterior end of upper jaw below posterior margin of eye (or posterior half of eye). Lower jaw short, about equal to head width. Lips somewhat thickened, gelatinous, and moderately wide. Lower lips with moderate labial lobes. Opercular lobe developed. Branchiostegal membranes broably united to isthmus, isthums width about equal to gill opening. Gill opening large, its lower end extending downward and forward beyond lower base of pectoral fin. Teeth small and conical; those on upper jaw arranged in 2 irregular rows anteriorly; those on lower jaw 10 (8～11) in number, arranged in a single row posteriorly and in 2 rows anteriorly; those on prevomer 2 (2～4) in number; those on palatine 7 (5～8) in number and arranged in a single row. Lateral teeth on lower jaw stout, large, and arranged in a single row. Body, bases of vertical and pectoral fins covered with small cycloid scales; belly scaled to base of pelvic fin; head completely scaleless; medial surface of pectoral fin also scaleless. Lateral line poorly developed, at most traceable to the level of the tip of the pectoral fin. Head pores relatively small but distinct; nasal pores 2, infraorbital pores 9, postorbital pores 4, the single interorbital pore situated on midpoint between anterior margin of eyes, occipital pores 3, preopercular pores 3, mandibular pores 4 and anteriormost one of which united in a single pore (Fig. 9). Vertical fins more or less thickened. Dorsal fin originated above anterior half of pectoral fin. Anal fin originating below 25th (22～24th) dorsal ray. Pectoral fan-shaped, moderate in size, about equal to (or slightly longer than) snout. Pelvic fins extremely short, shorter than pupil.

Color of fresh and alcohol specimens light in ground color. Very clear, irregular-shaped, dark blotches on body, head, dorsal fin, and sometimes on anal fin. Margin of pectoral fin somewhat dark. Ventral side of head and belly light. Oral and branchial cavities greyish. Peritoneum black. Stomach light.

Sexual dimorphism. Males tend to have wider heads (swollen cheeks) than females, 12.5～17.8 in total length as against 17.8～19.0 in the latter (Fig. 9). Males also have longer upper jaws (larger mouth) than females, 2.0～2.3 in head as against 2.6～2.7 in the latter.

Distribution. Known from off Fukushima Prefecture, Pacific coast of northern

Table 2. Comparison of *Lycenchelys maculatus* with its allied species, *L. kolthoffi*.

Characters	*L. maculatus*		*L. kolthoffi*	
	Holotype	Paratypes	Jensen (1904)	Andriashev (1958)
No. of specimens	1	7	2	2
Total length (mm)	198.0	282.6～298.4	128.5～131.5	135.5～177.0
% of TL:				
Preanal length	30.5	28.5～30.7	—	—
Predorsal length	14.2	12.5～14.5	18.6～18.9	18.9～20.6
Head length	13.9	11.5～13.7	14.3～14.8	13.7～16.2
Depth of body	6.3	5.5～6.0	4.9～5.2	5.2～6.1
Pectoral fin	5.9	5.6～6.8	10.3～11.3	—
% of HL:				—
Head width	57.7	43.9～52.6	—	46.0
Head depth	42.5	38.1～42.6	—	36.0～40.0
Eye diameter	18.1	17.3～21.2	—	20.6～24.2
Upper jaw length	50.7	37.3～46.9	—	37.7～49.0
Lower jaw length	43.9	30.9～43.8	—	—
Interorbital width	17.4	16.3～19.1	—	—
Snout length	43.9	30.9～43.8	33.1～34.1	—
Pectoral fin length	42.8	41.5～55.1	72.0～76.3	—
Counts:				
Dorsal rays	137	131～138	ca. 124	—
Anal rays	117	114～120	ca. 110	—
Pectoral rays	14	14～15	14～15	—
Vertebrae	27+110=139	27～28+111～120 =138～147	116～119	—

Japan.

Etymology. The *maculatus* was taken from the dark spots that characterize the present species.

Remarks. The new species, *L. albomaculatus* and *L. kolthoffi* are distinguished from other species of *Lycenchelys* by having blotches on body. The new species is closest to *L. kolthoffi* (known from the Greenland waters) in having dark blotches. However, *L. maculatus* can be easily separated from that species using certain proportional measurements and counts; shorter predorsal length, 12.5～14.5% of total length as against 18.6～20.6% in *L. kolthoffi*; shorter pectoral fin, 5.6～6.8% of total length as against 10.3～11.3%; somewhat shorter head, 11.5～13.9% of total length as against 13.7～16.2%: and numerous dorsal, anal, and vertebral counts, 131～138, 114～120, and 138～147 as against ca. 124, ca. 110, and 116～119 respectively (Table 2).

The present new species does not show the clear sexual dimorphism found in *L.*

albomaculatus. But males tend to have wider heads and longer upper jaws than females (Fig. 9).

Lycenchelys microporus Andriashev, 1955

Lycenchelys microporus Andriashev, 1955: 367, figs. 11, 12 (southwestern Bering Sea).

The present species has been represented by a single specimen (349 mm in total length). The following description is based on Andriashev (1955).

Diagnosis. Abdominal vertebrae 29. Pores around jaws relatively small. Palatine teeth in 2 or 3 rows. Postorbital pores 2, interorbital pore absent. Nostril overhanging down to lower jaw.

Counts and proportions. Pectoral 18, vertebrae 29+94=123. Head length 16.0% of total length, depth of body 7.7, predorsal length 21.8, preanal length 40.4, pectoral fin 9.2. Head width 59.0% of head length, head depth 51.0, eye diameter 13.4, snout 35.8, upper jaw 35.8, lower jaw 45.6, pectoral fin 57.2.

Distribution. Southwestern Bering Sea.

Remarks. *L. microporus* belongs to a group which is characterized by a high number of abdominal vertebrae (28~30) with *L. volki* and *L. pliciferus* etc. (Fig. 6). However, the small pores around mouth and bi- or triserial teeth on palatine separate *L. microporus* from the others.

Lycenchelys volki Andriashev, 1955

Lycenchelys volki Andriashev, 1955: 369, figs. 13, 14 (southwestern Bering Sea).

The present species is represented by a single specimen (208 mm in total length). The following description is based on Andriashev (1955).

Diagnosis. Dorsal fin originating above pectoral tip. Abdominal vertebrae 30. Opercular lobe well developed. Postorbital pores 2, interorbital pore 1 and situated before eye. Lateral line short, not reaching vertical through anal-fin origin. Eye small, about 10 in head.

Counts and proportions. Pectoral 17, vertebrae 30+96=126. Head length 15.4% of total length, depth of body 6.0, predorsal length 18.3, preanal length 35.6, pectoral fin 8.9. Head width about 50% of head length, head depth 40.7, eye diameter 10.0, snout 32.9, upper jaw 46.0, lower jaw 34.4, pectoral fin 57.8, pelvic fin about 20.0.

Distribution. Southwestern Bering Sea.

Remarks. *L. volki* is similar to *L. microporus* and *L. pliciferus* in having numerous abdominal vertebrae. However, the posterior dorsal origin (dorsal fin commencing above eighth interneural spine is highly distinctive in *Lycenchelys*), large opercular lobe, and small eye clearly separate *L. volki* from other species of *Lycenchelys*.

Lycenchelys roseus sp. nov.

(New Japanese name: akahebigenge)

Figs. 10, 11.

Holotype. HUMZ 88487 (236.7 mm TL, female), 52°49.13′N, 171°01.91′W, Bering Sea, 750 m, July 17, 1980.

Paratype. HUMZ 89341 (194.9 mm TL, female), 51°49′N, 178°36.13′W, Bering Sea, 358

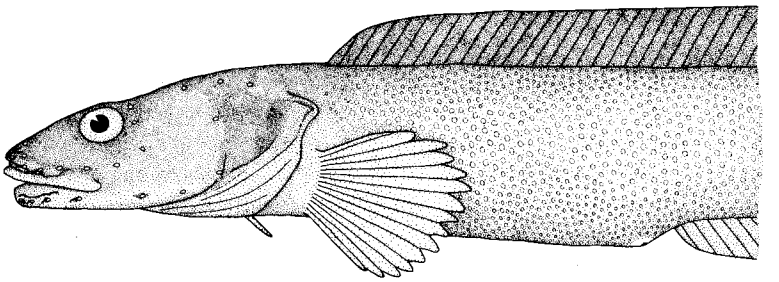

Fig. 10. Holotype of *Lycenchelys roseus* from the Bering Sea. HUMZ 88487 (236.7 mm TL, female). Scale indicates 10 mm.

m, August 9, 1980.

Diagnosis. Color in life dull red without blotches. Abdominal vertebrae 28, total vertebrae 146~147. Occipital pores absent. Interorbital pore 1.

Counts and proportions. Counts and proportions of the holotype are given first, followed by those of a paratype in parentheses. Dorsal 133 (130), anal 114 (115), pectoral 14 (15), gill rakers on 1st arch 1+9=10 (2+10=12), vertebrae 28+118=146 (28+119=147). Head length 13.3 (11.5)% of total length, predorsal length 13.5 (11.8), preanal length 27.8 (27.8), depth of body 6.0 (5.6), pectoral fin 6.6 (7.5). Head width 35.7 (34.5)% of head length, snout 28.6 (30.3), upper jaw 32.3 (34.5), lower jaw 29.4 (32.1), eye diameter 17.2 (18.9), interorbital width 13.5 (16.7), depth of body 45.4 (47.6), pectoral fin 55.5 (58.8), pelvic fin 14.9 (15.4), gill opening 32.3 (32.3), isthmus width 19.2 (23.3).

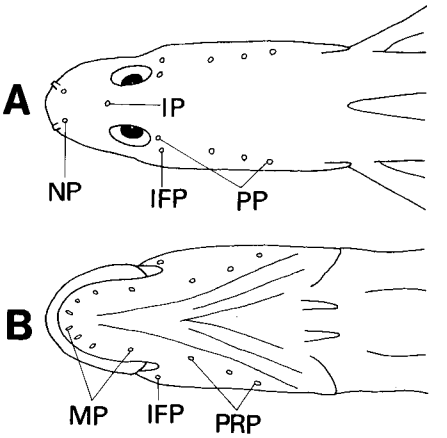

Fig. 11. Illustrations to show the shape of head and distribution of head pores in *Lycenchelys roseus*. Drawn from the holotype.

Description of holotype and paratype. Body considerably elongate, its depth about 17 (18 in paratype) in total length (Fig. 31B). Caudal region very long, more than 3 times of preanal length. Head small and relatively narrow, its length about 8 (9) in total length and its width about 3 in head. Snout rounded, long, and about 1.5 times of eye. Eye elliptical in shape, diameter clearly longer than pelvic fin. Very short nostril tube projecting forward. Interorbital region convex, its width shorter than eye. Mouth moderately large. Posterior end of upper jaw below middle of eye. Lips moderately wide. Lower lip with moderate labial lobe. Lower jaw slightly shorter than the upper. Branchiostegal membranes widely connected to isthmus. Gill opening large, about equal to upper jaw, its lower end extending downward and forward beyond lower base of pectoral fin. Midventral

region not having a ventral fold. Teeth small, conical, and strong; those on upper jaw in 2 rows anteriorly, in a single row laterally and posteriorly; those on prevemer 6 (7) in number and arranged in a group; those on palatine 13 (14) in number and arranged in a single row. Head pores well developed; nasal pores 2, infraorbital pores 8, postorbital pores 4, interorbital pore 1 and situated in midpoint between each anterior margin of eye, occipital pores absent, preopercular pores 4, mandibular pores 4 and anteriormost of which on each side not united in a single pore (Fig. 11). Lateral line apparently absent. Scales well developed on body; belly scaled; base of dorsal fin also scaled on its posterior half, anal fin, base of pectoral fin, medial surface of pectoral fin, and head completely scaleless; dorsum before dorsal-fin origin entirely scaleless. Ventral fold absent. Vertical fins moderately thickened at the base. Dorsal fin originating above base of pectoral fin. Anal fin originating below 22nd dorsal ray. Pectoral fin fan-shaped, relatively large, its margin incised, and the length slightly shorter than half of head. Pelvic fin moderate, longer than pupil.

Color in life dull red without blotches. Color in alcohol brownish. Head and dorsal fin somewhat darker than side of body. Preopercular region blackish. Lower side of head, lips, branchiostegal membranes, pectoral fin, and anal fin yellowish. Oral cavity dark brown. Branchial cavity and peritoneum blackish. Stomach light.

Distribution. Bering Sea.

Etymology. The species name was coined in reference to the dull red coloration of the body.

Remarks. The present species is highly distinctive among the species of *Lycenchelys* in having a reddish body. Such a coloration has never been reported in the species of the genus. Further, it is distinguishable from the others by the combination of numerous abdominal and caudal vertebrae, absence of occipital pores, and the presence of a single interorbital pore (Table 1).

Lycenchelys albeolus Andriashev, 1958

Lycenchelys albeolus Andriashev, 1958: 175, fig. 2 (east of Paramushir Island).

Only the holotype (187 mm in total length) is known. The following description is based on Andriashev (1958).

Diagnosis. Anterior portion of dorsal fin reduced to a rudimentary fold originating above pectoral tip. Interorbital and occipital pores absent. Lateral line dorsal, situated above midlateral of body. Head, body, and fins completely lacking pigment. Oral and branchial cavities also without pigment. Among the Pacific species the present one is quite unique in having a white (pigmentless) body.

Counts and proportions. Vertebrae $27+106=133$, pectoral 17, gill rakers on 1st arch $3+13=16$. Head length 13.8% of total length, depth of body 5.6, preanal length 31.8, pectoral fin 8.0, pelvic fin 2.5. Head width 44.6% of head length, head depth 40.7, eye diameter 13.0, snout 31.0, upper jaw 44.2, lower jaw 39.0, gill opening 26.0, pectoral fin 58.2, pelvic fin 18.2.

Distribution. Known from the northern part of the Kuril-Kamchatkan Trench (east of Paramushir Island) at depths of 3960~4070 m.

Lycenchelys pliciferus Andriashev, 1955

Lycenchelys pliciferus Andriashev, 1955: 372, fig. 15 (southwestern Bering Sea).

The present species has been represented by two specimens (109 and 130 mm in total length). The following description is based on Andriashev (1955).

Diagnosis. Body very elongate, its depth about 5% of total length. Head pores around mouth nostril-like. Interorbital and occipital pores absent. Lateral lines two; the ventral one extending from apex of gill opening obliquely downward and backward, and continuing along anal base almost to end of body; the midlateral one clearly distinguishable in fresh specimens but hardly visible in alcohol. Ventral fold present on midventral position.

Counts and proportions. Vertebrae 28~29+96~97=125, pectoral 15. Head length 15.0~15.3% of total length, depth of body 4.6, predorsal length 16.5~17.4, preanal length 33.8~34.6, pectoral fin 9.6~10.5. Head width 42.6~44.6% of head length, head depth 39.0~39.6, eye diameter 13.3~13.8, snout 32.4~34.8, gill opening 25.2~28.3, upper jaw about 30, pectoral fin 64.0~68.0, pelvic fin 20.5.

Distribution. Known from southwestern Bering Sea at depths of 3820~3830 m.

Lycenchelys uschakovi Andriashev, 1958

Lycenchelys uschakovi Andriashev, 1958: 176, fig. 3 (east of Paramushir Island).

The present species has been represented by the holotype (260 mm in total length). The following description is based on Andriashev (1958).

Diagnosis. Abdominal vertebrae 28. Postorbital pores 2, interorbital and occipital pores absent. Palatine teeth in 2 or 3 in number. Dorsal fin originating posterior to the pectoral tip, predorsal length 31% of total length.

Counts and proportions. Vertebrae 28+94=122, pectoral 17, gill rakers on 1st arch 3+10=13. Head length 16.9% of total length, depth of body 8.3, preanal length 38.1, pectoral fin 9.6, pelvic fin 2.4. Head width 47.7% of head length, head depth 46.6, eye diameter 14.1, upper jaw 43.2, lower jaw 37.4, pectoral fin 56.8, pelvic fin 14.3.

Distribution. Known from Kuril-Kamchatkan Trench (east of Paramushir Island) at depths of 3960~4070 m.

Lycenchelys bersteini Andriashev, 1958

Lycenchelys bersteini Andriashev, 1958: 178, fig. 4 (east of Paramushir Island).

The present species is known from two specimens (142 and 191 mm in total length). The following description is based on Andriashev (1958).

Diagnosis. Postorbital pore 1, interorbital and occipital pores absent. Dorsal fin originating above pectoral tip.

Counts and proportions. Vertebrae 30+92=122, pectoral 16, gill rakers on 1st arch 2+11=13. Head length 15.5~16.2% of total length, depth of body 4.7~5.5, preanal length 35.9~37.5, pectoral fin 8.4~8.5, pelvic fin 3.1~3.4. Head width 37.3~37.8% of head length, head depth 42.4~42.6, eye diameter 13.6~14.4, snout 30.5~34.3, upper jaw 44.8~47.5, lower jaw 30.4~33.0, gill opening 29.0, pectoral fin 54.3~54.4, pelvic fin 20.3~20.9.

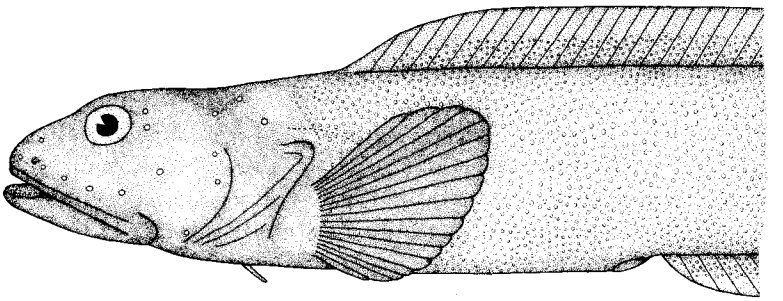

Fig. 12. *Lycenchelys squamosus* from off Miyagi Prefecture. HUMZ 78494 (260.0 mm TL, male). Scale indicates 10 mm.

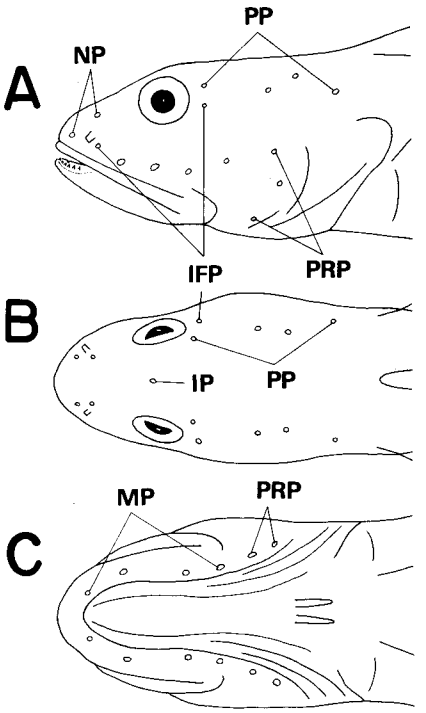

Fig. 13. Illustrations to show the shape of head and distribution of head pores in *Lycenchelys squamosus*. HUMZ 78494 (260.0 mm TL, male).

Distribution. Known from the Kuril-Kamchatkan Trench (east of Paramushir Island) at depths of 3960～4070 m.

Lycenchelys squamosus Toyoshima, 1983
(Japanese name: urokohebigenge)
Figs. 12, 13.

Lycenchelys squamosus Toyoshima, 1983: 145, figs. 20～22, pl. 93 (Pacific coast of northern Japan).

Material examined. HUMZ 72563 (201.8 mm TL, female), 37°09.4′N, 141°56′E, off Fukushima Prefecture, 900～920 m, January 19, 1978; HUMZ 78390 (233.2 mm TL, female), 40°41′N, 142°19.2′E, Pacific coast of Aomori Prefecture, 920 m, September 11, 1978; HUMZ 78464 (260.0 mm TL, male), 37°55.4′N, 142°24.5′E, off Miyagi Prefecture, 1005 m, October 8, 1970.

Diagnosis. Body rather deep, 10.0～10.7% of total length. Gill opening rather small, its lower end never extending downward and forward beyond lower base of pectoral fin. Lower jaw slightly protruding beyond the upper or nearly equal. Basal half of medial side of pectoral fin densely scaled. Dorsal 86～88, anal 72, vertebrae 91～93. Occipital pores absent.

Counts and proportions. Dorsal 86～88, anal 72, pectoral 18, vertebrae 19～20+72～73=91～93, gill rakers on 1st arch 1～3+10～14=11～17. Head length 16.6～17.8% of total length, predorsal length 17.3～17.7, preanal length 33.3～36.2, depth of body 10.0～10.7, pectoral fin 10.0

~10.7. Head width 38.9~45.8% of head length, snout 24.9~30.3, upper jaw 43.7 ~52.0, lower jaw 39.5~52.0, eye diameter 17.3~20.0, interorbital width 15.2~18.1, depth of body 59.2~64.6, pectoral fin 59.0~64.9, pelvic fin 10.1~11.7, gill opening 34.9~38.0.

Description. Body not gelationus, rather deep, its depth about equal to pectoral fin (Fig. 31C). Caudal region relatively short, less than twice of preanal length. Head rather large, relatively wide, its length about half of preanal length, and its width less than its depth. Postorbital region of head moderately long, about 1/10 of total length. Occipital region somewhat abruptly elevated toward dorsal origin. Cheek swollen outward or not so swollen. Snout moderately round in upper and lateral profiles, its length about twice eye. Nostril tube very short, clearly shorter than pupil diameter. Eye slightly oblong, rather high in position, its diameter nearly equal to interorbital width. Interorbital region more or less convex, its width slightly longer than pelvic fin. Mouth large. Maxillary extending slightly beyond posterior margin of eye. Lower jaw about equal to or slightly protruding beyond the upper. Upper lip narrow and not gelatinous. Lower lip wide, somewhat gelatinous with moderately developed labial lobe. Branchiostegal membranes widely connected to isthmus, isthmus width about equal to width of pectoral base. Gill opening rather small for a *Lycenchelys*, its lower end a little above of lower end of pectoral base, and never extending downward and forward beyond the lower base (Fig. 12). Ventral fold absent. Teeth on jaws sharp, relatively strong, and conical; those on upper jaw in 2 or 3 rows anteriorly, outer teeth larger and 4~10 in number, in a single row laterally and posteriorly; those on lower jaw in a band consisting of irregular 4~6 rows anteriorly, in a single row laterally and posteriorly, innermost teeth of anterior part and succeeding lateral and posterior teeth large and strong; those on prevomer 7~13 in number and in a group; those on palatine 7~15 in number and arranged in a single row. Head pores well developed, not provided with nostril-like tubes; nasal pores 2, infraorbital pores 6, postorbital pores 4, interorbital pore 1, occipital pores absent, preopercular pores 4, and mandibular pores 4 (Fig. 13). Lateral line poorly developed, very short, and indistinct; starting from above upper end of gill opening, and running obliquely downward to middle of pectoral fin. Small cycloid scales densely covering body; belly densely covered with very minute scales to base of pelvic fin; vertical fins also scaled almost to their margins; base of pectoral fin scaled, basal half of pectoral fin with scattered or dense scales, and medial basal half of the fin also densely scaled; scales on dorsum not extending anteriorly beyond a line connecting upper ends of gill openings; head completely scaleless. Vertical fins not gelatinous. Dorsal fin originating above base of pectoral fin. Anal fin originating below 18~19th dorsal ray. Pectoral fin rather large, longer than postorbital head length, fan-shaped, and each ray shallowly incised. Pelvic fin rather short, clearly shorter than eye.

Color in alcohol and fresh specimens dark brown. Head and margins of vertical fins blackish brown. Ventral side of head including lower lip, branchiostegal membranes, opercular region, belly, pelvic and pectoral fins purplish black. Nostril tube dark brownish. Light spots caused by dropping out of scales not distinct on side of body. Oral and branchial cavities, and peritoneum blackish.

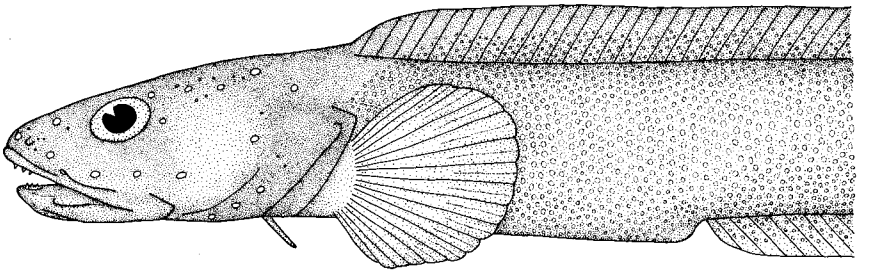

Fig. 14. Holotype of *Lycenchelys altus* from off Buldir Island of the Aleutian Islands. HUMZ 88704 (126.6 mm TL, male). Scale indicates 10 mm.

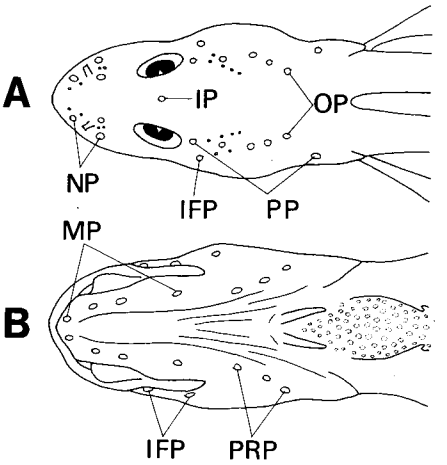

Fig. 15. Illustrations to show the shape of head and distribution of head pores in *Lycenchelys altus*. Drawn from the holotype.

Stomach light.

Distribution. Pacific coast of Tohoku District, northern Japan.

Remarks. The present species is characterized by the rather short and deep body, fewer vertebrae, dorsal and anal rays, scaled pectoral fin, small gill openings, and longer lower jaw.

Lycenchelys altus sp. nov.
(New Japanese name: futohebigenge)
Figs. 14, 15.

Holotype. HUMZ 88704 (126.6 mm TL, male), 52°03.69′N, 175°39′E, south of Buldir Island of Aleutian Islands, 336 m, August 14, 1980.

Diagnosis. Body relatively deep. Head length 20.4% of total length. Fin-ray counts and vertebrae few; dorsal 83, anal 68, vertebrae 88. Occipital pores 2, infraorbital pores 5.

Counts and proportions. Dorsal 83, anal 68, pectoral 18, gill rakers on 1st arch 1+7=8, vertebrae 21+67=88. Head length 20.4% of total length, predorsal length 20.7, preanal length 39.8, depth of body 9.2, pectoral fin 9.2. Head width 45.3% of head length, snout 27.9, upper jaw 49.0, lower jaw 45.7, eye diameter 18.6, interorbital width 15.9, depth of body 45.2, pectoral fin 45.0, pelvic fin 17.4, gill opening 29.7, isthmus width 26.6.

Description of holotype. Body relatively deep, and not so elongate for a *Lycenchelys*, its depth 10.9 in total length (Fig. 31D). Caudal region short, clearly shorter than twice the preanal length. Head relatively large and moderately wide, its length 4.9 in total length and its width 2.2 in head. Snout somewhat rounded, moderately long and its length greater than eye diameter. Eye elliptical in shape and clearly longer than interorbital width. Interorbital region convex, its width a

little shorter than pelvic fin. Mouth moderately large. Posterior end of upper jaw extending beyond posterior margin of eye. Lower jaw a little shorter than the upper. Upper lip narrow and not gelatinous. Lower lip relatively wide with well developed labial lobe. Branchiostegal membranes broadly united to isthmus. Gill opening moderately large, its lower end extending downward and forward beyond lower end of pectoral base. Ventral fold absent. Teeth small, conical, and sharply pointed; those on upper jaw in 2 rows anteriorly with outer ones larger, in a single short row posteriorly; those on lower jaw in a wide band anteriorly with inner ones very weak, in a single row laterally and posteriorly with each tooth well isolated from one another; those on prevomer 4 in number and in a group; those on palatine 7 in number and in a single row. Head pores well developed; nasal pores 2, infraorbital pores 5, postorbital pores 5, interorbital pore 1, occipital pores 2, preopercular pores 4, and mandibular pores 4. Lateral line poorly developed and represented by a several pits above pectoral fin. Scales well developed; belly and basal 2/3 of vertical fins scaled; head and pectoral base scaleless; medial basal half of pectoral fin also scaleless. Dorsal fin originating above opercular tip. Anal fin originating below 20th dorsal ray. Pectoral fin rounded, moderately long, and its length 2.2 in head. Pelvic fin moderately long, its length 5.7 in head.

Color in alcohol dark brown. Head darker than side of body especially in its opercular and branchiostegal regions. Dorsal fin also darker than side of body. Anal fin light, especially in its anterior half. Pectoral fin light with its base. Oral and branchial cavities blackish. Peritoneum brownish. Stomach light.

Distribution. South of Aleutian Islands.

Etymology. The specific name for the present species was taken from the deep body which is one of the diagnostic characters.

Remarks. The new species is most closely allied to *L. squamosus* in having a relatively deep and short body. However, it is easily separable from the latter by the scaleless pectoral fin, lower number of vertical-fin rays and vertebrae, and by the presence of two occipital pores and five infraorbital pores (Table 1, Figs. 6, 7, 31D).

Lycenchelys albomaculatus Toyoshima, 1983
(Japanese name: shirobuchihebigenge)
Figs. 16, 17.

Lycenchelys albomaculatus Toyoshima, 1983: 141, 269, figs. 16, 17, pls. 92, 156 (Pacific coast of northern Japan, Okhotsk Sea).

Material examined. HUMZ 59531 (443.2 mm TL, male), HUMZ 59532 (430.0 mm TL, female), HUMZ 59533 (354.2 mm TL, male), off Kamaishi, Pacific coast of Iwate Prefecture, October 14, 1976; HUMZ 69206 (441.0 mm TL, male), 42°25.0′N, 150°27.0′E, off Itrup Island, 530~645 m, December 3, 1968; HUMZ 70912 (458.0 mm TL, female), 44°12.0′N, 144°54.0′E, Okhotsk Sea, 750 m, October 23, 1977; HUMZ 71128 (430.0 mm TL, male) HUMZ 71129 (348.8 mm TL, female), 45°09.0′N, 144°31.0′E, Okhotsk Sea, 1000 m, October 29, 1977; HUMZ 72538 (366.0 mm TL, female), HUMZ 72539 (367.0 mm TL, female), 38°00′N, 142°10.5′E, off Fukushima Prefecture 800~810 m, February 6, 1978; HUMZ 72592 (426.4 mm TL, male), 38°41.5′N, 142°20.05′E, off Miyagi Prefecture, 850~890 m, January 20, 1978; HUMZ 72645 (405.7 mm TL, male), HUMZ 72646 (404.0 mm TL, male), 37°26.5′N, 142°09.5′E, off Fukushima Prefecture, 900 m, January 20, 1978; HUMZ 72656 (407.6 mm TL, male), HUMZ 72657 (338.0 mm TL, female.), 38°02.0′N, 142°29.0′E, off Miyagi Prefecture, 1100~1150 m, February

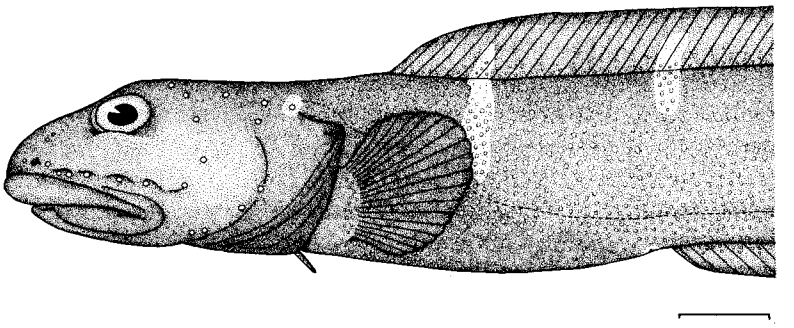

Fig. 16. *Lycenchelys albomaculatus* from off Kamaishi, the Pacific coast of Iwate Prefecture. HUMZ 59531 (443.2 mm TL, male). Scale indicates 20 mm.

7, 1978; HUMZ 72708 (335.0 mm TL, female), 36°58.8′N, 141°47.5′E, off Fukushima Prefecture, 800 m, January 19, 1978; HUMZ 72723 (401.2 mm TL, male), 37°11.0′N, 141°57.0′E, off Fukushima Prefecture, 810~820 m, January 20, 1978; HUMZ 72724 (373.0 mm TL, female), HUMZ 72737 (370.2 mm TL, female), 38°04.0′N, 142°12.2′E, off Miyagi Prefecture, 815~820 m, January 30, 1978; HUMZ 72847 (438.6 mm TL, male), HUMZ 72848 (397.0 mm TL, female), 42°10.5′N, 143°54.1′E, Pacific coast of Hokkaido, 840 m, April 3, 1978; HUMZ 72852 (452.3 mm TL, male), 42°33.2′N, 144°15.0′E, Pacific coast of Hokkaido, 840~850 m, April 4, 1978; HUMZ 72888 (426.0 mm TL, female), 42°04.4′N, 144°01.0′E, Pacific coast of Hokkaido, 1000 m, April 3, 1978; HUMZ 72890 (415.3 mm TL, female), HUMZ 72891 (394.5 mm TL, female), 42°06.6′N, 143°49.3′E, Pacific coast of Hokkaido, 800~810 m, April 2, 1978; HUMZ 78063 (429.6 mm TL, male), 42°21.6′N, 142°25.6′E, off Iwate Prefecture, 915~945 m, September 5, 1978; HUMZ 78074 (420.5 mm TL, male), 39°22.7′N, 142°36.5′E, off Iwate Prefecture, September 21, 1978; HUMZ 78082 (387.0 mm TL, female), HUMZ 78083 (381.8 mm TL, female), 39°42.6′N, 142°47.5′E, off Iwate Prefecture, 1120~1130 m, September 23, 1978; HUMZ 78087 (470.0 mm TL, female), 40°04.5′N, 142°43.5′E, off Iwate Prefecture, 1095~1100 m, September 25, 1978; HUMZ 78142 (383.8 mm TL, female), 39°04.5′N, 144°22.7′E, off Iwate Prefecture, 980~1000 m, September 19, 1978; HUMZ 78200 (451.0 mm TL, male), 39°40.0′N, 142°48.4′E, Pacific coast of Aomori Prefecture, 1180~1230 m, September 23, 1978; HUMZ 78262 (453.4 mm TL, male), 40°48.9′N, 142°26.2′E, Pacific coast of Aomori Prefecture, 1120~1165 m, September 11, 1978; HUMZ 78262 (491.8 mm TL, male), HUMZ 78269 (422.0 mm TL, female), 40°47.6′N, 142°16.7′E, Pacific coast of Aomori Prefecture, 920~948 m, September 11, 1978; HUMZ 78322 (448.0 mm TL, male), HUMZ 78323 (451.3 mm TL, male), 41°02.4′N, 142°11.9′E, Pacific coast of Aomori Prefecture, 1200~1205 m, September 8, 1978; HUMZ 78366 (413.0 mm TL, male), 41°15.4′N, 142°13.7′E, Pacific coast of Aomori Prefecture, 1190~1198 m, September 7, 1978; HUMZ 78842 (370.0 mm TL, female), 45°13.6′N, 144°41′E, Okhotsk Sea, 900~950 m, September 4, 1978; HUMZ 78843 (379.3 mm TL, female), HUMZ 78844 (411.0 mm TL, female), HUMZ 78845 (393.0 mm TL, female), 45°13.0′N, 144°41.6′E, Okhotsk Sea, 975~1030 m, September 4, 1978.

Diagnosis. Body dark brown with 6~10 white blotches on dorsal fin and dorsal half of body. Lateral line ventral. Abdominal vertebrae 22~24 and caudal ones 102~106.

Counts and proportions. Dorsal 117~120, anal 100~105, pectoral 18, vertebrae 22~24+101~106=123~130. Preanal length 30.9~38.8% of total length, head length 16.2~20.8 in males and 13.6~17.4 in females, head depth 6.9~9.0, head width 8.0~13.1 in males and 6.9~9.5 in females, pectoral fin 6.2~7.5, depth of body 5.5~8.5, upper jaw 8.3~13.1 in males and 5.9~8.4 in females. Head depth 44.2

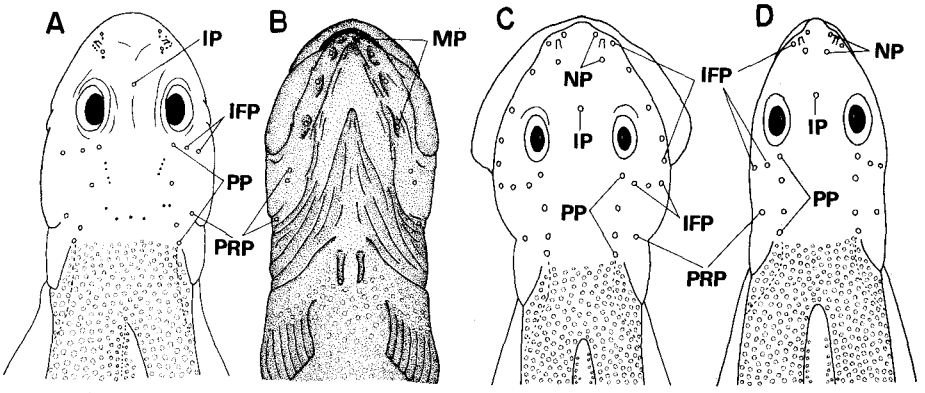

Fig. 17. Illustrations to show the shape of head and the distribution of head pores in male (A, C) and female (D) of *Lycenchelys albomaculatus*. A, B, holotype, HUMZ 59531 (443.2 mm TL, male); C, matured male, paratype, HUMZ 78262 (453.4 mm TL); D, matured female, paratype, HUMZ 78083 (381.8 mm TL).

~50.9% of head length, snout 23.9~39.4, lower jaw 32.2~47.4, eye diameter 14.9~21.2, interorbital width 18.4~25.1, pectoral fin 14.9~21.2, pelvic fin 34.5~51.0, gill opening 38.5~46.7.

Description. Body moderately elongate and relatively high for a *Lycenchelys*, its depth 11.1~14.7 in total length (Fig. 31E). Caudal region moderately long, more than twice the preanal length. Head rather large and considerably gelatinous, its length about 2 in preanal length. Eye rather high, oval in shape, moderately large, and its horizontal diameter much shorter than snout. Nostril tube very short, much shorter than pupil. Snout gelatinous, blunt and rounded, its length 2.5~3.3 in head. Interorbital region greatly elevated, flat, or convex, its width clearly longer than eye or nearly equal to it. Mouth large. Maxillary extending to below posterior half of eye or beyond it. Lower jaw completely included. Upper lip thickened, highly gelatinous, and very wide. Lower lip also highly gelatinous with laterally projecting prominent labial lobe. Branchiostegal membranes widely connected to isthmus. Gill opening large, its lower end extending downward and forward beyond lower end of pectoral base. Teeth small, weak, conical, and relatively numerous; those on upper jaw 15~17 in number and arranged in a single row; those on lower jaw in a wide band anteriorly and in a single row of about 12 teeth laterally; prevomer with a group of 4 or 5 teeth; palatine with a single row of 7 or 8 teeth. Anterior teeth of lower jaw much smaller than those of other parts. Small cycloid scales well developed on body; bases of pectoral and vertical fins densely scaled; medial side of pectoral fin scaleless; scales on dorsum not extending forward beyond a line connecting each upper end of gill openings. Ventral lateral line distinct and running nearly to end of body. Head pores relatively small but very clear; nasal pores 2, infraorbital pores 8~10, postorbital pores 4, interorbital pore 1, occipital pores absent, preopercular pores 5, and mandibular pores 4 (Fig. 17). Vertical fins thickened and gelatinous, especially in their basal parts. Dorsal fin originating above middle of pectoral fin. Anal fin originating below 2nd white blotch. Pectoral fin fan-shaped, gelatinous, moderately long, and its margin reach-

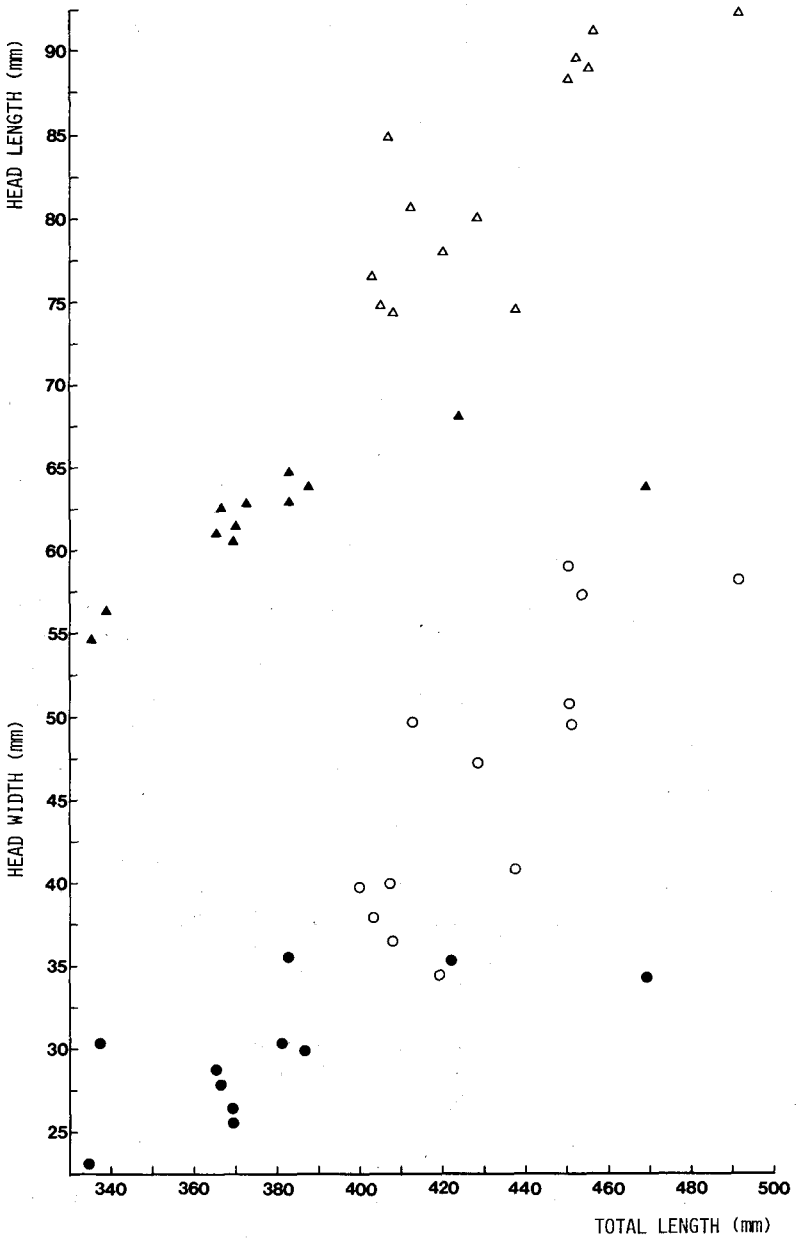

Fig. 18. Relationships between total and head lengths (triangles) and between total length and head width (circles) in *Lycenchelys albomaculatus*. Males were shown by open triangles and circles. Females were shown by closed triangles and circles.

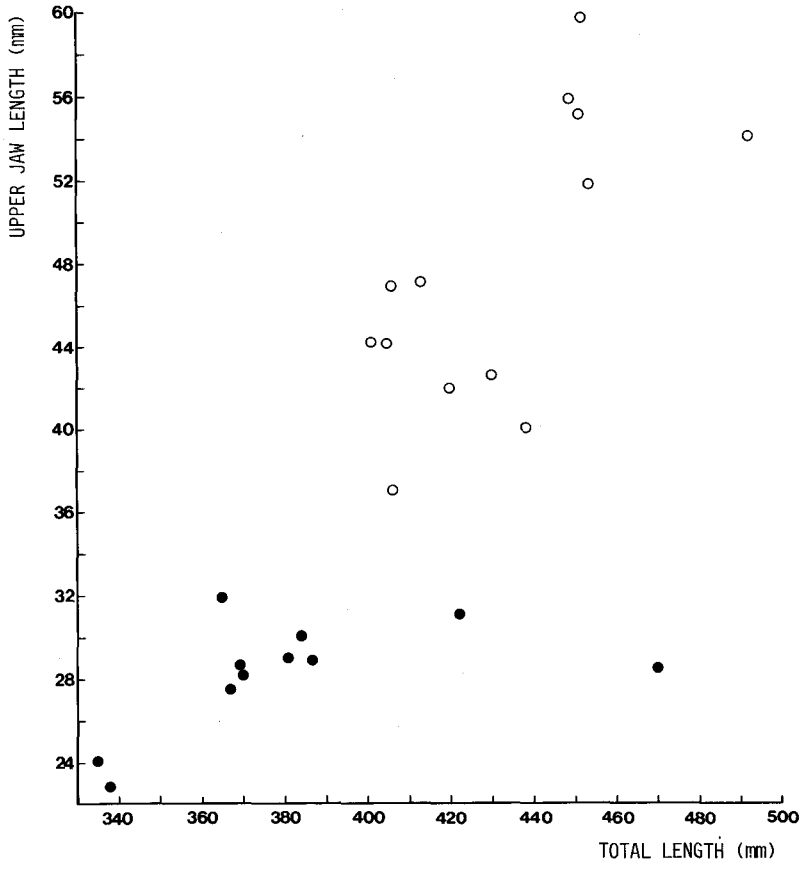

Fig. 19. Relationship between upper jaw and total lengths in males (open circles) and females (closed circles) of *Lycenchelys albomaculatus*.

ing 1st white blotch. Pelvic fin very small, its length 2~3 in eye.

Color of fresh specimens dark brown. Paired fins, margins of vertical fins, branchiostegal membranes, opercular margin, nostril tube, and ventral side of head including lips black. White blotches, 6~10 in number, on dorsal fin and extending onto dorsal part of body. Oral and branchial cavities, and peritoneum black. Stomach light.

Sexual dimorphism. *L. albomaculatus* shows the clear sexual dimorphism, especially in the head region. Male has the longer and wider head (Fig. 18), more gelatinous head and lips, and longer upper jaw than those of female (Fig. 19).

Distribution. Pacific coast of northern Japan (from off Fukushima Prefecture to off Kushiro), waters along Kuril Islands, and Okhotsk Sea.

Remarks. The present species is easily recognizable in having white blotches. Further, it is characteristic in showing the clear sexual dimorphism.

Lycenchelys vitiazi Andriashev, 1955

Lycenchelys vitiazi Andriashev, 1955: 371 (east of Paramushir Island).

The present species has been represented by the holotype (87 mm in total length). The following description is made based on Andriashev (1955).

Diagnosis. Body strongly elongate, its depth at origin of anal fin 4.8% of total length. Lateral line represented by a short series of neuromasts which extend ventrolaterally no further than to above the pectoral fin. A narrow cylindrical scaleless ventral fold commencing as a light-colored streak between pectoral bases and extending posteriorly for a distance about half of head. Two pairs of occipital pores present. Abdominal vertebrae 25.

Counts and proportions. Abdominal vertebrae 25, caudal vertebrae about 89 ~91. Head length 15.0% of total length, depth of body at origin of anal fin 4.8, predorsal length 19.5, preanal length 33.4, pectoral fin 10.3. Head width 44.5% of head length, head depth 42.5, eye diameter 28.5, snout 25.4, gill opening 28.5, pectoral fin 69.0.

Distribution. Known from the Kuril-Kamchatkan Trench near Paramushir Island at a depth of 2450 m.

Remarks. *L. vitiazi* resembles *L. pliciferus* in having ventral fold (rudimentary keel) in the midventral position, but differs from the latter in the lower number of abdominal vertebrae (25 as against 28~29) and presence of two pairs of occipital pores (absent in the latter).

Lycenchelys camchaticus (Gilbert et Burke, 1912)
Figs. 20, 21.

Lycodes camchaticus Gilbert and Burke, 1912: 89, fig. 34 (Avachinsk Bay).

Lycenchelys camchaticus: Andriashev, 1935b: 107 (in part, Avachinsk Bay, western coast of Bering Island); Andriashev, 1958: 172 (Kronotskii Bay); Peden, 1974: 117, fig. 1 (off the coast of Washington); Fedorov, 1976: 10 (off southeastern Kamchatka, Bering Sea).

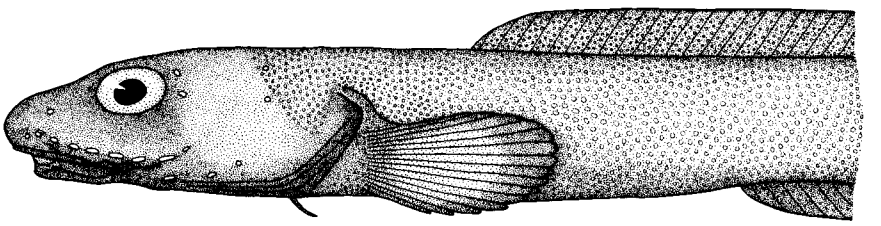

Fig. 20. *Lycenchelys camchaticus* from the Bering Sea. HUMZ 83223 (152.7 mm TL, female). Scale indicates 10 mm.

Material examined. HUMZ 81814 (144.4 mm TL, male), 54°20.5′N, 167°12.5′W, Bering Sea, 800 m, June 14, 1979: HUMZ 81839 (186.9 mm TL, female), 54°29′N, 167°22′W, Bering Sea, 800 m, June 14, 1979; HUMZ 81943 (176.3 mm TL, female), 58°33.3′N, 176°22.3′W, Bering Sea, 800~900 m, June 24, 1979; HUMZ 83222 (209.0 mm TL, male), HUMZ 83223 (152.7 mm TL, female), 54°49.40′N, 178°47.10′W, Bering Sea, 900~930 m, June 27, 1979.

Diagnosis. Dorsal surface of head and pectoral fin covered with scales. Center of pectoral fin light in alcohol, greenish in alive. Postorbital pores 2, interorbital and occipital pores absent.

Counts and proportions. Shown in Table 3.

Description. Body rather elongate, its depth 16.5~21.8 in total length (Fig. 31F). Head small and moderately wide, its length 6.2~7.3 in total length and its width 2.0~2.9 in head length. Eye small, its diameter 5.0~6.0 in head length. Snout moderately long, blunt in upper profile, and its length 2.6~3.1 in head length. Interorbital region moderately wide, convex, and its width 4.2~5.3 in head length. Mouth moderately large, posterior end of upper jaw below middle of eye. Labial lobe well developed. Teeth small and conical; those on upper jaw in a single row of 12~13 teeth; those on lower jaw in 2 rows anteriorly and in a single row laterally and posteriorly; those on prevomer 3~4 in number; those on palatine 7~10 in number and arranged in a single row. Small cycloid scales densely covering entire body; opercular region, dorsum before dorsal fin to occipital region, anterior to pelvic fins, vertical fins, and belly densely scaled; base of pectoral fin sparsely scaled; basal half of pectoral fin in its medial side also scaled. Head pores well developed; nasal pores 2, infraorbital pores 8~9, postorbital pores 2, interorbital and occipital pores absent, opercular pores 4, and mandibular pores 4. Lateral line ventral and developed only on anterior half of body. Dorsal fin originating above middle of pectoral fin. Anal fin originating below 15~18th dorsal ray. Pectoral fin moderately long, its length a little shorter than postorbital head length. Pelvic fin moderately long, its length a little shorter than eye diameter.

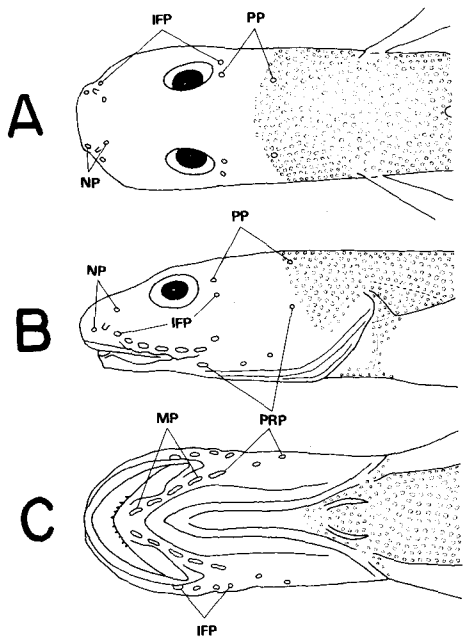

Fig. 21. Illustrations to show the shape of head, arrangement of head pores, and development of scale cover in *Lycenchelys camchaticus*. HUMZ 83223 (152.7 mm TL, female).

Color in alcohol dark brown. Margins of vertical and pectoral fins, pelvic fin, lower side of head, branchiostegal membranes, and opercular regions blackish. Center of pectoral fin light (greenish when alive). Belly bluish black. Oral and branchial cavities blackish. Peritoneum blackish. Stomach light.

Distribution. Okhotsk Sea, eastern coast of Kamchatka, Bering Sea, and off Washington.

Remarks. *L. camchaticus* is most closely related to *L. ratmanovi* especially in having greenish spots in the center of pectoral fin. However, it is easily separable from the latter by the scaled head and pectoral fin, absence of interorbital and

occipial pores, and presence of two postorbital pores.

Lycenchelys ratmanovi Andriashev, 1955

Lycenchelys camchaticus: Andriashev, 1935b: 107 (in part, Avachinsk Bay); Andriashev, 1937: 341, figs. 16, 18 (in part, southeastern Kamchatka).

Lycenchelys ratmanovi Andriashev, 1955: 355, figs. 2~4 (Avachinsk Bay); Fedorov, 1976: 6 (southeastern Kamchatka, Bering Sea).

The following characters are taken from the descriptions of 139~190 mm specimens made by Andriashev (1955) and Fedorov (1976).

Diagnosis. Head and medial surface of pectoral fin scaleless. Pectoral fin with a greenish-blue spot in the center. Lower jaw long, 40.3~50.0% of head length. Snout short, 18.0~28.0% of head length. Lateral line ventral, extending posteriorly a little beyond anal-fin origin.

Counts and proportions. Shown in Table 3.

Distribution. Southeastern Kamchatka, Bering Sea.

Remarks. *L. ratmanovi* resembles *L. longirostris* in most counts and measurements. However, it is separable from the latter by the long upper jaw, short snout, short lateral line, and pectoral fin with a greenish-blue spot (see the remarks on *L. longirostris*).

Lycenchelys longirostris sp. nov.

(New Japanese name: tsuranagahebigenge)

Figs. 22, 23.

Holotype. HUMZ 81914 (144.2 mm TL, female), 58°33.16′N, 175°05.3′W, Bering Sea, 895~910 m, June 22, 1979.

Paratype. HUMZ 83948 (156.0 mm TL, male), 58°14.44′N, 175°28.23′W, Bering Sea, 681~818 m, June 24, 1979.

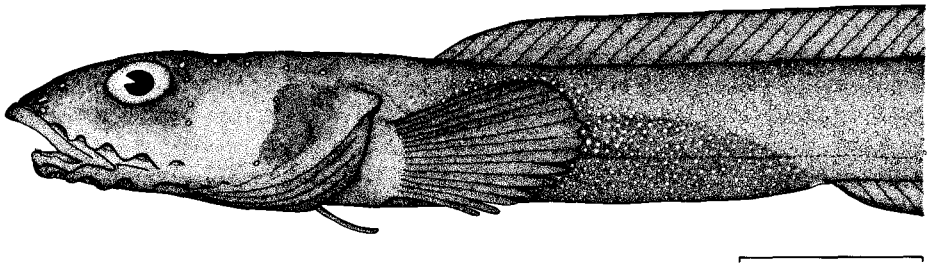

Fig. 22. Holotype of *Lycenchelys longirostris* from the Bering Sea. HUMZ 81914 (144.2 mm TL, female). Scale indicates 10 mm.

Diagnosis. Head and medial surface of pectoral fin completely scaleless. Lower jaw short, 29.8~35.3% of head length. Snout long, 28.7~33.3% of head length. Preopercular pores 6. Ventral lateral line extending backward behind midpoint of body.

Counts and proportions. Shown in Table 3.

Description of holotype and paratype. Body very elongate, its depth 21.5 (17.6 in paratype) in total length (Fig. 31G). Caudal region long. Head moderately

Table 3. Comparison of the proportions and counts in related three species of *Lycenchelys*.

Characters	*L. longirostris*		*L. ratmanovi*	*L. camchaticus*		
	Holotype	Paratype	Fedorov (1976)	Present materials	Schmidt (1950)	Fedorov (1976)
Total length (mm)	144.2	156.0	139.4～190.0	114.4～122.0	115～217	114～430
% of TL:						
Head length	13.8	16.5	14.4～16.6	13.8～16.2	14.9	13.9～17.9
Depth of body	4.6	5.7	5.0～7.0	4.6～6.3	5.8～8.0	5.0～8.0
Predorsal length	15.6	17.5	16.0～17.5	16.1～19.4	17.1～19.4	15.3～21.2
Preanal length	30.2	30.7	29.4～33.8	29.0～32.1	29.9～31.6	29.4～33.0
Pectoral fin length	7.1	6.8	6.8～9.1	6.3～8.5	6.7～7.8	5.7～9.3
% of HL:						
Head depth	39.6	38.1	39.1～45.3	37.5～51.6	42.7～48.3	36.5～48.3
Head width	36.6	41.1	32.0～50.0	34.4～49.5	41.7～44.9	33.7～54.0
Interorbital width	22.6	14.8	—	19.0～23.5	3.3～3.6	10.6～29.0
Snout length	33.3	28.7	18.0～28.0	32.1～37.0	27.7～30.8	25.7～36.7
Eye diameter	16.0	17.1	16.0～20.4	16.0～20.2	21.0～21.7	17.6～26.9
Upper jaw length	36.1	41.0	30.6～42.9	32.8～45.1	38.9～40.0	28.6～47.7
Lower jaw length	29.8	35.3	40.3～50.0	37.8～39.4	41.5～43.4	38.8～51.9
Gill opening length	33.3	32.6	35.7～44.4	26.4～33.1	30.8～32.4	—
Pectoral fin length	51.3	41.4	41.3～52.8	39.1～57.7	40.3～45.3	37.7～55.8
Counts:						
Dorsal rays	108	109	—	113～116	—	—
Anal rays	93	95	—	100～103	—	—
Pectoral rays	15	16	15～19	13～14	13～14	13～14
Abodominal v.	21	22	22～23	21～22	—	21～24
Caudal v.	92	93	88～89	99～103	—	97～103
Total v.	113	115	111	120～125	119～124	119～127
Gill rakers	9	11	9～10	14～15	—	13～14
Head pores:						
PP	5	5	5	2	—	2
IFP	9	9	8～10	8～9	—	7～9
PRP	6	6	4	4	—	4
MP	4	4	4	4	—	4
NP	2	2	2	2	—	2
OP	4	4	4	0	—	0
IP	1	1	1	0	—	0

large, relatively narrow, its length 7.2 (6.1) in head, and its width about equal to its depth. Eye relatively high in position, oval in shape, its horizontal diameter somewhat smaller than pelvic fin, and 6.2 (5.9) in head. Interorbital region narrow and convex, its width 4.4 (6.8) in head. Mouth small. Upper jaw terminating below anterior half of eye, and its length 2.8 (2.4) in head. Lower jaw very short, 3.4 (3.8)in head. Lips narrow. Lower lip with moderate, laterally projecting labial lobe. Branchiostegal membranes more or less widely connected to isthmus. Gill opening large, its lower end extending downward and forward beyond lower end of pectoral base. No ventral fold in midventral region. Small conical teeth on jaws, prevomer, and palatines ; those on upper jaw in a single row and partly in 2 rows anteriorly ; those on lower jaw in a band anteriorly and in a single row laterally and posteriorly ; those on prevomer 12 in number and in a group ; those on palatine 7 in number and arranged in a single row. Upper limb of 1 st gill arch without gill rakers. Head pores well developed ; nasal pores 2, infraorbital pores 9, postorbital pores 5, interorbital pore 1, occipital pores 4, preopercular pores 4, and mandibular pores 4. Lateral line ventral, starting from above upper end of gill opening, descending obliquely downward to anus, and then running behind the midpoint of body along base of anal fin. Scales densely covering body and bases of vertical fins ; head, dorsum before dorsal-fin origin, and base of pectoral fin also scaleless. Dorsal fin originating above anterior half of pectoral fin. Anal fin originating below 19th dorsal ray. Pectoral fin moderately long, 14.1 (14.6) in total length. Pelvic fin shorter than interorbital width.

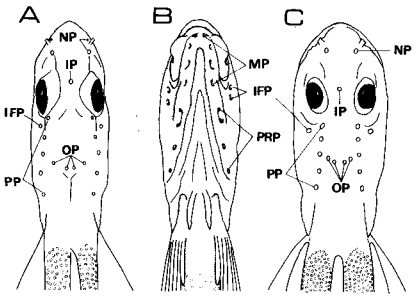

Fig. 23. Illustrations to show the shape of head, arrangement of head pores, and development of scale cover in *Lycenchelys longirostris*. A, B, holotype, HUMZ 81914 (144.2 mm TL, female) ; C, paratype, HUMZ 89948 (156.0 mm TL, male).

Color in alcohol brownish without blotches. Pectoral fin, abdominal and opercular regions, ventral surface of head, and branchiostegal membranes bluish black. Distal halves of vertical fins darker than side of body, especially in their anterior part. Branchial cavity and peritoneum black. Stomach light.

Etymology. The name for this species refers to the long snout distinguishing the species from *L. ratmanovi*.

Remarks. The new species is most closely allied to *L. ratmanovi* in having a relatively small number of abdominal and total vertebrae, pectoral rays, and a scaleless head and pectoral fin. It is separable from *L. ratmanovi* by the following characters although almost characters closely agree with the latter (Table 3) ; (1) preopercular pores are 6 instead of 4, (2) lower jaw is shorter, 29.8～35.3% of head length as against 40.3～50.0, (3) gill opening is relatively small, 32.6～33.3% of head length as against 35.7～44.4, (4) snout is longer, 28.7～33.3% of head length as against 18.0～28.0 (Table 3).

In addition to the differences in the counts and measurements, the present new species differs from *L. ratmanovi* in having uniformly bluish-black pectoral fins

without greenish blue spots and a ventral lateral line which extends posteriorly beyond the midpoint of body.

Except for *L. ratmanovi*, the present species resembles *L. camchaticus*. However, it is separable from that species by the pectoral coloration, scaleless head and pectoral fin (see remarks on *L. camchaticus*).

Lycenchelys hippopotamus Schmidt, 1950
(Japanese name: hebigenge)
Figs. 24, 25.

Lycenchelys hippopotamus Schmidt, 1935: 35 (nomen nudum); Taranetz, 1937: 61 (nomen nudum); Schmidt, 1950: 104, fig. 4 (Okhotsk Sea); Matsubara, 1955: 774; Andriashev, 1955: 361, figs. 7,8 (Okhotsk Sea); Fedorov, 1976: 8 (Okhotsk Sea, Bering Sea); Toyoshima, 1983: 267, pl. 154 (Okhotsk Sea).

Material examined. HUMZ 77571 (204.6 mm TL, male), 44°25.0′N, 145°04.0′E, Okhotsk Sea, 1320~1340 m, October 11, 1978; HUMZ 77573 (205.9 mm TL, female), 44°20.6′N, 144°56.5′E, Okhotsk Sea, 1000~1010 m, October 12, 1978; HUMZ 77774 (206.0 mm TL, male), 44°22.5′N, 144°29.5′E, Okhotsk Sea, 1310~1340 m, September 26, 1978.

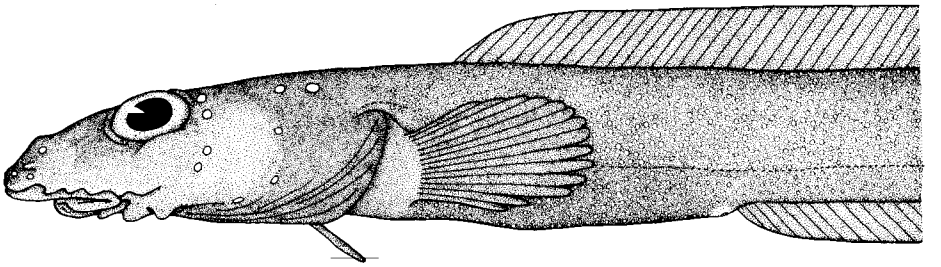

Fig. 24. *Lycenchelys hippopotamus* from the Okhotsk Sea. HUMZ 77571 (204.6 mm TL, male). Scale indicates 10 mm.

Diagnosis. Head pores well developed; postorbital pores 3 and interorbital pores 2. Head more or less depressed. Dorsal 129~131, anal 116~118, and vertebrae 133~137.

Counts and proportions. Dorsal 129 ~ 131, anal 116 ~ 118, pectoral 14 ~ 15, vertebrae 22 ~ 23 + 114 ~ 115 = 136 ~ 138. Head length 14.4 ~ 14.5% of total length, depth of body 5.1 ~ 6.6, predorsal length 15.6 ~ 16.7, preanal length 27.8 ~ 31.1, pectoral fin 6.9 ~ 7.9. Head width 34.5 ~ 42.0% of head length, head depth 37.1 ~ 42.8, eye diameter 16.2 ~ 20.1, snout 33.1 ~ 34.6, upper jaw 28.2 ~ 33.4, lower jaw 20.6 ~ 24.6, gill opening 28.7 ~ 31.2, pectoral fin 47.4 ~ 55.0, interorbital width 13.8 ~ 14.7.

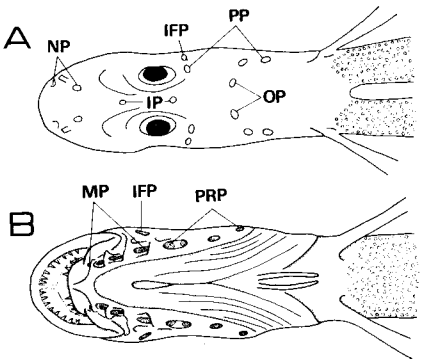

Fig. 25. Illustrations to show the shape of head and arrangement of head pores in *Lycenchelys hippopotamus*. HUMZ 77571 (204.6 mm TL, male).

Description. Body moderately elongate (Fig. 31H), its depth 15.3～19.5 in total length. Head long and slender, its length about 7 in total length and its width 2.4～2.9 in head. Snout long, clearly longer than eye diameter, and about 3 in head. Eye oval in shape, its longest axis 4.9～6.2 in head. Interorbital region moderately wide, convex, and its width about 7 in head. Upper jaw much longer than the lower, 3.0～3.6 in head and its posterior end below anterior margin of eye. Lower jaw short, its length 4.1～4.9 in head. Labial lobe moderately developed. Conical teeth on jaws, prevomer, and palatine ; those on upper jaw completely exposed when mouth closed, and 9 or 10 teeth arranged in a single row ; those on lower jaw in 3～5 rows, outermost row consisting of 2～4 regularly arranged large teeth, and inner in 2～4 rows consisting of irregularly arranged small teeth ; those on prevomer small and about 10 in number. Upper jaw teeth and outermost ones on lower jaw tending to be larger in males. Head pores well developed and large ; nasal pores 2, infraorbital pores 9, postorbital pores 3, interorbital pores 2, occipital pores 2, mandibular pores 4, and preopercular pores 6. Lateral line ventral. Scales covering body except for head ; vertical fins scaled in their posterior portion ; dorsum before dorsal origin naked. Dorsal fin originating above anterior half of pectoral fin. Anal fin originating below 17～19th dorsal ray. Pectoral fin moderately long, its length 12.6～14.6 in total length. Pelvic fin relatively long, about equal to eye diameter.

Color in alcohol brownish without blotches. Head, pectoral and pelvic fins, and belly blackish. Vertical fins darker than side of body. Peritoneum, oral and branchial cavities blackish. Stomach light.

Distribution. Okhotsk and Bering seas.

Lycenchelys melanostomias Toyoshima, 1983
(Japanese name : ohotsukuhebigenge)
Figs. 26, 27.

Lycenchelys melanostomias Toyoshima, 1983 : 271, figs. 25, 27, pl. 157 (Okhotsk Sea).

Material examined. HUMZ 77572 (192.8 mm TL, male), 44°19.5′N, 145°01′E, Okhotsk Sea, 915～925 m, October 11, 1978.

Diagnosis. Head small, 12.3% of total length. Predorsal region short, 13.6% of total length. Dorsal 117, anal 100, pectoral 15, vertebrae 22+99=121. Stomach black.

Counts and proportions. Shown in Table 4.

Description. Body not gelatinous, moderately elongate, and deep, its depth 16.8 in total length and about equal to pectoral-fin length (Fig. 31I). Caudal region moderately long, 2.5 times of preanal length. Head moderately large and wide, its length 8.1 in total length and its width 2.2 in its length. Postorbital region of head moderately long, somewhat longer than pectoral fin. Snout round in dorsal and lateral profiles, somewhat longer than eye and 3.6 in head. Nostril tube very short, clearly shorter than pupil. Eye oblong, moderately high in position, relatively large, about twice the interorbital width and 5.0 in head. Interorbital region convex, its width shorter than pelvic fin and 10.3 in head. Mouth moderately large. Maxillary extending to below middle of eye, upper jaw length 2.7 in head. Lower jaw clearly included in the upper, its length 3.2 in head. Upper lip moderately wide and somewhat gelatinous with laterally projecting prominent labial lobe. Bran-

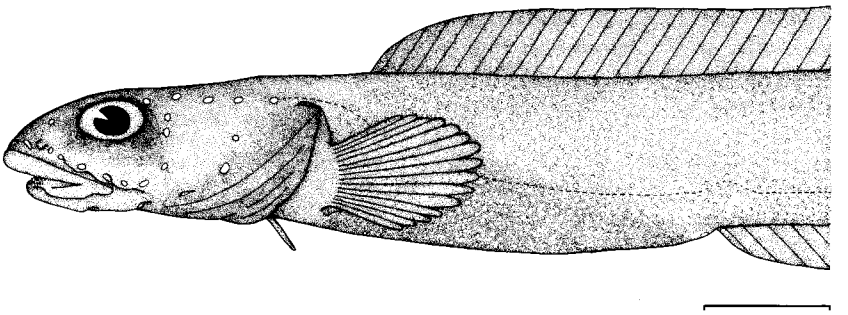

Fig. 26. *Lycenchelys melanostomias* from the Okhotsk Sea. HUMZ 77572 (192.8 mm TL, male). Scale indicates 10 mm.

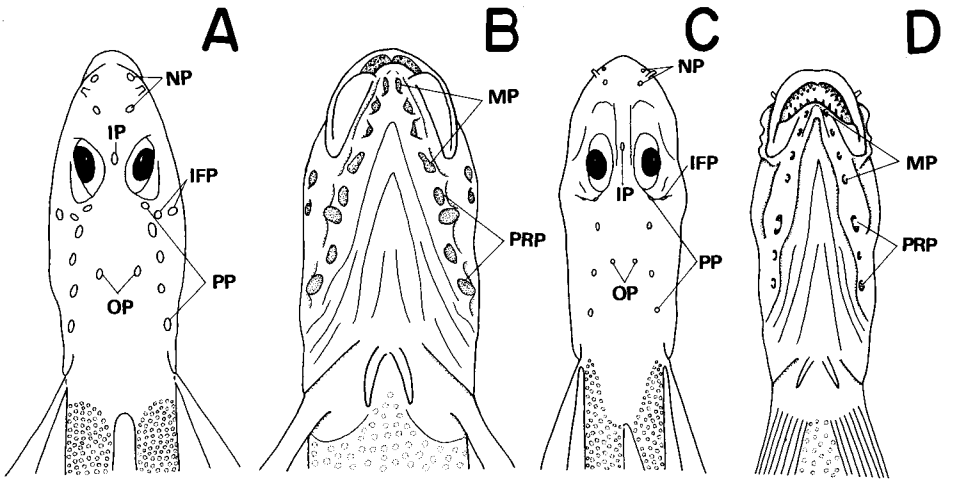

Fig. 27. Illustrations to show the shape of head and arrangement of head pores in *Lycenchelys melanostomias* (A, B) and *L. rassi* (C, D). A, B, HUMZ 77572 (192.8 mm TL, male); C, D, HUMZ 77747 (231.7 mm TL, male).

chiostegal membranes widely united to isthmus, isthmus width nearly equal to width of pectoral base. Gill opening moderately large, 3.1 in head, its lower end extending downward and forward beyond lower base of pectoral fin. Ventral fold absent from midventral region. Gill rakers on lst arch short and conical. Teeth small, conical, and relatively strong; those on upper jaw in a single row; those on lower jaw in a wide band consisting of irregular 5 rows anteriorly, becoming gradually narrow toward posterior part, and finally in a single row posteriorly; those on prevomer only 3 in number; those on palatine 10 in number and arranged in a single row. Head pores well developed, large, and not provided with nostril-like tubes; nasal pores 2, infraorbital pores 9, postorbital pores 5, interorbital pore 1, occipital pores 2, preopercular pores 5, and mandibular pores 4 (Fig. 27). Lateral line ventral, distinct, starting from above upper end of gill opening, descending obliquely downward to anus, and then extending posteriorly slightly beyond origin

Table 4. Comparison of *Lycenchelys melanostomias* with its related specie, *L. rassi*.

Characters	*L. melanostomias*	*L. rassi*		
		HUMZ 77747	Andriashev (1955)	Andriashev (1958)
No. of specimens	1	1	1	1
Total length (mm)	192.8	231.7	197	213
% of TL:				
Head length	12.3	15.0	16.1	15.0
Depth of body	6.0	6.1	6.1	5.9
Predorsal length	13.6	17.4	17.8	16.4
Preanal length	28.8	34.4	32.0	29.1
Pectoral fin length	6.6	6.5	6.9	7.0
% of HL:				
Head depth	44.3	40.8	41.0	37.5
Head width	44.5	40.4	45.5	—
Interorbital width	9.7	15.2	—	3.1
Snout length	27.8	30.9	29.3	27.2
Eye diameter	21.1	18.0	16.4	20.3
Upper jaw length	36.0	36.0	36.9	37.5
Lower jaw length	31.0	27.8	42.0	39.0
Gill opening length	32.3	28.9	—	31.3
Pectoral fin length	53.6	43.6	44.2	—
Counts:				
Dorsal rays	117	122	—	—
Anal rays	100	109	—	—
Abdominal vertebrae	22	24	23	23
Caudal vertebrae	99	105	103	102
Total vertebrae	121	129	126	125
Gill rakers	2+9	0+9	2+8	2+11
Head pores:				
PP	5	4	4	3
IFP	10	9	8	7
PRP	4	3	3	3
MP	4	4	4	4
NP	2	2	2	2
IP	1	1	1	1
OP	1	2	1	1
Distribution:	Okhotsk Sea	Okhotsk Sea	Okhotsk Sea	Bering Sea

of anal fin along base of that fin. Small cycloid scales densely covering body; belly densely scaled to tip of pelvic fin; head, dorsum before dorsal-fin origin, base of pectoral fin with basal half, medial basal half of pectoral fin, and vertical fins completely scaleless. Vertical fins not gelatinous. Dorsal fin originating above middle of pectoral fin. Predorsal region moderately long, 7.3 in total length. Anal fin originating below 18th dorsal ray. Preanal region moderately long, 3.5 in total length. Pectoral fin fan-shaped, moderately long, its length 1.9 in head, and each ray free distally, especially in the lower. Pelvic fin moderately large, about equal to eye and 4.9 in head.

Color in alcohol brownish without blotches. Head, belly, and all fins dark brown. Ventral side of head, opercular region, and margins of vertical fins blackish brown. Nostril tube dark brown. Oral and branchial cavities, peritoneum, and stomach completely black.

Distribution. Okhotsk Sea.

Remarks. The present species is allied to *L. rassi* in having fewer vertebrae and a similar arrangement of head pores. However, it is easily separable from that species by the relatively smaller head, shorter predorsal length, fewer dorsal and anal rays, and also fewer caudal and total vertebrae (Table 4). Neglecting the counts and proportional measurements, it differs from *L. rassi* in having large head pores and a completely black stomach (Toyoshima, 1983).

Lycenchelys rassi Andriashev, 1955
(Japanese name: rasuhebigenge)
Figs. 27C, D, 28.

Lycenchelys rassi Andriashev, 1955: 359, figs. 5, 6 (off eastern Sakhalin); Peden, 1974: 115, fig. 1 (Alaskan waters); Toyoshima, 1983: 269, pl. 155 (Okhotsk Sea).

Lycenchelys rassi var. Andriashev, 1958: 172 (Kronotskii Bay, eastern Kamchatka).

Material examined. HUMZ 77747 (231.7 mm TL, male), 44°38′N, 144°23′E, Okhotsk Sea, 1280~1340 m, September 24, 1978.

Diagnosis. Head scaleless and moderately large, 15.0~16.1% of total length. Opercular lobe absent. Predorsal length 16.4~17.8% of total length. Dorsal 122, anal 109, abdominal vertebrae 23~24, caudal ones 102~105, and total ones 125~129. Counts and proportions. Shown in Table 4.

Description. Body moderately elongate, its depth 16.3 in total length (Fig. 31J). Head large, moderately wide, its length 6.7 in total length, and its width 2.5 in head. Snout round in its upper profile and about equal to gill opening. Interorbital region narrow and shorter than eye. Eye oval in shape and longer than pelvic fin. Upper jaw moderately long, 2.8 in head, and its posterior end below anterior half of eye. Lower jaw short, 3.6 in head. Labial lobe moderately developed. Small conical teeth on jaws, prevomer, and palatines; those on upper jaw in 2 rows anteriorly and in a single row posteriorly; those on lower jaw in a band anteriorly and in a single row posteriorly, anterior teeth directed forward; those on prevomer 6 in number; those on palatine 5 in number and arranged in a single row. Opercular lobe absent. Gill rakers on lst arch 0+9. Head pores well developed; nasal pores 2, interorbital pore 1, occipital pores 2, infraorbital pores 8, postorbital pores 4, preopercular pores 3, and mandibular pores 4. Lateral line

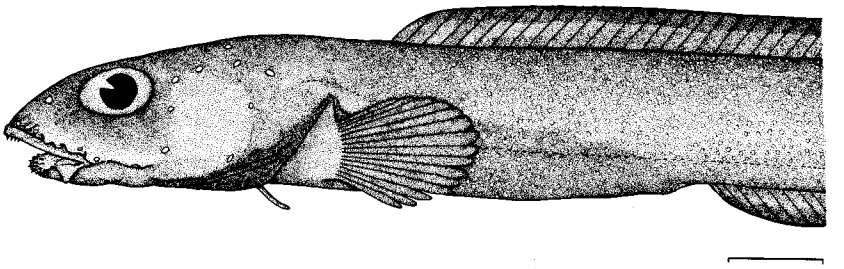

Fig. 28. *Lycenchelys rassi* from the Okhotsk Sea. HUMZ 77747 (231.7 mm TL, male). Scale indicates 10 mm.

ventral, extending beyond midpoint of body. Small cycloid scales covering body and vertical fins, absent from head and base of pectoral fin. Dorsal fin originating above anterior half of pectoral fin. Anal fin originating below 19th dorsal ray. Pectoral fin 15.6 in total length. Pelvic fin 1.4 in eye.

Color in alcohol dark brown. Pectoral fin, distal halves of vertical fins, opercular region, branchiostegal membranes, and belly blackish or bluish black. Stomach light.

Distribution. Okhotsk Sea, off eastern Kamchatka, Bering Sea.

Remarks. *L. rassi* was described from off the eastern Sakhalin based on one specimen by Andriashev (1955). Later he (1958) reported one specimen which was similar to *L. rassi* in almost all characters from the Kronotskii Bay of the eastern Kamchatka. He described that specimen as *L. rassi* var. to draw the attention of investigators to the fact that the new specimen had seven infraorbital pores instead of eight in *L. rassi* from the Okhotsk Sea and eleven gill rakers on lower limb of the first arch instead of eight.

These differences he described are not likely to be of specific value when the range of variation is considered, although he thought *L. rassi* var. was not identical with *L. rassi*. The number of infraorbital pores is variable in the genus *Lycenchelys* (*L. camchaticus* has 7～9 pores). The number of gill rakers is also variable (e.g. in *L. camchaticus*, they are 14～18). These facts indicate *L. rassi* var. is identical with *L. rassi*.

Lycenchelys brevimaxillaris sp. nov.

(New Japanese name: koguchihebigenge)

Figs. 29, 30.

Holotype. ACAP 4681 (189.4 mm TL, female), 41°13′N, 141°44′E, Pacific coast of Aomori Prefecture, 690～750 m, January 18, 1982.

Paratype. ACAP 4682 (134.0 mm TL, male), 41°06′N, 141°39′E, Pacific coast of Aomori Prefecture, 680～769 m, January 18, 1982.

Diagnosis. Postorbital pores 4, preopercular pores 5. Stomach light. Opercular lobe developed. Mouth small, posterior end of upper jaw not extending beyond anterior margin of eye.

Counts and proportions. Counts and proportions of the holotype are given first, followed by those of a paratype in parentheses. Dorsal 112 (115), anal 98

(102), pectoral 17 (16), gill rakers on lst arch 2+8=10 (2+5=7), vertebrae 23+95=118 (22+100=122). Head length 13.0 (13.8) % of total length, preanal length 30.0 (28.7), predorsal length 15.4 (14.5), depth of body 5.8 (4.6), pectoral fin 6.0 (7.0). Head width 42.1 (39.0) % of head length, snout 27.1 (25.2), upper jaw 33.6 (31.4), lower jaw 29.6 (29.3), eye diameter 25.5 (27.1), interorbital width 14.2 (8.1), pectoral fin 45.7 (50.9), pelvic fin 13.4 (17.6), gill opening 34.0 (31.4), isthmus width 17.0 (16.3).

Description of holotype and paratype. Body very elongate, its depth about 6 (5 in paratype) % of total length (Fig. 31K). Head small, moderately wide, its length 7.7 (7.3) in total length, and its width about equal to its depth. Caudal region long, more than twice preanal length. Snout round, moderately long, and 3.7 (4.0) in head. Nostril tube very short. Eye relatively large, its diameter 3.9 (3.7) in head. Interorbital region convex, relatively narrow, and its width 7.1 (12.3) in head. Mouth rather small. Posterior end of upper jaw reaching below anterior margin of pupil. Lips narrow. Lower lip with moderate labial lobe. Branchiostegal membranes widely united to isthmus. Gill opening large, its lower end extending downward and forward beyond lower base of pectoral fin. Ventral fold absent from midventral region. Teeth small and conical; those on upper jaw in 2 rows anteriorly, in a single row laterally and posteriorly; those on lower jaw in 3 rows anteriorly, in a single row laterally and posteriorly; those on prevomer 6 (5) in number; those on palatine 6 (7) in number and arranged in a single row. Head pores well developed and large; nasal pores 2, infraorbital pores 7 (8), interorbital pore 1, occipital pores 2, postorbital pores 4, preopercular pores 5, and mandibular pores 4. Lateral line poorly developed, running from upper end of gill opening to middle of pectoral fin and represented by about 10 pits. Small cycloid scales densely covering body except for head and pectoral fin; medial basal half of pectoral fin scaleless; basal half of vertical fins scaled posteriorly (scaleless in paratype); belly densely scaled. Dorsal fin originating above anterior half of pectoral fin. Anal fin originating below 17th dorsal ray. Pectoral fin relatively short, its length about half of head length. Pelvic fin moderate in size, its length a little longer than half of eye.

Color in alcohol dark brown. Head, pectoral and vertical fins blackish. Lips, branchiostegal membranes, margins of pectoral and vertical fins especially black. Belly bluish black. Oral and branchial cavities, and peritoneum black. Stomach

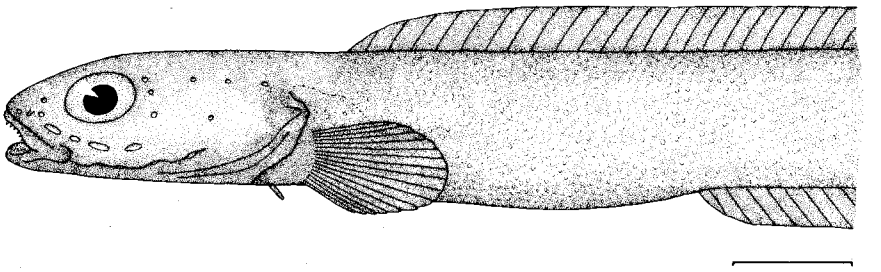

Fig. 29. Holotype of *Lycenchelys brevimaxillaris* from the Pacific coast of Aomori Prefecture. ACAP 4681 (189.4 mm TL, female). Scale indicates 10 mm.

light.

Distribution. Pacific coast of Aomori Prefecture.

Etymology. The specific name, *brevimaxillaris*, was taken from the small mouth.

Remarks. The new species is related to *L. rassi* and *L. melanostomias* in the counts of vertical-fin rays, vertebrae, occipital and interorbital pores. However, it differs from the former in having the five preopercular pores as opposed to three, a well developed opercular lobe which is absent in *L. rassi*. From *L. melanostomias*, the new species is separable in having four postorbital pores as opposed to five, and also having a light instead of dark stomach.

Additionally, it differs from the both species in having a smaller mouth, the posterior end of upper jaw just below the anterior margin of eye or terminating before it while in *L. rassi* and *L. melanostomias* the upper jaw extends posteriorly beyond the anterior margin of eye.

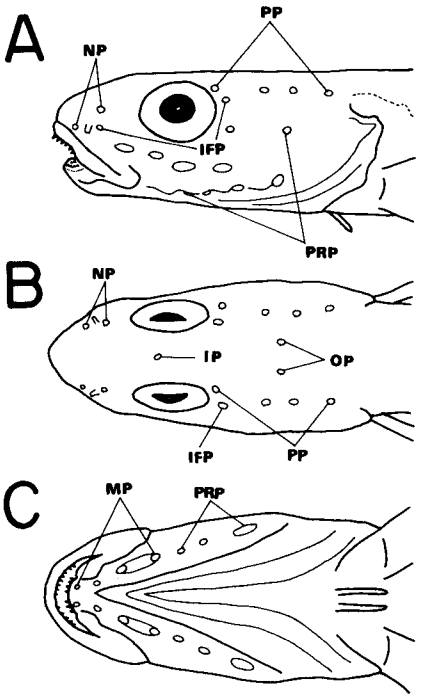

Fig. 30. Illustrations to show the shape of head and distribution of head pores in *Lycenchelys brevimaxillaris*. Drawn from the holotype.

13. Genus *Embryx* Jordan et Evermann, 1898

Embryx Jordan and Evermann, 1898 : 2458, type species by original designation, *Lycodopsis crotalinus* Gilbert, 1890 ; Andriashev, 1955 : 379.

Diagnosis. Prevomer and palatines toothless. Body scaled, very elongate, and head pores prominent as in *Lycenchelys*.

Description. Body very elongate and compressed as in *Lycenchelys*. Head pores well developed ; nasal, infraorbital, postorbital, preopercular, and mandibular pores usually present. Eye high in position. Labial lobe well developed. Gill opening moderately large, its lower end extending downward to lower end of pectoral base or beyond it. Jaws toothed. Prevomer and palatines toothless. Lateral line ventral. Scales well developed but lacking on the head except for the cheek. Pectoral fin not emerginated. Pelvic fin present, consisting of 3 soft rays.

Remarks. The present genus is most closely related to *Lycenchelys* in almost all characters except for the toothless prevomer and palatines. Three species have been assigned to the present genus, *E. crotalinus* (Gilbert, 1890), *E. crassilabris* (Gilbert, 1890), and *E. parallelus* (Gilbert, 1915), mainly from the eastern Pacific Ocean. Here, *E. crotalinus* is described because it has relatively wide range of distribution and is known to occur in the Bering Sea.

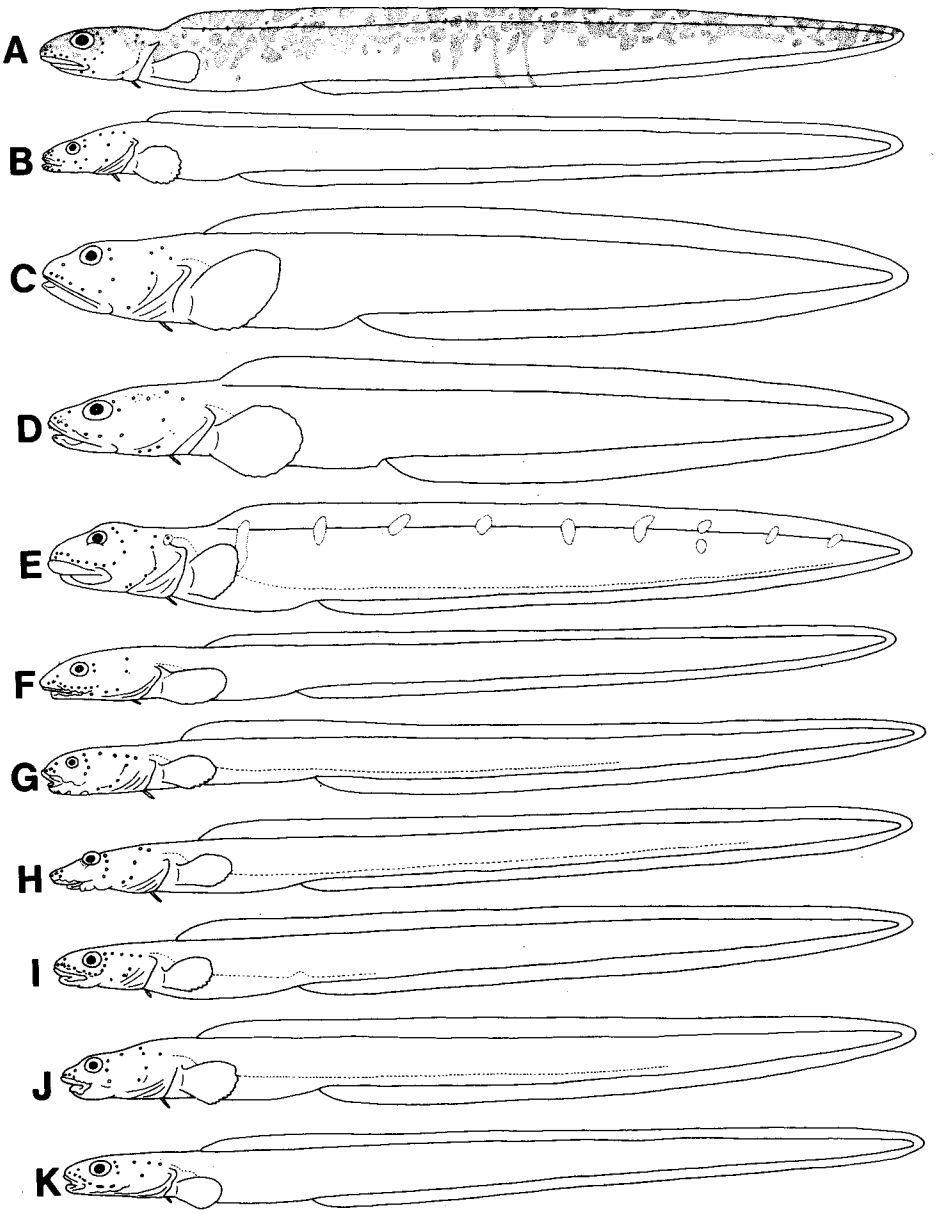

Fig. 31. Outline drawings to show the general body form, lateral-line pattern, and blotches in eleven species of *Lycenchelys*. A, *L. maculatus*, holotype, HUMZ 71361 (198.0 mm TL, male); B, *L. roseus*, holotype, HUMZ 88487 (236.7 mm TL, female); C, *L. squamosus*, HUMZ 78464 (260.0 mm TL, male); D, *L. altus*, holotype, HUMZ 88704 (126.6 mm TL, male), E, *L. albomaculatus*, HUMZ 59531 (443.2 mm TL, female); F, *L. camchaticus*, HUMZ 83223 (152.7 mm TL, female); G, *L. longirostris*, holotype, HUMZ 81914 (144.2 mm TL, female); H, *L. hippopotamus*, HUMZ 77571 (204.6 mm TL, male); I, *L. melanostomias*, HUMZ 77572 (192.8 mm TL, male); J, *L. rassi*, HUMZ 77747 (231.7 mm TL, male); K, *L. brevimaxillaris*, holotype, ACAP 4681 (189.4 mm TL, female).

Embryx crotalinus (Gilbert, 1890)
Figs. 32, 33.

Lycodopsis crotalinus Gilbert, 1890: 105 (off Santa Barbara Islands).
Embryx crotalinus: Jordan and Evermann, 1898: 2458, fig. 851 (off Santa Barbara Islands, Sanak Island of Alaska); Andriashev, 1955: 279; Peden, 1974: 119, fig. 1 (off British Columbia); Fedorov, 1976: 12 (Bering Sea, eastern coast of North and Middle America).

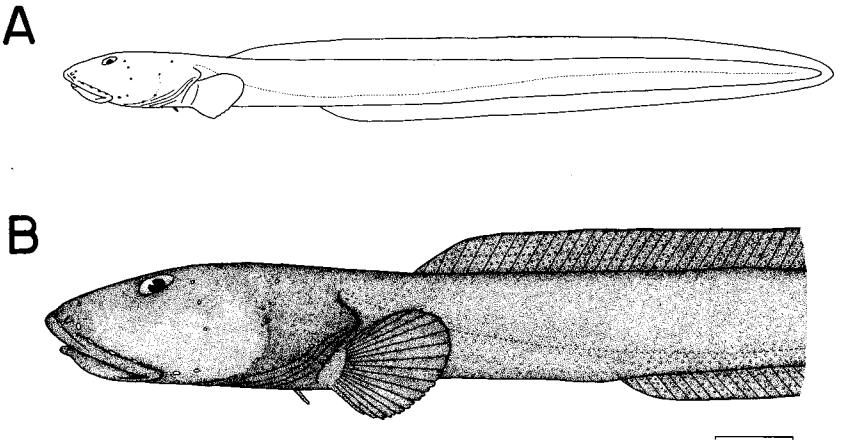

Fig. 32. *Embryx crotalinus* from the eastern Bering Sea. A, outline drawing; B, anterior half of body. HUMZ 83949 (467.8 mm TL, male). Scale indicates 20 mm.

Material examined. HUMZ 83403 (368.0 mm TL, female), 59°40.84′N, 178°37.37′W, eastern Bering Sea, 770~802 m, June 26, 1979; HUMZ 83949 (467.8 mm TL, male), HUMZ 83950 (338.0 mm TL, female), HUMZ 83951 (380.0 mm TL, male), HUMZ 83952 (416.6 mm TL, male), HUMZ 83953 (373.4 mm TL, male), 58°14.74′N, 175°28.39′W, eastern Bering Sea, 681~818 m, June 24, 1979; HUMZ 84106 (405.0 mm TL, male), 58°32.55′N, 174°41.80′W, eastern Bering Sea, 725 m, June 22, 1979; HUMZ 84126 (348.8 mm TL, male), 58°39.83′N, 177°55′W, eastern Bering Sea, 735~800 m, June 25, 1979.

Diagnosis. Body very elongate, its depth less than 7% of total length. Cheek densely scaled.

Counts and proportions. Proportions of females are shown in parentheses. Dorsal 122~126, anal 107~110, pectoral 16~17, vertebrae 22~23+106~109=128~132. Head length 15.9~18.7 (12.8~16.0)% of total length, preanal length 26.7~32.9 (24.6~31.0), predorsal length 17.4~20.7 (14.5~18.4), depth of body 6.3~7.2 (4.8~6.7), pectoral fin 7.4~8.4 (7.1~7.9). Head width 46.5~69.6 (43.5~54.1)% of head length, head depth 45.2~50.5 (47.6~53.1), snout 36.4~40.0 (31.6~35.3), upper jaw 38.8~45.8 (36.4~39.4), lower jaw 29.2~36.9 (24.5~30.5), eye diameter 12.4~15.5 (15.3~17.6), interorbital width 19.5~21.5 (14.8~21.0), pectoral fin 40.3~52.8 (48.3~55.3), pelvic fin 10.7~13.5 (11.5~17.7), gill opening 35.9~39.7 (34.4~40.8).

Description. Body very elongate, its depth less than 7% of total length. Head moderately large; males having relatively longer and more depressed heads;

its length 5.3~6.3 in total length in males and 6.2~7.8 in females. In males the head becomes wide; its width 1.4 ~2.1 in head in males and 1.8~2.3 in females (Fig. 33). Snout blunt, its length 2.5~3.2 in head. Eye round or oval, smaller in males; its diameter 6.5 ~8.0 in head in males and 5.7~6.6 in females. Mouth large, especially in males; upper jaw length 2.2~2.6 in head in males and 2.6~3.0 in females. Interorbital region convex, moderately wide, and its width clearly longer than eye. Teeth on jaws small, strong, and conical; those on upper jaw in a single row of 11~16 teeth; those on lower jaw in a band anteriorly, posterior teeth absent. Head pores well developed; nasal pores 2, infraorbital pores 7~9, interorbital and occipital pores absent, preopercular pores 3~4, and mandibular pores 4. Lateral line not very distinct, starts at top of gill opening, gradually descending downward, running along ventrolateral part of body, then gradually ascending and running to caudal base along midline of body. Scales densly covering entire body; cheek, occipital region, belly, vertical fins, and medial side of pectoral fin densely scaled. Dorsal fin originating above middle of pectoral fin. Pectoral fin relatively short, its length 1.8 ~2.5 in head. Pelvic fin moderately long, shorter than eye.

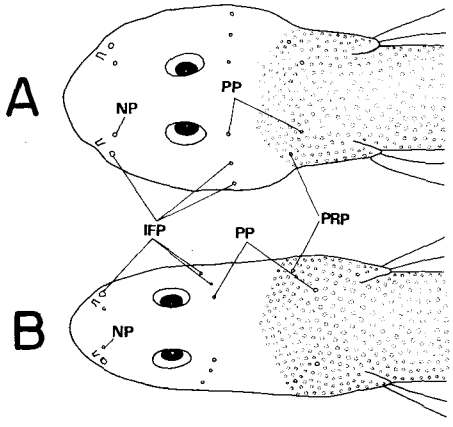

Fig. 33. Illustrations to show the shape of head, distribution of head pores, and development of scale cover in male (A) and female (B) of *Embryx crotalinus*. A, HUMZ 83949 (467.8 mm TL); B, HUMZ 83403 (368.0 mm TL).

Color in alcohol dark brown. Margins of vertical fins and pectoral fin, opercular region, branchiostegal membranes, and lips blackish. Center of pectoral fin somewhat light. Oral and branchial cavities blackish. Peritoneum blackish brown. Color of fresh specimens different from those preserved in alcohol in pectoral coloration. Margin of the fin black and its center with a greenish spot.

Distribution. Bering Sea, eastern Pacific Ocean.

Remarks. The present species is easily distinguishable from the other two species in having a scaled head. *E. crassilabris* and *E. parallelus* are represented by the holotype repectively. Although Gilbert (1895) considered that these two species differ from each other in the head width which is 2.8 in head length in the former and 2.0 in the latter (calculated from the data given by Gilbert, 1915). The distinctiveness of these two species is very doubtful because such a difference in head width is usually not significant in zoarcids.

In any event, *E. crotalinus* is certainly separable from the other two species of this genus.

Furthermore the present species differs in clearly exhibiting sexual dimorphism. Males have larger, wider, and more depressed head than females. The eye is smaller and the upper jaw is longer in males.

14. Genus *Lycodes* Reinhardt, 1831
(Japanese name: mayugaji-zoku)

Lycodes Reinhardt, 1831: 18, type species by monotypy, *Lycodes vahlii* Reinhardt, 1831; Reinhardt, 1838: 71; Collett, 1880: 77; Jordan and Evermann, 1898: 2461; Jensen, 1904: 10; Knipowitschi, 1906: 112; Vladykov and Tremblay, 1936: 16; Soldatov and Lindberg, 1930: 492; Taranetz, 1937: 161; Okada and Matsubara, 1938: 406; Schmidt, 1950: 84; Andriashev, 1954: 266; Matsubara, 1955: 774; Fowler, 1958: 303; Lindberg and Krasyukova, 1975: 139.

Lycodalepis Bleeker, 1874: 369, type species by original designation, *Lycodes mucosus* Richardson, 1855; Jordan and Evermann, 1898: 2468; Schmidt, 1950: 103.

Furcimanus (subgenus) Jordan and Evermann, 1898: 2869, type species by original designation, *Lycodes diapterus* Gilbert, 1891.

Lycias (subgenus) Jordan and Evermann, 1898: 2461, type species by original designation, *Lycodes diapterus* Gilbert, 1892; Andriashev, 1937: 339; Schmidt, 1950: 98.

Bergeniana (subgenus) Popov, 1931: 141, type species by original designation, *Lycodes uschakovi* Popov, 1931.

Diagnosis. Body moderately elongate and compressed. No barbels on head. Chin crest developed. Head pores usually absent, sometimes very small pits developed. Prevomer and palatines toothed. Pelvic fin with 3 rays.

Description. Body moderately elongate and compressed. No barbels on head. Conspicuous head pores absent although small pits sometimes developed. A pair of chin crests usually present on lower side of head, free or united each other anteriorly. Gill opening relatively large, but not extending far forward, and branchiostegal membranes broadly united to isthmus. Lower lip extending outward in its posterior part to form labial lobe. Lower jaw included. Jaws, prevomer, and palatines toothed. Body covered with small cycloid scales in many species. Lateral line consisting of a row or rows of small hardly perceptible neuromasts variously arranged (Table 5, Fig. 36): anterolateral (developed only anteriorly and not descending toward anus); anteroventral (developed only anteriorly and descending toward anus); midlateral (running along midlateral of body); ventromidlateral (descending toward anus, abruptly ascending above anus, and then running along midlateral of body, sometimes ascending part poorly expressed); ventral (descending toward anus and running along base of anal fin). Pectoral fin emerginate or not. Pelvic fin with 3 soft rays.

Remarks. The present genus includes numerous species and has a very wide distribution in the Northern Hemisphere. It is closely related to *Lycenchelys*, *Embryx*, *Lycodopsis*, *Aprodon*, and *Petroschmidtia*. From these genera, *Lycodes* is separable by the following combination of characters; (1) body is not very elongate; (2) conspicuous large head pores are absent (except young *Lycodes jugoricus*); (3) prevomer and palatines are toothed; (4) pelvic fins have three soft rays.

The species of *Lycodes* are so numerous and variable that some ichthyologists (Jordan and Evermann, 1898; Popov, 1931; Schmidt, 1950; Andriashev, 1954, etc.) attempted to subdivide the present genus into several subgenera (*Lycodes*, *Lycodalepis*, *Lycias*, *Furcimanus*, and *Bergeniana*) based on the development of scale cover and pectoral emergination. However, the genus is very difficult to split because those characters are variable and intermediate forms exist among species and

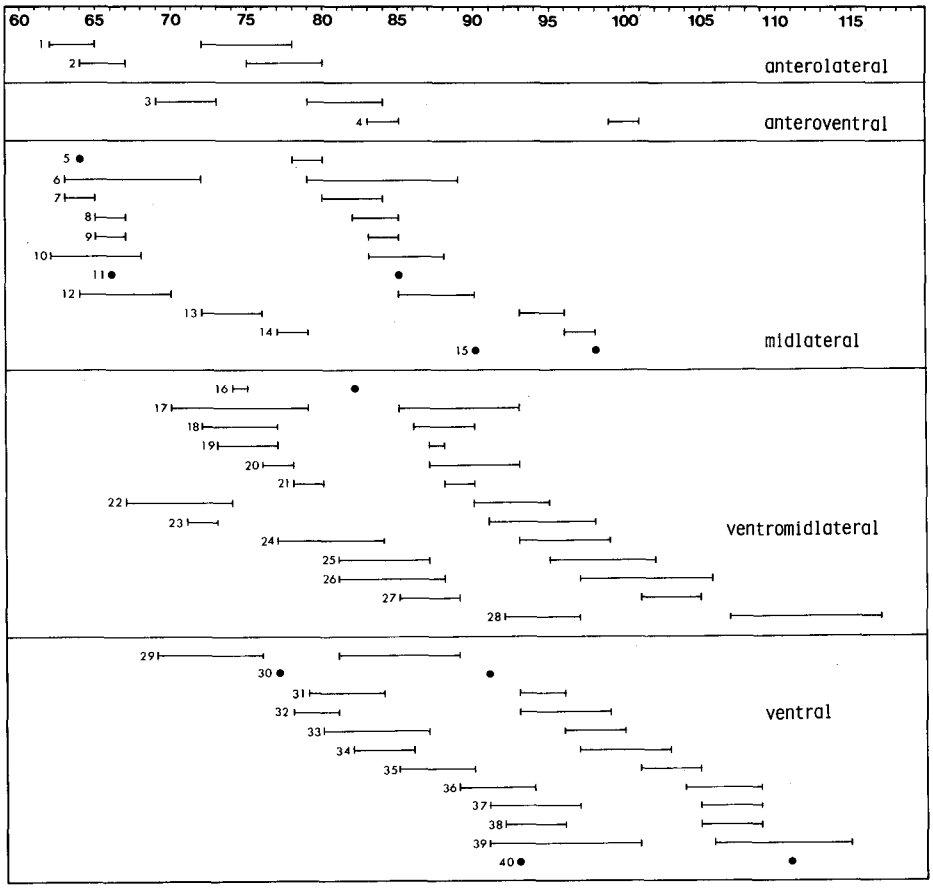

Fig. 34. Lateral-line pattern and number of dorsal and anal rays in the species of *Lycodes*. 1, *L. sadoensis*; 2, *L. teraoi*; 3, *L. japonicus*; 4, *L. diapteroides*; 5, *L. uschakovi*; 6, *L. macrolepis*; 7, *L. raridens*; 8, *L. knipowitschi*; 9, *L. turneri*; 10, *L. heinemani*; 11, *L. mucosus*; 12, *L. paucilepidotus*; 13, *L. sigmatoides*; 14, *L. tanakai*; 15, *L. bathybius*; 16, *L. microlepidotus*; 17, *L. macrochir*; 18, *L. fulvus*; 19, *L. ygreknotatus*; 20, *L. ochotensis*; 21, *L. jenseni*; 22, *L. fasciatus*; 23, *L. schmidti*; 24, *L. matsubarai*; 25, *L. soldatovi*; 26, *L. palearis*; 27, *L. multifasciatus*; 28, *L, yamatoi*; 29, *L. ocellatus*; 30, *L. obscurus*; 31, *L. microporus*; 32, *L. brevipes*; 33, *L. brunneofasciatus*; 34, *L. albolineatus*; 35, *L. caudimaculatus*; 36, *L. hubbsi*; 37, *L. nakamurai*; 38, *L. diapterus*; 39, *L. pectoralis*; 40, *L. andriashevi*.

even in the same species. Therefore, the subgenera are not adopted here.

Certain species of *Lycodes* were also split into many subspecies by the Russian ichthyologists (Andriashev, 1937, 1954; Schmidt, 1950; Lindberg and Krasyukova, 1975, etc.). Many subspecies were based on small samples and on minor differences which vary significantly with sex, growth, and locality. These methods resulted in confusion in the taxonomy of *Lycodes*. Therefore the subspecies are not adopted and subspecies which are clearly different from the others are described as indepen-

Table 5. Meristic characters and lateral-line patterns in the species of *Lycodes*.

Group	Species	Dorsal rays	Anal rays	Vertebrae	Lateral-line patterns
A	*L. sadoensis*	72~78	62~65	20+62~67=82~87	antero-lateral
	L. teraoi	75~80	64~67	19~20+63~68=82~88	
B	*L. japonicus*	79~84	69~73	19~20+68~72=87~93	antero-ventral
	L. diapteroides	99~101	83~85	—	
C	*L. uschakovi*	78~80	64	—	midlateral
	L. macrolepis	79~89	64~72	19~21+67~69=86~90	
	L. raridens	80~84	63~65	24~25+64~66=88~91	
	L. knipowitschi	82~85	65~67	24~26+68=92~94	
	L. turneri	83~85	65~67	100	
	L. heinemani	83~88	62~68	23~25+64~70=87~95	
	L. mucosus	85	66	25~29+65~67=92~94	
	L. paucilepidotus	85~90	64~70	25~27+66~71=91~98	
	L. sigmatoides	93~96	72~76	—	
	L. tanakai	96~98	77~79	25~26+77~81=104~107	
	L. bathybius	98	90	—	
	L. semenovi	—	—	—	
D	*L. microlepidotus*	82	74~75	—	ventro-midlateral
	L. macrochir	85~93	70~79	20~21+71~80=91~101	
	L. fulvus	86~90	72~77	19~21+73~77=92~98	
	L. ygreknotatus	87~88	73~77	—	
	L. ochotensis	87~93	76~78	20~21+77~78=98	
	L. jenseni	88~90	78~80	—	
	L. fasciatus	90~95	67~74	—	
	L. schmidti	91~98	71~73	—	
	L. matsubarai	93~99	77~84	21~22+81~85=102~107	
	L. soldatovi	95~102	81~87	—	
	L. palearis	97~106	81~88	23~25+83~90=106~114	
	L. multifasciatus	101~105	85~89	23~25+86~90=109~115	
	L. yamatoi	107~117	92~97	21~22+92~98=113~120	
E	*L. ocellatus*	81~89	69~76	19~20+75~78=94~98	ventral
	L. obscurus	91	77	20+77=97	
	L. microporus	93~96	79~84	18~20+78~83=96~103	
	L. brevipes	93~99	78~81	20~21+79~82=99~103	
	L. brunneofasciatus	96~100	81~87	22~23+79~86=101~109	
	L. albolineatus	97~103	82~86	21~22+85~87=106~109	
	L. caudimaculatus	101~105	85~90	21~23+86~90=107~113	
	L. hubbsi	104~109	89~94	20~21+89~94=109~115	
	L. nakamurai	105~109	91~97	20~21+89~98=110~118	
	L. diapterus	105~109	92~96	19~22+92~96=111~118	
	L. pectoralis	106~115	91~101	21~22+91~101=112~123	
	L. andriashevi	111	93	22+92=114	

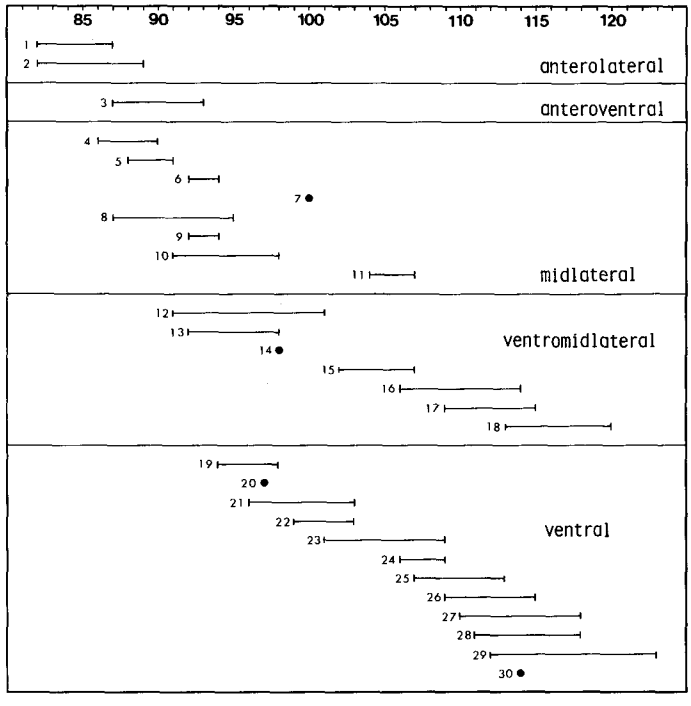

Fig. 35. Lateral-line pattern and number of vertebrae in the species of *Lycodes*. 1, *L. sadoensis*; 2, *L. teraoi*; 3, *L. japonicus*; 4, *L. macrolepis*; 5, *L. raridens*; 6, *L. knipowitschi*; 7, *L. turneri*; 8, *L. heinemani*; 9, *L. mucosus*; 10, *L. paucilepidotus*; 11, *L. tanakai*; 12, *L. macrochir*; 13, *L. fulvus*; 14, *L. ochotensis*; 15, *L. matsubarai*; 16, *L. palearis*; 17, *L. multifasciatus*; 18, *L. yamatoi*; 19, *L. ocellatus*; 20, *L. obscurus*; 21, *L. microporus*; 22, *L. brevipes*; 23, *L. brunneofasciatus*; 24, *L. albolineatus*; 25, *L. caudimaculatus*; 26, *L. hubbsi*; 27, *L. nakamurai*; 28, *L. diapterus*; 29, *L. pectoralis*; 30, *L. andriashevi*.

dent species.

In species of *Lycodes* and other zoarcids, it is essential to pay attention to the following character variation;

(1) Degree of pectoral emergination and scale cover vary with growth and localities.

(2) Head length, head width, eye diameter, fin lengths (dorsal, anal, pectoral, and pelvic fins) change proportionally with growth.

(3) Details of coloration are variable although the basic patterns are relatively constant, they gradually disappear with growth.

(4) Males tend to have longer and wider heads, higher dorsal and anal fins, larger mouths, larger and fewer teeth, and smaller eyes.

(5) Males tend to have darker paired and anal fins, belly, and head. Also, color patterns tend to be clear and characteristic in males.

As a result of the present study, the following characters were ascertained to be very useful for the separation of species. The fin-ray and vertebral counts are the

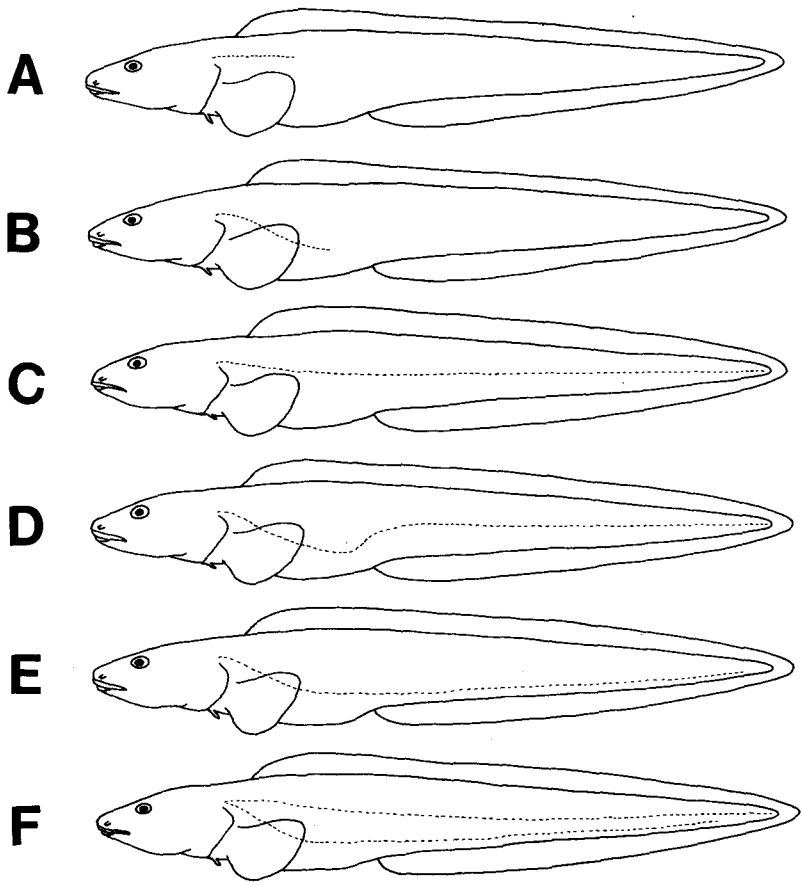

Fig. 36. Six lateral-line patterns in the genus *Lycodes*. A, anterolateral; B, anteroventral; C, midlateral; D, ventromidlateral; E, ventral; F, double.

most stable character of all and quite effective for distinguishing species. When the color is faded out or the specimens are young, we can decide to which species the specimens in question are related using those counts (Table 5). Identification is possible using the meristic values in Figs. 34 and 35. There are five lateral-line patterns in the species of *Lycodes* examined here. The species which have the double lateral lines are excluded here because they do not occur in Japan and adjacent waters. Those patterns are also very stable within a species (Fig. 36, Table 5) and are useful in the separation of species.

On the other hand, pectoral emergination, proportional measurements and coloration can be used when the range of variation is known.

Based on the careful observation of these characters, the following key is presented. At first, the species were conventionally divided into five groups based on the patterns of lateral line. Then, keys to species of each group are given.

15. Key to five groups of *Lycodes*

A1. Lateral line restricted to preanal region.
  B1. Lateral line anterolateral (2 species are included).
    ..... group A
  B2. Lateral line anteroventral (2 species are included).
    ..... group B
A2. Lateral line extending onto caudal region.
  C1. Lateral line running along midline of body in caudal region.
    D1. Lateral line midlateral (12 species are included).
      ..... group C
    D2. Lateral line ventromidlateral (13 species are included).
      ..... group D
  C2. Lateral line ventral, running along base of anal fin (12 species are included).
    ..... group E

16. Key to species of group A

A1. Body pale greyish pink without markings.
  ..... *L. teraoi* Katayama, 1943, p. 188
A2. Dorsal half of body brownish, dorsal fin with 3 or more dark spots.
  ..... *L. sadoensis* Toyoshima et Honma 1980, p. 189

17. Key to species of group B

A1. Markings on body band-like. Fin rays numerous: dorsal 99~101, anal 83~85, pectoral 20.
  ..... *L. diapteroides* Taranetz et Andriashev, 1937, p. 191
A2. Markings on body not band-like. Fin rays fewer: dorsal 79~84, anal 69~73, pectoral 14~15.
  ..... *L. japonicus* Matsubara et Iwai, 1951, p. 191

18. Key to species of group C

A1. Preanal region long, its length less than 2.3 in total length.
  B1. Scales present on preanal region, usually reaching pectoral tip.
    C1. Dorsal rays more than 95, anal rays more than 75.
      ..... *L. tanakai* Jordan et Thompson, 1914, p. 193
    C2. Dorsal rays fewer than 90, anal rays fewer than 70.
      D1. Dark markings on body Y-shaped or large saddle-like.
        ..... *L. knipowitschi* Popov, 1931, p. 195
      D2. Dark markings on body not Y-shaped or not saddle-like.
        E1. Light, narrow, band-like blotches 9~10 in number, on body.
          ..... *L. paucilepidotus* sp. nov., p. 196
        E2. Light, narrow bands absent. Irregular-shaped or band-like dark markings on body.
          ..... *L. raridens* Taranetz et Andriashev, 1934, p. 198
  B2. Scales absent from preanal region.

F1. Dark markings large and Y-shaped or wide band-like.
..... *L. mucosus* Richardson, 1855, p. 200
F2. Dark markings not large and Y-shaped or not wide and band-like.
G1. Head wide, its width equal to its length.
..... *L. turneri* Bean, 1878, p. 202
G2. Head not so wide, its width about half of its length.
..... *L. heinemani* Soldatov, 1916, p. 202
A2. Preanal region short, more than 2.5 in total length.
H1. Scales completely absent.
..... *L. bathybius* Schmidt, 1950, p. 203
H2. Scales present.
I1. Belly scaled.
J1. Light bands on body S-shaped or 8-shaped.
..... *L. sigmatoides* Lindberg et Krasyukova, 1975, p. 204
J2. Light bands on body not S-shaped or 8-shaped.
K1. Preanal length 43.2~45.1 % of total length. Regular bands of pigment on side of body.
..... *L. macrolepis* Taranetz et Andriashev, 1935, p. 204
K2. Preanal length 33.5% of total length. Inverted Y-shaped markings on side of body.
..... *L. semenovi* Popov, 1931, p. 205
I2. Belly scaleless.
..... *L. uschakovi* Popov, 1931, p. 205

19. Key to species of group D

A1. Pectoral fin deeply emerginate.
..... *L. macrochir* Schmidt, 1950, p. 205
A2. Pectoral fin not emerginate.
B1. Body black without blotches.
..... *L. soldatovi* Taranetz et Andriashev, 1935, p. 207
B2. Body dark, brownish, without blotches, or with bands or Y-shaped patterns.
C1. Dorsal rays more than 105, anal rays more than 90.
..... *L. yamatoi* sp. nov., p. 208
C2. Dorsal rays fewer than 104, anal rays fewer than 89.
D1. Light Y-shaped markings on dorsal fin.
..... *L. ygreknotatus* Schmidt, 1950, p. 210
D2. Y-shaped markings absent from dorsal fin.
E1. Dorsal rays fewer than 82, anal rays fewer than 75.
..... *L. microlepidotus* Schmidt, 1950, p. 210
E2. Dorsal rays more than 85, anal rays usually more than 76. If anal rays fewer than 75, dorsal rays more than 90.
F1. Body without markings.
G1. Dorsal rays fewer than 94, anal rays fewer than 80.
H1. Dorsal fin with light spots.
..... *L. ochotensis* Schmidt, 1950, p. 211

H2. Dorsal fin without light spots.
.....*L. jenseni* Taranetz et Andriashev, 1935, p. 211

G2. Dorsal rays more than 95, anal rays more than 81.
.....*L. palearis* Gilbert, 1895, p. 212

F2. Body with markings.

I1. Two light bands before dorsal fin.

J1. Dorsal rays less than 100, anal rays less than 80.

K1. Dark interspaces between light bands clearly diffused on lower parts. Ventral half of body light.
.....*L. fasciatus* (Schmidt, 1904), p. 214

K2. Dark interspaces between light bands not clearly diffused on lower parts. Ventral half of body not light.
.....*L. schmidti* Grazianov, 1907, p. 214

J2. Dorsal rays more than 101, anal rays more than 85.
.....*L. multifasciatus* Schmidt, 1950, p. 214

I2. A light band before dorsal fin or not.

L1. Dorsum before dorsal fin scaleless.
.....*L. fulvus* sp. nov., p. 216

L2. Dorsum before dorsal fin scaled.

M1. Snout 2.5~3.0 in head. Pectoral fin 8.1~9.2 in total length. Dorsal 97~106, anal 81~88.
.....*L. palearis* Gilbert, 1895, p. 212

M2. Snout 3.3~4.0 in head. Pectoral fin 7.9~8.3 in total length. Dorsal 93~99, anal 77~84.
.....*L. matsubarai* sp. nov., p. 218

20. Key to species of group E

A1. Posterior end of body marked with a white area with black marks present in this area.
.....*L. caudimaculatus* Matsubara, 1936, p. 220

A2. Posterior end of body without a white area.

B1. Small head pores provided with short tubes.
.....*L. microporus* Toyoshima, 1983, p. 221

B2. Small head pores, when present, not provided with short tubes.

C1. Round, black spots on side of body.
.....*L. ocellatus* sp. nov., p. 223

C2. Round, black spots absent from side of body.

D1. Pectoral fin emerginate.

E1. Black markings on upper margin of pectoral fin and anterior part of dorsal fin.
.....*L. nakamurai* (Tanaka, 1914), p. 224

E2. Black markings absent from pectoral and dorsal fins.

F1. Pectoral rays 20~23. Narrow light bands, 5~6 in number, on body.
.....*L. hubbsi* Matsubara, 1955, p. 226

F2. Pectoral rays 17~19. Narrow light bands present or absent.

G1. Head 5.7~6.4 in total length. Predorsal length 4.9~5.5 in total length.
..... *L. pectoralis* sp. nov., p. 228

G2. Head 4.7~5.4 in total length. Predorsal length 4.0~4.3 in total length.
..... *L. diapterus* Gilbert, 1891, p. 230

D2. Pectoral fin not emerginate.

H1. Body with markings.

I1. Anal rays more than 90, dorsal rays more than 105, vertebrae more than 110.
..... *L. diapterus* Gilbert, 1891, p. 230

I2. Anal rays fewer than 89, dorsal rays fewer than 104, vertebrae less than 109.

J1. Narrow light bands on body and dorsal fin, bands clearly narrower than eye.

K1. Body completely black.
..... *L. albolineatus* Andrishev, 1955, p. 232

K2. Body greyish or brownish.
..... *L. brevipes* Bean, 1890, p. 233

J2. Wide light bands on body and dorsal fin, bands usually wider than eye.
..... *L. brunneofasciatus* Suvorov, 1935, p. 234

H2. Body without markings.

L1. Dorsal rays more than 100, anal rays more than 86, vertebrae more than 105.
..... *L. andriashevi* Fedorov, 1966, p. 235

L2. Dorsal rays fewer than 99, anal rays fewer than 85, vertebrae fewer than 100.
..... *L. obscurus* sp. nov., p. 235

Lycodes teraoi Katayama, 1943
(Japanese name: hinagenge)
Fig. 37.

Lycodes teraoi Katayama, 1943: 103, fig. 2 (off Tsuiyama, Hygo Prefecture, Sea of Japan); Matsubara and Iwai, 1951: 373; Matsubara, 1955: 775; Fowler, 1958: 305; Lindberg and Krasyukova, 1975: 147, fig. 117.

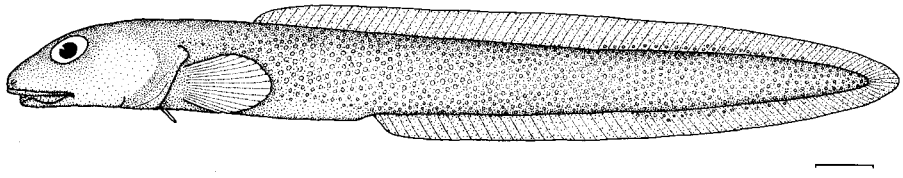

Fig. 37. *Lycodes teraoi* from off Tsuiyama, the Sea of Japan. HUMZ 81281 (155.0 mm TL, male). Scale indicates 10 mm.

Material examined. NSMT-P 18223 (165.0 mm TL, male), HUMZ 81281 (155.0 mm TL, male), HUMZ 86838 (109.3 mm TL, male), HUMZ 86839 (120.0 mm TL, male), HUMZ 86840 (137.0 mm TL, male), HUMZ 84841 (138.4 mm TL, male), off Tsuiyama, Hyogo Prefecture, Sea of Japan, about 150 m, April 2, 1943.

Diagnosis. Body without bands or markings. Upper jaw relatively short, about 2.6 in head. Lateral line anterolateral.

Counts and proportions. Shown in Table 6.

Description. Body relatively short, moderately deep with depth about 12 in total length. Head moderately large, about 5 in total length and sometimes with swollen cheeks. Snout rounded and longer than eye. Eye oval in shape, its diameter 4~5 in head. Interorbital region convex, narrow, and its width more than 2 in eye diameter. Mouth moderately large; upper jaw about 3 in head and its posterior end below posterior half of eye. Lower lip with prominent labial lobe. Teeth small and conical; those on upper jaw in a single row, anterior teeth larger; those on lower jaw in 2 or 3 irregular rows; prevomer with a group of about 5 teeth; those on palatine in a single row. Lateral line anterolateral, indistinct, and short. Body covered with small cycloid scales; vertical fins scaled posteriorly. Dorsal fin originating above posterior half of pectoral fin. Pectoral fin relatively short, its length about 2 in head. Pelvic fin short, about 5~8 in head.

Color in alcohol a grey monotone without markings. Branchial and oral cavities light. Peritoneum light.

Distribution. Sea of Japan.

Remarks. The present species is closely allied to *L. sadoensis*. However, it can be distinguished from the latter by some proportional measurements and coloration (see the remarks on *L. sadoensis*).

Lycodes sadoensis Toyoshima et Honma, 1980
(Japanese name: sadohinagenge)
Fig. 38.

Lycodes sp. (*Lycodes sadoensis* Matsubara et Honma MS.) Honma, 1963: 21 (nomen nudum: Japanese name, sadohinagenge, off Sado Island).

Lycodes sadoesis Honma and Sugihara, 1963: 7 (nomen nudum, off Sado Island).

Lycodes sadoensis Matsubara and Honma (MS.) Honma, 1969: 31, fig. 9 (nomen nudum, off Sado Island).

Lycodes sadoensis Toyoshima and Honma, 1980: 48, fig. 1 (off Ishikawa Prefecture).

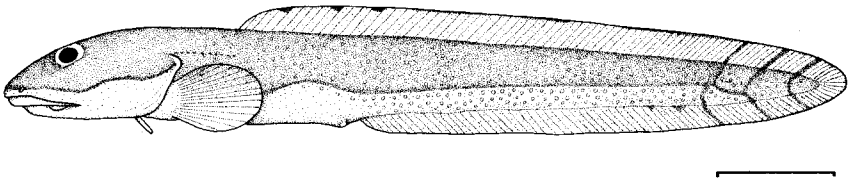

Fig. 38. *Lycodes sadoensis* from off Ishikawa Prefecture, the Sea of Japan. HUMZ 65832 (143.2 mm TL, male). Scale indicates 20 mm.

Material examined. HUMZ 65828 (139.6 mm TL, female), HUMZ 65829 (131.2 mm TL, male), HUMZ 65830 (130.8 mm TL, male), HUMZ 65831 (135.0 mm TL, male), HUMZ 65832 (143.2 mm TL, male), HUMZ 65833 (134.6 mm TL, male), ZUMT 54226 (134.0 mm TL, male), 37°33.5′N, 136°15′E, off Ishikawa Prefecture, Sea of Japan, 235 m, June 7, 1977; NMC 79797 (143.4 mm TL, male), 37°14′N, 136°27′E, off Ishikawa Prefecture, 169~210 m, June 7, 1977.

Diagnosis. Dorsal half of body and head brownish and ventral half light. Dorsal fin with fairly dark margins and 3 or more spots anteriorly. Dorsal 72~78, anal 62~65, pectoral 15, and vertebrae 20+62~67=82~87.

Counts and proportions. Shown in Table 6.

Description. Body moderately elongate and deep, its depth about 1/9~1/10 of total length. Head somewhat depressed. Interorbital region convex, narrow, and its width narrower than eye. Mouth large, posterior end of upper jaw extending below posterior half of eye. Lower jaw completely included, its length a little shorter than gill opening. Teeth small and conical; those on upper jaw in a single row laterally and 2 rows anteriorly; those on lower jaw in 2 or 3 irregular rows; prevomer with a group of about 5 teeth; those on palatine in a single row. Lateral line indistinct, consisting of a midlateral series of neuromasts which extend to a point below dorsal-fin origin. Small isolated scales covering body except for head, belly, and pectoral fin. Scales also extending onto basal half of pectoral fin. Anal

Table 6. Comparison of *Lycodes sadoensis* with related form, *L. teraoi*. Data on the both species are from the holotypes and paratypes.

Characters	*L. sadoensis*	*L. teraoi*
Total length (mm)	130.8~143.4	109.3~165.0
In TL:		
Preanal length	2.16~2.65	2.27~2.38
Head length	4.33~5.21	4.50~5.25
Depth of body	9.92~11.63	11.50~12.40
Pectoral fin length	9.50~12.35	8.60~11.37
In HL:		
Head width	1.76~2.26	2.06~2.47
Snout length	2.31~3.29	3.12~3.46
Upper jaw length	1.86~2.36	2.56~2.61
Lower jaw length	2.11~3.08	2.49~2.93
Eye diameter	3.97~5.36	3.78~5.13
Gill opening length	2.23~2.70	2.32~2.96
Pectoral fin length	1.93~2.51	1.63~2.51
Pelvic fin length	5.63~7.48	5.20~8.27
Counts:		
Dorsal rays	72~78	75~80
Anal rays	62~65	64~67
Pectoral rays	15	15~17
Vertebrae	20+62~67=82~87	19~20+63~68=82~88

fin originating below 13th or 14th dorsal ray. Pectoral fin short, fan-like, with round margin and length half of head. Caudal fin very short, having 8 principal rays. Pelvic fin short, 1.4~1.6 times of pupil.

Color of fresh specimens brownish in dorsal half and light in ventral half of body. Irregular vertical lines, 3 in number, on side of body near caudal fin, these lines becoming unclear in formalin and alcohol speciemens. Dorsal half of head brownish and ventral half light. Lower margin of brownish pigment on body and head defined by dark lines. Belly light. Dorsal fin having fairly dark margin and 3 or more spots anteriorly. Peritoneum blackish brown.

Distribution. Off Ishikawa Prefecture and near Sado Island, both Sea of Japan.

Remarks. *Lycodes sadoensis* is closest to *L. teraoi* in regard to fin-ray counts and the proportional measurements which separate these two species from other *Lycodes*. Although, dorsal, anal, and pectoral counts tend to be lower in *L. sadoensis* than in *L. teraoi*, the two species can not be distinguished by these counts. Proportionally, *L. sadoensis* is different from *L. teraoi* in having a somewhat longer upper jaw (Table 6). The other differences are found in coloration. The present species always has a brownish head and body and has vertical lines on the body near caudal fin and three or more dark spots on the dorsal fin in both sexes. On the other hand, *L. teraoi* has a uniformly pale greyish pink body without any markings (Toyoshima and Honma, 1980).

Lycodes diapteroides Taranetz et Andriashev, 1937

Lycodes brevipes diapteroides Taranetz and Andriashev, 1937: 334, figs. 11, 12 (Bering Sea).

The following characters are taken from the original description of the species.

Diagnosis. Lateral line indistinct, anteroventral; beginning at upper end of gill opening, extending downward and backward, disappearing under pectoral fin, and not reaching anus. Pectoral fin shallowly emerginate, the lower six rays with free tips, elongate in comparison with the middle rays and forming a weak lower lobe. Color greyish, lighter below with 13 light bars crossing body, continuing diagonally on dorsal fin. These bars generally faint in adults and alcoholic specimens.

Counts and proportions. Dorsal 99~101, anal 83~85, pectoral 19~20, gill rakers on 1st arch 2~3+11=13~14. Head length 19.8% of total length, preanal length 40.5~42.3, predorsal length 24.0~25.8, depth of body 7.7~9.4, pectoral fin 11.3~13.4, pelvic fin 1.3~1.9, interorbital width 0.6~0.8. Eye diameter 22.8 ~24.3% of head length, snout 28.1~30.9, interorbital width 3.5~4.7, pectoral fin 57.7~70.2, pelvic fin 6.7~10.2.

Distribution. Bering Sea.

Lycodes japonicus Matsubara et Iwai, 1951

(Japanese name: ashinagagenge)

Fig. 39.

Lycodes japonicus Matsubara and Iwai, 1951: 368, figs. 1, 2 (Toyama Bay, Sea of Japan); Matsubara, 1955: 775, fig. 291; Honma, 1963: 21 (off Sado Island, Sea of Japan); Lindberg and Krasyukova, 1975: 143, figs. 113, 114.

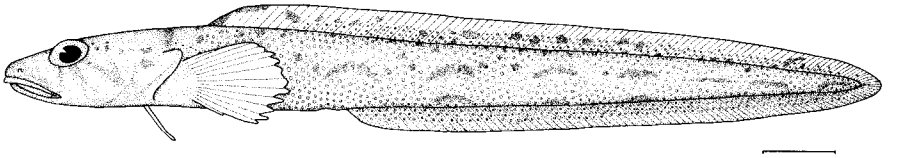

Fig. 39. *Lycodes japonicus* from Toyama Bay, the Sea of Japan. FAKU 13612 (123.9 mm TL, female). Scale indicates 20 mm.

Material examined. FAKU 13115 (106.0 mm TL, female), FAKU 13117 (122.0 mm TL, sex unknown), FAKU 13612 (123.9 mm TL, sex unknown), near Uozu, Toyama Bay, Sea of Japan, about 303 m, June 10, 1950; FAKU 12778 (122.2 m TL, male), FAKU 12770 (129.8 mm TL, male), Toyama Bay, May 15, 1950.

Diagnosis. Pelvic fin long, about as long as or slightly longer than eye diameter. Body light brown. Irregular blotches on side of body. Pectoral 14 ~15. Lateral line anteroventral.

Counts and proportions. Dorsal 79~84, anal 69~73, pectoral 14~15, gill rakers on 1st arch 1~2+8~11=9~13, vertebrae 19~20+68~72=87~93. Head length 4.8~5.6 in total length, predorsal length 4.0~5.1, preanal length 2.6~2.7, depth of body 11.3~15.0, pectoral fin 8.2~10.0. Head width 1.9~2.3 in head length, snout 3.0~3.6, upper jaw 2.2~3.0, lower jaw 2.5~3.2, eye diameter 4.3~5.8, interorbital width 4.6~6.0, depth of body 2.3~2.9, pectoral fin 1.6~2.2, pelvic fin 3.5~4.5, gill opening 3.1~3.9, isthmus width 4.5~5.4.

Description. Body elongate, its depth about 2~3 in head. Head depressed, wider than deep and upper profile greatly elevated above eye; cheeks more or less swollen in male, therefore usually much wider than in male than in female. Snout in front of nostril steep. Eye high in position, entering dorsal profile of head when viewed from lateral side, and large, about as large as or slightly shorter than snout. Interorbital region always much narrower than eye. Mouth small, posterior end of upper jaw below anterior half of eye. Teeth small and sharply pointed; those on upper jaw in 2 rows anteriorly, in a single row posteriorly, outer teeth larger than those in inner; those on lower jaw in 3 rows anteriorly, in a single row laterally and posteriorly; those on prevomer 9~10 in number; those on palatine about 15 in number and arranged in a single row. Minute pores, variable in number, present in operculomandibular, infraorbital, nasal, postorbital, occipital, and predorsal canals. Lateral line indistinct, anteroventral, decurved downward and backward from nape to scarcely beyond anterior 1/3 of pectoral fin. Body densely covered with scales; belly, basal halves of vertical fins also scaled; head scaleless. Dorsal fin originating above anterior 1/3 of pectoral fin. Anal fin originating below 15th or 16th dorsal ray. Pectoral fin moderately long, longer than postorbital head length, and lower 5 rays more or less deeply incised. Pelvic fin slender, about as long as or slightly longer than eye.

Color in alcohol brownish with irregular-shaped dark brown blotches on side of body, head and dorsal fin. Vertical fins and anterior half of pectoral fin dark grey. Oral and branchial cavities and peritoneum dark brown.

Distribution. Toyama Bay, Sea of Japan.

Lycodes tanakai Jordan et Thompson, 1914
(Japanese name: tanakagenge)
Figs. 40, 41.

Lycodes tanakae Jordan and Thompson, 1914: 299, pl. 37, fig. 2 (Sea of Japan); Lindberg and Krasyukova, 1975: 160, fig. 126 (eastern coast of Sakhalin, Okhotsk Sea).

Lycodes tanakai: Matsubara and Iwai, 1951: 373 (Sea of Japan); Hikita and Misu, 1951: 49 (western coast of Hokkaido); Katayama, 1949: 76 (Toyama Bay, Sea of Japan); Matsubara, 1955: 778; Honma, 1963: 21 (off Sado Island, Sea of Japan); Honma and Sugihara, 1963: 8 (off Sado Island); Toyoshima, 1983: 261, pl. 151 (Okhotsk Sea).

Lycodes brevicauda Taranetz and Andriashev, 1935: 248, figs. 4, 5 (Okhotsk Sea); Taranetz, 1937: 163 (Okhotsk Sea); Okada and Matsubara, 1938: 407; Matsubara, 1955: 778.

Lycodes schmidti brevicauda: Schmidt, 1950: 89 (northwestern Okhotsk Sea, eastern coast of Sakhalin, western coast of Kamchatka).

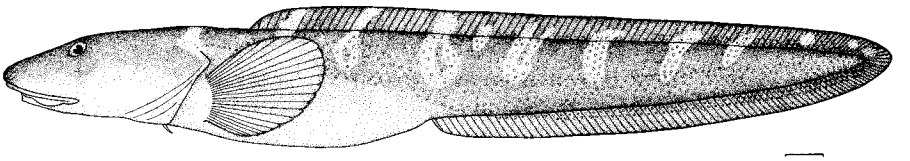

Fig. 40. *Lycodes tanakai* from the Sea of Japan. HUMZ 41273 (516.0 mm TL, female). Scale indicates 20 mm.

Material examined. HUMZ 33985 (664.7 mm TL, male), southern Okhotsk Sea, October 27, 1974; HUMZ 41103 (261.0 mm TL, female), HUMZ 41106 (323.0 mm TL, male), off Kasumi, Sea of Japan, December 20, 1963; HUMZ 41228 (643.0 mm TL, female), HUMZ 41230 (860.0 mm TL, male), HUMZ 41232 (630.0 mm TL, female), HUMZ 41247 (361.7 mm TL, male), HUMZ 41248 (336.5 mm TL, male), HUMZ 41249 (422.8 mm TL, male), HUMZ 41254 (386.7 mm TL, male), HUMZ 41255 (359.9 mm TL, male), HUMZ 41256 (393.0 mm TL, male), HUMZ 41257 (380.5 mm TL, male), HUMZ 41260 (383.0 mm TL, male), HUMZ 41273 (516.0 mm TL, female), Wakasa Bay, Sea of Japan, March 27, 1975; HUMZ 53278 (749.6 mm TL, male), 45°14.5′N, 143°19′E, Okhotsk Sea, 175 m, June 1, 1976; HUMZ 53294 (912.8 mm TL, male), 45°16.5′N, 143°33′E, Okhotsk Sea, 165 m, June 1, 1976; HUMZ 53896 (335.2 mm TL, female), 38°07.5′N, 136°52.2′E, Okhotsk Sea, 506 m, June 18, 1976.

Diagnosis. Preanal length about 2 in total length. Numerous transverse light bands or irregular-shaped blotches on body and dorsal fin. Lateral line midlateral. Dorsal 96~98, anal 77~79.

Counts. Dorsal 96~98, anal 77~79, pectoral 19~20, gill rakers on 1st arch 3~4+13=16~17, vertebrae 25~26+77~81=103~107.

Proportions of young specimens. Head length 4.4~4.6 in total length, depth of body 10.8~12.7, pectoral fin 6.9~7.9, preanal length 2.1~2.2, predorsal length 3.5~4.2. Head width 1.7~2.3 in head length, snout 3.4~3.7, upper jaw 2.3~3.0, isthmus width 3.9~5.5, interorbital width 5.4~8.7, depth of body 2.4~2.8, pectoral fin 1.5~1.8, gill opening 1.6~2.7. Eye diameter 1.8~2.8 in snout, 2.2~4.1 in upper jaw, 0.7~1.8 in interorbital width. Pelvic fin 1.2~1.5 in eye diameter.

Proportions of adult male and female specimens. Proportions of females are shown in parentheses. Head length 3.7~4.7 (4.4~4.9) in total length, depth of

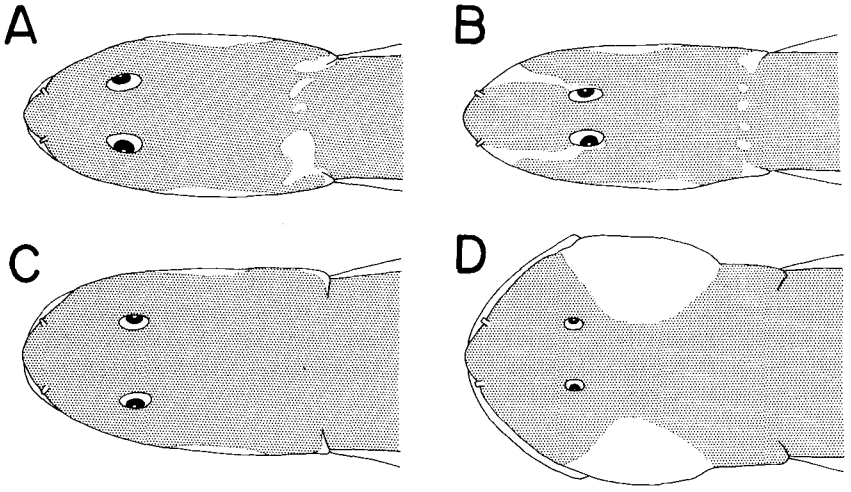

Fig. 41. Schematic illustrations to show the color patterns and shape of head in *Lycodes tanakai*. A, HUMZ 41273 (516.0 mm TL, female); B, HUMZ 41103 (261.0 mm TL, female); C, HUMZ 41228 (643.0 mm TL, female); D, HUMZ 41230 (860.0 mm TL, male).

body 7.7~10.6 (8.4~9.8), pectoral fin 7.5~8.2 (7.3~7.8), preanal length 2.0~2.2 (1.9~2.1), predorsal length 3.4~3.9 (3.6~3.8). Head width 1.3~2.0 (1.5~1.7) in head length, snout 3.2~4.5 (3.1~3.9), upper jaw 1.7~2.3 (2.0~2.4), eye diameter 10.2~14.5 (7.9~10.2), isthmus width 3.1~3.9 (2.8~3.8), interorbital width 4.7~9.7 (5.0~6.2), depth of body 1.8~2.5 (1.8~2.2), pectoral fin 1.6~2.5 (1.5~1.8), gill opening 1.9~2.5 (1.9~2.3). Eye diameter 2.8~4.0 (2.4~3.3) in snout, 4.7~7.5 (3.0~4.5) in upper jaw, 1.1~2.5 (1.5~2.0) in interorbital width. Pelvic fin 1.0~1.3 (1.1~1.6) in eye diameter, nostril tube 1.7~2.6 (2.1~2.5).

Description. Body elongate, compressed, tapering to tail. Head moderately large, about 4~5 in total length. Head width changeable by sexual dimorphism (Fig. 41). Snout rounded, about 4 in head. Chin crest well developed, free anteriorly. Nostril tube short, less than half of eye. Branchiostegal membranes united to isthmus, isthmus width 4~5 in head. Mouth very large. Posterior end of upper jaw extending below anterior half of eye, posterior half of eye, or beyond posterior end of it. Teeth conical; those on upper jaw in a single row; those on lower jaw in a broad band (irregular 3~4 rows) anteriorly; prevomer with a group of about 6 teeth; those on palatine in a single row. Teeth on palatine, prevomer, and lateral portion of lower jaw usually weakly developed. Body covered with small cycloid scales; vertical fins also scaled; head and belly naked. Scales denser in posterior portion of body. Dorsal fin originating above middle of pectoral fin. Vertical fins thickened, especially in larger specimens. Pectoral fin rounded, moderately large, and more than half of head. Pelvic fin small, longer than eye diameter.

Color in alcohol and fresh specimens brownish or greyish brown. In young specimens many light bars (10~19) on body and extending onto dorsal fin. These bars very variable and irregular in adults. Sometimes in smaller specimens many irregular-shaped light blotches (round, oval, etc.) on body. Variously-shaped

blotches, band-like, rounded, or oval on occipital region (Fig. 41). A pair of narrow light bars extending from eye to tip of snout, especially in smaller specimens; in adults, large specimens these bars absent. Base of pectoral fin, ventral surface of head, and belly light. Head darker than side of body. Margins of vertical fins blackish. Peritoneum blackish brown. Oral cavity light.

Sexual dimorphism. In the male the head is wider (about half of head length) than in female and young specimens (Fig. 41). Upper jaw extends to below posterior half of eye or beyond posterior margin of eye in male, while in female and young it reaches below anterior half of eye. In male, teeth are fewer, larger, and stronger than those in female; those on palatines are larger and widely spaced.

Distribution. Sea of Japan (from off Shimane Prefecture to Tater Strait), Okhotsk Sea.

Remarks. This species is very abundant in the Sea of Japan where it shows much intraspecific variation in the shape of blotches and bars reported in detail by Katayama (1949). In addition it is known that this species shows the sexual dimorphism in dentition, size of eye, head width, and upper jaw length.

Lycodes knipowitschi Popov, 1931
(Japanese name: nisewaijigenge)
Fig. 42.

Lycodes knipowitschi Popov, 1931: 138, 152, pl. 2, fig. 4 (Okhotsk Sea); Andriashev, 1937: 337 (Chuckchee Sea, Anadyr Bay); Taranetz, 1937: 164; Schmidt, 1950: 101; Matsubara, 1955: 778.
Lycodes knipowitschi panthera Schmidt, 1950: 103, pl. 8, fig. 2 (northern Okhotsk Sea).
Lycodes pantera: Matsubara, 1955: 778.

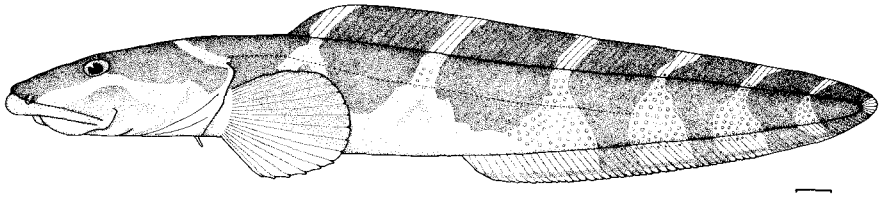

Fig. 42. *Lycodes knipowitschi* from the western coast of Kamchatka. HUMZ 61111 (253.9 mm TL, male). Scale indicates 10 mm.

Material examined. HUMZ 54243 (489.9 mm TL, sex unknown), 61°27.0′N, 174°30.03′E, Bukhta Bay, Bering Sea, 60~65 m, July 26, 1976; HUMZ 55401 (425.6 mm TL, male), 61°01′N, 159°00′E, northern Okhotsk Sea, 77~80 m, June 7, 1976; HUMZ 57675 (444.0 mm TL, male), HUMZ 57676 (385.4 mm TL, sex unknown), 54°29′N, 140°49′E, northern Okhotsk Sea, 68 m, September 6, 1976; HUMZ 58098 (378.0 mm TL, male), HUMZ 58100 (314.0 mm TL, male), 54°31′N, 140°51′E, northern Okhotsk Sea, 78 m, September 21, 1976; HUMZ 61099 (386.2 mm TL, male), HUMZ 61101 (332.4 mm TL, female), HUMZ 61111 (253.9 mm TL, male), 54°30′N, 141°00′E, eastern Okhotsk Sea, 69 m, September 6, 1976.

Diagnosis. Body with saddle-like or Y-shaped marks. Scales relatively well developed, reaching pectoral tip. Lateral line midlateral.

Counts and proportions. Dorsal 82~85, anal 65~67, pectoral 17~19, gill rakers on 1st arch 2~3+10~12=12~15, vertebrae 24~26+68=92~94. Head

length 3.6~4.0 in total length, preanal length 1.8~2.0, predorsal length 3.0~3.4, depth of body 9.7~11.5, pectoral fin 6.7~8.8. Head width 1.4~1.9 in head length, snout 2.5~3.1, upper jaw 1.8~2.0, lower jaw 2.1~2.6, eye diameter 8.4~13.9, interorbital width 3.9~5.5, depth of body 2.5~3.0, pectoral fin 1.7~2.2, pelvic fin 8.2~15.7, gill opening 2.5~3.0, isthmus width 2.4~4.6.

Description. Body relatively short, its depth about 10 in total length. Caudal region very short, preanal length less than 2 in total length. Head moderately large, depressed and very wide, its length about 4 in total length and its width less than 2 in head length. Snout rather blunt in dorsal profile, less than 3 in head. Eye small and always smaller than interorbital width, its diameter 8~14 in head. Mouth relatively large; posterior end of upper jaw usually extending beyond posterior margin of eye. Lips gelatinous, wide, and thickened. Labial lobe well developed. Chin crest on each side relatively prominent and not united anteriorly. Gill opening moderately large, its lower end extending downward beyond lower base of pectoral fin. Lateral line midlateral, posterior lateral line somewhat poorly expressed. Teeth small and conical; those on upper jaw in 2 or 3 rows anteriorly, in a single row laterally and posteriorly; those on lower jaw in 2~5 rows anteriorly, in a single row laterally and posteriorly; those on prevomer 4~7 in number; those on palatine 9~10 in number and arranged in a single row. Scales only reaching pectoral tip and sparse on trunk region. Dorsal fin originating above middle of pectoral fin. Anal fin originating below 23rd dorsal ray. Pectoral fin large, fan-like in shape, its length about 2 in head length. Pelvic fin short, its length about equal to eye diameter.

Ground color in alcohol light. Dark brownish saddle-like or Y-shaped marks on body, 6~8 in number, and extending onto dorsal fin. One longitudinal, greyish bar sometimes present near distal margin of anal fin. Dorsal surface of head dark brownish. One light horseshoe-shaped band connecting upper ends of gill opening. Ventral side of head, lips, and belly light. Pectoral fin sometimes greyish in dorsal half and light in ventral half. Oral and branchial cavities light. Peritoneum also light.

Distribution. Okhotsk and Bering seas.

Remarks. The present species is most closely related to *L. mucosus* known from the Bering Sea and Arctic Ocean. It is easily separable from the latter in having much denser scaling than in *L. mucosus* (see remarks on *L. mucosus*). Andriashev (1954) stated that the present species should be described as the subspecies of *L. mucosus* under the name of *L. mucosus knipowitschi*. However, the subspecies rank has not adopted here because the present species can be easily distinguished from *L. mucosus* and also because use of the subspecies has brought much confusion to the taxonomy of *Lycodes*.

Lycodes paucilepidotus sp. nov.
(New Japanese name: hagemayugaji)
Fig. 43.

Holotype. HUMZ 58117 (425.0 mm TL, male), 58°33′N, 147°25′E, northern Okhotsk Sea, 138 m, September 10, 1976.

Paratypes. HUMZ 55142 (213.6 mm TL, male), HUMZ 55144 (164.5 mm TL, sex un-

known), HUMZ 55159 (158.3 mm TL, male), 59°59′N, 160°00′E, northern Okhotsk Sea, 112 ~113 m, June 6, 1976; HUMZ 57658 (373.0 mm TL, male), 47°43′N, 144°10′E, eastern coast of Sakhalin, 120 m, September 30, 1976; HUMZ 57659 (431.0 mm TL, female), 57°28′N, 148° 27′E, northern Okhotsk Sea, 170 m, September 11, 1976; HUMZ 57792 (343.4 mm TL, female), 58°28′N, 150°10′E, northern Okhotsk Sea, 131 m, September 26, 1976; HUMZ 57862 (354.2 mm TL, female), HUMZ 57865 (347.4 mm TL, female), HUMZ 56867 (351.7 mm TL, male), HUMZ 57868 (410.8 mm TL, female), HUMZ 57869 (342.2 mm TL, female), 56°12′N, 140°29′E, northern Okhotsk Sea, 156 m, September 8, 1976; HUMZ 58058 (418.7 mm TL, female), HUMZ 60844 (221.8 mm TL, sex unknown), HUMZ 60846 (174.6 mm TL, sex unknown), 55°30′N, 139°00′E, northwestern Okhotsk Sea, 117 m, September 7, 1976; HUMZ 58117 (425.0 mm TL, male), 58°33′N, 147°25′E, northern Okhotsk Sea, September 10, 1976; HUMZ 58222 (360.5 mm TL, male), HUMZ 58224 (252.2 mm TL, female), 55°00′N, 142°02′E, north of Sakhalin, 121 m, September 6, 1976; HUMZ 60756 (615.2 mm TL, male), 57°58′N, 150°22′E, northern Okhotsk Sea, 165 m, October 11, 1976; HUMZ 60814 (206.8 mm TL, sex unknown), HUMZ 60815 (204.7 mm TL, male), HUMZ 60816 (156.5 mm TL, sex unknown), HUMZ 60817 (147.8 mm TL, sex unknown), HUMZ 60818 (187.8 mm TL, sex unknown), HUMZ 60819 (159.8 mm TL, male), HUMZ 60820 (161.0 mm TL, sex unknown), HUMZ 60822 (149.0 mm TL, sex unknown), HUMZ 60823 (103.5 mm TL, sex unknown), 60°01′N, 159°19′E, northern Okhotsk Sea, 120 m, June 6, 1976; HUMZ 61071 (215.0 mm TL, female), 55°23′N, 139°12′E, northwestern Okhotsk Sea, 120 m, October 16, 1976; HUMZ 61458 (229.0 mm TL, male), 56°55′N, 140°36′E, northwestern Okhotsk Sea, September 8, 1976; HUMZ 61480 (213.4 mm TL, male), HUMZ 61497 (190.0 mm TL, sex unknown), 55°00′N, 144°02′E, north of Sakhalin, September 6, 1976; HUMZ 61506 (158.0 mm TL, sex unknown), HUMZ 61509 (196.5 mm TL, sex unknown), HUMZ 61512 (218.5 mm TL, sex unknown), 55°02′N, 141°54′E, northwestern Okhotsk Sea, 138 m, September 6, 1976; HUMZ 68063 (703.3 mm TL, male), 44° 31′N, 140°17′E, northwestern Hokkaido, Sea of Japan, 315~330 m, May 16, 1977.

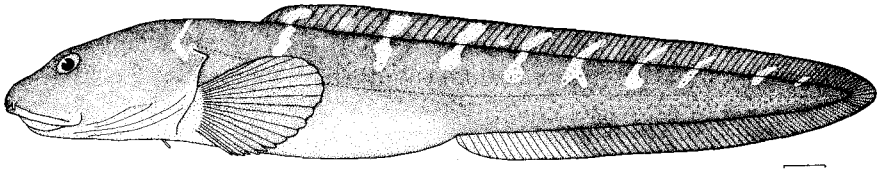

Fig. 43. Holotype of *Lycodes paucilepidotus* from the Okhotsk Sea. HUMZ 58117 (425.0 mm TL, male). Scale indicates 20 mm.

Diagnosis. Belly and area above pectoral fin completely scaleless. Preanal distance long, its length about 2 in total length. Lateral line midlateral. Body with light bars or irregular-shaped marks. Dorsal 85~90, anal 64~70.

Counts and proportions. Counts and proportions of the holotype are given first, followed by those of paratypes in parentheses. Dorsal 86 (85~90), anal 67 (64 ~70), pectoral 19 (18~21), vertebrae 25+67=92 (25~27+66~71=91~98). Head length 3.9 (3.8~4.4) in total length, predorsal length 3.1 (3.3~3.7), preanal length 2.0 (1.8~2.2), depth of body 10.2 (9.1~12.3), pectoral fin 7.4 (6.0~7.9). Head width 1.8 (1.7~2.5) in head length, snout 3.2 (2.9~3.7), upper jaw 2.3 (2.2 ~2.7), lower jaw 2.7 (2.5~3.1), eye diameter 8.9 (5.0~8.9), interorbital width 7.0 (6.0~11.8), depth of body 3.0 (1.8~2.8), pectoral fin 1.9 (1.4~2.0), pelvic fin 7.5 (6.3 ~13.3), gill opening 2.5 (2.3~3.0), isthums width 3.6 (3.1~4.8).

Description of holotype and paratypes. Body moderately elongate, not very

deep, its depth about equal to pectoral base. Caudal region very short, clearly shorter than preanal length. Head moderately lerge and wide, its length more than 2 in preanal length, and its width about equal to its depth. Snout moderately blunt in dorsal profile and moderately long, its length more than twice eye diameter. Nostril tube short, sometimes overhanging on upper lip. Eye small and high in position, its diameter longer than pelvic fin. Interorbital region highly convex, relatively narrow, and equal to eye. Lips thickened. Labial lobe prominently developed. Mouth large. Posterior margin of upper jaw reaching below posterior margin of eye. Chin crests moderately developed, not united anteriorly. Branchiostegal membranes widely connected to isthmus, its width a little shorter than snout. Gill opening relatively small, its lower end extending downward slightly beyond lower base of pectoral fin. Teeth conical and relatively strong; those on upper jaw in a single row; those on lower jaw in 3 rows grouped in a small patch, in a single row laterally and posteriorly where they strong, large, and widely spaced; those on prevomer 8 (7~12 in paratypes) in number; those on palatine 11 (9~15) in number and arranged in a single row. Scales weakly developed; head, belly, and vertical fins completely scaleless; dorsum before dorsal-fin origin also scaleless; on side of body scales extending anteriorly a little beyond pectoral tip. Lateral line midlateral, distinct, starting from upper end of gill opening, gradually descending, and running midlaterally on body almost to caudal base. Dorsal fin originating above middle of pectoral fin. Anal fin originating rather posteriorly, its origin at about midpoint of body. Pectoral fin large, fan-shaped, and its length about equal to head width. Pelvic fin very short, about equal to pupil diameter.

Color in alcohol dark greyish. Light transverse bars (or irregular blotches), 9 (9 or 10) in number, on body extending onto dorsal fin. A similar light bar connecting upper ends of gill openings. Ventral side of head and belly light. Dorsal side of head and vertical fins similarly dark brown to side of body. Nostril tube greyish. Pectoral fin greyish. Oral and branchial cavities light. Peritoneum and stomach light.

Distribution. Okhotsk Sea, northern Sea of Japan.

Etymology. The *paucilepidotus* is taken from the weak developement of scales which is one of the diagnostic characters.

Remarks. The new species is most closely related to *L. sigmatoides* in having similar pattern of blotches, long preanal length, midlateral lateral line, and in the agreement of almost all proportional measurements. However, it is clearly separable from the latter in the weak development of scale cover; the belly and the area above pectoral fin are completely scaleless, while these regions are scaled in the latter. Further, the present species also differs from *L. sigmatoides* in the number of dosral and anal rays; dorsal 85~90 and anal 64~70 as against 93~96 and 72~76 respectively in the latter.

Lycodes raridens Taranetz et Andriashev, 1937
(Japanese name: kitanogenge)
Fig. 44.

Lycodes sp. Schmidt, 1904: 199 (off Cape Rymnik of Sakhalin).

Lycodes knipowitschi Popov, 1931: 139 (in part, Okhotsk Sea).
Lycodes raridens Taranetz and Andriashev, 1937: 335, fig. 14 (Chuckchee, Bering, and Okhotsk seas); Schmidt, 1950: 87, pl. 5, fig. 2 (Okhotsk Sea); Andriashev, 1954: 289, Fig. 160 (Chuckchee, Bering, and Okhotsk seas); Okada and Kobayashi, 1968: 64, pl. 9, fig. 34 (Bering Strait, Bristol Bay); Lindberg and Krasyukova, 1975: 161, fig. 128 (Okhotsk Sea).

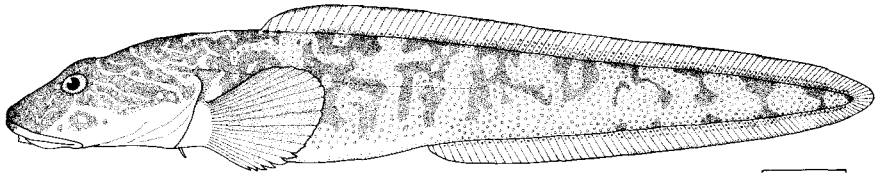

Fig. 44. *Lycodes raridens* from the Okhotsk Sea. HUMZ 61115 (199.8 mm TL, female). Scale indicates 20 mm.

Material examined. HUMZ 56598 (230.6 mm TL, male), 58°30′N, 151°57′E, Okhotsk Sea, 119~120 m, June 9, 1976; HUMZ 57657 (290.0 mm TL, male), 47°43′N, 144°10′E, Okhotsk Sea, 120 m, September 30, 1976; HUMZ 57658 (364.9 mm TL, male), 54°29′N, 140°49′E, Okhotsk Sea, 68 m, September 6, 1976; HUMZ 57679 (325.6 mm TL, male), HUMZ 57976 (367.6 mm TL, sex unknown), HUMZ 57978 (333.6 mm TL, male), 51°32′N, 138°08′E, Okhotsk Sea, 85 m, September 7, 1976; HUMZ 61115 (199.8 mm TL, female), 54°30′N, 141°00′E, Okhotsk Sea, 69 m, September 6, 1976; HUMZ 76110 (576.6 mm TL, sex unknown), HUMZ 76225 (447.4 mm TL, female), 57°33.3′N, 166°46.2′W, Bering Sea, 68 m, May 30, 1978; HUMZ 76947 (518.0 mm TL, male), HUMZ 76948 (505.4 mm TL, sex unknown), HUMZ 77157 (310.2 mm TL, sex unknown), HUMZ 77158 (289.6 mm TL, male), HUMZ 77159 (255.7 mm TL, male), HUMZ 77160 (320.7 mm TL, female), 58°39.5′N, 172°47.5′W, Bering Sea, 110 m, June 15, 1978; HUMZ 86883 (170.2 mm TL, female), 66°09′N, 168°25′W, Chuckchee Sea, June 30, 1964.

Diagnosis. Lateral line midlateral. Belly scaleless. Irregular-shaped or bar-like blotches on body. Horseshoe-shaped light band connecting upper ends of gill openings. Dorsal side of head with irregular light blotches.

Counts and proportions. Dorsal 80~84, anal 63~65, pectoral 18~20, vertebrae 24~25+64~66=88~91. Head length 3.9~4.6 in total length, predorsal length 3.4~3.9, preanal length 2.0~2.3, depth of body 8.1~10.5. Head width 1.6~2.6 in head length, snout 2.8~3.3, upper jaw 2.0~2.4, lower jaw 2.4~2.9, eye diameter 6.6~13.4, interorbital width 4.4~6.8, depth of body 1.9~2.4, pectoral fin 1.6~2.0, pelvic fin 8.3~15.0, gill opening 2.3~2.8, isthmus width 3.1~4.8.

Description. Body relatively short, moderately deep, its depth about half of head. Preanal distance long, its length about half of total length. Snout blunt, rather long, and its length about 3 in head. Eye high in position, very small, and more than 6 in head. Interorbital region moderately wide, its width usually longer than eye diameter. Chin crest prominently developed, not united anteriorly. Mouth variable in size; posterior end of upper jaw below anterior margin of eye or extending below posterior half of it. Teeth conical; those on upper jaw in a single row; those on lower jaw in 2 rows anteriorly in a single row laterally and posteriorly; those on prevomer 2~4 in number and in a group; those on palatine 6~8 in number and arranged in a single row. Body covered with small relatively spaced

scales; head and belly scaleless; dorsum also scaleless; base of vertical fins scaled. Lateral line midlateral. Dorsal fin originating above middle of pectoral fin. Pectoral fin relatively large, fan-shaped, its length about equal to postorbital head length. Pelvic fin moderate in size, its length about equal to eye diameter.

Color in alcohol light in ground color. Dark greyish blotches, sometimes becoming band-like, on body. Pectoral fin light greyish. Characteristic horseshoe-shaped light band connecting upper ends of gill openings. Head dark dorsally and with irregular light blotches. Oral and branchial cavities, and peritoneum light.

Distribution. Okhotsk, Chuckchee, and Bering seas.

Lycodes mucosus Richardson, 1855
(Japanese name: numerigenge)
Fig. 45.

Lycodes mucosus Richardson, 1855: 362, pl. 26, figs.1~5 (Northumberland Sound, Arctic Ocean); Goode and Bean, 1895: 306; Jordan and Evermann, 1898: 2470 (Arctic Ocean).

Lycodes coccineus Bean, 1881: 144 (Bering Strait).

Lycodes mucosus coccineus: Andriashev, 1954: 278, figs. 148, 149 (Anadyr Bay, Chuckchee Sea); Okada and Kobayashi, 1968: 59, pl. 8, fig. 31 (Bering Strait).

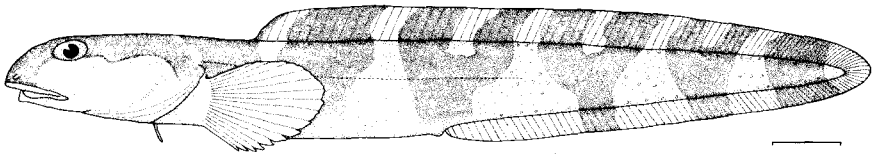

Fig. 45. *Lycodes mucosus* from the Bering Strait. HUMZ 86882 (126.5 mm TL, male). Scale indicates 10 mm.

Material examined. HUMZ 42794 (240.0 mm TL, male), 71°24′N, 156°43′W, near Point Barrow, Beaufort Sea, about 825 m, September 2, 1973; HUMZ 86882 (125.6 mm TL, male), 64°30′N, 167°58′W Bering Strait, July 29, 1964.

Diagnosis. Body with Y-shaped blotches. Scales weakly developed, limited to posterior half of body, and absent in smaller specimens. Lateral line midlateral.

Counts and proportions. Dorsal 85, anal 66, pectoral 17~18, vertebrae 25~29+65~67=92~94, gill rakers on lst arch 2+10=12. Head length 4.1~4.5 in total length, depth of body 10.2~10.3, pectoral fin 6.4~7.0, preanal length 2.0, predorsal length 4.0~4.1. Head width 1.0~1.5 in head length, snout 3.1~3.8, upper jaw 2.3~2.6, eye diameter 6.3~7.7, interorbital width 4.9~5.6, depth of body 2.3~2.5, pectoral fin 1.4~1.7, gill opening 2.5~3.0. Pelvic fin 1.1~1.4 in eye diameter.

Description. Body relatively short, its depth about 10 in total length. Head moderately large and wide, more or less depressed, its length about 1/4 of total length and its width about equal to or larger than head. Eye high in position and oval in shape. Chin crest weakly developed, free anteriorly. Labial lobe well developed. Mouth wide, posterior end of upper jaw below anterior half of eye in female, extending beyond posterior margin of eye in male. Teeth small and

conical; those on upper jaw in a single row laterally, partly in 2 rows anteriorly; those on lower jaw in a single row laterally and in 2 rows anteriorly; those on prevomer 4~6 in number; those on palatine 8~10 in number and arranged in a single row. Scales only sparsely scattered on posterior half of body. Lateral line midlateral. Dorsal fin originating above middle of pectoral fin. Pectoral fin relatively large, about 2/3 of head. Pelvic fin small, about equal to or larger than eye.

Color in alcohol light brown or blackish brown. Ventral surface of head, pelvic fin, and pectoral fin light. Large brownish blotches, 6 in number, on body and they extending onto dorsal fin; 3rd and 4th ones Y-shaped and forked dorsally, last 3 extending onto anal fin. One, light, horseshoe-shaped band connecting upper ends of gill openings. Margins of vertical fins darker. Oral and branchial cavities, and peritoneum light.

Distribution. Bering Sea, Arctic Ocean.

Remarks. This species has been variously treated as shown in the list of synonyms based on the difference of the scale cover. Three species which have weakly developed scale covers had been considered to be closely related; *L. coccineus* described from the Arctic Ocean, *L. mucosus* from the Bering Sea, and *L. knipowitschi* from the Okhotsk Sea. These species are different only in the scale cover as follows (Andriashev, 1954).

L. coccineus from Bering Strait is completely naked in young specimen (126 mm in total length) and sparsely located scales cover the posterior part of body without reaching median fins in larger specimens (150~327 mm in total length). *L. mucosus* from the Canadian and American Arctic Ocean is completely naked, while in the adult specimens from the Bering and Chuckchee Seas have scales. *L. knipowitschi* has even denser scales which reach the end of pectoral fin and cover the basal half of vertical fins in adult specimens (278~301 mm in total length).

In other words, apart from *L. knipowitschi*, Andriashev (1954) suggested that the scale cover becomes denser with growth concerning *L. coccineus* and that there are geographic variation in the scale cover of *L. mucosus*. These facts show that we can not separate these two species if the localities of the specimens were unknown. Further, the present two specimens from the Bering Strait and Beaufort Sea have the similarly scattered scales although the localities are far apart. In conclusion, it is considered to be best to unite these two species in a single one as Andriashev (1954) proposed.

Also, he (1954) admitted three subspecies in *L. mucosus*; *L. mucosus mucosus*, *L. mucosus coccineus*, and *L. mucosus knipowitschi*. The establishment of the subspecies rank for the former two is quite meaningless because they can not be distinguished as already noted. Hence, the specific name *mucosus* was adopted here.

While, Okhotsk form which was treated as *L. mucosus knipowitschi* is always clearly separable. Therefore, it was described as an independent species (see the remarks on *L. knipowitschi*).

Lycodes turneri Bean, 1878
(Japanese name: hokkyokugenge)

Lycodes turneri Bean, 1878: 463 (Michael Island in Norton Sound of Alaska); Andriashev, 1954: 536, figs. 298, 299 (Anadyr Bay); Okada and Kobayashi, 1968: 58, pl. 8, fig. 30 (Bering Strait).

Lycodalepis turneri: Jordan and Gilbert, 1899, 485; Evermann and Goldsborough, 1907: 344, fig. 121.

Lycodalepis polaris Jordan and Evermann, 1898: 2468, fig. 857.

The following description is based on Jordan and Evermann (1898), Andriashev (1954), and Okada and Kobayashi (1968).

Diagnosis. Body scaleless. Head wide, depressed, its width about 1.4 times of its depth and almost 3/4 of its length. Preanal distance long, about half of total length. Interorbital region wide, width about 1/10 of head length. Lateral line midlateral. Light transverse bands, 11~12 in number, on body.

Counts and proportions. Dorsal 83~85, anal 65~67, pectoral 18, vertebrae 100. Head length 22.1% of total length, predorsal length 27.8, preanal length 49.0, depth of body 11.1, pectoral fin 14.1. Upper jaw 52.0% of head length, interorbital width 10.4.

Distribution. Bering Sea, Arctic Ocean.

Lycodes heinemani Soldatov, 1916
(Japanese name: wanukegenge)
Fig. 46.

Lycodes heinemani Soldatov, 1916: 215, fig. 1 (Okhotsk Sea); Soldatov and Lindberg, 1930: 493, fig. 70 (Okhotsk Sea); Taranetz, 1937: 164 (Okhotsk Sea); Schmidt, 1950: 103 (Okhotsk Sea); Matsubara, 1955: 776.

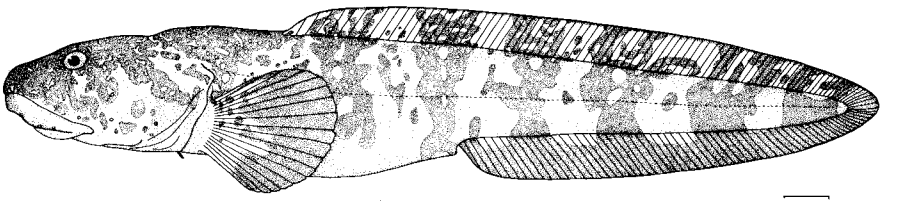

Fig. 46. *Lycodes heinemani* from the Okhotsk Sea. HUMZ 60692 (377.4 mm TL, male). Scale indicates 20 mm.

Material examined. HUMZ 57650 (247.2 mm TL, female), 47°43′N, 144°10′E, Okhotsk Sea, 120 m, September 30, 1976; HUMZ 57682 (201.3 mm TL, female), HUMZ 57684 (216.4 mm TL, male), 54°00′N, 140°49′E, Okhotsk Sea, 68 m, September 6, 1976; HUMZ 57977 (258.9 mm TL, male), HUMZ 57987 (226.0 mm TL, male), HUMZ 57979 (264.0 mm TL, male), HUMZ 57971 (159.6 mm TL, male), HUMZ 57983 (208.2 mm TL, male), 55°32′N, 138°08′E, Okhotsk Sea, 85 m, September 7, 1976; HUMZ 58097 (191.3 mm TL, female), HUMZ 58101 (258.9 mm TL, sex unknown), 54°31′N, 140°51′E, Okhotsk Sea, 78 m, September 21, 1976; HUMZ 60692 (377.4 mm TL, male), HUMZ 60693 (397.1 mm TL, male), HUMZ 61081 (419.2 mm TL, male), HUMZ 61082 (183.7 mm TL, male), HUMZ 61084 (328.2 mm TL, male), HUMZ 61089 (200.0 mm TL, male), 55°02′N, 141°54′E, Okhotsk Sea, 138 m, September 6, 1976; HUMZ 61096

(207.8 mm TL, male), HUMZ 61120 (354.5 mm TL, male), 54°30′N, 141°00′E, Okhotsk Sea, 69 m, September 6, 1976.

Diagnosis. Body completely scaleless. Six transverse dark bars with round spots on body. Head large, about 4 in total length. Lateral line midlateral. Vertical fin-ray counts relatively fewer, dorsal 83~88, anal 62~68.

Counts and proportions. Dorsal 83~88, anal 62~68, pectoral 18~21, gill rakers on 1st arch 2+12~13=14~15, vertebrae 23~25+64~70=87~95. Head length 3.8~4.4 in total length, predorsal length 3.1~3.8, preanal length 1.8~2.1, depth of body 8.7~10.4, pectoral fin 6.2~9.1. Head width 1.9~2.4 in head length, snout 2.8~3.3, upper jaw 1.8~2.3, lower jaw 2.2~3.0, eye diameter 6.1~9.1, interorbital width 5.4~7.6, depth of body 2.0~2.7, pectoral fin 1.7~2.2, pelvic fin 7.6~12.3, gill opening 2.1~2.7, isthmus width 3.1~6.4.

Description. Body elongate, relatively short, and its depth about 9~10 in total length. Head large, about 4 in total length. Snout long, about 3 in head length. Eye more or less small, clearly shorter than snout. Interorbital region moderately wide, its width about equal to eye. Mouth moderate in size, upper jaw 2~3 in head. Lips thickened. Chin crest low but distinct at tips. Teeth conical; those on upper jaw in a single row; those on lower jaw in 3 rows anteriorly, in a single row posteriorly; those on prevomer 3~4 in number; those on palatine in a single row. Lateral line midlateral. Body scaleless. Dorsal fin originating above middle of pectoral fin. Pectoral fin large, about 2 in head length. Pelvic fin very small, especially in larger specimens, usually about equal to pupil.

Color in alcohol light grey with brown band-like blotches. Head dark with numerous light spots. Two light bands with irregular margin running from eye obliquely downward. On lateral surface of body 6 intricately outlined transverse dark bars with round spots and these bars extending onto dorsal fin. Anal fin blackish. Ventral surface of head and belly light. Pectoral fin grey with vague and irregular transverse bands and spots. Transverse bands more regular and distinct in young specimens.

Distribution. Okhotsk Sea.

Lycodes bathybius Schmidt, 1950

Lycodes bathybius Schmidt, 1950: 105, pl. 9, fig. 2 (southern extremity of Kamchatka).

This species has been represented by the holotype (64.5 mm in total length). The following description is based on Schmidt (1950).

Diagnosis. Head with small pores in interorbital, infraorbital, mandibular, occipital, and preopercular canals. Scales completely absent. Lateral line midlateral. Body yellowish grey. Head yellow. Vertical fins grey with almost black margin. Pelvic fin black except for its tip. Oral and branchial cavities, and peritoneum black.

Counts and proportions. Dorsal 98, anal 90, pectoral 21. Predorsal length 23.3% of standard length, preanal length 37.2, pectoral fin 14.2, pelvic fin 5.4.

Distribution. Known from the southern extremity of Kamchatka at a depth of 591 m.

Lycodes sigmatoides Lindberg et Krasyukova, 1975
(Japanese name: esujigaji)

Lycodes schmidti Soldatov, 1917: 115, fig. 2 (Okhotsk Sea); Soldatov and Lindberg, 1930: 496 (Okhotsk Sea); Okada and Matsubara, 1938: 407; Hikita and Misu, 1951: 48 (northern Sea of Japan); Matsubara, 1955: 48.

Lycodes schmidti schmidti: Schmidt, 1950: 88 (Okhotsk Sea).

Lycodes sigmatoides Lindberg and Krasyukova, 1975: 161, fig. 127 (Okhotsk Sea).

The following description is based on Soldatov (1917).

Diagnosis. S-shaped or Y-shaped light bars on dorsal fin. These bars sometimes simply oblique with diffused dark blotches in middle. Belly scaleless. Vertical fins sometimes scaleless. Lateral line midlateral. Dorsal 93~96, anal 72~76.

Counts and proportions. Dorsal 93~96, anal 72~76, pectoral 18~20. Head length 21.3~24.1% of total length, predorsal length 26.7~27.5, preanal length 44.3~50.0, snout 6.0~7.4, pelvic fin 2.1~2.9, pectoral fin 14.3~14.7, eye diameter 2.6~4.0, depth of body 11.2~12.6, gill opening 11.4~12.8.

Distribution. Okhotsk Sea.

Remarks. This species has been described under the name of *Lycodes schmidti* Soldatov, 1917. However, the specific name *schmidti* had already used for another species of *Lycodes* (*L. schmidti* Grazianov, 1907). Since Lindberg and Krasyukova (1975) correctly described the present species and gave it the new name *L. sigmatoides* adopted here.

Lycodes macrolepis Taranetz et Andriashev, 1935
(Japanese name: yokoshimagaji)

Lycodes macrelopis Taranetz and Andriashev, 1935: 251, figs. 6, 7 (Okhotsk Sea); Taranetz, 1937: 163; Okada and Matsubara, 1938: 407; Schmidt, 1950: 88, pl. 5, fig. 1 (Okhotsk Sea, Tater Strait); Fowler, 1958: 305, fig. 35; Lindberg and Krasyukova, 1975: 153, fig. 121 (Okhotsk Sea, Tater Strait),

The following description is based on Taranetz and Andriashev (1935), Schmidt (1950), and Lindberg and Krasyukova (1975).

Diagnosis. Clear light bars, about 9 in number, on body and dorsal fin. A similar light bar connects upper ends of gill openings. Belly scaled. Lateral line midlateral. Dorsal 79~89, anal 64~72.

Counts and proportions. Dorsal 79~89, anal 64~72, pectoral 20, gill rakers on lst arch 1+11~13=12~14, vertebrae 19~21+67~69=86~90. Head length 19.9~20.3%of total length, predorsal length 27.5, preanal length 43.2~45.1, pectoral fin 13.7~16.4, pelvic fin 2.2~2.4. Eye diameter 22.6~24.1% of head length, pectoral fin 68.5~80.7, pelvic fin 10.6~12.2.

Distribution. Northern Sea of Japan, Okhotsk Sea.

Remarks. This species is closely related to *L. yamatoi* in general appearance. However, it is easily separable by counts and proportions (see the remarks on *L. yamatoi*).

Lycodes semenovi Popov, 1931
(Japanese name: kanmurigenge)

Lycodes semenovi Popov, 1931: 144, pl. 1, fig. 2 (Okhotsk Sea); Tarantz, 1937: 164; Schmidt, 1950: 96; Matsubara, 1955: 775.

This species is represented by the holotype (88.0 mm in total length). The following description is based on Popov (1931) and Schmidt (1950).

Diagnosis. Upper jaw short, slightly exceeding the lower. Eye large, exceeding snout. Chin crest weakly developed, united anteriorly. Lateral line midlateral. Blotches on body inverted Y-shaped. Belly scaled.

Counts and proportions. Fin-ray and vertebral counts are unknown. Head length 5.5 in total length, 18.2% of total length. Preanal length 3.0 in total length, 33.5% of total length. Pelvic fin 6.4 in head length, 15.6% of total length.

Distribution. Okhotsk Sea.

Lycodes uschakovi Popov, 1931
(Japanese name: kanmurigenge)

Lycodes uschakovi Popov, 1931: 141, pl. 2, fig. 7 (Okhotsk Sea); Taranetz, 1937: 164 (Okhotsk Sea); Schmidt, 1950: 96 (Okhotsk Sea): Matsubara, 1955: 775; Lindberg and Krasyukova, 1975: 147 (Okhotsk Sea, northern Sea of Japan).

Lycodes colletti Popov, 1931: 143, pl. 2, fig. 6 (Okhotsk Sea); Taranetz, 1937: 164 (Okhotsk Sea); Matsubara, 1955: 775.

Lycodes lindbergi Popov, 1931: 142, pl. 2, fig. 5 (Okhotsk Sea); Taranetz, 1937: 164 (Okhotsk Sea).

The following description is based on Popov (1931), Schmidt (1950), and Lindberg and Krasyukova (1975).

Diagnosis. Predorsal region and belly scaleless. Lateral line midlateral. Small pores above lateral line, preopercular, and postorbital region. A light bar connecting upper ends of gill openings. Similar light bars with dark borders, 8~10 in number, cross body and extending onto dorsal fin, and posteriorly extend onto anal fin.

Counts and proportions. Dorsal 78~80, anal 64, pectoral 18, gill rakers on 1st arch 2+12=14. Head length 19.4~24.5% of total length, depth of body 8.8~10.6, predorsal length 25.0~29.8, preanal length 42.0~45.0, pectoral fin 10.8~12.4. Eye diameter 19.0~28.0% of head length, interorbital width 2.2~3.9, snout 27.0~33.3.

Distribution. Northern Sea of Japan, Okhotsk Sea.

Lycodes macrochir schmidt, 1950
(Japanese name: tenagakurogenge)
Fig. 47.

Lycodes macrochir Schmidt, 1937: 163 (nomen nudum); Schmidt, 1950: 99, pl. 8, fig. 1 (Okhotsk Sea); Matsubara, 1955: 776.

Material examined. HUMZ 54803 (206.4 mm TL, female), HUMZ 54814 (203.3 mm TL, sex unknown), HUMZ 54815 (213.0 mm TL, male), HUMZ 54820 (222.3 mm TL, female), HUMZ 54823 (210.2 mm TL, female), 57°59′N, 152°00′E, northern Okhotsk Sea, 200~215 m, June 9, 1976; HUMZ 57699 (413.9 mm TL, male), HUMZ 57702 (400.8 mm TL, male), HUMZ 57704 (285.0 mm TL, male), HUMZ 57708 (337.8 mm TL, male), HUMZ 57711 (297.7 mm TL, male), HUMZ 57714 (203.7 mm TL, male), HUMZ 58239 (389.5 mm TL, male), HUMZ 58242

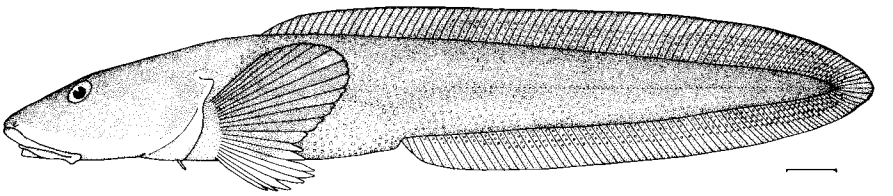

Fig. 47. *Lycodes macrochir* from the Okhotsk Sea. HUMZ 57825 (341.7 mm TL, male). Scale indicates 20 mm.

(259.3 mm TL, female), HUMZ 58247 (398.3 mm TL, male), HUMZ 58251 (398.4 mm TL, male), HUMZ 58253 (361.6 mm TL, female), 57°26′N, 149°16′E, northern Okhotsk Sea, 220 m, September 11, 1976; HUMZ 57818 (354.9 mm TL, female), HUMZ 57825 (341.7 mm TL, female), 57°16′N, 145°11′E, northern Okhotsk Sea, 208 m, September 16, 1976; HUMZ 57857 (404.7 mm TL, male), HUMZ 57858 (384.6 mm TL, male), HUMZ 57859 (388.0 mm TL, male), 56°44′N, 143°30′E, northern Okhotsk Sea, 305 m, September 16, 1976.

Diagnosis. Pectoral fin large, deeply emerginate, and longest ray 5.7～7.0 in total length. Latral line ventromidlateral. No transverse bars on body and fins.

Counts and proportions. Dorsal 85～93, anal 70～79, pectoral 20～22, vertebrae 20～21+71～80=91～101. Head length 3.7～4.4 in total length, predorsal length 3.3～3.9, preanal length 2.1～2.4, depth of body 8.0～10.7, upper lobe of pectoral fin 5.7～7.0, shortest pectoral ray in fork 6.7～13.1, lower lobe of pectoral fin 7.5～9.4. Head width 2.0～2.7 in head length, snout 2.6～3.4, upper jaw 2.1～2.9, lower jaw 2.3～3.3, eye diameter 5.1～8.9, interorbital width 4.8～10.2, depth of body 1.8～2.4, upper lobe of pectoral fin 1.3～1.6, shortest ray of pectoral fin in fork 1.6～3.0, lower lobe of pectoral fin 1.2～2.4, pelvic fin 7.0～15.9, gill opening 2.1～3.0, isthmus width 4.5～6.1.

Description. Body moderately elongate and relatively deep, its depth about 8～11 in total length. Head large, about 4 in total length. Eye relatively small, about 5～9 in head. Mouth moderate in size, posterior end of upper jaw below middle of eye or posterior half of eye. Gill opening more or less large, 2 or 3 in head. Lateral line ventromidlateral and very clear. Teeth conical; those on upper jaw in a single row, anteriorly becoming in 3 rows, and anterior teeth somewhat enlarged; those on lower jaw smaller, in 3～4 rows anteriorly, in a single row laterally and posteriorly; a group of 7～8 relatively large teeth on prevomer; palatine teeth in a single row. Body covered with scales; belly, vertical fins, and predorsal region scaled; head and pectoral base scaleless. Dorsal fin originating above middle of pectoral fin. Pectoral fin large and deeply emerginate, lower lobe somewhat shorter than the upper, 1.4 in head. Pelvic fin very small, more than 7 in head.

Color in alcohol greyish brown usually without markings or bars. In some specimens, dorsal fin with 5 dark blotches on its margin, and also sometimes margins of vertical fins darker. Ventral surface of head and belly light. Oral and branchial cavities light. Peritoneum light.

Distribution. Okhotsk Sea.

Lycodes soldatovi Taranetz et Andriashev, 1935
(Japanese name: Kurogaji)
Fig. 48.

Lycodes soldatovi Taranetz and Andriashev, 1935: 246, fig. 3 (Okhotsk Sea); Okada and Matsubara, 1938: 407; Schmidt, 1950: 90, pl. 6, fig. 2 (Okhotsk Sea); Matsubara, 1955: 777; Lindberg and Krasyukova, 1975: 153, fig. 120 (Okhotsk Sea); Toyoshima, 1983: 267, pl. 153 (Okhotsk Sea).

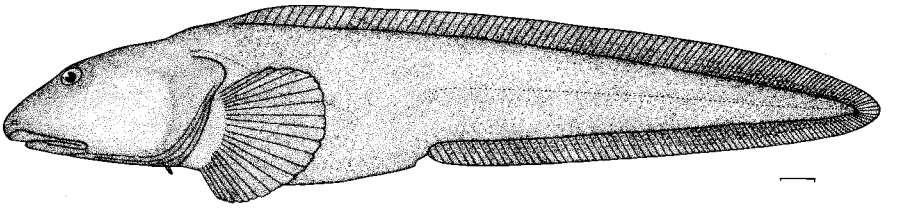

Fig. 48. *Lycodes soldatovi* from the southern Okhotsk Sea. HUMZ 49070 (507.6 mm TL, male). Scale indicates 20 mm.

Material examined. HUMZ 33949 (435.5 mm TL, sex unknown), 56°02.5′N, 140°33′E, northern Okhotsk Sea, 300~322 m, September 22, 1973; HUMZ 45302 (539.2 mm TL, female), 51°55′N, 154°55′E, western coast of Kamchatka, May 11, 1975; HUMZ 49069 (636.7 mm TL, male), HUMZ 49070 (507.6 mm TL, male), 44°25′N, 144°17.5′E, southern Okhotsk Sea, 385~400 m, July 3, 1975; HUMZ 49073 (671.5 mm TL, male), HUMZ 49078 (576.8 mm TL, female), 45°48′N, 143°49′E, southern Okhotsk Sea, October 10, 1975; HUMZ 55500 (586.2 mm TL, female), HUMZ 55501 (598.3 mm TL, female), 55°02′N, 154°18′E, western coast of Kamchatka, 445~465 m, June 1, 1976.

Diagnosis. Body completely black without blotches. Lateral line ventromidlateral. Fin-ray counts relatively fewer, dorsal less than 100, anal less than 90.

Counts and proportions. Dorsal 95~102, anal 81~87, pectoral 20~22. Head length 3.9~4.4 in total length, predorsal length 3.6~4.0, preanal length 2.1~2.3, depth of body 7.5~9.2, pectoral fin 7.5~8.8. Head width 1.7~2.2 in head length, snout 2.5~3.1, upper jaw 2.1~2.5, lower jaw 2.2~2.9, eye diameter 10.0~13.3, interorbital width 4.0~5.4, depth of body 1.7~2.3, pectoral fin 1.8~2.3, pelvic fin 10.6~18.4, gill opening 3.9~4.8.

Description. Body elongate and rather deep, its depth about 8~9 in total length. Head relatively large, about 4 in total length. Snout long and blunt, its length about 3 in head. Eye small and high in position, its diameter 10 or more in head. Interorbital region wide, about 4 or 5 in head. Labial lobe well developed. Chin crests well developed, high, and not united anteriorly. Mouth large, posterior end of upper jaw below posterior margin of eye or extending beyond it. Teeth small and conical; those on upper jaw in irregular 3 rows anteriorly, in a single row laterally and posteriorly; those on lower jaw in a wide band anteriorly, in a single row laterally and posteriorly, and lateral teeth larger than the others; those on prevomer in a group of about 8 teeth; those on palatine in a single row of more than 20 teeth. Lateral line ventromidlateral. Body covered with small cycloid scales; belly and vertical fins scaled; base of pectoral fin and predorsal region scaleless; head also scaleless. Dorsal fin originating above middle of pectoral fin. Pectoral

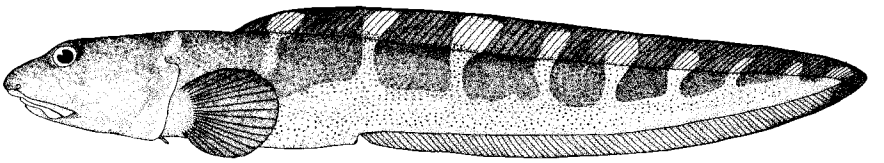

Fig. 49. Holotype of *Lycodes yamatoi* from the Sea of Japan. HUMZ 41094 (339.0 mm TL, male). Scale indicates 20 mm.

fin large and fan-shaped, its length about 8~9 in total length. Pelvic fin short, knob-like, and more than 10 in head.

Color in alcohol uniformly blackish brown without marks. Oral cavity brownish. Branchial cavity and peritoneum blackish brown.

Distribution. Okhotsk Sea.

Lycodes yamatoi sp. nov.
(New Japanese name: yamatomayugaji)
Fig. 49.

Lycodes macrolepis: Katayama, 1949: 76, fig. 5 (Toyama Bay, Sea of Japan); Honma, 1957a: 104, fig. 2 (off Sado Island, Sea of Japan); Honma, 1957b: 111 (off Sado Island); Honma and Sugihara, 1963: 8 (off Sado Island).

Lycodes macrops Honma, 1963: 21 (lapsus calami, off Sado Island).

Holotype. HUMZ 41094 (339.0 mm TL, male), off Kasumi, Hyogo Prefecture, Sea of Japan, March 13, 1975.

Paratypes. HUMZ 42480 (327.6 mm TL, female), 42°08.6′N, 139°41.1′E, near Okushiri Island, Sea of Japan, 560 m, June 4, 1975; HUMZ 53191 (355.2 mm TL, male), 46°43′N, 141°33′E, southern Okhotsk Sea, March 26, 1976; HUMZ 53597 (260.3 mm TL, female), HUMZ 53598 (288.8 mm TL, male), HUMZ 53601 (230.0 mm TL, male), HUMZ 53610 (248.0 mm TL, female), HUMZ 53611 (237.0 mm TL, male), 39°17.0′N, 135°03.5′E, Yamato Bank, Sea of Japan, 375 m, May 30, 1976; HUMZ 53618 (272.7 mm TL, male), HUMZ 53620(228.0mm TL, male), HUMZ 53630(180.8 mm TL, male), HUMZ 53634 (216.2 mm TL, male), 39°16.7′N, 135°02.8′E, Yamato Bank, May 31, 1976; HUMZ 53658 (218.8 mm TL, female), HUMZ 53668 (280.0 mm TL, male), HUMZ 53672 (241.6 mm TL, female), HUMZ 53682 (265.0 mm TL, female), HUMZ 53684 (210.7 mm TL, male), 39°07.9′N, 135°04.6′E, Yamato Bank, 435 m, May 30, 1976; HUMZ 53726 (254.4 mm TL, female), 38°24.7′N, 137°23′E, Yamato Bank, 450 m, June 4, 1976; HUMZ 53734 (253.8 mm TL, male), HUMZ 53735 (356.7 mm TL, male), HUMZ 53737 (260.0 mm TL, female), HUMZ 53738 (370.3 mm TL, male), HUMZ 53740 (250.8 mm TL, female), HUMZ 53741 (224.8 mm TL, female), HUMZ 53742 (158.0 mm TL, female), 38°23.0′N, 137°18.3′E, Yamato Bank, 315 m, June 5, 1976; HUMZ 53798 (267.0 mm TL, male), 39°17.0′N, 135°14.5′E, Yamato Bank, 460 m, May 29, 1976; HUMZ 53805 (261.5 mm TL, male), HUMZ 53817 (202.6 mm TL, male), 39°16′N, 135°02.7′E, Yamato Bank, 360 m, May 31, 1976; HUMZ 53856 (304.0 mm TL, male), HUMZ 53866 (242.5 mm TL, female), 39°16.8′N, 135°04.0′E, Yamato Bank, 450 m, May 30, 1976; HUMZ 53911 (212.4 mm TL, male), HUMZ 53917 (206.5 mm TL, female), HUMZ 53918 (265.4 mm TL, male), HUMZ 53921 (244.8 mm TL, female), 45°22′N, 143°30′E, southern Okhotsk Sea, 160 m, June 1, 1976; HUMZ 53923 (314.0 mm TL, female), HUMZ 53925 (234.0 mm TL, male), 38°07.5′N, 136°52.2′E, Yamato Bank, 560 m, June 18, 1976.

Diagnosis. Narrow white bars, 8~9 in number, on body and dorsal fin.

Palatine teeth in 2 rows anteriorly. Preanal length 2.4~2.6 and predorsal length 4.0~4.6 in total length. Dorsal 107~111, anal 92~97, pectoral 19~20.

Counts and proportions. Counts and proportions of the holotype are given first, followed by those of paratypes in parentheses. Dorsal 108 (107~111), anal 93 (92~97), pectoral 20 (19~20), vertebrae 21+94=115 (21~22+92~98=113~120). Measurements in per cent of total and head lengths are shown in Table 7. Head length 5.0 (5.0~5.7) in total length, depth of body 10.4 (9.3~10.8), preanal length 2.4 (2.4~2.6), predorsal length 4.0 (4.0~4.6), pectoral fin 8.7 (7.8~8.7). Head width 1.7 (1.8~2.3) in head length, snout 3.5 (3.2~3.9), upper jaw 2.4 (2.4~2.9), eye diameter 7.1 (5.6~7.2), isthmus width 3.8 (3.4~4.9), interorbital width 5.1 (4.9~6.1), depth of body 2.1 (1.6~2.2), gill opening 2.3 (2.2~2.5). Eye diameter 2.0 (1.4~2.0) in snout, 3.0 (2.0~3.0) in upper jaw. Pelvic fin 2.8 (2.2~3.5) in eye.

Description of holotype and paratypes. Body moderately elongate, deep, and its depth about equal to pectoral fin. Caudal region moderately short, about 1.5 times of preanal length. Head moderately large, wide, its length about half of preanal length and its width about equal to body depth. Snout round, and about twice eye. Nostril tube very short. Eye high in position, oval, small, and its diameter about half of snout. Chin crest well developed, free anteriorly. Branchiostegal membranes broadly united to isthmus. Gill opening moderately large, its lower end extending downward and forward beyond lower base of pectoral fin. Mouth moderately large. Posterior end of upper jaw extending beyond posterior

Table 7. Comparison of *Lycodes yamatoi* with *L. macrolepis*.

Characters	*L. yamatoi* Holotype and paratypes	*L. macrolepis* Taranetz and Andriashev (1935)
% of TL:		
Head length	17.7~20.1	19.9~20.3
Predorsal length	21.6~25.1	26.4~27.5
Preanal length	39.1~42.4	43.2~45.1
Depth of body	9.1~10.8	8.8~10.2
Pectoral fin length	11.5~12.8	13.7~16.4
Pelvic fin length	0.9~1.3	2.2~2.4
Bony interorbital width	0.8~0.9	0.8~0.9
% of HL:		
Pectoral fin length	57.3~67.4	68.8~80.7
Pelvic fin length	5.0~7.2	10.6~12.2
Eye diameter	14.1~18.0	22.6~24.1
Bony interorbital width	4.2~4.8	3.9~4.4
Counts:		
Dorsal rays	107~111	83~89
Anal rays	92~97	64~72
Pectoral rays	19~20	20
Gill rakers	3~4+12~13	1+11~13

margin of eye (below eye in paratypes). Lips not gelatinous. Lower lip with well developed labial lobe. Teeth small, blunt, and conical; those on upper jaw in a single row laterally and in 2 (2 or 3) rows anteriorly; those on lower jaw in a single row posteriorly, in a band of irregular 4 (3 or 4) rows anteriorly; those on prevomer 4 (4~7) in number; those on palatine in a single row anteriorly, in 2 rows posteriorly. Body covered with small cycloid scales; belly and vertical fins scaled; head, pectoral fin, and pectoral base scaleless. Lateral line ventromidlateral. Dorsal fin originating above middle of pectoral fin. Preanal region long. Pectoral fin round, moderately large, and about equal to postorbital head length. Pelvic fin very small, clearly shorter than eye.

Color in alcohol brownish with 8 (8~9) narrow white bands on body and dorsal fin. A pair of light blotches on upper ends of gill openings. Head, dorsal fin, posterior half of anal fin a little darker than side of body. Ventral surface of head, pelvic fin and belly light. Oral cavity light. Branchial cavity somewhat brownish. Peritoneum brownish. Stomach light.

Distribution. Sea of Japan, southern Okhotsk Sea.

Etymology. The specific name for this species is taken from the locality, Yamato Bank, where the present species is abundant.

Remarks. This species resembles *L. macrolepis*, but clearly differs from the latter in having higher numbers of dorsal and anal rays, shorter predorsal and preanal lengths, also shorter pectoral and pelvic fins, and smaller eyes than those of *L. macrolepis* (Table 7). Furthermore, the species differs from the latter in having a single or two irregular long rows of palatine teeth (inner 11, outer 8 in number) instead of a single short row of 8 teeth.

Lycodes ygreknotatus Schmidt, 1950

(Japanese name: waijigenge)

Lycodes ygrek-notatus Schmidt, 1937: 163 (nomen nudum); Schmidt, 1950: 92 (northwestern Okhotsk Sea).

Lycodes ygreknotatus: Matsubara, 1955: 777; Lindberg and Krasyukova, 1975: 155, fig. 123 (Okhotsk Sea).

This species is known from three specimens (180~288 mm in standard length). The following description is based on Schmidt (1950).

Diagnosis. Body covered with large cycloid scales except for area in front of pectoral fin. Predorsal region scaled as far as line connecting upper ends of gill openings. Posterior part of vertical fins scaled. Lateral line ventromidlateral. Dorsal fin with 5 white Y-shaped marks extending downward onto body. Pectoral fin dusky grey.

Counts and proportions. Dorsal 87~88, anal 73~77, pectoral 21, gill rakers on 1st arch 1+11=12, vertebrae 20~21+72=92~93. Depth of body 11.1% of standard length, head length 20.2, pectoral fin 14.5, predorsal length 25.0, preanal length 42.0~44.0. Eye diameter 24.6% of head length, interorbital width 5.5, snout 25.6.

Distribution. Okhotsk Sea.

Lycodes microlepidotus Schmidt, 1950

Lycodes microlepidotus Schmidt, 1950: 91, pl. 6, fig. 1 (Okhotsk Sea).

This species is known from five specimens (178~292 mm in standard length). The following description is based on schmidt (1950).

Diagnosis. Chin crests well developed. Trunk and vertical fins scaled. Occipital region also scaled. Pectoral fin slightly emerginate. Lateral line ventromidlateral and unclear in caudal region. Color in alcohol greyish brown and with an orange tinge. Six or seven poorly defined light bars on dorsal fin. Pectoral fin yellowish. Dorsal 82, anal 74~75, pectoral 20~21.

Counts and proportions. Dorsal 82, anal 74~75, pectoral 20~21. Head length 18.0~19.9% of standard length, depth of body 9.2~11.0, pectoral fin 11.3~13.2, predorsal length 22.6~24.1, preanal length 38.2~40.5. Eye diameter 20.3~23.7% of head length, interorbital width 4.9~5.8.

Distribution. Okhotsk Sea.

Lycodes ochotensis Schmidt, 1950

Lycodes brevipes ochotensis Schmidt, 1937: 163 (nomen nudum, Okhotsk Sea); Lindberg and Krasyukova, 1975: 155, fig. 122 (Okhotsk Sea).

This species is known from four specimens (281~342 mm instandard length). The following description is based on Schmidt (1950) and Lindberg and Krasyukova (1975).

Diagnosis. Eye relatively large, only slightly shorter than snout. Chin crest well developed, with round but prominent anterior tip. Small conspicuous pores in postorbital, infraorbital, preopercular, and mandibular regions. Lateral line ventromidlateral. Body brownish without spots or bands. Weak traces of several light spots on dark-margined dorsal fin. Dorsal 87~93, anal 76~78, vertebrae 98.

Counts and proportions. Dorsal 87~93, anal 76~78, vertebrae 20~21+77~78=98. Head length 20.8% of standard length, depth of body 9.8, pectoral fin 12.5, pelvic fin 0.9, predorsal length 25.0, preanal length 40.0 (39.1~40.0% of total length). Eye diameter 23.5% of head length, snout 27.8, interorbital width 0.9.

Distribution. Okhotsk Sea.

Lycodes jenseni Taranetz et Andriashev, 1935
(Japanese name: ebisugaji)

Lycodes jenseni Taranetz and Andriashev, 1935: 242, figs. 1, 2 (Okhotsk Sea); Taranetz, 1937: 164; Okada and Matsubara, 1938: 407; Schmidt, 1950: 98 (Okhotsk Sea); Matsubara, 1955: 777.

This species is known from two specimens (176 and 202 mm in total length). The following description is based on Taranetz and Andriashev (1935) and Schmidt (1950).

Diagnosis. Body without bands and markings. Belly scaled. Lateral line ventromidlateral. Dorsal 88~90, anal 78~80.

Counts and proportions. Dorsal 88~90, anal 78~80, pectoral 18~20, gill rakers on 1st arch 2+10=12. Head length 19.3% of total length, predorsal length 23.9, preanal length 39.9, pectoral fin 13.9, pelvic fin 2.7. Eye diameter 26.5% of head length, pelvic fin 14.1.

Distribution. Okhotsk Sea.

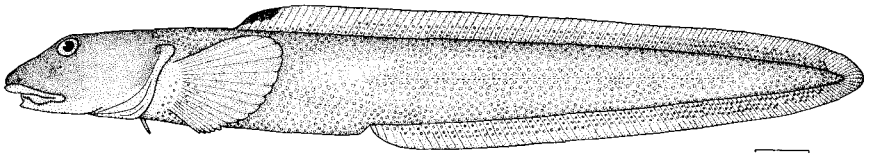

Fig. 50. *Lycodes palearis* from the Bering Sea. HUMZ 67489 (338.6 mm TL, male). Scale indicates 20 mm.

Lycodes palearis Gilbert, 1985
(Japanese name: hakusengaji)
Fig. 50.

Lycodes palearis Gilbert, 1895: 454 (Bristoly Bay, Bering Sea); Jordan and Evermann, 1898: 2466 (Bering Sea); Evermann and Goldsborough, 1907: 342 (off Alaska); Clemens and Wilby, 1946: 190, fig. 126 (Pacific coast of Canada); Slipp and DeLacy, 1952: 201 (Pacific coast of North America); Matsubara, 1955: 777; Okada and Kobayashi, 1968: 62 (Bristol Bay, north of Pribilof Island); Hart, 1973: 244 (from Oregon, Puget Sound, through British Columbia, Bering Sea).

Lycodes digitatus Gill and Townsend, 1897: 232 (Bering Sea); Jordan and Evermann, 1898: 2466 (Bering Sea); Evermann and Goldsborough, 1907: 342 (off Alaska).

Lycodes sp. Schmidt, 1904: 200, fig. 13 (Okhotsk Sea).

Lycodes palearis palearis: Taranetz, 1937: 163 (Bering Sea).

Lycodes palearis arcticus Andriashev, 1954: 291, fig. 160 (Arctic Ocean).

Material examined. HUMZ 36847 (400.4 mm TL, female), HUMZ 36848 (435.0 mm TL, female), HUMZ 36849 (442.0 mm TL, female), HUMZ 36852 (406.8 mm TL, male), HUMZ 35854 (415.0 mm TL, male), 55°44.3′N, 168°00′W, Bering Sea, 137 mm, July 15, 1974; HUMZ 36853 (378.0 mm TL, female), 56°40′N, 167°23′W, Bering Sea, 106 m, July 14, 1974; HUMZ 67489 (338.6 mm TL, male), 54°35′N, 160°52′W, Bering Sea, 127~128 m, June 12, 1977; HUMZ 68011 (445.5 mm TL, male), HUMZ 68012 (420.8 mm TL, male), HUMZ 68014 (411.8 mm TL, male), HUMZ 68256 (453.8 mm TL, female), HUMZ 68258 (389.5 mm TL, sex unknown), HUMZ 68259 (374.0 mm TL, male), HUMZ 68262 (414.2 mm TL, male), HUMZ 68263 (400.6 mm TL, female), HUMZ 68264 (277.0 mm TL, male), HUMZ 68265 (425.2 mm TL, female), HUMZ 68266 (422.0 mm TL, male), HUMZ 68267 (439.8 mm TL, male), 54°54′N, 165°37′W, Bering Sea, 133~135 m, June 16, 1977.

Diagnosis. Pelvic fin somewhat smaller than eye but clearly longer than pupil. Light transverse bars, less than 6 in number, on dorsal fin, or sometimes completely absent. Dorsal 97~106, anal 81~88, vertebrae 106~114.

Counts and proportions. Dorsal 97~106, anal 81~88, pectoral 17~19, gill rakers on 1st arch 2~4+10~14=12~18, vertebrae 23~25+83~90=106~114. Head length 4.4~5.3 in total length, predorsal length 3.7~4.4, preanal length 2.3~2.5, depth of body 9.5~12.2, pectoral fin 8.1~9.2. Head width 1.9~2.2 in head length, snout 2.5~3.0, upper jaw 2.2~2.4, lower jaw 2.7~3.1, eye diameter 6.9~9.0, interorbital width 4.7~7.2, depth of body 1.8~2.7, pectoral fin 1.5~1.9, pelvic fin 8.1~11.2, gill opening 2.5~2.8, isthmus width 3.6~4.6.

Description. Body elongate, its depth about 10~12 in total length. Head more or less large, 4 or 5 in total length. Snout blunt and rounded, about 3 in head. Interorbital region wide, longer than eye. Labial lobe well developed. Chin crest well developed, forming prominent lobe at tip. Mouth moderately large, posterior

Table 8. Comparison of the specimens referable to *Lycodes palearis palearis* with *L. palearis arcticus*.

Characters	**L. palearis palearis* Present materials	*L. palearis arcticus* Andriashev (1937)
Total length (mm)	333~452	90~250
% of TL:		
Head length	18.3~24.1	20.3~21.0
Depth of body	7.7~8.4	7.8~9.1
Pectoral fin length	10.2~12.4	13.0~15.6
Predorsal length	22.4~26.3	24.4~27.6
Preanal length	40.1~43.7	41.2~43.3
Pelvic fin length	1.6~2.2	2.7~3.1
% of HL:		
Eye diameter	10.7~16.0	19.0~21.9
Snout length	25.5~36.0	28.5~34.5
Counts:		
Dorsal rays	97~106	98~104
Anal rays	81~88	84~88
Pectoral rays	17~19	17
Vertebrae	106~114	105

* The data do not include those of the intermediate specimens between the two subspecies.

end of upper jaw below posterior half or posterior margin of eye. Teeth conical; those on upper jaw in 2~3 rows anteriorly, in a single row laterally and posteriorly; those on lower jaw in a broad band (irregular 3~6 rows) anteriorly, in a single row laterally and posteriorly; those on prevomer in a group; those on palatine in a single row. Body covered with small cycloid scales; vertical fins scaled; belly densely scaled; head naked. Lateral line ventromidlateral, ascending part poorly developed. Dorsal fin originating above anterior half or middle of pectoral fin. Pectoral fin round, its lower 4 or 5 rays thickened and incised. Pelvic fin moderately large, about equal to eye.

Color in alcohol and fresh specimens light or blackish brown. Head and vertical fins darker than side of body. Ventral surface of head and belly light. Narrow light bars, less than 6 in number, on body. These bars obscure or sometimes absent in larger specimens. Anterior margin of dorsal fin with a blackish blotch.

Distribution. Okhotsk Sea, Arctic Ocean, Bering Sea, Pacific coast of North America.

Remarks. *L. palearis* known from the Bering Sea, Bering Strait, and southern Arctic Ocean has been described as *L. palearis palearis* and *L. palearis arcticus* by Taranetz (1937) and Andriashev (1935, 1954). According to Andriashev (1935, 1954), the latter subspecies has larger pectoral fins and eyes (Table 8). However, similar degrees of difference are widely observable throughout the genus *Lycodes* and

these two forms do not deserve to be separated as the independent subspecies when the similarities of many other characters and the variation are considered. Therefore, these two subspecies are not believed to be worthy of recognition.

However, the other two subspecies, *L. palearis fasciatus* and *L. palearis multifasciatus*, known from the Okhotsk Sea, are described as independent species (see the description of each species), distinct from *L. palearis*.

Lycodes fasciatus (Schmidt, 1904)
(Japanese name: mayugaji)

Lycenchelys fasciatus Schmidt, 1904: 203 (Aniva Bay); Soldatov and Lindberg, 1930: 498.
Lycodes palearis fasciatus: Taranetz, 1937: 163 (northern Sea of Japan, Aniva Bay); Lindberg and Krasyukova, 1975: 157, fig. 124 (Okhotsk Sea, northern Sea of Japan).
Lycodes fasciatus: Fowler, 1958: 308, fig. 37.

The following description is based on Schmidt (1904, 1950).

Diagnosis. Lateral line ventromidlateral. Dorsal 90~95, anal 67~74. Narrow light bars, 12~13 in number, cross dorsal fin and extending onto body. The interspaces between these bars dark with diffused lower parts on body. A light bar connecting upper ends of gill openings.

Counts and proportions. Dorsal 90~95, anal 67~74, pectoral 18. Head length 19.1~20.4% of standard length, depth of body 9.9~12.0, pectoral fin 11.8~13.4, predorsal length 23.1~24.6, prenal length 40.7~42.0, pelvic fin 1.1~1.9. Snout 29.0~30.7% of head length, eye diameter 18.3~20.4.

Remarks. This species resembles *L. multifasciatus*. However, it is separable from the latter by fin-ray counts and coloration (see the remarks under *L. multifasciatus*).

Lycodes schmidti Grazianov, 1907

Lycodes schmidti Grazianov, 1907: 426, 430 (Okhotsk Sea).
Lycodes brashnikovi Soldatov, 1917: 112, fig. 1 (northern Sea of Japan); Soldatov and Lindberg, 1930: 495, fig. 71 (northern Sea of Japan, eastern coast of Sakhalin).
Lycodes palearis brashnikovi: Taranetz and Andriashev, 1935: 253; Taranetz, 1937: 163.
Lycodes perspicillum: Tanaka, 1908: 252 (Sea of Japan); Schmidt, 1950: 93 (Okhotsk Sea).
Lycodes palearis schmidti: Lindberg and Krasyukova, 1975: 158, fig. 125 (Okhotsk Sea).

The following description is based on Soldatov (1917) and Lindberg and Krasyukova (1975).

Diagnosis. Lateral line ventromidlateral. Belly and vertical fins with scales. Dark cross bars, 12~13 in number, on body separated by narrow light interspaces. Dorsal 91~98, anal 71~83, pectoral 18.

Proportions. Preanal length 40.0~46.6% of total length. Head length less than 4.5 in total length.

Distribution. Northern Sea of Japan, Okhotsk Sea.

Lycodes multifasciatus Schmidt, 1950
(Japanese name: ohotsukuhakusengaji)
Fig. 51.

Lycodes palearis multifasciatus Schmidt, 1950: 95, pl. 7, fig. 2 (western coast of Kamchatka).

Material examined. HUMZ 45333 (334.4 mm TL, male), HUMZ 45334 (389.0 mm TL,

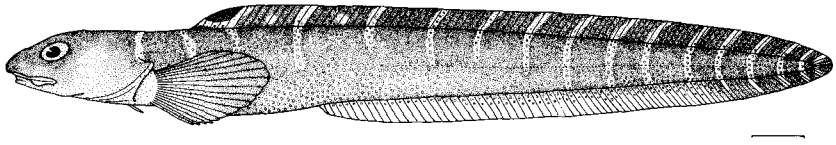

Fig. 51. *Lycodes multifasciatus* from the Okhotsk Sea. HUMZ 56526 (155.0 mm TL, male). Scale indicates 10 mm.

male), 51°47′N, 156°00′E, western coast of Kamchatka, Okhotsk Sea, 74～76 m, May 12, 1975; HUMZ 55102 (400.0 mm TL, female), HUMZ 55104 (417.0 mm TL, female), 52°01′ N, 155°31′ E, western coast of Kamchatka, 175～180 m, May 29, 1976; HUMZ 55273 (417.2 mm TL, female), 53°59′N, 155°04′E, western coast of Kamchatka, 90～100 m, May 31, 1976; HUMZ 55327 (308.8 mm TL, female), HUMZ 55334 (283.6 mm TL, female), HUMZ 55335 (252.8 mm TL, female), HUMZ 55336 (299.1 mm TL, female), HUMZ 56574 (312.4 mm TL, sex unknown), 54°16′N, 160°57′E, eastern coast of Kamchatka, 125～300 m, May 20, 1976; HUMZ 56526 (155.0 mm TL, male), HUMZ 56531 (253.8 mm TL, male), HUMZ 56533 (244.6 mm TL, sex unknown), HUMZ 56534 (345.9 mm TL, male), 58°30′N, 151°57′E, northern Okhotsk Sea, 119～120 m, June 9, 1976; HUMZ 56640 (234.4 mm TL, male), HUMZ 56641 (430.8 mm TL, sex unknown), HUMZ 56646 (376.7 mm TL, male), HUMZ 56631 (383.6 mm TL, female), HUMZ 56638 (316.0 mm TL, female), HUMZ 56643 (411.2 mm TL, sex unknown), 61°01′N, 158°17′E, northern Okhotsk Sea, 94～95 m, June 7, 1976; HUMZ 56549 (363.0 mm TL, male), HUMZ 56574 (312.4 mm TL, sex unknown), 52°02′N, 156°20′E, northern Okhotsk Sea, 135～139 m, June 7, 1976; HUMZ 68261 (415.7 mm TL, sex unknown), 54°54′N, 165°37′E, Bering Sea, 133～135 m, June 16, 1977; HUMZ 76612 (246.4 mm TL, female), 55°34′N, 164°45′W, eastern Bering Sea, 98～100 m, May 5, 1978.

Diagnosis. Numerous, narrow, light bars, 12～15 in number, on dorsal fin. Two similar bars before dorsal fin.

Counts and proportions. Dorsal 101～105, anal 85～89, pectoral 17～18, gill rakers on 1st arch 1～3+10～12=11～15, vertebrae 23～25+86～90=109～115. Head length 4.4～6.0 in total length, predorsal length 3.8～5.0, preanal length 2.1～2.7, depth of body 9.3～14.6. Head width 1.8～2.6 in head length, snout 2.6～3.2, upper jaw 2.0～2.6, lower jaw 2.7～3.4, eye diameter 5.0～8.0, interorbital width 4.8～8.0, depth of body 1.7～2.5, pectoral fin 1.5～1.9, pelvic fin 6.5～10.0, gill opening 2.3～3.0, isthmus width 3.7～5.6.

Description. Body moderately elongate, depth 2 or more in head length. Head moderately long, about twice pectoral fin. Snout relatively long, about 3 in head. Eye small, 5～8 in head. Interorbital width about equal to eye diameter. Mouth large, about 2～3 in head. Labial lobe well developed. Chin crest high and not united anteriorly. Conical teeth on jaws, prevomer, and palatines. Lateral line ventromidlateral. Body covered with small cycloid scales; belly and vertical fins scaled; scales not extending forward beyond a line connecting upper ends of gill openings. Dorsal fin originating above middle of pectoral fin. Pectoral fin large, less than 2 in head. Pelvic fin relatively small, shorter than eye.

Color in alcohol dark grey with numerous narrow, light bars, 12～15 in number, on body and dorsal fin. Two similar bars before dorsal origin. A black blotch on anterior margin of dorsal fin. Belly and ventral surface of head light. Oral and branchial cavities light. Peritoneum light.

Distribution. Okhotsk Sea, eastern coast of Kamchatka, Bering Sea.

Remarks. This species is most similar to *L. fasciatus* in general appearance, lateral-line pattern and proportions. However, it is easily separable from the latter in the numerous dorsal and anal rays, dorsal 101~105, anal 85~89 as against 90~95 and 67~74 in the latter respectively. Further, it is also different from *L. fasciatus* in the coloration: there are two clear light bars before dorsal-fin origin and a black blotch on anterior margin of the fin, while, in the latter there is a single light bar connecting upper ends of gill openings and the dark blotch on anterior margin of dorsal fin is absent.

Lycodes fulvus sp. nov.
(New Japanese name: Kiiromayugaji)
Fig. 52.

Holotype. HUMZ 60246 (185.9 mm TL, female), 55°19′N, 142°34′E, Okhotsk Sea, 178 m, October 23, 1976.

Paratypes. HUMZ 58291 (195.8 mm TL, female), HUMZ 58292 (160.6 mm TL, female), HUMZ 58293 (204.3 mm TL, male), HUMZ 60244 (206.2 mm TL, female), HUMZ 60248 (163.0 mm TL, female), HUMZ 60249 (221.7 mm TL, male), HUMZ 60250 (180.3 mm TL, female), HUMZ 60251 (165.8 mm TL, female), HUMZ 60252 (202.8 mm TL, male), HUMZ 60254 (173.8 mm TL, female), HUMZ 60255 (221.5 mm TL, male,), HUMZ 60256 (208.0 mm TL, male), HUMZ 60257 (195.2 mm TL, female), HUMZ 60258 (223.3 mm TL, male), HUMZ 60278 (162.3 mm TL, male), captured with the holotype; HUMZ 61434 (188.6 mm TL, female), 54°19′N, 140°40′E, Okhotsk Sea, 68 m, September 6, 1976; HUMZ 61466 (184.9 mm TL, sex unknown), 56°55′N, 140°36′E, Okhotsk Sea, 150 m, September 8, 1976.

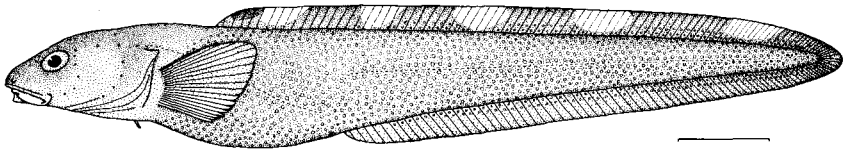

Fig. 52. Holotype of *Lycodes fulvus* from the Okhotsk Sea. HUMZ 60246 (185.9 mm TL, female). Scale indicates 20 mm.

Diagnosis. Body yellowish brown. Dorsal fin with 5~7 light blotches. Lateral line ventromidlateral. Dorsum before dorsal fin scaled to occipital region. Eye relatively small, 14.4~22.0% of head length. Interorbital space wide, 15.7~24.6% of head length.

Counts and proportions. Counts and proportions of the holotype are given first, followed by those of paratypes in parentheses. Dorsal 87 (86~90), anal 75 (72~77), pectoral 20 (19~21), vertebrae 19+76=95 (19~21+73~77=92~98). Head length 5.0 (4.7~5.4) in total length, preanal length 2.5 (2.4~2.6), predorsal length 4.1 (3.9~4.5), depth of body 8.7 (8.2~10.5), pectoral fin 9.0 (7.2~9.6). Head width 2.3 (1.8~2.6) in head length, snout 3.4 (2.0~3.2), upper jaw 2.7 (2.2~2.9), lower jaw 3.3 (2.8~3.5), eye diameter 5.8 (4.5~6.9), interorbital width 5.6 (4.3~6.4), depth of body 1.7 (1.6~2.3), pectoral fin 1.8 (1.5~2.0), pelvic fin 10.8 (7.9~16.2), gill opening 2.5 (2.3~3.0), isthmus width 4.4 (2.8~4.4), postorbital head length 1.8 (1.7~1.9).

Description of holotype and paratypes. Body relatively short, its depth somewhat longer than twice pectoral base. Head more or less large, more than half of preanal length, and moderately wide, somewhat longer than upper jaw. Snout blunt and rounded in dorsal profile, nearly equal to or somewhat longer than eye. Nostril tube very short. Eye oblong, moderately large, and about equal to interorbital width. Chin crest well developed, high and united anteriorly. Mouth moderately large. Posterior end of upper jaw below middle of eye. Branchiostegal membranes broadly united to isthmus. Gill opening relatively small, its lower end slightly extending downward beyond lower base of pectoral fin. Labial lobe moderately developed. Teeth relatively strong, small, and conical; those on upper jaw in a single row laterally, in 2 rows anteriorly; those on lower jaw in 3 rows anteriorly and in a single row laterally; those on prevomer 4 (4~6 in paratypes) in number; those on palatine 11 (9~13) in number and arranged in a single row. Body covered with small scales; belly scaled; basal half of vertical fins also scaled especially in their posterior part; head before dorsal fin and base of pectoral fin scaleless. Small head pores in infraorbital, postorbital, occipital, preopercular, and mandibular regions. Lateral line ventromidlateral and clear except for ascending part. Dorsal fin originating above middle of pectoral fin. Preanal region relatively short, about twice head. Pectoral fin relatively large, somewhat longer than postorbital head length. Pelvic fin very short, clearly shorter than eye, and nearly equal to pupil diameter.

Table 9. Comparison of *Lycodes fulvus* with *L. microlepidotus*.

Characters	*L. fulvus*		*L. microlepidotus* Schmidt (1950)
	Holotype	Paratypes	
Standard length (mm)	181.9	157.2~218.5	178.0~292.0
No. of specimens	1	17	5
% of SL:			
Head length	20.5	19.1~21.9	18.0~19.9
Predorsal length	24.8	22.8~26.5	22.7~24.1
Preanal length	41.2	39.2~43.3	38.2~40.5
Pectoral fin length	11.4	10.2~13.1	11.3~13.2
Depth of body	11.8	9.7~12.4	9.2~11.0
% of HL:			
Snout length	29.2	31.3~36.0	26.7~31.1
Eye diameter	17.3	14.4~22.0	20.3~23.7
Interorbital width	17.8	15.7~24.6	4.9~5.8
Counts:			
Dorsal rays	87	86~90	82
Anal rays	75	72~77	74~75
Pectoral rays	20	19~21	20~21
Vertebrae	95	92~98	—

Color in alcohol yellowish brown. Light blotches, 5 (5~7) in number, on dorsal fin. A black blotch on anterior end of dorsal fin. Ventral side of head and ventral half of pectoral fin lighter than side of body. Oral and branchial cavities light. Peritoneum brownish. Stomach light.

Distribution. Okhotsk Sea.

Etymology. The specific name of this species is taken from the yellowish body.

Remarks. The new species is most similar to *L. microlepidotus* in coloration, meristic counts, lateral-line pattern, and many proportional measurements. However, it is easily separable from the latter by the scaleless dorsum which in *L. microlepidotus* is scaled to the occipital region. Proportionally, *L. fulvus* is different from that species in some characters (Table 9); the former has wider interorbital space which is 15.7~24.6% of head as opposed to 4.9~5.8 in the latter; the eye is somewhat smaller, 14.4~22.0% of head as opposed to 20.3~23.7 in the latter. Further, the pectoral fin is smaller in the present species; the posterior margin of the fin does not extend beyond the midpoint between posterior end of head and anal-fin origin, while, the margin clearly extends posteriorly beyond the midpoint in *L. microlepidotus*.

Lycodes matsubarai sp. nov.
(New Japanese name: matsubaragenge)
Fig. 53.

Holotype. HUMZ 33970 (337.0 mm TL, male), 44°47′N, 144°01.5′E, Kitami-yamato Bank, southern Okhotsk Sea, 200 m, October 31, 1974.

Paratypes. HUMZ 33974 (338.0 mm TL, female), 45°05, 0′N, 143°05.2′E, southern Okhotsk Sea, 235 m, October 31, 1974; HUMZ 33948 (315.0 mm TL, male), HUMZ 33971 (320.0 mm TL, male), HUMZ 33972 (331.9 mm TL, male), HUMZ 33974 (336.3 mm TL, male), HUMZ 33975 (317.5 mm TL, male), HUMZ 33976 (320.8 mm TL, male), HUMZ 33977 (271.7 mm TL, male), HUMZ 33978 (314.9 mm TL, male), HUMZ 33979 (317.2 mm TL, male), HUMZ 33981 (285.6 mm TL, female), HUMZ 33983 (333.2 mm TL, female), 45°12.5′N, 143°06.5′E, southern Okhotsk Sea, 128 m, October 27, 1975; HUMZ 33950 (363.5 mm TL, male), 44°47′N, 144°01.5′E, southern Okhotsk Sea, 200 m, October 31, 1974; HUMZ 33950 (297.0 mm TL, female), HUMZ 33960 (314.8 mm TL, male), HUMZ 33968 (322.1 mm TL, male), HUMZ 33969 (320.8 mm TL, female), 45°02.5′N, 144°05.0′E, southern Okhotsk Sea, 235 m, October 31, 1974; HUMZ 49045 (305.5 mm TL, sex unknown), HUMZ 49096 (305.5 mm TL, sex unknown), southern Okhotsk Sea, 290~480 m, October 8, 1975.

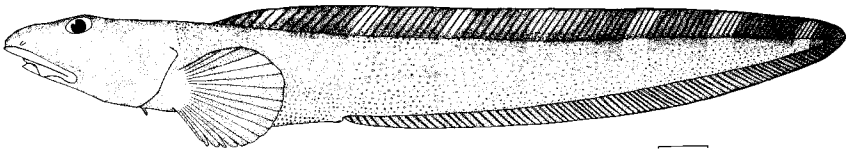

Fig. 53. Holotype of *Lycodes matsubarai* from the Okhotsk Sea. HUMZ 33970 (337.0 mm TL, male). Scale indicates 20 mm.

Diagnosis. Relatively narrow, light, transverse bars, 7 in number, on body and dorsal fin. Lateral line ventromidlateral. Dorsal 93~99, anal 77~84, pectoral 17~19, vertebrae 102~107.

Counts and proportions. Counts and proportions of the holotype are given first, followed by those of paratypes in parentheses. Dorsal 98 (93~99), anal 82 (77~84), pectoral 18 (17~19), vertebrae 22+81=103 (21~22+81~85=102~107), gill rakers on 1st arch 3+11=14 (2~4+11~14=13~18). Head length 5.1 (4.8~6.2) in total length, depth of body 10.6 (9.5~11.1), pectoral fin 7.5 (7.9~8.3), preanal length 2.6 (2.3~2.7), predorsal length 4.4 (4.1~4.9). Head width 1.8 (1.5~2.3) in head length, snout 3.3 (3.3~4.0), eye diameter 6.7 (5.1~6.8), isthmus width 4.1 (3.5~4.9), depth of body 2.1 (1.7~2.1), gill opening 2.7 (2.2~2.8). Eye diameter 2.0 (1.3~2.0) in snout. Pelvic fin 2.1 (1.7~2.7) in eye.

Description of holotype and paratypes. Body relatively elongate and compressed, its depth about twice pectoral base. Caudal region moderately long, clearly shorter than twice preanal length, and width about half of head. Snout somewhat pointed, about twice eye. Nostril tube very short. Chin crests well developed, forming prominent lobe at tip. Branchiostegal membranes broadly united to isthmus, isthmus width a little shorter than eye. Gill opening large, its lower end extending downward and forward beyond lower base of pectoral fin. Mouth moderately large. Posterior end of upper jaw below anterior half of eye. Labial lobe well developed. Teeth conical; those on upper jaw in 2 rows anteriorly, outer ones larger than the inner, in a single row laterally and posteriorly; those on lower jaw in a single row laterally, in a broad band of irregular 4 (3 or 4 in paratypes) rows anteriorly, and outer ones larger; those on prevomer 4 (4~6) in number; those on palatine in a single row. Body covered with small cycloid scales; vertical fins scaled; head and pectoral fin with its base scaleless. Lateral line ventromidlateral. Dorsal fin originating above anterior half of pectoral fin. Preanal region more or less short, about twice head. Pectoral fin large and round, clearly longer than postorbital head length. Pelvic fin very small, about half of eye.

Color of fresh specimens blackish brown with 7 light bars on body and dorsal fin. A pair of light blotches on upper ends of gill openings. Head darker than side of body. Pectoral fin light brown. Belly light. Oral and branchial cavities light. Peritoneum brownish. Stomach light.

Distribution. Southern Okhotsk Sea.

Etymology. The new species is named after Dr. Matsubara who contributed to the zoarcid taxonomy.

Remarks. In the genus *Lycodes*, the lateral-line pattern is quite effective for the distinction of species as noted in the generic description. The new species shares the same lateral-line pattern (ventromidlateral) with thirteen species listed as group D in Table 5. The present species is allied to *L. yamatoi* in the similar coloration and also to *L. fasciatus* in the fin-ray counts among the species which have the same

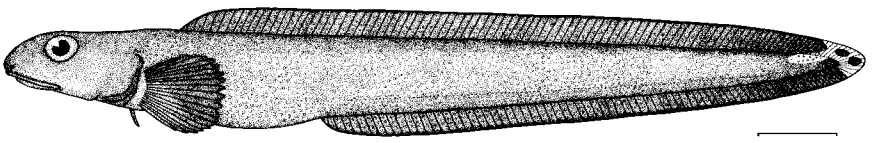

Fig. 54. *Lycodes caudimaculatus* from off Onahama, the Pacific coast of Fukushima Prefecture. HUMZ 71540 (218.4 mm TL, male). Scale indicates 20 mm.

lateral-line pattern.

However, it is separable from *L. yamatoi* by the lower meristic counts; dorsal 93~99, anal 77~84, vertebrae 102~107 as against 107~111, 92~97, and 113~120 respectively. From *L. fasciatus*, the present species is easily separable by the coloration; there are seven, uniformly narrow, light bars on body and dorsal fin, while, the narrow light bars are 12~13 in number and the dark interspaces of these bars have the diffused lower part in *L. fasciatus*.

Lycodes caudimaculatus Matsubara, 1936
(Japanese name: irezumigaji)
Fig. 54.

Lycodes caudimaculatus Matsubara, 1936: 115, fig. 1 (off Owase, Mie Prefecture); Matsubara, 1955: 775, fig. 293; Lindberg and Krasyukova, 1975: 144, fig. 116 (off Fukushima Prefecture); Yamakawa, 1982: 243 (off Kochi).

Material examined. HUMZ 71211 (161.3 mm TL, sex unknown), off Onahama, Fukushima Prefecture, 200~300 m, November 8, 1977; HUMZ 71357 (236.6 mm TL, female), HUMZ 71358 (218.5 mm TL, female), HUMZ 71359 (232.2 mm TL, male), HUMZ 71360 (214.0 mm TL, female), off Onahama, 200~300 m, November 10, 1977; HUMZ 71393 (230.1 mm TL, male), HUMZ 71394 (238.3 mm TL, male), off Onahama, 200~300 m, November 11, 1977; HUMZ 71358 (247.0 mm TL, male), HUMZ 71359 (238.7 mm TL, female), HUMZ 71540 (218.4 mm TL, male), HUMZ 71541 (150.6 mm TL, female), HUMZ 71542 (223.6 mm TL, female), HUMZ 71543 (220.0 mm TL, female), HUMZ 71544 (208.2 mm TL, female), HUMZ 71545 (231.8 mm TL, female), HUMZ 71546 (215.2 mm TL, female), HUMZ 71547 (203.6 mm TL, male), HUMZ 71548 (237.8 mm TL, male), HUMZ 71549 (230.2 mm TL, male), HUMZ 71550 (223.0 mm TL, female), 200~300 m, November 13, 1977.

Diagnosis. Posterior end of body marked by white area with jet black spots. Lateral line ventral.

Counts and proportions. Dorsal 101~105, anal 85~90, pectoral 19~21, vertebrae 21~23+86~90=107~113. Head length 5.7~6.6 in total length, predorsal lenght 4.9~5.6, preanal length 2.7~3.3, depth of body 10.5~12.7, pectoral fin 9.6~11.5. Head width 1.8~2.2 in head length, snout 2.7~3.3, upper jaw 2.1~2.9, lower jaw 2.6~3.6, eye diameter 3.3~4.4, interorbital width 3.5~5.1, depth of body 1.7~2.1, pectoral fin 1.5~1.9, pelvic fin 4.6~6.8, gill opening 2.1~2.6, isthmus width 6.3~10.4.

Description. Body elongate, depth about 11~13 in total length. Head somewhat depressed, width about 2 in head length. Mouth moderate in size, posterior end of upper jaw below eye. Teeth small and conical; those on jaws irregularly arranged, in a rather broad band anteriorly, in a single row posteriorly; those on prevomer in a group; those on palatine in a very narrow band. Lateral line ventral, decurved extending downward and backward from nape to scarcely beyond midpoint of body. Head including nape, pectoral fin with its base naked; belly and vertical fins scaled. Dorsal fin originating above anterior half of pectoral fin. Anal fin originating below 20th dorsal ray. Pectoral fin rounded, less than 2 in head. Pelvic fin shorter than eye.

Color in alcohol light brownish grey and paler below. Head dark. Vertical fins light grey margined by black. Caudal region marked by large oblong white area as long as head except for snout, with 2 or 3 irregular small black spots present

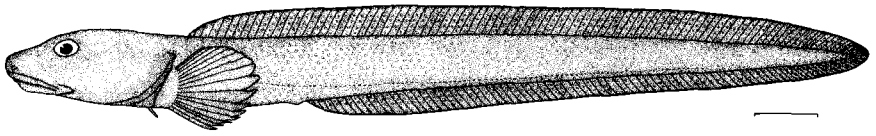

Fig. 55. *Lycodes microporus* from the Okhotsk Sea. HUMZ 77795 (274.0 mm TL, male). Scale indicates 20 mm.

in it; a jet black blotch on upper anterior border of white area and 3 similar, but smaller blotches on lower border. A large jet black blotch on anal fin under middle of white area.

Distribution. From off Kochi to off Fukushima Prefecture, Pacific coast of Japan.

Lycodes microporus Toyoshima, 1983
(Japanese name: yasemayugaji)
Figs. 55, 56.

Lycodes microporus Toyoshima, 1983: 263, pl. 152, figs. 23, 24 (Okhotsk Sea).

Material examined. HUMZ 77783 (258.5 mm TL, male), HUMZ 77784 (239.6 mm TL, male), HUMZ 77785 (257.2 mm TL, male), HUMZ 77786 (275.6 mm TL, male) HUMZ 77787 (252.3 mm TL, male), 44°23′N, 144°40′E, Okhotsk Sea, 1250~1310 m, September 7, 1978; HUMZ 77795 (274.0 mm TL, male), 44°11′N, 144°47′E, Okhotsk Sea, 650~700 m, October 3, 1978; HUMZ 77807 (261.4 mm TL, male), 44°15′N, 144°36′E, Okhotsk Sea, 900~925 m, October 8, 1978; HUMZ 78782 (274.0 mm TL, male), 44°11.5′N, 145°02.4′E, Okhotsk Sea, 400~500 m, September 13, 1978; HUMZ 79662 (296.2 mm TL, male), HUMZ 79663 (291.0 mm TL, male), 44°11.2′N, 145°00′E, Okhotsk Sea, 455~500 m, September 14, 1978.

Diagnosis. Body rather elongate, depth 7.9~10.4% of total length. Head with very small pores in nasal, infraorbital, interorbital, postorbital, preopercular, and mandibular canals. In infraorbital, preopercular, and mandibular regions, pores provided with very short tubes. Body uniformly dark brown.

Counts and proportions. Dorsal 93~96, anal 79~84, pectoral 15~17, vertebrae 18~20+78~83=96~103. Predorsal length 4.5~5.1 in total length, preanal length 2.7~3.0, head length 4.9~5.7, depth of body 9.6~12.7, pectoral

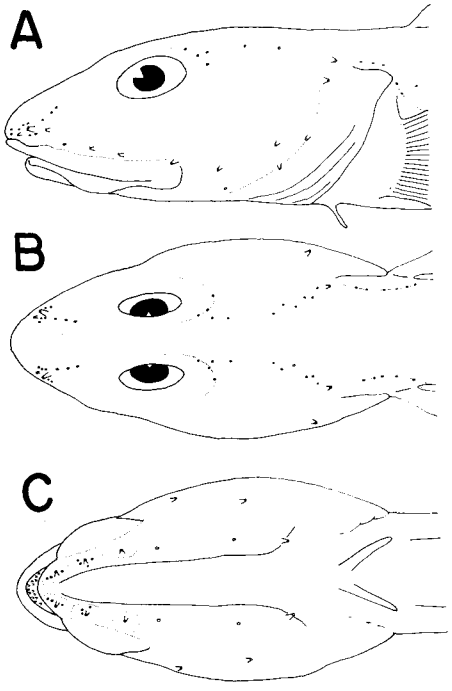

Fig. 56. Head of *Lycodes microporus* to show small head pores. HUMZ 77795 (274.0 mm TL, male).

fin 9.7～10.9. Head width 1.8～2.5 in head length, snout 2.9～3.3, upper jaw 2.0～2.5, eye diameter 5.4～6.2, interorbital width 5.3～7.2, depth of body 1.0～2.5, pectoral fin 1.8～2.0, gill opening 2.6～3.2, isthmus width 4.1～5.3.

Description. Body rather elongate, not very deep, and its depth clearly shorter than pectoral fin. Caudal region rather long, about twice preanal length. Head moderately large, relatively wide with swollen cheeks, its length more than half of preanal length, and its width nearly equal to its depth. Postorbital region of head moderately long, longer than pectoral fin. Snout more or less pointed in lateral and dorsal profiles, longer than width of pectoral base. Nostril tube very short. Eye relatively high in position, oval, and moderately large, its horizontal diameter about half of snout. Interorbital region convex and relatively narrow, its width shorter than eye. Mouth large. Maxillary extending to below posterior margin of eye or slightly beyond it. Lower jaw completely included. Lower lip with prominent labial lobe. Chin crest poorly developed. Gill opening relatively small, its lower end nearly same level as lower end of pectoral base. Gill rakers very short and bluntly conical in shape. Teeth small, sharply pointed, and strong; those on upper jaw in 2 or 3 rows anteriorly, in a short row laterally and posteriorly; those on lower jaw in a band anteriorly, in a short single row laterally and posteriorly; prevomer with a group of 8～10 teeth; those on palatine 14～18 in number and arranged in a single row. Anterior upper jaw teeth somewhat inwardly bent. Anterior outer teeth of lower jaw anteroventrally bent. Lateral teeth on lower jaw largest and strongest of all. Small cycloid scales covering entire body; belly densely covered with minute scales to base of pelvic fin; vertical fins also densely scaled to its distal 1/3; pectoral base with scattered scales; medial basal half of pectoral fin scaled; head completely scaleless, scales not extending anteriorly beyond a line connecting upper ends of gill openings. Head pores very small but opening as nostril-like tubes or simple pores, and the number not constant; numerous small pores around nostril tube, infraorbital pores about 7, postorbital pores about 5, mandibular pores about 4, and no pores in interorbital and occipital regions (Fig. 56). Lateral line ventral, running to very end of body. Vertical fins not gelatinous and thickend. Dorsal fin originating above base of pectoral fin. Anal fin originating below 15～17th dorsal ray. Pectoral fin fan-shaped, its length about twice the basal width. Pelvic fin small, somewhat shorter than eye diameter.

Color of fresh specimens uniformly blackish brown. Nostril tube transparent. Ventral side of head including lips, branchiostegal membranes, belly, margins of pectoral and vertical fins, and pelvic fin black. Center of pectoral fin bluish black. Oral and branchial cavities, and peritoneum black. Stomach light. Color in alcohol somewhat faded, dark brown with numerous light spots caused by loss of scales.

Distribution. Okhotsk Sea.

Remarks. *L. microporus* is related to *L. obscurus* in the general appearance, counts, and lateral-line pattern. However, it is easily separable from the latter in more prevomerine teeth and in having small head pores which are provided with small tubes. Such a condition concerning the head pores is highly distinctive amongst species of *Lycodes*.

Further, it also resembles *L. soldatovi* in the coloration and fin-ray counts.

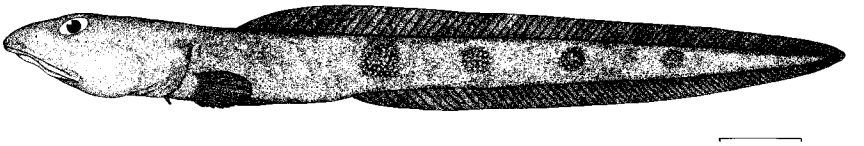

Fig. 57. Holotype of *Lycodes ocellatus* from off Kushiro, the Pacific coast of eastern Hokkaido. HUMZ 36817 (205.7 mm TL, male). Scale indicates 20 mm.

However, it is clearly separable from the latter by the lateral-line pattern and many proportional measurements (Toyoshima, 1983).

Lycodes ocellatus sp. nov.
(New Japanese name: kurohoshimayugaji)
Fig. 57.

Holotype. HUMZ 36817 (205.0 mm TL, male), off Kushiro, eastern coast of Hokkaido, 600 m, July 17, 1974.

Paratypes. HUMZ 36811 (208.0 mm TL, sex unknown), HUMZ 36815 (205.0 mm TL, sex unknown), HUMZ 36823 (199.0 mm TL, sex unknown), HUMZ 36824 (192.0 mm TL, sex unknown), HUMZ 36826 (202.0 mm TL, sex unknown), HUMZ 36829 (201.0 mm TL, sex unknown), HUMZ 36830 (193.0 mm TL, sex unknown), HUMZ 36844 (207.0 mm TL, sex unknown), captured with the holotype.

Diagnosis. Body uniformly blackish brown with 4~5 black ocelli on body. Lateral line ventral. Dorsal 81~89, anal 69~76, pectoral 15~17.

Counts and proportions. Counts and proportions of the holotype are given first, followed by those of paratypes in parentheses. Dorsal 85 (81~89), anal 72 (69~76), pectoral 16 (15~17), gill rakers on 1st arch 2+10=12 (2~3+7~10=9~13), vertebrae 19+76=95 (19~20+75~78=94~98). Head length 4.5 (4.5~5.2) in total length, depth of body 13.7 (11.0~13.0), pectoral fin 9.8 (9.9~11.2), preanal length 2.6 (2.4~2.7), predorsal length 4.0 (4.1~4.5). Head width 2.1 (2.2~2.6) in head length, snout 4.0 (3.4~4.9), eye diameter 5.7 (4.5~5.7), pectoral fin 2.2 (2.0~2.5), gill opening 3.3 (2.9~3.7). Interorbital width 1.4 (1.2~1.5) in eye. Eye diameter 1.4 (1.3~1.6) in snout.

Description of holotype and paratypes. Body rather elongate, compressed, and its depth about twice pectoral base. Caudal region long, about 1.5 times of preanal length. Head large, depressed, wide, its length more than half of preanal length and its width about half of head (less than half of head in paratypes). Postorbital region of head rather long, a little shorter than twice pectoral fin. Cheek swollen especially in male. Snout more or less pointed, relatively long, and clearly longer than eye. Nostril tube extremely short. Eye rather high in position, moderately large, and clearly shorter than pelvic fin. Interorbital region slightly convex, narrow, and its width shorter than eye. Chin crest weakly developed, united anteriorly. Lips narrow. Lower lip with moderate labial lobe. Mouth large. Posterior end of upper jaw below posterior margin of eye (or extending beyond it). Branchiostegal membranes broadly united to isthmus. Gill opening large, the lower end extending downward and forward beyond lower base of pectoral fin. Teeth small and conical; those on upper jaw in 2 rows anteriorly, in a single row laterally,

and exposed outside when mouth closed; those on lower jaw in irregular 3 or 4 rows anteriorly, in a single row laterally; those on prevomer 2 (2 or 3) in number and larger than those on palatines; those on palatine about 10 in number and arranged in a single row. Body covered with small scales; vertical fins and belly scaled; head except for occipital region scaleless; pectoral base scaleless. Lateral line ventral, distinct, originating above upper end of gill opening, obliquely descending toward anus, and then running along base of anal fin to caudal base. Dorsal fin originating above middle of pectoral fin. Pectoral fin rather low in position, rather small, clearly shorter than gill opening, its lower rays thickened and shallowly incised. Pelvic fin clearly shorter than eye.

Color in alcohol and fresh specimens blackish brown. Ventral surface of head including lips, branchiostegal membranes, opercular region, and fins darker than side of body. Black ocelli with obscure margins, 4 (4 or 5) in number, on midlateral of body. A black bar connecting upper ends of gill openings. Peritoneum, oral and branchial cavities black. Stomach light.

Distribution. Pacific coast of eastern Hokkaido.

Etymology. The name *ocellatus* is taken from the black, round blotches which characterize the new species.

Remarks. The new species is closely related to *L. obscurus* and *L. microporus* in general body form, coloration, and lateral-line pattern. However, it is separable from the last two species in having black round blotches on body, fewer fin rays; dorsal rays fewer than 89, anal rays fewer than 76 as opposed to more than 90 and more than 77 respectively. Furthermore it is different from them in the absence of small head pores (see the remarks under *L. obscurus* and *L. microporus*).

Lycodes nakamurai (Tanaka, 1914)
(Japanese name: kurogenge)
Fig. 58

Furcimanus nakamurae Tanaka, 1914: 303, pl. 82, fig. 277 (off Niigata, Sea of Japan); Jordan and Hubbs, 1925: 320 (Sea of Japan); Okada and Matsubara, 1938: 406; Katayama, 1949: 74, fig. 2 (Toyama Bay, Sea of Japan); Hikita and Misu, 1951: 48 (western coast of Hokkaido).

Lycodes nakamurai: Matsubara, 1955: 776; Honma and Sugihara, 1963: 8 (off Sado Island, Sea of Japan).

Lycodes diapterus nakamurae: Taranetz, 1937: 164 (Okhotsk Sea); Andriashev, 1939: 78 (Okhotsk Sea); Lindberg, 1947: 171; Schmidt, 1950: 85 (Okhotsk Sea); Lindberg and Krasyukova, 1975: 149, fig. 119 (Okhotsk Sea, Sea of Japan).

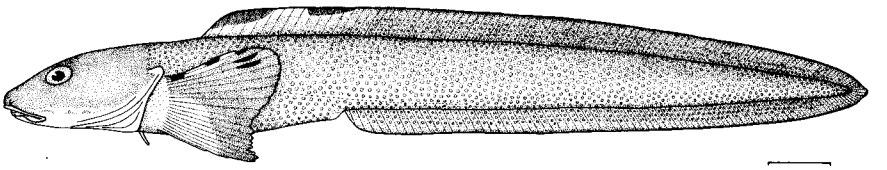

Fig. 58. *Lycodes nakamurai* from the Sea of Japan. HUMZ 41112 (277.2 mm TL, male). Scale indicates 20 mm.

Lycodes diapterus nakamurai: Honma, 1963: 21 (off Sado Island).

Material examined. HUMZ 41112 (277.2 mm TL, male), Wakasa Bay, Sea of Japan, March 27, 1975; HUMZ 41136 (285.0 mm TL, male), HUMZ 41137 (292.3 mm TL, female), HUMZ 41139 (295.2 mm TL, female), HUMZ 41140 (281.0 mm TL, male), HUMZ 41142 (309.6 mm TL, male), HUMZ 41145 (237.9 mm TL, male), HUMZ 41148 (290.2 mm TL, male), HUMZ 41151 (231.0 mm TL, male), Wakasa Bay, March 30, 1975; HUMZ 45026 (285.8 mm TL, female), HUMZ 45257 (316.0 mm TL, female), HUMZ 45258 (307.8 mm TL, male), 44°38′N, 141°01′E, near Rebun Island, northern Sea of Japan, 141~162 m, July 6, 1975; HUMZ 53641 (286.4 mm TL, male), HUMZ 53811 (220.0 mm TL, male), 39°16.7′N, 135°02.8′E, Yamato Bank, Sea of Japan, 410 m, May 3, 1976; HUMZ 53723 (220.9 mm TL, sex unknown), HUMZ 53724 (218.0 mm TL, male), 38°23.4′N, 137°23.1′E, Yamato Bank, 560 m, June 4, 1976; HUMZ 53733 (229.0 mm TL, male), 38°23′N, 137°18.3′E, Yamato Bank, June 5, 1976; HUMZ 53910 (223.2 mm TL, male), HUMZ 53916 (260.5 mm TL, female), 38°07.5′N, 136°52.2′E, Yamato Bank, 506 m, June 18, 1976; HUMZ 54723 (310.7 mm TL, male),HUMZ 54731 (220.5 mm TL, male), 44°43′N, 144°05′E, Kitami-yamato Bank, southern Okhotsk Sea, 193~198 m, June 17, 1976; HUMZ 76039 (270.9 mm TL, sex unknown), 45°08′N, 143°45′E, Kitami-yamato Bank, October 5, 1977; HUMZ 81256 (240.0 mm TL, male), 45°25.5′N, 140°22.2′E, Kitami-yamato Bank, 405 m, June 13, 1979.

Diagnosis. Emergination of pectoral fin deep, upper and lower lobes of the fin about equal in length. Body greyish without cross bands. Black spots sometimes surrounded by white area on anterior margin of dorsal fin and upper part of pectoral fin. Lateral line ventral. Dorsal 105~109, anal 91~97, pectoral 17~19.

Counts and proportions. Dorsal 105~109, anal 91~97, pectoral 17~19, gill rakers on lst arch 1~2+11~12=12~14, vertebrae 20~21+89~98=110~118. Head length 5.0~6.2 in total length, predorsal length 4.0~5.0, preanal length 2.4~2.8, depth of body 10.9~12.5, upper lobe of pectoral fin 7.2~8.9, shortest pectoral ray in fork 10.4~13.4, lower lobe of pectoral fin 6.7~10.8. Head width 2.0-2.5 in head length, snout 2.7~3.4, upper jaw 2.3~3.0, lower jaw 2.8~3.6, eye diameter 4.6~6.5, interorbital width 3.6~4.9, depth of body 1.9~2.7, pelvic fin 6.8~12.5, gill opening 2.4~4.9, isthmus width 4.2~6.8.

Description. Body elongate and compressed. Head about 5~6 in total length. Chin crest weakly developed, free anteriorly. Branchiostegal membranes widely united to isthmus. Mouth small; posterior end of upper jaw below anterior margin or anterior half of eye. Teeth conical; those on upper jaw in 2 rows anteriorly and in a single row posteriorly, outer teeth larger and outermost ones largest; those on lower jaw in a single row laterally and posteriorly, in a broad band (3~4 rows) anteiorly, outer teeth larger; those on prevomer about 4 or 5 in number; those on palatine in a single row. Body covered with small cycloid scales; head naked; belly and vertical fins scaled. Lateral line ventral, developed in anterior half of body, originating from upper end of gill opening and descending toward anus, and then running posteriorly along base of anal fin. Dorsal fin originating above middle of pectoral fin. Pectoral fin deeply emerginate, the upper and lower lobes about equal in length. Pelvic fin small and slender.

Color in alcohol and fresh specimens greyish. Margins of vertical fins blackish. Spots present on anterior margin of dorsal fin and upper part of pectoral fin. Spots on dorsal fin sometimes absent especially in larger specimens. These black spots occasionally surrounded by white area.

Distribution. Sea of Japan, southern Okhotsk Sea.

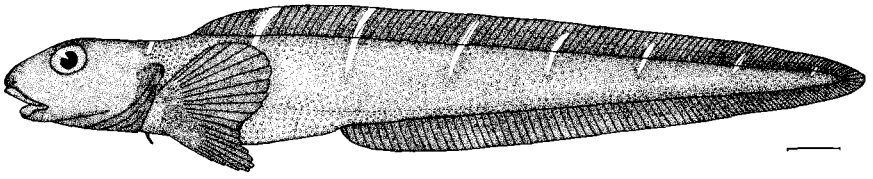

Fig. 59. *Lycodes hubbsi* from the Pacific coast of Hokkaido. HUMZ 81036 (314.8 mm TL, female). Scale indicates 20 mm.

Remarks. This species has been described as *L. diapterus nakamurae* by the Russian ichthyologists with *L. diapterus beringi* and *L. diapterus diapterus* (Andriashev, 1935; Taranetz, 1937; Schmidt, 1950; Lindberg and Krasyukova, 1975). However, the name *L. diapterus nakamurae*, was not adopted here and the other two subspecies were described under the name of *L. diapterus* (see the remarks on *L. diapterus*).

Lycodes hubbsi Matsubara, 1955
(Japanese name: yokosujikurogenge)
Fig. 59.

Lycodes hubbsi Matsubara, 1955: 776 (off Kinkazan, off Kushiro); Amaoka and Nakaya, 1983: 77 (Pacific coast of northern Japan); Toyoshima, 1983: 139, 261, pls. 90, 150 (Pacific coast of northern Japan, Okhotsk Sea).

Lycodes taranetzi Lindberg, 1950: 251 (nomen nudum).

Lycodes (*Furcimanus*) *taranetzi* Andriashev, 1975: 152, fig. 119 (waters along Kuril Islands, Okhotsk coast of Sakhalin).

Lycodes esmarki: Maruyama, 1971: 46 (off Iwate Prefecture).

Material examined. HUMZ 59534 (333.8 mm TL, male), off Kamaishi, Iwate prefecture, October 14, 1976; HUMZ 73612 (272.8 mm TL, male), HUMZ 72703 (299.8 mm TL, male), 38° 41.5′N, 142°20.05′E, off Miyagi Prefecture, 850~890 m, February 2, 1978; HUMZ 72807 (295.4 mm TL, female), HUMZ 72808 (286.6 mm TL, female), HUMZ 72811 (239.6 mm TL, male), HUMZ 72812 (191.0 mm TL, male), HUMZ 72813 (197.0 mm TL, male), HUMZ 72814 (200.4 mm TL, male), HUMZ 72815 (201.8 mm TL, male), HUMZ 72817 (155.8 mm TL, female), 41°58.3′N, 143°46.1′E, Pacific coast of Hokkaido, 420~430 m, April 2, 1978; HUMZ 75932 (282.8 mm TL, female), 44°54.3′N, 144°26′E, Okhotsk Sea, 465~480 m, June 29, 1978; HUMZ 78680 (315.8 mm TL, male), 44°49′N, 144°28′E, Okhotsk Sea, September 20, 1978; HUMZ 78733 (386.7 mm TL, male), HUMZ 78735 (358.8 mm TL, male), HUMZ 78737 (321.4 mm TL, male), 44°11′N, 145°00′E, Okhotsk Sea, 470~520 m, September 11, 1978; HUMZ 78781 (352.0 mm TL, male), 44°11.5′N, 142°02.4′E, Okhotsk Sea, 400~450 m, September 13, 1978; HUMZ 81036 (314.8 mm TL, female), Pacific coast of Hokkaido, June 1, 1978.

Diagnosis. Body brownish with narrow white, transverse bars on body and dorsal fin. Pectoral fin scaled, deeply emerginate, its longest ray of upper and lower lobes about equal in length. Eye large, about equal to snout. Lateral line ventral. Dorsal 104~109, anal 89~94, pectoral 20~23, vertebrae 109~115.

Counts and proportions. Dorsal 104~109, anal 89~94, pectoral 20~23, gill rakers on lst arch 2~4+8~9=11~12, vertebrae 20~21+89~94=109~115. Head length 4.9~5.7 in total length, predorsal length 4.5~5.0, preanal leogth 2.2 ~3.0, depth of body 8.2~12.3, upper lobe of pectoral fin 7.5~9.2, shortest ray of pectoral fin in fork 9.7~12.7, lower lobe of pectoral fin 7.8~9.8. Head width 1.7

~2.5 in head length, snout 2.5~3.1, upper jaw 2.6~3.3, lower jaw 3.0~4.0, eye diameter 3.6~5.4, interorbital width 3.4~5.3, depth of body 1.6~2.4, upper lobe of pectoral fin 1.4~1.7, shortest ray of pectoral fin in fork 2.0~2.6, lower lobe of pectoral fin 1.5~2.0, pelvic fin 6.0~10.4, gill opening 2.2~2.7, isthmus width 4.0 ~6.5.

Description. Body elongate and compressed. Head relatively large, 5~6 in total length. Snout blunt and rounded, about 3 in head. Eye moderately large, clearly shorter than snout. Chin crest weakly developed, united anteriorly. Mouth small, upper jaw about 3 in head. Posterior end of upper jaw below anterior half of eye. Teeth small and conical; those on upper jaw in 2 rows, anteriormost one largest and inner ones very small; those on lower jaw in a single row laterally and in a broad band anteriorly; those on prevomer with a group of 5~10 teeth; those on palatine in a single row. Body covered with small cycloid scales; dorsal and anal fins scaled; basal half of pectoral fin scaled; head except for nape naked. Lateral line ventral. Dorsal fin originating above anterior half of pectoral fin. Basal halves of vertical fins thickened. Pectoral fin deeply emerginate, upper and lower lobes about equal in length; emergination always present; lower lobe especially thickened. Pelvic fin small, clearly shorter than eye.

Color in alcohol and fresh specimens dark brown. Branchiostegal membranes and vertical fins blackish. Narrow, white bars, 5~6 in number, on body and extending onto dorsal fin. A similar bar on occipital region. These bars clear in young specimens and becoming obscure with growth. Nostril tube blackish. Oral and branchial cavities black.

Distribution. Okhotsk Sea, Pacific coast of northern Japan and waters along Kuril Islands.

Remarks. The scientific name of this species was originally appeared in Lindberg (1950) as *Lycodes taranetzi* (without description and figure). Thereafter, Matsubara (1955) included this species as *Lycodes* sp. in his book "Fish morphology and hierarchy" and described many diagnostic characters. Then, he noted in the footnote (p. 776) that he would publish the species under the name of *Lycodes hubbsi* as a new species. Hewever, he did not publish a subsequent paper. After that, Andriahev (1975) fully described the present species as new under the name *Lycodes (Furcimanus) taranetzi*.

Here, the scientific name, *Lycodes hubbsi*, was adopted because the diagnostic characters, which clearly separate the present species from the others of *Lycodes*, were given by Matsubara (1955), although illustrations were not presented and the scientific name was given only in a footnote. Dr. W. I. Follett of the California Academy of Science suggested me this would be correct according to International

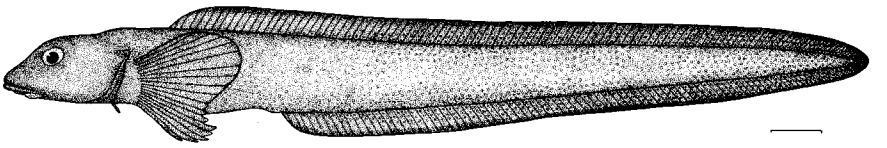

Fig. 60. Holotype of *Lycodes pectoralis* from the Okhotsk Sea. HUMZ 49083 (346.2 mm TL, male). Scale indicates 20 mm.

Code of Zoological Nomenclature (pers. comm.). Therefore, *Lycodes* (*Furcimanus*) *taranetzi* is treated as a junior synonym of *L. hubbsi*.

Lycodes pectoralis sp. nov.
(New Japanese name : kitanokurogenge)
Fig. 60.

Holotype. HUMZ 49083 (346.2 mm TL, male),45°37′N, 143°53′E, southern Okhotsk Sea, 290～480 m, October 8, 1975.

Paratypes. HUMZ 33951 (266.7 mm TL, female), HUMZ 33964 (292.6 mm TL, male), 44°47′N, 144°01.5′E, southern Okhotsk Sea, 200 m, October 31, 1974 ; HUMZ 33956 (271.0 mm TL, female), 45°02.5′ N, 144°05.0′E, southern Okhotsk Sea, 235 m, October 31, 1974 ; HUMZ 49071 (341.3 mm TL, male), HUMZ 49085 (331.8 mm TL, male), HUMZ 49088 (372.8 mm TL, male), 45°48′N,143°49′E, southern Okhotsk Sea, 143～149 m, October 10, 1975 ; HUMZ 49075 (328.4 mm TL, sex unknown), HUMZ 49076 (322.8 mm TL, female), HUMZ 49077 (273.8 mm TL, female), HUMZ 49082 (228.4 mm TL, male), HUMZ 49084 (343.6 mm TL, male), HUMZ 49087 (204.6 mm TL, male), HUMZ 49089 (270.8 mm TL, male), HUMZ 49090 (306.0 mm TL, female), HUMZ 49091 (321.2 mm TL, male), captured with the holotype ; HUMZ 49086 (345.8 mm TL, female), 45°35.5′N, 142°46.5′E, southern Okhotsk Sea, 280～395 m, October 9, 1975.

Diagnosis. Pectoral fin deeply emerginate. Head small, 5.7～6.4 in total length. Predorsal length short, 4.9～5.5 in total length. Preanal length short, 2.8 ～3.2 in total length. Lateral line ventral. No blotches or bars on body and fins. Dorsal 106～115, anal 91～101, vertebrae 112～123.

Counts and proportions. Counts and proportions of the holotype are given first, followed by those of paratypes in parentheses. Dorsal 110 (106～115), anal 97 (91～101), pectoral 18 (17～18), gill rakers on lst arch 3+11=14 (2～3+11～12=13 ～15), vertebrae 21+95=116 (21～22+91～101=112～123). Head length 5.9 (5.7 ～6.4)in total length, predorsal length 5.0 (4.9～5.5), preanal length 2.8 (2.9～3.2), depth of body 10.7 (10.7～12.5), upper lobe of pectoral fin 9.2 (7.7～9.0), shortest pectoral fin in fork 14.5 (10.5～13.5), lower lobe of pectoral fin 11.9 (9.4～12.1). Head width 2.0 (1.7～2.0) in head length, snout 3.0 (2.6～3.1), upper jaw 2.6 (2.4 ～2.7), lower jaw 3.1 (2.6～3.2), eye diameter 5.0 (4.0～5.9), interorbital width 4.1 (3.7～4.7), depth of body 1.8 (1.7～2.0), upper lobe of pectoral fin 1.6 (1.3～1.5), shortest pectoral fin in fork 2.5 (1.7～2.2), lower lobe of pectoral fin 2.0 (1.6～2.0), pelvic fin 8.7 (6.0～9.5), gill opening 2.7 (2.4～2.9), isthmus width 5.2 (4.7～6.0).

Description of holotype and paratypes. Body rather elongate and moderately deep, depth about equal to lower lobe of pectoral fin. Caudal region long, more than twice preanal length. Head rather small, moderately wide, its length a little longer than half of preanal length, and its width about equal to lower lobe of pectoral fin. Dorsal contour of head rather steep in snout region and also steeply ascending in occipital region. Snout somewhat pointed, less than twice eye. Nostril tube very short. Chin crest weakly developed without prominent lobe at tip. Branchiostegal membranes broadly united to isthmus, isthmus width about half of gill opening length. Gill opening large, its lower end extending downward and forward beyond lower base of pectoral fin. Mouth small, posterior end of upper jaw reaching anterior half of eye. Teeth small and conical ; those on upper jaw in irregular 2 (1 or 2 in paratypes) rows anteriorly, in a single (2 or 3) row laterally ; prevomer with a group of 9 (5～8) teeth ; those on palatine in a single row. Body

Table 10. Comparison of *Lycodes pectoralis* with *L. diapterus*.

Characters	*L. pectoralis*	*L. diapterus*
In TL:		
Head length	5.7~6.4	4.7~5.4
Predorsal length	4.9~5.5	4.0~4.3
Preanal length	2.8~3.2	2.7~2.9
Depth of body	10.7~12.5	9.9~14.6
Upper lobe of pectoral fin	7.7~9.2	6.9~8.8
In HL:		
Head width	1.7~2.0	2.6~3.3
Snout length	2.6~3.1	2.7~3.3
Upper jaw length	2.4~2.7	2.5~3.1
Lower jaw length	2.6~3.2	2.9~3.6
Eye diameter	4.0~5.9	3.7~4.9
Interorbital width	3.7~4.7	3.4~5.2
Pelvic fin length	6.0~9.5	5.5~10.4
Counts:		
Dorsal rays	106~115	105~109
Anal rays	91~101	92~96
Pectoral rays	17~18	17~19
Vertebrae	112~123	111~118

densely covered with scales; dorsum before dorsal origin entirely scaleless; head completely scaleless. Lateral line ventral, very distinct, starting from apex of gill opening, descending toward anus, and then running along base of anal fin almost to base of caudal fin. Dorsal fin originating above anterior half of pectoral fin. Anal-fin origin pening32.0,pectoralfin62.0.Distribuply emerginate, lower lobe clearly shorter than the upper. Pelvic fin small, shorter than eye diameter.

Color in alcohol and fresh specimens greyish. No bars or markings on body and fins. Margins of vertical fins blackish. Oral and branchial cavities dark. Peritoneum blackish. Stomach light.

Distribution. Okhotsk Sea.

Etymology. The specific name was taken from the emerginate pectoral fin characterizing the present species.

Remarks. The new species is most closely related to *L. diapterus* in having numerous vertical-fin rays and an emerginate pectoral fin (Table 10). However, it is easily separable from the latter by the smaller head (5.7~6.4 in total length as against 4.7~5.4 in the latter) and shorter predorsal length (4.9~5.5 as against 4.0 ~4.3). These proportional measurements are so stable throughout zoarcids that they provide sufficient evidence to indicate the distinctiveness of the present species.

Further, the present species is also distinguishable from *L. diapterus* by the lack of markings or bars both in the smaller and larger specimens.

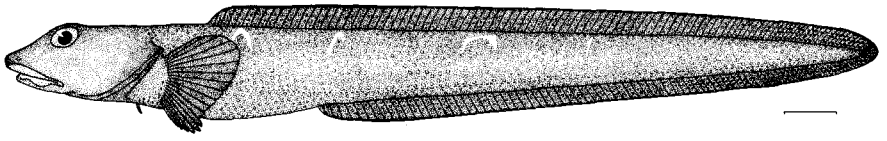

Fig. 61. *Lycodes diapterus* from the northern Okhotsk Sea. HUMZ 56662 (317.5 mm TL, male). Scale indicates 20 mm.

Lycodes diapterus Gilbert, 1891
Fig. 61.

Lycodes diapterus Gilbert, 1891 : 564 (coast of Oregon) ; Gilbert, 1895 : 470 (coast of California).

Furcimanus diaptera : Jordan and Evermann, 1898 : 2472, fig. 861 (coast of Oregon) ; Evermann and Goldsborough, 1907 : 344, fig. 122 (Bering Sea).

Furcimanus diapterus : Schmidt, 1904 : 331 ; Gilbert, 1915 : 363 (off San Diego, Monterey Bay) ; Chapman and DeLacy, 1933 : 103 ; Clemens and Wilby, 1946 : 191, fig. 128 (off British Columbia).

Lycodes (*Furcimanus*) *diapterus beringi* : Andriashev, 1935 : 115, fig. 1 (Bering Sea) ; Taranetz, 1937 : 164.

Material examined. HUMZ 34532 (248.0 mm TL, male), 51°15′N, 130°02′W, Bering Sea, 330 m, May 29, 1969 ; HUMZ 44939 (208.5 mm TL, male), 55°24′N, 154°25′E, western coast of Kamchatka, 300～305 m, May 11, 1975 ; HUMZ 45048 (343.9 mm TL, female), 51°55′N, 154°55′E, western coast of Kamchatka, 300～305 m, May 11, 1975 ; HUMZ 45642 (371.2 mm TL, male),52°15′N, 155°15′E, western coast of Kamchatka, May 11, 1975 ; HUMZ 54792 (330.6 mm TL, male), 54°05′N, 160°42′E, western coast of Kamchatka, May 20, 1976 ; HUMZ 55491 (334.6 mm TL, female), 55°02′N, 154°18′E, western coast of Kamchatka, 445～465 m, June 1, 1976 ; HUMZ 55191 (315.7 mm TL, male), 53°43′N, 160°23′E, western coast of Kamchatka, 515～520 m, May 20, 1976 ; HUMZ 56510 (285.9 mm TL, female), HUMZ 56522 (299.8 mm TL, female), 58°30′N, 151°57′E, northern Okhotsk Sea, 119～120 m, June 9, 1976 ; HUMZ 56651 (291.7 mm TL, female), HUMZ 56652 (318.6 mm TL, male), HUMZ 56658 (333.0 mm TL, male), HUMZ 56621 (321.0 mm TL, male), HUMZ 56662 (317.5 mm TL, male), HUMZ 56664 (358.7 mm TL, male), HUMZ 56674 (282.3 mm TL, female), HUMZ 56675 (325.7 mm TL, male), HUMZ 56676 (291.0 mm TL, female), 61°01′N. 158°17′E, northern Okhotsk Sea, 94～95 m, June 7, 1976 ; HUMZ 82616 (143.3 mm TL, male), 54°29.83′N, 167°62′W, Bering Sea, 800 m, June 14, 1979 ; HUMZ 83202 (275.0 mm TL, male), 54°30.05′N, 166°39.18′W, Bering Sea, 480～485 m, June 10, 1979 ; HUMZ 83250 (282.2 mm TL, female), 59°26.25′N. 178°20.16′W, Bering Sea, June 26, 1979 ; HUMZ 83304 (254.6 mm TL, female), 54°59.74′N, 167°39.70′W, 455 m, June 15, 1979 ; HUMZ 83532 (196.3 mm TL, male),, HUMZ 83533 (266.4 mm TL, male), 55°09.30′N, 167°58.42′W, 830 m, June 16, 1979 ; HUMZ 83695 (159.6 mm TL, male), 58°33.28′N, 175°05.39′W, 895～910 m, June 22, 1979 ; HUMZ 84038 (279.0 mm TL, female), HUMZ 84049 (261.0 mm TL, male), 54°19.9′N, 166°39.98′W, 730～750 m, June 13, 1979 ; HUMZ 84109 (168.0 mm TL, female), 58°32.55′N, 174°41.08′W, 725 m, June 22, 1979 ; HUMZ 84511 (253.4 mm TL, male), 59°20.25′N, 175°02.18′W, 740 m, June 23, 1979 ; HUMZ 84775 (293.2 mm TL, female), HUMZ 84789 (153.8 mm TL, male), 59°19.65′N, 178°06.70′W, 610 m, June 28, 1979.

Diagnosis. Head small, about 5 in total length. Pectoral fin deeply or only slightly emerginate and basal half with scattered sacles. Body blackish brown. Margins of vertical fins and branchiostegal membranes blackish. Vertical-fin rays numerous, dorsal 105～113, anal 92～96, pectoral 17～19.

Counts and proportions. Shown in Table 10.

Description. Body slender and not deep, depth about 10~15 in total length. Head small, about 5 in total length. Snout rounded, long, and about 3 in head. Eye relatively large, about 4~5 in head. Interorbital width about equal to eye. Chin crest weakly developed, united anteriorly. Branchiostegal membranes broadly united to isthmus, isthmus width about equal to eye. Mouth moderately large, posterior end of upper jaw below anterior half or middle of eye. Teeth conical; those on upper jaw in 2 or 3 rows anteriorly, in 2 rows posteriorly; those on lower jaw in a band (irregular 4 or 5 rows) anteriorly, in a single row posterolaterally; those on prevomer 5~6 in number; those on palatine in a single row. Body covered with small cycloid scales; occipital region, vertical fins, and belly scaled; basal half of pectoral fin with scattered scales. Lateral line ventral. Dorsal fin originating above anterior half of pectoral fin. Vertical fins thickened and gelatinous. Pectoral fin gelatinous, deeply or slightly emerginate. Pelvic fin small and thin.

Color in alcohol and fresh specimens dark brown. Light bars, 3~8 in number, on body and dorsal fin. Branchiostegal membranes, pectoral fin, and belly blackish. Branchial cavity black. Oral cavity and peritoneum black.

Distribution. Okhotsk Sea, Bering Sea, western coast of North and Middle America.

Remarks. Andriashev (1935), Taranetz (1937), and Schmidt (1950) divided *L. diapterus* into three subspecies; *L. diapterus diapterus* (known from the western coast of America); *L. diapterus beringi* (known from the Bering Sea), and *L. diapterus nakamurai* (known from the Sea of Japan and Okhotsk Sea). They thought *L. diapterus beringi* was separable from *L. diapterus diapterus* by the relatively shallower pectoral emergination, fewer cross bars on body, and longer nortril tube. However, these characters are so variable even if in the Bering Sea specimens that the two subspecies are not distinguishable. Therefore, *L. diapterus beringi* was judged as a synonym of *L. diapterus*.

While, *L. diapterus nakamurai* is distinctly different from *L. diapterus diapterus* in the possession of very clear markings on upper part of pectoral fin and anterior part of dorsal fin, and in the absence of cross bars on body and dorsal fin. Especially, the pectoral coloration is very distinctive amongst all the species of *Lycodes* and is considered to be of specific value. Hence, the two subspecies are elevated to independent species.

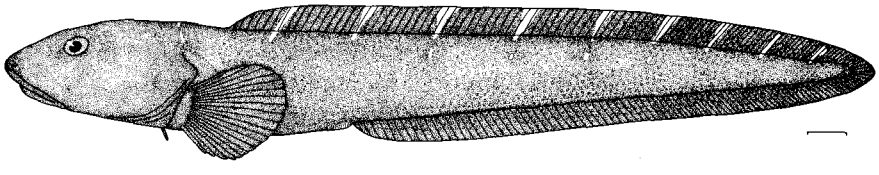

Fig. 62. *Lycodes albolineatus* from the western coast of Kamchatka. HUMZ 54156 (460.4 mm TL, male). Scale indicates 20 mm.

Lycodes albolineatus Andriashev, 1955
Fig 62.

Lycodes albolineatus Andriashev, 1955 : 397, figs. 4~6 (near Cape Lopatka, southern extremity of Kamchatka).

Material examined. HUMZ 45006 (489.6 mm TL, female), 49°07′N, 155°08′E, Okhotsk Sea, 295~300 m, June 24, 1975 ; HUMZ 54149 (387.2 mm TL, sex unknown), HUMZ 54150 (506.8 mm TL, male), HUMZ 54151 (504.2 mm TL, sex unknown), HUMZ 54152 (422.6 mm TL, sex unknown), HUMZ 54153 (439.6 mm TL, sex unknown), HUMZ 54154 (425.8 mm TL, sex unknown), HUMZ 54155 (396.4 mm TL, sex unknown), HUMZ 54156 (460.4 mm TL, male), HUMZ 54157 (509.1 mm TL, sex unknown), HUMZ 54158 (398.2 mm TL, sex unknown), 49°00′N, 155°05′E, Okhotsk Sea, 250~265 m,May 21, 1976 ; HUMZ 55112 (435.4 mm TL, male), HUMZ 55114 (487.0 mm TL, male), HUMZ 55117 (318.6 mm TL, male), HUMZ 55120 (390.2 mm TL, sex unknown),49°00′N, 155°19′E, Okhotsk Sea, 325~340 m, May 26, 1976 ; HUMZ 56582 (540.0 mm TL, sex unknown), HUMZ 56682 (655.2 mm TL, male), HUMZ 56683 (609.4 mm TL, male), HUMZ 56688 (546.9 mm TL, sex unknown), HUMZ 56689 (610.0 mm TL, female), HUMZ 56698 (813.0 mm TL, male), HUMZ 56701 (555.4 mm TL, sex unknown), 50°58′N, 157°52′E, near Cape Lopatka, 242~245 m, May 22, 1976.

Diagnosis. Body black with very narrow white bars, 7~9 in number, extending onto dorsal fin. A similar discontinuous bar on predorsal region. Lateral line ventral.

Counts and proportions. Dorsal 97~103, anal 82~86, pectoral 21, vertebrae 21~22+85~87=106~109. Head length 4.0~4.8 in total length, preanal length 2.3~2.7, predorsal length 3.8~4.5, depth of body 7.4~11.2, pectoral fin 7.9~9.7, gill opening 8.4~10.9. Head width 1.3~2.5 in head length, snout 2.9~3.7, upper jaw 1.8~2.9, eye diameter 7.2~12.3, interorbital width 4.1~5.4, depth of body 1.7~2.4, pectoral fin 1.7~2.3, gill opening 2.0~2.3, isthmus width 3.6~6.4. Pelvic fin 1.0~1.8 in eye.

Description. Body elongate and compressed, especially in posterior half. Head large and gelatinous, less than 5 in total length. Snout blunt and rounded, about 3 times of eye. Eye small. Interorbital region convex and wide. Chin crest moderately high and free anteriorly. Mouth moderately large, posterior end of upper jaw below eye. Teeth small and conical ; those on upper jaw in a band, toothed only anteriorly and anterolaterally ; those on lower jaw in a wide band anteriorly, in a single row laterally and posteriorly ; those on prevomer 5~9 in number ; those on palatine in a single row. Lateral teeth of lower jaw large and strong. Body covered with small cycloid scales ; head and dorsum before dorsal fin naked ; belly and vertical fins densely scaled. Lateral line ventral. Anterior half of vertical fins thickened with gelatinous connective tissue. Dorsal fin originating above anterior half of pectoral fin. Pectoral fin round and gelatinous, about half of head. Pelvic fin small, usually less than eye diameter.

Color of fresh specimens blackish. Very narrow white bars, 7~9 in number, on dorsal fin and extending on body. A similar discontinuous bar on predorsal region. Peritoneum, oral and branchial cavities blackish.

Distribution. Western and eastern coast of Kamchatka.

Lycodes brevipes Bean, 1890
(Japanese name: ashibosogenge)
Fig. 63.

Lycodes brevipes Bean, 1890: 38 (Bering Sea); Gilbert, 1895: 454 (Bering Sea); Jordan and Evermann, 1898: 2467; Schmidt, 1904: 331 (Bering Sea); Evermann and Goldsborough, 1907: 343; Clemens and Wilby, 1946: 191, fig. 127 (Pacific coast of Canada); Matsubara, 1955: 777: Okada and Kobayashi, 1968: 60 (Bering Sea); Hart, 1973: 242 (off Oregon through Washington and British Columbia to Alaska).

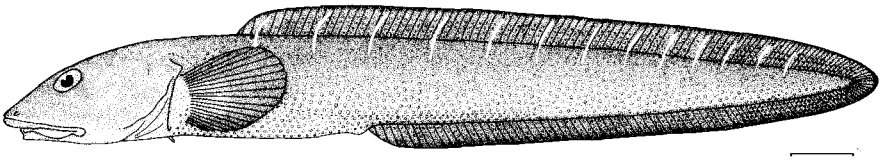

Fig. 63. *Lycodes brevipes* from the Bering Sea. HUMZ 76785 (280.5 mm TL, male). Scale indicates 20 mm.

Material examined. HUMZ 36904 (282.2 mm TL, male), 55°43.3′N, 168°00′W, Bering Sea, 137 m, July 15, 1974; HUMZ 76784 (328.0 mm TL, male), HUMZ 76875 (280.5 mm TL, male), HUMZ 76786 (313.4 mm TL, male), HUMZ 76787 (278.0 mm TL, female), 55°18.0′N, 165°16.5′W, 115 m, May 5, 1978; HUMZ 76936 (290.0 mm TL, male), 58°53.0′N, 173°15.5′W, 113 m, June 15, 1978; HUMZ 77203 (216.4 mm TL, sex unknown), HUMZ 77207 (284.0 mm TL, male), 55°34.5′N, 165°44.5′W, 116 m, May 8, 1978; HUMZ 77282 (301.8 mm TL, male), HUMZ 77284 (236.4 mm TL, male), HUMZ 77285 (292.0 mm TL, male), Bering Sea, June 16, 1978; HUMZ 77319 (260.0 mm TL, female), 59°52.0′N, 177°20.8′W, 136 m, June 21, 1978; HUMZ 77345 (240.3 mm TL, male), HUMZ 77346 (243.0 mm TL, female), 55°01.0′N, 165°43.0′W, 121~125 m, May 4, 1978.

Diagnosis. Lateral line ventral. Very narrow light bars, 9~12 in number, on body and dorsal fin.

Counts and proportions. Dorsal 93~99, anal 78~81, pectoral 19~21, gill rakers on lst arch 2~4+9~11=11~15, vertebrae 20~21+79~82=99~103. Head length 4.1~5.2 in total length, predorsal length 3.7~4.1, preanal length 2.3~2.5, depth of body 9.7~12.1, pectoral fin 8.3~10.0. Head width 2.7~3.3 in head length, upper jaw 1.9~2.6, lower jaw 2.2~3.0, eye diameter 4.7~6.7, interorbital width 4.9~7.6, depth of body 2.0~2.6, pectoral fin 1.6~2.1, pelvic fin 10.0~24.5, gill opening 2.5~3.0, isthmus width 4.5~6.8.

Description. Body moderately elongate. Head more or less large, about 4 or 5 in total length. Chin crest moderately developed. Mouth small, posterior end of upper jaw below anterior half of eye. Teeth small and conical; those on upper jaw in 2~5 rows anteriorly, in a sigle row posteriorly, and outer teeth larger; those on lower jaw in a single row posteriorly, in 1~3 rows laterally, and in 3~5 rows anteriorly, outer and inner teeth about equal in size; those on prevomer 2~6 in number; those on palatine in a single row, but anteriorly they form 2 irregular rows. Lateral line ventral, indistinct. Body covered with small cycloid scales; bases of vertical fins scaled; head naked. Dorsal fin originating above anterior half of pectoral fin. Pectoral fin about 2 in head, its lower rays somewhat thickened.

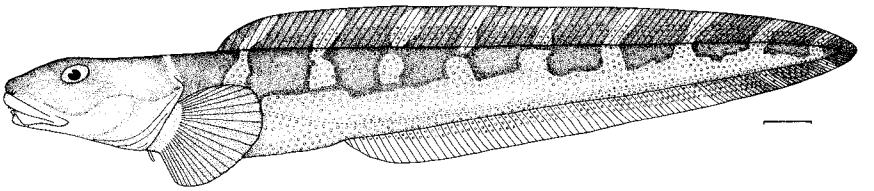

Fig. 64. *Lycodes brunneofasciatus* from the eastern coast of Kamchatka. HUMZ 56575 (353.0 mm TL, male). Scale indicates 20 mm.

Pelvic fin very small, less than half of eye.

Color in alcohol brownish with 9~12, narrow, light bars on body and dorsal fin. Margin of dorsal fin blackish. Anal fin completely black or only its margin black. Pectoral fin dark. Pelvic fin as dark as or darker than side of body. A light bar, sometimes discontinuous, crossing occipital region. Light bars on head and body sometimes lacking, Branchial and oral cavities greyish.

Distribution. Bering Sea.

Lycodes brunneofasciatus Suvorov, 1935
(Japanese name: harasujigenge)
Fig. 64.

Lycodes brunneofasciatus Suvorov, 1935: 439, fig. 3 (eastern coast of Kamchatka); Schmidt, 1950: 91 (Okhotsk Sea); Matsubara, 1955: 776; Ueno and Abe, 1964: 16, figs. 11, 12 (near Itrup Island).

Material examined. HUMZ 33990 (507.3 mm TL, female), 45°10.4′N, 140°27.3′E, near Itrup Island, 486~490 m, November 21, 1967; HUMZ 44975 (477.8 mm TL, male), HUMZ 45329 (541.8 mm TL, male), 50°45′N, 157°07′E, near Cape Lopatka, 88~90 m, May 13, 1975; HUMZ 54850 (655.3 mm TL, male), HUMZ 54851 (639.0 mm TL, sex unknown), HUMZ 54854 (580.5 mm TL, female), 53°56′N, 160°26′E, eastern coast of Kamchatka, 215~240 m, May 20, 1976; HUMZ 54930 (556.8 mm TL, female), HUMZ 54932 (412.0 mm TL, female), HUMZ 54933 (311.0 mm TL, male), HUMZ 54937 (342.5 mm TL, female), 51°35′N, 158°18′E, eastern coast of Kamchatka, 250~265 m, May 21, 1976; HUMZ 55118 (329.0 mm TL, sex unknown), HUMZ 55121 (303.6 mm TL, female), 49°00′N, 155°19′E, eastern coast of Kamchatka, 325~340 m, May 26, 1976; HUMZ 60276 (614.4 mm TL, female), 55°19′N, 142°34′E, Okhotsk Sea, 178 m, October 23, 1976; HUMZ 56575 (353.0 mm TL, male), 50°58′N, 157°52′E, eastern coast of Kamchatka, 242~245 m, May 22, 1976.

Diagnosis. Ten, saddle-like, dark brown bands on body and dorsal fin. A light band on occipital region. Lateral line ventral. Dorsal 96~100, anal 81~87, pectoral 20~22, vertebrae 101~109.

Counts and proportions. Dorsal 96~100, anal 81~87, pectoral 20~22, gill rakers on lst arch 2~3+11~12=13~15, vertebrae 22~23+79~86=101~109. Head length 4.0~5.0 in total length, predorsal length 3.4~4.6, preanal length 1.9~2.7, depth of body 7.0~11.0, pectoral fin 7.3~9.7. Head width 1.5~2.5 in head length, upper jaw 1.9~2.6, lower jaw 1.9~3.2, eye diameter 6.1~10.9, interorbital width 3.0~5.6, depth of body 1.4~2.3, pectoral fin 1.2~2.2, pelvic fin 8.2~17.8, gill opening 1.5~2.4.

Description. Body moderately elongate, depth about equal to pectoral fin. Head somewhat gelatinous, large, and wide. Eye small, clearly longer than snout.

Snout round and long. Interorbital region wide, about equal to isthmus width. Chin crest moderately high. Mouth large and wide. Posterior end of upper jaw below eye. Gill rakers on first arch with minute spines on their tips. Teeth conical; those on upper jaw in 2 or 3 rows anteriorly, in a single row laterally and posteriorly; those on lower jaw in a band anteriorly, in a single row posteriorly; those on prevomer 4~6 in number; those on palatine about 12 in number and arranged in a single row. Body covered with small cycloid scales; head completely naked; belly and vertical fins scaled. Lateral line ventral and distinct. Vertical fins somewhat thickened with gelatinous connective tissue. Dorsal fin originating above anterior half of pectoral fin. Pectoral fin rounded, gelatinous, thickened, and its lower rays slightly incised. Pelvic fin shorter than eye.

Color in alcohol and fresh specimens brownish. Ten, dark brown, saddle-like bands on body and dorsal fin. Head and pectoral fin dark brown. Anal fin without blotches or sometimes with 4~5 dark brown bands. Lips, ventral surface of head, margins of lower pectoral rays and base of pectoral fin light. Branchial cavity blackish. Peritoneum brownish.

Distribution. Okhotsk Sea, eastern coast of Kamchatka.

Lycodes andriashevi Fedorov, 1966

Lycodes andriashevi Fedorov, 1966: 160, fig. 1 (Bering Sea).

The following description is based on Fedorov (1966).

Diagnosis. Body black without blotches. Lateral line ventral. Dorsal rays more than 100, anal rays more than 86, vertebrae more than 105.

Counts and proportions. Dorsal 117 (including half caudal rays), anal 99 (including half caudal rays), gill rakers on lst arch 2+12=14, vertebrae 22+92=114. Predorsal length 27.8% of total length, preanal length 42.7, head length 23.1, depth of body 14.5, pelvic fin 1.4, pectoral fin 13.3. Eye diameter 11.1% of head length, interorbital width (bony part) 5.9.

Distribution. Bering Sea.

Lycodes obscurus sp. nov.

(New Japanese name: sumiiromayugaji)

Figs. 65, 66.

Holotype. HUMZ 76006 (162.6 mm TL, male), 44°59.7′N, 144°21.2′E, southern Okhotsk Sea, 340 m, June 28, 1978.

Paratypes. HUMZ 92885 (208.4 mm TL, male), HUMZ 92886 (205.0 mm TL, male), HUMZ 92887 (192.3 mm TL, male), 44°51′N, 144°25′E, southern Okhotsk Sea, 380~400 m, October 8, 1981.

Diagnosis. Body dark brownish without blotches. Lateral line ventral and very clear. Small head pores without tubes present.

Counts and proportions. Counts and proportions of the holotype are given first, followed by those of paratypes in parentheses. Dorsal 91 (90~93), anal 77 (79~80), pectoral 16 (16~17), vertebrae 20+77=97 (18~20+76~78=94~97). Head length 5.9 (4.9~5.5) in total length, predorsal length 5.1 (4.4~4.9), preanal length 2.9 (2.6~2.8), depth of body 11.4 (10.0~11.2), pectoral fin 10.5 (10.6~11.4). Head width 1.9 (1.7~2.0) in head length, snout 3.3 (2.1~2.8), eye diameter 3.8 (5.0

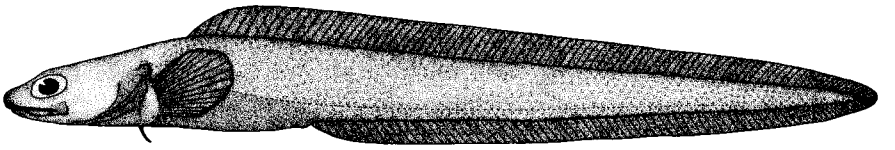

Fig. 65. Holotype of *Lycodes obscurus* from the southern Okhotsk Sea. HUMZ 76006 (162.6 mm TL, male). Scale indicates 10 mm.

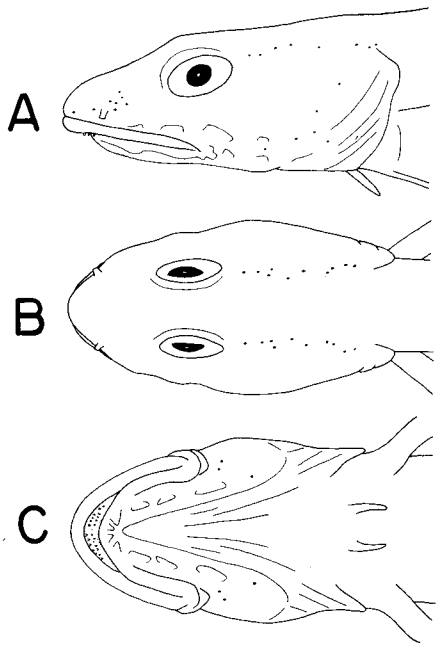

Fig. 66. Illustrations to show the shape of head and distribution of head pores in *Lycodes obscurus*. Drawn from the holotype.

~5.8), interorbital width 8.4 (4.7~5.5), upper jaw 2.5 (2.1~2.3), lower jaw 2.9 (2.5~2.8), pectoral fin 1.8 (2.0~2.2), gill opening 2.9 (2.7~3.0), isthmus width 4.7 (3.8~4.8), pelvic fin 5.5 (8.4~8.8).

Description of holotype and paratypes. Body moderately elongate and compressed, its depth about equal to pectoral fin. Caudal region moderately long, about equal to twice preanal length. Head relatively small, about half of preanal length, with swollen cheeks, and width a little shorter than half of head (or equal in paratypes). Dorsal contour of head gently ascending toward dorsal fin. Snout round in upper profile and a little longer than eye (or clearly longer than it). Nostril tube very short. Eye relatively high in position and large. Interorbital region convex and narrow. Mouth moderately large. Posterior end of upper jaw reaching posterior half of eye. Lips not conspicuously thickened. Labial lobe moderately developed. Chin crest low. Branchiostegal membranes rather broadly united to isthmus. Gill opening relatively small, its lower end nearly same level as lower base of pectoral fin, and not extending downward and forward beyond the base. Teeth small, weak, and conical; those on upper jaw in 2 (2 or 3) rows anteriorly, in a single row of 7 (9~11) teeth laterally and posteriorly; those on lower jaw in 3 (5) rows anteriorly, in a short row of 5 (6~8) teeth laterally and posteriorly; those on prevomer in a group of 5 (2~6) teeth; those on palatine in a single row of 9 (10~12) teeth. Small cycloid scales well developed on body; belly densely scaled; vertical fins also densely scaled to their margins; dorsum before dorsal fin, head, and pectoral fin with its base scaleless. Small head pores in nasal, infraorbital, postorbital, preopercular, and mandibular regions (Fig. 66). Lateral line ventral, distinct, starting from above gill opening,

descending obliquely downward to anus, and then running along base of anal fin almost to caudal base. Dorsal fin originating above anterior half of pectoral fin. Anal fin originating below 16th (16~17th) dorsal ray. Pectoral fin slightly incised in its tip, more or less small, and about equal to postorbital head length. Pelvic fin very short, about equal to pupil.

Color in alcohol blackish without markings. Vertical fins black. Pectoral fin black, especially along the margin. Lips, branchiostegal membranes, belly, and opercular region black. Oral and branchial cavities, and peritoneum black. Stomach light.

Distribution. Southern Okhotsk Sea.

Etymology. The specific name *obscurus* refers to the blackish body.

Remarks. The new species is most similar to *L. microporus* in general appearance, fin-ray counts, lateral-line pattern, and presence of small head pores. However, it is easily separable from the latter in the characters that the head pores are not provided with the short tubes (see the remarks on *L. microporus*).

21. Genus *Aprodon* Gilbert, 1891

Aprodon Gilbert, 1891: 106, type species by monotypy, *Aprodon cortezianus* Gilbert, 1891; Goode and Bean, 1895: 527; Jordan and Evermann, 1898: 2460.

Diagnosis. Head pores absent. Pelvic fin consisting of 3 soft rays. Prevomer toothless. A single row of palatine teeth present.

Description. Body moderately elongate and compressed especially in posterior half. Head large. Head pores completely absent. Lower jaw included. Lateral line midlateral. Gill opening large, extending downward and forward beyond lower end of pectoral base. Small teeth on jaws and palatines. Prevomer toothless. Pectoral fin large without fork. Pelvic fin consisting of 3 soft rays.

Remarks. This genus is closely related to *Lycodes* and *Lycodopsis*. It can be distinguished from these two genera by the toothless prevomer and toothed palatines. Only one species, *A. cortezianus*, is known from the eastern Pacific Ocean and Bering Sea.

Aprodon cortezianus Gilbert, 1891
Fig. 67.

Aprodon cortezianus Gilbert, 1891: 107 (Cortez Banks, off San Diego); Goode and Bean, 1895: 527; Jordan and Evermann, 1898: 2461, fig. 852 (off northern coast of California).

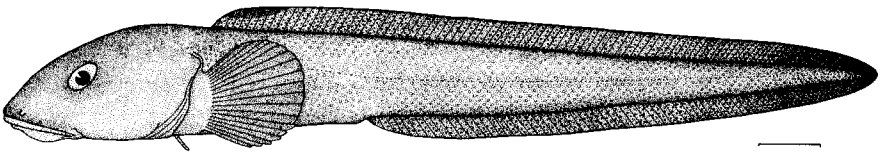

Fig. 67. *Aprodon cortezianus* from off San Diego. HUMZ 64342 (273.8 mm TL, male). Scale indicates 20 mm.

Material examined. HUMZ 30678 (427.7 mm TL, male), 40°53.0′N, 124°34′W, 570 m, October 17, 1973; HUMZ 34545 (416.6 mm TL, female), 51°22′N, 130°02′W, southeast of Alaska, 304~310 m, May 18, 1969; HUMZ 64342 (273.8 mm TL, male), 32°49.7′N, 119°20.0′ W, off San Diego, 362 m, October 9, 1973.

Diagnosis. Head large, less than 5 in total length. Pectoral fin large, 7~8 in total length. Gill opening large, nearly equal to postorbital head length. A black blotch on anterior margin of dorsal fin.

Counts and proportions. Dorsal 106~109, anal 89~92, pectoral 19, vertebrae 23+89~92=112~115. Head length 3.9~4.5 in total length, preanal length 2.2 ~2.4, predorsal length 3.7~4.1, depth of body 9.9~11.2, pectoral fin 7.4~7.9. Head width 2.7~3.1 in head length, snout 2.5~2.6, eye diameter 6.4~7.7, interorbital width 4.4~4.6, postorbital head length 1.9, upper jaw 2.1~2.7, lower jaw 2.4 ~2.8, gill opening 2.2~2.4, pelvic fin 9.9~10.4.

Description. Body moderately elongate, depth about 10% of total length. Head large, about 24% of total length. Snout rounded and long, a little shorter than postorbital head length. Interorbital region convex, width longer than eye. Mouth large. Posterior end of upper jaw below anterior half of eye. Labial lobe moderately developed. Chin crest low, not united anteriorly. Teeth small and conical; those on upper jaw in 2 rows, outer teeth larger; those on lower jaw in 3 rows anteriorly, in 2 rows laterally and posteriorly; those on palatine in a single row of about 9 teeth. Lateral line midlateral, distinct. Small scales covering entire body; vertical fins densely scaled to their margins; head and pectoral base scaleless. Gill opening very large, nearly equal to postorbital head length. Dorsal fin originating above pectoral base. Pectoral fin large, very slightly emerginate, its length more than 50% of head. Pelvic fin a little shorter than eye.

Color in alcohol brownish. Margins of vertical fins blackish especially in their posterior part. Pectoral fin darker than side of body. Anterior margin of dorsal fin with a black blotch. Oral and branchial cavities somewhat dark. Peritoneum black.

Distribution. Bering Sea, eastern Pacific Ocean.

22. Genus *Lycodopsis* Collett, 1879

Lycodopsis Collett, 1879: 381, type species by original designation, *Lycodes pacificus* Collett, 1879; Gill 1881: 247; Jordan and Gilbert, 1883: 784; Gill, 1885: 180; Goode and Bean, 1895: 313; Jordan and Evermann, 1896: 2460.

Leurynnis Lockington, 1880: 326, type species by monotypy, *Leurynnins paucidens* Lockington, 1880 (=*L. pacificus*).

Diagnosis. Head pores absent. Skin tough and adhering tightly to body and fins. Scales covering body except for head and fins. Pelvic fin present. Prevomer and palatines toothless.

Remarks. The present genus is allied to *Lycodes*. It is separable from the latter by the absence of teeth on both prevomer and palatines. Only one species, *L. pacificus* (Collett, 1879), is known from the eastern Pacific Ocean.

V. Summary

The goal of the present study was to clarify the taxonomic status of those genera

and species belonging to the subfamily Lycodinae which occur in Japan and neighbouring waters. The results are summarized as follows.

1. The subfamily Lycodinae comprises 13 genera in the Northern Hemisphere.
2. The following 8 genera are known to occur in Japan and its adjacent waters; *Petroschmidtia* (2 species), *Hadropogonichthys* (1 species), *Lycodonus* (1 species), *Taranetzella* (1 species), *Lycenchelys* (19 species), *Embryx* (1 species), *Lycodes* (41 species), and *Aprodon* (1 species).
3. Five new species are described in the genus *Lycenchelys*; *L. maculatus* (Pacific coast of northern Japan), *L. roseus* (Bering Sea), *L. altus* (south of Aleutian Islands), *L. longirostris* (Bering Sea), and *L. brevimaxillaris* (Pacific coast of northern Japan).
4. Seven new species are described in the genus *Lycodes*; *L. paucilepidotus* (Okhotsk Sea), *L. ocellatus* (Pacific coast of Hokkaido), *L. pectoralis* (Okhotsk Sea), *L. obscurus* (Okhotsk Sea), *L. yamatoi* (northern Sea of Japan and Okhotsk Sea), *L. fulvus* (Okhotsk Sea), and *L. matsubarai* (Okhotsk Sea).

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