Lycodes japonicus, A New Ophidioid Fish from Toyama Bay

Kiyomatsu MATSUBARA and Tamotsu IWAI
(Dept. Fisheries, Fac. Agriculture, Kyoto Univ., Maizuru)

The present new species is based on forty specimens obtained by motor-trawler near the sea-coast of Uozu, south-eastern part of Toyama Bay, at a depth of about 303 meters (200 "hiro"). The measurements were made in the same way as the senior writer had done in his previous studies on the deep-sea fishes of Japan.

Lycodes japonicus, new species

Holotype.—— MATSUBARA's Fish Coll. No. 13117, a mature male specimen, measuring 122.0 mm in total length, collected by Hachiro KINOSHITA, on June 10, 1950.

Paratypes. —— 15 specimens, MATSUBARA's Fish Coll. Nos. 12773 to 12787, measuring 109.0 to 134.5 mm in total length, collected by Tamotsu IWAI, on May 15, 1950. 24 specimens, MATSUBARA's Fish Coll. Nos. 13115 to 13116, 13118 to 13138 and 13150, measuring 99.2 to 137.0 mm in total length, collected by Hachiro KINOSHITA, on June 10, 1950.

DIAGNOSIS.- *L. japonicus* is a dwarf species, full grown eggs are found even in our smallest female specimen measuring 99.5 mm in total length. The largest one at our disposal is a mature male measuring 137.0 mm in total length. Dorsal rays 79–84. Anal rays 69–73. Pectoral rays 14–15; the six lower rays are simple, more or less thickened and the membrane between each ray is deeply incised; lower half of the pectoral fin is symmetrical with upper half of it. Ventral fin is very long, about as long as or slightly longer than diameter of eye, and 3.32 to 4.47 into length of head. Pyloric coeca usually 2 and very rarely 3. Vertebrae 87–93. Head is usually broader in male than in female. Eyes are rather large, about as long as or slightly shorter than length of snout. Lower inner edges of mandibular rami are not produced as free fleshy flaps anteriorly. Belly is scaly, the scales are extending below lower end of base of pectoral fin anteriorly. Color patterns on sides of body are peculiar in shape.

DESCRIPTION.- The counts and proportional measurements of bodily parts in the holotype and paratypes are given in Table 1. Body is moderately elongate, compressed and tapering into a pointed caudal. Head is depressed, wider than deep and the upper profile is gently elevated above the eye; cheeks are more or less swollen in male; the head is, therefore, usually, but not always, much wider in male than in female (Fig. 2 and Table 1). Snout is rather steep before the nostril. Eyes are round and entering the upper profile of head when viewed from the lateral side; it is very large, about as long as or slightly shorter than length of snout; interorbital space is scarcely elevated and always much narrower than diameter of eye. Nostril is single on each side, opening at the tip of moderately long tube and is much nearer tip of snout than anterior end of eye.

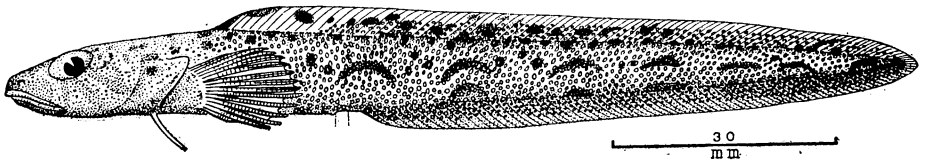

Fig. 1 *Lycodes japonicus* in lateral view, from the holotype, 122.0 mm in total length. Drawing by K. MATSUBARA.

Mouth is slightly oblique, the maxillary extends to below the anterior end of pupil; when mouth is closed the lower jaw is entirely included under the upper jaw which is projecting beyond the lower for a distance equal to about half the diameter of pupil; lips are rather thin. The lower inner edges of the mandibular rami are narrowly keeled; the keels are rather low, united anteriorly immediately behind the symphysis of lower jaw and are not produced as free fleshy flaps anteriorly. Teeth are small, but sharply pointed; those on premaxillary are placed in two series anteriorly, but in a single series posteriorly, the outer teeth are much larger than those of the inner series and the anteriormost one of the outer series is canine-like and curved inward; vomerine teeth are 9 or 10, subequal in size, curved inward and forming a quadrate patch; palatine with a single series of about fifteen teeth; teeth on lower jaw are set in three rows anteriorly, but in a single series laterally and posteriorly, the outer teeth are much larger than those of the inner series (Fig. 2 A, B). Tongue is thick, round and not free in front.

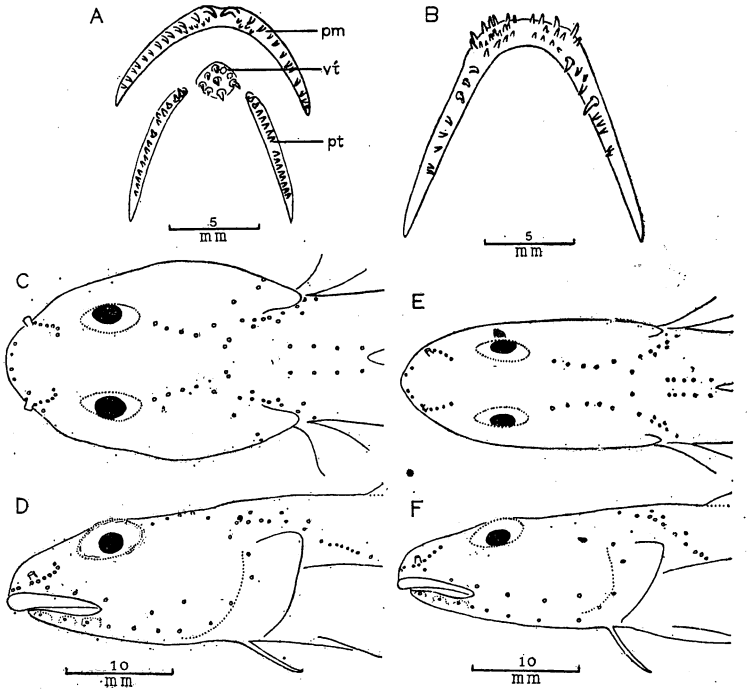

Fig. 2 Dentition and head in *L. japonicus*. A, premaxillary teeth (pm), vomerine teeth (vt) and palatine teeth (pt); B, teeth on lower jaw; C and E, dorsal view of head; D and F, lateral view of head. A–D, from a male specimen, 134.5 mm in total length (No. 12777); E–F, from a female specimen, 123.5 mm in total length (No. 12775). Drawings by K. MATSUBARA and T. IWAI.

Table 1. Counts and proportional measurements in *L. japonicus*. Total length: 99.2 to 137.0 mm in males, 99.5 to 129.0 mm in females.

Items	Holo-type	Males (Paratypes)				Females (Paratypes)			
		No.	Range	Mode	Mean	No.	Range	Mode	Mean
Dorsal rays	82	17	79–84	83	81.89	13	79–84	82	81.46
Anal rays	70	17	69–73	70	70.53	13	69–71	70	69.84
Pectoral rays	15	17	14–15	15	14.77	13	14–15	15	14.69
Caudal rays	9	17	8–10	9	8.61	13	7– 9	9	8.54
Gill-rakers		17	9–13	11	10.65	13	10–13	10	11.16
Vertebrae		17	87–93	89	88.82	13	88–91	88	89.15
Pyloric coeca		17	2	2	2	13	2– 3	2	2.08
In total length:									
Head	4.98	22	4.48–5.00	4.6–4.8	4.68	17	4.57–5.67	4.8–5.0	4.88
Depth at pectoral base	10.89	22	9.07–12.19	10.0–10.5	10.41	17	9.92–11.90	10.0–10.5	10.65
Depth at dorsal origin	10.61	22	8.51–11.63	9.5–10.0	10.28	17	8.71–11.47	10.0–10.5	10.43
Width at pectoral base	13.55	22	11.21–15.24	13.5–14.0	13.39	17	11.00–15.26	13.0–13.5	13.22
Width at dorsal origin	13.86	22	11.65–15.26	13.5–14.0	13.34	17	11.22–15.25	13.0–13.5	13.03
Dist. from tip of snout to dorsal origin	4.07	22	3.64–4.12	3.9–4.0	3.87	17	3.73–4.25	3.9–4.0	3.95
Dist. from tip of snout to vent	2.74	22	2.51–2.96	2.7–2.8	2.73	17	2.58–2.94	2.6–2.7	2.71
Dist. from ventral base to vent	4.88	22	4.38–4.96	4.8–4.9	4.72	17	4.22–4.93	4.7–4.8	4.64
In head length:									
Snout	3.95	22	3.50–4.00	3.6–3.7	3.63	17	3.54–4.09	3.7–3.8	3.77
Eye	3.89	22	3.78–4.54	4.0–4.1	4.17	17	3.63–4.28	3.9–4.0	3.96
Interorbital space	5.44	22	4.97–5.58	5.2–5.3	5.39	17	5.00–6.06	5.3–5.4	5.48
Width of head	1.96	22	1.70–2.52	1.8–1.9	1.94	17	2.11–2.63	2.3–2.4	2.31
Maxillary	2.58	22	2.38–3.23	2.5–2.7	2.68	17	2.63–3.39	2.7–2.9	2.84
Width of gill-opening	3.40	22	2.86–3.52	3.1–3.2	3.21	17	2.80.3.39	3.1–3.2	3.18
Interspace between gill-openings in ventral side	4.90	21	4.58–5.72	4.9–5.1	4.91	17	4.67–5.73	5.1–5.3	5.18
Pectoral	1.83	22	1.79–2.13	1.9–2.0	1.98	17	1.61–2.08	1.9–2.0	1.88
Ventral	3.77	22	3.52–4.47	3.9–4.1	4.12	17	3.32–4.36	3.7–3.9	3.95
Caudal	6.13	22	5.84–6.66	6.2–6.3	6.25	17	5.63–6.57	6.1–6.2	6.10
In eye diameter:									
Nasal tube	6.30	22	6.00–7.22	6.4–6.6	6.57	17	6.11–7.86	6.4–6.6	6.61

Gill-openings are about as long as the distance between tip of snout and anterior end of pupil, and the interspace between gill-openings at their lower extremities is slightly narrower than diameter of eye. Gill-rakers on first arch 9 to 13, of which 1 or 2 on upper limb; they are very small, tubercular and their tips are bluntly pointed. Branchiostegal rays are constantly 6 in number. Posterior extremity of opercular membrane extends slightly beyond the upper end of base of pectoral fin.

Minute sensory pores, which can not be seen without an aid of lens; are present in operculomandibular, suborbital, nasal, postorbital, occipital and predorsal regions. The operculomandibular series with about eight pores on the marginal region of preopercle and four on mandible. The suborbital series is consisting of seven or eight pores, of which two or three are on lower part of cheek, three above the upper lip and two on tip of snout. The nasal series is a row of six or seven pores, running from base of nasal tube to the midway between nostril and anterior end of the eye. The postorbital series with a row of five pores, extending from immediately behind eye to before the origin of the lateral line. One or two pores form the occipital series. The predorsal series with a row of four or five pores, extending from the origin of dorsal to above the end of opercular membrane (Fig. 2).

Lateral line is indistinct, decurved downward and backward from the nape to scarcely beyond anterior one-third of the pectoral fin.

Head, nape and pectoral are naked; trunk and tail are rather densely covered with embedded scales which are elliptical or ovoid in shape; belly is scaly, the scales extend anteriorly to below base of pectoral. Basal half of the dorsal, anal and caudal are rather sparsely covered with similar but smaller scales except about anterior one-sixth of the dorsal fin.

Dorsal fin is rather high, inserted above a vertical through anterior one-third of the pectoral fin. Anal is slightly higher than dorsal, beginning below fifteenth or sixteenth dorsal ray. Pectoral rays are fewer than in other species of the present genus; the lower half of the fin is symmetrical with the upper half of the fin; the six lower rays of the fin are simple, more or less thickened and the membrane between each ray is deeply incised. Ventral rays are always 3, slender, about as long as or slightly longer than diameter of eye.

Coloration.–In the fresh condition prior to preservation the ground color of head and body are light grey with faint yellowish tint, but the top of head is slightly darker and the belly is dull gray. Upper half of the head and body, and the dorsal fin are scattered with small irregular dark brown blotches which are usually smaller than pupil; sometimes three faint dark brown bars are radiating from the eye as in the holotype (Fig. 1), the anteriormost one is running from the lower edge of eye to the angle of mouth, the second one runs downward and backward from the lower edge of eye to the anterior end of preopercular margin, the third one also runs backward and downward from the posterior margin of the eye to the middle part of the preopercular edge. Sides of the body is furnished with remarkable dark brown pattern which individually varies rather extensively in general form. The form of the pattern,

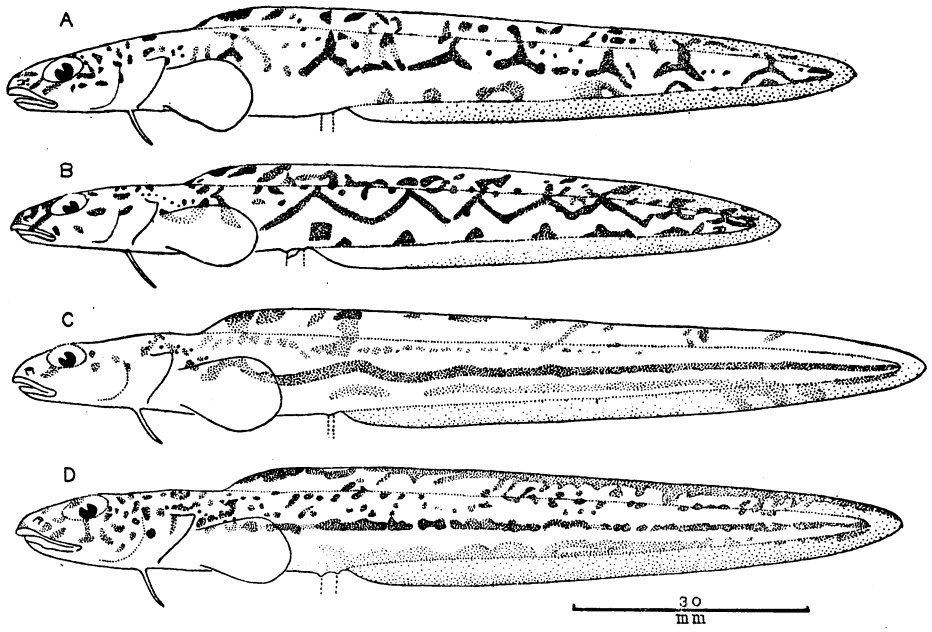

Fig. 3 Color variation in *L. japonicus*. A, female, 109.5 mm in total length (No. 13115); B, female, 100.0 mm (No. 13116); C, female, 119.0 mm (No. 11319); D, male, 116.0 mm (No. 13118). Drawings by K. MATSUBARA.

however, may be classified into five types. In the first type including the holotype and the several paratypes the pattern consists of about eight converted dish-shaped blotches in a lengthwise series and about as long as or slightly longer than the diameter of eye (Fig. 1); the first one is placed behind the axial of pectoral fin and the last one before the base of the caudal fin. In the second type the pattern is composed of about seven or eight converted Y-shaped blotches running in a lengthwise series as is the case with the first type (Fig. 3A). In the third type the pattern is of about eight converted V-shaped blotches connected with each other, the upper end of the each blotch reaches to base of the dorsal fin (Fig. 3B). In the fourth type the pattern is represented by a broad longitudinal bar, slightly undulated anteriorly, but straight posteriorly (Fig. 3C). The pattern of the fifth type closely resembles that of the fourth type, but the bar is broken here and there (Fig. 3D). In the first to third types, each of the posterior six or seven blotches is associated by an irregular dark brown blotch below it; in the fourth and fifth types, however, the pattern on sides of the body is associated by a much lighter and irregular dark brown longitudinal band below it. Anal, caudal and posterior half of the pectoral are dark grey, but the other parts of the fins are generally pale.

Buccal cavity, branchial chamber and peritoneum are all dark brown; alimentary canal is pale.

EGGS.- Female specimens thus far examined have twenty to twenty-three full grown eggs. The individual eggs have a diameter of 3.0 to 3.5 mm and are orange yellow with slightly bluish tint in color.

COMPARISON.-We compared our specimens of the present new species with that of

all the hitherto known Japanese species referred to the present genus. Our new species may clearly be distinguished from them by the following artificial key:

1a.–Lower inner edges of the mandibular rami are produced as free fleshy flaps anteriorly. Body attains more than 400 mm (*L. tanakae* reaches more than 900 mm in total length).

2a.–Belly is naked. Head is much shorter than the distance between base of ventral and vent. Dorsal rays 95–99; anal rays 74–78; pectoral rays 19–20; vertebrae 102–105. ..... *L. tanakai* JORDAN et THOMPSON(10)*

2b.–Belly is scaly, the scales extend anteriorly to base of ventral fin; head is slightly shorter than the distance between origin of the ventral and vent. Dorsal rays 93; anal rays 81; pectoral rays 21; vertebrae 103. .... *L. macrolepis* TARANETZ et ANDRIASHEV(1)

1b.–Lower inner edges of the mandibular rami are narrowly keeled; the keels are rather low, united anteriorly immediately behind the symphysis of lower jaw and never produced as free fleshy flaps anteriorly. Never attains more than 300 mm in total length.

3a.–Belly is naked. Dorsal rays 76–77; anal rays 64–67; pectoral rays 15–16; vertebrae 84–85. Body is uniformly pale greyish pink. ..... *L. teraoi* KATAYAMA(5)

3b.–Belly is scaly.

4a.–Lower half of the pectoral fin is never symmetrical with the upper half of the fin; lower pectoral rays are branched, the membrane between each ray is not deeply incised; ventral is much shorter than diameter of eye. Scales on belly are extending anteriorly as far as the base of the ventral fin. Dorsal rays 98–101, anal rays 83–86; pectoral rays 19–21; vertebrae 106–111. Sides of body without any markings except the caudal region. Attains more than 200 mm in total length. ..... *L. caudimaculatus* MATSUBARA(10)

4b.–Lower half of the pectoral fin is symmetrical with the upper half of the fin; the six lower rays are simple and more or less thickened, the membrane between each ray is deeply incised; ventral fin is about as long as or longer than the diameter of eye. Scales on belly extend anteriorly to below base of pectoral fin. Dorsal rays 79–84; anal rays 69–73; pectoral rays 14–15; vertebrae 87–93. Sides of body furnished with conspicuous pattern. The largest one observed was of a mature male, 137.0 mm in total length. ..... *L. japonicus*, sp. n.

The present new species differs from most of the American and Russian species at least in having fewer number of dorsal, anal and pectoral rays. But resembles Russian species *Lycodes heinemani* SOLDATOV, in the number of both dorsal and anal rays, and differs from it at least in having much longer ventral fin and much fewer pectoral rays (19–20 in *L. heinemani*).

* Number of specimens examined.

Acknowledgement.-The writers express their hearty thanks to Messrs Masao Katayama and Hachiro Kinoshita for their assistance rendered in obtaining the material.

Literature

Andriashev, A. P. 1935: New data on deep-water fishes of the Bering Sea. Compt. Rend. l'Acad. Sci. l'URSS, 4 (9): 113-116, 1 fig.

Clemens, W. A. and G. V. Wilby 1949: Fishes of the Pacific coast of Canada. Bull. Fish. Res. Board Canada, (68): 1-368, figs. 1-253.

Evermann, B. W. and E. L. Goldsborough 1907: The fishes of Alaska. Bull. Bur. Fish, 26: 219-360, figs. 1-144, pls. 14-42.

Gilbert, C. H. 1896: The ichthyological collections of the steamer Albatross during the years 1890 and 1891. Report on the fishes collected in Bering Sea and the North Pacific Ocean during the summer of 1890. Rep. U. S. Comm. Fish and Fisher. for 1893: 393-460, pls. 20-33.

Gilbert, C. H. and C. V. Burke 1912: Fishes from Bering Sea and Kamchatka. Bull. U. S. Bur. Eish., 30: 33-96 figs. 1-37.

Goode, G. B. and H. B. Bean 1895: Oceanic Ichthyology. U. S. Nat. Mus. Special bulletin: i-xxxv, 1-553, pls. 1-123.

Jordan, D. S. and B. W. Evermann 1898•1900: The fishes of North and Middle America, parts 3-4. Bull. U. S. Nat. Mus., 47 (3 • 4): i-xxiv, 2183-3136, pls. 1-392.

Jordan, D. S. and W. F. Thompson 1914: Record of the fishes obtained in Japan in 1911 Mem. Car. Mus., 6 (4): 205-313, figs. 1-87, pls. 24-42.

Kamohara, T. 1938: On the offshore bottom-fishes of Prov. Tosa, Shikoku, Japan. Maruzen Co. Ltd.: 1-86, figs. 1-43.

Katayama, M. 1941: A new ophidioid fish from Toyama Bay. Zool. Mag., 53 (12): 593-594, 1 fig.

—— 1942: On some rare fishes from Toyama Bay (in Japanese). Botaoy andꝺZoology, 10 (4): 67-68, figs. 1-4.

—— 1943: On two new ophidioid fishes from the Japan Sea. Annot. Zool. Jap., 22 (2): 101-104, figs. 1-2.

—— 1949: On the fishes of Zoarcidae found in the Japan Sea (in Japanese). Saisyu to Shiiku, (3): 73-78, figs. 1-6.

Knipowitch, N. M. 1906: Ichthyologische Untersuchungen im Eismeer. 1. *Lycodes* und *Lycenchelys*. Mèn. Acad. Sci. St. Pètersb, 8 Sèr. 19 (1): 1-130, pl. and map.

Matsubara K. 1936: A new and a rare ophidioid fishes from Japan. Jour. Imp. Fish. Inst., 31 (2): 115-118, figs. 1-2

Popov, A. 1931: Sur un nouveau genre des poissons *Davidijordania* (Zoarcidae, Pisces) en Pacifique. Compt. Rend. l'Acad. Sci. l'URSS: 210-215.

Schultz, L. P. 1936: Keys to the fishes of Washington, Oregon and closely adjoining regions. University of Washington Publications in Biology, 2 (4): 103-228, figs. 1-46, pl. 5.

Soldatov, V. K. 1917: Notes on two new species of *Lycodes* from Okhotsk Sea. After reprint: 112-117, figs. 1-2.

Soldatov, V. K. and G. J. Lindberg 1930: A review of the fishes of the seas of the Far East. Bull. Pacific Sci. Fish. Inst, 5: i-xlvii, 1-576, figs. 1-76, ols. 1-16.

TANAKA, S. 1908: Notes on a collection of fishes made by prof. Ijima in the southern part of Sakhalin. Annot. Zool. Jap., 6 (4): 235–254, pl. 9.

TARANETZ, A. J. 1937: Handbook for identification of fishes of Soviet Far East and adjacent waters. Bull. Pac. Sci. Inst. Fish. Ocea., 11: 1–200, figs. 1–103.

TARANETZ, A. J. and A. P. ANDRIASHEV 1934: On a new genus and species, *Petroschmidtia albonotata* (Zoarcidae, Pisces), from the Okhotsk Sea. Compt. Rend. l'Acad. Sci. l'URSS: 506–512, figs. 1–2.

——.—— 1935: Vier neue Fischarten der Gattung *Lycodes* Reinh. aus dem Ochotskischen Meer. Zool. Anz., 112 (9•10): 242–253, figs. 1–7.

VLADYKOV, V. D. and J. L. TREMBLAY 1936: Nouvelles espèces de *Lycodes* (Pisces, Zoarcidae) du Saint-Laurent et revision de toutes les espèces du méme genre de l'Atlantique Occidental. Station Biologique du Saint-Laurent Fauna et Flora Laurentiane (1): 1–45, figs. 1-2, pls. 1–7.

YOSHIDA, H. 1936: On the fishes taken from the fishing ground of motor-trawler off the coast of Primorsk (in Japanese). Spec. Bull. Chosen Fish. Exp. st., (9): 1–18, pls. 1–10.