

Lycenchelys ryukyuensis sp. nov. (Perciformes: Zoarcidae) from the Okinawa Trough, Japan

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Abstract A new zoarcid fish, *Lycenchelys ryukyuensis*, is described on the basis of 5 specimens (113.2–169.8 mm in standard length) collected from 991–1533 m in the Okinawa Trough near the Ryukyu Islands, Japan. Although this species resembles *Lycenchelys remissaria* in having similar meristic counts of fin rays, absence of interorbital and occipital pores, and body coloration, it differs from the latter in having 6+1 (rarely 6+2) suborbital pores, 4+4 preoperculomandibular pores, a single ventral lateral line, and the pelvic fin located at about mid-distance between the eye and the pectoral fin base. These specimens are the southernmost records for *Lycenchelys* in the western North Pacific.

Key words: Zoarcidae, *Lycenchelys ryukyuensis*, *Lycenchelys remissaria*, Okinawa Trough, Western North Pacific.

The zoarcid genus *Lycenchelys* includes 59 deep-sea species (about 1/4 the total numbers of valid species in the family) and almost all species inhabit soft bottoms from the upper bathyal to abyssal zones (Anderson, 1995; Anderson and Fedorov, 2004) with some polar species from the continental shelves (see Møller and Jørgensen, 2000). The genus is distributed mainly in the northern hemisphere, but species also occur in the South Pacific, southwestern Atlantic, subantarctic, and Antarctic waters. The genus is mainly characterized by the followings: 6–10 suborbital bones with 6–10 pores from the canal; first dorsal fin ray pterygiophore associated with vertebrae 2–21, with 0–16 free pterygiophores; weak palatopterygoid series; weak oral valve; presence of pseudobranch, usually pelvic fins, usually both vomerine and palatine teeth; scales, pyloric caeca, and lateral line(s) present; and vertebrae 19–30+66–118=85–144 (Anderson, 1994; Shinohara and Matsuura, 1998). Ten *Lycenchelys* species are known from Japanese waters, and the southern limit of the distribution in

the western North Pacific is northern Honshu Island, Japan (Anderson and Imamura, 2002; Hataoka, 2002; Imamura *et al.*, 2004).

In 2002, 5 specimens of *Lycenchelys* were collected during beam trawl surveys made by the National Science Museum, Tokyo, and Ocean Research Institute, the University of Tokyo from the Okinawa Trough near the Ryukyu Islands in the East China Sea. This species is most similar to *Lycenchelys remissaria* Fedorov, 1995 among the Japanese *Lycenchelys* in lacking interorbital and occipital pores. It differs from the latter in having the pelvic fin in a normal position, and we describe it as a new species to science.

Methods for taking counts and measurements follow Peden and Anderson (1978) and Anderson (1982). Vertebrae and other osteological elements were examined from radiographs. Terminology of head pores follows Anderson (1994). Standard length (SL) and head length (HL) are used throughout.

The specimens examined are deposited in the Department of Zoology, National Museum of



Fig. 1. *Lycenchelys ryukyuensis* sp. nov., Okinawa Trough, East China Sea, Japan, holotype, NSMT-P 63965, male, 159.8 mm SL. Fresh specimen (top), line drawings (bottom)

Nature and Science (formerly National Science Museum), Tokyo (NSMT), Laboratory of Marine Biology, Kochi University (BSKU), Laboratory of Marine Biology and Biodiversity, Hokkaido University (HUMZ), and Zoological Institute, Russian Academy of Sciences, St. Petersburg (ZIN).

Lycenchelys ryukyuensis sp. nov.

(New Japanese name: Ryukyu-hebigenge)

(Figs. 1–2, Table 1)

Holotype. NSMT-P 63965, male, 159.8 mm SL, Okinawa Trough, East China Sea, 26°11.34'N, 124°54.27'E–26°12.65'N, 124°55.47'E, 1493–1533 m, 26 April 2002, R/V *Tansei-maru*, beam trawl.

Paratypes. BSKU 57850–57851, 2 females, 113.2–151.3 mm SL, Okinawa Trough, 26°15.10'N, 125°17.22'E–26°13.85'N, 125°18.43'E, 991–995 m, 26 April 2002, R/V *Tansei-maru*, beam trawl; NSMT-P 63966–63967, 2 females, 118.6–143.2 mm SL, collection data as same as holotype.

Diagnosis. Vertebrae 22–24+96–102=118–124; interorbital pore and occipital pores absent; postorbital pores 3 (rarely 4); suborbital pores 6+1 (rarely 6+2); preoperculomandibular pores 4+4; lateral line ventral, complete; dorsal fin rays 110–114; anal fin rays 98–104; pelvic fin base about mid-distance between the eye and pectoral fin base.

Description. Counts and proportional measurements are shown in Table 1. Conditions of holotype given first, followed by those of paratypes in parentheses. Body long, its cross-section almost round at nape, elliptical at both abdominal and caudal regions. Head short, its dorsal profile gently convex. Scales absent on head, nape, thorax, pectoral fin, and pelvic fin. Scales present on body, abdomen, tail, on dorsal and anal fins, extending to about half of their height. Eye ovoid, not entering dorsal profile of head. Interorbital space convex. Gill slit extending ventrally below the level of lower pectoral base. Dorsal fin origin above middle of pectoral fin. Opercular flap at upper margin of gill slit developed. Pectoral fin origin about level of body midline. Posterior margin of pectoral fin slightly

pointed, ray tips almost evenly rounded dorsally but well exerted ventrally (Fig. 2). Pelvic fin small and thin.

Mouth subterminal, upper jaw extending beyond anterior margin of pupil. Nostril tube small, not reaching upper lip when depressed forward. Snout rounded. Labial lobe of lower jaw weak. Jaw teeth conical, sharp; upper jaw with 3 (2) anterior tooth rows, lower jaw with 3 (2–3) irregular rows; teeth in outer row in both jaws slender, large. Two (2–4) vomerine teeth in small patch; palatine teeth in a single row, 2 in left/1 in right (1–2/1).

Head pores well developed (Fig. 2). Two nasal pores, anterior one set just in front of nostril tube, the other situated dorsoposteriorly. Seven (7, rarely 8) suborbital pores which associated with 8 suborbital bones (NSMT-P 63966); 6 pores arising from ventral ramus of bone chain under eye and 1 (1–2) from ascending ramus behind eye just posteroventral to first postorbital pore [formula 6+1 (6+1, rarely 6+2 in left of NSMT-P 63966)]. Three (3, rarely 4 in right of BSKU 57851) postorbital pores. Eight preoperculomandibular pores (4 mandibular pores+4 preopercular pores): 4 arising from dentary, one from anguloarticular and 3 from preopercle. Interorbital and occipital pores absent. Lateral line ventral, complete; of reduced superficial neuro-masts from above posterior tip of opercle to near tip of tail.

Dorsal fin origin associated with 7th (7th or 8th) vertebra; no supraneurals. Anal fin origin associated with ultimate precaudal vertebra, with 3 (2–4) pterygiophores inserted anterior to haemal spine of first caudal vertebra; last anal pterygiophore associated with 4th (3rd or 4th) preural vertebra, with 2 (2–3) anal rays articulating with haemal spine. Caudal fin with 2 epural, 4 (4–5)

upper and 3 lower hypural rays.

Gill rakers degenerated, triangular. Pseudo-branch filaments short. Pyloric caeca 2, nublike.

Color when fresh (in alcohol). Head, pectoral fin, and pelvic fin black (brown). Margin of vertical fins dark brown (brown). Body and tail grayish (light brown).

Etymology. The specific name is derived from the collection locality.

Distribution. Known only from the Okinawa Trough near Ryukyu Islands, East China Sea in depths of 991–1533 m.

Comparison. In having no interorbital pores, no occipital pores, 3 (rarely 4) postorbital pores, pelvic fins, a single ventral lateral line, *Lycenchelys ryukyuensis* sp. nov. is similar to *Lycenchelys aratrirrostris* Andriashev and Permitin, 1968 (Antarctica), *Lycenchelys bellingshausenni* Andriashev and Permitin, 1968 (Antarctica),

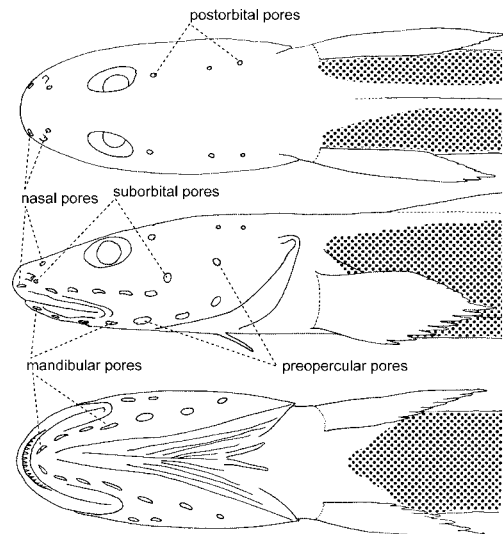


Fig. 2. Head and anterior body of *Lycenchelys ryukyuensis* sp. nov., holotype, NSMT-P 63965, male, 159.8 mm SL. Shaded area indicates squamation



Fig. 3. Alcohol preserved specimen of *Lycenchelys remissaria*, off Fukushima Prefecture, Japan, holotype, ZIN 50586, photographed by G. Shinohara (November 1999)

Table 1. Comparison of counts and proportional measurements between *Lycenchelys ryukyuensis* sp. nov. and *L. remissaria*

	<i>Lycenchelys ryukyuensis</i> sp. nov.		<i>Lycenchelys remissaria</i>		
	Holotype	Paratypes (n=4)	Holotype	Non-types (n=4)	Shinohara <i>et al.</i> (1996) (n=7)
Counts					
Dorsal fin rays	114	110–114	118 ^a	115–119	–
Anal fin rays	104	98–102	104 ^a	102–107	–
Pectoral fin rays	15	13–15	17	15–17	16–17
Pelvic fin rays	3	3	3	3	–
Caudal fin rays	9	9–10	11 ^a	9–10	–
Gill rakers	12	11–13	13 ^a	12–16	–
Vertebrae	124	118–123	128 ^a	123–127	122–130
Nasal pores	2	2	2	2	–
Suborbital pores	7	7–8	8	8	8
Postorbital pores	3	3–4	3	3–4	3
Interorbital pores	0	0	0	0	0
Preopercular pores	4	4	4	4	4
Mandibular pores	4	4	5	4–5	5
Occipital pores	0	0	0	0	0
% SL					
Head length	14.3	14.3–14.7	14.1	14.7–16.2	–
Body height at pectoral fin base	5.1	5.5–5.8	6.5	6.0–7.5	–
Body height at anal fin origin	5.8	4.7–5.7	7.2	5.3–8.4	–
Predorsal length	20.2	18.7–19.7	17.9	19.5–20.9	–
Preanal length	31.4	30.9–32.3	29.8	31.7–34.3	–
Pectoral fin length	8.8	8.3–10.8	8.3	8.8–11.3	–
Gill slit length	4.8	4.8–5.6	5.0	5.2–5.7	–
% HL					
Upper jaw length	38.6	30.0–39.9	37.2	29.6–37.4	36.9–41.7
Pectoral fin length	61.8	56.5–73.5	58.9	59.4–69.7	–
Snout length	29.0	24.7–29.6	27.3	23.5–30.3	–
Eye diameter	18.4	18.4–20.6	24.8	20.9–23.5	20.3–24.9
Gill slit length	33.3	33.3–38.0	35.5	32.5–38.9	–
Interorbital width	3.5	3.0–4.4	4.3	4.9–6.1	3.2–3.7
Pelvic fin length	14.9	16.1–18.8	19.2	12.2–18.3	–
Pectoral base/length ratio	0.34	0.23–0.31	–	0.31–0.39	–

–, no data.

^aData from Fedorov (1995).

Lycenchelys folletti Anderson, 1995 (Gulf of California), *Lycenchelys lonchoura* Anderson, 1995 (eastern South Pacific), and *Lycenchelys maoriensis* Andriashev and Fedorov, 1986 (western South Pacific). The new species is different from *L. aratrirostris*, *L. bellingshauseni*, *L. folletti*, and *L. lonchoura* in having higher counts of vertebrae (118–124 in *L. ryukyuensis* vs. 101–110 in *L. aratrirostris*, 102–110 in *L. bellingshauseni*, 102–109 in *L. folletti*, and 107 in *L. lonchoura*), dorsal fin rays (110–114 vs. 97–107, 94–103, 97–104, and 103), and anal fin rays

(98–104 vs. 79–89, 82–91, 83–92, and 86) (see Anderson, 1990, 1995). *Lycenchelys ryukyuensis* is further distinguished from *L. aratrirostris* in having entirely dark pectoral fins (vs. only margin of pectoral fin dark in *L. aratrirostris*), from *L. bellingshauseni* in having scales on posterior parts of dorsal and anal fins (no scales on both fins in *L. bellingshauseni*), from *L. folletti* in having both vomerine and palatine teeth (vs. no teeth on vomer and palatine in *L. folletti*), and from *L. lonchoura* in having 13–15 pectoral fin rays and 2 pyloric caeca (18 and 0 in *L. lon-*

choura). The new species differs from *L. maoriensis* in having 7–8 suborbital pores and no black or brown variegations all along body and tail in males (vs. 6 and the variegations present in the latter).

Except the position of pelvic fins and the lateral line configuration, *L. ryukyuensis* appears close to *L. remissaria*, also known from Japan (Pacific side of Tohoku, northern Honshu Island) in having similar body color and meristic counts (122–130 vertebrae, 115–119 dorsal fin rays, 102–107 anal fin rays, 15–17 pectoral fin rays in the latter; Table 1). The new species is distinguished from *L. remissaria* by having the pelvic fin origin mid-distance between the eye and pectoral fin base (vs. nearer the eye), a single ventral lateral line (vs. lateral line double, with mediolateral and ventral branches), 4 preopercular pores (vs. 5), and normally 7 suborbital pores (vs. 8).

In the western North Pacific, the southern limit of the distribution of *Lycenchelys* spp. has been northern Honshu Island (ca. 36°30'N, 141°10'E, *Lycenchelys squamosa* Toyoshima, 1983, *Lycenchelys makushok* Fedorov, 1993, and *L. remis-*

saria; see Shinohara *et al.*, 1996). The specimens of *L. ryukyuensis* extend the range of the genus by about 1800 km.

Taxonomic notes on *Lycenchelys remissaria*.

The holotype of *Lycenchelys remissaria* has scales in front of the dorsal fin origin and along the dorsal fin base (Fedorov, 1995: fig. 2). *Lycenchelys ryukyuensis*, however, lacks them in these parts. The 2 smallest specimens of *L. remissaria* (NSMT-P 49210, 87.6–102.6 mm SL) have a naked anterior dorsal fin base which is similar to the condition in *L. ryukyuensis*. Thus the squamation of both the nape and dorsal fin base show an ontogenetic change in *L. remissaria*.

Key to Japanese *Lycenchelys* species.

Here we provide a key to the known species of *Lycenchelys* found in Japanese waters. All occur along the Okhotsk and Pacific coasts of Hokkaido and the Pacific of northern Honshu except the new *L. ryukyuensis*. Other species from the southern Okhotsk and Kuril Islands may eventually be found in the area. We have tried to avoid characters observable only by radiography, thus the key requires specimens in good condition.

Key to Late Juveniles and Adults of *Lycenchelys* in Japanese Waters

- 1a. Interorbital and occipital pores absent 2
- 1b. Interorbital pore present; occipital pores present or absent 3
- 2a. Pelvic fin base shifted forward, its origin at about a vertical through middle of preopercle; preoperculomandibular pores 9; suborbital pores 7+1; 2 lateral lines *L. remissaria*
- 2b. Pelvic fin base at about a vertical through posterior margin of preopercle, mid-distance between eye and pectoral base; preoperculomandibular pores 8; suborbital pores 6+1 or 6+2, 1 lateral line *L. ryukyuensis*
- 3a. Preoperculomandibular pores 7–9; body depth >5% total length 4
- 3b. Preoperculomandibular pores 10; body depth 3–4% total length *L. makushok*
- 4a. Pelvic fins present; 1 lateral line 5
- 4b. Pelvic fins absent; 2 lateral lines *L. tohokuensis*
- 5a. Suborbital pores 6 6
- 5b. Suborbital pores 8–11 7

- 6a. Color more or less uniformly orange; preoperculomandibular pores 7; pectoral fin rays 13–16
..... *L. aurantiaca*
- 6b. Color more or less uniformly dark brown; preoperculomandibular pores 8; pectoral fin rays
17–19 *L. squamosa*

- 7a. Body dark brown, with 6–10 wide, white, vertical bands extending from the dorsal fin to mid-
body; pectoral fin rays 18–19 *L. albomaculata*
- 7b. Body and dorsal fin without white bands; pectoral fin rays 13–17 8

- 8a. Body, tail and dorsal fin with many distinct dark blotches, sometimes on anal fin; total vertebrae
138–147 *L. maculata*
- 8b. Body uniformly dark brown or black, no blotches; total vertebrae 118–138. 9

- 9a. Preoperculomandibular pores 8; postorbital pores 3–4; total vertebrae 122–138 10
- 9b. Preoperculomandibular pores 9; postorbital pores 5; total vertebrae 118–122.
..... *L. melanostomias*

- 10a. Pelvic fin rays 3; nostril tube not reaching upper lip when depressed forward; total vertebrae
132–138. *L. hippopotamus*
- 10b. Pelvic fin rays 2; nostril tube reaching upper lip or overhanging it; total vertebrae 122–131
..... *L. rassi*

Comparative materials. *Lycenchelys albomaculata*: NSMT-P 48684(1), 190.5 mm SL, male, 36°57.5'N, 141°41.46'E–36°50.9'N, 141°44.06'E (Pacific off Fukushima Prefecture, Japan), 777–905 m depths, 5 Nov. 1995, R/V *Watakata-maru*, coll. by G. Shinohara; NSMT-P 49610 (2), 163.0–184.0 mm SL, males, 36°57.02'N, 141°46.09'E–36°56.22'N, 141°45.35'E (Pacific off Fukushima Prefecture), 800–802 m depths, 16 Apr. 1996, R/V *Tanshu-maru*, coll. by G. Shinohara; NSMT-P 53659(1), 175.0 mm SL, male, 36°57.08'N, 141°50.8'E–36°55.13'N, 141°57.33'E (Pacific off Fukushima Prefecture), 1001–1023 m, 16 Apr. 1996, R/V *Tanshu-maru*, coll. by G. Shinohara; NSMT-P 61162(2), 186.0–190.0 mm SL, females, 37°1.36'N, 141°38.96'E–37°0.03'N, 141°38.03'E (Pacific off Fukushima Prefecture), 500–501 m depths, 17 Apr. 1997, R/V *Tanshu-maru*, coll. by G. Shinohara. *Lycenchelys aurantiaca*: NSMT-P 73401(4), 109.0–128.0 mm SL, 2 females and 2 males, 37°54.69'N, 141°58.44'E–37°53.81'N, 141°56.94'E (Pacific off Fukushima Prefecture), 21 Apr. 1997, R/V *Tanshu-maru*, coll. by G. Shinohara; NSMT-P 73402(1), 124.0 mm SL, male, 36°59.99'N, 141°46.00'E–36°58.97'N, 141°44.65'E (Pacific off Fukushima Prefecture), 17 Apr. 1997, R/V *Tanshu-maru*, coll. by G. Shinohara. *Lycenchelys hippopotamus*:

NSMT-P 69787(1), female, 203.0 mm SL, 44°9.565'N, 144°52.673'E–44°9.243'N, 144°51.371'E (Okhotsk Sea off Hokkaido, Japan), 491–495 m depths, 13 Sep. 2004, R/V *Tansei-maru*, coll. by G. Shinohara and K. Suetsugu; HUMZ 126197(1), 126199(1), female and male, 175.5–177.1 mm SL, 44°34.1'N, 144°59.7'E (Sea of Okhotsk), 1301 m depth, 26 May 1993; HUMZ 126212(1), female, 187. mm SL, 44°21.2'N, 144°51.8'E (Sea of Okhotsk), 1068 m depth, 28 May 1993. *Lycenchelys makushok*: NSMT-P 73403(1), 139.0 mm SL, male, 36°59.99'N, 141°46.00'E–36°58.97'N, 141°44.65'E (Pacific off Fukushima Prefecture), 17 Apr. 1997, R/V *Tanshu-maru*, coll. by G. Shinohara; NSMT-P 61163(4), 136.0–149.0 mm SL, females, 37°1.36'N, 141°38.96'E–37°0.03'N, 141°38.03'E (Pacific off Fukushima Prefecture), 500–501 m depths, 17 Apr. 1997, R/V *Tanshu-maru*, coll. by G. Shinohara; NSMT-P 73404(1), 90.0 mm SL, female, 36°26.45'N, 141°12.13'E–36°31.05'N, 141°15.50'E (Pacific off Ibaraki Prefecture, Japan), 785–794 m depths, 10 Nov. 1995, R/V *Wakataka-maru*, coll. by G. Shinohara. *Lycenchelys rassi*: HUMZ 126251(1), 126253(1), 126254(1), 126258(1), 126259(1), 149.2–216.4 mm SL, 3 females and 2 males, 44°40.7'N, 144°24.9'E (Sea of Okhotsk off Hokkaido, Japan), 1336 m depth, 8 June

1993. *Lycenchelys remissaria*: ZIN 50586(holotype), male, 36°54'4"N, 141°55'7"E, 1020 m depth, 4 Feb. 1981, R/V *Mys Dal'niy*; NSMT-P 47278(1), female, 262.1 mm SL, 38°10.5'N, 143°7.6'E–38°10.6'N, 143°7.8'E (Pacific off Sendai, Miyagi Prefecture, Japan), 2021–2034 m depths, 20 May 1995, R/V *Wakataka-maru*, coll. by T. Fujita; NSMT-P 48697(1), 277.7 mm SL, 36°28.43'N, 141°24.18'E–36°27.27'N, 141°32.2'E (Pacific off Ibaraki Prefecture, Japan), 1464–1537 m depths, 10 Nov. 1995, R/V *Wakataka-maru*, coll. by G. Shinohara; NSMT-P 49210(2), 87.6–102.6 mm SL, 36°45.41'N, 141°43.16'E–36°45.06'N, 141°42.78'E (Pacific off Ibaraki Prefecture), 1408 m depth, 19 Apr. 1996, R/V *Tanshu-maru*, coll. by G. Shinohara. *Lycenchelys squamosa*: NSMT-P 49609(1), 204.0 mm SL, male, 36°57.02'N, 141°46.09'E–36°56.22'N, 141°45.35'E (Pacific off Fukushima Prefecture), 800–802 m depths, 16 Apr. 1996, R/V *Tanshu-maru*, coll. by G. Shinohara; NSMT-P 49043(1), 218.0 mm SL, female, 36°30.31'N, 141°8.51'E–36°26.04'N, 141°7.12'E (Pacific off Ibaraki Prefecture), 588–603 m depths, 9 Nov. 1995, R/V *Wakataka-maru*, coll. by G. Shinohara; NSMT-P 65692(1), 221.0 mm SL, female, 36°32.45'N, 141°7.82'E–36°29.09'N, 141°4.44'E (Pacific off Ibaraki Prefecture), 748–789 m depths, 25 Oct. 2002, R/V *Wakataka-maru*, coll. by G. Shinohara; NSMT-P 49917(1), 195 mm SL, male, 37°29.3'N, 142°15.6'E–37°28.9'N, 142°13.8'E (Pacific off Fukushima Prefecture), 810–823 m depths, 15 Apr. 1996, R/V *Tanshu-maru*, coll. by G. Shinohara; NSMT-P 48696(1), 225 mm SL, male, 36°57.5'N, 141°41.46'E–36°50.9'N, 141°44.06'E (Pacific off Fukushima Prefecture), 777–905 m depths, 5 Nov. 1995, R/V *Wakataka-maru*, coll. by G. Shinohara.

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