

ZOOSYSTEMATICA ROSSICA

Zoological Institute, Russian Academy of Sciences, St Petersburg - https://www.zin.ru/journals/zsr/ Vol. 33(2): 147–155 - Published online 5 August 2024 - DOI 10.31610/zsr/2024.33.2.147

RESEARCH ARTICLE

New species of snailfish of the genus *Crystallichthys* (Cottiformes: Liparidae) from the Pacific waters off Kamchatka

Новый вид липаровых рыб рода *Crystallichthys* (Cottiformes: Liparidae) из тихоокеанских вод Камчатки

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Abstract. A new species of snailfish, *Crystallichthys longirostris* **sp. nov.**, is described from Kronotskiy Bay, southeastern Kamchatka, from depths of 192 to 200 m. The new species differs from the three other species of the genus, *C. mirabilis* Jordan et Gilbert, 1898, *C. cyclospilus* Gilbert et Burke, 1912, and *C. cameliae* (Nalbant, 1965), in the unusually elongated shape of the narrow snout, the dot-like round pupil, simple (not three-lobed) teeth, and the short distance from the anus to the beginning of the anal fin (9% vs. 17–19% of standard length). The colour is pink, with clearly defined red-brown rings in an elongated oval shape. The new species is also recorded near the Northern Kuril Islands at a depth of 309 m. The diagnosis of the genus *Crystallichthys* Jordan et Gilbert, 1898 is emended considering the characters of the new species.

Резюме. Новый вид липаровых рыб, *Crystallichthys longirostris* **sp. nov.** описан из Кроноцкого залива юго-восточной Камчатки с глубины 192–200 м. Новый вид отличается от остальных видов рода, *C. mirabilis* Jordan et Gilbert, 1898, *C. cyclospilus* Gilbert et Burke, 1912 и *C. cameliae* (Nalbant, 1965), необычно вытянутым узким рылом, точечным круглым зрачком, простыми (не трехлопастными) зубами и небольшим расстоянием от ануса до начала анального плавника (9% стандартной длины *vs.* 17–19%). Окраска розовая, с четко ограниченными красно-коричневыми кольцами удлиненно-овальной формы. Вид отмечен также у Северных Курильских островов на глубине 309 м. Диагноз рода *Crystallichthys* Jordan et Gilbert, 1898 уточнен с учетом признаков нового вида.

Key words: taxonomy, Kamchatka, Kuril Islands, fish, Liparidae, Crystallichthys, new species

Ключевые слова: таксономия, Камчатка, Курильские острова, рыбы, Liparidae, *Crystallichthys*, новый вид

ZooBank Article LSID: B40DA87B-3769-4192-83CA-F229452F1A46

Introduction

During the trawl survey in the Pacific waters of Kamchatka by the Kamchatka branch of the Federal Research Institute of Fisheries and Oceanography in 2022, an unusual species of liparid fish with distinctive coloration was collected. The fish had irregular, clearly defined red-brown rings that stood out against the pink background of its body. Based on external characters, including the gelatinous consistency of the skin and subcutaneous layer, the fish resembled species of *Careproctus* Krøyer, 1862, but fishes of this genus from the Far Eastern seas do not have spots on the bodies. In coloration and other characters, the specimen examined is similar to snailfish of the genera *Crystallias* Jordan et Snyder, 1902 and *Crystallichthys* Jordan et Gilbert, 1898.

Both genera are characterised by the body with roundish or irregular blotches, the presence of the pelvic disc, a single nostril, three-lobed teeth, the pyloric coeca, and six branchiostegal rays, as well as the absence of pseudobranchiae (Burke 1930; Kido 1988).

The monotypic genus *Crystallias* includes *C. matsushimae* Jordan et Snyder, 1902, described from the Pacific waters of Honshu Island (Matsushima Bay). This species is characterised by the presence of 20–30 barbels on the snout and both jaws, a vertical slit-like fold on the frontal and lower sides of the snout, the longitudinally-oval pupil, the silvery lower half of the eye, and pores 2-5-6-1 (Burke, 1930; Kido, 1988; Matsuzaki et al., 2022). The specimen examined differs from it in all this characters.

The genus Crystallichthys includes three species: C. mirabilis Jordan et Gilbert, 1898, C. cuclospilus Gilbert et Burke, 1912, and C. cameliae (Nalbant, 1965) (Fricke et al., 2024). All of them differ from Crystallias in the absence of barbels and in the pupil, which is horizontally elliptical and partially divided dorsally by the projection of the iris (in the holotypes of C. cyclospilus and C. mirabilis) (Burke, 1930). Crystallichthys mirabilis was described from the Pacific waters off the southeastern Kamchatka (Jordan & Gilbert, 1898). The other two species were described from the area of the western Aleutians, northeast of Semisopochnoi Island at Petrel Bank (C. cyclospilus) and close to the Near Islands (C. cameliae) (Gilbert & Burke, 1912; Nalbant, 1965). The specimen examined differs from them in having simple (not three-lobed) teeth, the dot-like pupil, and the longer narrow snout. These and other characters significantly distinguish it from all three species of the genus.

The purpose of this research is to describe a new species belonging to the genus *Crystallichthys*, found in the western Pacific.

Materials and methods

The material was collected during a bottom trawl survey carried out in June and July 2022 aboard the MRTK "Engineer Martynov" and RS "MRTK-316" (Kamchatka branch of the Federal Research Institute of Fisheries and Oceanography) in the waters of the Kronotskiy and Avachinskiy bays, as well as in the vicinity of the southeastern tip of Kamchatka. Trawls were conducted using a bottom trawl DT 18.8/28.5 with a vertical and horizontal opening of 3.5 and 16 m, respectively. After trawling, the RS "MRTK-316" transferred the codend of the fishing gear to the MRTK "Engineer Martynov" using a non-contact scheme. The scientific group then analysed the catches following generally accepted methods (Borets, 1997). In total, 83 trawls were conducted at depths ranging from 26 to 210 m.

Fish from the catch intended for analysis were transferred to water with an anesthetic (clove oil, at a rate of one milliliter per ten liters of water). Photography of the caught specimen was taken on board the vessel. Subsequently, fixation was carried out in a 4% formaldehyde solution in seawater. Upon reaching the shore, under laboratory conditions, the fish was transferred to 70% ethanol. Further studies were conducted at the laboratory of the Zoological Institute of the Russian Academy of Sciences (ZIN).

The systematic position of Liparidae is accepted in accordance with classifications that include the suborder Cottoidei in the order Cottiformes (Imamura & Yabe 2002; Wiley & Johnson, 2010). We accept Crystallias as a separate genus, but include it below in comparisons because some authors classify it as *Crystallichthys*. On the other hand, in some faunistic lists, Crystallichthys cameliae was included in the genus Crystallias (Fedorov, 1973: 21) or placed in synonymy with the related species Crystallichthys mirabilis (Sheiko & Fedorov, 2000: 32; Parin et al., 2014: 329) or C. cyclospilus (Fedorov in Parin et al., 2002: S116). Despite the absence of new captures of this species, C. cameliae is unique, and there is no reason to place it in synonymy, as was pointed out earlier and by Mecklenburg et al. (2002).

Photos of the type specimens of *C. mirabilis* (USNM 51466) and *C. cyclospilus* (USNM

74381) are available on the respective pages of FishBase (Froese & Pauly, 2023). Redescriptions of these species were published by Burke (1930).

Radiography was performed using a multifunctional X-ray system PRDU 2021 "ELTECH-MED" ("Taxon" Core Facilities Centre, ZIN).

When measuring fixed specimens, we utilised methods for liparid fish (Burke, 1930; Andriashev, 2003). Standard length (SL) is the distance from the fleshy tip of the snout to the base of the *C*-rays; total length (TL) is the same to the end of the caudal fin; head length (c) is measured from the tip of the snout to the tip of the opercular lobe; the height and width of the body were measured at their greatest points; measurements of the height of the body and above the beginning of the anal fin include the gelatinous tissue covering the fins; the snout length was measured from the tip of the snout to the anterior margin of the eye; the size of the eye is its longitudinal diametre; the length of the gill opening was measured from its upper end to the lower end; predorsal and preanal distances are the lengths from the tip of the snout to the bases of the anterior rays of the D- and A-fins; interorbital distance is the space between the margins of the eyes, while postorbital distance is measured from the posterior rim of the eve to the tip of the opercular lobe. The sex of the fish was determined by examining the gonads through a small incision on the abdomen. The head pore pattern (e.g., 2-6-7-2) follows Burke (1930) and subsequent studies of snailfishes, listing nasal, infraorbital, preoperculomandibular, and suprabranchial pores.

Also, the following abbreviations are used in the text: ray numbers in dorsal (*D*), anal (*A*), pectoral (*P*), and caudal (*C*) fins; collector (coll.); small fishing trawler for stern trawling (MRTK); fishing trawler (RT); research vessel (RV).

All the material examined, including the holotype of the new species, is deposited at the Zoological Institute of the Russian Academy of Sciences, St Petersburg (ZIN).

Material for comparison. Crystallias matsushimae: ZIN No. 12933, TL 65 mm, SL 60 mm, Sea of Japan, off Cape Povorotnyy, ca. 42°40'38"N, 133°02'33"E, depth 230–196 m, 10.V.1900, trawl 48, coll. P. Schmidt. Crystallichthys cyclospilus: ZIN No. 24491, female, TL 254 mm, SL 225 mm, Sea of Okhotsk, 52°30'N, 154°47'E, 04.VIII.1932,

Taxonomic part

Order Cottiformes

Family Liparidae

Genus *Crystallichthys* Jordan et Gilbert, 1898

Diagnosis (after Kido, 1988; emended). Pelvic disc distinct, 8-13% *SL*; one pair of nostrils; pseudobranchiae absent; branchiostegal rays 6; body with roundish or elongated red-brown blotches; barbels around mouth abseny; teeth three-lobed or simple; pyloric caeca 36–40 (unknown in *C. longirostris* **sp. nov.)**. *D* 48–56, *A* 42–53, *P* 28–36, *C* 10–14.

Crystallichthys longirostris sp. nov. (Figs 1–3)

Holotype. ZIN No. 57040, adult male, *TL* 338 mm, *SL* 304 mm, **Pacific Ocean**, eastern Kamchatka, Kronotskiy Bay, 53°25′00″–53°25′06″N, 160°13′08″–160°13′09″E, 5.VII.2022, depth 192–200 m, MRTK "Engineer Martynov", bottom trawl, coll. Yu.K. Kurbanov.

Additional records. Four specimens recorded by the second author near the Northern Kuril Islands, abeam the Shumshu and Paramushir islands, 50°30′–50°31′N, 157°27′–157°28′E, 24.V.2021, depth of 309 m, RV "Dmitry Peskov", trawl No. 53; *TL* 38–43 cm (measured on board). These specimens were not preserved.

Diagnosis. In life, colour pink, with clearly defined red-brown oval rings. Barbels around mouth absent. Teeth simple (not three-lobed). Head pores 2-6-7-2. Snout narrow, duck-like protruding, 3.2 times as long as eye, without vertical cleft. Body deep and compressed. Pupil dot-like, round. Gill opening 0.8 eye diametre. Vertebrae 62, *D* 56, *A* 45, *P* 36, *C* 13 (2+5/5+1).

Description. When fresh, body deep and compressed laterally (3.6 times as high as its width, 1.3 times as long as head). Dorsal and anal fins almost completely hidden in gelatinous tissue. In ethanol, greatest height of body in middle of its length (Fig. 1A), 3.1 times in *TL*. Precaudal part



Fig. 1. *Crystallichthys longirostris* **sp.nov.**, holotype. **A**, field photo; **B**, radiogram of the museum specimen (the dark caudal part reflects the lack of gelatinous tissue at the end of the tail); **C**, teeth.

relatively short; distance from tip of snout to beginning of *A*-fin 36% of *SL*.

Head compressed laterally; its height at occiput 2.8 times its width, head length 4.1 times in SL. Dorsal contour of head steeply sloping from occiput to level below eye. Snout unusually narrow and flattened, elongated (duck-like) (Fig. 3), noticeably protruding beyond upper jaw below level of eye. Snout length to symphysis of upper jaw 1.5 times (or 20.0% of c) and to anterior margin of eye 3.2 times eye diametre. Lower side of snout with shallow skin folds and shallow pit (Fig. 3C, D); vertical groove or cleft on its frontal/lower surface absent (unlike in *C. mirabilis*). As seen on radiogram, snout reinforced by dense cord of cartilage up to apex (Fig. 2B).

Nostrils tubular, one pair, as long as half eye diametre. Eye 7.5 times in head length and 2.1 times in interorbital distance. Pupil small, dotlike, round (Fig. 2A). Postorbital distance to tip of opercular lobe almost half of head length (49.3%). Mouth lower, horizontal; upper jaw reaching to below anterior margin of eye. Width of mouth 26.7% of c. Upper lip unusually wide at jaw symphysis (9.3% of c), protruding anteriorly, smooth (Fig. 3C, D). Membranes inside mouth anterior to tooth plates densely covered with papillae. Teeth strong, simple, blunt (Fig. 1C). Each jaw with up to nine oblique rows, up to five teeth in rows anteriorly. Gill slit short (0.8 times as long as eye diametre), extending from mid-orbit, ending above pectoral fin at distance of 75% of gill slit length. Tip of operucular lobe almost not protruding.

Seismosensory head pores 2-6-7-2, two nasal, six infraorbital (postorbital pore present), seven preoperculo-mandibular, and two suprabranchial



Fig. 2. *Crystallichthys longirostris* **sp.nov.**, anterior part of the holotype. **A**, fresh fish; **B**, X-ray of the museum specimen, showing the cartilaginous reinforcing of the snout.

pores. Chin pores in common skin fold. Free neuromasts not found on body of fixed specimen.

Pectoral fin low inserted, with upper ray almost at level of mouth; *P*-symphysis at vertical of eye centre. Rays *P* 36. Upper pectoral lobe separated from lower lobe by a shallow notch; in upper lobe, 28 (left side) and 27 (right side) rays, including shortest ray of notch. In lower *P*-lobe, eight and nine rays, respectively, of these, sixth and seventh rays most elongated. Length of lower pectoral lobe 63% of length of its upper lobe, length of shortest notch ray, 52%.

Distance from pelvic disc to symphysis of lower jaw equal to its diametre; anterior margin of pelvic disc located under posterior margin of eye. Disc quite large (3.0 times in c), with indistinct anterior lobe, wide margins, unclear segmental pads, and diametre of central part being 0.4 times disc length. Anus located under gill slit, opening closer to posterior margin of disc than to beginning of anal fin. Distance from disc to anus 40% of length of disc and about 3.0 times in distance from anus to beginning of A. Distance from chin to anus 2.2 times distance from anus to beginning of A.

Gelatinous tissue thick at entire body, including snout, excluding last one-fifth of body length (20% of SL), where skin quite tightly attached to muscles (Fig. 1B). Dorsal and anal fins completely immersed in thick gelatinous tissue for approximately four-fifth of their length; they free only at end of caudal part, which clearly more mobile. Dorsal fin connected to caudal fin by 50% of its length; place of their connection with a notch. Anal fin covering *C* for 58% of its length. Caudal-fin end truncated. Skin smooth; prickles absent.

X-ray. Twelve precaudal and 50 caudal vertebrae (including urostyle). Four pairs of pleural ribs; anterior pair thin, short, subsequent ribs long, saber-shaped. Haemal process of first caudal vertebra elongated. First ray D thin, shortened (vestigial), located between neural processes of vertebrae two and three; next (normally developed) ray located between processes of vertebrae three and four. Free dorsal pterygiophores absent; D-rays 56 (one short + 55); of these, eleven (one short + ten) in precaudal part. A-rays 45; A-rays before first haemal process absent. Two anal-fin pterygiophores located between haemal processes of first and second caudal vertebrae. In tail, counting from caudal end, three pre-urostylar vertebrae free from fin rays. Pterygiophore of last *D*-ray located between fourth and fifth neural processes (counting from caudal end), while pterygiophore of last A-ray positioned between third and fourth haemal processes. Two hypural plates fused with urostyle at base and separated by wide gap distally. One epural. Primary C-rays 5+5, two upper and one lower secondary rays; C 13(2+5/5+1).



Fig. 3. *Crystallichthys longirostris* **sp.nov.**, holotype, field photos. **A**, lateral view; **B**, dorsal view; **C**, **D**, ventral views. A rounded depression on the belly (C) outlines the pelvic disc, which is covered by pectoral fins. The protruding hindgut (D) indicates the position of the anus, which is close to the rear margin of the pelvic disc, partly protruding from under the pectoral fins.

Colour. In life, head and body soft pink, abdomen and bases of pectoral fins lighter. Head and body with irregular brownish red ringed spots having light centre and clear double contour. These rings mostly vertically oval; some of them

ribbon-like near eye and on fins. Mouth, branchial cavity and peritoneum light (not pigmented).

After preservation in ethanol, gelatinous tissue partially dehydrated, causing skin sagging in loose folds. Pink background and ringed spots discolored, only slight grayish pigmentation remaining on rear quarter of caudal part of body and anterior to dorsal fin.

Measurements. In % of *SL* (% of *c*): head length 24.6, head height 22.7 (92.0), and width 8.2 (33.3); snout length 10.5 (42.7); eye 3.3 (13.3), interorbital distance 6.9 (28.0); gill slit 2.6 (10.7); body width 8.9 (36.0), maximum body height 32.2 (130.7), height above beginning of A 29.9 (121.3); predorsal and preanal distances 25.7 and 36.2, respectively; disc length 8.2 (33.3) and width 6.6 (26.7); distance from symphysis of lower jaw to pectoralfin symphysis 5.9, the same to disc anterior rim 8.2, the same to anus 19.7; from posterior rim of disc to anus 3.3, from anus to beginning of A 8.9; from disc to beginning of A 12.8; length of upper P-fin lobe 15.8 (64.0), shortest ray of pectoral notch 8.2, longest ray of lower P-fin lobe 9.9; C-fin length 11.8 (48.0). *TL* of five known specimens 34–43 cm. Weight of holotype when captured 740 g.

Comparison. The photograph of *Crustallias* matsushimae in Matsuzaki et al. (2022, Supplementary, ESM fig. S1) depicts an adult male (287.0 mm SL) with a prominent, duck-like snout, similar to that of the specimen examined here, while large females (305.0 and 319 mm SL) have a normal snout. According to Matsuzaki et al. (2022), this species has barbels around the mouth, three-lobed teeth, and a 2-5-6-1 pore pattern, which confirms that the species belongs to the genus Crystal*lias*. It raises some doubts that none of the authors (Jordan & Snyder, 1902; Burke, 1930; Lindberg & Krasyukova, 1987; Kido, 1988; Tokharin et al., 2015, and others) mention a duck-like snout in any specimen of C. matsushimae, despite studying both females and males (up to 360 mm in length). The same can be said about Crystallichthys. However, this photographic evidence suggests that the duck snout may represent a sexual dimorphism in *Crystallias*, and probably also in *Crystallichthys*. For this reason, we use other characters in the comparisons below.

Crystallichthys longirostris **sp. nov.** differs from *C. matsushimae* in the absence of barbels around the mouth (vs. 20–30 present), in the pore pattern 2–6–7–2 (vs. 2–5–6–1), and simple teeth (vs. three-lobed) (Burke, 1930; Lindberg & Krasyukova, 1987; Kido, 1988; Matsuzaki et al., 2022; our data). From *C. cameliae*, known from the only holotype (Nalbant, 1965), the new species differs in simple (not three-lobed) teeth. It has more numerous *D*-rays 56 (vs. 50) and *P*-rays 36 (vs. 28), the less deep head (22.7% vs. 27.2% of *SL*) but the deeper body (32.2% vs. 27.2% of *SL*; 130.7% vs. 110% of *c*), the much smaller eye (13.3% vs. 23.8% of *c*), and the beginning of the anal fin clearly located posterior to the beginning of the dorsal fin (vs. almost below it) (Burke, 1930).

Crystallichthys longirostris sp. nov. differs from two other congeners, C. cuclospilus and C. mirabilis (using Burke's data, who studied their types, 200 and 330 mm long, respectively), in having simple teeth (vs. three-lobed), a dot-like pupil, which is small and round (vs. horizontally elliptical pupil in both species, partially divided dorsally by the projection of the iris), and the shorter distance from the anus to the beginning of the anal fin (9% vs. 17–19% of SL in specimens ZIN Nos 24491 and 29105). The new species differs from C. cyclospilus also in the larger number of D rays (56 vs. 48-50) and the smaller disc (33% vs. 43%)of c). The new species differs from C. mirabilis by the shorter gill opening (11% vs. 26% of c), which is smaller than the eye (0.8 times its diametre vs. 1.6 times), the pore pattern with the presence of a postorbital pore and two suprabranchial pores (2-6-7-2 vs. 2-5-6-1), and the absence of a medial groove on the snout (vs. the snout is divided anteriorly by a vertical slit-like groove).

Among other representatives of the genus *Crystallichthys*, the new species is second in size only to *C. mirabilis*, which can reach a length of 50 cm (Tokranov & Orlov, 2014).

Etymology. The specific name is derived from the Latin adjective *longus* (long) and the noun *rostrum* (snout or muzzle of an animal), with the adjective-forming suffix *-is*.

Distribution. The known distribution of *Crystallichthys longirostris* **sp. nov.** is the area from eastern Kamchatka (Kronotskiy Bay) to the northern Kuril Islands at depths of 192–309 m (Fig. 4). The catches were confined to bottom areas with sandy grounds.

Previously, specimens of *C. longirostris* **sp. nov.**, due to their similar (spotted) general appearance, may have been mistakenly attributed to *C. cyclospilus, C. mirabilis*, or *Crystallias matsushimae*, since all of them were recorded from the



Fig. 4. Records of *Crystallichthys longirostris* **sp.nov.** The holotype (star) and additional specimens (circle). Designations: Kronotskiy Bay (1), Cape Shipunskiy (2), Shumshu Island (3), Paramushir Island (4); isobaths 100, 200, and 500 m.

same region. In the area from the northern Kuril Islands to the western Bering Sea, all three species are recorded: *Crystallias matsushimae* (Orlov, 1998; Parin et al., 2014), *Crystallichthys cyclospilus* (Tokranov & Polutov, 1984; Orlov, 1998; Fedorov & Parin, 1998; Parin et al., 2014), and *C. mirabilis* (Borets et al., 2001; Andronov & Datsky, 2014; Tokranov & Orlov, 2014). Some of their findings may actually be of *C. longirostris* **sp. nov.** Therefore, it is necessary to reconsider the ranges of these species using collection materials.

Acknowledgements

The authors express their gratitude to the crew of the MRTK "Engineer Martynov" for their assistance in carrying out work related to catching fish. Special thanks to S.A. Veselov, the senior specialist of the Kamchatka branch of the Federal Research Institute of Fisheries and Oceanography, who assisted during the trawl survey off the Pacific coast of Kamchatka in 2022. We are grateful to A.O. Yurtseva (ZIN) for assistance in transporting the material, as well as E.A. Nikolaeva (ZIN) for the radiography. We thank the reviewers, Dr. James Orr and an anonymous reviewer, whose constructive comments helped improve the manuscript. The work was based on the taxonomic collection of ZIN and performed in the frames of the State Research Project No. 122031100285-3.

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Received 12 March 2024 / Accepted 29 July 2024. Editorial responsibility: B.A. Levin & D.A. Gapon