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SHORT COMMUNICATIONS

The First Finding of the Striped Tripletooth Goby *Tridentiger trigonocephalus* (Perciformes, Gobiidae) in the Black Sea (the Estuary of the Chernaya River, Sevastopol Bay)

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In the estuary zone of the Chernaya River, approximately within 400 m from its inflow in the Sevastopol Bay, on September 4, 2006, a goby was captured and brought alive to the Institute of Biology of Southern Seas, identified later as the Striped tripletooth goby *Tridentiger trigonocephalus*. Fishing was made at a permanent station with a hauled dipnet touching the bottom. The aperture of the dipnet is semicircular, 1.0 × 0.5 m in size, mesh size 6.5 mm. The depth of the haul was 4–5 m, temperature at water surface 20.5°C, and salinity at 14.96‰. The ground was silt sandy and partly covered with aquatic vegetation.

The species was identified using the key for species of the genus *Tridentiger* composed by Pinchuk (1992) on the basis of publications of Japanese authors (Akihito et al., 1984; Akihito and Sakamoto, 1989), comparative materials from the collection of the Zoological Museum of Moscow State University (ZMMU), and morphological data, photographs and drawings of species of this genus are from various publications (Wu, 1931; Wang and Wang, 1935; Berg, 1949; Takagi, 1963; Lindberg and Krasyukova, 1975; Kawanabe and Mizuno, 1955; Kim and Park, 2002; Shimizu et al., 2006) and Internet sites: DFG WA, 2005; The Fishes of Primor'e, 2005; FishBase (Froese and Pauly, 2007); USGS (Nico and Fuller, 2007); Species blog, 2007; Japanese Freshwater Fishes, 2007.

As the occurrence of this species in the basin of the Black Sea is unexpected, we include in the present publication a detailed description of the captured specimen with the data of morphometric analysis made according to standard methods (Smirnov, 1986; Miller, 2003) and a description of morphology and coloration used in the diagnoses of species of this genus. At present this goby (female) is deposited at the ZMMU (P-21675).

D VI, I 11; A I 11; P 19; V 10; number of transverse rows of scales 51. Absolute length (TL) 44.2 mm, body length from snout to base of middle rays of caudal fin (SL) 36.5 mm. Teeth in outer row on upper and lower jaws tricuspid; forehead is narrow and convex, its width smaller than horizontal diameter of eye and is 5.1 times in head length; pores of supraorbital canals large, their diameter is similar in size to diameter of posterior nostril; supraorbital canals wide, connivent, smallest distance between canal of left and right sides of head (in the middle of forehead) noticeably smaller than half of horizontal eye diameter; rays of first dorsal fin not threadlike, elongated; uppermost ray of pectoral fin free of membrane (ends of ray broken on both sides); scales on occiput and belly present.

Morphometric characters, in % SL: greatest body depth at beginning of dorsal fin 21.3, depth of caudal peduncle 12.8, length of caudal peduncle 21.9, antedorsal distance 38.1, postdorsal distance 51.8, anteventral distance 35.9, anteanal distance 60.3, pectoventral distance 16.2, ventroanal distance 26.3, pectoral fin length 21.6, ventral fin length 18.4, depth of first dorsal fin 14.3, length of base of first dorsal fin 19.2, depth of second dorsal fin 13.2, length of base of second dorsal fin 26.0, distance between dorsal fins 2.5, depth of anal fin 13.7, length of base of anal fin 20.0, length of caudal fin 20.6, head length (*c*) 28.0. In % *c* are the following: greatest depth of head 68.6, greatest width of head 78.4, snout length 32.4, length of upper jaw 29.4, length of lower jaw 31.4, horizontal eye diameter 21.6, postorbital distance 55.9, distance between eye and angle of mouth 21.6, cheek depth 38.2, distance between angles of mouth 34.3, width of forehead 19.4.

The intravital coloration is light gray, the body is almost transparent, and there are two contrasting dark bands along the whole body: the upper band begins over the eye and extends along the dorsal part at the base of dorsal fins up to the beginning of the upper rays of the caudal fin, the lower band extends from the beginning of the snout, through the eye, bases of pectoral fins, and along the median line of the body up to the

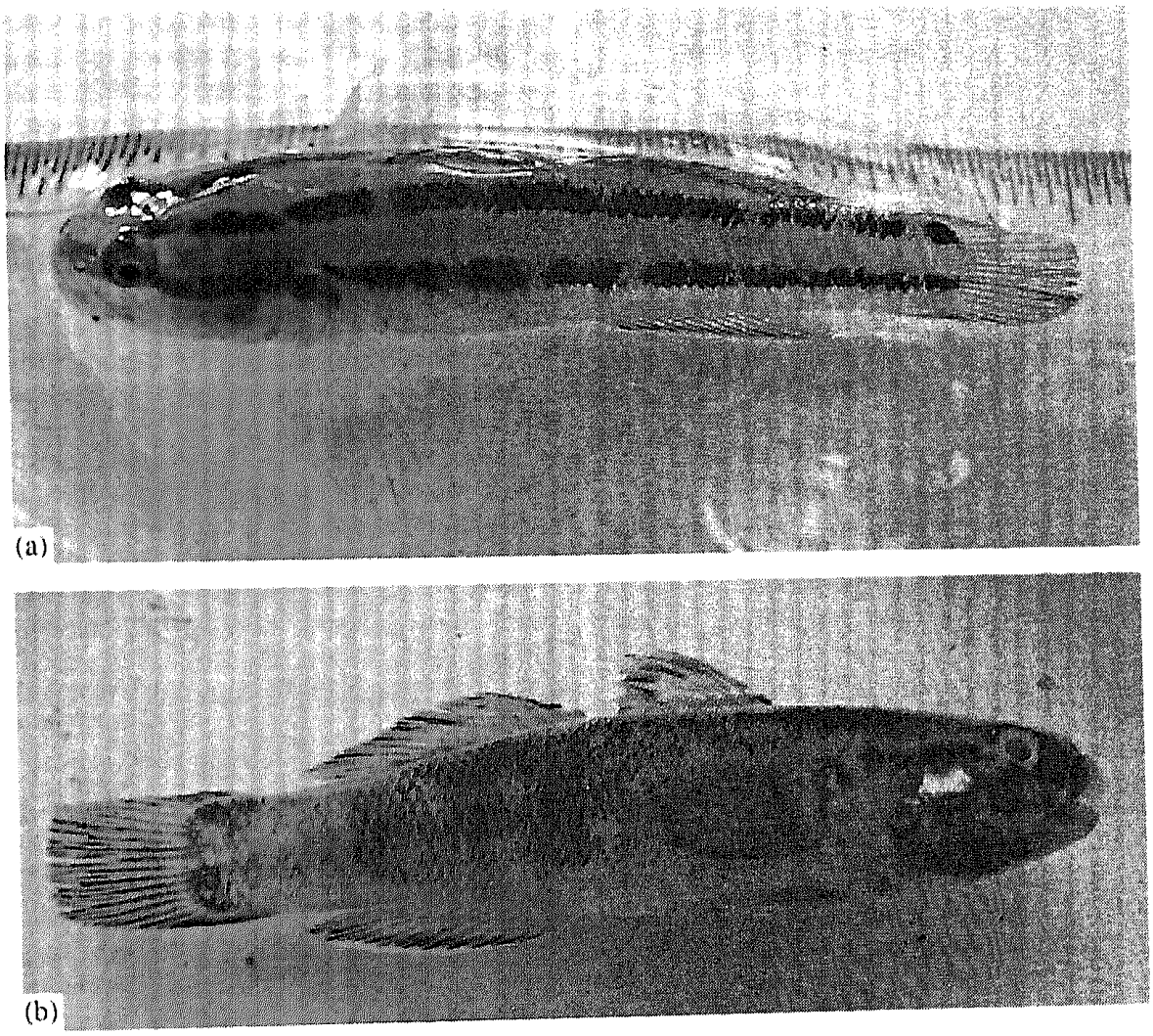

Fig. 1. The Striped tripletooth goby *Tridentiger trigonocephalus* from Sevastopol Bay. TL 44.2 mm, SL 36.5 mm: (a) intravital coloration, (b) coloration after preservation.

base of middle rays of the caudal fin (Figure).On the first rays of both dorsal fins there are small pinkish dots, and there is a vague pinkish band along the bases of dorsal fins. The coloration of the goby significantly changed during its keeping in an aquarium: the bands became interrupted, sometimes became very pallid.

After preservation in 4% formalin, the goby became gray, transverse dark gray stripes appeared on sides, the ventral side more light, dark dots on the throat, and few spaced whitish spots on cheeks. The longitudinal bands were still present, but became hardly noticeable and light pinkish, margins of anal and dorsal fins became darker, and a clear pinkish orange band appeared at their bases. Later, in the preserving fluid, the pinkish coloration disappeared, the upper dark band along the dorsal fins became clear and the lower band was seen on the head only and farther along the body—very slightly. The edges of the anal and of both dorsal fins dark, a gray band at their bases; tips of rays of the anal fin whitish; on the first rays of both dorsal fins, by three black spots; no white spots on the lower part of the head; spaced rare rather large whitish spots on sides of the head.

Presence of tricuspid teeth in the outer row on the upper and lower jaws makes a sure reason to attribute this goby to the genus *Tridentiger.* The number of transverse rows of scales (51) and presence of two paired longitudinal dark bands along the whole body distinguish it from "large-scaled" species (*T. brevispinis* and *T. obscurus)* having not more than 46 transverse rows of scales on the body and not having two dark longitudinal bands on the body sides (Berg, 1949; Lindberg and Krasyukova, 1975; Pinchuk, 1992; Shed'ko and Chereshnev, 2005; our data on *T. brevispinis* from the ZMMU collection—P-13966, the Olginka River near its mouth, July 14, 1973, collected by V. Pinchuk, eight specimens).

Of the two known at present "small-scaled" species of this genus, the goby found in the Black Sea basin clearly differs from *T. bifasciatus* living in Russian Pacific waters, possessing a wide and flat forehead, its width noticeably greater than the horizontal eye diameter, not more than 3.5 times in the head length; pores of supraorbital canals very small, "pointlike," not commensurate with the diameter of the posterior nostril, supraorbital canals narrow, widely spaced, the smallest distance between the canals of the left and right side of

the head (in the middle part of the forehead) noticeably exceeds a half of the horizontal eye diameter, in some specimens almost equaling the eye diameter; the pectoral fin without the ray free of interray membrane; lower and lateral side of the head densely covered with numerous small whitish mottles; the second dorsal and anal fins with orange edges and without longitudinal bands (Wang and Wang, 1935; Berg, 1949; Pinchuk, 1992; our data on three specimens (one female, two males) from the collections of Pinchuk, 1972, the Amur Bay in the ZMMU collection—P-13958). At the same time, by most of characters from the key for species of the genus *Tridentiger* (Pinchuk, 1992), the goby from the Chernaya River corresponds to the species *T. trigonocephalus*, differing only in minor points of coloration. According to this key, in *T. trigonocephalus* "the second dorsal fin with a white margin and with a dark red longitudinal band near the base; the anal fin with a white margin and reddish longitudinal bands" (p. 31). However, examination of color photographs of both small-scaled species, shown in the publications (Kawanabe and Mizuno, 1995; Kim and Park, 2002) and in the aforementioned Internet sites, indicates that the coloration of fins in them varies and in many cases does not correspond to "species" characteristics of the cited key. At the same time, taking into consideration the published and our data, such characters as the relative width of supraorbital canals and of their pores, presence/absence of a free ray in the pectoral fin, and the relative width of the forehead are important diagnostic characters easily distinguishing small-scaled species of tripletooth gobies. On the basis of these characters, we identified a specimen of a goby from Nagasaki which in the ZMMU collection was listed for many years as *Tridentiger* sp. (P-1449). It should be noted that a very narrow forehead, whose width is smaller than the eye diameter and is 8.1 times in the head length (Wang and Wang, 1935), is noted in *T. marmoratus* (a junior synonym of *T. trigonocephalus* (Eschmeyer, 1998) from the coast of the Yellow Sea in the area of Chifu (China, Shandung Cape) and in a specimen of *T. marmoratus* from the Foochow region: the forehead width is 2.5 times in the eye diameter (Wu, 1931).

With consideration of the aforementioned facts, we attribute the goby, caught in the mouth of the Chernaya River, to the species *T. trigonocephalus,* Striped tripletooth goby (Chameleon goby), whose native area comprises the coastal waters of the Pacific Ocean off Japan, China, and Korea (no reliable findings of this species at Russian coasts are known yet). How did the Pacific goby get to the mouth of the Chernaya River in the Sevastopol Bay? Two explanations are possible in the present case.

The Striped tripletooth goby might be brought to the Black Sea with ballast waters. In 1960, two specimens of this species were found in the Los Angeles Bay (California) and in 1962 one specimen—in the southern part of San Francisco Bay (Matern and Fleming, 1996). In Australian waters its first finding was recorded in 1973; in Sydney Bay and somewhat later, in 1977, it was found off the western coast—in the Cockburn Strait and the Swan River and in the coastal zone of Victoria (DFG WA, 2005). It assumed that, in waters of California and Australia, it got there either by transportation of eggs or adults with ballast water or by transportation of fertilized eggs attached to shells of Pacific oyster. The latter was repeatedly imported in large quantities for artificial cultivation (DFG WA, 2005; Nico and Fuller, 2007). The Australian scientists prefer the first version, as the ecological surveillance recorded living gobies in ballast tanks (DFG WA, 2005). In Sevastopol Bay, where the Striped tripletooth goby was found, two small freight terminals work at present loading grain and metal scrap as well as a large ship repairing plant periodically repairing foreign ships, including those from the Far East. However, according to information from the ecological surveillance of the Sevastopol marine trade port, the cargoes are delivered principally to Mediterranean and Western European countries.

Another possibility is not excluded. In 1981, from the Far Eastern Pos'et Bay, for the Sevastopol aquarium, over the living 20 specimens attributed to the Striped tripletooth goby, together with other exotic for the Black Sea fishes, were brought.[1]

Due to their small size and extremely variable coloration not attractive for demonstration in the aquarium, all specimens were released to Sevastopol Bay.

Under all circumstances there is a problem of a possibility of naturalization of the Striped tripletooth goby in the basin of the Black Sea. It is known that this goby belongs to small-sized, short-cycle marine, euryhaline species, usually attains TL 8 (rarely 12) cm, attains maturation in one year, and lives three years. It spawns from the second half of spring until early autumn. Females may lay eggs several times during the season. For egg laying they build nests on the inner surface of shells of oysters and of other mollusks, under stones, or in crevices. In the absence of suitable natural substrata, it may use various jars and bottles. During the whole incubation period, continuing from 8 to 12 days, the male protects and ventilates the egg clutch. Juveniles feed on zooplankton, and adults consume crustaceans, gastropods, polychaetes, and fish eggs (Berkeley Digital Library Project, 1995; *Ryby Primorya*, 2005; DFG WA, 2005). According to some published data (Pinchuk, 1992), this goby is rare in strongly freshened brackish waters and usually occurs in waters with oceanic salinity. Other authors (Matern and Fleming, 1996) believe that this goby keeps in the coastal zone of seas and may penetrate to river mouths and lower reaches of rivers. Up to the present, this species has formed two self-reproducing isolated populations in the

[1] As it is not always known which species is mentioned in publications, and in confidential communications it is not possible to state to what species these fish actually belonged.

aforementioned bays of California and in bays and estuaries connected with them (Berkeley Digital Library Project, 1995) and fully naturalized in Australian waters, having attained a high biomass (Bell et al., 1987). Under new conditions the goby already renders a certain negative impact on the aboriginal ichthyofauna being a competitor for food and eating the egg clutches of native species (DFG WA, 2005). We believe that the environmental conditions of Sevastopol Bay also are quite suitable for the life of this species. Whether its importation led to naturalization or this is just a single finding will be seen only from further repeated collections.

REFERENCES

1. Akihito, M. Hayashi, and T. Yoshino, "Suborder Gobioidei," in *The fishes of the Japanese Archipelago* (Tokai Univ. Press, Tokyo, 1984), pp. 228–276 [in Japanese].
2. Akihito and K. Sakamoto, "Reexamination of the Status of the Striped Goby," Jpn. J. Ichthyol. **36** (1), 100–112, 1989 [in Japanese].
3. J. D. Bell, A. S. Steffe, and R. B. Talbot, "The Oriental Goby, *Acanthogobius flavimannus*, Colonizes a Third Estuary in New South Wales, Australia," Jpn. J. Ichthyol. **34** (2), 227–230 (1987).
4. L. S. Berg, *Fishes of Fresh Waters of the USSR and Adjacent Countries* (AN SSSR, Moscow, 1949), Part 3 [in Russian].
5. *Berkeley Digital Library Project. 1995. University of California. http://elib.cs.berkeley.edu.*
6. *Catalog of Fishes*, Vols. 1–3, Ed. by W.N. Eschmeyer (Calif. Acad. Sci., San Francisco, 1998).
7. DFG WA (Dept. Fish. Government W. Australia). 2005. Introduced Marine Aquatic Invaders—a Field Guide. http://www.fish.wa.gov.au
8. *Fishes of Primor'ye* (Reference Data Base of the Institute of Marine Biology of the Far Eastern Division, Russian Academy of Sciences, Vladivostok, 2005) (http://fish.dvo.ru).
9. *FishBase. World Wide Web Electronic Publication*, Ed. by R. Froese and D. Pauly, www.fishbase.org, version 04.2007.
10. iSpecies blog. 2007. Rod Page of Glasgow University. http://darwin.zoology.gla.ac.uk/~rpage/ispecies.
11. Japanese Fresh Water Fishes. 2007. http://tansui-gyo.maxs.jp [in Japanese].
12. H. Kawanabe and N. Mizuno, *Freshwater Fishes of Japan* (Yama-Key Publ. Co. Ltd., Tokyo, 1995) [in Japanese].
13. I. S. Kim and J. Y. Park, *Freshwater Fishes of Korea* (Kyo-Hak Publ. Co. Ltd., Seoul, 2002) (in Korean).
14. G. U. Lindberg and Z. V. Krasyukova, *Fishes of the Sea of Japan and Adjacent Parts of the Sea of Okhotsk and the Yellow Sea* (Nauka, Leningrad, 1975), Part 4 [in Russian].
15. S. A. Matern and K. J. Fleming, "Invasion of a Third Asian Goby Species, *Tridentiger bifasciatus*, into California," Calif. Fish Game **81** (2), 71–76 (1996).
16. L. Nico and P. Fuller, *Tridentiger trigonocephalus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. http://nas.er.usgs.gov/queries/FactSheet.asp speciesID = 717. Revision Date: April 24, 2006.
17. V. I. Pinchuk, "On the Fauna of Gobiidae from Primor'ye and Sakhalin," Vopr. Ikhtiol. **32** (4), 30–36 (1992).
18. S. V. Shed'ko and I. A. Chereshnev, "Review of Gobiidae (Perciformes) from Fresh Waters off the Kuril Islands," Chteniya Pamyati V.Ya. Levanidova, No. 3, 435–455 (2005).
19. T. Shimizu, H. Takahashi and M. Shibuya, "Freshwater Fishes in Saijyo City, Ehime Prefecture, Japan," Bull. Tokushima Pref. Mus., No. 16, 65–114 [in Japanese].
20. A. I. Smirnov, *Fauna of the Ukraine. Vol. 8: Fishes, Issue 5: Perciformes (Gobiidae), Scorpaeniformes, Pleuronectiformes, and Lophiformes* (Naukova Dumka, Kiev, 1986) [in Russian].
21. K. Takagi, "Studies of the Gobioid Fishes in the Japanese Waters on the Comparative Morphology, Phylogeny, Taxonomy, Distribution and Binomics." Dr. Th. Fac. Agr., Kyoto Univ., 1963 [in Japanese].
22. P. J. Miller, *The Freshwater Fishes of Europe. Vol. 8/I. Mugilidae, Atherinidae, Atherinopsidae, Blenniidae, Odontobutidae, Gobiidae 1 Ed. by P.J. Miller* (AULA-Verlag, Wiebelsheim, 2003).
23. K. F. Wang and S. C. Wang, "Study of the Teleost Fishes of Coastal Region of Shangtung III," Contrib. Biol. Lab. Sci. Soc. China. Zool. Ser. **11** (6), 165–237 (1935).
24. H. W. Wu, "Notes on the Fishes from the Coast of Foochow Region and Ming River," Contrib. Biol. Lab. Sci. Soc. China, Zool. Ser. **7** (1), 1–64 (1931).

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