

ORIGINAL ARTICLE

## New records, habitats and features of ecology four-banded goby *Chromogobius quadrivittatus* (Steindachner, 1863) (Pisces: Gobiidae) along the Russian coasts of the Black Sea

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Four-banded, or chestnut, goby *Chromogobius quadrivittatus* (Steindachner, 1863) (Actinopterygii, Perciformes, Gobiidae) is recorded from in Kazachiya Bay, Sevastopol, Crimean Peninsula. The study shows that the species is more numerous and probably widely distributed in the Black Sea being a cryptobenthic species inhabiting darkened and twilight biotopes, such as grottos, marine caves, clusters of rocks and boulders, rocks with wide cracks and various artificial constructions. At the same time, the sampling of the species need a special method with "trap" simulating darkened and twilight biotopes.

**Keywords:** Diversity; Pisces; *Chromogobius*; Gobiidae; new records; ecology; goby; Black Sea; Crimean Peninsula

The Gobiidae family is one of the most diverse in ichthyofauna of the Black Sea, including, according to various estimates, up to 25 species. One of poorly studied gobiid fishes in the region is four-banded, or chestnut, goby *Chromogobius quadrivittatus* (Steindachner, 1863) (Actinopterygii, Perciformes, Gobiidae), firstly recorded in the Black Sea by Ptchelina (1939), who described it as a new genus and species – *Relictogobius kryzanowskii*, lately synonymized. This species is also widely distributed in the Mediterranean basin. The species has been previously recorded from the Mediterranean Sea: from coasts of Spain (Catalonia), southern continental France, Corse, Italia, Israel, Syria and Lebanon; northern Adriatic Sea: Croatia; Aegean and Marmor seas (Miller, 1965, 1971, 1986; Ahnelt, 1990; Alberto, Nieto, 1993; Adib Saad, 2005; Kovacic, 2005, Colombo & Langeneck, 2013). In Black Sea the species was recorded along the northern Turkish coast, coasts of Ukraine (Odessa) and Russia (Sochi, Abrau (Novorossiysk) and Crimean Peninsula (Tarkhankut and Sevastopol)) (Ptchelina, 1939; Berg, 1949; Pichuk, 1987; Ahnelt, 1990; Kovtun, 2013; Engin et al., 2016; Boltachev et al., 2018). It is assumed that the species is widespread in the Black Sea (Ahnelt, 1991), however, only separate records are still known from different areas. One of the suggested reasons for the rarity of this species is considered as anthropogenic impact (Pashkov et al., 2013). Pashkov et al. (2013) analyzed the historical data on the distribution and findings of this species and concluded that *Ch. quadrivittatus* is presently absent in the points where it was found earlier because of human activity.

At the same time, Kovtun (2012) has consistently found individuals of this species in the underwater marine caves of the Tarkhankut Peninsula since 2005, where several new and rare species of marine animals have also been discovered, including the cryptobenthic cave goby *Gammogobius steinitzi* Bath, 1971 (Pisces: Gobiidae) (Kovtun, 2012). According to Kovtun (2012), this species lives in large and deep underwater caves, in twilight zone, on some distance from the entrances, near deep cracks, holes and other shelters, at the bottom level or slightly higher. Studying the behavior of the goby in the natural habitats (Kovtun, 2012) has shown that they possess with secretive lifestyle and do not swim far from their shelter, which probably occupy for a long time. In addition, the goby reacted negatively to the light of the underwater lamp and immediately hid in the shelter. Also, Kovtun (2012) mentioned that the records of the species in open coastal biotopes are negligible and, most likely, accidental while records of this goby from salt lakes, according to his assumption, are consequence of accidental drift during strong storms. Kovtun (2012) summarized that this species, even considering poor knowledge, is extremely rare in the Black Sea, mainly inhabiting marine underwater caves of the western part of the Crimean Peninsula.

During the study of the diversity of the Black Sea cryptobenthic animals by simulating a rock substrate several adult specimens of this goby were sampled. Also, the repeated setting of the "traps" allowed collecting additional specimens that clearly indicates the ecological preferences of this species as the inhabitant of darkened and twilight biotopes - various rocks, crevices and artificial structures as well as its rarity in collecting by usual collecting gears or hand sampling, for example used in previous investigation (e.g. Pashkov et al., 2013). Another example of such gears is a bait pump (or yabbi-pump) already allowing sampling some new cryptic species for the Black Sea region (see Marin & Turbanov, 2016; Marin, 2018).

## Materials and methods

Fieldwork and sampling were carried out in Kazachiya Bay (44°34'14.3"N 33°24'45.9"E), Sevastopol, Crimean Peninsula in August 2015. To collect cryptobenthic animals, we used "traps" with different configurations, which allowed us to create the natural structure of rock geocenoses. The "trap" structures consisted of metal grids filled with mussels or porous stones containing a number of large and small cavities; the overall construction forms one large cavity with a series of smaller branches and shelter. Coloration and morphology of alive specimens were photographed using Canon PowerShot G16. All specimens were preserved in 90% ethanol for further DNA analysis. Species names and modern taxonomy are given according to the international species database WoRMS (World Register of Marine Species) and Marine Species Identification Portal. Only primary species synonyms are given. The examined material is deposited in the collection of Zoological Museum of Moscow State University, Moscow (ZMMU) and personal author collection deposited in A.N. Severtzov Institute of Ecology and Evolution of Russian Academy of Sciences, Moscow, Russia (LEMMI) and I.D. Papanin Institute of Biology of Inland Waters of RAS, Yaroslavl Province, Russia (IBIW).

## Results

Family Gobiidae Cuvier, 1816

Genus *Chromogobius* de Buen, 1930

*Chromogobius quadrivittatus* (Steindachner, 1863) - (Fig. 1)



**Figure 1.** Alive coloration of four-banded or chestnut goby *Chromogobius quadrivittatus* (Steindachner, 1863) (Actinopterygii, Perciformes, Gobiidae) from Kazachiya Bay, Sevastopol, Crimean Peninsula, Black Sea, male: *a* – general lateral view; *b* – head, lateral view; *c* – head, dorsal view.

*Gobius quadrivittatus* Steindachner, 1863  
*Gobius depressus* Kolombatovic, 1891  
*Gobius depressus quadrivittatus* Steindachner, 1863  
*Gobius planiceps* Bellotti, 1879  
*Relictogobius kryzhanovskii* Ptchelina, 1939  
*Chromogobius kryzanowskii* (Ptchelina, 1939) (misspelling)  
*Gobius quadrivittatus* Steindachner, 1863

**Material examined.** 3 ovigerous females and 2 males (LEMMI) – Mediterranean Basin, Black Sea, Crimean Peninsula, Sevastopol, Kazachiya Bay, 44°34'6"N 33°24'44"E, littoral zone, 6–8 August 2015, coll. I. Marin, I. Turbanov, G. Turbanov.

**Ecology.** According to our data, as well as observations of Kovtun (2012), this species refers to a group of cryptobenthic species that inhabit darkened and twilight biotopes, such as marine caves and grottos, clusters of rocks and boulders, rocks with wide cracks and various artificial constructions. Also the species is found in marine caves and grottoes. *Ch. quadrivittatus* shows a negative phototaxis avoiding direct sunlight, which mainly determines its nighttime activity. Probably, the species is more numerous and widely distributed that suggested before, but need special methods of sampling such as "trap" simulating darkened and twilight biotopes.

**Distribution.** This species has been previously recorded from Mediterranean Sea (Spain (Catalonia), southern continental France, Corse, Italia, Israel, Syria and Lebanon), northern Adriatic Sea (Croatia), Aegean Sea and Marmor Sea (Miller, 1971, 1986; Ahnelt, 1990; Alberto, Nieto, 1993; Adib Saad, 2005; Kovacic, 2005, Colombo & Langeneck, 2013). In Black Sea the species is known along northern coasts of Turkey, Russian (Sochi, Abrau (Novorossiysk), Crimean Peninsula (Tarkhankut Peninsula, Martynova Bay, Kazachya Bay) and Ukraine (Odessa) coasts (Ptchelina, 1939; Berg, 1949; Pichuk, 1987; Ahnelt, 1990; Kovtun, 2013; Engin, 2016; Boltachev et al., 2018; present paper).

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