

Description of two new species of tadpole-gobies (Teleostei: Gobiidae: *Benthophilus*)

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Benthophilus durrelli and *B. ragimovi*, two new species of tadpole-gobies, are described. Both belong to an assemblage of *Benthophilus* species with clearly differentiated dermal ossifications. *B. durrelli* inhabits estuarine regions, deltas, lower reaches of rivers, and dam lakes in the Sea of Azov basin and is introduced in the Volga. It was hitherto not distinguished from the Azov tadpole-goby, *B. stellatus*, from which it differs in the posterior position of the second dorsal fin (behind vs. in front of the anal-fin origin), comparatively small (vs. considerable) difference in size of tubercles and granules, rectangular dermal fold with slightly undulated margin (vs. triangular, with clearly undulated margin), narrow (vs. wide) first semiring-like blotch behind the first dorsal fin, and 17-21, commonly 18-20 transverse rows of neuromasts on the flanks (vs. 20-25). *B. ragimovi*, a deepwater species, is only recorded at western coast of middle and south Caspian from Chechen' Island to Astara. It differs from the closest congener, *B. pinchuki*, in the weak (vs. well-developed) depression on the head, absence of granules in the head depression, very small, densely-set granules located on whole upper head surface and anterior part of back, sometimes also on caudal peduncle (vs. enlarged granules located only along the lateral margins of the head depression), reduced first tubercles of the dorsal row (vs. anterior dorsal tubercles of the same size as the posterior ones).

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Introduction

Gobiid fishes of the genus *Benthophilus* (tadpole-gobies) are found in the basins of the Caspian and Black Sea including Sea of Azov. They are small size species (maximum total length does not exceed 150 mm) and may be found in fresh and brackish waters with salinity up to 20‰ and slightly higher. They have been never found in areas with true marine salinity (over 30‰) being typical inhabitants of deltas, estuaries and coastal waters of the brackish Caspian Sea and Sea of Azov. Only some Caspian species inhabit deep waters.

There are over 18 species of *Benthophilus*. Most of them are poorly known and may easily be misidentified. Most our knowledge of these fishes came from papers by Iljin (1927a, 1927b, 1927c, 1930, 1938, 1949, 1956) and Ragimov (1969, 1972, 1976, 1978, 1982, 1985a, 1985b, 1998). Quite recently, a summarizing review of European *Benthophilus* has appeared (Miller, 2004) mainly based upon unpublished data by

Pinchuk. However, the taxonomic diversity of *Benthophilus* appears to be still underestimated, and taxonomic status of some forms or subspecies is pending wider morphological and genetic studies (Pinchuk & Miller, 2004a).

As presently understood, the genus is apparently monophyletic (Pinchuk & Miller, 2004a). It is defined by a number of autapomorphies. Among them, a distinctively depressed head, absence of normal scales but modification of dermal ossification into bony plates of different sizes and shapes, reduction of the first dorsal fin to 1-4 unbranched rays and both dorsal fins widely interspaced, presence of a chin barbel and a dermal fold just behind the corner of the mouth. The biology of species in this genus is characterized by a distinct specialization, which we call "ephemery". Tadpole-gobies live about a year reaching maturity the following spawning season after a year of hatching, or some individuals can attain maturity at an age of 6-7 months (Iljin, 1927b; Ragimov, 1985b; Boldyrev, unpubl. data). All individuals die after spawning, females earlier than males.

Species of the genus may be roughly grouped into two assemblages based upon the structure of dermal ossifications. In the first group, bony plates are not differentiated by size and generally small; each plate has a base embedded into the skin and a portion with more or less developed thorns exposed to outside. In species of the second group, bony plates are differentiated into tubercles and granules. Tubercles are relatively large polygonal bony scutes, which are spiny, thorny or stellate and located on head and body; they are usually arranged in longitudinal rows on the body (dorsal and ventral ones, and 1 or 2 additional lateral rows). Granules are small bony projections, which resemble dermal ossification in species of the first group. In mature males, granules and tubercles are reduced, and in spawning males of most species the body is completely naked.

We have started a revision of the genus *Benthophilus*; first results of it revealed two new species described below.

Methods

Standard length (SL) is measured from the tip of the upper jaw to the end of the hypural complex. Other measurements made point to point are explained in the table. Last two branched rays articulated on a single pterigiophore in second dorsal and anal fin are noted as "1S". Osteological characters and dermal ossification are examined in cleared-and-stained with alizarin red S specimens and from radiographs. The number of tubercles in the body rows does not include those on the head and the bases of caudal fin rays. Since a mature male loses tubercles, its head widens and the fins lengthen, the descriptions are based only on females and larger immature males.

Abbreviations: ZIN, Zoological Institute, Russian Academy of Sciences, St. Petersburg; ZIAz, Institute of Zoology, National Academy of Sciences of Azerbaijan, Baku.

Benthophilus durrelli sp. n. (Fig. 1)

Common name. Don tadpole-goby.

Holotype. ♂, ZIN 53211, SL 42.9 mm, **Russia**, Tsimlyansk Reservoir, 25.IV.2003, coll. V. Boldyrev.

Paratypes (all from Russia). 4 specs, ZIN 53212, SL 36.6-54.2 mm, same data as holotype; 7 specs, ZIN 9972, SL 40-47 mm, Taganrog, 1892, coll. Tarnani; 7 specs, ZIN 10167, SL 37-51.6 mm, same data; 5 specs, ZIN 44445, SL 47.2-54.5 mm, at Taganrog, VII.1909, coll. Alferaki; 1 spec., ZIN 44449, SL 35.5, Azov Expedition, 26.VIII.1926, coll. B. Iljin; 4 specs, ZIN 53213, SL 40.2-48.8 mm, lower Don, VII.2003, coll. V. Boldyrev; 23 specs, ZIN 53214, SL 32.6-40.3 mm, Tsimlyansk Reservoir at Kalach-na-Donu, 10.IV.2004, coll. V. Boldyrev; 25 specs, ZIN 53215, SL 37-66 mm, same locality, IV.2003, coll. V. Boldyrev.

Description. First dorsal fin with 3 or 4 unbranched rays. Second dorsal fin with 7S or 8S (rarely 6S or 9S) branched rays. Anal fin with 7S or 8S (rarely 6S) branched rays. Origin of second dorsal fin behind vertical through origin of anal fin. Pectoral fin with (15)16-17 rays. Tubercles small but not reduced in size on head; 26-29, commonly 27-28, tubercles in dorsal row; 20-24 tubercles, commonly 21-23, in ventral row; 19-27 tubercles in upper lateral row markedly reduced in size on caudal peduncle; 10 tiny tubercles in lower lateral row. One tubercle between eyes. Dorsal tubercle with two radii of small thorns on posterior surface. Granules not numerous, sparse on flanks and absent from caudal peduncle. Chin barbel slightly compressed, with thick base; its length exceeds half eye diameter. Dermal fold large (length of its base up to two eye diameters), clearly rectangular, with slightly indulated margin. Mouth corner below anterior eye margin. Number of transverse rows of neuromasts on flanks 17-21, commonly 18-20. Total number of vertebrae 28-29 (9 precaudal and 19-20 caudal).

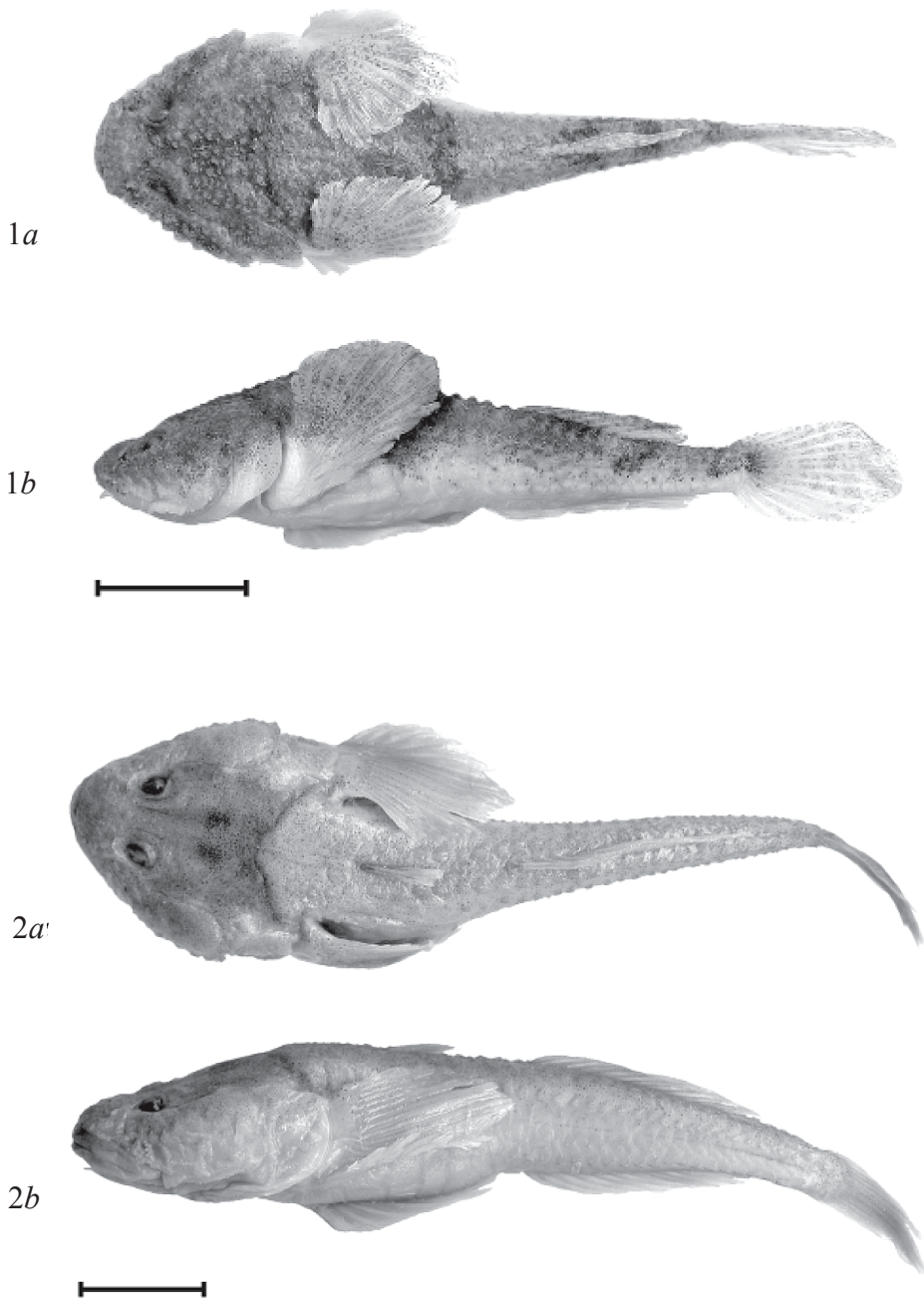
Morphometric characters given in the Table.

General coloration variably pale. Dark blotches on back often not bright. Dark spot in front of second dorsal fin present in about 50% of specimens. First semiring blotch not wide behind first dorsal fin (not reaching base of first ray of second dorsal fin).

Size up to 66 mm SL. Total length up to 81.5 mm in Tsimlyansk Reservoir (our data) and 70 mm in Saratov Reservoir (Kudersky et al., 1995).

Comparison. *Benthophilus durrelli* was hitherto not distinguished from the Azov tadpole-goby, *B. stellatus* (Kudersky et al., 1995; Evlanov et al., 1998; Pinchuk & Miller, 2004c; etc.). When compared to *B. durrelli* (see the diagnosis given above), *B. stellatus* clearly differs in the anterior position of the second dorsal fin (in front of the anal-fin origin), comparatively great difference in size between tubercles and granules, triangular dermal fold with a clearly undulated, oblique free margin, absence of any additional dark spot in front of the second dorsal fin, wide first semiring-like blotch behind the first dorsal fin (posterior margin of this blotch usually reaches the base of the first ray of the second dorsal fin), and 20-25 transverse rows of neuromasts on the flanks. *B. stellatus* and *B. durrelli* from the same locality are also different in the size of adults: SL 31-98 (41.7) mm and 22-47 (29.9) mm, respectively, in Tsimlyansk Reservoir (April 2002) and 62-88 (75.1) mm and 22-62 (41) mm in lower Don (May 2003).

B. durrelli is morphologically very close to *B. mahmudbejovi* from the North Caspian. Ragimov



Figs 1, 2. *Benthophilus*, holotypes, dorsal (a) and lateral (b) views. **1,** *B. durrelli* sp. n.; **2,** *B. ragimovi* sp. n.

(1976: 1196) identified six specimens from the Sea of Azov (ZIN 44445 and 44449, now paratypes of *B. durrelli* sp. n.) as *B. mahmudbejovi*, and most subsequent authors followed him in including the Sea of Azov into the range of *B. mahmudbejovi* (Pinchuk & Miller, 2004b). These two species are similar in having comparatively small tubercles, narrow first semiring-like blotch behind the first dorsal fin and the second dorsal fin starting behind the vertical through the anal-fin origin. However, *B. mahmudbejovi* is different in having numerous and densely-set granules, which cover the whole body (except for the abdominal area) including the caudal peduncle, where granules are located between the dorsal and upper lateral rows of tubercles. Besides, in *B. mahmudbejovi* sparse granules are present on the abdomen in front of the pelvics, transverse rows of neuromasts on the flanks are more numerous (commonly 22-24), and a dorsal tubercle bears one radius of thorns on its posterior surface instead of two.

Benthophilus species from the Sea of Azov, Black Sea and North Caspian basins with differentiated dermal ossification are characterized by a number of common features, among them are the following ones: presence of tubercles on the head (though very small in *B. abdurahmanovi*), both paired and unpaired ones between the eyes and in the middle of the posterior head surface; 24-30 tubercles in the dorsal row; commonly 3 neuromasts in the abdominal transverse rows; and a well-developed chin barbel. A key is given below for identification of species from this group.

1. Dark brown saddles or blotches on back absent or indistinct 2
 - Three distinct large dark semiring-shaped blotches or saddles along midline of back and flanks 4
2. Tubercles on head and body well distinguishable from very small granules 3
 - Tubercles and granules on head very small and of almost equal size, hardly distinguishable from each other; only 1 or 2 of them are identifiable at the border between head and back; tubercles of dorsal row increase in size from head to base of first dorsal; no tubercle in middle of head posterior surface 3
3. Distance between mouth corners over 4.5 eye diameters; commonly 9S rays in second dorsal and 8S branched rays in anal fin 4
 - Distance between mouth corners less than 4.5 eye diameters; commonly 10S rays in second dorsal and 9S branched rays in anal fin 5
4. Groove between eyes along midline of head; tubercles behind eyes large; granules on head behind eyes large (some of them almost of same size as nearby tubercles) 6
 - No groove between eyes along midline of head; granules on head minute 5
5. Two tubercles between eyes; upper jaw considerably projected over lower jaw 6
 - One tubercle between eyes 6

6. Origin of second dorsal fin behind vertical through origin of anal fin 7
 - Origin of second dorsal fin in front of vertical through origin of anal fin 8
7. Granules present between dorsal and upper lateral rows of tubercles on whole body including caudal peduncle; sparse granules present on abdomen in front of pelvics; commonly 22-24 transverse rows of neuromasts on flanks 8
 - Granules sparse on flanks and absent from caudal peduncle; no granules in abdomen area; commonly 18-20 transverse rows of neuromasts 8
8. Head elongate, its width 77-91% of its length; first semiring-like blotch not wide behind first dorsal fin and never touches base of first ray of second dorsal fin; commonly bright dark additional spot in front of second dorsal fin present 8
 - Head widened, its width 94-104% of its length; first semiring-like blotch wide behind first dorsal fin and usually reaches base of first ray of second dorsal fin; no additional spot in front of second dorsal fin 8

Distribution. Gulf of Taganrog of the Sea of Azov. In the River Don, from delta to Tsimlyansk Reservoir. Probably in tributaries: Severskii Donetz and Manych (Solodovnikov, 1930; Vitkovsky, 2000; etc.). Unintentionally introduced (with mysids introduction from Tsimlyansk Reservoir) to Kuibyshev Reservoir on Volga, from which it widely spread in Volga from Gorky Reservoir to Volgograd Reservoir (Gavlena, 1973; Kudersky et al., 1995; Evlanov et al., 1998; our data). *B. durrelli* inhabits both fresh and brackish waters. It is abundant in coastal areas of the Sea of Azov, especially in estuarine regions at river mouths with considerably freshened water (less than 1.5-3‰), lower reaches of rivers, and dam lakes. The species prefers silty sand with mollusc shells.

Etymology. The species is named after Jerald Durrell, famous English animal writer.

Benthophilus ragimovi sp. n. (Fig. 2)

Benthophilus ctenolepidus – Berg, 1949: 1113, 1114 (part.: Figs. 852-855).

Benthophilus ctenolepidus ctenolepidus – Ragimov, 1982: 48 (western coast of Caspian Sea, up to Astara in the south).

Common name. Ragimov's tadpole-goby.

Holotype. ♂, ZIN 53216, SL 67.8 mm, Azerbaijan, Caspian Sea, western coast, off Yamma-Kilyazi, depth 50 m, 27.VI.1984, coll. D. Ragimov.

Paratypes. Azerbaijan: 1 spec., ZIN 53217, SL 62.5 mm, same data as holotype; 3 specs, ZIN 23126, SL 63.5-76.5 mm, north of Apshehon Peninsula, Caspian Exped., 11.II.1915, coll. N.M. Knipowitch; 8 specs, ZIAz 93, SL 66.4-73.5 mm, same data as holotype; 6 specs, ZIAz 467, SL 63.4-72 mm, middle Caspian Sea, western coast, X.1984, coll. D. Ragimov; 7 specs, ZIN 53218, SL 65-78.3 mm, Andreyeva Bank, depth 150 m, 22.IX.1984,

Table. Measurements of *B. durrelli* and *B. ragimovi*; range (mean).

Measurement	<i>B. durrelli</i> (n = 30)	<i>B. ragimovi</i> (n = 23)
SL, mm	35.0-46.0 (41.0)	58.3-79.6 (69.3)
% in SL:		
maximum body depth	18.4-23.1 (20.9)	18.3-22.9 (21.1)
maximum body width	19.4-24.5 (22.3)	17.5-26.2 (21.8)
caudal peduncle depth	5.3-6.8 (6.0)	5.0-7.3 (6.0)
caudal peduncle width	3.2-4.8 (3.9)	3.1-5.2 (4.4)
distance from tip of snout to first dorsal fin origin	42.3-47.8 (44.0)	39.5-42.9 (41.3)
distance from tip of snout to second dorsal fin origin	62.3-66.3 (64.0)	58.8-62.5 (61.1)
caudal peduncle length	17.9-23.2 (20.8)	17.9-22.8 (20.3)
preanal distance	60.2-66.2 (63.6)	55.6-63.1 (60.1)
prepectoral distance	35.1-40.7 (37.8)	32.5-37.8 (35.2)
preventral distance	31.8-37.4 (34.7)	28.5-36.1 (32.8)
ventral disc length (from unbranched fin base to end of longest median branched ray)	27.8-32.5 (30.1)	22.0-26.7 (24.5)
maximum depth of first dorsal fin	7.5-9.7 (8.7)	8.4-11.5 (9.9)
length of second dorsal fin	16.0-22.1 (18.5)	19.9-26.1 (22.3)
maximum depth of second dorsal fin	12.5-15.1 (13.8)	11.8-17.4 (14.1)
anal fin length	16.8-21.9 (19.6)	18.4-22.6 (20.8)
maximum depth of anal fin	10.0-14.6 (11.9)	9.0-12.8 (10.9)
head length (from anteriormost point of upper jaw to posteriormost point of opercle (without membrane))	35.0-40.2 (37.0)	31.9-37.7 (34.8)
% in head length		
head width	97.4-106.6 (96.8)	81.9-97.9 (91.1)
head depth	43.2-56.6 (49.5)	48.0-56.2 (52.3)
eye diameter	12.1-16.8 (17.2)	8.1-15.1 (11.8)
interorbital distance	13.2-18.7 (15.7)	12.0-18.7 (14.4)
snout length	29.4-33.6 (30.5)	20.9-25.9 (23.9)
postorbital distance (without membrane)	56.7-62.7 (59.5)	59.4-66.8 (63.6)
mouth width	47.9-58.4 (53.0)	46.5-57.5 (52.6)
dermal fold base length	20.8-26.5 (22.5)	4.4-11.3 (8.1)

coll. D. Ragimov; 4 specs, ZIN 53219, SL 60.2-67.2 mm, off Yamma-Kilyazi, 1984, coll. D. Ragimov.

Additional material (poorly preserved or not located currently). **Russia:** 1 spec., ZIN 33122, SL 28.6 mm, off Makhachkala, depth 17 m, Caspian Exped., 31.V.1912; **Azerbaijan:** 3 specs, ZIAz 100, SL 28.6-58.3 mm, Shakhova Spit, depth 50 m, 30.VII.1985, coll. D. Ragimov; 5 specs, ZIAz 469, SL 66.4-79.6 mm, Andreyeva Bank, depth 150 m, 27.IX.1984, coll. D. Ragimov.

Description. First dorsal fin with 4 unbranched rays. Second dorsal fin with 9S or, commonly, 10S branched rays. Anal fin with 8S or 9S (rarely 10S) branched rays. Origin of second dorsal fin on vertical through origin of anal fin. Pectoral fin with 15-17 rays. No tubercles on head. First tubercles of dorsal row (in front of first dor-

sal fin) commonly reduced in size; 30-33, usually 31 or 32, tubercles in dorsal row; 24-25 tubercles in ventral row; over 20 tubercles in upper lateral row markedly reduced in size on caudal peduncle; 19 to 16 tiny tubercles in lower lateral row. Granules very small, densely-set on whole upper head surface and anterior part of back, sometimes also on caudal peduncle between dorsal and upper lateral rows of tubercles. Chin barbel thin and short, its length less than half eye diameter. Dermal fold small (its length less than eye diameter), triangular. Mouth corner below posterior half of eye. Head depression shallow, often well-developed only between eyes. Number of transverse rows of neuromasts on flanks 23-

26, commonly 23-24. Total number of vertebrae 30-31 (9 precaudal and 21-22 caudal).

Morphometric characters given in the Table.

Coloration pale. No dark spots or blotches.

SL up to 80 mm. Maximum total length recorded is 94 mm (Ragimov, 1982).

Comparison. *Benthophilus ragimovi* sp. n. belongs to another group of *Benthophilus* species with differentiated dermal ossifications. Species of this group occur only in the middle and south Caspian never entering fresh waters. In addition to *B. ragimovi* sp. n., the group includes *B. ctenolepidus* Kessler, 1877, *B. leptcephalus* Kessler, 1877, and *B. pinchuki* Ragimov, 1982. They share a number of characters, among them the complete absence of tubercles on the upper head surface, usually 4 abdominal transverse rows of neuro-masts, and a poorly developed chin barbel.

B. pinchuki is the closest congener to *B. ragimovi* having a complete dorsal row (incomplete in *B. ctenolepidus* and *B. leptcephalus*) with an increased number of tubercles (31-33), a small triangular dermal fold and comparatively numerous vertebrae (30-31 total vertebrae with 21 or 22 caudal ones). However, *B. pinchuki* differs in the following characters: well-developed depression on the head between and behind the eyes; absence of granules in the head depression; presence of granules only along the lateral margins of the head depression and absence from the body (if granules present on the back, they are relatively large, very sparse, and only located in front of the first dorsal fin); tubercles in the dorsal row comparatively large; anterior dorsal tubercles of the same size as the posterior ones.

Distribution. Recorded off the western coast of middle and south Caspian Sea from Chechen' Island to Astara (Ragimov, 1965, 1982). Deep-water species.

Etymology. The species is named after the late Dadash Ragimov, well-known ichthyologist, expert in Caspian gobiid fishes.

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