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## Description of two new species of the genus *Gobio* (Teleostei: Cyprinidae) from the Black Sea coast of Turkey

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The systematics of the genus *Gobio*, especially of the populations on the southern Black Sea coast, seems to be still far from being resolved. Seven species were recorded from the northern Black Sea coast while three species were recognized from the southern Black Sea coast. We examined in total 43 specimens from Kızılırmak River (southern Black Sea basin), 80 specimens from Çoruh River (the Western Caucasus of the Black Sea basin), 14 specimens from Rioni River (the Western Caucasus of the Black Sea basin), and 6 specimens from Kherota and Shakhe Rivers (the Western Caucasus of the Black Sea basin). Based on an analysis of 32 metric and 5 meristic data as well as the number of vertebrae, we concluded that the Kızılırmak and Çoruh populations are two distinct, unnamed species, and we describe them here as *Gobio kizilirmakensis* from the Kızılırmak River and *G. artvinicus* from the Çoruh River.

<http://www.zoobank.org/urn:urn:lsid:zoobank.org:pub:1ED54FB1-588F-4412-B376-4BE4E4516EB1>

**Keywords:** Gudgeons; taxonomy; Kızılırmak River; Çoruh River; Anatolia

### Introduction

The genus *Gobio* has a wide distribution throughout Europe and northern Asia, including Turkey and the Caucasus. Within the genus, *G. gobio* is considered to be a highly variable species because of its adaptation to different habitats (Berg, 1949; Bănărescu, 1999). A number of subspecies and local forms of *G. gobio* have been described (Berg, 1949; Bănărescu, 1954; Bănărescu & Nalbant, 1973; Bănărescu, 1992; Bănărescu, 1999; Bănărescu, Bless, & Economidis, 1999; Doadrio & Madeira, 2004). Recent studies have revealed some remarkable morphological differences between populations (e.g. Erk'akan et al., 2005; Nowak et al., 2008) and molecular studies have supported this diversity within the former *G. gobio* sensu lato (Yang, He, Freyhof, Witte, & Liu, 2006; Mendel, Lusk, Vasil'eva, & Vasil'ev, 2008), while some of the taxa described as subspecies and local forms have been shown to be valid species (Vasil'eva, Vasil'ev, & Kuga, 2004; Kottelat & Persat, 2005; Freyhof & Naseka, 2005; Vasil'eva, Vasil'ev, & Boltachev, 2005; Naseka et al., 2006; Kottelat & Freyhof, 2007; Mendel et al., 2008; Nowak et al., 2008). Recently, Kottelat & Freyhof (2007) revised the European taxa and Naseka et al. (2006, 2010) revised those of Russia and Central Anatolia. As a result, the genus *Gobio* Cuvier, 1816 is represented by approximately 32 species in Europe and Asia (Kottelat & Freyhof, 2007; Naseka et al., 2006; Nowak et al., 2008; Naseka, 2010; Turan, Ekmekçi, Luskova, & Mendel, 2012).

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The systematics of Black Sea *Gobio*, especially for *Gobio* individuals distributed along the southern Black Sea coast, seems to be still far from being resolved. Seven species were recorded or described from the northern Black Sea coast: *Gobio kubanicus* Vasil'eva, 2004 (Kuban River); *G. delyamurei* Freyhof & Naseka, 2005 (Chornaya River, Crimea); *G. carpathicus* Vladykov, 1925 (Tisza River, Danube drainage); *G. krymensis* Banarescu & Nalbant, 1973 (Crimean streams); *G. brevicirris* Fowler, 1976 (Don River); *G. sarmaticus* Berg, 1949 (Dnieper and South Bug); *G. obtusirostris* Valenciennes, 1842 (Danube River basin and Odra River). In addition, three species were recognised from the southern Black Sea coast: *Gobio kovatschevi* Chichkoff, 1937 (the streams in Bulgaria, Rezova, Kara Menderes and Biga Stream (Biga Peninsula)); *G. sakaryaensis* Turan, Ekmekçi, Luskova & Mendel, 2012 from Sakarya River; and *Gobio lepidolaemus* var. *caucasica*. Another *Gobio* from the southeastern Black Sea coast was described by Kamensky (1901) based on five syntypes as *Gobio lepidolaemus* var. *caucasica*. Four of these syntypes are from Podkumok and Sulak (Caspian basin) and one from Rioni (Black Sea basin). Berg (1914) reported Caspian populations as *Gobio gobio lepidolaemus* natio *holurus* and Black Sea populations as *Gobio gobio lepidolaemus* natio *caucasica*. Naseka (2010) treated the East Ciscaucasia population as *G. holurus* and West Transcaucasia population as *G. causicus*. We here follow Naseka (2010) and tentatively accept the Rioni population as *G. causicus* and the Caspian population as *G. holurus*.

We compared the specimens from the Kızılırmak and Çoruh with known *Gobio* species from adjacent areas (*G. causicus* [Rioni River, the Western Caucasus of the Black Sea basin], *Gobio sakaryaensis* [Sakarya River, Southern Black Sea coast], *G. kovatschevi* [Rezova River [southwestern Black Sea coast], and Biga Stream in Biga Peninsula [Southern Marmara Sea coast]), and *G. cf. causicus* [Kherota and Shakhe Rivers, the Western Caucasus of the Black Sea basin]). We concluded that they belong to two distinct, unnamed species which we describe here.

### Material and Methods

Fish were caught using pulsed DC electro-fishing equipment. The material is deposited in the Zoology Museum of the Faculty of Fisheries, Recep Tayyip Erdoğan University, Rize, Turkey. Measurements were made using digital calipers (0.1 mm accuracy), and counts and measurements follow those of Hubbs & Lagler (1947) except the following: head width<sub>1</sub>: distance between anterior margin of eyes; head width<sub>2</sub>: distance between posterior margin of eyes; head width<sub>3</sub>: head width at the opercle; head depth<sub>1</sub> through eye; head depth<sub>2</sub>: head depth at nape (posterior extent of head on dorsal midline); snout width: at level of nostrils; width of mouth gape: measured between corners of mouth; length of mouth gape: measured from tip of the upper lip to the corner of mouth (Figure 1). The lateral-line scales are counted from the anteriormost scale (the first one to touch the shoulder girdle) to the posteriormost one (at the end of the hypural complex). The unpored scales on the caudal fin itself are indicated by '+'. Vertebral counts were obtained from radiographs and given according to Naseka (1996). The last two branched dorsal and anal fin rays, which articulate on a single pterygiophore, were counted as "1½". In the descriptions, numbers in parenthesis after a count indicate the number of specimens in which this count was observed.

Twenty-eight measurements of the four *Gobio* species (*G. kizilirmakensis*, *G. artvinicus*, *G. causicus* and *G. cf. causicus*) were analysed with principal component analysis (PCA) using the software package PAST version 1.8 (Hammer, Harper, & Ryan, 2001).

The morphometric and meristic data for *Gobio microlepidotus*, *G. intermedius*, *G. gymnostethus*, *G. insuayanus*, *G. hettitorum*, *G. battalgilae*, *G. maeandricus*, *G. bulgaricus*, *G. kovatschevi*, *G. sakaryaensis* and *Gobio cf. causicus* (the Kherota and Shakhe Rivers, Northeastern Black Sea coast) are taken from Turan et al. (2012).

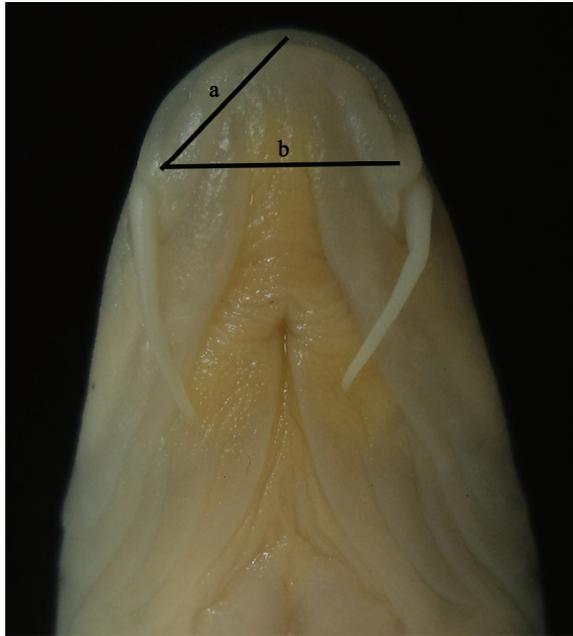


Figure 1. Ventral view of the head of *Gobio kizilirmakensis* sp. n., paratype, FFR 2507, 102 mm SL, male; Turkey: Kızılırmak River; a. length of mouth gape; b. width of mouth gape.

**Abbreviations:** GNM: Georgian National Museum, Tbilisi, Georgia; IUSHM: Istanbul University, Science Faculty, Hydrobiology Museum, Turkey; SCFK-SDU: Fish Collection of Fahrettin Küçük, Suleyman Demirel University, Isparta, Turkey.

## Results

### *Gobio kizilirmakensis* sp. n. (Figure 2)

**Holotype.** FFR05930, 83 mm SL, male; Turkey: Çankırı Prov.: Uluşu Stream, 40°48'N, 32°53'E, Kızılırmak River drainage; D. Turan, E. Bayçelebi & C. Kaya, 16.viii.2014. – **Paratypes.** FFR05933, 24, 71–105 mm SL; same data as holotype, – FFR05930, 18, 50–111 mm SL; Turkey: Çankırı Prov.: Uluşu Stream, 40°47'N, 32°55'E, Kızılırmak River drainage; D. Turan, E. Bayçelebi & C. Kaya, 16.viii.2014. The holotype and paratypes were deposited in the Zoology Museum of the Faculty of Fisheries, Recep Tayyip Erdoğan University, Rize, Turkey.

**Diagnosis.** *Gobio kizilirmakensis* sp.n. is distinguished from all other species of *Gobio* in Anatolia and adjacent areas by a combination of the following characters: scales on belly smaller than pupil; head length 26–29 % SL, its length 1.3–1.5 times body depth; snout rounded, conspicuously shorter than postorbital distance (postorbital distance 1.3–1.6 times snout length); width of mouth gape conspicuously greater than its length, its width 1.3–1.6 times its length; preanal length 68–74 % SL; prepelvic length 47–52 % SL; length of caudal peduncle 2.1–2.7 times its depth; distance between pelvic-fin origin and anal-fin origin 3.0–4.4 times distance between anus and anal-fin origin; 38–42 + 1–3 lateral line scales; 5–6 scale rows between anus and anal-fin origin; 8–10 scale rows between posterior extremity of pelvic-fin base and anus; 8–9 midlateral black blotches (greater than eye diameter), commonly separated from one another.

Table 1. Morphometry of *Gobio kizilirmakensis*, *G. artvinicus*, *G. caucasicus* and *G. cf. caucasicus*. Mean values are given in parenthesis. H: holotype.

|  | <i>G. kizilirmakensis</i> | H    | <i>G. artvinicus</i> | H    | <i>G. caucasicus</i> | <i>G. cf. caucasicus</i> |
|--|---------------------------|------|----------------------|------|----------------------|--------------------------|
|  | Kızılırmak R.             |      | Çoruh River          |      | Rioni River          | Kherota & Shakhe R.      |
| N  | 25                        |      | 27                   |      | 14                   | 6                        |
| Standard Length (SL) (mm)                                    | 71-105                    | 83   | 55-94                | 88   | 49-83                | 52-81                    |
| <b>In % of SL</b>  |                           |      |                      |      |                      |                          |
| Head length  | 25.8-29.1 (27.6)          | 27.5 | 24.3-26.4 (25.3)     | 24.8 | 26.2-28.2 (27.1)     | 25.3-28.0 (26.7)         |
| Eye diameter   | 4.1-6.9 (5.5)             | 5.6  | 4.1-6.4 (5.2)        | 5.1  | 4.5-7.6 (6.1)        | 4.7-6.0 (5.3)            |
| Interorbital width   | 7.7-9.7 (8.6)             | 8.5  | 6.6-8.6 (7.6)        | 8.0  | 6.7-10.7 (8.1)       | 6.8-7.4 (7.2)            |
| Head width <sub>1</sub> (anterior margin of eye)             | 12.1-14.1 (12.8)          | 12.7 | 10.7-12.3 (11.5)     | 11.9 | 10.3-13.9 (12.0)     | 9.1-10.3 (9.7)           |
| Head width <sub>2</sub> (posterior margin of eye)            | 15.0-16.8 (16.0)          | 15.5 | 13.5-15.5 (14.5)     | 14.3 | 11.5-16.7 (13.7)     | 13.5-14.2 (13.8)         |
| Head width <sub>3</sub> (at opercle)                         | 15.1-18.2 (16.8)          | 15.7 | 14.6-16.8 (15.7)     | 15.3 | 13.8-18.1 (15.5)     | 13.5-15.4 (14.7)         |
| Head depth <sub>1</sub> at interorbital region               | 12.5-17.3 (14.0)          | 13.4 | 11.1-14.0 (12.8)     | 13.7 | 12.3-15.8 (14.0)     | 12.4-13.6 (13.1)         |
| Head depth <sub>2</sub> (at occiput)                         | 16.7-18.6 (17.5)          | 16.7 | 14.9-17.6 (16.3)     | 16.3 | 15.1-17.6 (16.1)     | 15.9-17.5 (16.7)         |
| Snout length   | 9.6-11.8 (10.8)           | 10.3 | 9.2-11.8 (10.4)      | 10.9 | 9.3-12.0 (10.7)      | 10.0-11.0 (10.5)         |
| Snout width at nostrils                                      | 9.9-11.5 (10.7)           | 11.5 | 8.9-11.4 (10.2)      | 9.4  | 7.8-11.3 (9.7)       | 7.5-10.2 (8.9)           |
| Snout depth at nostrils                                      | 8.6-11.1 (9.9)            | 10.1 | 7.9-10.5 (9.2)       | 9.7  | 8.5-12.6 (10.5)      | 8.5-10.6 (9.4)           |
| Length of mouth gape   | 5.2-7.2 (6.4)             | 7.2  | 5.9-7.3 (6.4)        | 6.1  | 4.5-7.8 (6.1)        | 5.1-6.7 (6.0)            |
| Width of mouth gape  | 7.8-9.9 (8.8)             | 9.9  | 6.4-8.8 (7.8)        | 7.2  | 5.4-8.9 (6.9)        | 6.0-7.4 (7.3)            |
| Length of barbel   | 6.4-10.5 (8.8)            | 6.5  | 7.3-10.9 (8.5)       | 8.3  | 7.0-11.3 (8.7)       | 6.0-9.9 (8.3)            |
| Body depth at dorsal fin origin                              | 18.6-22.4 (20.7)          | 20.5 | 19.1-23.0 (21.5)     | 20.2 | 20.2-25.0 (22.2)     | 21.0-34.3 (22.6)         |
| Predorsal length   | 46.4-49.3 (47.7)          | 46.5 | 44.9-48.8 (47.3)     | 44.9 | 47.2-50.9 (48.6)     | 46.9-48.6 (47.7)         |
| Prepelvic length   | 46.6-52.0 (49.2)          | 49.0 | 47.0-50.7 (48.9)     | 47.2 | 50.3-53.8 (51.7)     | 47.8-51.8 (49.3)         |
| Preal length   | 67.9-74.4 (71.0)          | 71.4 | 68.2-71.9 (69.8)     | 71.9 | 71.9-76.8 (73.8)     | 68.4-72.0 (70.4)         |
| Pectoral-fin origin to anal fin                              | 43.2-47.3 (45.7)          | 46.3 | 44.3-48.2 (46.6)     | 44.4 | 45.7-51.5 (48.0)     | 45.3-50.1 (46.6)         |
| Pectoral-fin origin to pelvic fin                            | 21.5-26.0 (23.6)          | 22.9 | 23.4-26.6 (25.0)     | 24.3 | 23.3-28.7 (26.0)     | 22.8-25.5 (24.9)         |
| Pelvic-fin origin to anal fin                                | 19.2-24.3 (21.9)          | 24.3 | 19.0-23.0 (20.9)     | 20.2 | 21.1-26.7 (22.7)     | 20.5-23.2 (21.8)         |
| Caudal peduncle length                                       | 19.1-24.8 (21.7)          | 22.1 | 20.0-23.4 (21.6)     | 21.1 | 17.4-21.3 (19.8)     | 19.9-24.0 (22.7)         |
| Caudal peduncle depth  | 9.1-11.2 (10.0)           | 10.0 | 8.8-11.4 (10.0)      | 9.4  | 9.6-10.8 (10.2)      | 9.9-11.0 (10.3)          |
| Dorsal fin height  | 21.1-24.8 (23.0)          | 23.6 | 18.6-22.9 (20.6)     | 20.3 | 21.9-24.7 (23.2)     | 20.0-24.1 (23.3)         |
| Anal-fin length  | 17.1-20.5 (18.7)          | 18.9 | 15.1-17.5 (16.1)     | 15.3 | 16.8-20.3 (18.2)     | 16.2-18.1 (17.5)         |
| Upper caudal-fin lobe  | 15.3-24.6 (22.0)          | 22.7 | 18.4-22.0 (20.5)     | 19.3 | 21.7-24.2 (23.0)     | 21.0-24.2 (23.0)         |
| Pectoral-fin length  | 20.2-24.5 (21.9)          | 21.9 | 16.9-21.7 (19.2)     | 19.3 | 20.3-26.1 (22.3)     | 19.9-22.7 (21.7)         |
| Pelvic-fin length  | 15.2-19.7 (17.4)          | 17.8 | 14.3-17.1 (15.3)     | 14.5 | 16.0-19.6 (18.0)     | 17.3-19.0 (17.1)         |
| <b>In % of caudal peduncle length</b>                        |                           |      |                      |      |                      |                          |
| Caudal peduncle depth  | 2.1-2.7 (1.6)             | 2.5  | 2.0-2.5 (2.2)        | 2.1  | 1.7-2.1 (1.9)        | 2.1-2.3 (2.2)            |
| <b>In % of distance pelvic-fin origin to anal-fin origin</b> |                           |      |                      |      |                      |                          |
| Dist. between anus and anal-fin origin                       | 3.4-4.6 (3.9)             | 3.8  | 2.8-3.3 (3.0)        | 2.9  | 3.3-3.6 (3.4)        | 3.3-4.1 (3.6)            |
| <b>In % of width of mouth gape</b>                           |                           |      |                      |      |                      |                          |
| Length of mouth gape   | 1.3-1.6 (1.4)             | 1.4  | 1.10-1.4 (1.2)       | 1.1  | 0.9-1.2 (1.0)        | 1.1-1.4 (1.2)            |
| <b>In % of postorbital</b>                                   |                           |      |                      |      |                      |                          |
| Snout length   | 1.3-1.6 (1.4)             | 1.3  | 1.0-1.2 (1.0)        | 1.1  | 1.2-1.4 (1.2)        | 1.1-1.3 (1.2)            |



Figure 2. *Gobio kizilirmakensis*, sp. n., holotype, FFR05930, 83 mm SL, male; Turkey; Kızılırmak River.

Description. General appearance is shown in Figure 2; morphometric and meristic data are given in Tables 1 and 2. Breast scaled, scales extending slightly behind isthmus (Figure 3a). Body slender, its dorsal profile behind head slightly convex, ventral profile straight. Head somewhat long, dorsal profile straight or slightly convex in interorbital area, slightly concave on nostrils. Snout broad, tip rounded, conspicuously smaller than postorbital distance. Barbel short, not reaching posterior margin of eye, generally reaching to posterior margin of pupil. Mouth inferior, horseshoe-shaped, with slight chin. Eye diameter 4–7 % SL. Interorbital width 8–10 % SL, 1.3–2.0 times eye diameter. Caudal peduncle slender, its length 2.1–2.7 times its depth. The largest known individual 105 mm SL.

Dorsal-fin with 3 simple and 7½ branched rays, its height greater than pectoral-fin length, distal margin straight or slightly concave, its origin two to three scales in front of vertical through pelvic-fin origin. Pectoral-fin long, almost reaching or 1 to 2 scales in front of pelvic-fin origin in males, 3 to 4 scales in females, distal margin straight or slightly concave, with 12–14 branched rays. Pelvic-fin markedly reaching behind anus in both sexes, distal margin markedly rounded, with 8 branched rays. Anal-fin with 3 simple and 6½ branched rays, distal margin convex anteriorly, straight posteriorly. Caudal fin somewhat short, markedly forked, lobes slightly rounded. Lateral line scales 40 (3), 41 (10), 42 (7) and 43 (5); 6 (2), 7 (21) and 8 (2) scales rows between lateral line and dorsal fin origin; 4 (1), 5 (18) and 6 (6) scales between lateral line and anal fin origin; 8 (14), 9 (6) and 10 (5) scales between posterior extremity of pelvic fin base and anus; 5 (10) and 6 (15) scales between anus and anal fin origin. Number of total vertebrae 39 (6) and 40 (6), number of abdominal vertebrae 22 (5) and 23 (7), and caudal vertebrae 16 (5) 17 (4) and 18 (3), including 3–4 (commonly 3) preanal caudal vertebrae. Vertebral formulae 22+17 (2), 22+18 (3), 23+16 (5) and 23+17 (2). Pharyngeal teeth 5.3–3.5 slightly hooked.

Sexual dimorphism. The pectoral fins are longer in males than in females. Pectoral almost reaching or 1 to 2 scales in front of pelvic-fin origin in males, 3 to 4 scales in female.

Colouration. Formalin preserved individuals on back and flank dark greyish or dark brownish, whitish on belly, 8–9 midlateral black blotches, and blotches commonly separated from one another. 10–15 blotches on dorsal and upper part of flank. Highly dense grey pigment on back and flank scales; pectoral, pelvic and anal fins yellowish; and dorsal and caudal fins greyish with 3–5 rows of small black spots.

Notes on biology. *Gobio kizilirmakensis* is presently known only from the Ulusu Stream, a tributary of the Kızılırmak River (Figure 4). It inhabits swift and warm flowing water, with cobbled and pebbled bottoms with algae. *Squalius* sp., *Capoeta*

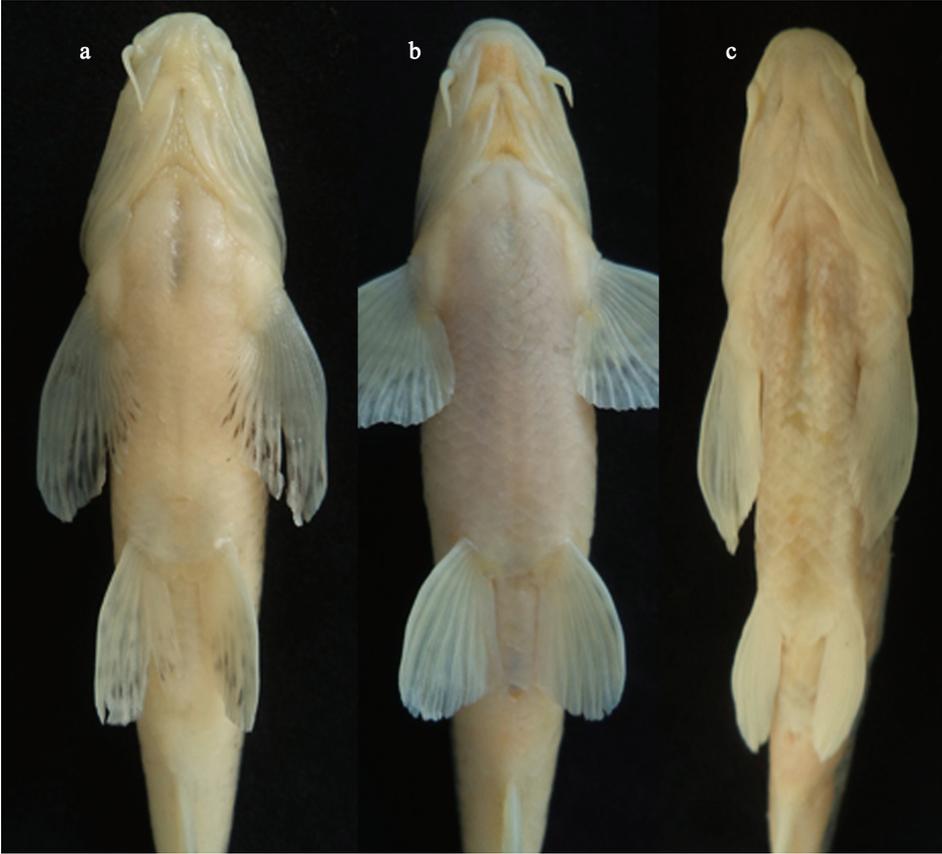


Figure 3. Ventral view of body: a, *Gobio kizilirmakensis* sp. n., paratype, FFR 05983, 102 mm SL, male; Turkey: Kızılırmak River; b, *G. artvinicus* sp. n., paratype, FFR 05934, 100 mm SL; Turkey: Çoruh River; c, *G. caucasicus*, FFR 05924, 76 mm SL; Georgia: Rioni River.

*baliki*, *Alburnus escherichi* and *Oxynoemacheilus kosswigi* and *Ponticola* sp. have been collected together with *G. kizilirmakensis* sp. n.

Distribution. *Gobio kizilirmakensis* sp. n. is only known from the Kızılırmak River basin (Figure 4).

Etymology. The name of the species is derived from the Kızılırmak River.

### ***Gobio artvinicus* sp. n. (Figure 5)**

*Gobio* cf. *caucasicus*: Turan et al., 2012: 62 (Aralık Stream, Çoruh River drainage)

**Holotype.** FFR 2507, 88 mm SL; Turkey: Artvin Prov.: Aralık Stream, a drainage of Çoruh River, Black Sea basin, D. Turan, E. Bayçelebi, C. Kaya & H. Baytaşoğlu, 20.vi.2011. – **Paratypes.** FFR 2508, 59, 55–100 mm SL; same data as holotype. – FFR 2509, 20, 70–80 mm SL; Turkey: Artvin Prov.: Çifteköprü Stream, a drainage of Çoruh River, Black Sea basin, D. Turan, E. Bayçelebi, C. Kaya & H. Baytaşoğlu, 20.vi.2011. The holotype and paratypes were deposited in the Zoology Museum of the Faculty of Fisheries, Recep Tayyip Erdoğan University, Rize, Turkey.

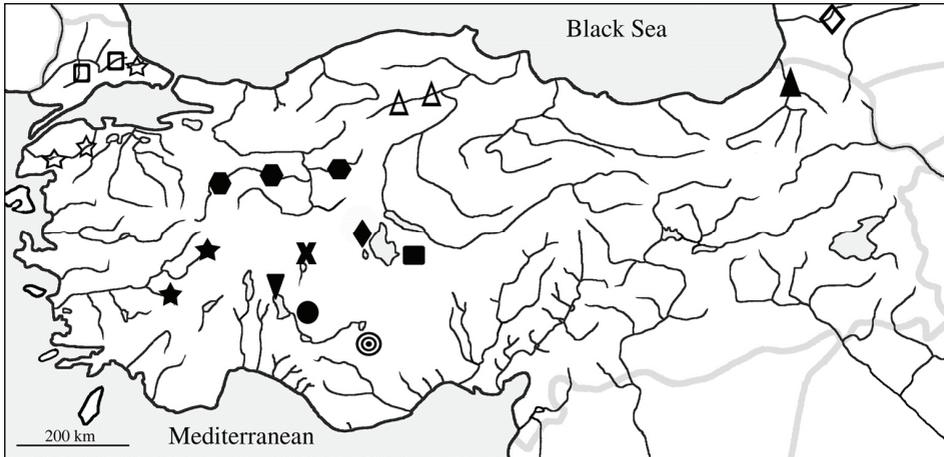


Figure 4. Distribution of *Gobio* species in Anatolia and nearby areas: *G. microlepidotus* (●), *G. intermedius* (×), *G. gymnostethus* (■), *G. insuayanus* (◆), *G. hettitorum* (◎), *G. battalgilae* (▼), *G. maeandricus* (★), *G. bulgaricus* (□), *G. kovatschevi* (☆), *G. sakaryaensis* (●), *G. kizilirmakensis* (Δ), *G. artvinicus* (▲), and *G. caucasicus* (◇).

**Diagnosis.** *Gobio artvinicus* is distinguished from all other species of *Gobio* in Anatolia and adjacent areas by a combination of the following characters: scales on belly equal or greater than pupil; head length 24–26% SL, 1.1–1.3 times body depth; snout pointed; slightly shorter than postorbital distance (postorbital distance 1.0–1.2 times snout length); width of mouth gape 1.0–1.4 times its length; preanal length 68–72% SL; pre-pelvic length 47.0–51.0% SL; caudal peduncle length 2.0–2.5 times its depth; distance between pelvic-fin origin and anal-fin origin 2.8–3.3 times distance between anus and anal-fin origin; length of caudal-fin lobes not equal, upper lobe commonly longer than lower lobe; 38–40 + 1–2 lateral line scales; 6 scales rows between lateral line and dorsal fin origin; 4–5 scales between lateral line and anal fin origin; 4–6 scales between anus and anal fin origin; 5–6 scales between posterior extremity of pelvic fin base and anus; 7–8 mid-lateral blotches.

**Description.** General appearance is shown in Figure 5; morphometric and meristic data are given in Tables 1 and 2. Breast scaled between pectorals, commonly scales extending forward to half-distance between pectoral fin and isthmus, scales on the inner base of the pectoral fins embedded in the skin in almost all specimens (Figure 3b). Body slender, its upper profile convex and ventral profile straight or slightly convex. Head short and slender, dorsal profile straight in interorbital area, slightly concave on nostrils. Snout with pointed tip. Mouth inferior and horseshoe-shaped, width of mouth gape 1.0–1.4 times its length. Barbels commonly reaching posterior margin of eye in both sexes. Eye diameter 4–6 % SL. Interorbital width 1.1–1.6 times eye diameter. The largest known individual 94 mm SL.

Dorsal fin with 3 simple and 7½ branched rays, distal margin straight or slightly concave, its origin 1 or 2 scales in front of vertical through pelvic fin origin. Pectoral-fin short, not reaching pelvic-fin origin, distal margin slightly convex, with 13–16 branched rays. Pelvic-fin short, reaching slightly behind anus in both sexes, distal margin slightly rounded, with 8 branched rays. Anal-fin short, with 3 simple and 6½ branched rays, distal margin slightly concave posteriorly. Caudal fin short, markedly forked, lobes slightly pointed. Length of upper caudal-fin lobe commonly longer than lower lobe.

Table 2. Frequency distribution of meristic features of *Gobio kizilirmakensis*, *G. artvinicus*, *G. caucasicus* and *G. cf. caucasicus*. 'X' indicates mean values .

Lateral line scales

|                           | N  | 39 | 40 | 41 | 42 | 43 | X    |
|---------------------------|----|----|----|----|----|----|------|
| <i>G. kizilirmakensis</i> | 25 | -  | 3  | 10 | 7  | 5  | 41.6 |
| <i>G. artvinicus</i>      | 30 | 9  | 14 | 6  | 1  | -  | 40.0 |
| <i>G. caucasicus</i>      | 14 | -  | 6  | 4  | 3  | 1  | 41.1 |
| <i>G. cf. caucasicus</i>  | 6  | 1  | 2  | 1  | 2  | -  | 40.7 |

Transverse line scales

|                           | N  | Above lateral line |    |    |   |     | Below lateral line |   |    |   |     |
|---------------------------|----|--------------------|----|----|---|-----|--------------------|---|----|---|-----|
|                           |    | 5                  | 6  | 7  | 8 | X   | 3                  | 4 | 5  | 6 | X   |
| <i>G. kizilirmakensis</i> | 25 | -                  | 2  | 21 | 2 | 7.0 | -                  | 1 | 18 | 6 | 5.2 |
| <i>G. artvinicus</i>      | 30 | -                  | 30 | -  | - | 6.0 | -                  | 4 | 26 | - | 4.8 |
| <i>G. caucasicus</i>      | 14 | -                  | 11 | 3  | - | 6.2 | -                  | 4 | 10 | - | 4.7 |
| <i>G. cf. caucasicus</i>  | 6  | -                  | 3  | 3  | - | 6.5 | -                  | - | 6  | - | 5.0 |

Scales between pelvic and anal fins

|                           | N  | Scales between anus and anal-fin origin |    |    |     | Scales between pelvic-fin insertions and anus |    |    |   |    |   |    |     |
|---------------------------|----|---|----|----|-----|---|----|----|---|----|---|----|-----|
|                           |    | 4                                       | 5  | 6  | X   | 4   | 5  | 6  | 7 | 8  | 9 | 10 | X   |
| <i>G. kizilirmakensis</i> | 25 | -                                       | 10 | 15 | 5.6 | -   | -  | -  | - | 14 | 6 | 5  | 8.6 |
| <i>G. artvinicus</i>      | 30 | 1                                       | 15 | 14 | 5.4 | -   | 13 | 17 | - | -  | - | -  | 5.6 |
| <i>G. caucasicus</i>      | 14 | 7                                       | 7  | -  | 4.5 | -   | 2  | 10 | 2 | -  | - | -  | 6.0 |
| <i>G. cf. caucasicus</i>  | 6  | 3                                       | 2  | 1  | 4.7 | -   | 3  | 3  | - | -  | - | -  | 5.5 |

Lateral line scales 39 (9), 40 (14), 41 (6) and 42 (1); 6 (30) scale rows between lateral line and dorsal fin origin; 4 (4) and 5 (26) scales between lateral line and anal fin origin; 5 (13) and 6 (17) scales between posterior extremity of pelvic fin base and anus; 4 (1), 5 (15) and 6 (14) scales between anus and anal fin origin. Number of total vertebrae 38 (2), 39 (2), and 40 (1), number of abdominal vertebrae 21 (2), 22 (8) and 23 (2), and caudal vertebrae 16 (4) and 17 (8), including 2-3 (commonly 3) preanal caudal vertebrae. Vertebral formulae 21+17 (2), 22+16 (4), 22+17 (4) and 23+17 (2). Pharyngeal teeth 5.3–3.5 slightly hooked.

Sexual dimorphism. No sexual dimorphism between males and females was noted.

Colouration. Formalin preserved individuals dark brown on back and flank, whitish on belly, 7–8 midlateral blotches (greater than eye diameter), blotches separated from each other in specimens smaller than about 90 mm SL, rarely fused in specimens larger than 90 mm SL; there are 5–6 slightly marked blotches (approximately equal to pupil) on back. Dorsal and caudal fins greyish with 3–4 black spot rows. Pectoral, pelvic and anal fins yellowish with few small black spots.

Distribution and notes on biology. *Gobio artvinicus* is presently known only from the Aralık and Çiftköprü streams, tributaries of the lower part of Çoruh River (Figure 4). It inhabits swift and warm flowing water, with cobbled and pebbled bottoms. *Squalius orientalis*, *Capoeta ekmekciae*, *Alburnus derjugini*, *Oxynoemacheilus* sp. and *Ponticola constructor* have been collected together with *G. artvinicus* sp. n.

Etymology. The name of the species is derived from the name of the city and eponymous province of Artvin, where we first observed it. An adjective.



Figure 5. *Gobio artvinicus*, sp. n., holotype, FFR 2507, 88 mm SL, male; Turkey: Çoruh River.

### Discussion

There is no record of *Gobio* in the Çoruh and Kızılırmak Rivers in previous studies (Polat et al., 2008; İlhan & Balık, 2008). We have surveyed the Çoruh and Kızılırmak Rivers, and sampled at 17 localities from the Kızılırmak River and 25 localities from the Çoruh River between 2000 and 2015. We were able to collect 43 specimens of *Gobio* in Ulusu stream, a tributary of the Kızılırmak River and 80 specimens in Aralık and Çiftköprü streams, lower courses of the Çoruh River. Also, we had an opportunity to examine 3 of the syntypes [in bottle number 174] belonging to *G. lepidolaemus* natio *caucasicus* (now named under *G. holurus*) from the Podkumok River in the Georgian National Museum, Tbilisi. However, these specimens were in poor condition and we could only obtain data for the number of vertebrae. Furthermore, we did not have the opportunity to examine the fourth syntype from the Sulak River and the fifth syntype from Rioni because we could not find them in the Georgian National Museum. These syntypes might have been lost or destroyed.

We compared the material from the Kızılırmak (Southern Black Sea basin) and Çoruh Rivers (the Western Caucasus of the Black Sea basin) with the known species in adjacent basins: *Gobio sakaryaensis* (Sakarya River [Southern Black Sea basin]), *G. kovatschevi* (Rezova River [southwestern Black Sea basin], and Biga Stream in Biga Peninsula [southern Marmara Sea coast]), *G. caucasicus* (Rioni River, the Western Caucasus of the Black Sea basin) and *G. cf. caucasicus* (the Kherota and Shakhe Rivers, the Western Caucasus of the Black Sea basin). Additionally, we examined some individuals of the other Anatolian gudgeons: *Gobio microlepidotus* from Lake Beyşehir, *G. intermedius* from Lake Eber and Lake Akşehir basin, *G. gymnostethus* from Eastern Lake Tuz basin, *G. insuyanus* from western Lake Tuz basin, *G. hettitorum* from southern Lake Tuz basin, and *G. battalgilae* from Eyilik Stream, Lake Beyşehir basin. Although the examined specimens from the Kherota and Shakhe Rivers are similar to *C. caucasicus*, there are some differences between them: *G. caucasicus* has a narrower head (head width at anterior margin of eye 10–14, mean 12, vs 9–10, mean 9.7), a shorter preanal length (72–77, mean 73.8, vs. 68–72, mean 70.4) and a shorter caudal peduncle (17–21, mean 19.8, vs. 20–24, mean 22.7). We need more materials from the Kherota and Shakhe Rivers to determine their taxonomic position. Therefore, we treated these populations as *C. cf. caucasicus*.

Four species of *Gobio* from the southeastern Black Sea basin and Western Caucasus of the Black Sea basin (*G. kizilirmakensis*, *G. artvinicus*, *G. caucasicus* and *G. cf. caucasicus*) were compared using principal component analysis (PCA). The PCA was

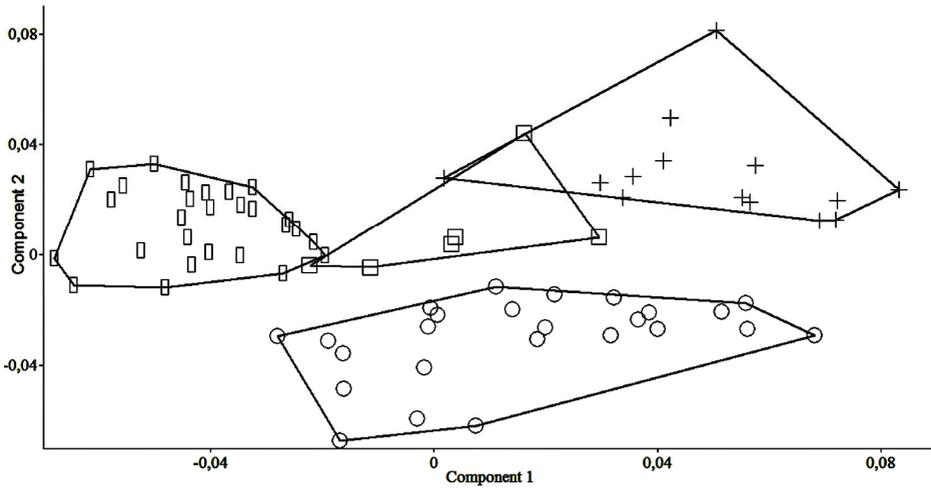


Figure 6. Scatter plot of the scores of the first two principal components (PC I, PC II) for 72 specimens of four species of *Gobio*: *G. kizilirmakensis* (○), *G. artvinicus* (◻), *G. caucasicus* (+) and *G. cf. caucasicus* (◻), based on 28 morphometric characters.

performed using 28 morphometric characters of the four species of *Gobio*. The PCA shows that the two new species almost separated from *G. caucasicus* and *C. cf. caucasicus* as well as from each other. There was a slight overlap between *G. caucasicus* and *G. cf. caucasicus* (Figure 6). Variables used on the first metric PC I–II are given in Supplementary Table S1.

*Gobio kizilirmakensis* is distinguished from *G. artvinicus*, *G. caucasicus*, *G. sakaryaensis*, *G. kovatschevi*, *G. bulgaricus* and *Gobio* sp. by having more scales between posterior extremity of pelvic-fin base and anus (8–10, vs. 6–8 in *G. sakaryaensis*, 5–6 in *G. artvinicus*, 5–7 in *G. caucasicus*, 4–5 in *G. kovatschevi*, 4–5 in *G. bulgaricus*, and 5–6 *Gobio cf. caucasicus*), smaller scales on belly (smaller than pupil [Figure 3a], vs. equal or larger than pupil [Fig. 3 b, c]) and more scales between anus and anal-fin origin (5–6, vs. 4–5, except *G. artvinicus* and *Gobio cf. caucasicus*).

*Gobio kizilirmakensis* differs from *G. artvinicus* by having more scales between the dorsal-fin origin and the lateral line (6–8, vs. 6). *Gobio kizilirmakensis* has a longer head (26–29 % SL, mean 27.6, vs. 24–26, mean 25.3), a wider head (head width at anterior margin of eye 12–14 % SL, mean 12.8, vs. 11–12, mean 11.5) and a greater interorbital distance (8–10 % SL, mean 8.6, vs. 7–9, mean 7.6) than *G. artvinicus*. Besides the differences given above, in *G. kizilirmakensis* the distance between the pelvic-fin origin and the anal-fin origin is 3.4–4.6, mean 3.9 times the distance between the anus and the anal-fin origin ([Fig. 3 a] vs. 2.8–3.3, mean 3.0 [Figure 3 c]), the width of mouth gape 1.3–1.6 times its length (vs. 1.0–1.4) and the postorbital distance 1.3–1.6 times the snout length (vs. 1.0–1.2).

*Gobio kizilirmakensis* differs from *G. caucasicus* by a more slender and longer caudal peduncle (caudal peduncle length 2.1–2.7 times its depth, vs. 1.7–2.1) and a wider mouth gape (width of mouth gape 1.3–1.6 times its length, vs. 0.9–1.2).

*Gobio kizilirmakensis* differs from *G. sakaryaensis* by having a more slender body (body depth at dorsal-fin origin 19–22 % SL, vs. 22–27), a smaller predorsal distance (46–49 % SL, vs. 49–53). In *Gobio kizilirmakensis*, the head length is 1.3–1.5 times body depth (vs. 1.0–1.3), the width of mouth gape is 1.3–1.6 times length (vs. 0.9–1.2); the postorbital distance is 1.3–1.6 times the snout length (vs. 1.1–1.2).

*Gobio kizilirmakensis* differs from *G. kovatschevi* by having more midlateral blotches (8–9, mode 9, vs. 7–8, mode 7 in *G. kovatschevi*), more blotches on back and upper part of flank (10–15, vs. 0–5 in *G. kovatschevi*), more scale rows between the dorsal-fin origin and the lateral line (6 [2], 7 [21], 8 [2], vs. 5 [3], 6 [22] in *G. kovatschevi*). *Gobio kizilirmakensis* has more scale rows between the anal-fin origin and the lateral line (4 [1], 5 [18], 6 [7] in *G. kizilirmakensis*, vs. 3 [1], 4 [24] in *G. kovatschevi*) and more scales between the anus and the anal-fin origin (5 [10], 6 [15] in *G. kizilirmakensis*, vs. 4 [22], 5 [3] in *G. kovatschevi*). In *G. kizilirmakensis*, the postorbital distance is 1.3–1.6 times the snout length vs. 0.9–1.1), the width of mouth gape is 1.3–1.6, mean 1.5 times its length (vs. 1.1–1.4, mean 1.3). *Gobio kizilirmakensis* has a more rounded snout than *G. kovatschevi*.

*Gobio kizilirmakensis* is distinguished from *Gobio* species in Central Anatolia and south-western Anatolia (except *G. gymnostethus*) by having fewer scale rows between the dorsal fin origin and the lateral line (6–8, vs. 8–10 in *G. maeandricus*, *G. microlepidotus*, *G. battalgilae*, *G. insuayanus*, *G. hettitorum* and *G. intermedius*). It also has fewer total lateral-line scales than *G. microlepidotus*, *G. intermedius*, *G. hettitorum* and *G. maeandricus* (40–43, vs. 44–47 in *G. microlepidotus*, 42–49 in *G. intermedius*, 44–48 in *G. hettitorum*, 53–56 in *G. maeandricus*). It is distinguished from *G. gymnostethus* by the shape of the head at the nostrils (straight or slightly concave, vs. markedly convex), the pelvic-fin reaching behind the anus in both sexes (vs. not reaching behind the anus in females). *Gobio kizilirmakensis* further differs from *G. gymnostethus* by having a more slender body (body depth at dorsal-fin origin 19–22 % SL, vs. 23–26), a smaller predorsal distance (46–49, mean 47.7 % SL, vs. 48–52, mean 49.7) and more scales between posterior extremity of pelvic-fin base and anus (8–10, vs. 6–8).

*G. kizilirmakensis* is distinguished from *G. holurus* by having more abdominal vertebrae (22–23, vs. 20–21) and fewer caudal vertebrae (16–18, vs. 18–19).

*Gobio artvinicus* is distinguished from *Gobio caucasicus* by the position of the anus. In *G. artvinicus*, the distance between the anus and the anal-fin origin is 2.8–3.3 mean 3.0 times the distance between the pelvic-fin origin and the anal-fin origin (vs. 3.3–3.6, mean 3.4). *G. artvinicus* is further distinguished from *Gobio caucasicus* by a shorter head (24–26 % SL, vs. 26–28), a smaller prepelvic distance (47–51 % SL, vs. 50–54), a smaller preanal distance (68–72 % SL, vs. 72–77), a longer and more slender caudal peduncle (the caudal peduncle depth 2.0–2.5, mean 2.2, vs. 1.7–2.1, mean 1.9 times in its length), a shorter caudal-fin (the length of upper caudal-fin length 18–22 % SL, mean 20.5, vs. 22–24, mean 23.0) and a shorter dorsal-fin (19–23 % SL, vs. 22–25). *Gobio artvinicus* has fewer pored scales on the lateral line (39–40, vs. [(39) 40–41(42)]) and more scales between the anus and the anal-fin origin than *G. caucasicus* [(4) 5–6, mean 5.4, vs. 4–5, mean 4.5]. Besides the differences listed above, in *G. artvinicus* mid-lateral blotches are commonly distinct and separated from each other, rarely fused in specimens larger than 90 mm SL; there are 5–6 slightly marked blotches (approximately equal to pupil) on the back. In *G. caucasicus*, the mid-lateral blotches are distinct in specimens smaller than about 50 mm SL but fused in those on the anterior part of the body in specimens up to about 75 SL mm; and all the mid-lateral blotches are commonly fused in specimens larger than about 75 mm SL; there are 7–8 small black blotches on the back (smaller than eye diameter). Moreover, in *G. artvinicus*, the snout is pointed

(vs. the snout is rounded), upper profile of the snout slightly convex at the level of nostrils (vs. upper profile of the snout is markedly concave)

*Gobio artvinicus* is distinguished from *Gobio* cf. *caucasicus* from the Kherota and Shakhe Rivers in Russia by a shorter head (24–26 % SL, mean 25.3, vs. 25–28, mean 26.7), a wider head (head width anterior margin of eye 11–12 % SL in *Gobio artvinicus*, vs. 9–10). Beside the differences given above, in *G. artvinicus* the distance between the pelvic-fin origin and the anal-fin origin is 2.8–3.3 times the distance between the anus and the anal-fin origin (vs. 3.3–4.1) and the pelvic-fin length is 14–17% SL (vs. 17–19).

*Gobio artvinicus* is distinguished from *G. sakaryaensis* by having fewer scales between the posterior extremity of the pelvic fin base and anus (5–6, vs. 6–8), fewer mid-lateral blotches (7–8, vs. 8–9), fewer blotches on dorsal (5–6, vs. 10–14). The new species further differs from *G. sakaryaensis* by a shorter head (24–26 % SL, vs. 27–30), a smaller predorsal length (45–49 % SL, mean 47.3, vs. 49–53, mean 51.4), a more slender head (head depth at occiput 15–18 % SL, mean 16.3, vs. 17–20, mean 18.6) and a greater distance between anus and anal-fin origin (distance between pelvic-fin origin and anal-fin origin 2.8–3.3 times distance between anus and the anal-fin origin, vs. 3.9–5.1). Beside the differences listed above, it is further distinguished from *G. sakaryaensis* by a more slender dorsal-fin (height 19–23 % SL, vs. 22–27 % SL), a shorter pectoral-fin (17–22 % SL, vs. 22–27) and a shorter pelvic-fin (14–17 % SL, mean 15.3, vs. 16–19, mean 17.7).

*Gobio artvinicus* are distinguished from *G. holurus* by having more abdominal vertebrae (21–23, vs. 20–21) and fewer caudal vertebrae (16–17, vs. 18–19).

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#### Disclosure Statement

No potential conflict of interest was reported by the authors.

#### References

- Bănărescu, P. M. (1954): Biometrische und systematische Studien an *Gobio gobio* aus Rumänien. *Věstník Československé Společnosti Zoologické*, 18, 6–40.
- Bănărescu, P. M. (1992): A critical updated checklist of Gobioninae (Pisces, Cyprinidae). *Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa"*, 32, 305–330
- Bănărescu, P. M. (ed.) (1999): *The freshwater fishes of Europe. Cyprinidae 2/I*. Wiesbaden: Aula-Verlag.
- Bănărescu, P. M., Bless, R., & Economidis, P. S. (1999): *Gobio uranoscopus* (Agassiz, 1828). Pp. 183–202. In: Bănărescu P. M. (ed.), *The freshwater fishes of Europe. Vol. 5/I. Cyprinidae 2. Part 1. Rhodeus to Capoeta*. Wiebelsheim: Aula Verlag.
- Bănărescu, P. M., & T. T. Nalbant (1973): Pisces, Teleostei. Cyprinidae (Gobioninae). *Das Tierreich*, 93, 1–304.
- Berg, L. S. (1914): *Faune de Russie et des pays limitrophes Poissons (Marsipobranchii et Pisces)* vol. 3. Ostariophysi Izdatelstvo Akademii Nauk, St-Petersbourg, 2, 337–704.
- Berg, L. S. (1949): *Freshwater fishes of the U.S.S.R. and adjacent countries*. 4th ed., vol. 2–3. Guide to the Fauna of the U.S.S.R. No. 29: 467–925; 30: 927–1382 [In Russian; English translation: Israel Program for Scientific Translations, Jerusalem, 1964, p. 1–496, 1–510].

- Doadrio, I., & Madeira, M. J. (2004): A new species of the genus *Gobio* Cuvier, 1816 (Actynopterigii, Cyprinidae) from the Iberian Peninsula and southwestern France. *Graellsia*, 60, 107–116.
- Erk'akan, F., Tatlıdil, H., & Özeren, S. C. (2005): Biometric investigation on *Gobio gobio* subspecies from Turkey. *Folia Zoologica*, 54, 90–98.
- Freyhof, J., & Naseka, A. M. (2005): *Gobio delyamurei*, a new gudgeon from Crimea, Ukraine (Teleostei: Cyprinidae). *Ichthyological Exploration of Freshwaters*, 16, 331–338.
- Hammer, O., Harper, D. A. T., & Ryan, P.D. (2001): PAST: paleontological statistics software package for education and data analysis. *Palaeontologia Electronica*, 4, 9.
- Hubbs, C. L., & Lagler, K. F. (1947): Fishes of the Great Lakes region. *Cranbrook Institute of Science, Bulletin*, 26, i-xi, 1–186.
- İlhan, A., & Balik, S. (2008): Batı Karadeniz Bölgesi İçsularının Balık Faunası [Fish fauna of the inland waters of the western Black Sea region]. *Ege Üniversitesi Su Ürünleri Dergisi*, 25, 75–82.
- Kamensky, S. N. (1901): *Die Cypriniden der Kaukasusländer und ihrer angrenzenden Meere*. 2. Lieferung. Tiflis [Unspecified Publisher].
- Kottelat, M., & Freyhof, J. (2007): *Handbook of European Freshwater Fishes*. Cornol (Switzerland) & Berlin: Kottelat & Freyhof.
- Kottelat, M., & Persat, H. (2005): The genus *Gobio* in France, with redescription of *G. gobio* and description of two new species (Teleostei: Cyprinidae). *Cybium*, 29, 211–234.
- Mendel, J., Lusk, S., Vasil'eva, E. D., & Vasil'ev, V. P. (2008): Molecular phylogeny of the genus *Gobio* Cuvier, 1816 (Teleostei: Cyprinidae) and its contribution to taxonomy. *Molecular Phylogenetics and Evolution*, 47, 1061–1075.
- Naseka, A. M. (1996): Comparative study on the vertebral column in the Gobioninae (Pisces, Cyprinidae) with special reference to its systematics. *Publicaciones Especiales del Instituto Español de Oceanografía*, 21, 149–167.
- Naseka, A. M. (2010): Zoogeographical Freshwater divisions of the Caucasus as a part of the West Asian Transitional Region. *Proceedings of the Zoological Institute RAS*, 314, 469–492.
- Naseka, A. M., Erk'akan F., & Küçük F. (2006): A description of two new species of the genus *Gobio* from Central Anatolia (Turkey) (Teleostei: Cyprinidae). *Zoosystematica Rossica*, 15, 185–194.
- Nowak, M., Popek, W., Drąg-Kozak, E., & Epler, P. (2008): Morphology of the common gudgeon, *Gobio gobio* (L.) sensu lato from the Vistula River drainage in the context of recent literature data (Teleostei: Cyprinidae). *Archives of Polish Fisheries*, 16, 37–48.
- Polat, N., Uğurlu, S., & Kandemir, Ş. (2008): Aşağı Kızılırmak Havzası (Samsun-Türkiye) Balık Faunası [Fish fauna of lower basin of Kızılırmak River]. *Journal of Fisheries Sciences*, 2, 489–498.
- Turan, D., Ekmekçi, F. G., Luskova, V., & Mendel, J. (2012): Description of a new species of the genus *Gobio* from Turkey (Teleostei: Cyprinidae). *Zootaxa*, 3257, 56–65.
- Vasil'eva, E. D., Vasil'ev, V. P., & Boltachev, A. R. (2005): Taxonomic relationships of gudgeons (*Gobio*, Gobioninae, Cyprinidae) of Crimea. *Journal of Ichthyology*, 4, 730–743.
- Vasil'eva, E. D., Vasil'ev, V. P., & Kuga, T. I. (2004): On taxonomy of gudgeons of the genus *Gobio* (Gobioninae, Cyprinidae) of Europe: a new gudgeon species *Gobio kubanicus* from the basin of the Kuban River. *Journal of Ichthyology*, 44, 716–731.
- Yang, J., He, S., Freyhof, J., Witte, K., & Liu, H. (2006): The phylogenetic relationships of the Gobioninae inferred from mitochondrial cytochrome b gene sequences. *Hydrobiologia*, 553, 255–266.