



## A new species of *Knipowitschia* (Perciformes: Gobiidae) from southern Montenegro

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**ABSTRACT.** *Knipowitschia montenegrina* sp. nov. is described from the River Morača, southern Montenegro. The new species is assigned to *Knipowitschia* based on diagnostic features belonging to the genus. The new species is distinguished from all other species of the genus *Knipowitschia* by the following combination of characters: 1) body squamation reduced to axillary patch, 2) head canals absent, 3) pelvic disc with midline depth of anterior membrane 1/3-1/2 length of pelvic spinous ray, 4) neuromast suborbital row *a* reaching anteriorly at maximum to below middle of eye, 5) suborbital row *b* reaching anteriorly at maximum to below rear border of eye.

**KEY-WORDS.** Gobiidae, *Knipowitschia montenegrina*, new species, Montenegro.

### INTRODUCTION

*Knipowitschia*, a “sand-goby” genus of Ponto-Caspian origin, comprises thirteen described eurytopic or freshwater species, mostly endemic and of limited distribution, present in the Black and Caspian Sea, and in drainages of the Aegean, Ionian, and Adriatic Sea (Miller 2004, Kovačić 2005). The present state of taxonomic knowledge on these species in the Mediterranean basin is still insufficient, and the likelihood of further new species being recognized in this area was predicted by Kovačić (2005). However, during the last decade, all such systematic progress has focused on the Adriatic *Knipowitschia* species (Mrakovčić et al. 1996, Kovačić & Pallaoro 2003, Kovačić 2005). Recently, specimens of a freshwater *Knipowitschia* species have been obtained by one of us (RŠ) from the River Morača that drains into Lake Skadar, which lies close to the Adriatic coast of southern Montenegro. This material was collected together with another new gobiid, a *Pomatoschistus* species described by Miller & Šanda (in press). The Morača *Knipowitschia* is now identified as a new species that is described below.

### METHODS

If not otherwise stated, morphometric and meristic methods follow Miller (1988). Fin abbreviations: A, anal fin; C, caudal fin; D1, D2, first and second dorsal fins; P, pectoral fin; V, pelvic disc.

MORPHOMETRIC ABBREVIATIONS: Ab, anal fin base; Ad and Aw, body depth and width at anal fin origin; Cl, caudal fin length; CHd, cheek depth (lower border of eye to posterior point of jaw angle); CP and CPd, caudal peduncle length (from vertical of end of A base to origin of the middle rays of C) and depth (minimum); D1b and D2b, first and second dorsal fin base; E, eye diameter (horizontal, just eyeball, without skinny ridge around eye); H, head length (snout to midline opposite upper origin of opercle); Hw, head width (between upper junction of opercles); I, interorbital width; Pl, pectoral fin length; PO, postorbital length; SL, standard length; SN, snout length (tip of upper jaw to eye); SN/A and SN/AN, distance from snout to vertical of anal fin origin and anus; SN/D1 and SN/D2, distance from snout to origin of first and second dorsal fins; SN/V, distance from snout to vertical of pelvic fin origin; V/AN, distance from pelvic fin origin to anus; Vd, body depth at pelvic fin origin; Vl, pelvic fin length, distance from V origin to tip of longest pelvic ray. The terminology of lateral-line system follows Sanzo (1911) and Economidis & Miller (1990).

COLLECTION ABBREVIATIONS: NMP P6V – vertebrate collection, National Museum, Praha, Czech Republic; PMR – Prirodoslovni muzej, Rijeka, Croatia.

COMPARATIVE MATERIAL: *K. croatica*: 19 males, 25.2+5.1 mm to 36.8+7.2 mm, 10 females, 26.6+5.2 mm to 33.3+6.4 mm, PMR VP1599, Polje Rastoka, R. Matica, Dalmatia, Croatia, 19 October 2006; leg. M. Kovačić.

## SYSTEMATIC PART

### *Knipowitschia montenegrina* sp. nov.

(Figs. 1 and 2)

MATERIAL: Holotype and eight paratypes.

HOLOTYPE (Fig. 1): Male, 27.3+6.2 mm, NMP P6V 80370, Golubovci (42° 18' 55.3"N, 19° 12' 3.5"E), R. Morača, above Lake Skadar, southern Montenegro, 18 July 2002, leg. R. Šanda.

PARATYPES: Male, 26.5+5.3 mm, NMP P6V 80366; female, 28.3+6.0 mm, NMP P6V 80371, (Fig. 2); two juveniles of unidentified sex, 18.8+4.0 mm, NMP P6V 80373 and 19.7+4.1 mm, NMP P6V 80369; all with the same collection data as holotype. 4 juveniles of unidentified sex, 17.2+3.5 mm to 19.9+4.0 mm, PMR VP1600, Golubovci, R. Morača, above Lake Skadar, southern Montenegro, 22 July 2002; all leg. R. Šanda.

GENERIC IDENTIFICATION: This species is placed in *Knipowitschia* Iljin, 1927 (type species: *Gobius longicaudatus* var. a and var. b., Kessler, 1877), based on a description of the genus *Knipowitschia* by Economidis & Miller (1990) and Miller (2004), by following combination of characters: (1) scales present only in lateral axillary patch (*Knipowitschia*: squamation reduced; at least head, back to origin of D2, and abdomen naked), (2) head canals absent (*Knipowitschia*: head lateral-line canals reduced, anterior oculoscapular canal if present ending anteriorly between eyes without pores  $\sigma$ , or head lateral-line canals completely absent), (3) anterior nostril a short tube, without rim tentacle, (4) pectoral fin with upper rays enclosed by fin membrane, (5) pelvic disc without reduction and pelvic anterior membrane well developed, (6) branchiostegal mem-



Fig. 1. *Knipowitschia montenegrina* sp. nov., holotype, male, 27.3+6.2 mm, NMP P6V 80370. Scale bar = 5 mm.



Fig. 2. *Knipowitschia montenegrina* sp. nov., paratype, female, 28.3+6.0 mm, NMP P6V 80371. Scale bar = 5 mm.

brane attached to entire lateral margin of isthmus, (7) sensory papillae with suborbital row *a* including more than one transverse row, (8) suborbital row *c* in several transverse rows, (9) anterior dorsal row *o* absent, (10) interorbit without multiple transverse rows of papillae and (11) preorbital upper rows *r* and *s* longitudinal without transverse rows.

DIAGNOSIS: *Knipowitschia montenegrina* is similar to *Knipowitschia croatica* Mrakovčić et al., 1996, *Knipowitschia ephesi* Ahnelt, 1995 and *Knipowitschia punctatissima* (Canestrini, 1864), but differs from all other species of the genus by body squamation reduced to axillary patch and head canals absent. *K. montenegrina* differs from *K. punctatissima*, *K. ephesi* and *K. croatica* by the following combination of characters: (1) D1 VI, (2) P extends back approximately to below posterior end of D1, 3) pelvic disc with midline depth of anterior membrane 1/3-1/2 length of pelvic spinous ray, 4) neuromast suborbital row *a* reaching anteriorly at maximum to below middle of eye, 5) suborbital row *b* reaching anteriorly at maximum to below rear border of eye (6) single suborbital transverse row *cp* situated below beginning of row *b*, (7) anterior dorsal row *g* shorter than distance between row *g* and *n*, (8) preorbital row *s* ending anteriorly in front of anterior end of row *r*, (9) preorbital row *s* and intraorbital row *p* not clearly separated.

DESCRIPTION

**Morphology:** Body proportions are given in table I. Body moderately elongate, anteriorly robust with slender caudal peduncle. Head large and moderately depressed, subhorizontal in dorsal profile. Snout oblique, eyes dorsolateral. Anterior nostril short, tubular, erect, without process from rim, posterior nostril pore-like, near orbit. Mouth oblique, posterior angle of jaws below anterior part of pupil, more towards middle of eye in adult males, more forward in female and juveniles. Branchiostegal membrane attached to entire lateral margin of isthmus.

**Fins:** D1 VI; D2 I/7-8 (7: 1, 8: 8); A I/6-7 (6: 1, 7: 8); C 11-13 branched rays (11: 2; 12: 3; 13: 4), 14-16 segmented rays (14: 1; 15: 7; 16: 1); P 15-17 (both sides: 15 and 15: 3, 16 and 16: 3, 17 and 17: 3), V I/5+5/I. Fin-bases and lengths in proportion to standard body length are given in Table I. D1 spines III-V extending when depressed to D2 I in adult males, but not reaching D2 in female and juveniles. D1 and D2 bases well separated. D2 commences over vertical of anus to vertical of anterior beginning of urogenital papilla, with last ray over vertical of last or penultimate A ray. A commences below second or third segmented ray of D2. C rounded. P extends back to below posterior end of D1, a bit longer in one adult male and a bit shorter in some juveniles. V rounded, not reaching anus, anterior membrane in midline 1/3 to 1/2 V I length, with slightly crenate rear edge in adults, smooth rear edge in juveniles.

**Scales:** Scales present only in lateral axillary patch, not compactly placed, but scattered. Axillary patch transversely from the lateral edge of V to at maximum the level of upper edge of opercle, longitudinally from near axilla to vertical of rear end of D1.

**Lateral line system:** Head canals absent. Rows and the number of sensory papillae (Fig. 3): (I) *preorbital*: snout with three rows in median preorbital series: internal row *r* (3-6), outer row *s* (4-8) posteriorly not clearly separated from intraorbital row *p*, ending anteriorly in front of anterior end of row *r*, anterior row *s*<sup>3</sup> above upper lip (3-5). Lateral series *c* in

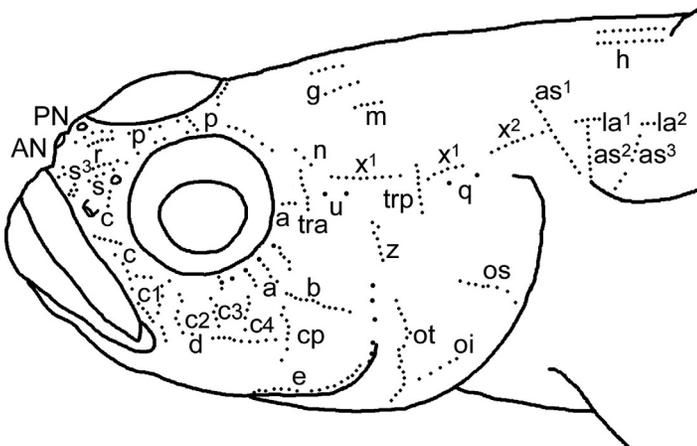


Fig. 3. *Knipowitschia montenegrina* sp. nov., head lateral-line sensory papillae and canal pores of paratype, female, 28.3+6.0 mm, NMP P6V 80371. AN, PN, anterior and posterior nostrils; see other terminology in text.

three or four parts: superior ( $c^2$ ) vertical below PN (2-4); middle  $c^1$  (2-6) horizontal, anteriorly beginning below AN; single inferior row  $c$  (2-3) or two rows,  $c_2$  (4-5) and  $c_1$  (2-3) distinct. (II) *suborbital*: row  $a$  reaching anteriorly at maximum to below middle of eye, consisting of 5-6 longitudinally arranged papillae with 2-5 transverse proliferation (with 2-5 papillae), including a longer transverse row  $atp$  (3-8). Longitudinal row  $b$  (7-12) reaching anteriorly at maximum to below rear border of eye. Five to seven transverse row  $c$ :  $c1$  (2-5),  $c2$  (3-5),  $c3$  (3-6),  $c4$  (2-5),  $c5$  (3-6),  $c6$  (2) and  $cp$  (8-13). Single suborbital transverse row  $cp$  below  $b$ , from under beginning of row  $b$  downwards to below level of row  $d$ , except in one specimen where it ends on the level of row  $d$ . Longitudinal row  $d$  with separated supralabial (5-9) and posterior part (9-14), not reaching posteriorly row  $cp$ , except in one specimen where it passes backwards behind vertical of row  $cp$ . (III) *preoperculo-mandibular*: external row  $e$  divided into anterior ( $e^1$ : 14-24), and posterior sections ( $e^2$ : 15-31); and internal row  $i$  not clearly divided ( $i$ : 28-38), mental row  $f$  (4-7). (IV) *oculoscapular*: anterior transverse series  $tra$  (6-11) behind eye, anterior longitudinal row  $x^1$  divided by posterior transverse row,  $trp$  (6-11) in anterior section (7-12), above row  $z$  and posterior section (4-6), posterior longitudinal row  $x^2$  developed (4-8); row  $u$  (1-3) behind transverse row  $tra$ , row  $z$  (5-8) developed, row  $q$  as two distant papillae behind transverse row  $trp$ , except in one specimen where just single papilla was visible, row  $y$  present as single papilla below row  $x^2$  or not visible. Axillary rows  $as^1$  (6-13),  $as^2$  (5-8),  $as^3$  (6-10),  $la^1$  (2-5) and  $la^2$  (2-3) present. (V) *opercular*: transverse row  $ot$  (14-21); superior longitudinal row  $os$  (6-13); and inferior longitudinal row  $oi$  (5-12), two to three additional papillae on the position of missing preopercular canal. (VI) *anterior dorsal*: row  $n$  (3-8) above or above and posterior to row  $tra$ , row  $g$  (4-7) shorter than distance between row  $g$  and  $n$ , row  $m$  (3-5) and row  $h$  (9-12) present, row  $o$  absent. (VII) *interorbital*: interorbit with longitudinal rows  $p$  (5-11). Two additional papillae were present in posterior part of interorbit, inbetween rows  $p$  except in one specimen with single papilla, and one specimen without any papilla inbetween rows  $p$ .

**Coloration** (preserved): Males (Fig. 1): body fawn, lighter below, with several vertical stripes along sides. Body, with the exception of belly, covered with numerous melanophores, which are biggest in the vertical stripes. Predorsal pigmented, more intensively at the beginning of D1. Head dusky, pigmented. D1 with lower broad band, and the second upper band along the end of fin; intensive black spot between upper part of D1 IV and the rear end of fin. D2 with four pigmented longitudinal bands. C with several vertical, slightly curved bands. Other fins more or less uniformly pigmented, with numerous small melanophores. Females (Fig 2): body fawn, whitish below, with several blotches along the lateral midline. Body, with the exception of ventral part to the beginning of A, covered with numerous melanophores, which are biggest in the darker blotches. Predorsal pigmented, more intensively at the beginning of D1, forming two more or less defined marks in front of D1. Upper postorbital part of head dusky, lower part yellowish; head with poorly visible preorbital bar and blotch on the chin forming with preorbital bars Y shape. D1 with lower broad band, and the second narrow band along the end of fin; the lower band slightly darker around D1 VI, forming spot. D2 irregularly pigmented, more intensively at frontal part. C with several vertical, slightly curved bands. A and V transparent. P slightly pigmented, more intensively in upper P origin. Juveniles coloured similarly to the female, differing from the female in defined dots at A rays origin and C irregularly pigmented.

**Table 1. Body proportions of *Knipowitschia montenegrina* sp. nov. Values for adult males and adult female are for individuals. Values for juveniles are range, and, in parentheses, mean and standard deviation. For abbreviations see the „Methods“ section.**

	Adult males		Adult female	Juveniles
n	2		1	6
SL (mm)	26.5	27.3	28.3	17.2-19.9
%SL, H	30.2	28.9	28.6	29.8-31.4 (30.5±0.6)
Hw	23.4	23.4	20.1	16.5-19.1 (18.4±1.1)
SN/D1	39.2	37.0	36.7	37.2-41.5 (39.9±1.6)
SN/D2	58.1	54.6	60.1	55.3-57.9 (56.8±1.0)
SN/AN	56.6	54.2	60.4	54.3-56.9 (55.2±1.0)
SN/A	60.8	59.3	66.1	58.8-62.8 (60.5±1.5)
SN/V	30.2	27.8	32.5	26.2-29.8 (28.7±1.4)
CP	25.3	25.6	22.3	22.7-26.9 (24.7±1.6)
D1b	12.1	12.5	10.2	9.0-11.2 (10.0±0.7)
D2b	20.8	20.9	15.2	16.5-18.3 (17.4±0.8)
Ab	14.0	15.0	11.7	12.7-16.6 (15.0±1.4)
Cl	20.0	22.7	21.2	20.1-21.3 (20.7±0.5)
Pl	23.8	23.8	24.0	18.1-22.1 (20.2±1.5)
VI	21.5	24.2	23.3	21.3-23.3 (22.3±0.7)
Vd	23.0	21.2	20.8	20.2-22.3 (20.7±0.8)
Ad	17.0	16.5	13.8	13.8-16.5 (15.3±0.9)
Aw	11.7	11.7	14.1	10.6-12.2 (11.7±0.6)
CPd	11.3	11.0	8.5	8.5-10.2 (9.4±0.6)
V/AN	26.4	26.4	27.9	25.1-29.1 (26.6±1.4)
%CP, CPd	44.8	42.9	38.1	34.7-43.2 (38.0±3.4)
%H, SN	17.5	19.0	21.0	16.9-21.4 (19.8±1.7)
E	23.8	21.5	24.7	21.4-26.4 (24.2±2.0)
PO	57.5	55.7	54.3	50.0-55.4 (52.5±1.9)
CHd	17.5	16.5	16.0	13.2-15.3 (14.4±0.8)
Hw	77.5	81.0	70.4	55.4-67.9 (61.6±4.4)
%E, I	35.7	33.3	41.2	27.3-40.0 (32.9±4.3)
%V/AN, VI	81.4	91.7	83.5	80.0-89.6 (84.1±3.9)

ETYMOLOGY. The specific name is derived from that of Montenegro, where the type material was collected.

DISTRIBUTION (Fig. 4): Found in the lower part of the River Morača. This distribution corresponds well with previous records of freshwater gobies identified as *Knipowitschia panizzae* (Verga, 1841) in the lower Morača (Marić 1995). *Knipowitschia montenegrina* occurs most probably also in Lake Skadar, because Ivanović (1973) and Marić (1995) recorded *Knipowitschia panizzae* there.

HABITAT: At the type-locality, *K. montenegrina* was caught in the shallows of the Morača and in pools remaining in gravel pits after river flooding. The substrate was gravel, covered with fine sediment and overgrown by dense filamentous algae, within which gobies were concealed. Current in the shallows was slow, about  $0.1 \text{ ms}^{-1}$ . Non-gobiid fishes in this microhabitat were the nemacheilid loach *Barbatula zetensis* (Šorić, 2000), cobitid loach *Cobitis ohridana* Karaman, 1928, cyprinids *Barbus rebeli* Koller, 1926, *Phoxinus phoxinus* (Linnaeus, 1758), *Squalius cephalus* (Linnaeus, 1758), *Cyprinus carpio* Linnaeus, 1758, *Gobio gobio* (Linnaeus, 1758), *Rutilus ohridanus* (Karaman, 1924), *Pseudorasbora parva* (Temminck & Schlegel, 1846), *Carassius auratus* (Linnaeus,

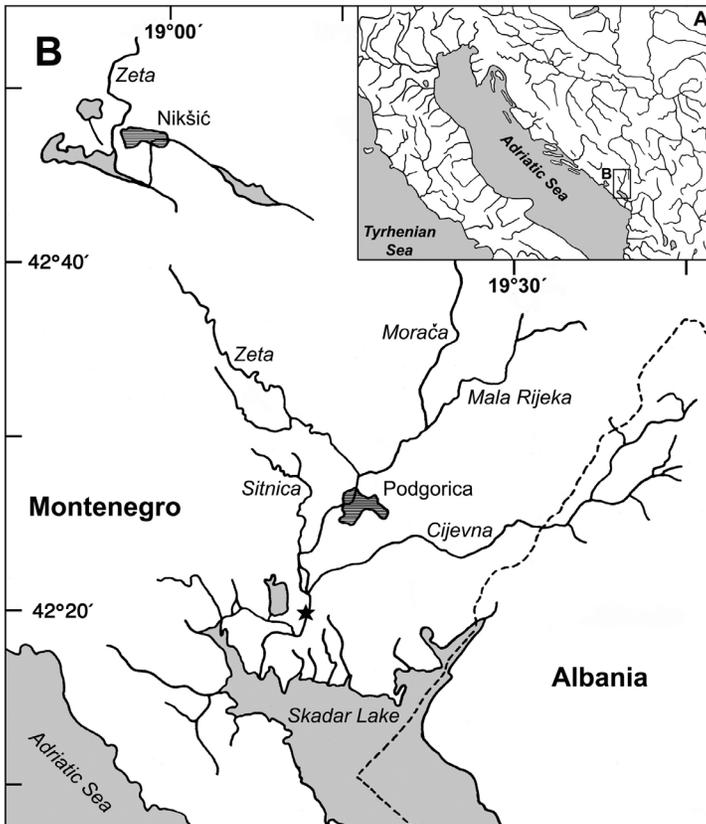


Fig. 4. (A) Adriatic Sea and river catchments, showing location of River Morača and Lake Skadar; (B) River Morača and Lake Skadar with type-locality asterisked.

1758), *Alburnus scoranza* (Heckel & Kner, 1858), *Telestes montenigrinus* (Vuković, 1963), *Pachychilon pictum* (Heckel & Kner, 1858), gasterosteid *Gasterosteus aculeatus* Linnaeus, 1758, blenniid *Salaria fluviatilis* (Asso, 1801), and a lamprey, *Lethenteron zanandreaei* (Vladykov, 1955). As well as *K. montenegrina*, another gobiid, an undescribed *Pomatoschistus* species (Miller & Šanda, in press), was also common there.

#### REMARKS

The occurrence of freshwater gobies in the Lake Skadar basin has been previously reported (Ivanović 1973, Marić 1995). However, both authors assigned their gobies to *K. panizzae*. Recent detailed investigations have now revealed that two species are present here: a *Knipowitschia* (this work) and a *Pomatoschistus* (Miller & Šanda in press), both new to science and with known distributions limited at present to the Lake Skadar basin. However, either of these species may well occur throughout the whole Ohrid-Drim-Skadar system, Vinciguerra (1933) having noted a freshwater goby in Lake Ohrid, although later authors do not mention gobies from Ohrid or the River Drim. Among described *Knipowitschia* species, *K. montenegrina* is morphologically closest to *K. croatica*, *K. punctatissima* and *K. ephesi*, sharing with them greatly reduced squamation and the absence of head canals. The first two of these species occur in Adriatic drainages, *K. punctatissima* in north-eastern Italy and *K. croatica* in Croatia. *K. montenegrina* clearly differs from these two species in head lateral line system, meristic ranges for unpaired fins, some morphometric characters, male coloration, and adult size.

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