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## Records of two uncommon goby species (*Millerigobius macrocephalus*, *Zebrus zebrus*) from the Aegean Sea

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*Two goby species endemic to the Mediterranean Sea were collected from the northern and southern Aegean Sea. A new record of *Millerigobius macrocephalus* from the area is presented and the occurrence of *Zebrus zebrus* off Turkish coasts is substantiated.*

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**Key words:** *Millerigobius macrocephalus*, *Zebrus zebrus*, Gobiidae, Aegean Sea

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### INTRODUCTION

Gobiidae is the most species-rich family in the Mediterranean Sea, represented by 63 species (AHNELT & DORDA, 2004; BILECENOGLU *et al.*, 2008). A high level of endemism makes them an important component of the local biodiversity. However, knowledge about the biology, distribution and ecology of many species is rather scarce, primarily due to sampling difficulties regarding their small sizes, cryptic habits and markedly sparse occurrences. It is a known fact that several gobies, especially those inhabiting caves and crevices, were previously overlooked (FRANCOUR *et al.*, 2007) and a much wider distribution can be expected for many goby species.

The western and central Mediterranean have higher numbers of gobies compared to the eastern basin, i.e. 46 vs. 23 species in the Adriatic and Levant seas, respectively (GOLANI,

1996; KOVAČIĆ, 2005). However, recent findings of *Gobius roulei*, *G. couchi*, *G. fallax* and *Odondebueania balearica* from the Levant Sea (KOVAČIĆ & GOLANI, 2006, 2007) and *Didogobius splechnai*, *Thorogobius macrolepis*, *Chromogobius zebratus*, *Pomatoschistus quagga* and *P. minutus* from the Aegean and Levantine coast of Turkey (FRANCOUR *et al.*, 2007; FRICKE *et al.*, 2007; ÖZEN *et al.*, 2007) prove that the low biodiversity of gobies in the eastern Mediterranean is much more related to an insufficient number of studies rather than a biogeographical phenomenon.

In this paper, we present information on two uncommon gobies from the Aegean Sea. One of them, *Millerigobius macrocephalus*, is a new record for Turkey, while the other species (*Zebrus zebrus*) is a very rare species off Turkish coasts and lacking description.

## MATERIAL AND METHODS

Morphometric and meristic methods follow MILLER (1988). Meristic abbreviations are: A, anal fin; C, caudal fin; D1, D2, first and second dorsal fin; P, pectoral fin; V, pelvic disc; LL, scales in lateral series; TR, scales in transverse series. Terminology of lateral-line system follows SANZO (1911) and MILLER (1986). Part of the examined material is deposited in the Prirodoslovni Muzej Rijeka (PMR). All the collected specimens of both species were checked to fit the diagnoses.

## RESULTS AND DISCUSSION

Goby samples from the southern Aegean Sea (Bodrum peninsula) were collected during scuba diving (Fig. 1). One male specimen of *Millerigobius macrocephalus*, 20.0+5.1 mm, was caught on 25/08/2007 in a closed bay, 5 km north of Yalikavak. The habitat at the site was mostly rocky (up to 1.5 m in diameter) encircled by a hard sand bottom, with the large stones and rocks covered by large brown and green algae. The goby was found between small stones



Fig. 2. Habitat of *Zebrus zebrus* observed at Karaada, Bodrum (southern Aegean Sea) (Photograph: S. BOGORODSKY)

beneath the large rocks at a depth of 1 m. The other species, *Zebrus zebrus*, was collected on 12/09/07 at the southern point of Karaada (south of Bodrum) at a depth of ~6 m. Wave action was prominent at the sampling locations, with rocky bottoms and patches with stones in the size range of 10 to 60 cm and covered by algae. The specimen was found in tubed holes of stones (stone size ~20 cm) (Fig. 2).

Samplings in the northern Aegean Sea (Fig. 1) were carried out by a beach seine. One specimen of *M. macrocephalus* was obtained from *Zostera marina* covered sandy shallow waters (<2 m) at the entrance of the Dardanelles Strait. Surface water temperature was 27.0°C and salinity was 28.5 ppt on the sampling day. The other sampling was from a coarse gravel bottom in Edremit Bay, resulting in the collection of six *Z. zebrus* individuals, where the water temperature and salinity were 14.6°C and 37 ppt, respectively.

### *Millerigobius macrocephalus* (Kolombatović, 1891)

Material examined: 1 male, 20.0+5.1 mm, PMR VP 1752, Bodrum, Turkey, Aegean Sea, September 2007 (Fig. 3A), Coll. S.Bogorodsky; 1 male, 30.0+5 mm, Dardanelles Strait (40° 03' 00" N, 26° 12' 42" E), July 2007, Coll. O.Ozen.

Diagnosis: The following minimum combination of characters positively identify the researched specimen as *M. macrocephalus* among Mediterranean species of Gobiidae fam-



Fig. 1. Sampling locations of the two goby species collected from the Aegean Sea



Fig. 3. A – *Millerigobius macrocephalus* (Kolombatović, 1891) (PMR VP 1752), B – *Zebrus zebrus* (Risso, 1826) (PMR VP 1751) (Photograph: S. Bogorodsky)

ily: (1) suborbital papillae without longitudinal row *a*; (2) posterior oculoscapular canal absent; (3) V fins not separate; (4) interorbital rows present.

**Description:** Anterior nostril tubular, long, reaching upper lip, without process from rim. Posterior nostril also erected. Branchiostegal membrane attached to entire side of isthmus. Fins: D1 VI; D2 I/11; A I/9; C, 15 branched rays, 17 articulated rays; P 15; V I/5+I/5. Damaged fins (C, P, V) did not influence the counting, except for right P fin. P uppermost rays damaged; V rear edge destroyed, but V not separate, with anterior transverse membrane. Body with ctenoid scales, LL 30-32, TR 9. Head, predorsal area and breast naked. Colour preserved: body more or less uniformly greyish brown. Origin of P, isthmus, breast, belly and the lower part of caudal peduncle paler comparing to the rest of the body. Reticulate pattern, formed by dark markings along the scale margins visible. Head uniformly pigmented, except for a few more intensively pigmented points above operculum. Pigments on D1 forming two broad longitudinal bands. Other fins pigmented without any recognizable pattern. Head with anterior and preopercular canals, with pores  $\sigma$ ,  $\lambda$ ,  $\kappa$ ,  $\omega$ ,  $\alpha$ ,  $\beta$ ,  $\rho$  and  $\gamma$ ,  $\delta$ ,  $\varepsilon$  respectively. Rows of sensory papillae: No suborbital row *a*. Seven transverse suborbital rows of sensory papillae. Four transverse suborbital rows before, one below longitudinal row *b*. Transverse suborbital rows 2 and 3 more distant from orbit, other suborbital rows (1, 4, 5, 6, 7) begin close to the orbit. Row *b* anteriorly begin-

ning below rear border of eye. Suborbital row *d* divided, with gap below transverse suborbital row 3. Predorsal area damaged, anterior dorsal rows not visible. Two interorbital rows present. The presently collected specimens correspond in body morphology and coloration to the populations of *M. macrocephalus* from the other parts of the Mediterranean basin (BATH, 1973; MILLER, 1977, 1986).

**Distribution:** The species is known only from the Mediterranean and was previously recorded off southern Spain, the island of Corsica, the Dalmatian coast of the Adriatic Sea, the island of Rhodes and off Israeli coasts (MILLER, 1977; RAMOS-ESPLA & PERÉZ RUZAFÁ, 1987; BOUCHEREAU & TOMASINI, 1989; BOUCHEREAU, 2002). Recent collections from two distinct basins of the Aegean Sea considerably expands the known distribution range of *M. macrocephalus*, which also indicates the high ecological tolerance of the species to salinity and water temperature variations, in accordance with statements of MILLER (1977).

#### *Zebrus zebrus* (Risso, 1826)

**Material examined:** 1 male, 23.4+5.0 mm, PMR VP 1751, Bodrum, Turkey, Aegean Sea, September 2007 (Fig. 3B), Coll. S. Bogorodsky; 2 specimens, 25.1+6.0 mm – 30.0+6.2 mm, Edremit Bay (39° 33' 24" N, 26° 39' 24" E), July 2007, Coll. O. Ozen.

**Diagnosis:** The following minimum combination of characters positively identify the researched specimen as *Z. zebrus* among species of Gobiidae family in the Clofnam area: (1) suborbital papillae without longitudinal row *a*; (2) all three head canals present; (3) anterior-dorsal row *g* ends behind lateral end of row *o*; (4) 7 suborbital transversal rows; (5) 2 transversal suborbital rows below longitudinal row *b*.

**Description:** Anterior nostril short, tubular, with tentacle from inner part of rim. Branchiostegal membrane attached to entire side of isthmus. Fins: D1 VI; D2 I/11; A I/8-9; C 15 branched rays, 17 articulated rays; P 16-17; V I/5+I/5. Damaged C fin of the Bodrum specimen did not influence the counting. P uppermost rays

free from membrane; V complete, with anterior transverse membrane. Body with ctenoid scales, LL 30-31, TR 9-10. Head, predorsal area and breast naked. Color preserved: body greyish brown, pale vertical stripes poorly visible. Head with three transverse pale bars spreading from each eye over cheek and snout. Predorsal area uniformly pigmented, operculum mottled. Underside of head, breast and even belly pigmented. Pigments on D1 forming two broad longitudinal bands; on D2 forming more or less visible three longitudinal bands; C with vertical dark strips, the most intensive strip along origin; P poorly pigmented, but with intensive dark mark, higher than longer, on origin of upper P rays; A and V pigmented. Head with anterior and posterior oculoscapular, and preopercular canals, with pores  $\sigma$ ,  $\lambda$ ,  $\kappa$ ,  $\omega$ ,  $\alpha$ ,  $\beta$ ,  $\rho$ ,  $\rho^1$ ,  $\rho^2$ , and  $\gamma$ ,  $\delta$ ,  $\varepsilon$  respectively. Rows of sensory papillae: No suborbital row *a*. Seven transverse suborbital rows of sensory papillae. Four transverse suborbital rows before, two below longitudinal row *b*. Transverse suborbital rows 2 and 3 more distant from orbit, other suborbital rows (1, 4, 5, 6, 7) begin close to orbit. Row *b* anteriorly beginning below pupil. Suborbital row *d* continuous.

Anterior dorsal row *g* ending close to lateral part of row *o*, row *o* separated from fellow in dorsal midline. No interorbital rows. The presently collected specimens correspond in body morphology and coloration to the populations of *Z. zebrus* from the other parts of the Mediterranean basin (MILLER, 1977, 1986; KOVAČIĆ *et al.*, 2005).

Distribution: Definite records of *Z. zebrus* from the Mediterranean Sea are scattered, though KOVAČIĆ *et al.* (2005) suggested a fairly continuous distribution and far more common abundance for the species. The specimens collected from Edremit Bay substantiates the previous single record from Ayvalik, northern Aegean Sea (MILLER, 1977), while the Bodrum sample suggests the possibility of widespread occurrence of *Z. zebrus* along the Turkish Aegean Sea coasts.

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## Nalazi dvaju rijetkih glavoča (*Millerigobius macrocephalus*, *Zebrus zebrus*) u Egejskom moru

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### SAŽETAK

Dvije vrste mediteranskih endemičnih glavoča su ulovljene u sjevernom i južnom Egejskom moru. Prikazan je novi nalaz vrste *Millerigobius macrocephalus*, te je obrazložena pojava vrste *Zebrus zebrus* u turskim vodama.

**Ključne riječi:** *Millerigobius macrocephalus*, *Zebrus zebrus*, Gobiidae (glavoči), Egejsko more