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The first record of *Gobius incognitus* (Actinopterygii: Gobiiformes: Gobiidae) from Malta

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The first record of Gobius incognitus *Kovačić & Šanda, 2016 was reported from Malta. Two specimens were collected at the island of Gozo and stored as unidentified in 2012, several years before the description of* Gobius incognitus*. A decade later the material was finally identified based on morphology and coloration pattern of preserved specimens. The habitat preferences and geographic distribution of this species are discussed.*

Key words: Malta; *Gobius incognitus*; first record; morphology

INTRODUCTION

The family Gobiidae is the species richest family of fishes in the Mediterranean (KOVAČIĆ, 2020). *Gobius incognitus* Kovačić & Šanda, 2016 is one of about dozen Mediterranean gobiid species described during the last decade (KOVAČIĆ & ŠANDA, 2016; KOVAČIĆ, 2020). The new species was discovered by phylogenetic analyses as genetically highly distinct clade among specimens tentatively identified as *Gobius bucchichi* Steindachner, 1870. The description of this new cryptic species was also well supported by morphological differential diagnosis vs. *G. bucchichi* (KOVAČIĆ & ŠANDA, 2016). The knowledge on confirmed geographic distribution of *G. incognitus* has remained the same since the species description: north, middle and south Adriatic Sea, in the north-western Mediterranean in France, Banyuls-sur-Mer and in the eastern Mediterranean at Crete Island and in Israel (Fig. 1).

However, considering morphological and coloration similarity with *G. bucchichi*, earlier records of *G. bucchichi* elsewhere in the Mediterranean, in the Black Sea and from south-west Portugal and Morocco on the Atlantic coast (MILLER, 1986) has been questioned, since presently confirmed distribution of *G. bucchichi* is restricted just to Adriatic, Ionian and Aegean Sea (KOVAČIĆ & ŠANDA, 2016; TIRALONGO & PILLON, 2020) (Fig. 1). The widespread pale *Gobius* species with longitudinal rows of brown dots identified as *G. bucchichi* before *G. incognitus* description (green area in Fig. 1) (KOVAČIĆ & ŠANDA, 2016) still waits for reidentification for the most of the area. Surprisingly, only one additional record of *G. incognitus* was reported since

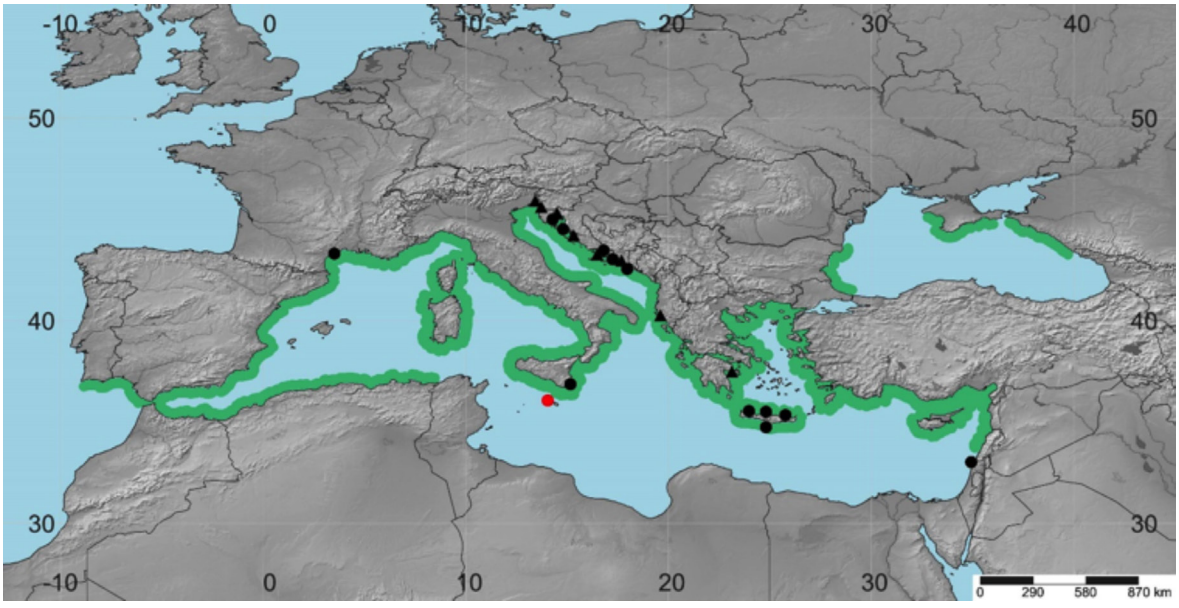

Fig. 1. Map of the Mediterranean Sea showing 1) present record (red circle) and earlier records of Gobius incognitus *(black circles), 2) the confirmed records of* Gobius bucchichi *(black triangles) and 3) the geographic distribution of what was then considered to be* G. bucchichi, *according to* MILLER *(1986) (green area)*

2016 (TIRALONGO *ET AL*., 2020). *G. incognitus* has not been reported for Malta and *G. bucchichi* was listed in LANFRANCO (1993). However, the presence of *G. bucchichi* was claimed without diagnosis based on actual material, without photograph and without voucher specimens (LANFRANCO, 1993). Since *G. bucchichi* can easily be confused and misidentified with very similar or closely related species, not just with later described *G. incognitus*, but also with *Gobius fallax* Sarato, 1889, the presence of *G. bucchichi* at Malta was considered unconfirmed (KOVAČIĆ & SCHEMBRI, 2019).

The aim of the present paper is to report the presence of *G. incognitus* from Malta, expanding the known species distribution.

MATERIAL AND METHODS

The two specimens of *Gobius incognitus* were collected by one of the authors (OAK) with hand net during snorkeling on the island of Gozo on 14 September 2012. One of the specimens was examined in detail and deposited in the Prirodoslovni muzej Rijeka (PMR). The reporting of new gobiid species record includes diagnosis based on actual material, the photograph, and the voucher specimen. The genus identification is a minimum combination of characters that positively identify fresh or preserved specimens of genus *Gobius* among marine genera of family Gobiidae in the Mediterranean area (KOVAČIĆ, 2020). The species diagnosis is a minimum combination of characters that positively identify fresh or preserved specimens of *G. incognitus* among species of genus *Gobius* (KOVAČIĆ & ŠANDA, 2016). Terminology of the lateral-line system, morphometric and meristic methods, and meristic abbreviations followed those in KOVAČIĆ & ŠANDA (2016). The identification of the second specimen from the coloration pattern on the photo is based on the coloration characters in KOVAČIĆ (2020) and KOVAČIĆ *et al*. (2022).

RESULTS

Material collected (standard length + caudal fin length): 1 male, 44.7 + 10.3 mm, PMR VP5183 and male, 40.1+8.3 mm, San Lowrenz, Gozo island, Malta (36.052694°N, 14.188545°E), 14 September 2012, collected by O.A. Kovtun (Figs. 2 & 3).

Genus identification. 1) Suborbital sensory papillae without row *a* below eye; 2) all three

Fig. 2. Gobius incognitus*, A) male, 44.7 + 10.3 mm, PMR VP5183; B) male, 40.1+8.3 mm*; *San Lowrenz, Gozo island, Malta, photographs by M. Kovačić (A) and O. Kotvun (B)*

head canals present; 3) anterior dorsal row *g* of sensory papillae ends behind or on lateral end of row *o*; 4) six suborbital transverse row *c* of sensory papillae, if seven, then predorsal area scaled.

Species diagnosis. *Gobius incognitus* sp. nov. is unique among species of *Gobius* by the following combination of characters: 1) scales in lateral series 51-59 (56 and 55 in the specimen PMR VP5183); 2) predorsal scales 25-35 (26 in the specimen PMR VP5183); 3) opercle scaled in adults with 10-16 scales present (14 in the specimen PMR VP5183); 4) pectoral fin count 18-20 (20 in the specimen PMR VP5183); 5) free tips on upper pectoral fin rays well developed and at the first ray longer that 2/3 of entire ray length (83% in the specimen PMR VP5183) (Fig. 3a); 6) pelvic disc complete; 7) pelvic disc anterior membrane without lateral lobes (Fig. 3b); 8) anterior oculoscapular canal with pore α at rear of orbit; 9) oculoscapular row x^1 not extending forwards to pore β; 10) suborbital row *d* discontinuous with large gap below suborbital rows *3* and *4*; 11) eye diameter 1.08-1.32 in snout length (1.14 in the specimen PMR VP5183); 12) the pigment dots on cheek irregularly scattered or, if rows are visible, then additional dots or a third row present across the middle of the cheek between the lower row, starting anteriorly at the angle of mouth and the upper row that touches ventral margin of eye

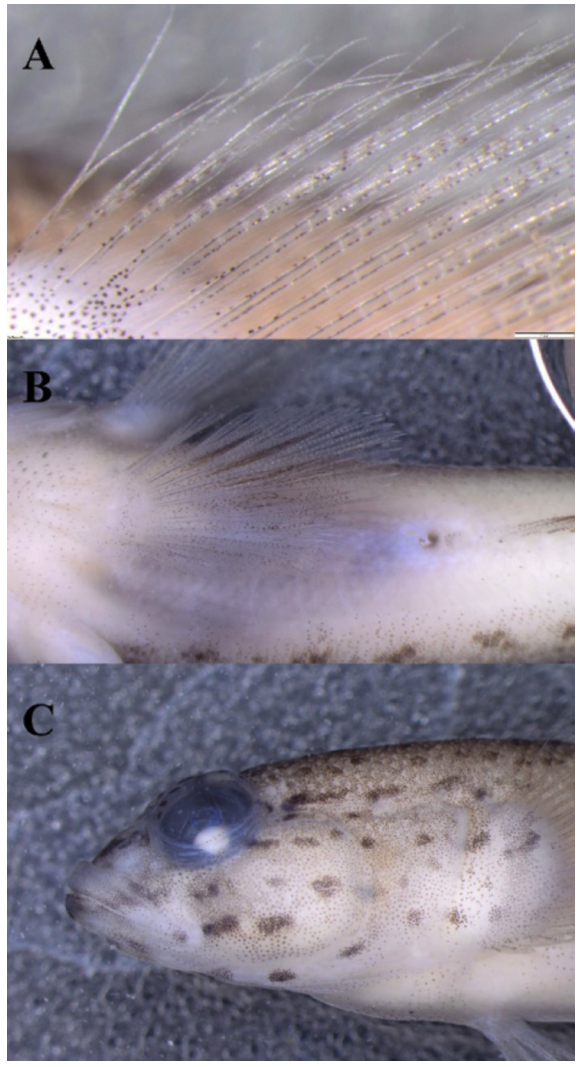

Fig. 3. Gobius incognitus*, PMR VP5183: A) free tips on upper pectoral fin rays; B) pelvic disc; C) the coloration pattern on head. Photographs by M. Kovačić*

(three rows in the specimen PMR VP5183) (Fig. 3c); 13) the upper mark on the pectoral fin base single or doubled, reaching downwards to 8th-10th rays counting from upper part of fin (single mark, downwards to 8th ray in the specimen PMR VP5183) (Fig. 3c).

Morphology and coloration of preserved specimen 44.7 + 10.3 mm, PMR VP5183. General body and head morphology as on Figs. 2 and 3c. First dorsal fin VI; second dorsal fin I+14; anal fin I+12; pectoral fins 20 (both sides), free tips on upper five pectoral fin rays well developed and at the first ray 83% of entire ray length is free (Fig. 3a); pelvic disc

I+5, complete, truncate, with anterior membrane without lateral lobes (Fig. 3b); caudal fin rounded. Scales in lateral series 56 and 55, left and right, respectively, in transversal series 15 and 16, predorsal longitudinally with 26 scales. Predorsal area, prepectoral and opercle scaled, scales on predorsal area small and cycloid. Head with anterior and posterior oculoscapular, and preopercular canals, with pores σ, λ, κ, ω, α, β, ρ, ρ^1, ρ^2 and γ, δ and ε, respectively; anterior oculoscapular canal with pore α at rear of orbit. Snout with five median preorbital sensory papillae rows, cheek with six transverse suborbital rows (*1–6*) of sensory papillae, suborbital row *d* discontinuous with large gap below suborbital rows *3* and *4*; anterior oculoscapular longitudinal row x^l with posterior end above pore ρ^1 and not extending forwards to pore β but ending above *z*; anterior dorsal transverse row *o* distant from felow in dorsal midline; longitudinal row *g* not reaching anteriorly to row *o*. Preserved coloration with body yellowish brown, covered with longitudinal lines of brown dots, the most prominent along the lateral midline (Fig. 2a). The upper mark on the pectoral fin base single reaching downwards to 8th ray counting from upper part of fin (Fig. 3c). The lower mark on the pectoral fin base visible. Head dusky with brown pigmentation pattern. Upper iris with separate brown dots or radiating stripes without a longitudinal mark uniting them (Fig. 3c). The center of the snout with the V-shaped line. The pigment dots on cheek with three longitudinal rows, third row present across the middle of the cheek between the lower row, starting anteriorly at the angle of mouth and the upper row that touches ventral margin of eye (Fig. 3c). Mouth with difuse isolated dot at posterior angle, followed by two short horizontal dashes of the lowermost row over lower cheek (Fig. 3c). Upper lip with difuse mark anteriorly to the dot at the corner of the mouth (Fig. 3c). Underside of head with three longitudinally arranged gular spots.

Identification of the second specimen 40.1+8.3 mm from the photograph (Fig. 2b). 1) Body yellowish brown, covered with longitudinal lines of brown dots, the most prominent along the lateral midline; 2) rows on cheek visible, additional dots poorly shaping third row present across the middle of the cheek between the lower row, starting anteriorly at the angle of mouth and the upper row that touches ventral margin of eye; 3) upper iris with separate brown dots or radiating stripes without a longitudinal mark uniting them; 4) the upper mark on the pectoral fin base single downwards to 8th ray; 5) mouth with difuse isolated dot at posterior angle, followed by two short horizontal dashes of the lowermost row over lower cheek.

Ecological data

Two specimens were caught with a net in the littoral baths of the stone shore at a depth of no more than 0.5 meters.

DISCUSSION

This record represents the first record of *G. incognitus* from Malta, and extends the central Mediterranean distribution of this species further south (TIRALONGO *ET AL*., 2020). The specimen matches well the original species description (KOVAČIĆ & ŠANDA, 2016). The record also gives the highly likely solution to the question on *G. bucchichi* presence for Malta in LANFRANCO (1993). The pale *Gobius* species with longitudinal rows of brown dots previously identified as *G. bucchichi* in LANFRANCO (1993) could be *G. incognitus, G. bucchichi* or even *G. fallax*, with only *G. fallax* among them having confirmed record for Malta (KOVAČIĆ AND SCHEMBRI, 2019). The similarity of three species was large enough that *G. fallax* was found among the type material of *G. bucchichi* i.e. one *G. bucchichi* syntype from Staatliches Museum für Naturkunde in Stuttgart (SMNS 2701) was indeed *G. fallax* (KOVAČIĆ & ŠANDA, 2016). The Malta area therefore hosts *G. incognitus* and *G. fallax,* while the presence of *G. bucchichi* could be rejected. The total number of confirmed gobiid species from Malta is 21 presently, while nine more gobiid species remain questioned for the area, still lacking the evidence from voucher specimens or from photographs (present data, KOVAČIĆ & SCHEMBRI, 2019).

Considering presently confirmed distribution of *G. incognitus* and *G. bucchichi* (present data; KOVAČIĆ & ŠANDA, 2016; TIRALONGO & PILLON, 2020; TIRALONGO *et al*., 2020) (Fig. 1), it is more likely that the earlier geographic distribution of *G. bucchichi* elsewhere in the Mediterranean, also in the Black Sea and from south-west Portugal and Morocco on the Atlantic coast (MILLER, 1986), was based on records of *G. incognitus* and not *G. bucchichi*. Luckily, the two species can be distinguished already by coloration pattern, and good photographs can be used for identifying positive records of any of two species, so citizen science can be involved using underwater photographs to help resolving this question. The former geographic distribution of what was expected to be *G. bucchichi* (Fig 1, see MILLER, 1986) compared to present *G. incognitus* extant of occurrence was extended west of Banyuls-Sur-Mer to westernmost Mediterranean and Atlantic Ocean neighboring Gibraltar, and on east through the entire Aegean Sea to the Black Sea. Also, there are considerable gaps inside present *G. incognitus* extant of occurrence between Banyuls-Sur-Mer on west and Sicily and Malta, and between Sicily and Malta and the eastern Adriatic coast (present data; KOVAČIĆ & ŠANDA, 2016; TIRALONGO *ET AL*., 2020). The remote population from the Black Sea shows more similar pattern of coloration to *G. bucchichi* than to *G. incognitus* (Sergey Bogorodsky, personal communication). Although the species identity from the most of these areas can be checked already from photograph, the specimens studied for morphology or even for genetics should be used if coloration pattern is doubtful since additional cryptic species cannot be excluded.

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Prvi nalaz glavoča nepoznatog *Gobius incognitus* (Actinopterygii: Gobiiformes: Gobiidae) na Malti

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SAŽETAK

Prvi nalaz vrste *Gobius incognitus* zabilježen je za Maltu. Dva primjerka ove vrste sakupljena su na otoku Gozo još 2012. godine, prije opisa same vrste 2016. godine. Desetljeće poslije, materijal je određen pomoću morfologije i obojenja konzerviranih primjeraka. Raspravljeni su podaci o staništu i zemljopisnoj rasprostranjenosti ove vrste.

Ključne riječi: Malta; *Gobius incognitus*; prvi nalaz; morfologija