

NEW DISTRIBUTIONAL RECORDS OF *GOBIUS BUCCHICHI*  
(PISCES, GOBIIDAE) FROM THE MEDITERRANEAN SEA AND *IN SITU*  
COMPARISONS WITH *GOBIUS INCOGNITUS*

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*ABSTRACT*

*We report for the first time the presence of Gobius bucchichi from the coastal waters of three Mediterranean countries, namely Italy, Slovenia and Greece, thus increasing the knowledge on the distribution of this species in the Mediterranean Sea. We provide high quality in situ photos of the species, highlighting the main differences between similar species as a useful tool for in situ identification, which can be used for monitoring purposes. Habitat preferences, abundance and behaviour of G. bucchichi and similar species are also described. Comparisons with similar species, ecological notes, and the current distribution of G. bucchichi in the Mediterranean Sea are discussed.*

**Key words:** identification key, Mediterranean gobies, new records, Adriatic Sea, Aegean Sea, underwater photography

NUOVE SEGNALAZIONI DI *GOBIUS BUCCHICHI* (PISCES, GOBIIDAE) NEL MAR  
MEDITERRANEO E CONFRONTI *IN SITU* CON *GOBIUS INCOGNITUS*

*SINTESI*

*Riportiamo per la prima volta la presenza di Gobius bucchichi nelle acque costiere di tre nazioni mediterranee, ovvero Italia, Slovenia e Grecia, apportando nuove conoscenze sulla distribuzione di questa specie nel Mediterraneo. Forniamo anche foto della specie in ambiente di elevata qualità, evidenziando le principali differenze con le specie simili, fornendo quindi uno strumento utile per l'identificazione in situ della specie che può essere usato a fini di monitoraggio. Le preferenze di habitat, l'abbondanza e il comportamento di G. bucchichi e delle specie simili sono anch'essi descritti. Confronti con le specie simili, note ecologiche e l'attuale distribuzione di G. bucchichi nel Mediterraneo vengono discussi.*

**Parole chiave:** chiavi di identificazione, gobiidi mediterranei, nuove segnalazioni, Adriatico, Egeo, fotografia subacquea

## INTRODUCTION

Members of the family Gobiidae Cuvier, 1816, with more than 1900 valid species (Fricke *et al.*, 2019), make up one of the largest fish families in the world (Nelson *et al.*, 2016). The same is true for the Mediterranean Sea, where Gobiidae, with over 70 species, are the most speciose fish family (Patzner, 2019). However, despite the numerical dominance and ecological relevance of the family, data about ecology and distribution are, for most of the species, scarce and dated (Patzner, 1999; Kovačić *et al.*, 2012; Ordines *et al.*, 2019). Only in relatively recent times have there been studies considering some ecological aspects and only in certain species (Herler & Patzner, 2005; Kovačić & Pijevac, 2008; Kovačić *et al.*, 2012; Tiralongo *et al.*, 2020).

Most of the recently described gobies from the Mediterranean Sea are morphologically distinct species (Miller, 1992; Ahnelt & Patzner, 1995; Kovačić & Miller, 2000; Schliewen *et al.*, 2019), and their late recognition is probably only due to their cryptobenthic nature and small size, or to their deeper habitat, like in the cases of *Buenia massutii* Kovačić, Ordines & Schliewen, 2017, *Gobius kolombatovici* Kovačić & Miller, 2000, *Lebetus patzneri* Schliewen, Kovačić & Ordines, 2019, and *Speleogobius llorisi* Kovačić, Ordines & Schliewen, 2016 (Kovačić & Miller, 2000; Tiralongo & Pagano, 2015; Kovačić *et al.*, 2016; Kovačić *et al.*, 2017; Schliewen *et al.*, 2019). Hence, their identification *in situ* is relatively simple, yet limited to those species which can be directly observed by divers in the infralittoral (or upper circalittoral). However, *Gobius bucchichi* Steindachner, 1870, a shallow water species, was considered a widespread Mediterranean species until the recent discovery of *Gobius incognitus* Kovačić & Šanda, 2016, a very similar species, yet distinct in morphological, meristic and molecular traits (Kovačić & Šanda, 2016). According to this latter study, the current distribution of *G. bucchichi* appears to be restricted to the eastern Adriatic Sea (Croatia and Montenegro) and northern Ionian Sea (Albania), while *G. incognitus* is widely distributed in the Mediterranean Sea, having been reported from the western to the eastern part of the basin. In consideration of these new data, most, if not all, of the previous literature on *G. bucchichi* concerns *G. incognitus*, although new biological and ecological studies are needed to obtain data clearly attributable to either of the two species (Tiralongo *et al.*, 2020).

With this paper we aim to increase the knowledge about the distribution of *G. bucchichi*, reporting first records from three countries and discussing the species distribution in the Mediterranean Sea. We also provide some ecological notes and underline the most important characters for the species identification *in situ*, highlighting above all the main differences with the very similar *G. incognitus*.

## MATERIAL AND METHODS

Data were collected in summer during the period 2017–2019 in snorkeling surveys (with a duration of about 1.5 hour per survey) performed within the bathymetric range of 0–4 m at different locations of the Mediterranean Sea (Fig. 1): Piran (Slovenia; Adriatic Sea; 45.51725 N, 13.56823 E) in August 2017, Muggia (Italy, Adriatic Sea; 45.60577 N, 13.72073 E) in August 2018, and Kondyli beach (Greece; Aegean Sea; 37.53090 N, 22.93402 E) in July 2019. In each area we collected data about the abundance of *G. bucchichi*, the depth range in which the species was present and more abundant, and the habitat and contemporary presence of *G. incognitus* and any other similar species. Identification was based on the diagnostic characters that are visible *in situ* and on photographs (Kovačić & Svensen 2018). *Gobius bucchichi*, *G. incognitus* and *Gobius fallax* Sarato, 1889 differ from all other Mediterranean gobies in a lively coloration of the body and head, which is generally light, *i.e.*, basically white with yellowish, greenish or greyish tones, and displaying longitudinal rows of darker dots. The identification characters for distinguishing *G. bucchichi* from *G. fallax in situ* and on photographs



**Fig. 1: Updated distribution of *Gobius bucchichi*; black circles indicate published records; red circles indicate new distributional records from Italy (Adriatic Sea), Slovenia (Adriatic Sea), and Greece (Aegean Sea).**

**Sl. 1: Dopolnjena razširjenost vrste *Gobius bucchichi*; črni krogi označujejo objavljene zapise o pojavljanju; rdeči krogi označujejo nove podatke o razširjenosti v Italiji (Jadransko morje), Sloveniji (Jadransko morje), in Grčiji (Egejsko morje).**

**Tab. 1: Main differences between *Gobius bucchichi* and *Gobius incognitus* useful for *in situ* identification. See Fig. 1 for photographic comparisons.**

**Tab. 1: Glavne razlike med vrstama *Gobius bucchichi* in *Gobius incognitus*, uporabne za razlikovanje na mestu samem. Glej Sl. 1 za fotografsko primerjavo.**

	<i>Gobius bucchichi</i> Steindachner, 1870	<i>Gobius incognitus</i> Kovačić & Šanda, 2016
<b>Dots on cheeks</b>	Usually only two longitudinal rows of dots, with a large dot-free area at the center. In some cases, very close small dots can be present in the central and anterior part of the cheeks. The lower row start behind the corner of the mouth, with two horizontally elongated dots.	Three longitudinal rows of dots, with the central one close to the lower one, parallel to each other. The dots of the central row are very variable in number and are often irregular in shape. The lower row start with a dot on the corner of the mouth.
<b>Dots of the midlateral line</b>	Marked, well aligned and distinct.	Often fused to form larger dark blotches separated by spaces.
<b>Background body color</b>	Uniform, pale yellowish.	Light greenish-grey, often with alternate slightly light and dark areas on the dorsal surface.

are presented in the Results and Discussion section as original contributions. The diagnostic characters for *in situ* distinguishing between *G. bucchichi* and *G. incognitus* are original contributions presented in Table 1. At every reported locality specimens of both species were photographed to record their presence in high quality photos that preserve all the main valid and useful qualities for distinguishing the two species *in situ* (Tab. 1).

## RESULTS AND DISCUSSION

In Piran (Slovenia), the mixed sea bottom was characterized by the presence of silt and large boulders (diameter > 1 m). In this area, *G. bucchichi* was quite rare: in a total of 4 surveys with a duration of about 1.5 hours each, only 1–3 medium-sized specimens per survey were observed, at a depth of about 3 m. During the surveys, no specimens of *G. incognitus* were encountered, instead, a massive presence of another similar species, *Gobius fallax* Sarato, 1889, was observed. All the specimens of this latter species were large.

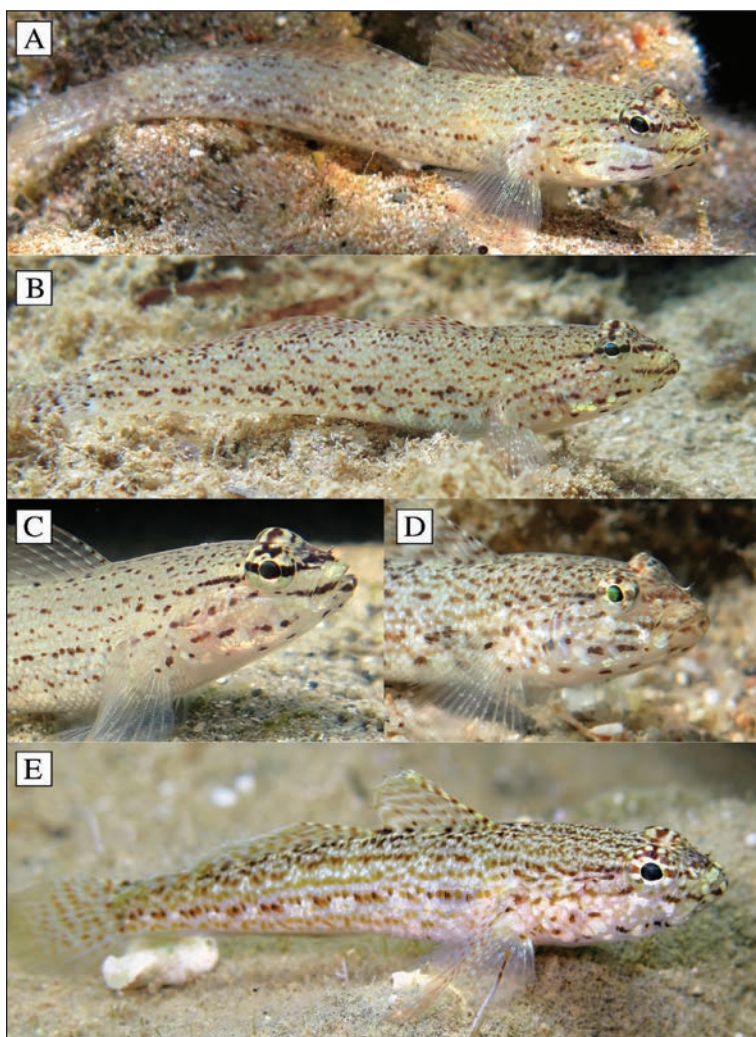
In Muggia (Italy), the nature of the sea bottom was similar to that of Piran. In this area, about 10 specimens per survey of *G. bucchichi* were observed. Most of them were of large size and observed at a depth of 2–4 m. Again, no specimens of *G. incognitus* were observed, while *G. fallax* was quite abundant.

At Kondyli beach (Greece), the mixed bottom was composed of coarse sand and boulders. In this area, some 15 medium-sized specimens per survey of *G. bucchichi* were observed, at a depth of 1–1.5 m (Fig. 2A). Contrarily to the other two locations investigated, we recorded the presence of *G. incognitus*. The size range of the specimens of *G. incognitus* observed was from 4 to 8 cm in total length (TL). While *G. bucchichi* was aggregated in groups of several individuals, the specimens of *G. incognitus* exhibited a more scattered distribution.

In all the locations, the specimens of *G. bucchichi* were observed in sheltered environments, such as small bays, rather than in more exposed surrounding areas with increased wave action. Furthermore, *G. bucchichi*, unlike *G. incognitus*, was never observed associated with *Anemonia viridis* (Forsskål, 1775). On the other hand, this association is common for *G. incognitus*: when it feels threatened it seeks protection among the tentacles of the sea anemone (Tiralongo *et al.*, 2020).

*Gobius bucchichi* and *G. incognitus* are similar to *G. fallax* (Fig. 2E). However, *G. bucchichi* is distinguished from *G. fallax* by several traits: 1. *G. fallax* presents a stouter body; 2. with the exception of the larger dots along the midlateral line, similar in the two species, the longitudinal lines of brown dots are aligned and well-defined in *G. fallax* (very numerous and tighter in the dorsal area), looking more as interrupted lines or rows of dashes than rows of dots. In *G. bucchichi*, these longitudinal lines are composed of fewer and less aligned brown dots; 3. In *G. fallax*, the dots on the cheeks are not so well-defined as in *G. bucchichi*; 4. *Gobius fallax* displays a “neutral buoyancy” or hyperbenthic position, sometimes staying suspended 10–30 cm above the sea floor or having only a few contact points when resting on the bottom; contrariwise, *G. bucchichi* (and *G. incognitus*) always rests on the bottom. In Table 1, we report all the main differences between *G. bucchichi* and *G. incognitus* useful for *in situ* identification (see Fig. 2A–D for photographic comparisons).

This work reports for the first time the presence of *G. bucchichi* from three new Mediterranean areas: Italy (Adriatic Sea), Slovenia (Adriatic Sea), and Greece (Aegean Sea). Hence, the species shows a wider distribution than previously reported and restricted to the eastern Adriatic Sea and the Albanian Ionian Sea. However, compared to the similar species *G. incognitus* and in agreement with Kovačić & Šanda (2016), the distribution of *G. bucchichi* appears to be significantly more



**Fig. 2:** *Gobius buccichi*, specimen from Greece, 15 July 2019 (A); *Gobius incognitus*, specimen from Greece, 10 September 2018 (B); detail of the head of *G. buccichi*, specimen from Italy, 24 August 2018 (C); detail of the head of *G. incognitus*, specimen from Italy, 22 June 2016 (D); *Gobius fallax*, specimen from Croatia, 29 May 2013 (E).

**Sl. 2:** *Gobius buccichi*, primerek iz Grčije, 15. julij 2019 (A); *Gobius incognitus*, primerek iz Grčije, 10. september 2018 (B); detajl glave pri vrsti *G. buccichi*, primerek iz Italije, 24. avgust 2018 (C); detajl glave pri vrsti *G. incognitus*, primerek iz Italije, 22. junij 2016 (D); *Gobius fallax*, primerek iz Hrvaške, 29. maj 2013 (E).

limited. Indeed, we failed to detect the presence of *G. buccichi* in many other locations throughout the Italian seas (with the exception of the northernmost part of the Adriatic) and in Greek waters (Cephalonia, Methoni, Elafonissos, Sithonia, Andros, Paros, Antiparos, Shinoussa, Milos, Kimolos and the Pagasetic Gulf), where we recorded the presence of *G. incognitus* only. We also analysed our photos taken before 2016 in other Greek locations, namely Limnos, Karpathos, Crete, Skiathos, Naxos, Koufonisia, and Donoussa, and the only photographed species was again *G. incognitus*.

Although the differences between the two species (*G. buccichi* vs. *G. incognitus*) are not very pronounced, an accurate *in situ* examination in most cases allows a reliable identification. Based on the recent discovery of *G. incognitus* (Kovačić & Šanda, 2016), further targeted studies in other Mediterranean areas are necessary in order to expand our knowledge about the true distribution of *G. buccichi* in the Mediterranean Sea (but also in the Marmara and Black Seas), and about the ecological factors affecting its distribution. *Gobius buccichi* seems to prefer more sheltered habitats than *G. incognitus*, such as small bays. Furthermore, the former species shows a more gregarious behaviour than the latter one. The current distribution of *G. buccichi* still appears to be confined to the north of the central-eastern part of the Mediterranean Sea, where the species is usually sympatric with *G. incognitus*. *Gobius incognitus*, on the other hand, appears to be a ubiquitous Mediterranean species.

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## NOVI PODATKI O RAZŠIRJENOSTI VRSTE GLAVAČA *Gobius bucchichi* (PISCES, GOBIIDAE) IZ SREDOZEMSKEGA MORJA IN *IN SITU* PRIMERJAVE Z VRSTO *Gobius incognitus*

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### POVZETEK

Avtorja poročata o prvem pojavljanju vrste glavača *Gobius bucchichi* v obalnih vodah treh sredozemskih držav, Italije, Slovenije in Grčije in na ta način prispevata k poznavanju razširjenosti te vrste v Sredozemskem morju. V prispevku objavljata visokokakovostne fotografije, posnete na mestu samem in podajata glavne razlike med podobnimi vrstami, kar je uporabno orodje za identifikacijo na mestu samem in uporabno za namene monitoringa. Opisujeta habitatne preference, abundanco in vedenje vrste *G. bucchichi* in sorodnih vrst. Nadalje razpravljata o primerjavi vrste s sorodnimi vrstami, ekološke beležke in razširjenost vrste v Sredozemskem morju.

**Ključne vrste:** ključ za določanje, sredozemski glavači, novi zapisi o pojavljanju, Jadransko morje, Egejsko morje, podvodna fotografija

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