The Adriatic record of *Gobius xoriguer* Iglésias, Vukić & Šanda, 2021 and additional records of *Vanneaugobius dollfusi* Brownell, 1978 (Actinopterygii: Gobiiformes: Gobiidae)

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Résumé. – Second signalement de *Gobius xoriguer* Iglésias, Vukić & Šanda, 2021 et nouveaux signalements de *Vanneaugobius dollfusi* Brownell, 1978 (Actinopterygii: Gobiiformes: Gobiidae) en mer Adriatique.

Cette étude constitue le second signalement du gobie méditerranéen *Gobius xoriguer* Iglésias, Vukić & Šanda 2021, auparavant uniquement connu à travers sa description originale, et étend sa répartition connue à la mer Adriatique. La récolte dans l'étage bathyal (374 m) de la mer Tyrrhénienne élargit significativement sa répartition bathymétrique. Les spécimens de *Vanneaugobius dollfusi* Brownell, 1978 collectés dans la partie ouest de l'Adriatique constituent les premiers signalements de l'espèce pour l'Italie.

Key words. – Gobiinae – Circalittoral – Bathyal – New record – Adriatic Sea – Tyrrhenian Sea.

The family Gobiidae is the species richest family of fishes in the Mediterranean (Kovačić *et al*., 2022), most of them restricted to infralittoral depths (Miller, 1986). The eurybathic species and exclusively deep-water species are not just minority among Mediterranean gobies, but also, in most cases, much less known than the shallow water gobies (Kovačić *et al*., 2022). Among species present at circalittoral or even bathyal depths, six of them were described in the last decade and many others are known from a limited number of records, despite being described decades ago (Kovačić *et al*., 2022). Among the gobies present in the Mediterranean but not recorded in the Adriatic Sea, about half of them are aliens, followed by the deep circalittoral and bathyal species (Kovačić *et al*., 2022).

The fish collection, assembled by the second author (CF) and his late wife (M.E. Gramitto) in several decades of fishery investigations and biological sampling in the Adriatic Sea and the Mediterranean Sea, was recently transferred to the Museo Civico di Storia Naturale in Verona. The unidentified fish specimens of family Gobiidae present in the collection were sent to the first author (MK) for study and identification. Individuals of two rare gobiid species were found among this material. *Gobius xoriguer* Iglésias, Vukić & Šanda, 2021 is a recently described species, recorded only from the type localities in the Tyrrhenian Sea off Corsica, in the Gulf of Lyon and in the Balearic Sea (Iglésias *et al*., 2021). *Vanneaugobius dollfusi* Brownell, 1978 was described from off Agadir, Atlantic coast of Morocco, with all subsequent records from the North Mediterranean region (Kovačić, 2008 and references therein; Consoli *et al*., 2019; Kovačić and Schembri, 2019; Ordines *et al*., 2019; Iglésias *et al*., 2020).

The aim of the present work is to report the second record of *G. xoriguer*, and the first record of *V. dollfusi* for the Italian seas.

MATERIAL AND METHODS

Material herein reported was collected in the 2011 SOLEMON survey on board the R/V *G. Dallaporta*, and in the period 2003-2013, cruises CORTI, ARCO, ALTRO, carried on with the R/V *Urania*.

The sampling gear used in the SOLEMON surveys, carried on yearly to assess flatfish resources in the Adriatic GSA 17, is the professional beam-trawl rigged with iron teeth along the lower leading edge, called "rapido" by fishers, towed for 30 minutes at each station. The gobies were picked up from the large amount of epibenthic organisms in the catch discard. In the cruises with the R/V "Urania", aimed to investigate palaeontology and bionomy of deep water corals in the Adriatic and the Mediterranean seas, different kind of dredges and a Van Veen grab (surface 0.2 m^2) were used and the fishes were picked up sieving the sediment. Fishes were immediately preserved on board in a formol saline solution.

The morphological data is a combination of characters that positively identify the species in the family Gobiidae in the CLOFNAM area (Kovačić, 2008; Iglésias *et al*., 2021). The terminology and the format style of the head canal pores and head rows of sensory papillae and the meristic method followed Iglésias *et al*. (2021). The specimens were sexed from the shape and size of the urogenital papilla. The studied material is deposited in the Museo Civico di Storia Naturale, Verona, Italy (MSNVR) and the Prirodoslovni Muzej, Rijeka, Croatia (PMR).

RESULTS

***Gobius xoriguer* Iglésias, Vukić & Šanda 2021** (Fig. 1)

Studied material

Female, 48.0 + 12.3 mm, MSNVR P01016, North Tyrrhenian Sea, off Capraia, 43°13.17'N, 9°36.41'E, 374 m depth, 31 Dec. 2003, cruise CORTI st. 79. Female, 53.3 + 12.2 mm, PMR VP5426 (Fig. 1B), North Adriatic Sea, 44°29.2'N, 14°02.2'E, 58 m depth, 15 Nov. 2011, survey SOLEMON st. 53. Male, 47.7 mm, caudal fin damaged, PMR VP5427 (Fig. 1A), South Adriatic Sea, 42°01.55'N, 18°41.85'E, 47 m depth, 2 Jan. 2013, cruise ALTRO st. 25.

Identification

The species was identified by the following combination of characters: (1) all three head canals present, anterior oculoscapular

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Figure 1. – *Gobius xoriguer*. **A**: Male, 47.7 mm, caudal fin damaged, PMR VP5427, South Adriatic Sea. **B**: Female, 53.3 + 12.2 mm, PMR VP5426, North Adriatic Sea. Preserved specimens (photo M. Kovačić).

canal with pores σ, λ, $\varkappa$, ω, α, β, ϱ, posterior oculoscapular with pores $\varrho 1$, $\varrho 2$, and preopercular canal with pores γ, δ, ε; (2) anterior oculoscapular head canal with pore α at rear of orbit; (3) suborbital sensory papillae without row *a* below eye; (4) seven suborbital transverse row *c* of sensory papillae; (5) suborbital row *d* of sensory papillae discontinuous; (6) oculoscapular row x^1 of sensory papillae ending forward behind pore β; (7) anterior dorsal row *g* of sensory papillae ends behind row *o*; (8) anterior dorsal rows *o* of sensory papillae separated; (9) predorsal area scaled; (10) midlateral scale count 47-51 scales (47-52 in the present specimens); (11) second dorsal fin I/14; anal fin I/13; (12) pectoral fin 18-19 (18 in the present specimens); (13) third spine of the first dorsal fin the longest, in adult males reaching backward, when folded down, to second dorsal fin rays 2 to 5 (ray 4 in the present male); (14) pelvic disc emarginated, *i.e.* posterior edge concave.

Ecology

The specimens were collected with beam trawl at depth 58 m at bottom composed of coarse sands with rhodoliths and *Holothuria* sp. (PMR VP5426), grab at depth 47 m on bottom made of bioclastic coarse sand with calcareous algae and bryozoan, mollusks (PMR VP5427) and at depth of 374 m on a muddy ground characterized by buried white corals (MSNVR P01016).

Remarks

The present material matches well the species description (Iglésias *et al*., 2021), the meristics have extended only for the range of midlateral scale count by one scale, from 51 to 52. The species is now known from the North Tyrrhenian Sea off Corsica and Capraia, the Gulf of Lyon, the Balearic Sea and the Adriatic Sea (present records, Iglésias *et al*., 2021) (Fig. 2). The described habitats of the species include circalittoral calcareous algae beds or coarse sands with calcareous algae at depths 47-104 m and bathyal muds with fossil white corals at depth of 374 m (present records, Iglésias *et al*., 2021).

***Vanneaugobius dollfusi* Brownell, 1978** (Fig. 3)

Studied material

Male, 38.8 + 8.6 mm, PMR VP5428, West-central Adriatic Sea, 41°51.6'N, 16°15.15'E, 73 m depth, 20 Dec. 2008, cruise ARCO st. 72. Male, 34.4 + 8.6 mm, PMR VP5429 (Fig. 3A), West-central Adriatic Sea, 42°08'N, 15°30.15'E, 57 m depth, 15 Dec. 2008, cruise ARCO, st. 11. Female, 29.7 + 6.9 mm and male 36.0 + 8.5 mm, MSNVR P01017 (Fig. 3B), North-western Adriatic Sea, 44°23'N, 13°14.2'E, 59 m depth, 16 Nov. 2011, survey SOLEMON st. 22. Female, 26.8 + 5.6 mm and male 34.0 mm, caudal fin damaged, MSNVR P01018, West-central Adriatic Sea (Tremiti Islands), 42°06.9'N, 15°29.8'E, 15-20 m depth, 12 Aug. 1981.

Identification

The species was identified by the following combination of characters: (1) anterior oculoscapular and preopercular head canals present with pores σ, λ, $\varkappa$, ω, α, β, ϱ and γ, δ, ε respectively, posterior oculoscapular canal absent; (2) suborbital papillae without

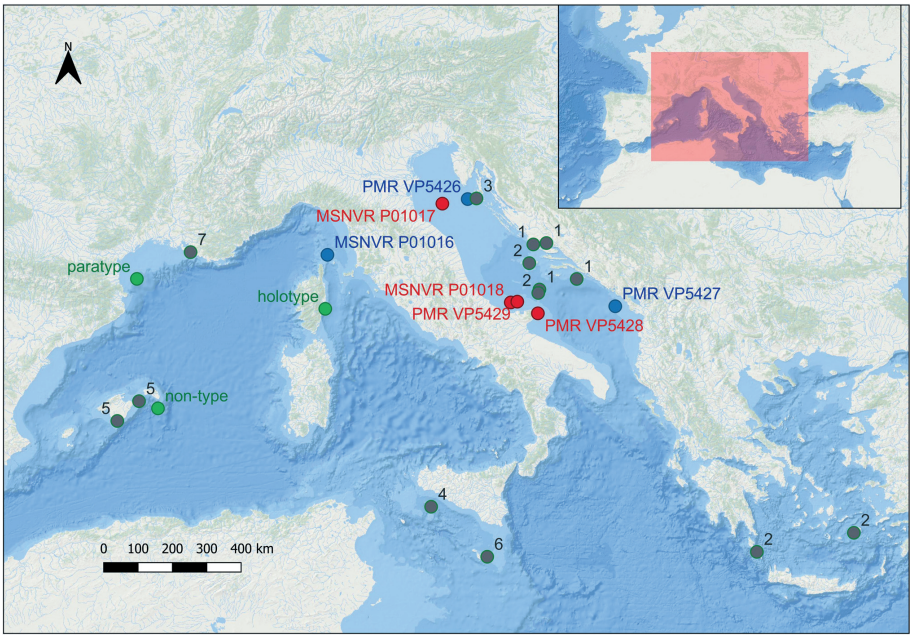

Figure 2. – The records of *Gobius xoriguer*: (●) material from the species original description (Iglésias *et al*., 2021); (●) present data. The Mediterranean records of *Vanneaugobius dollfusi*: (●) all previously published records: 1-3, Kovačić (2008) and references therein, 4: Consoli *et al*. (2019), 5: Ordines *et al*. (2019), 6: Kovačić and Schembri (2019), 7: Iglésias *et al*. (2020); (●) present data.

Figure 3. – *Vanneaugobius dollfusi*. **A**: Male, 34.4 + 8.6 mm, West-central Adriatic Sea, PMR VP5429. **B**: Female, 29.7 + 6.9 mm, North-western Adriatic Sea, MSNVR P01017. Preserved specimens (photo M. Kovačić).

longitudinal row *a*; (3) transverse suborbital rows seven (last one with 1 papilla near pore *α*); (4) suborbital row *d* continuous; (5) scales on base of caudal fin with lateral ctenii greatly enlarged (all of the them lost in MSNVR P01017 and MSNVR P01018 males, the most of them lost in MSNVR P01017 and MSNVR P01018 females); (6) second dorsal fin I/9–10; anal fin I/8–9 (present material, respectively I/10 and I/9); (7) pectoral fin 16-19 (17-19 in the present specimens); (8) first dorsal fin with spine I the longest, elongate in males; (9) pelvic fins separate; (10) first dorsal fin with dark blotch at the base between spines I and V or VI (posteriorly to spine VI in presently studied males, to spines IV-V in presently studied females).

Ecology

The specimens were collected by beam trawl at depth 59 m (MSNVR P01017), grab on muddy sand at 57 m depth and on sandy muds at 73 m (PMR VP5428 and PMR VP5429), and dredge (MSNVR P01018) at 15-20 m depth on sandy bottom near a *Posidonia* meadow.

Remarks

The present material matches well the published species morphology (Kovačić, 2008 and references therein; Consoli *et al*., 2019; Kovačić and Schembri, 2019; Ordines *et al*., 2019). Some of the present individuals have lost most, if not all, of the scales with enlarged lateral ctenii that typically appear on the base of the caudal fin. The type specimens used in the species description also lacked scales on the caudal fin base. P.J. Miller previously noted in the species description that the absence of these scales may have been a result of damage during collection or storage. The species is now known from the western and eastern Adriatic Sea, the Aegean Sea, the Strait of Sicily, Malta, Gulf of Lion and the Balearic Islands in the Mediterranean and from Agadir, the locality of the species' description in the Atlantic coast of Morocco (present records; Kovačić, 2008 and references therein; Consoli *et al*., 2019; Kovačić and Schembri, 2019; Ordines *et al*., 2019; Iglésias *et al*., 2020) (Fig. 2). The described habitats vary from the mud, sandy mud, sandy-silt bottom, bottom covered with *Osmundaria volubilis,* sand with rocky outcroppings and corals, coarse sand and gravel, shell-gravel and stones covered with calcareous red algae, maërl beds, bedrock mixed with detritic coarse sand and shell-gravel (present records, Kovačić, 2008 and references therein; Consoli *et al*., 2019; Kovačić and Schembri, 2019; Ordines *et al*., 2019; Iglésias *et al*., 2020). When observed by divers, *V. dollfusi* is usually found along the foot of deep rocky or coralligenous walls (Kovačić, 2008; Iglésias *et al*., 2020). The species has been reported from the circalittoral zone in the depth range 30-160 m (Kovačić, 2008 and references therein). The only exception is the present record from Tremiti Islands in infralittoral zone, depth 15-20 m, on sandy bottom near a *Posidonia* meadow.

DISCUSSION

The current results demonstrate the value of using different sampling gears capable of collecting small fish at various depths, like otter-trawl, beam-trawl, dredge or even grab (Iglésias *et al*., 2021). In the last decade six new deepwater gobiid species, all collected by the "Medits trawl surveys", were described in the Western Mediterranean, showing the presence of an original gobiid fauna in two deep bottom habitats: circalittoral red algae beds and bathyal muds (Iglésias *et al*., 2021; Kovačić *et al*., 2022). The Medits surveys and the present SOLEMON findings show that, even when surveys are aimed at studying exploited and potentially exploitable demersal species, a limited additional research effort aimed at searching for small fish hidden in trawl bycatch and discard may provide important scientific results.

Gobius xoriguer and *V. dollfusi,* due to their deep habitats and small size, are hard to collect and notice, which can explain why the discovery of *G. xoriguer* and the Mediterranean records of *V. dollfusi* had to wait until the present century (Kovačić, 2008; Iglésias *et al*., 2021), same as the discovery or the new records of many other deep-water small sized Mediterranean gobiid species (Kovačić *et al*., 2022). The present records of *G. xoriguer* are only the second published finding of this recently described Mediterranean goby. The westernmost Adriatic records of *V. dollfusi* represent the first record of this species for Italy. The species was reported in the Italian check-list of Osteichthyes by Relini and Lanteri (2010), but it was found only in the mid-Adriatic sector outside the Italian territorial waters, *e.g*. on the Croatian side of the Adriatic Sea.

The *Gobius xoriguer* bathyal record is interesting. It is the fifth native Mediterranean gobiid species recorded on the continental slope. The two Mediterranean bathyal species, *Gymnesigobius medits* Kovačić, Ordines, Ramirez-Amaro & Schliewen, 2019 and *Buenia lombartei* Kovačić, Ordines & Schliewen, 2018, and the two eurybathic species, *Lesueurigobius friesii* (Malm, 1874) and *Lesueurigobius suerii* (Risso, 1810), were the only gobies found in the Mediterranean bathyal zone (Goren *et al*., 2019; Kovačić *et al*., 2022). Three other species, also present in the Mediterranean, (*Crystallogobius linearis* (Düben, 1845), *Gobius roulei* De Buen, 1928, *Pomatoschistus norvegicus* (Collett, 1902)) were reported from depths of more than 200 m, but only in the Atlantic Ocean, according to Miller (1986). In addition, the alien goby *Trypauchen vagina* (Bloch & Schneider, 1801) was collected at 200 m depth in the East Mediterranean (Goren *et al*., 2019).

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