

Scientific note

First record for the Gulf of Venice: Mediterranean Cardinal fish, *Apogon imberbis* (Linnaeus, 1758), spotted in the Brijuni Marine Protected Area and marine caves at the slopes of Banjol Island (Croatia)

(Teleostei, Apogonidae)

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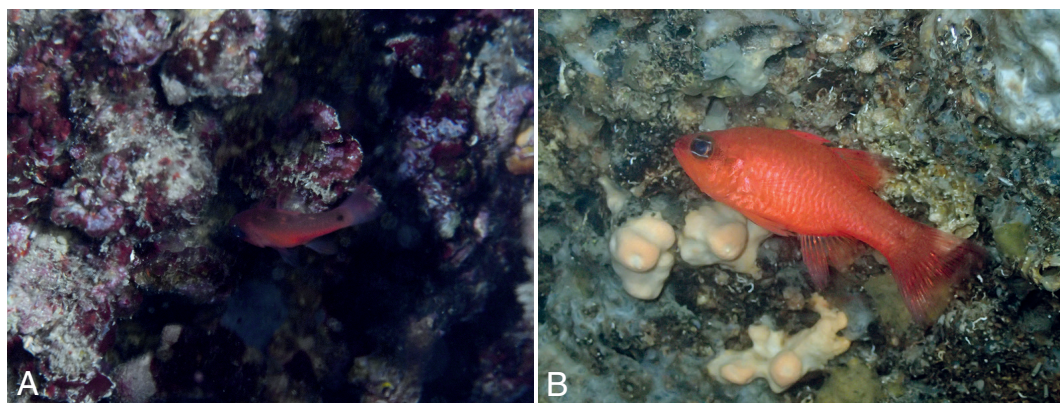


Fig. 1. Photographic records of *A. imberbis*. **A.** Brijuni MPA, crevice surrounded by red algae, *Peyssonnelia* sp. The head is to the left, the tail is to the right (Photo: B. Mavrič, June 5th, 2024). **B.** Banjol Island off the coast of Rovinj (Photo: M. Heß, March 20th, 2025).

As part of our ongoing biodiversity inventories of the Brijuni Marine Protected Area and the Island of Banjol off Rovinj (Croatia), several species of marine animals that had remained unknown for the northernmost part of the Adriatic, specifically the Gulf of Venice, were recorded for the first time (e.g. Ceseña et al. 2017, Melzer et al. 2023). In this report, we present another first record for this area: the Cardinal fish *Apogon imberbis* (Linnaeus, 1758).

It is a nocturnal species that hides during the day in dark, shady rocky habitats of the warmer regions of the Eastern Atlantic and Mediterranean Sea and that has hitherto been reported only in the southern Adriatic Sea (Tortonese 1986, Dulčić & Kovačić 2020).

During our expedition to Brijuni archipelago in 2024, one individual of a cardinalfish (Apogonidae) species, *A. imberbis*, was spotted on June 5th, 2024 during a night dive at Rt. Kavran (West, 44°54'14" N,

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13°46'33"E), in a crevice between big limestone boulders at 6 meters (Fig. 1A). On March 19th and 20th, 2025 up to six specimens of cardinal fish were observed simultaneously and photographed at the deepest cave (13 m) at the island of Banjol (45°4'27.36"N, 13°36'36.23"E) (Fig. 1B). Among Mediterranean cardinalfishes, the specimens were identified as *A. imberbis* by a species-specific combination of characters: a general red/pink coloration, large black eyes with two white horizontal stripes above and below the pupil, much greater than snout, and the (facultative) presence of dark spot(s) at the caudal fin base (Tortonese 1986, Dulčić & Kovačić 2020).

A. imberbis is a common species found throughout the Mediterranean Sea, including the central and southern Adriatic Sea (e.g. Županović 1987, Bussotti et al. 2002, 2003, Mačić et al. 2019). There are no records of its presence in the northernmost part of the Adriatic Sea, specifically the Gulf of Venice. Until the records presented here from the island of Veliki Brijun in 2024 and from the island of Banjol in 2025, no previous observations of this species were documented in these two areas, despite regular underwater surveys conducted at these locations since 2016 for the Brijuni National Park and from 2021 for the island of Banjol. This suggests that *A. imberbis* has recently expanded its range northward, potentially due to rising of the sea water temperatures (Raichich & Colucci 2019). This interpretation finds support by novel records in the adjacent sector of the Gulf of Venice off Medulin, Susak and Mali Lošinj available on iNaturalist (<https://www.inaturalist.org/observations/233767673>, 245412490 and 37467633), and also by the specimens of *A. imberbis* from Susak and Ilovik islands (near Mali Lošinj), Island of Hvar and Island of Brač stored at the Natural History Museum in Rijeka (Marcelo Kovačić, pers. comm.). As early as 1983, Kotrschal (1983) had proposed that, at that time, the north Adriatic lower sea water temperatures might hinder some thermophilic reef fishes common elsewhere in the Mediterranean from access to the Gulf of Venice; as examples he gave *Muraena helena* Linnaeus, 1758 (Muraenidae), *Anthias anthias* (Linnaeus, 1758) (Serranidae) and *Apogon imberbis*. Only *M. helena* has been spotted since that time (Lipej & Moskon 2011) and *A. imberbis* is recorded here for the first time.

There are also records of other species emerging in the area, migrating northwards as a result of "tropicalization" driven by climate change and rising water temperatures (e.g. Dulčić & Lipej 2015). Given the evident positive trends in average water temperatures in the region (e.g. da Costa et al. 2024), it is likely that more newcomers will arrive.

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