Aquatic Invasions (2009) Volume 4, Issue 2: 409-411
DOI 10.3391/ai.2009.4.2.21

Short communication

First record of the Indo-Pacific cardinal fish *Apogon fasciatus* (White, 1790) in the Mediterranean Sea

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Received 6 January 2009; accepted in revised form 2 February 2009; published online 19 February 2009

Abstract

To date, three alien species of the cardinal fish genus *Apogon* (Lacépède, 1801) have been reported from the Mediterranean Sea. Here we report the first record of a fourth Indo-Pacific species, *A. fasciatus*, from the Mediterranean coast of Israel. The invasion, within three years, of three alien cardinal fish species of Indo-Pacific origin of the soft bottom infralittoral in the eastern Mediterranean is discussed.

Key words: Mediterranean Sea, alien species, *Apogon fasciatus*

The Indo-Pacific cardinal fish, *Apogon fasciatus* (White, 1790), is the fourth species of the genus to have joined the ichthyofauna of the Levantine Sea, eastern Mediterranean. The first alien cardinal fish in the Mediterranean, *A. pharaonis* Bellotti, 1874, was reported in 1947 (Haas and Steinitz 1947). For nearly six decades, this species remained the sole alien cardinal fish in the Mediterranean. Recently, two additional species were reported: *A. queketti* Gilchrist, 1903 and *A. smithi* (Kotthaus, 1970), in 2006 and 2008 respectively (Eryilmaz and Dalyan, 2006; Golani et al. 2008; Goren et al. 2008). The three newcomers represent an ecologically distinct group of cardinal fishes. Unlike the native Mediterranean *A. imberbis* (Linaeus, 1758) - which inhabits rocky reefs and sea-grass habitats, and *A. pharaonis* - which inhabits sea grass and algae meadows, as well as soft bottom habitats (Goren et al. 2008), the three newcomer species all occur on bare muddy silt bottoms.

The taxonomic status of *A. fasciatus* is yet unsettled. Gon and Randall (2003:23) considered *A. quadrifasciatus* Cuvier, 1828, a valid species, since "live fasciatus differ from quadrifasciatus in having 3 dark stripes on the body". Fraser (2005), who studied numerous specimens, considered *A. quadrifasciatus* a junior synonym of *A. fasciatus*. That judgement was accepted by Eschmeyer (2008). We follow the recent nomenclature and use here the name *A. fasciatus*.

Abbreviations: TAU – fish collection of Tel Aviv University; TL - total length.

Apogon fasciatus (White, 1790) (Figure 1)

Mullus fasciatus White, 1790: 268, Figure 1. Type locality: Port Jackson (Australia, New South Wales); designation of neotype from type locality by Lachner in Schultz et al. 1953: 439.

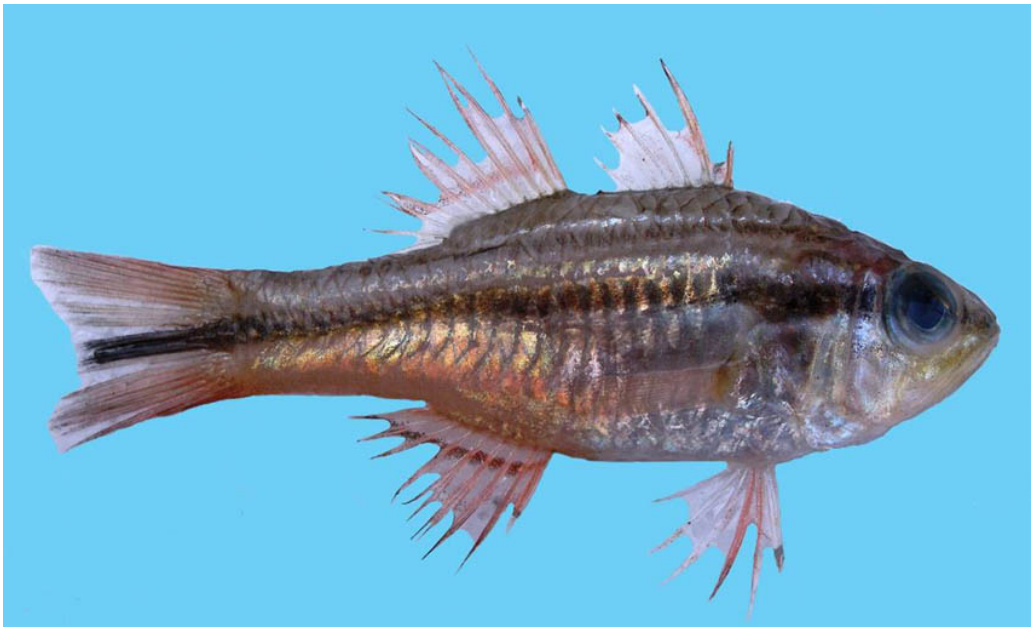

Figure 1. *Apogon fasciatus* collected off Ashdod, Israel (TAU – P. 13581)

Material examined: TAU – P. 13581, off Ashdod, 31°50'N, 34°30'E to 31°50'N 34°33'E, Israel. Three specimens TL 54.4-63.2 mm, collected 15 December, 2008 by trawl, at a depth of 40 m.

A brief description of the specimens: An *Apogon* species with two dark brown stripes on body. The lower stripe runs from snout along mid-body to end of caudal fin. Dark pigmentation on caudal fin. The upper stripe, narrower, runs from above post-temporal bone backward to below posterior end of second dorsal fin, where it become less visible, and continues to the upper origin of caudal fin. A whitish along the base of anal and both dorsal fins. In fully erected second dorsal and anal fins, a reddish stripe with tiny black spots is visible above the bright stripe. Above this, the fin is pinkish-orange with tiny black spots. Pelvic fins bright, with reddish color on membrane between third and fifth rays. Lateral line with pored scales 25-26 and 1-2 scales without pores on base of caudal fin. Median predorsal scales 5, the posterior one enlarged with median notch. First dorsal fin with 7 spines; first spine is very short, its length about one quarter of second spine, which is about one third length of third spine. Third spine is longest in first dorsal fin and very robust.

Second dorsal fin with a spine and 9 rays. Anal fin with 2 spines and 8 rays. Pectoral fin with 15-16 rays. Sixteen developed gill rakers on first gill arch. Two to three large scales on preopercle. Three-four large scales on opercle. Preopercle margin serrated.

Selected proportions are presented in Table 1.

Table 1. Selected proportions (in %) of 3 specimens of *A.fasciatus* collected off Ashdod, Israel. SD – standard deviation

Proportions in %	range	mean	SD
Standard length of total length	78.5-80.5	79.7	1.1
Head length of standard length	34.0-36.0	35.2	1.1
Body depth of standard length	28.3-33.7	30.9	2.7
Longest pectoral ray of standard length	18.0-22.4	20.5	2.2
Longest pelvic ray of standard length	21.6-23.9	22.7	1.1
Distance snout – first dorsal fin of standard length	38.9-42.6	40.9	1.9
Distance snout – second dorsal fin of standard length	58.3-58.5	58.5	0.1
Distance snout – anal fin of standard length	58.5-59.4	58.9	0.4
Eye diameter of head length	31.2-34.9	32.8	1.9
Interorbital space of head length	20.3-23.7	22.2	1.7

Remarks: *Apogon fasciatus* is distinguished from all other *Apogon* species in the Mediterranean by its unique color pattern: it lacks any vertical bar on its body and/or black spot proximally on the dorsal and anal fins. In addition, it differs from A. imberbis in having 7 spines on first dorsal fin rather than 6.

Distribution: Indo-West Pacific Ocean, from Fiji and New Caledonia, to the Persian Gulf and the Red Sea (Fraser, 2005).

The finding of three recently arrived cardinal fish species in the eastern Mediterranean is remarkable since, unlike the native *A. imberbis* and the veteran alien *A. pharaonis*, which mostly inhabit rocky reefs and sea-grass habitats (Goren et al. 2008), the newcomers have been collected on bare muddy-silt bottoms. This raises the question of the possible ecological impact of these species. Cardinal fish are nocturnal planktivorous predators (Kume 2003; Gon and Randall 2003; Barnett 2006). However, we have yet to determine whether *A. fasciatus* and the other two cardinal fish feed in the Mediterranean on zooplankton or, rather, have reverted to feeding on zoobenthos, as some other alien planktivores have done (Ogorok 1999; unpublished data).

Although the recent appearance of the three cardinal species in this habitat might be considered a coincidence, we suggest it is more likely that their almost simultaneous appearance is indicative of ecological changes that may be attributed either to a rise in water temperature in the region (EEA 2007) or to unknown biotic and/or anthropogenic factors. We suggest that a possible combination of water warming and massive trawling, together with the increased accessibility of the Mediterranean to Red Sea biota, due to the enlargement of the Suez Canal, constitute a kind of intermediate disturbance (sensu Connell 1978; Dial and Roughgarden 1998) that has led to increased biodiversity in the eastern Mediterranean.

Acknowledgements

This research was supported by the Porter School of Environmental Studies at Tel Aviv University with funding from the Italian Ministry of the Environment, Land and Sea. We thank Ms. N. Paz for editing the manuscript.

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