

NEW RECORDS OF *Aphanius fasciatus* (Valenciennes, 1821) ALONG THE EASTERN COAST OF THE ADRIATIC SEA, CROATIA

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ABSTRACT

Two new locations of Mediterranean toothcarp (*Aphanius fasciatus*) were confirmed along the eastern Adriatic coast: one on the island of Rab and the second near the small village of Zblače, near Šibenik. At both locations, multiple individuals of both sexes were caught using a small hand net. Total length ranged from 12.4 to 39.4 mm and weight ranged from 0.1 to 0.8 g.

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INTRODUCTION

Mediterranean toothcarp *Aphanius fasciatus* (Valenciennes, 1821) is a small fish (Fig. 1) highly adapted to a wide range of physicochemical conditions (Triantafyllidis et al. 2007). The IUCN lists its distribution as coastal waters of the entire Mediterranean, except the Pyrenean Peninsula (Crivelli, 2006) and the Marmara and Black Seas (Jardas, 1996; Jardas et al., 2008). It is widely distributed along the coasts of large Mediterranean islands (Kottelat & Freyhof, 2007), though Bianco et al. (1996) excluded it from Crete. It has also been recorded in the Suez Canal (Lotan & Ben-Tuvia, 1996) and recently at the mouth of the Ebro River in Spain where it was likely introduced by aquarists (Kottelat & Freyhof, 2007). Along the eastern Adriatic coast, it primarily inhabits hypersaline waters that are characterised by extreme ranges of salinity and temperature that are unsuitable for the majority of marine fish species. It has been recorded in the salt pans at Sečovlje, Slovenia (Beltram, 2007), Ulcinj, Montenegro (Saveljić, 2008), and Narta, Albania (Miočić-Stošić, 2012). Along the Adriatic coast, there are many other,

yet unchecked, suitable habitats that could be inhabited by Mediterranean toothcarp, particularly in the Albanian territory where there are several large lagoon systems (Pano et al., 2008).

According to the Red Books of freshwater and marine fish in Croatia (Mrakovčić et al., 2006; Jardas et al., 2008), this species has been recorded at several sites in Croatia: in the salt pans at Ston, Pag and Nin, in the bays Zrće and Dinjiška on the island of Pag, in the Pantan Special Ornithological/Ichthyological Reserve near Trogir and at the mouths of the Dragonja, Zrmanja, Karišnica and Neretva Rivers. Though it was previously listed that this species has a discontinuous distribution range along the entire coast, from which it also penetrates into fresh and brackish waters (Jardas, 1996; Vuković & Ivanović, 1971), the species has recently only been confirmed in the salt pans of Pag, Nin and Ston, in Dinjiška Bay on the island of Pag and in the Pantan Reserve near Trogir (Miočić-Stošić, 2012).

The species is strictly protected in Croatia pursuant to the Ordinance on strictly protected species (OG 80/13). It has been listed in the Red Book of Freshwater Fish of Croatia

(Mrakovčić et al., 2006) and the Red Book of Marine Fish of Croatia (Jardas et al., 2008) as Endangered (EN). The primary causes of threat are habitat degradation and reduction and pollution. Kottelat & Freyhof (2007) stated that Mediterranean toothcarp is threatened by competition from introduced taxa, particularly Eastern mosquitofish (*Gambusia holbrooki* Girard, 1859). On the global (Crivelli, 2006) and on European (Freyhof & Brooks, 2011) IUCN Red List, its status is that of Least Concern (LC). The species is under international protection under the Bern Convention (Annexes II and III) and the European Habitats Directive (Annex II).



Fig 1. Male individual of *Aphanius fasciatus* from salt pans at Ston, Croatia (photo by Perica Mustafić)



Fig 2 Habitat of *Aphanius fasciatus*, Soline in Supetarska Draga on Rab (photo by Zoran Marčić)



Fig 3. Habitat of *Aphanius fasciatus*, Male Soline Lake at Zablaće near Šibenik (photo by Šimun Galić, Google Earth)

MATERIAL AND METHODS

Individuals of Mediterranean toothcarp were collected using a small hand net at the Soline locality on the island of Rab, in Supetarska Draga Bay (Fig. 2) (Croatian terrestrial reference system - HTRS96_ $x = 359.945,420$; $y = 4.963.638,333$) and at Mala Solina Lake at Zablaće near Šibenik, on the central Adriatic coast (Fig. 3) (HTRS96 $x = 449.103,170$; $y = 4.841.459,723$). The species was identified according to Kottelat & Freyhof (2007). Individuals were preserved in 70% ethyl alcohol and stored at the Division of Zoology, Faculty of Science, University of Zagreb..

Total length (TL) and standard length (SL) were measured using calipers in millimetres to an accuracy of ± 0.1 mm and mass (m) was weighed in grams to an accuracy of ± 0.1 g. Bars along the flank (BF) were counted: dark blue or grey bars in males and brown bars in females.

RESULTS AND DISCUSSION

On the island of Rab, 14 individuals of *A. fasciatus* were captured at Soline in Supetarska Draga Bay on 12 August 2011. The majority of these individuals were female ($n=12$), which significantly differed from the expected sex ratio 50:50 ($\chi^2 = 0.007526$). In Mala Solina Lake at Zablaće near Šibenik on the mainland, 21 individuals of *A. fasciatus* were captured. The ratio of males and females at this site did not statistically differ from the expected sex ratio (9 males and

12 females; $\chi^2 = 0.512691$). The measurements and flank stripes for both sexes in both populations is shown in Table 1. The majority of individuals from the Rab population were

Table 1. Standard measurements and counts of bars on flanks (BF) of the two new populations of *Aphanius fasciatus* (n = number of individuals; TL = total length; SL = standard length; BF = bars on flanks; \bar{x} = mean value; SD = standard deviation; M = median)

Locality	Rab Island			Zablaće		
n	14 (2 ♂, 12 ♀)			21 (9 ♂, 12 ♀)		
Morphometric measurements	Range (min - max)	\bar{x}	SD	Range (min - max)	\bar{x}	SD
TL (mm)	12.4 - 33.8	19.6	6.8	20.2 - 39.4	30.8	5.6
SL (mm)	10.5 - 27.9	15.8	5.3	15.6 - 31.6	24.9	4.7
mass (g)	0.1 - 0.5	0.2	0.1	0.1 - 0.8	0.4	0.2
Meristic traits	Range (min - max)	M		Range (min - max)	M	
BF (♂)	9 - 9	9		8 - 12	9	
BF (♀)	6 - 11	11		7 - 12	10	

smaller than 20 mm SL, with the exception of only two females (27.9 and 25.3 mm SL). In the Zablache population, the majority of individuals were over 20 mm SL, with the exception of three females (18.7, 17.7, 15.6 mm SL). The number of bars on the flanks in males corresponded to that listed for this species in the literature (Kottelat & Freyhof, 2007); however, females exhibited fewer bars in all individuals smaller than 20 mm SL from the Rab population and in all individuals smaller than 30 mm SL from the Zablache populations.

These new findings support the claim that this species is discontinuously distributed along the entire eastern Adriatic coast (Jardas, 1996; Vuković & Ivanović, 1971) and it is evident that detailed research of all habitats that could potentially be inhabited by this species is needed. The find of two individuals of *A. fasciatus* from Vransko Lake near Biograd na moru, currently archived at the Trieste Natural History Museum under inventory number 881, is also very interesting. All historic and recently confirmed localities of *A. fasciatus* are presented in Fig. 4. The conclusions of molecular analysis (Miočić-Stošić, 2012) indicate that there are two genetically and spatially distinct population groups of *A. fasciatus* on the eastern Adriatic coast. In line with these conclusions, both of these newly discovered populations would fall within the northern population of *A. fasciatus*.



Fig 4. All known localities of *Aphanius fasciatus* in Croatia (x – historic localities; o – recently confirmed localities) (map downloaded from www.d-maps.com, downloaded on 21 April 2015)

Kottelat & Freyhof (2007) state that Mediterranean toothcarp spawns in the submerged vegetation on the seabed, with a spawning period from March to September, depending on the geographic position of the population. Populations in Italy spawn from March to June, in Greece from April to July and off Corsica from April to September. At the location on the island of Rab, eggs were also found in algae, suggesting that Mediterranean toothcarp spawns in August at this location.

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Sažetak

NOVI NALAZI OBRVANA, *Aphanius fasciatus* (Valenciennes, 1821), U HRVATSKOJ

Dva nova lokaliteta obrvana (*Aphanius fasciatus*) potvrđena su na istočnoj obali Jadranskog mora. Prvi je lokalitet na otoku Rabu, a drugi je pokraj sela Zablache u blizini Šibenika. Na obje lokacije malom ručnom mrežicom zabilježeno je više jedinki oba spola. U radu su prikazane glavne morfometrijske i merističke mjere. Totalna dužina (TL) zabilježenih jedinki obrvana varirala je od 12,4 do 39,4 mm, a masa od 0,1 do 0,8 g.

Cljučne riječi: *Aphanius fasciatus*, rasprostranjenost, Hrvatska, Jadransko more

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