

FIRST RECORD OF THREE-SPINED STICKLEBACK (*Gasterosteus aculeatus* Linnaeus, 1758) IN THE DANUBE BASIN OF CROATIA

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ABSTRACT

One specimen of three-spined stickleback (*Gasterosteus aculeatus*) was found in a puddle near the Mura River in October 2014 near the town of Mursko Središće. This is the first record of this species in the Danube Basin of Croatia.

Keywords:

Mura River

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Low-plated morph

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INTRODUCTION

The three-spined stickleback (*Gasterosteus aculeatus* Linnaeus, 1758) is a small teleost fish considered to be one of the most widely distributed freshwater fishes in the world (Morrow, 2008). In the northern hemisphere, sticklebacks are absent only along the Arctic coasts of Siberia and North America (Mrakovčić et al., 2006). In Europe they often form highly abundant populations, and in some ecosystems are dominant (Clavero et al., 2009).

Three-spined sticklebacks are listed as a species of Least Concern (LC) in the European IUCN Red List (Freyhof et al., 2008). However, freshwater populations in the Mediterranean region have experienced a sharp decline or even local extinction events (Clavero et al., 2009). Despite their wide global distribution, stickleback populations in Croatia are present in a fragmented distribution in isolated rivers of the Adriatic Basin: the Krka River (Visovac Lake), Neretva River catchment and Mirna River catchment on the Istrian peninsula (Mrakovčić et al., 2006; Zanella, 2009; Zanella et

al., 2015). Croatian populations have been categorised as endangered (EN) (Mrakovčić et al., 2006).

The ability to adapt rapidly to new environmental conditions makes the three-spined stickleback a suitable model for numerous evolutionary studies (DeFaveri et al., 2012). Over millions of years, this taxon experienced numerous freshwater habitat colonization events that resulted in repeated and independent adaptive radiation from an oceanic ancestor (Clavero et al., 2009). Today, three-spined sticklebacks exist in several morphological forms based on the expression of the number of lateral plates. Specimens with 10 or less lateral plates are called low-plated, 11-20 lateral plates are called partial-plated, and specimens with more than 20 lateral plates are called high-plated or complete morphs (Colosimo et al., 2004). Life-history traits may vary widely, and sticklebacks can exist as marine, freshwater or anadromous populations (Clavero et al., 2009). Marine forms inhabit shallow coastal areas whilst freshwater forms can be found

in various habitats, including rivers and lakes. Freshwater stickleback forms prefer areas with abundant submerged vegetation and good water flow or still water with sandy and muddy bottoms (Mrakovčić et al., 2006; Kottelat and Freyhof, 2007; Clavero et al., 2009).

MATERIAL AND METHODS

On October 7, 2014, one specimen of three-spined stickleback was accidentally found in a small temporary puddle between the Mura River and an artificial lake near the village of Miklaveč in Međimurje County. The standard length of the specimen was measured to the nearest mm. The puddle was located next to a macadam road (Croatian terrestrial reference system - HTRS96: x=500782.522; y=5149827.750), approximately 450 m from the Mura River. The specimen was preserved in 96% ethyl alcohol and stored at the Division of Zoology, Faculty of Science, University of Zagreb.

RESULTS AND DISCUSSION

This is the first record of the three-spined stickleback (Fig. 1) in the Croatian waters of the Danube Basin. The found specimen had standard length of 30 mm. The morph of this specimen was low-plated, i.e. it had less than 10 lateral plates. Sticklebacks are known to inhabit the Mura River in Slovenia and Austria (Povž and Sket, 1990; Zulka, 2006; DeFaveri et al., 2012; Govedič, 2012) where all three typical morphs (complete, partial and low) were found (Zanella, 2009). Sticklebacks are also recorded in Danube drainage in Serbia (Cakić et al., 2000; Šipos et al., 2007) and in Hungary in Drava River (Csipkés et al., 2012). The nearest finding recorded is near the villages of Bunčani and Veržej in Slovenia, approximately 15 km upstream from the Croatian-Slovenian border and 30 km from this site (DeFaveri et al., 2012). It is considered that this Slovenian population is allochthonous (Govedič, 2012) and may have been derived from populations released near Vienna about 130 years ago, very likely by aquarists (Ahnelt et al., 1998; Zanella, 2009).

Three weeks prior to this record, on September 15, 2014, the Mura River achieved the highest water levels in history

at the town of Mursko Središće (536 cm) (Sekovanič, 2014), about 10 km upstream from the finding location. It is most likely that this specimen was carried downstream with the flood wave from Slovenia and likely remained in a temporary puddle as the flood waters began to withdraw. Further research is required to confirm the possible presence of more specimens or a self-sustaining population of this species in this area. Taking into account the biology of the species and surrounding habitats, it is possible that the three-spined stickleback may be found during additional surveys.

According to several authors (Cuvier, 1829; Dhoræet al., 2001; Kottelat and Freyhof, 2007), freshwater populations of three-spined sticklebacks in Eastern Europe and coastal populations of the northern Europe are restricted to the name *G. aculeatus*, while populations of Western Europe and Mediterranean basin are called *G. gymnurus*, based exclusively on lateral plates counts (Kottelat and Freyhof, 2007). In the IUCN Red List of freshwater fishes, *G. gymnurus* is listed as a species of Least Concern (LC) (Freyhof et al., 2008) and in the Catalog of Fishes of the California Academy of Sciences (Eschmeyer, 2015), *G. gymnurus* is listed as a valid name. However, Foster et al. (2003) stated that all freshwater populations were derived from common marine ancestor which was complete or high-plated morph and the results of Zanella et al. (2015) complement the earlier genetic (Mäkinen and Merilä, 2008; DeFaveri et al., 2012) and phenotypic (Cano et al., 2008; Zanella, 2009) surveys of Adriatic stickleback populations, demonstrating widespread and substantial ecologically driven phenotypic differentiation independent of neutral genetic differentiation, suggesting that the populations of the three-spined sticklebacks of Europe form part of the species complex *G. aculeatus*.

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Sažetak

PRVI NALAZ KOLJUŠKE (*Gasterosteus aculeatus* Linnaeus, 1758) U DUNAVSKOM SLIJEVU U HRVATSKOJ

Jedna jedinka koljuške (*Gasterosteus aculeatus*) pronađena je u privremenoj lokvi pokraj rijeke Mure u listopadu 2014. godine pokraj mjesta Mursko Središće. Ovo je prvi nalaz koljuške u dunavskom slijevu u Hrvatskoj.

Ključne riječi: rijeka Mura, koljuške, malopločni oblik, dunavski slijev



Fig 2. Three-spined stickleback (*Gasterosteus aculeatus*)

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