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RECORDS OF INVASIVE EUROPEAN CATFISH *Silurus glanis* (LINNAEUS, 1758) IN THE NERETVA RIVER DELTA (CROATIA): SOCIAL MEDIA AS INFORMATION SOURCE

Pero Tutman¹, Branko Dragičević^{1*}, Jakov Dulčić¹, Višnja Bukvić², Vitaly Bekh³, Branko Glamuzina⁴

¹ Institute of Oceanography and Fisheries, Laboratory for Ichthyology and Coastal Fisheries, Šetalište Ivana Meštrovića 63, 21000 Split, Croatia

² University of Herzegovina, Blajburških žrtava 100, 88000 Mostar, Bosnia and Hercegovina

³ National University of Life and Environmental Sciences of Ukraine, Aquaculture Department Heroyiv Oborony str., 15, Kyiv – 03041, Ukraine

⁴ University of Dubrovnik, Department for Aquaculture, Ćira Carića 4, 20000 Dubrovnik, Croatia

*Corresponding Author: brankod@izor.hr

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ABSTRACT

Records of European catfish *Silurus glanis* in the Neretva River delta (Adriatic Sea basin) in Croatia are reported. The first occurrence of this non-native species was reported via social network which led to its timely detection by researchers. Origin of introduction is unknown but it is most likely the case of human-mediated introduction. The importance of social networks as a useful tool for the timely detection of non-native fish species, as well as the importance of raising awareness about the impacts of biological invasions, is discussed in this paper.

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INTRODUCTION

The modern age of the Internet and digital communication technologies has brought about a significant increase in both the speed and efficiency of information exchange. Social networking sites, i.e. Facebook, Twitter and Flickr, have proven to be an exceptional source of quality information for scientists documenting biodiversity (Barve, 2014). Such platforms have been especially important for early detection and subsequent tracking of non-indigenous species in the marine (Azzurro et al., 2013; Bariche and Azzurro, 2016; Langeneck et al., 2017) and freshwater environment (Dulčić et al., 2017) that otherwise would have hardly been obtained through regular scientific sampling (Dulčić et al., 2018). As non-indigenous species can remain undetected for years after initial colonization (Crooks, 2005), the ability to timely detect such occurrences is essential for successful mitigation of their impacts. Indeed, information obtained through social networks has already enabled early detection of non-native species in the area of the Neretva River delta in Croatia (Dulčić et al., 2017; Dulčić et al., 2018).

The introduction of non-native freshwater fish species caused by human activities represents one of the most serious threats to biodiversity and ecosystem integrity in different parts of Europe, but also worldwide (Clavero and García-Berthou, 2005; Gozlan et al., 2010; Ribeiro and Leunda, 2012). Non-native species usually have a high potential for dispersion and can impact native species by occupying their ecological niches as the former usually have competitive advantages over the latter and benefit from the absence of predators (Moyle and Light, 1996). Additionally, adverse ecological impacts on native species can also be imposed by non-natives through habitat alteration and importation, and movement of pathogens and parasites (Moyle et al., 1987).

The wide area of the Neretva River delta has been recognized as a very important freshwater wetland habitat in the Mediterranean karst area of Croatia (Mrakovčić et al., 1995; Smith and Darwall, 2006) and Bosnia and Herzegovina (Glamuzina et al., 2017). It supports rich ichthyoplankton and highly diverse fish community, as well as important commercial fisheries (Dulčić et al., 2007; Dulčić and Glamuzina, 2010). This wetland also hosts several protected ornithological and ichthyological reserves and is considered as one of the most important wetlands in Europe for resting and wintering of migratory birds (Stumberger and Schneider-Jacoby, 2010). However, this area also suffers from uncontrolled introduction of freshwater (Dulčić et al., 2011; Dulčić and Tutman, 2015; Dulčić et al., 2017) and marine non-native species (Onofri et al., 2008; Cukrov et al., 2010; Despalatović et al., 2013) which pose a threat to the natural equilibrium of the delta community.

European catfish *Silurus glanis* (Linnaeus, 1758) is native to the North, Baltic, Black, Caspian and Aral Sea drainages

but has been introduced and translocated throughout Europe and the Balkhash basin (Kazakhstan) (Kottelat and Freyhoff, 2007). Although native to rivers of Eastern Europe and Western Asia, it is currently being introduced worldwide due to its popularity among anglers and interest as a potential species for aquaculture (Alp et al., 2011). This species appears sufficiently robust for translocation and introduction outside its native range. It is the largest European freshwater fish and due to its piscivorous diet, it is assumed to pose a threat to native species and ecosystems (Copp et al., 2009). In Croatia and Bosnia and Herzegovina, it is native in the Danube basin but it has also been introduced in the lakes of the Adriatic basin, namely Vransko Lake near Biograd and Peručko Reservoir in the Cetina River basin (Sofradžija, 2009; Pofuk et al., 2017; Čaleta et al., 2019). In Bosnia and Herzegovina, it has been introduced in Buško Blato Reservoir in the Cetina River basin (Aganović et al., 1974) and Bilečko Lake Reservoir in the Trebišnjica River basin (Hamzić et al., 2008). Recently it has also been introduced in the Hutovo Blato wetland (Glamuzina et al., 2010).

The aim of this study is to present the first record of non-native *S. glanis* from the Neretva River delta (Adriatic Sea basin), indicating an extension of the known distribution of this species in Croatia. Additionally, the role of social networks in obtaining and transmitting information essential for tracking biodiversity changes is discussed.

MATERIAL AND METHODS

On 15 April 2018, a photograph of a fish was posted by a fisherman in the Facebook group titled „Morski ribolov“ (Eng. Marine fisheries), with a request for its identification. The specimen was caught in the area close to the Neretva River delta (42°9733 N, 17°6075 E; Fig. 1 – Location 1).

The features which helped identify the species as *Silurus glanis* were as follows: elongated body, mottled body colour pattern and particularly long and emarginated anal fin and long barbels (Fig. 2). These were in agreement with the description provided by Kottelat and Freyhoff (2007). After the identification, the fisherman who posted the photograph was contacted and additional data on this, but also on other occurrences of the same species, were obtained. The photographed individual of *S. glanis* was approximately 30 cm long (TL) and weighed 0.30 kg. Unfortunately, additional data, such as those on habitat type and water temperature were not available. According to the fisherman's statement, in the same catch, approx. 10 specimens of *S. glanis* were caught along with other non-native fish species such as *Ameiurus nebulosus* (Linnaeus, 1758) and *Micropterus salmoides* (Linnaeus, 1766). Additionally, a photo of another specimen, previously caught near Lake Kutu, was also provided by the fisherman. Upon this realization, other fishermen operating in the same area were contacted.

Several of these fishermen confirmed the presence of *S. glanis* in the wider area of the Neretva River delta in the

recent period and one provided an additional photo of a large specimen caught in the area of the Hutovo Blato. None of the specimens were preserved. Through a web search, a media article reporting a catch of a large specimen (150 cm TL and weighing over 20 kg) caught in the wider area of the Neretva River delta was

found. In this article, the fisherman stated that other catches of the same species occurred in the area (<http://metkovic-news.com/news/nas-poznati-ribolovac-ante-krsticevic-baja-ulovio-soma-od-metar-i-pol-teskog-preko-20-kg/>).

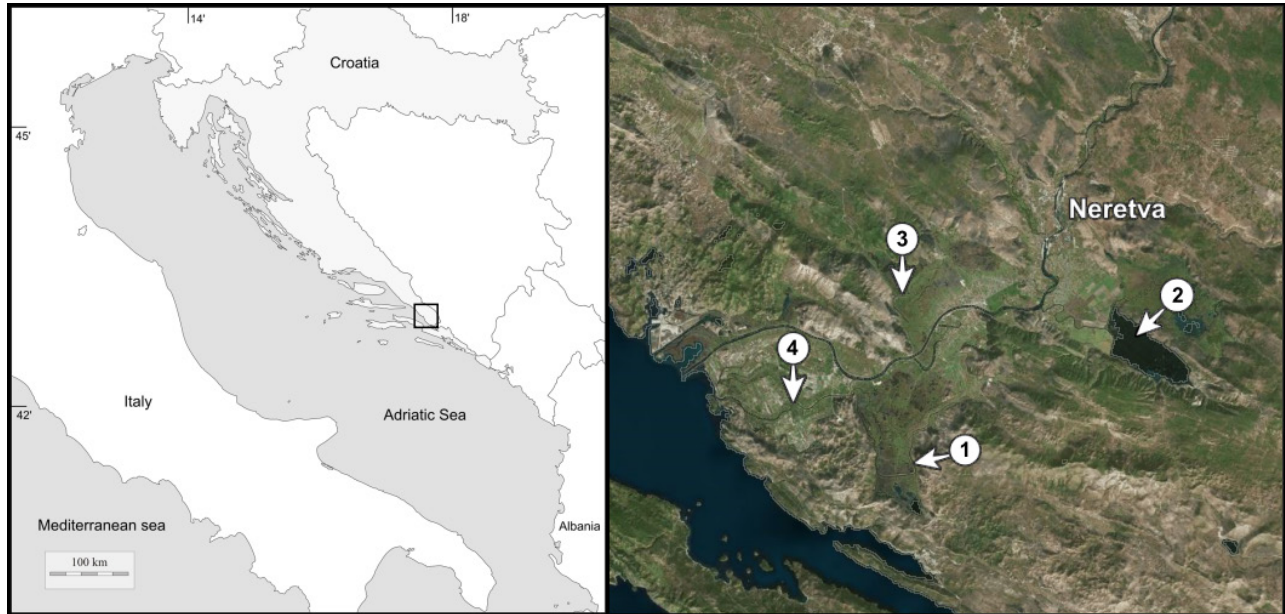


Fig 1. Location of the area where occurrences of *S. glanis* have been recorded. Numbers correspond to the locations indicated in the paper



Fig 2. The specimen of *Silurus glanis* caught in the area of Neretva River delta on 15 April 2018. This photo was posted by the fisherman in the Facebook group „Morski ribolov“

RESULTS AND DISCUSSION

The modern age has brought significant changes in the field of digital innovation, especially in the development of social communication media, which have opened up large and numerous opportunities in obtaining data valuable to research and conservation. Social networks have become an increasingly important source of information relevant to researchers that would otherwise go unnoticed. This has been especially important in tracking occurrences of non-indigenous species, as already evidenced through many studies (e.g. Dulčić et al., 2017; Dulčić et al., 2018; Langeneck et al., 2017). Interest groups on social networks (i.e. Facebook), oriented toward fishery, biodiversity or other related topics, have provided a common place for sharing photos and videos of various species and in such a way have greatly improved the odds of early detection of those species which are non-native. This means of obtaining information has been especially important in cases and particular areas where no comprehensive and targeted monitoring system has been deployed. Recording and reporting species in non-native areas represents the initial step in the process of preventing invasions or mitigating their consequences (Banha et al., 2015). To raise the possibility of reporting such occurrences by the local community, it is also essential to spread the information about the importance of reporting such findings to researchers. In our case, such a step has already been initiated through contacts with local fishermen to whom such information has been provided. In this area, there has been no specific sampling network established for non-native species detection. Therefore, reports by local people may provide valuable information, complementing other sources and improving monitoring and action plans dealing with aquatic invasions. Such reports have also proven to be valuable in cases of largemouth bass *Micropterus salmoides* (Lacépède, 1802) and featherfin squeaker *Synodontis eupterus* (Boulenger, 1901) which came to the attention of scientists through reports shared on social network (Dulčić et al., 2017, 2018).

Silurus glanis is native to the Danube basin in Bosnia and Herzegovina and Croatia, but it has been introduced and translocated in freshwaters throughout the Adriatic Sea basin where it is considered invasive (Glamuzina et al., 2017; Pofuk et al., 2017). Because of its ability to adapt and robustness which facilitates its translocation and introduction into new habitats, established populations outside of its native range are known to cause negative effects in the new environment (Copp et al., 2009). As a voracious predator, invasive *S. glanis* can disrupt the native ecology of the systems to which they have been introduced. The risk that *S. glanis* poses to the native fauna includes a decrease of abundance of native fish and other vertebrates (i.e. amphibians) through predation and competitive advantage and indirect alteration of planktonic and benthic communities through its effects on the food chain (Kottelat and Freyhof, 2007; Carol et al.,

2009; Almeida et al., 2013).

The origin of *S. glanis* in the Neretva River delta area has not been established with certainty. It is a widespread and highly valued species in sportive and recreational fishery in its native range in the Danube basin in Croatia (Čaleta et al., 2019). It is also known to be used for illegal stocking. Given the length range of recorded specimens (ranging from approx. 30 to 150 cm) and taking into account the fact that at a length of 30 cm catfish is still in its juvenile phase (Alp et al., 2004), it could be suggested that this area hosts an established population of the species. Anecdotal evidence on the previous occurrences of *S. glanis* in the Neretva River delta suggests it was first recorded in 2011 from the River Norin (a right-hand tributary of the lower River Neretva; Fig. 1 – Location 2) (Glamuzina, unpublished data). Some years previously, catfish were introduced for sport fishing into the Hutovo Blato wetland in Bosnia and Herzegovina (lower Neretva River basin) (Glamuzina et al., 2010), where it is now frequent (Glamuzina, unpublished data). The fishermen's observations suggest possible establishment in the shallow and warmer River Mala Neretva wetland area (Neretva River delta; Fig. 1 – Location 3). Recently, it has also been recorded in a reservoir in the middle Neretva River basin and further upstream in Jablaničko Reservoir in Bosnia and Herzegovina (Glamuzina, unpublished data). Data presented in this study, together with occasional records in other estuarine and riverine areas of the region, suggest that invasion by this species may be limited to shallow, warmer and slightly brackish estuarine areas. Additionally, it seems that following its introduction, this species subsequently became economically relevant locally, evidenced by its price at fish markets of 50 HRK/kg (approx. 7 EUR per kg).

Intentional and unintentional introductions by anglers have been major drivers behind the spread of *S. glanis* (Carol et al., 2009). Anglers intentionally introduce this species to create more fishing opportunities, without considering the potential impacts. At present, the impacts of *S. glanis* on the native ecosystem are unknown and should be investigated in the future.

Besides the expansion of non-indigenous species in the Neretva River delta (Onofri et al., 2008; Cukrov, 2010; Despalatović et al., 2013; Dulčić and Tutman, 2015; Dulčić et al., 2011, 2017, 2018), this area has also been exposed to various other anthropogenic stressors such as organic and nutrient pollution and contamination from agriculture and local industries, and hydromorphological degradation of habitats (Mateljak and Matić, 2011). Saltwater intrusion deep through the Neretva River delta (Glamuzina et al., 2019; Glamuzina and Dobrosravić, 2020), as a result of anthropogenic influence and climate change, represents an additional threat to the ecosystem.

Despite rich biodiversity in the area, threatened by an increasing number of non-native species, there are no species monitoring and detection networks established. Therefore, additional sources of information such as those

obtained through social networks have proven to be of great value in early detection of non-native species. Also, there is an urgent need for additional research aimed at the detection and evaluation of impacts of such species. Data obtained through such research should provide a basis for mitigation of impacts of non-native species, especially those which prove to be invasive. To achieve the desired goals, monitoring of the *S. glanis* spreading and the potential effect on the environment and local fishery in the Neretva River delta is strongly recommended.

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NALAZI INVAZIVNOG EUROPSKOG SOMA, *Silurus glanis* (LINNAEUS, 1758.), U DELTI RIJEKE NERETVE, HRVATSKA: INFORMACIJE PRIKUPLJENE KROZ DRUŠTVENE MREŽE

SAŽETAK

U radu se prikazuju nalazi europskog soma *Silurus glanis* u delti rijeke Neretve (sliv Jadranskog mora) u Hrvatskoj. Pojava ove nezavičajne vrste prijavljena je putem društvene mreže, što je dovelo i do pravovremenog otkrivanja od strane istraživača. Podrijetlo unosa vrste nije poznato, ali najvjerojatnije se radi o namjernom unosu posredstvom čovjeka. U radu se govori o važnosti društvenih mreža kao korisnog alata za pravovremeno otkrivanje nezavičajnih vrsta riba, kao i o važnosti podizanja svijesti o utjecajima bioloških invazija.

Ključne riječi: prvi zapis, strane vrste, sliv Jadranskog mora, kontrola upravljanja

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