

# Invasiveness assessment of European perch (*Perca fluviatilis*), pike-perch (*Sander lucioperca*) and northern pike (*Esox lucius*) in Albanian freshwater ecosystems by using the Aquatic Species Invasiveness Screening Kit (AS-ISK)

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## ABSTRACT

Fresh water ecosystems in the Balkan region are well recognized by high level of endemism and therefore could be very sensitive to the negative impact of invasive fish species. These impacts are due to interaction among native and non-native fauna. Generally, the most obvious and common ones are competition for food and space resources as well as the predation. In order to evaluate the current or future impacts of these non-native fish species, Aquatic Species Invasiveness Screening Kit (AS-ISK) risk identification screening tools was used to assess the invasiveness potential of these fish species in Albanian freshwater ecosystems. The basic AS-ISK score for all the considered species suggests that these species pose a high risk of being invasive, and this risk is expected to be even higher in the future for European perch, taking in consideration the potential effects of climate change. This study results suggest that it can be a useful decision-support tool for informing legislation, policy and management of potential, existing and even future, undesired translocations of non-native freshwater fish species in the country, like the northern pike.

**Keywords:** Biological Invasion, Risk Analyses, Non-native Species, Kukes Lake, Shkoder Lake, Prespa lake

## INTRODUCTION

The pioneer studies on Non-Native (NN) or Non-Indigenous species (NIS) date back to the 1970s. Since then, global research in this field has grown rapidly. Globally, the introduction of marine and freshwater NIS can

happen deliberately or accidentally. Balkan Peninsula, one of the world biodiversity hotspots, possesses the highest proportion of range-restricted endemic fish species in Europe. However, recent surveys from several

Balkan countries have revealed that 15%–23% of their freshwater fish fauna is alien, with catchments, such as the Danube River and Pamvotis Lake (Greece) having ichthyofauna comprised of more than 50% and 80% of alien fishes, respectively. Until the early 1950s, introductions were primarily of North American and Asian species, while the interest for the species from Northern and Western Europe arose later. In total, 60 fish species have been introduced in the Balkan Peninsula intentionally, accidentally, or by natural dispersal (Piria *et al.*, 2017).

European perch (*Perca fluviatilis*) and pike-perch (*Sander lucioperca*) represent ray-finned fish from the family Percidae, while northern pike (*Esox lucius*) represent a member of Esocidae family; all these species are present almost in most of the European countries and several studies have been conducted about the invasiveness in different European regions. In Albania the European perch and the pike perch have been introduced from more than one decade (Shumka *et al.*, 2008; Mrdak *et al.*, 2018), though their distribution is restricted in Shkoder Lake (only European perch) and Fierza Lake (both species). Regarding the northern pike (*Esox lucius*, native in northern Europe) there is also evidence for an unsuccessful introduction in Prespa lakes (Crivelli *et al.*, 1997); though in Albania it is inexistent (Shumka & Apostolou, 2018), its presence has been documented in Greece (Bobori & Economidis, 2006) and Northern Macedonia (Talevski *et al.*, 2009).

The aim of the study presented in this scientific paper is to assess the invasiveness potential 3 fish species in Albanian freshwater ecosystems by using the Aquatic Species Invasiveness Screening Kit (AS-ISK) risk identification screening tool to evaluate the current and future impacts of these non-native fish species.

## MATERIAL AND METHODS

In order to identify the potential invasiveness of European perch (sharroku in Albanian language), pike-perch (lucioperka) and northern pike, the AS-ISK decision-support toolkit was used by us. Responses to these (Qs) questions provide a Basic Risk Assessment (BRA) score, which is complemented by six additional ‘climate change’ questions that ask the assessor to foretell the likely effects of predicted future climate on the risk screening (risks and magnitude of introduction, establishment and dispersal). Response scores to these Climate Change Assessment (CCA) Qs are added to the BRA score (BRA + CCA score). It is important to identify a ‘threshold’ value for the risk assessment (RA) area concerned by way of a ‘calibration’ process to distinguish between species of medium and high risk of invasiveness (Copp *et al.*, 2020).

Because there has been no calibration of AS-ISK for (freshwater fish in) Albania, the choice of BRA and BRA + CCA thresholds to distinguish between medium vs high risk was based on the identified threshold values by Glamuzina *et al.* (2017) for 24 freshwater fish species in Balkans, the BRA threshold of 10 and BRA + CCA threshold of 12.62, for the same set of species.

## RESULTS AND DISCUSSION

Native to Eurasia (in Europe from northern Europe), *P. fluviatilis* has been widely introduced as a sport fish. Several countries have reported adverse ecological impacts after the introduction of *P. fluviatilis* (Froese & Pauly, 2011; Mrdak *et al.*, 2017). Its habitat are represented by freshwater and brackish water ecosystems. In Fierza Lake (5000 ha) shared with former Yugoslavia, beginnings from 1980

there are introduced (escapees from some fish farms) two other species: pike perch and European perch. Most of introduced fish species in Albania are aquaculture aimed and more rarely for recreational fishery (Shumka *et al.*, 2008).

*S. lucioperca* is an obligate piscivore as an adult, this species will predate on native and non-native fish species where introduced. *S. lucioperca* is a vector of fish diseases and parasites which can be transmitted to native and farmed fish and it has also been found to be capable of hybridizing with Eurasian perch (*P. fluviatilis*) (Kahilainen *et al.*, 2011) and Volga perch (*Sander volgensis*) (Specziar *et al.*, 2009; Müller *et al.*, 2010).

There is also evidence for an unsuccessful introduction of *Esox lucius* in Prespa lakes

(Crivelli *et al.*, 1997). Though in Albania it is inexistent (Shumka & Apostolou, 2018), its presence has been documented in Greece (Bobori & Economidis, 2006) and Northern Macedonia (Talevski *et al.*, 2009).

Regarding *P. fluviatilis*, as it is shown in Fig. 1, based on the reference threshold score of 10 (Glamuzina *et al.*, 2017), the identified average BRA score (by the three assessors) in Albania (24.7) falls within the ‘high risk’ category. When the potential effects of climate change on the risk screening responses are taken into consideration, *P. fluviatilis* BRA + CCA score increases to 36.7 (hence well above the 12.62 threshold) reflecting an even higher risk of the species being invasive in Albania in the future.

Identified average BRA score (by the three

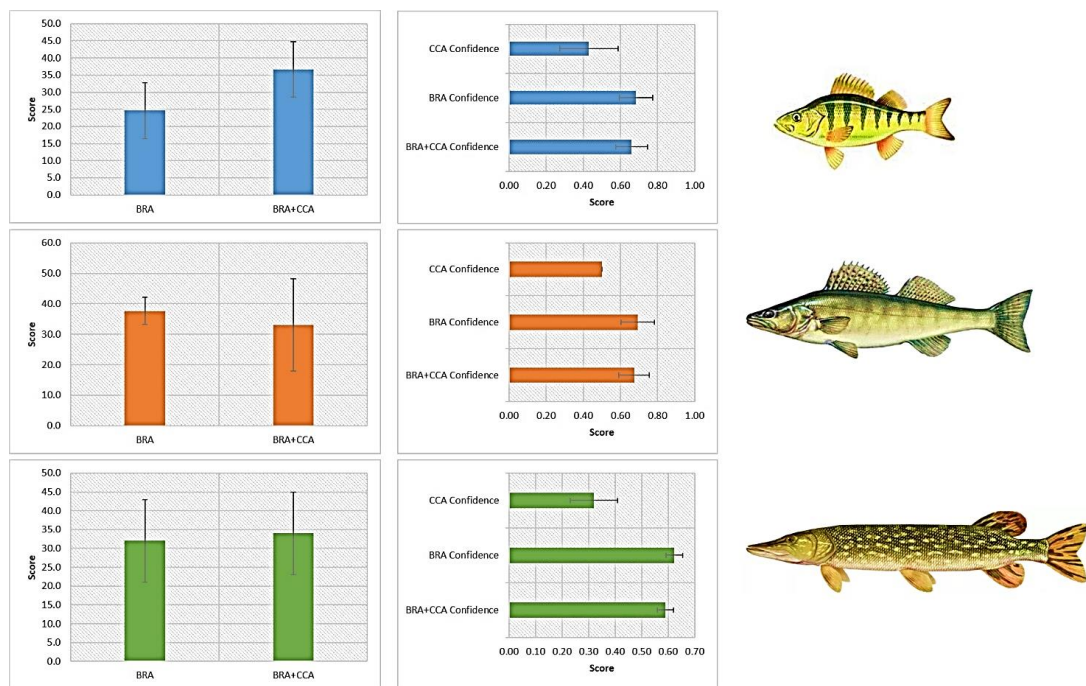


Figure 1. Estimated AS-ISK decision-support toolkit scores for each of the species: in front *P. fluviatilis*, middle *S. lucioperca* and bottom *E. lucius*

assessors) in Albania (37.7) falls within the ‘high risk’ category (*S. lucioperca*). When the potential effects of climate change on the risk screening responses are taken into consideration, *S. lucioperca* BRA + CCA score

increases to 33.0 (hence well above the 12.62 threshold) reflecting a high risk of the species being invasive in Albania in the future, but little influence by the climate change effects.

Resulting average BRA score (by the three

assessors) in Albania (32) falls within the ‘high risk’ category – it means that it will be highly invasive when it will be present in the Albanian territory (*E. lucius*). When the potential effects of climate change on the risk screening responses are taken into consideration, *E. lucius* BRA + CCA score increases to 34 (hence well above the 12.62 threshold) reflecting an even higher risk of the species being invasive in Albania in the future, it would be present – registered presence in

North Macedonia and Greece.

Generally (for all the investigated species, Fig. 2), the most affected sectors will be those included in the commercial sectors category (represented mostly by fisheries and aquaculture). Not less important are also the species or population nuisance traits, which will create problems to the biota of the aquatic ecosystem, with indirect effects to fishery sectors.

Discrepancies came out during the

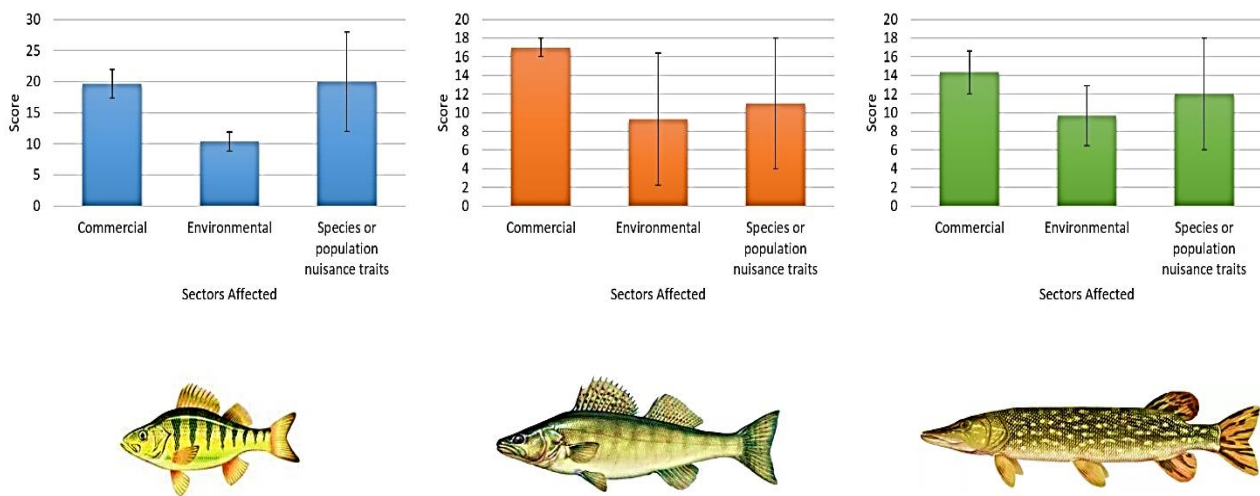


Figure 2. The sectors affected by the potential invasiveness of the considered freshwater species in this study, based on the estimated scores by AS-ISK

evaluation of the climate change effects to the invasiveness of pike-perch, while the evaluators were certain for the other two

species (Fig. 3). Probably, the climate change will contribute to larger distribution of European perch in the Albanian territory.

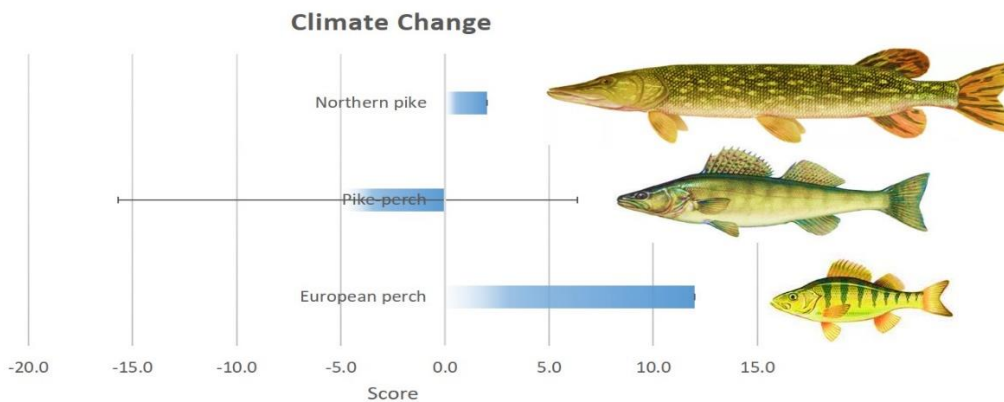


Figure 3. Climate change effects to the potential invasiveness of the considered freshwater species in this study, based on the estimated scores by AS-ISK

This is the first estimation performed in the Albanian territorial waters and survey based investigations in the near future would be required to confirm these estimations for the considered species in the study. In addition, further investigations would be required by the presence of other potentially invasive freshwater fish species.

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# **Procjena invazivnosti grgeča (*Perca fluviatilis*), smuđa (*Sander lucioperca*) i štuke (*Esox lucius*) u albanskim slatkovodnim ekosistemima upotrebom metoda za procjenu invazivnosti vodenih vrsta (AS-ISK)**

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## **SAŽETAK**

Slatkovodni ekosistemi na Balkanu su dobro poznati po visokom nivou endemizma i stoga bi mogli biti veoma osjetljivi na negativan uticaj invazivnih vrsta riba. Ovi uticaji su posledica interakcije između autohtone i alohtone faune. Uopšteno govoreći, najočigledniji i najčešći su takmičenje za hranu i prostor kao i predatorstvo. Da bi se procijenili trenutni ili budući uticaji alohtonih vrsta riba, korišćen je Metod za procjenu invazivnosti vodenih vrsta (AS-ISK) za procjenu potencijala invazivnosti ovih vrsta riba u albanskim slatkovodnim ekosistemima. Osnovni AS-ISK rezultat za sve razmatrane vrste sugerise da ove vrste predstavljaju visok rizik da budu invazivne, a očekuje se da će ovaj rizik u budućnosti biti još veći za grgeča, uzimajući u obzir i potencijalne efekte klimatskih promjena. Rezultati ove studije sugerisu da to može biti koristan pomoćni alat u odlukama za informisanje o zakonodavstvu, politici i upravljanju potencijalnim, postojećim, pa čak i budućim, neželjenim premještanjima alohtonih slatkovodnih vrsta riba u zemlji, kao što je štika.

**Ključne riječi:** biološka invazija, analiza rizika, alohtone vrste, Kukeš jezero, Skadarsko jezero, prespanska jezera