AMAZON SAILFIN CATFISH *PTERYGOPLICHTHYS PARDALIS* (CASTELNNUA, 1855) (LORICARIIDAE, SILURIFORMES), A NEW FISH SPECIES RECORDED IN THE SERBIAN SECTION OF THE DANUBE RIVER

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ABSTRACT

Amazon sailfin catfish *Pterygoplichthys pardalis* (Castelnau, 1855) (Loricariidae, Siluriformes) is a new non-indigenous fish species recorded in the Serbian section of the Danube River, being reported for the first time in inland waters of Europe, as well. A single, female fish was ripe and in good shape, although considering its original neotropical dispersal area and recording of occurrence in summer, with the only single female individual, its acclimatization is not likely. However, both its estimated invasive potential after the FISK protocol scoring of 26 and the risk of its introduction and establishment in the recipient area in concern after the IFRA protocol scoring of 61 should be considered moderate. That, together with the invasive history of this sailfin catfish and its congeners in south-eastern Asia and Meso-American region imposes a need for precaution.

Keywords: Alien fish species, Amazon sailfin catfish, *Pterygoplichthys pardalis*, Danube River, Serbia

Introduction

Danube River is the most downstream constituent of the Southern Corridor as the one of four main invasion corridors in Europe that links Black and Northern Seas via Danube River, Rhine – Main canal and Rhine River. The total length of that corridor is about 3500 km, with more than 125 harbors and 67 locks along that waterway (23). Danube River and its backwaters in Serbia comprise the pool of 17 introduced fish species originating from the moderate climate regions (Ponto-Caspian, North American and Siberian regions), being of the various status and of different invasive traits. Within that alien species pool, declaring certain species invasive after Richardson et al. (25) in the Danube River was possible only after an estimation of their invasive potential using available risk assessment procedures, which showed that gibel carp *Carassius gibelio* and two bullhead species, *Ictalurus melas* and *Ictalurus nebulosus* are the most invasive fish species in the Serbian section of the Danube River and its large tributaries, as well as with the greatest likeliness for successful introduction and acclimatization in that recipient area (27).

Risk assessment protocols were promoted first as tools after the implementation of the codes of practice (CoP) for responsible fisheries management (ICES 1995, 2004), primarily for the purpose of intentional introductions of fish (15, 16). Subsequently, the risk assessment protocols were developed for the non-native fish already occurring, or those most likely to get imported, as well as for intentionally introduced fish species (17). Copp et al. (9) developed the protocols for hazard identification and hazard assessment of the invading potential of non-native fish species already occurring in inland waters of the UK, or those assumed as potential invaders. It was developed using the semi-quantitative approach of Pheloung et al. (24) to provide 1) the hazard identification, using the Fish Invasiveness Screening Kit (FISK) protocol that identifies a hazard of non-native fish species that have been already introduced, or are likely to be introduced, and 2) the hazard assessment, using Invasive Fish Risk Assessment (IFRA) protocol. Whereas the FISK protocol identifies the risk by evaluating features of biogeography and history of invasiveness (domestication
and/or cultivation, climate and distribution, invasiveness elsewhere) of alien fish species, as well as those in concern to their biology and ecology (undesirable or persistence traits, feeding guild, reproduction, dispersal mechanisms and tolerance attributes), the IFRA protocol evaluates the risk of introduction of invasive fish species by evaluating 1) the likelihood, i.e., risk of deliberate and accidental, i.e., unintentional introductions of particular non-native fish species; 2) risk of establishment, i.e., naturalization of particular non-native fish species by examining the environmental similarity – degree of matching between the environments of native and introduced areas; 3) impact assessment, decomposed to three components: economic impact, environmental impact, social impact and likelihood of dispersal and spread, including the risk of importing the new fish diseases. It provides the series of paces leading the evaluator through the process of the characterization of fish species. In addition to the firm determinants, there is also the possibility to declare as yet unknown features in 13 given paces, and to calculate the “uncertainty level” by calculating the percentage of occurrence of unknown features.

Weber (28, 29) assigned sailfin catfishes to three genera and described this species as new under the name Loposarcus pardalis. Armbruster (1), after a detailed systematic review, placed the genus Liposarcus into the synonymy of Pterygoplichthys. Weber (29) provided a key and distinguishing characteristics and photographs of specimens. Page (21) also provided a few distinguishing characteristics and Armbruster (4) and Armbruster & Page (5) provided the most recent identification key for this genus that helped in final distinguishing between species. Measurements and counts for several Florida specimens were given by Ludlow and Walsh (18).

The native dispersal range of Amazon sailfin catfish encloses the Amazon River Basin (lower, middle and upper) of Brasil and Peru, South America (30). It favors tropical climate conditions, as well as neutral and hard water, with the optimal temperature range between 23°C and 28°C.

The sailfin catfish genus Pterygoplichthys already has the invasive history, since species P. multiradiatus, P. pardalis and P. disjunctivus have been so far recorded as exotic in Mesoamerica – Puerto Rico and Mexico (8, 12); in North America: southern United States – Florida, Texas, Washington and North Carolina, as well as at Hawaii islands (10, 11, 19, 18, 20); in Philippines and south-eastern Asia: peninsular Malaysia, Singapore, Taiwan, Java and Sumatra (22). In all those recipient areas recorded so far, the aquarists were assigned responsible for their releasing into natural ecosystems and subsequent establishment.

This paper reports about the appearance of the Amazon sailfin catfish Pterygoplichthys pardalis (Castelnau, 1855) (Loricariidae, Siluriformes) in the Serbian section of the Danube River belonging to its middle course and considers a risk of introduction into, as well as an invasiveness of that fish species in this new recipient area.

### Materials and Methods

Amazon sailfin catfish was caught in the Danube River on August 6, 2009 in about 5 p.m., at the river km 1026, in the area of village of Orešac (44°39’29.00”N and 20°49’45.98”E) situated at the right bank (Fig. 1). Only that one individual was caught by professional fisherman, who used deep-running drifting seine net of the length of about 60 m, depth of 1.85 m and of the mesh size of 4.5 cm, driven downstream at the mainstream about 80 m from the left bank’s shoreline, at the depth of about 20 m. Fish was kept alive in the keeping tank and taken from the fisherman tomorrow afternoon.
(August 7, 2009) and kept alive for three more days in very harsh conditions in field, until the submersion into the anesthetics (MS 222) and immediate preservation in 70% ethanol two days later (August 9, 2009). The identification was accomplished using keys of Armbruster (3, 4) and Armbruster & Page (5). It was measured for standard, fork and total lengths (Sl, Fl and Tl, respectively) by digital caliper (of 0.01 mm precision), as well as for weight (w) by digital scale Philips HR 2388 (of 1 g precision). Gender was assessed by dissection, as well as the feeding status.

Fig. 2. Lateral (a), dorsal (b) and ventral (c) views of the female Amazon sailfin catfish Pterygoplichthys pardalis caught in the Serbian section of the Danube River, showing plated trunk and round caudal peduncle with the adipose fin and chevrons, pectoral girdle covered in skin, as well as the naked head and belly with spots tied into short vermiculations in coloration.

Fish Invasiveness Screening Kit (FISK) and Invasive Fish Risk Assessment (IFRA) protocols (9) were used to esteem hazards from invasiveness in and from introduction into the recipient area, respectively, for the Amazon sailfin catfish as a new and alien fish species for the Danube River ecosystem.

Results and Discussion

Individual in concern (Fig. 2a-c) was female (Fig. 3a) of 192.44 mm in Sl, 223.29 mm in Fl and 254.73 mm in Tl, as well as of 111 g in w. D I 11, A I 4, P I 5, V I 5, C I 15 I, lateral plates 28. Body behind head completely plated dorsally and laterally (Fig. 2a-b). Belly naked, with the plates occurring on the ventral side of the body only at the caudal peduncle in one longitudinal row (Fig. 2c). Ventral surface of the pectoral girdle covered in skin mesial to the coracoid strut (Fig. 2b). Caudal peduncle round in cross section. Adipose fin present (Fig. 2a). Edge of snout covered with plates (Fig. 3b). Postdorsal ridge inconspicuous, with the single, median, unpaired preadipose plate (Fig. 3c). Each jaw ramus with 17 – 19, i.e, less than 60, but anyway more than 10 teeth (Fig. 3d). Lateral plates clearly keeled, with sharp and short odontodes directed posteriorly (Fig. 3e). Supraoccipital without a distinct median crest. Belly with broad dark and narrow light vermiculations, short in length and contain less than five coalescing spots. Dark vermiculations on head and chevrons on caudal peduncle (Fig. 2). The stomach was empty and only the most distal part of gut contained traces of entirely digested food material dark green to brownish in colour.

The IFRA protocol score of 61 for the Amazon sailfin catfish denoted it as a species of an overall moderate risk of acting like an invasive species. Its Establishment Risk Score of 8 is low, as well as the Economic Risk Score of 1, Environmental Risk Score of 1 and Social Impact Score of 1. However, it revealed very high Risk of Dispersal Score of 16 due to an occurrence of convenient habitats and their availability to it, as well as due to its environmental versatility. Therefore, it achieved the very high Impact Assessment Score of 30, due to influence it might have on the benthic resources if it would establish in the recipient area. The FISK protocol score of 26 also denoted this species as moderately capable of establishment. Its score of Domestification/Cultivation was 2, Climate & Distribution 3, Invasive Elsewhere 7, Undesirable or Persistent Traits 7, Feeding Guild 2, Reproduction 2, Dispersal Mechanisms 2 and Tolerance Attributes 1.
This finding of Amazon sailfin catfish is the first one reported in inland waters of Europe. Finding of a single female specimen of Amazon sailfin catfish does not imply automatically its occurrence, i.e., introduction into the Danube River ecosystem, regardless of the ripeness of her gonads (Figure 3) in late summer period. Having in mind the optimal temperature range for this tropical fish species, an establishment event for it seems fair unlikely. However, both FISK and IFRA scores it gained (26 and 61, respectively) warn, when comparing them with those of giebel carp, who scored 36 and 77, respectively, or bullhead species, who scored 30 and 71, respectively, and imply its environmental versatility and certain invasive potential for the Danube River ecosystem closest to that of neogobiids, who scored 24 and 63, respectively. Additional precautiousness should be taken due to their capability of breathing atmospheric air in an enlarged stomach (2) and their brood care that the most likely could enhance their dispersal and establishment (i.e., the naturalization) after an introduction into various recipient areas. Their congeners’ (*Pterygoplichthys multiradiatus, P. disjunctivus*) invasive history, with the successful establishment in Philippines, Hawaii, Puerto Rico, Mexico, Indonesia, peninsular Malaysia, Java, Sumatra, Singapore and Taiwan (7, 8, 10, 11, 12, 20) also rises the risk of the successful introduction and strong invading potential of the Amazon sailfin catfish in the recipient area. The acclimatization of the Amazon sailfin catfish in southern United States started after the allegedly releasing from aquaria into lakes, ponds and rivers, e.g., in Florida, in early 1970’s, where for years only single fish was caught annually, until recently (the lag phase of acclimatization), when the population there suddenly boomed. Samat *et al.* (26) and Page & Robins (22) reported about the findings of Amazon sailfin catfish in Singapore, Malaysia and Singapore, where they were released into the Asian water bodies by aquarists, again and established there.

Considering that Amazon sailfin catfish grow up to about 43 cm TL and that they have reportedly strong potential for natural production, as well as their feeding habit of grazing and removing attached algae, benthic organisms and detritus, they may be having a significant impact on the aquatic food base and negatively effecting native invertebrate and vertebrate species, as suspected in pond and lake ecosystems in Florida (20). Lack of the food content in the stomach of the female Amazon sailfin catfish caught in the Danube River did not enable reliable concluding about her diet, but remnants of
gut content that remained in the most distal portion of gut suggest that female sailfin catfish the most likely fed with the periphitic algae and/or detritus. It is expected that grazing of algae might decrease the secondary production in herbivorous food webs of ecosystems represented by small aquatic insect larvae and crustaceans, which would have an impact on the drop in production at higher levels of food webs. In addition, the impact on the habitat component of aquatic ecosystems by sailfin catfishes was also noticed. E.g., in the Lake Okeechobee, larger vermiculated sailfin catfish P. disjunctivus were reported to erode a bank by burrowing up to one meter deep holes in it (Anonymous 2004). The resistance of Amazon sailfin catfish P. multiradiatus to predators was observed at Puerto Rico, where the brown pelicans Pelecanus occidentalis have stangled trying to swallow them (Bunkley-Williams et al. 1994); similar could be expected in an attempt of preying of great cormorant Phalacrocorax carbo on the Amazon sailfin catfish in the Danube River ecosystem.

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