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Report on the invasion of South American armored suckermouth catfish (*Pterygoplichthys disjunctivus*) from Southern India

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Abstract

A survey was carried out at Parakkai Freshwater Lake, Kanyakumari, Tamil Nadu, India (8.1519°N; 77.4544°E) to study the freshwater fish biodiversity. The survey manifested the invasion of South American Armored Suckermouth catfish (*Pterygoplichthys disjunctivus*) native to Madeira River basin of South America province to the lake. The invasions of this non-native catfish to many parts of the native waters were already reported by many ichthyologists. However, no such detailed data available for the occurrence of this non-native catfish and its negative effect on the native freshwater fish biodiversity of Kanyakumari, a part of Southern Western Ghats region of India. The present paper records the occurrence of *P. disjunctivus*, a non-native invasive catfish to the natural waters of Kanyakumari. In addition, the potential impact of this non-native invasive catfish on the native aquatic biodiversity is pertinently discussed in this report.

Keywords: Biodiversity threat, freshwater lake, invasive catfish, non-native fish, southern Western Ghats, Tamil Nadu

Introduction

According to ichthyologists, invasion of non-native fishes to natural waters are recognized as being the most important threat to native fish biodiversity (Singh *et al.*, 2014) ^[23]. The experts in the field also express their opinion that one of the most important detrimental factors that threaten native biodiversity is invasive species (Mollot *et al.*, 2017) ^[17], and the majority of aquatic invasions are occurring through irregular trading of ornamental fishes (Picker, 2013) ^[20]. A vast number of previous studies had witnessed that non-native fishes may elicit following negative causes to native fish biodiversity: (i) invasive alien fishes may outcompete with native fishes for food and space which decline the native populations (Pimentel *et al.*, 2005) ^[21]; (ii) settlement of invasive alien fishes to non-native waters may alters the living environment which favourable for their breeding, propagation and survival, thereby diminishing the population of native fish biodiversity (Hermoso *et al.*, 2011) ^[12]; (iii) invasive alien fishes could act as a carrier for the disease transmission to native fishes (Faruk *et al.*, 2012) ^[10]; (iv) some non-native fishes may eat the eggs of native fishes causing alarm to the propagation of native fishes (Chaichana & Jongphadungkiet, 2012) ^[7]; and, (v) some non-native species may hybridize with the indigenous fishes and transfer their genetic information through introgression of genes which results to dilute the wild genetic stock (Blackwell *et al.*, 2021) ^[6].

Though non-native fishes are harmful to the native fish biodiversity, few of them were introduced deliberately for the farming purposes; however, the entry of sucker mouth catfish to the native waters could be mostly attributed through the irregular ornamental fish trading as it is not an edible fish. *P. disjunctivus* is native to Madeira River basin of South America province under the water drainage of two country including Bolivia and Brazil (Page & Robin, 2006) ^[9]. Due to its coloration, scavenging nature and tolerance to any physico-chemical conditions, the fish has been introduced by fish hobbyist to many countries outside its native range (Nico *et al.*, 2009) ^[18]. Due to escape of the non-native fishes into the natural waters of many parts of the country, now this fish is mixed with the native fishes, and they generally found in floodplain lakes, swamps and borrow pits under poorly-oxygenated waters because of their long periods of air breathing ability due to their specialized (enlarged) stomach which appear to function as accessory respiratory organs (Armbruster, 1998) ^[2]. An

infestation of *P. disjunctivus* has been documented from Andhra Pradesh, Bihar, Kerala, West Bengal and Uttar Pradesh in the country so far (Singh *et al.*, 2014) [23]. However, the information regarding the occurrence and invasion of this exotic invasive catfish to the natural waters of Tamil Nadu is less known. In our previous works, we reported the occurrence of *Cichlasoma trimaculatum*, an invasive alien fish to the natural waters of Chennai, Southern India (Daniel *et al.*, 2020) [9]. In the present paper, we validate the infestation of *P. disjunctivus* into the natural waters of South Western Ghats region of Kanyakumari District, Tamil Nadu, India. In addition, we studied the length and weight relationships of *P. disjunctivus* and we pertinently discussed the potential negative impact of *P. disjunctivus* on the aquatic native fish biodiversity.

Materials and Methods

The field survey on the assessment of freshwater fish biodiversity of Southern Western Ghats was carried out at the Parakkai freshwater lake (8.1519°N; 77.4544°E) [See view of the Lake drainage in Fig. 1]. The fish collection was employed using gill net with the mesh size of >200 mm. The collected fish samples were subjected to taxonomic analysis, and the morphometric, meristic and abdominal section of the specimen confirmed that the species invaded is *P. disjunctivus*, native to South America (See Fig. 2-4). The following literatures were used to identify the species (Armbruster *et al.*, 2006; Bijukumar *et al.*, 2015) [1, 3]. Length and weight relationship were calculated using Le Cren formula $W = aL^b$, where W is the total weight (g), L is the total length (cm) and b are the intercept and slope of regression curve (Le Cren, 1951) [16].

Results and Discussion

India harbours enormous resources for freshwater fish biodiversity comprising of both edible and ornamental variability. Over the few years, there has been a huge concern over the deliberate release of non-native ornamental fishes into the native waters. In the same way, accidental entry of some non-native fishes to the natural waters of few regions in the country were also spotted on account of periodic natural calamities such as flood, which calls for the proper legislation measures to control it. In recent years, report on the occurrence of non-native fishes to the natural waters become one of the interests among the researchers who indulge them in the biodiversity kind of research (Daniel *et al.*, 2020) [9].

According to recent literature, many non-native fishes have been reported to colonize in the freshwater ecosystem of our country. The data on the earlier reports indicate that non-native fish varieties have been keep growing in the native waters of the country, including the cultivable fishes such as Nile/red tilapia (*Oreochromis niloticus*), African catfish (*Clarias gariepinus*), Thai pangus (*Pangasiandon hypophthalmus*) and common carp (*Cyprinus carpio*) (Bijukumar, 2000; Singh *et al.*, 2013; Singh *et al.*, 2014) [4, 22, 23]. Previous research claims that native species such as *Puntius dubius* and *Labeo kontius* has been close to the extinction mainly due to the colonization of tilapia (Lakra *et al.*, 2008) [15]. The similar results were noticed on account of invasion of some other non-native invasive species such as *Poecilia reticulata*, *Pterygoplichthys multiradiatus* and *Pterygoplichthys pardalis* to the natural waters of India (Bijukumar, 2000; Singh *et al.*, 2013; Bijukumar *et al.*,

2015; Knight & Balasubramanian, 2015; Tripathi, 2013; and Tripathi, 2015) [4, 22, 5, 14, 24, 25].

According to FishBase, *P. disjunctivus* grows the maximum length of 70.0 cm. Unlike other non-native species, the genus of the fish *Pterygoplichthys* is little difficult to control due to its successful establishment in the native waters since they can survive even under poorly-oxygenated waters due to their long periods of air breathing ability by their specialized (enlarged) stomach (Armbruster, 1998; Chaichana & Jongphadungkiet, 2012) [2, 7]. The successful establishment of this fish has been reported in the many parts of the country, including Andhra Pradesh, Bihar, Kerala, West Bengal, Uttar Pradesh, etc. (Singh *et al.*, 2014) [23].

It would be patient to discuss that we spoke with the local peoples about the introduction of *P. disjunctivus* to the Parakkai Lake, but they had no idea on how and when it was introduced. However, they stated that *P. disjunctivus* is a real threat to our native fishes as they witnessed the catch reduction of native barbs as soon as they started seeing this invasive catfish from the natural waters. On the contrary, few local people in the region added that the introduction of this invasive catfish effectively control the propagation of African Catfish (*Clarias gariepinus*), another invasive, predatory non-native catfish which also colonized into the lake. The local people consider *C. gariepinus* as a non-tasty fish and hence they do not want to catch them for the consumption. They opined that *C. gariepinus* tends to eat *P. disjunctivus* and die because they could not digest the hard calcareous body parts of the *P. disjunctivus* once they consumed. The successful invasions of this non-native catfish into the native waters are not only a threat to the native fish biodiversity, but also threaten the avian biodiversity, as its consumption may leads them to mortality [7].

Among the invasive catfishes collected, 30 numbers of samples were subjected to study the length and weight relationships. The total lengths of the fishes were ranged from 20.5 - 37.1 cm, and weights of the fishes were ranged between 65.56 - 413 gram. In the present study, the estimated r^2 values were 0.94 which indicates smaller dispersion of analysed data (Correia *et al.*, 2018) [8]. In this study, a values were ranged from 0.003 - 0.012, with the mean value of 0.008, and the coefficient of allometry (b) were ranged between 2.70-3.26 with the mean value of 2.98. According to the earlier researchers, the b value of more than 3 denotes that fish become plumper with increase in length (Jobling, 2002) [13], and the optimal range of b value for the fish in the ecosystem is ranges between 2.5-3.5 (Froese, 2006) [11]. The results of the present study for the b value are within the recommended range; therefore our data clearly depict that this invasive catfish had already successfully settled in the native waters.



Fig 1: View of Parakkai Lake drainage where *P. disjunctivus* recorded in the survey



Fig 2: *P. disjunctivus* collected at Parakkai Lake drainage during the survey



Fig 3: Abdominal view of *P. disjunctivus* collected during the survey



Fig 4: Few collected samples of *P. disjunctivus* from Parakkai Lake drainage during survey

Conclusion

India has limited numbers of the legislative act for ornamental fish trading. As a results, ornamental fish traders, hobbyists, and ornamental fish entrepreneurs are most often clandestinely release the non-native fishes into the natural waters because either they don't prefer the fish

when attains maximum size or they don't have big rearing tanks to maintain them. Doing such practices often pay way to mix non-native fishes into the natural waters which renders destructive effect to the natural fish diversity. Considering the concerns, the critical awareness on the release of the exotic fish into the natural waters must be rendered to the ornamental fish traders, public, policy makers and researcher scholars. With no doubt, the release of the exotic fish species into the natural waters would demolish the natural fish populations. Therefore, the stringent measures must be ensured to protect the deliberate or accidental release of non-native invasive fishes into the natural waters of India.

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