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Occurrence of exotic vermiculated sailfin catfish *Pterygoplichthys disjunctivus* from the lower stretch of River Ganga, West Bengal, India

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The present study reports a record of invasive Loricariid catfish *Pterygoplichthys disjunctivus* (Weber, 1991) (Siluriformes: Loricariidae) from the Bhagirathi–Hooghly system of River Ganga in West Bengal, India. The species was encountered from Farakka and Balagarh regions of Ganga, two areas with different hydrological regimes. The average total length and total weight of the collected species was in the range of 360–450 mm and 314–545 g respectively. This exotic species is reported to contribute about 10% of the total catch from the Balagarh area of the river stretch, while its occurrence is sparse in Farakka. The algivorous nature of feeding can pose a threat to native-bottom dwelling fish due to feeding competition. As the presence of this exotic fish in the lower parts of Ganga has been confirmed, we discuss necessary management interventions like identifying the source of its introduction in order to prevent future threats from this invasive species to native river species.

Keywords: Algivorous feeding, exotic fish, invasive species, *Pterygoplichthys disjunctivus*, river system.

RIVER Ganga prior to draining into the sea flows for a distance of about 260 km within West Bengal, India acquiring its local name ‘Hooghly’. The Hooghly is the largest estuary in India and forms a part of one of the largest estuarine systems globally. The Hooghly along with other distributaries of River Ganga in West Bengal provides a constant supply of water to the associated plains for domestic, agriculture and industrial usage. The faunal resources of River Ganga have distinct characteristic features that fall into three zones: the upper region of Ganga River in hilly terrain; the middle stretch of Ganga River flowing in Uttar Pradesh, Bihar and West Bengal, and the lower Ganga River in deltaic tract¹. Introduction of alien and invasive fish species into River Ganga has

been reported by several researchers in the recent past from Patna, Bihar and in river Gomti near Lucknow, Uttar Pradesh². Species like *Pterygoplichthys disjunctivus* and *P. pardalis* (Family: Loricariidae, Order: Siluriformes) have been encountered from several wetlands in West Bengal as well³. During our surveys in 2018, four specimens of exotic fishes were recorded from the Farakka and Balagarh regions of River Ganga in West Bengal, and these were identified as *Pterygoplichthys disjunctivus*⁴. This is considered to be one of the rapid dispersing species introduced predominately through uncontrolled pet trade, and its invasion impact results in serious ecological and economic outcome⁵. This algivorous species has expanded to a large extent owing to its swift nature and ability to withstand diverse environments. The most recent establishment of the species has been reported from the upper stretches of river Cauvery in South India⁶. In recent fish faunal studies in the tidal stretch of the Hooghly estuary^{7,8}, occurrences of Loricariid catfish have not been seen. To the best of our knowledge, there have been no previous studies of *P. disjunctivus* from the Bhagirathi–Hooghly river system.

Materials and methods

Although climate in the region is tropical throughout the year, due to their geographical location both Farakka (24°48′47.31″N, 87°55′1.22″E) and Balagarh (23°7′38.88″N, 88°27′58.74″E) regions have diverse hydrological regimes. Unlike the former, the latter experiences continuous tidal effects. In the present study, a total of four specimens were collected from the above-mentioned locations during a fish diversity study on 6 and 16 July 2018 using gill nets (locally known as fasla-jaal) of mesh size 40–45 mm during early morning between 5.00 and 6.00 a.m. Immediately after collection, the fishes were photographed and measured on the spot to the nearest 1 mm using Vernier callipers, and weighed

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Figure 1. *Pterygoplichthys disjunctivus* (Weber, 1991).

Table 1. Morphometric characteristics of the samples ($N = 4$)

| Parameters (mm) | Range (mm) | Mean \pm SD |
|---------------------------------------|------------|------------------|
| Total length | 360–450 | 39.62 \pm 3.53 |
| Standard length | 270–300 | 29.0 \pm 1.30 |
| Curved fork length | 320–360 | 34.6 \pm 1.75 |
| Head length | 63–83 | 7.32 \pm 0.76 |
| Snout length | 12–16 | 1.42 \pm 0.15 |
| Body depth | 45–60 | 5.32 \pm 0.61 |
| Barbel length | 10–19 | 1.45 \pm 0.38 |
| Eye diameter | 6–8 | 0.70 \pm 0.07 |
| Dorsal fin base length | 89–104 | 10.07 \pm 0.76 |
| Pectoral fin base length | 16–19 | 1.72 \pm 0.13 |
| Anal fin base length | 9–15 | 1.27 \pm 0.24 |
| Adipose fin base length | 13–19 | 1.55 \pm 0.23 |
| Dorsal fin height | 61–72 | 6.57 \pm 0.42 |
| Pectoral fin height | 82–96 | 8.72 \pm 0.56 |
| Pelvic fin height | 54–68 | 6.12 \pm 0.59 |
| Anal fin height | 36–55 | 4.55 \pm 0.71 |
| Adipose fin height | 13–18 | 1.70 \pm 0.36 |
| Depth of caudal peduncle | 30–32 | 3.25 \pm 0.19 |
| Distance between snout and dorsal fin | 106–114 | 11.17 \pm 0.37 |

to the nearest 0.1 g. After preserving in 10% formaldehyde solution, the specimens were brought to the laboratory in air-tight plastic containers for morphometric and meristic studies. The specimens were identified and confirmed following several taxonomic keys^{4,9,10}. At the time of collection, triplicate water samples were collected for measuring physico-chemical parameters following standard methods¹¹.

Results and discussion

P. disjunctivus is an air-breathing catfish species of family Loricariidae (Order Siluriformes). Fishes belonging to the genus *Pterygoplichthys* are commonly known as sucker mouth catfishes and are native to the South American continent from the Madeira basin¹². The genus *Pterygop-*

lichthys consists of four species which show similar pattern in biology and morphology¹³. *P. disjunctivus* is a popular aquarium species due to its hardiness and is extensively used in ornamental fish trade^{14,15}. The specimens collected (Figure 1) from the Bhagirathi–Hooghly river system had average total lengths (TL) ranging from 360 to 450 mm (Table 1). The total weight ranged between 314 and 545 g. The genus *Pterygoplichthys* can be easily distinguished from the majority of other Loricariids by a large dorsal fin consisting of 10 or more dorsal fin rays¹⁰. Each specimen is characterized by having a depressed body covered with typical bony plates and a wide sucker mouth. The head is covered with strong bony casing, and the supra occipital process is absent. The spots radiating in the abdomen exhibit a distinctive unification of both dark and light patches. The species can be easily distinguished by ventral sucker consisting of strong lateral line bony plates. The dorsal fin consists of 14 rays, the second fin being large and the first minute (Table 2). The anal fin consists of four rays, while the pectoral and pelvic fins consist of five rays each respectively; the first ray is the largest. The adipose fin is short, situated in the mid portion between dorsal and initiation of caudal fin. The caudal fin is emarginated in nature, attributed by an extended lower lobe and subsequently pointed at the terminal. The body is covered with tuff and large bony plates with small spines extending over lateral line. The dorsal surface of the head exhibits dark vermiculation, and the entire body is characterized with black and yellow spots. The fins are brown–grey with light grey dots. The abdominal portion has continuous white and brown reticulations.

Habitat description

The ability of the introduced fish species to flourish in poor aquatic environments or otherwise has been

assessed, since the water quality of the Ganga River has deteriorated over the past few decades^{16,17}. Dissolved oxygen was found to be in optimum condition (i.e. >5 mg/l) from both the collection points (Table 3). River water was alkaline in nature. The water temperature remained above 25°C at the time of collection. However, from both the locations the degree of water hardness recorded was more than 120 mg/l, which is considered to be very hard in nature. The Loricariids have great adaptive nature to the changing environment and water quality¹⁸, which creates an added advantage for them in estuarine areas of the river where the hydrological parameters alter rapidly. Data collected as a part of this study from both locations showed varied salinity regimes. The salinity value being 0.20 and 0.29 ppt from Farakka and Balagarh respectively, clearly indicates their tolerance limits. Soil organic carbon of more than 0.90% from both the collection points indicates a conducive environment for their growth and sustenance. Soil conductivity was 281 and 185 $\mu\text{S}/\text{cm}$ from Farakka and Balagarh respectively. The species was found to adhere to the rocky bottom in higher numbers during post-monsoon period (January and February) when the water level is low. Since the species prefers a bottom-dwelling habitat with a typical adherence capacity; it is commonly found residing in swamps where it remains by borrowing pits. It can also thrive well in poorly oxygenated, low water velocity and polluted water bodies. The species can also sustain a good fluctuation of water pH ranging from acidic to alkaline condition¹⁹.

Table 2. Meristic counts of samples collected from the Bhagirathi–Hooghly river system, West Bengal, India

| Parameters | Measure |
|--------------------------|------------|
| Dorsal fin | II + 12 |
| Pectoral fin | I + 5 |
| Pelvic fin | I + 5 |
| Adipose fin | I + 4 |
| Anal fin | IV + 26 |
| Caudal fin | I + 14 + I |
| Lateral line bony plates | 29 |

Table 3. Average physico-chemical parameters of the sites at the time of sample collection

| Average water parameters | Farakka | Balagarh |
|--|------------------|------------------|
| Dissolved oxygen (mg/l) | 6.8 \pm 0.10 | 6.0 \pm 0.90 |
| Transparency (cm) | 78 \pm 0.0 | 28 \pm 0.22 |
| Depth (m) | 7.4 \pm 0.08 | 8.5 \pm 1.12 |
| pH | 8.2 \pm 0.20 | 8.4 \pm 0.82 |
| Salinity (ppt) | 0.196 \pm 0.28 | 0.286 \pm 0.31 |
| Total alkalinity (mg/l) | 104 \pm 0.11 | 108 \pm 0.01 |
| Total hardness (mg/l) | 160 \pm 1.0 | 154 \pm 2.19 |
| Velocity (m/s) | 0.1 \pm 0.09 | 1.1 \pm 0.49 |
| Specific conductance ($\mu\text{S}/\text{cm}$) | 281 \pm 0.19 | 185 \pm 0.70 |

Aquarium fish trade is a prominent source of external faunal introduction that has a specific role in the spread and invasion of exotic species²⁰. The extensive establishment of the species world over is mainly due to several congenial environmental factors. Distribution of the sailfin armoured catfish in the Bhagirathi–Hooghly river system might be the result of fewer effective preventative measures leading to accidental introduction. The batch spawning behaviour of the species along with prolonged reproductive periods might have created an added advantage over their establishment and proliferation¹⁴. On the other hand, being a detritivore and algivore in feeding habit²¹, the species can cause considerable damage and indulge in feeding competition with other aquatic species of the river system. It may also have a significant impact on various aquatic invertebrates and vertebrates by scraping the algal base. The species is reported to contribute about 10% of the total catch from Balagarh, while it is sparse in the Farakka region. This fish also has a high socio-economical impact as it brings no monetary benefit to the fishermen in the region, and has also been reported to damage fishing gear (gill nets) at the time of operation.

Conclusion

Due to multifarious effects owing to different anthropological impacts, River Ganga has been facing abiotic and biotic stress in the recent past resulting in the establishment of a number of foreign aquatic species. This uninterrupted spread of invasive fish species in River Ganga has become a global concern³. Owing to continuous degradation of natural habitats with deteriorated water quality, there is a declining trend of species diversity. This in turn creates tremendous opportunity for invasion of exotic fish species. The evidence of Loricariid species in the lower stretch of River Ganga is another such example. As the specimen has been recorded from two different areas of the river, we can conclude that the species has started to establish its population in stretches of the Bhagirathi–Hooghly river system. The species might have entered the river through local and nearby perennial fish ponds or adjacent wetlands which get inundated during monsoon period, or due to unintentional release. Although the complete effect of *P. disjunctivus* on native fish fauna in the river is not comprehensible, its establishment might threaten the native inhabitant species by entering into the food chain through grazing habits of the species. As the lower stretch of the river supports unique fish faunal diversity, appropriate legislative structure and community participation along with strict management measures must be implemented to prevent the introduction of such alien invasive species. Mass awareness campaigns along with demonstrations regarding the threats due to such alien species, and their possible impact on the natural system must be highlighted to the local fishers

and ornamental culturist to prevent such menace in the future.

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