

## Present status, distribution and relative abundance of IUCN Red-listed fish species of River Ganga

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Quarterly field sampling was conducted from 2016 to 2020 to understand the distribution and current status of IUCN Red-listed fish species along the entire stretch of River Ganga. During the study, 18 fish species belonging to 8 orders and 12 families were recorded under the IUCN Red list. Fishes belonging to the family Synodontidae contributed highest among the threatened group. The status of fish species have been categorized on the basis of IUCN Red list. Among 18 fish species, *Clarias magur* and *Tor putitora* were categorized as endangered, whereas *Wallago attu* and *Schizothorax richardsonii* were categorized as vulnerable. The present study suggests the necessary management plans and conservation strategies for these IUCN Red-listed fish species of River Ganga.

**Keywords:** Fish, IUCN Red list, relative abundance, River Ganga.

The freshwater ecosystem provides the habitat of rich, sensitive, endemic biota and harbours around 6% of the total species<sup>1</sup>. India is considered as a hotspot of freshwater fish diversity and contributes a high number of the world's endemic biological resources<sup>2,3</sup>. Also, 11.7% of fish species in the world have been recorded from Indian waters<sup>4</sup> and 295 endemic fish species which are exclusively found in India are listed under IUCN<sup>5</sup>.

River Ganga along with its tributaries supports extensive aquatic biodiversity and plays an important role in maintaining livelihood and nutritional security<sup>6</sup>. The riverine ecosystem has experienced habitat degradation of fish fauna due to anthropogenic activities like industrial pressure, pollution, overexploitation, illegal fishing activities, misuse of resources resulting in rapid biodiversity loss resulting in many threatened fish species<sup>7</sup>. Proper attention is needed for endemic fish diversity specifically those which are habituated under restricted distribution, otherwise, alteration of their habitats might lead to their disappearance<sup>8</sup>. In the present study, several fish species have been recorded under IUCN Red-list category<sup>9</sup> during a survey from 2016 to 2020. As these are economically prized fish, effective conservation and sustainable management plans should be implemented to restore the geomorphology of fish species.

River Ganga was divided into three stretches based on its characteristics, viz. upper (Uttarakhand), middle (Uttar

Pradesh and Bihar) and lower (West Bengal) stretches. Quarterly field sampling was done along the whole stretch of River Ganga to collect data on fish diversity and their abundance over a period of four years from April 2016 to March 2020. The sampling sites covered Uttarakhand, Uttar Pradesh, Bihar and West Bengal. Figure 1 shows the distribution pattern of the threatened fish species.

Eighteen sampling stations were selected along River Ganga, namely Tehri, Haridwar, Bijnour, Narora, Farakhabad, Kangur, Allahabad, Varanasi, Buxar, Patna, Bhagalpur, Farakka, Bahampore, Balagrah, Tribeni, Godakhali, Diamond Harbour and Fraserganj (GIS map). The main river channels as well as adjacent landing centres were visited to collect fish samples. The samples were collected from the main river channels through experimental fishing by locally hired fishers. Various selective and non-selective gears like gill nets, seine nets, barrier and falling nets, cast nets, drag nets, bag nets and traps were used for fish catch. The fish specimens were identified using the taxonomic characteristics reported earlier<sup>10-12</sup>. Statistical analysis, i.e. one-way ANOVA followed by Duncan's multiple range test was carried out for studying the significance of relative abundance of different species using SPSS, version 22.

A total of 190 fish species representing 19 orders and 132 genera were recorded from the Ganga, of this 18 species belonging to 8 orders and 12 families were reported under IUCN Red-list. Threatened fish species under the IUCN Red list, recorded from River Ganga are mentioned in Table 1. Freshwater fish species were categorized by the National Bureau of Fish Genetic Resources (NBFGR), 2010 and their present status under IUCN Red-list was also documented (Table 2). Table 3 indicates the present status and distribution of these fish species in the entire stretch of River Ganga. Relative abundance of these species was analysed station-wise. The present study showed that the family Synodontidae contributed the highest (53.8%), followed by Cyprinidae (16.68%) and Siluridae (13.94%) (Figure 2).

Maximum threatened fish species (Table 3) were found in the middle stretch of River Ganga, viz. Buxar, Patna, Bhagalpur, Farakka, Bahampore and Balagrah followed by the upper stretch, viz. Bijnour and Narora. Among 18 fish species, *Clarias magur* and *Tor putitora* were under the endangered category, whereas *Wallago attu* and *Schizothorax richardsonii* were under the vulnerable category. The remaining 15 were recorded under the near threatened category of IUCN Red list. *Tor putitora*, *Bogartus jayralii* and *Opsok pabo* were under the endangered category according to NBFGR, Lucknow<sup>9</sup>, whereas five endangered, four vulnerable and two low risk near threatened fish species have been listed under Conservation Assessment and Management Plan<sup>13</sup>.

The most dominant fish was *Harpodon nehereus*, followed by *T. putitora* from the entire stretch of River Ganga (Figure 3). *Bogartus bogartus*, *Ailia coila*, *W. attu* and

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