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ARTICLE

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ASSESSMENT AND EVALUATION OF SMALL INDIGENOUS FISHES (SIF) OF RIVER GANGA FOR CONSERVATION AND LIVELIHOOD SECURITY

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Introduction

In India 2,319 finfish species have been recorded of which 838 from freshwater resources[1]. The report indicates that out of 765 native freshwater fish species about 450 are categorized as small indigenous freshwater fish species. According to the assessment of NBFGR, 23% (104 species) of reported SIF have been considered as highly important food fish and other significance as well as play a significant role in aquarium trade by ensuring security in daily livelihood.

The highest diversity of the SIF's has been recorded from the North East region followed by Western Ghat and Central India. Unfortunately, the information on the exploration and assessment of SIFs in the different freshwater resources are limited and no database is available on the abundance and catch despite their importance as a potential source of livelihood of the small scale fishers in inland waters.

Small Indigenous Fish species (SIFs) are generally fish species that attain maturity at the length of about 25 cm[2]. The SIFs are often caught by local village people from rivers, canals, beels, channels, backyard or derelict water body for subsistence fishing as SIFs are an integral part of the rural diet and also, they can easily afford it with their daily meal. However, several species of small indigenous fishes have become threatened and endangered due to pollution, over exploitation, habitat destruction, water abstraction, siltation, channel fragmentation, diseases and introduction of exotic varieties.

The river Ganga traversing a long course, originates from Gangotri, passing through different states, and finally drains into the east coast of the country at Ganga Sagar in the Bay of Bengal. During its course of flow, the river navigates through several growing cities with a population of over one lakh. The Ganga River system serves as important habitat for fish specifically for Small Indigenous Fish and also an important source of food and income for riparian communities. In order to achieve, sustainable utilisation, appropriate planning for conservation and management strategies are of utmost importance. This article addresses the untapped potential of the small indigenous fishes of India and challenging issues for sustaining biodiversity, production, management, nutrition and livelihood security as well as highlights the future priorities.

SIF Towards Livelihood and Nutritional Security

The SIFs are considered an excellent source of nutrients like essential protein, macro, and micro-nutrients, vitamins, and minerals, which play a vital role to fulfil the nutritional requirements of human beings[3]. Trace elements like copper, zinc, iodine, selenium, iron, cobalt, magnesium, and chromium are present in SIF along with macro minerals like calcium and phosphorous. Besides this, SIF is a rich source of vitamins like A, D, and E as well as vitamin B

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complex SIFs have more health benefits compared to other commercial fishes and are an important source of calcium and other micronutrients as they are consumed as whole including bone, head, and eye portion,[4,5]. The sustainability of livelihoods particularly depends on the SIF of the Ganga River is challenged by a series of factors. The major cause is declining of SIF stocks due to overfishing and destructive fishing practices. The SIF-based livelihood is also affected by habitat shifting of species in a riverine ecosystem.

Small Indigenous Fishes of River Ganga

About 190 fish species were reported from river Ganga, among them 63 fish species considered small indigenous fish species belong to 33 families and 14 orders in the entire Ganga River stretch. Of these species, 4 are listed as Near Threatened (NT), 1 under Near Endangered (NE), and 1 Endangered (EN) category under IUCN Red List[6]. The order Cypriniformes (36%) was dominant in the SIF fish group followed by Siluriformes (16%) and Clupeiformes (11%) during the present study. However, 43 fish species are habitat in freshwater, 11 are brackish water, and 10 are found in both freshwater and brackishwater zone. Earlier, the study reported that the abundance of the indigenous fish species in the river Ganga showed the maximum contribution of SIFs[7].

The study revealed that fish genera like *Salmostoma*, *Amblypharyngodon*, and *Pethia* are dominant among the fishes, and generally considered rich sources of micronutrients. SIF lika *Eleotris fusca, Macrobrachium malcolmsonii, Mystus cavasius, Silonia silondia* and *Macrognathus pancalus* are rich source of essential amino acids and consumption of these fish on daily basis can fulfil the requirement of amino acids. However, *Glossogobius giuris, Eleotris fusca, Securicola gora, Cabdio morar* are found to be important source of minerals like Ca, Cu, Fe, Zn etc. Vitamin A in the form of retinol has been reported in freshwater indigenous fish species like *Amblypharyngodon mola, Parambassis ranga, Osteobrama cotio, Esomus danricus* in high amounts[4]. The inclusion of nutrient-dense small indigenous fishes in a regular diet might be a significant strategy to utilize animal

Table 1. Commercially Important Small Indigenous Fishes of River Ganga

SIF Species	Local Name	Habitat	Value Range (Rs/kg)
Ailia coila	Kajri/sutri	Fw	300-350
Amblypharyngodon mola	Mola/Mourola	Fw	100-150
Anabas testudineus	Koi/Kawai	Fw	400-500
Barilius barila	Ral	Fw	50-90
Barilius bendelisis	Ral	Fw	50-90
Megarasbora elanga	Anga/ Chelwa	Fw	50-90
Brachirus pan	Pata machh	Fw,Bw	40-60
Cabdio morar	Piyali/chikua	Fw	50-100
Chanda nama	Chanda	Fw	40-60
Channa punctata	Lyata	Fw	200-300
Coilia dussumieri	Amude	Bw	150-200
Coilia reynaldi	Amude	Bw	150-200
Corica soborna	Sona korke/Maya	Fw, Bw	300-350
Escualosa thoracata	Gang mouti	Fw, Bw	200-250
Glossogobius giuris	Aash bele	Fw, Bw	60-100
Gonialosa manmina	Sugva/khoira	Fw, Bw	100-150
Gudusia chapra	Khoira	Fw, Bw	100-150
Heteropneustes fossilis	Singhi	Fw	400-500
Labeo bata	Bata	Fw	200-300
Osteobrama cotio	Cotio	Fw	100-120
Macrognathus pancalus	Pancal	Fw	80-100
Nandus nandus	Bhyada/nadosh	Fw	100-110
Mystus tengara	Tengara	Fw	250-300
Mystus cavasius	Tengara	Fw, Bw	250-301
Mystus vittatus	Deshi tengara	Fw, Bw	500
Notopterus notopterus	Foloi/Phali	Fw	300-350
Ompok pabda	Pada	Fw	350-400
Ompok bimaculatus	Pada	Fw	350-400
Pethia conchonius	Punti	Fw	100-120
Pethia ticto	Tit punti	Fw	150-200
Puntius sophore	Sona punti	Fw	150-200
Salmostoma bacaila	Chela	Fw	80-100
Systomus sarana	Sar punti	Fw	150-250
Xenentodon cancila	Kakila	Fw	50-60
Pachypterus atherinoides	Teen katiya/ Batashi	Fw	250-300

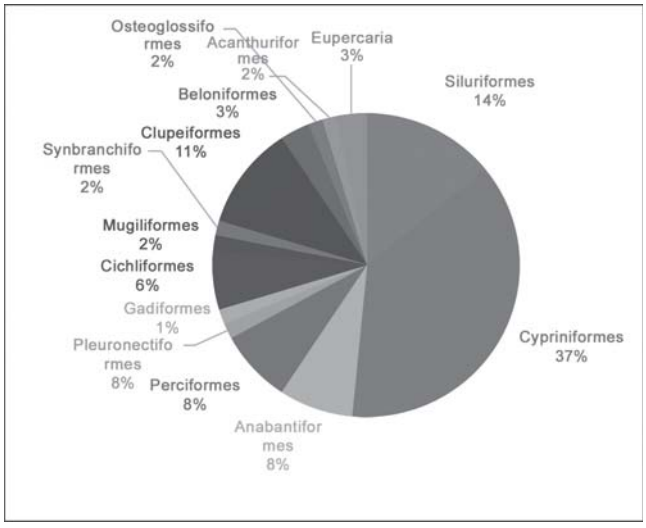

Fig. 1 Percentage of small indigenous fish group

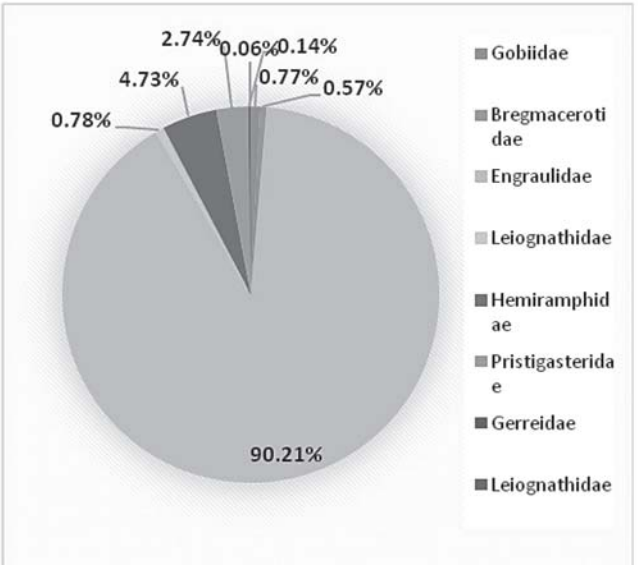

Fig. 3 Abundance of small indigenous fish of brackishwater zone

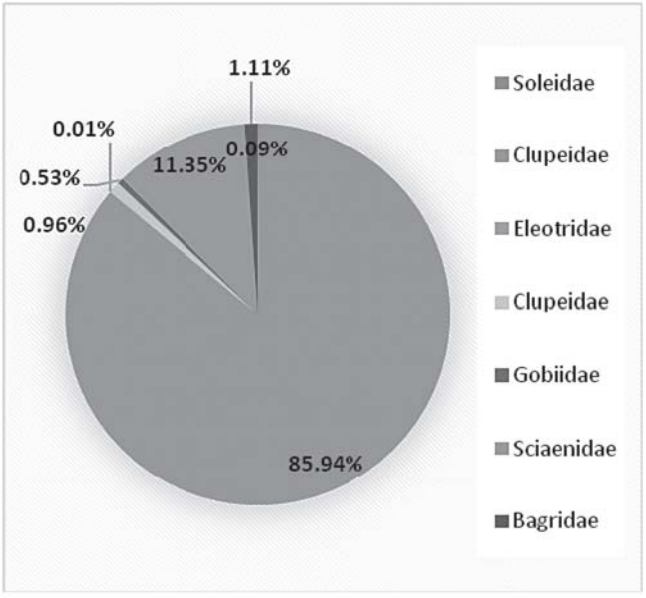

Fig. 2 Abundance of small indigenous fish of freshwater zone

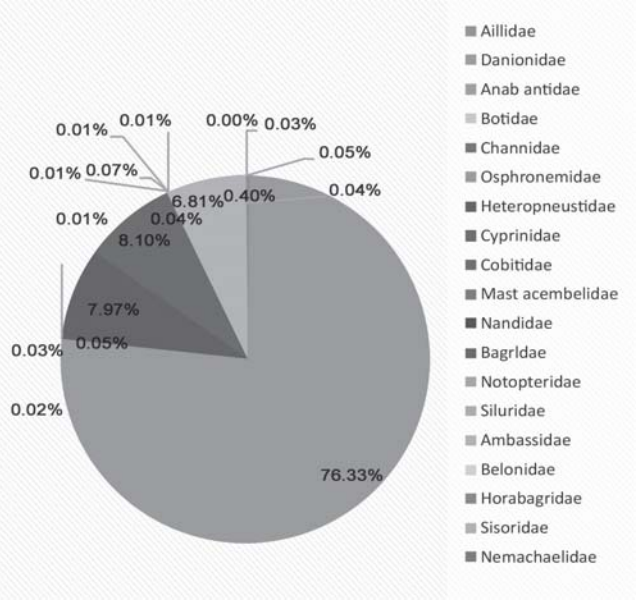

Fig. 4 Abundance of small indigenous fish of freshwater and brackishwater zone

protein and nutrients. As the rich biodiversity of SIFs was observed in the entire stretch of river Ganga, the intervention of livelihood sustainability based on SIFs can be evolved among riparian communities. Human nutrition and livelihood enhancement based on SIFs are indispensable in Ganga River fisheries.

Conclusion

Ganga River is considered the rich hub of small indigenous fishes for decades. Small indigenous fish not only contributes domestic economies, but also ensure food security to the fishing communities in developing countries. Periodical and systematic management of SIF stock of the large river ecosystem can be effective for conservation planning. The present study indicates the diverse status of SIF, their availability, and their status in river Ganga. As SIF provide nutritional security in the human body, such stock of small fish and their production need to be increased through conservation. Threatened SIF should be prioritized under *ex-situ* conservation for their existence and a protection site can be designed accordingly. Effective mechanism to document the fish

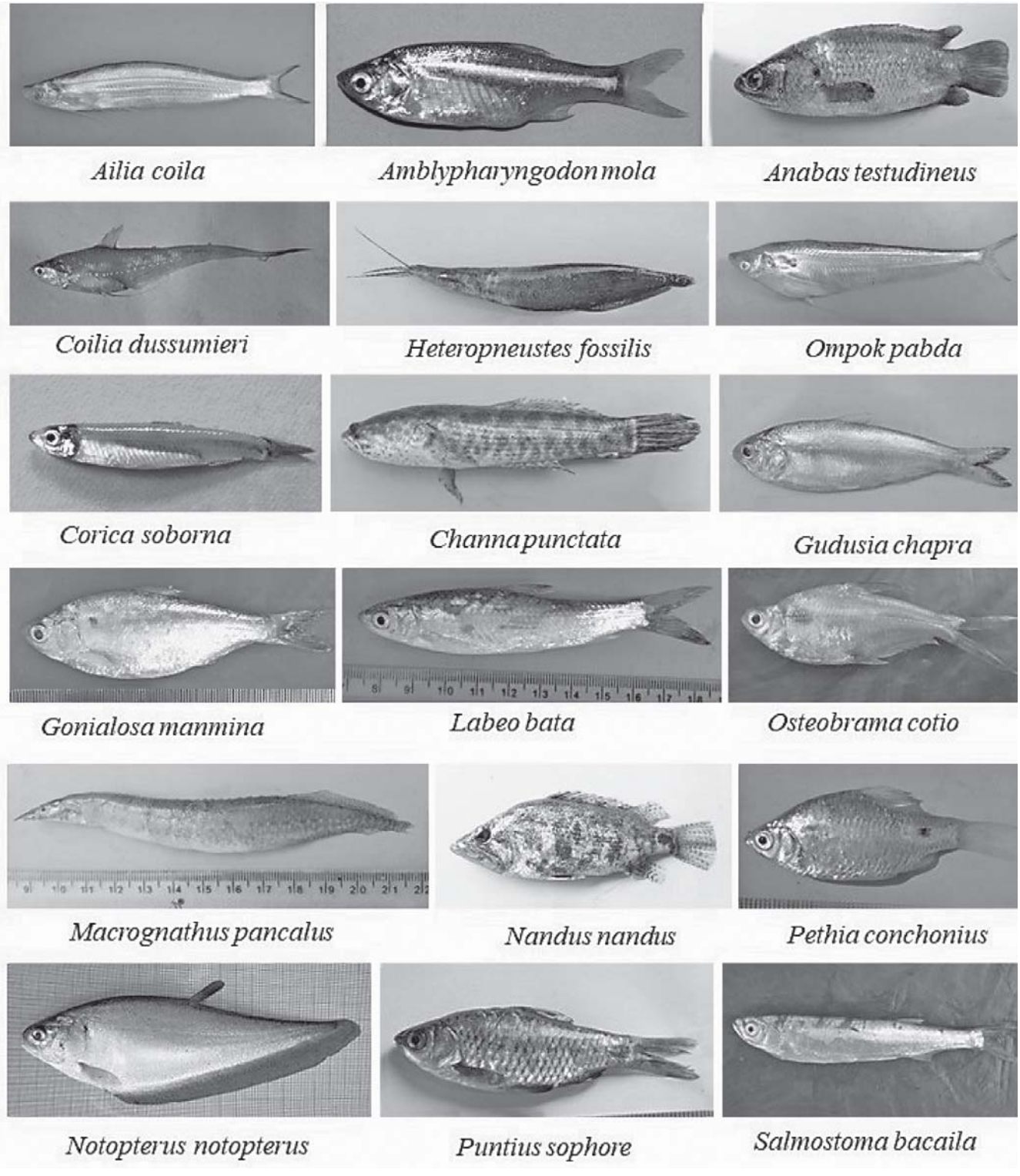

Fig. 5. Commercially Important Small Indigenous Fishes (SIFs)

Table 2. List of Small Indigenous Fishes of River Ganga

SIF Species	Family	Order	Common Name	Habitat	IUCN
Ailia coila	Aillidae	Siluriformes	Gangetic Ailia	Fw	NT
Amblypharyngodon mola	Danionidae	Cypriniformes	Mola carplet	Fw	LC
Anabas testudineus	Anabantidae	Anabantiformes	Climbing perch	Fw	LC
Barilius barila	Danionidae	Cypriniformes	Baril	Fw	LC
Barilius bendelisis	Danionidae	Cypriniformes	Indian Hill trout	Fw	LC
Megarasbora elanga	Danionidae	Cypriniformes	Bengala barb	Fw	LC
Boleophthalmus boddarti	Gobiidae	Perciformes	Boddart's goggle-eyed goby	Bw	LC
Botia dario	Botiidae	Cypriniformes	Bengal loach	Fw	LC
Botia lohachata	Botiidae	Cypriniformes	Reticulate loach	Fw	LC
Brachirus pan	Soleidae	Pleuronectiformes	Pan sole	Fw,Bw	LC
Opsarius barna	Danionidae	Cypriniformes	Barna baril	Fw	LC
Bregmaceros mcclellandi	Bregmacerotidae	Gadiformes	Unicorn cod	Bw	NE
Cabdio morar	Danionidae	Cypriniformes	Morari	Fw	LC
Chanda nama	Ambassidae	Cichliformes	Elongate glass-perchlet	Fw	LC
Channa punctata	Channidae	Anabantiformes	Spotted snakehead	Fw	LC
Coilia dussumieri	Engraulidae	Clupeiformes	Goldspotted grenadier anchovy	Bw	LC
Coilia reynaldi	Engraulidae	Clupeiformes	Reynald's grenadier anchovy	Bw	LC
Corica soborna	Clupeidae	Clupeiformes	Ganges river sprat	Fw, Bw	LC
Devario devario	Danionidae	Cypriniformes	Sind danio	Fw	LC
Deveximentum insidiator	Leiognathidae	Perciformes	Pugnose ponyfish	Bw	LC
Eleotris fusca	Eleotridae	Perciformes	Dusky sleeper	Fw,Bw	LC
Escualosa thoracata	Clupeidae	Clupeiformes	white sardin	Fw, Bw	LC
Trichogaster fasciata	Osphronemidae	Anabantiformes	Banded gourami	Fw	LC
Trichogaster lalius	Osphronemidae	Anabantiformes	dwarf gourami	Fw	LC
Glossogobius giuris	Gobiidae	Perciformes	Tank goby	Fw, Bw	LC
Gonialosa manmina	Clupeidae	Clupeiformes	Ganges river gizzard shad	Fw, Bw	LC
Gudusia chapra	Clupeidae	Clupeiformes	Indian river shad	Fw, Bw	LC
Heteropneustes fossilis	Heteropneustidae	Siluriformes	Stinging catfish	Fw	LC
Hyporhamphus limbatus	Hemiramphidae	Beloniformes	half beak	Bw	LC
Johnius coitor	Sciaenidae	Perciformes	Croaker	Fw, Bw	LC
Labeo bata	Cyprinidae	Cypriniformes	Bata	Fw	LC
Osteobrama cotio	Danionidae	Cypriniformes	Cotio	Fw	LC
Lepidocephalichthys guntea	Cobitidae	Cypriniformes	Guntea loach	Fw	LC
Macrognathus pancalus	Mastacembelidae	Synbranchiformes	Barred spiny eel	Fw	LC
Nandus nandus	Nandidae	Anabantiformes	Gangetic leaf fish	Fw	LC
Mystus tengara	Bagridae	Siluriformes	Tengara catfish	Fw	LC
Mystus cavasius	Bagridae	Siluriformes	Gangetic mystus	Fw, Bw	LC
Mystus vittatus	Bagridae	Siluriformes	Striped dwarf catfish	Fw, Bw	LC
Notopterus notopterus	Notopteridae	Osteoglossiformes	Bronze featherback	Fw	LC
Ompok pabda	Siluridae	Siluriformes	Pada catfish	Fw	NT

SIF Species	Family	Order	Common Name	Habitat	IUCN
Ompok bimaculatus	Siluridae	Siluriformes	Pada catfish	Fw	NT
Parambassis lala	Ambassidae	Cichliformes	Highfin glassy perchlet	Fw	NT
Parambassis baculis	Ambassidae	Cichliformes	Himalayan glassy perchlet	Fw	LC
Parambassis ranga	Ambassidae	Cichliformes	Indian glassy fish	Fw	LC
Pellona ditchela	Pristigasteridae	Clupeiformes	Indian Pellona	Bw	LC
Pethia conchonius	Cyprinidae	Cypriniformes	Rosy barb	Fw	LC
Pethia gelius	Cyprinidae	Cypriniformes	Golden barb	Fw	LC
Pethia phutunio	Cyprinidae	Cypriniformes	Spottedsail barb	Fw	LC
Pethia ticto	Cyprinidae	Cypriniformes	Ticto barb	Fw	LC
Puntius sophore	Cyprinidae	Cypriniformes	Pool barb	Fw	LC
Rasbora daniconius	Danionidae	Cypriniformes	Slender Rasbora	Fw	LC
Salmostoma bacaila	Danionidae	Cypriniformes	Large razorbelly minnow	Fw	LC
Salmostoma phulo	Danionidae	Cypriniformes	Finescale razorbelly minnow	Fw	LC
Salmostoma acinaces	Danionidae	Cypriniformes	Silver razorbelly minnow	Fw	LC
Securicula gora	Danionidae	Cypriniformes	Gora chela	Fw	LC
Systomus sarana	Cyprinidae	Cypriniformes	Olive barb	Fw	LC
Xenentodon cancila	Belonidae	Beloniformes	Full beak	Fw	LC
Pachypterus atherinoides	Horabagridae	Siluriformes	Indian potasi	Fw	LC
Gagata cenia	Sisoridae	Siluriformes	Indian gagata	Fw	LC
Paracanthocobitis botia	Nemachaelidae	Cypriniformes	Zipper loach	Fw	LC
Nuchequula blochii	Leiognathidae	Acanthuriformes	Two blotch ponyfish	Bw	LC
Gerres filamentosus	Gerreidae	Eupercaria	Whipfin silver-biddy	Bw	LC
Gerres oyena	Gerreidae	Eupercaria	Common silver-biddy	Bw	LC

Fw=Freshwater; Bw=Brackishwater; NT=Near Threatened; NE=Near Endangered; EN=Endangered; LC=Least Concern

catch by individual fishers and maintenance depicting the group/category-wise catch of SIF is suggested for estimating the actual fish production. The fish used for domestic consumption/hidden harvest must also be recorded. Development and application of mobile applications may help to directly monitor and estimate the SIF catch. Overfishing and the use of destructive fishing gear should be strictly prohibited and public awareness among local community can be effective measures for enhancing the SIF population as well as restoration of native small fish stock. ❐

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