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Fish fauna of Indrayani River, northern Western Ghats, India

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Abstract: The freshwater fish fauna of the Indrayani River, a northern tributary of the Krishna River system in the Western Ghats of India was studied. A total of 57 species of freshwater fish belonging to 18 families and 39 genera were recorded. However, based on the previous literature it is possible that the Indrayani River harbours around 67 species. Out of the 57 species in the present collection, 12 are endemic to the Western Ghats while six are endemic to the Krishna River system. *Neotropius khavalchor*, an endemic fish of the Krishna River system, was recorded for the first time from the northern tributaries. The fish fauna of the Indrayani River is threatened due to seven introduced species and anthropogenic activities such as deforestation leading to siltation, tourism, sand mining, over fishing and organic and inorganic pollution. Since the Indrayani River hosts endemic and threatened species, including *Glyptothorax poonaensis*, conservation measures to ensure habitat protection in the river are essential.

Keywords: Freshwater fish fauna, Indrayani River, Krishna River system, Threats.

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The Indrayani River originates in the northern Western Ghats of India at Kurwande Village (18.731^{0}N & 73.382^{0}E) near Lonawala, Pune District, Maharashtra. It is one of the tributaries of Bhima River, which in turn is a major tributary of the Krishna River system. In his seminal work on the fishes of the Deccan, Sykes (1839) described two species of freshwater fish from the Indrayani River. After more than 100 years, Suter (1944) recorded one more species from the Indrayani River at Kalumbre Village. A major study on the fish fauna of Indrayani River was carried out by Yazdani & Mahabal (1976), which resulted in the collection of 34 species belonging to 10 families and 19 genera. These three studies account for hardly 37 species of freshwater fish, which seems an under representation when compared with fish fauna of other rivers such as Mula-Mutha with a record of 102 fish species (Kharat et al. 2003) and Pavna with a record of 59 fish species (Chandanshive et al. 2007), which are also tributaries of the Bhima River. Furthermore, the habitats along the Indrayani River have faced major alterations in the recent years due to increasing urbanization, industrialization and various recreational activities. Reassessment of the fish fauna and identifying the threats, so as to build baseline information for possible conservation action

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Figure 1. Indrayani River and the sampling locations.

plans are thus a priority. For the current study, we sampled the entire stretch of the Indrayani River to identify the current status and threats to the freshwater fish fauna of this region.

Fish were collected from local fisherman and local markets at Markal (18.674^{0}N & 73.983^{0}E), Charholi Khurd (18.660^{0}N & 73.906^{0}E), Alandi (18.677^{0}N & 73.895^{0}E), Dehu road (18.719^{0}N & 73.764^{0}E), Wadgaon (18.754^{0}N & 73.653^{0}E), Kamshet (18.767^{0}N & 73.551^{0}E) and Lonawala (18.753^{0}N & 73.432^{0}E) located on the Indrayani River (Fig. 1) from May 2009 to April 2011. Fish were preserved in 4% formaldehyde and identified using available literature (Jayaram 1991, 2010; Menon 1964, 1987, 1992; Talwar & Jhingran 1991; Jayaram & Dhas 2000; Jayaram & Sanyal 2003). Collected fish specimens are deposited at the Museum of the Zoological Survey of India, Western Regional Center, Akurdi, Pune (accession numbers P/2588 to P/2627). Assuming that the fishing effort for a given type of net (gill net or drag net) was constant, the relative abundance of the fish was grossly categorized (for each type of net separately) into four categories, namely: abundant (76–100 % of the total catch), common (51–75 % of the total catch), moderate (26–50 % of the total catch) and rare (1–25 % of the total catch).

We recorded a total of 57 species belonging to 18 families and 39 genera (Table 1). Of these, 12 species are endemic to the Western Ghats while five are endemic to the Krishna River system. Seven species that we collected were observed to be introduced into the Indrayani River. According to the abundance categories defined earlier there are 11 abundant, 14 common, 23 moderate and nine rare species. The list of species recorded by earlier studies on the Indrayani River is given in Table 2. Based on the previous literature and not considering two species, namely *Schistura dayi* and *S. savona*, which need taxonomic validation as they are restricted to central and northeastern India respectively, the total number of species in the Indrayani River can be summed up to 67. However, out of these 67 species, *Schismatorhynchos nukta* is locally extirpated while *Aplocheilus lineatus* is probably locally extirpated from Indrayani River.

Sykes (1839) described two species, namely *Schismatorhynchos nukta* and *Leuciscus chitul*, from Indrayani River. We could not record *S. nukta* in our study and the species was also not recorded in an earlier study by Yazdani & Mahabal (1976). Based on our discussions with the local fishermen, the species is locally extirpated from its type locality in Indrayani River. Ghate et al. (2002) suggested that the population of *S. nukta* is rapidly declining in the Krishna River system and suspected that pollution could be a major threat. Kharat et al. (2003) suggested that over fishing could be a driving force for local extinction of this

Table 1. List of freshwater fish species recorded from Indrayani River in the present study.

Family/Species [a]	Abundance [b]	Remarks[c]	IUCN redlist status[d]
Notopteridae			
Notopterus notopterus (Pallas, 1769)	C		LC
Cyprinidae			
Catla catla (Hamilton, 1822)	M	T	
Cirrhinus fulungee (Sykes, 1839)	C		LC
Cirrhinus reba (Hamilton, 1822)	C		LC
Cirrhinus mrigala (Hamilton, 1822)	M	T	
Cyprinus carpio Linnaeus, 1758	M	T	
Gonoproktopterus curmuca (Hamilton, 1807)[e]	A	WGE	EN
Labeo ariza (Hamilton, 1807)	R		LC
Labeo boggut (Sykes, 1839)	R		LC
Labeo calbasu (Hamilton, 1822)	M		LC
Labeo porcellus (Heckel, 1844)	R	WGE	LC
Labeo rohita (Hamilton, 1822)	M	T	
Osteobrama cotio peninsularis Silas, 1952	M		NE
Osteobrama neilli (Day, 1873)	R	WGE	LC
Osteobrama vigorsii (Sykes, 1839)	C		LC
Puntius amphibius (Valenciennes, 1842)	A		DD
Puntius conchonius (Hamilton, 1822)	R		LC
Puntius jerdoni (Day, 1870)	R	WGE	LC
Puntius sarana subnasutus (Valenciennes, 1842)	M	WGE	NE
Puntius sophore (Hamilton, 1822)	A		LC
Puntius ticto (Hamilton, 1822)	A		LC
Rohtee ogilbii (Sykes, 1839)	M	WGE, KRE	LC
Amblypharyngodon mola (Hamilton, 1822)	A		LC
Salmophasia balookee (Sykes, 1839) [f]	M		LC
Salmophasia boopis (Day, 1874)	A	WGE	LC
Salmophasia novacula (Valenciennes, 1840)	C	WGE	LC
Devario aequipinnatus (McClelland, 1839)	C		LC
Rasbora daniconius (Hamilton, 1822)	A		LC
Crossocheilus cf. latius (Hamilton, 1822)	C		LC
Garra mullya (Sykes, 1839)	A		LC
Parapsilorhynchidae			
Parapsilorhynchus tentaculatus (Annandale, 1919)	M		LC
Balitoridae			
Acanthocobitis mooreh (Sykes, 1839) [g]	M		LC
Oreonectes evezardi (Day, 1872)	M		LC
Nemachilichthys rueppelli (Sykes, 1839) [g]	M	WGE, KRE	LC
Noemacheilus anguilla Annandale, 1919	M	WGE, KRE	LC
Schistura denisoni Day, 1867	C		LC
Cobitidae			
Lepidocephalichthys thermalis (Valenciennes, 1846)	A	D	LC
Bagridae			
Mystus bleekeri (Day, 1877)	M		LC
Mystus seengtee (Sykes, 1839)	C		LC
Mystus malabaricus (Jerdon, 1849)	M	WGE	NT
Rita gogra (Sykes, 1839)	M		LC
Sperata seenghala (Sykes, 1839)	M		LC
Siluridae			
Ompok bimaculatus (Bloch, 1794)	C		NT
Wallago attu (Bloch & Schneider, 1801)	R		NT
Schilbeidae			
Neotropius khavalchor Kulkarni, 1952	R	KRE	DD
Sisoridae			
Glyptothorax poonaensis Hora, 1938	R	WGE, KRE	EN
Claridae			
Clarias gariepinus (Burchell, 1822)	M	I	
Heteropneustidae			
Heteropneustes fossilis (Bloch, 1794)	M		LC
Belonidae			
Xenentodon cancila (Hamilton, 1822)	M		LC
Poeciliidae			
Poecilia reticulata Peters, 1859	A	I	
Ambassidae			
Chanda nama Hamilton, 1822	C		LC
Parambassis ranga (Hamilton, 1822)	M		LC
Cichlidae			
Oreochromis mossambicus (Peters, 1852)	A	I	
Gobiidae			
Glossogobius giuris (Hamilton, 1822)	C		NE
Channidae			
Channa marulius (Hamilton, 1822)	M		LC
Channa punctata (Bloch, 1793)	C		LC
Mastecembalidae			
Mastacembelus armatus (Lacepède, 1800)	C		LC

a - Taxonomic status as per Jayaram (2010);
b - Abundance categories: A = abundant, C = common, M = moderate, R = rare;
c - WGE = Western Ghats endemic; KRE = Krishna river system endemic; T = transplanted; I = invasive; D = unknown disease.
d - IUCN (2011). EN = Endangered, NT = Near Threatened, LC = Least Concern, NE = Not Evaluated, DD = Data Deficient. Statuses for introduced/transplanted species are not provided.
e - *Gonoproktopterus kolus* is considered as synonym of *G. curmuca* (Jayaram 2010). However, if they are proved to be different, then our species should be considered as *G. kolus* as per Jayaram (1991).
f - Replacement name for *Salmophasia clupoides* (Kottelat 1996).
g - Species spellings as per Eschmeyer & Fricke (2011).

Table 2. List of fishes recorded by earlier workers.

Study	Species	Current taxonomic status	Remarks
Sykes (1839)	*Cyprinus nukta*	*Schismatorhynchos nukta*	Species is locally extirpated
	Leuciscus chitul	Current status unknown. Doubtful synonym of *Amblypharyngodon mola* in Day (1878)	Species needs further taxonomic studies
Suter (1944)	*Barbus* (*Tor*) *mussullah*	*Tor mussullah*	
Yazdani & Mahabal (1976)	*Chela cachius*	*Chela cachius*	
	Danio aequipinnatus	*Devario aequipinnatus*	
	Danio malabaricus	*Devario malabaricus*	
	Rasbora daniconius	*Rasbora daniconius*	
	Cirrihina fulungee	*Cirrhinus fulungee*	
	Garra gotyla	*Garra gotyla stenorhynchus*	Taxonomic status based on distribution of the subspecies given in Jayaram (2010)
	Garra mullya	*Garra mullya*	
	Puntius amphibius	*Puntius amphibius*	
	Puntius dorsalis	*Puntius dorsalis*	
	Puntius kolus	*Gonoproktopterus curmuca*	
	Puntius sarana	*Puntius sarana subnasutus*	Taxonomic status based on distribution of the subspecies given in Jayaram (2010)
	Puntius ticto	*Puntius ticto*	
	Osteobrama vigorsii	*Osteobrama vigorsii*	
	Parapsilorhynchus tentaculatus	*Parapsilorhynchus tentaculatus*	
	Lepidocephalus guntea	*Lepidocephalus guntea*	
	Lepidocephalus thermalis	*Lepidocephalus thermalis*	
	Noemacheilus anguilla	*Noemacheilus anguilla*	
	Noemacheilus botia aurius	*Acanthocobitis mooreh*	
	Noemacheilus dayi	*Schistura dayi*	Needs taxonomic validation
	Noemacheilus denisoni	*Schistura denisoni*	
	Noemacheilus evezardi	*Oreonectes evezardi*	
	Noemacheilus savona	*Schistura savona*	Needs taxonomic validation
	Noemacheilichthys rueppelli	*Nemachilichthys rueppelli*	
	Mystus bleekeri	*Mystus bleekeri*	
	Mystus cavasius	*Mystus seengtee*	
	Mystus malabaricus	*Mystus malabaricus*	
	Ompok bimaculatus	*Ompok bimaculatus*	
	Glyptothorax lonah	*Glyptothorax lonah*	
	Xenentodon cancila	*Xenentodon cancila*	
	Aplocheilus lineatus	*Aplocheilus lineatus*	Species is probably locally extirpated
	Channa orientalis	*Channa gachua*	
	Channa punctatus	*Channa punctatus*	
	Glossogobius giuris	*Glossogobius giuris*	
	Mastacembelus armatus	*Mastacembelus armatus*	

species from Mula-Mutha Rivers of Pune. Both, over fishing and inorganic and organic pollution are common in Indrayani River and may have been the driving force for the local extirpation of *S. nukta*. Nevertheless, we also suspect that competition created by introduced carps, such as *Cirrhinus mrigala* and *Labeo rohita*, may also have contributed to the loss of *S. nukta*. Currently, *S. nukta* is assessed as Endangered

in the IUCN Red List of Threatened Taxa (Dahanukar 2010a).

Another species, *Leuciscus chitul*, described by Sykes (1839) from Indrayani River has problematic taxonomic status. Eschmeyer & Fricke (2011) have included the species in their online Catalogue of Fishes but the current status of the fish is not mentioned. Day (1878) has considered *L. chitul* as a doubtful synonym of *Amblypharyngodon mola*. However, we think that the doubtful synonymy is invalid as the description of *L. chitul* does not apply to *A. mola*. We could not record any species from Indrayani River which could fit into the description of *L. chitul* given by Sykes (1839).

Suter (1944) recorded *Tor mussullah* from the Indrayani River. Even though we could not record this species and its allied species *Tor khudree* from the Indrayani River, both species are present in the Valvan reservoir on the Indrayani River at Lonawala where they are subjected to aquaculture.

Yazdani & Mahabal (1976) recorded 34 species from Indrayani River out of which 10 species were not recorded in our current study. Of these 10 species, we are doubtful about the taxonomic identification of two species, namely *Schistura dayi* and *S. savona*. *S. dayi* is restricted to the Chota Nagpur plateau in central India (Jayaram 2010) and its occurrence in the Krishna River system is unlikely (Raghavan et al. 2010). Similarly, *S. savona* is restricted to northeastern India (Jayaram 2010). We think that *Aplocheilus lineatus* recorded by Yazdani & Mahabal (1976) is probably locally extirpated from the Indrayani River, as we could not record a single specimen of this species during our investigation. Nevertheless, we could record abundant populations of *Poecilia reticulata* or Guppy fish introduced to the Indrayani River for the purpose of mosquito control. It has been suggested that *P. reticulata* is a strong competitor to *A. lineatus*, as both have the same larvivorous feeding habits, and has the capacity to affect the *A. lineatus* population negatively (Kharat et al. 2003; Wagh & Ghate 2003). Therefore, we think that the introduction of *P. reticulata* could have been a major driving force for the decline in the population and possible local extirpation of

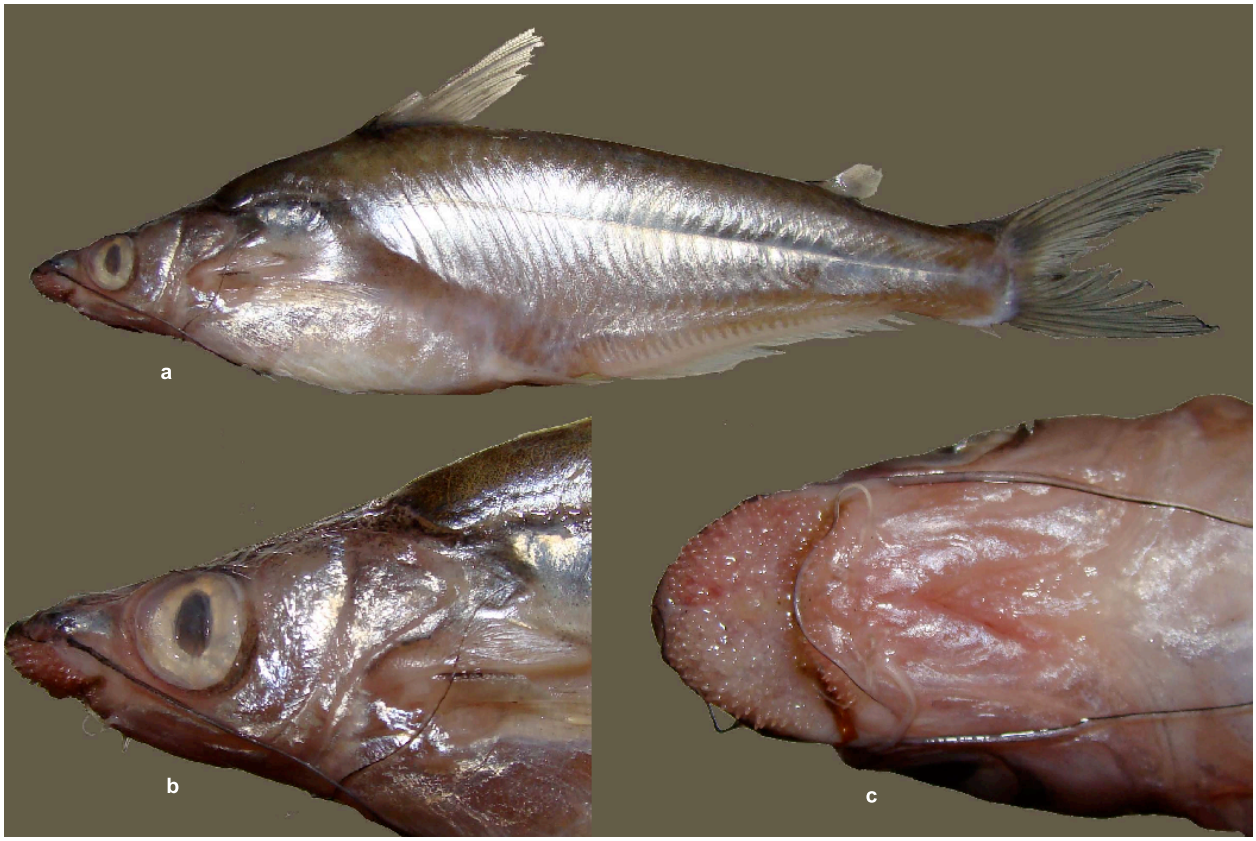

Image 1. *Neotropius khavalchor* collected from Kamshet with (a) details of its body, (b) head and (c) ventral side of the upper lip showing external teeth.

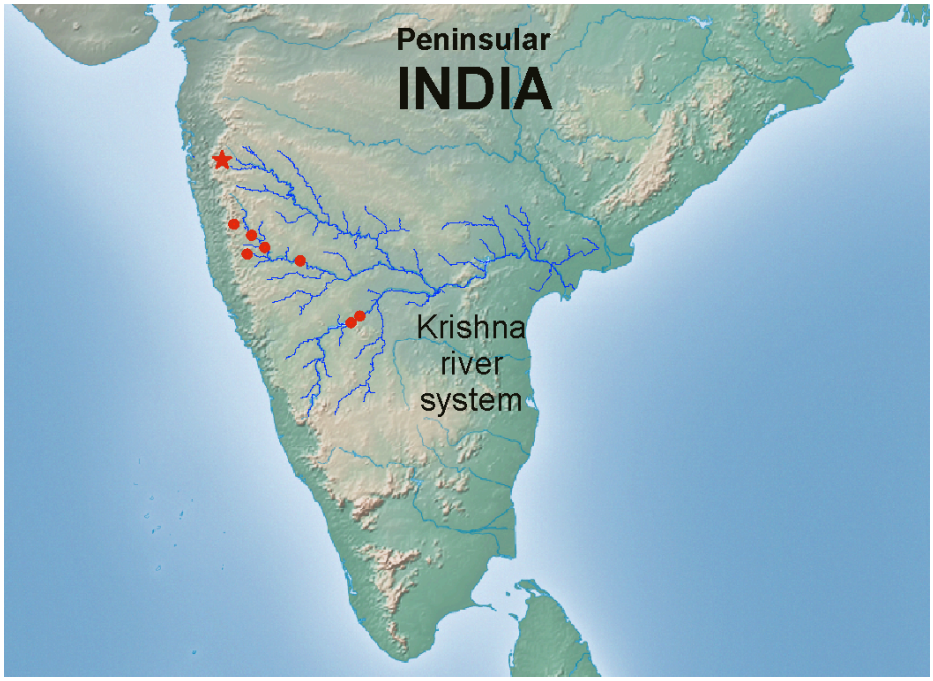

Image 2. Distribution of *Neotropius khavalchor*. Star indicates present record from Kamshet on Indrayani River.

Aplocheilus lineatus from Indrayani River.

We have recorded *Neotropius khavalchor* (Image 1) for the first time from the northern tributaries of the Krishna River system. *N. khavalchor* is a unique lepidophagous species (feeds on scales of other fishes and hence the local Marathi name Khavalchor [Khaval = scales, Chor = thief]) and is endemic to the Krishna River system (Menon 1999; Jayaram 2010). It is a very rare species and has been considered as threatened by Menon (2004) by suggesting that small changes in water quality is likely to have adverse effects and may result in the loss of this species. We recorded this species from Kamshet (Fig. 1 & Image 2). The species is also known from Panchaganga River near Kolhapur (Kulkarni 1952; Kalawar & Kelkar 1956), Krishna River near Islampur (Kulkarni 1952), Koyna River near Patan (Jadhav et al. 2011), Krishna River near Sangli (Jayaram 1995), Krishna River at Jamkhandi (Jayaram 1995), Tunga-Bhadra River (Shahnawaz & Venkateshwarlu 2009) and in the Eastern Ghats of Andhra Pradesh (Devi & Indra 2003). However, since there is little information about the population status, life history and ecology of this species, *N. khavalchor* is assessed as Data Deficient in the current IUCN Red List (Dahanukar 2010c).

Despite the fact that the Indrayani River hosts a number of endemic species and Endengered endemic species, such as *Glyptothorax poonaensis* (Dahanukar 2010b; Dahanukar et al. 2011) the fish fauna of Indrayani River is under threat as a result of several anthropogenic interferences. We recorded seven introduced species (four transplanted and three invasive) from the Indrayani River (Table 1), which have been suggested as possible threats to the indigenous fish fauna (Kharat et al. 2003; Raghavan et al. 2008; Knight 2010). Other anthropogenic activities such as deforestation leading to siltation, recreational activities and sand mining are common in most of the stretches of the river. Such activities modify the specific habitat required by loaches belonging to family Balitoridae and Cobitidae and other hill stream fishes like *Glyptothorax poonaensis* (Dahanukar et al. 2011). Tourism in the upper stretches of the river leading to organic and inorganic pollution of smaller streams is another threat to the fishes of this region. The fish fauna of Indrayani River is also subjected to over fishing for consumption. Inorganic pollution of the river between Dehu Road to Markal due to industrial activities is another important threat to the fish fauna. Further, we observed an unidentified disease in *Lepidocephalichthys thermalis* in the upper stretches of the river near Lonawala where almost 70% of exploited individuals were affected. The nature of this disease, however, is still under study.

In conclusion, the Indrayani River hosts a number of freshwater fish species including globally threatened

and endemic species of the Western Ghats. However, the fish fauna in this region is threatened due to several anthropogenic activities including introduced fish species, deforestation, over fishing, sand mining, recreational activities and organic and inorganic pollution. Since the fish fauna in this region also supports the livelihood of several economic classes there is an urgent need to understand the conservation priorities and to design and implement conservation action plans.

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