

The Mahseer's redemption! Can we save India's freshwater megafauna from hybridization?

Freshwater fishes are one of the most threatened vertebrate groups. Generally when we think of a fish, we first think about its food value rather than its role, and the adversities faced by it in the ecosystems. Although India harbours the greatest number of endemic freshwater fishes in Asia, many are at the brink of extinction.

Mahseer, the most iconic of India's freshwater fauna belongs to the family Cyprinidae which are large-bodied fishes with thick scales, powerful jaws, and protrusible, sometimes very fleshy, lips adapted for taking food from the bottom. The taxonomy of mahseers are complicated due to the morphological variations they exhibit. They are widely found in freshwater rivers and lakes of India,

with a distribution range extending from the Himalayan foothills, Indus, Brahmaputra, and Ganga basins, to southern river basins like Tambraparini, Balamore, Cauvery, Periyar, and Chalakudy with most species believed to ascend into rapid streams with rocky bottoms for breeding. They are omnivorous like other types of carps, can eat algae, crustaceans, insects, frogs, and other fish, along with some fruits that fall from overhanging trees. The mahseer species fetch high market prices and hence they are potential candidate species for aquaculture.

Amongst the three known genus of Mahseer such as *Tor*, *Naziritor*, and *Neolissochilus*, the famous *Tor* has eight known species that occur in India.



Table 1. Conservation status of currently valid mahseer (*Tor* spp.), based on the IUCN Red List of Threatened Species.

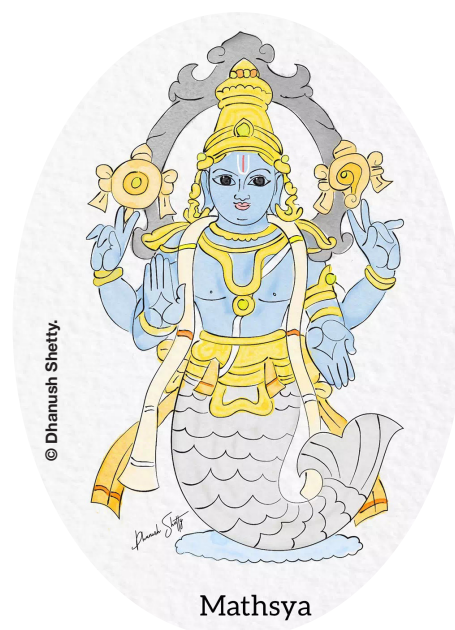
	Valid Species Name	Common Name	IUCN Current Status
1	<i>Tor barake</i>	Barak Mahseer	Near Threatened
2	<i>Tor khudree</i>	Deccan / Blue-finned Mahseer	Least Concern
3	<i>Tor kulkarnii</i>	Dwarf Mahseer	Data Deficient
4	<i>Tor malabaricus</i>	Malabar Mahseer	Endangered
5	<i>Tor mosal</i>	Copper Mahseer	Data Deficient
6	<i>Tor putitora</i>	Golden Mahseer	Endangered
7	<i>Tor remadevii</i>	Hump-backed Mahseer	Critically Endangered
8	<i>Tor tor</i>	Red Fin Mahseer	Data Deficient

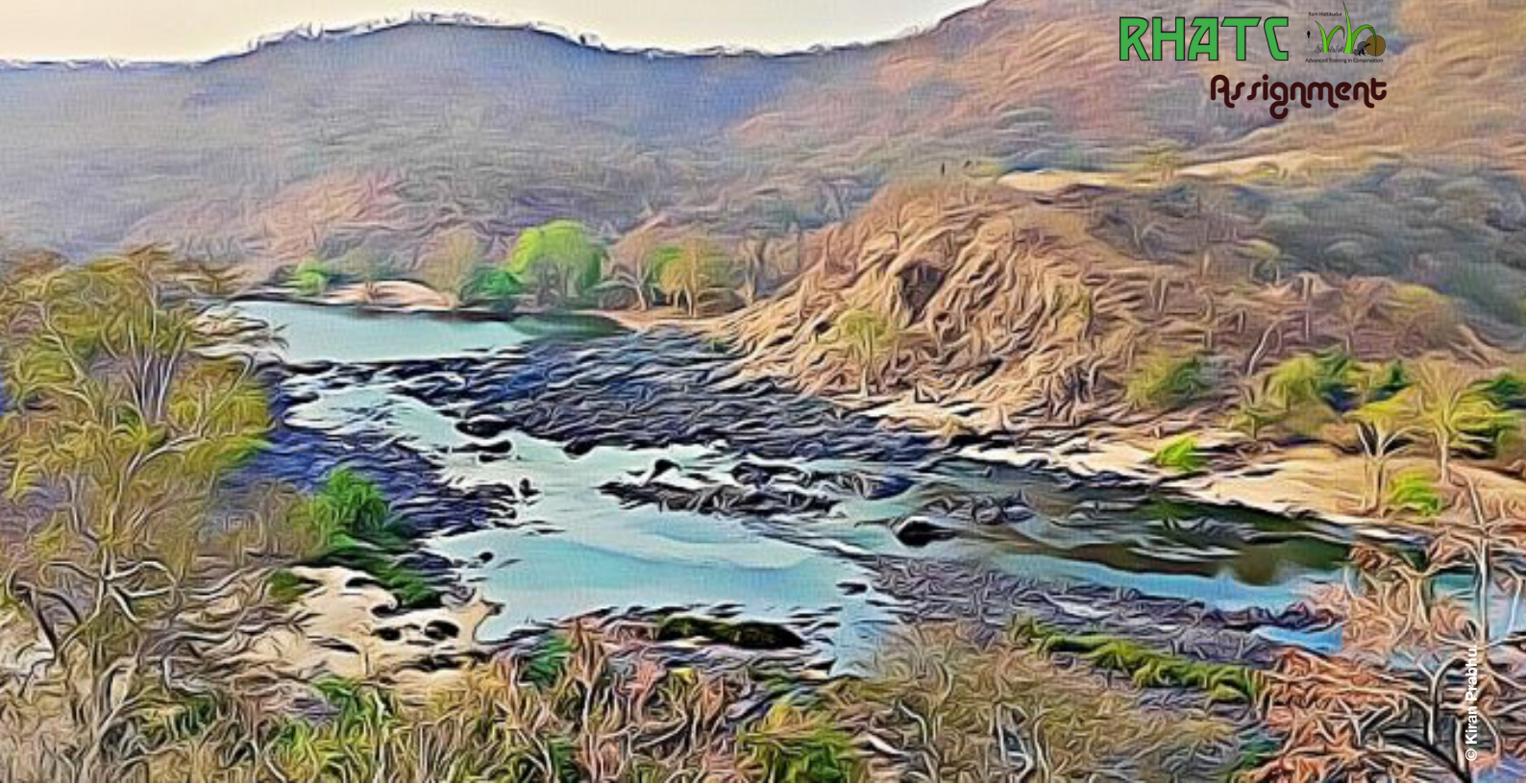
Freshwater fishes and their religious role in India

Since the Vedic period, freshwater fishes have been considered sacred in many parts of India. Even though freshwater fishes were a staple part of the diet of the Indus valley civilization, the mahseer was not consumed due to its high cultural value. Species of mahseer are also mentioned in Hindu religious scriptures, symbols, motifs, sculptures, and in ancient literature. It is believed the fish ‘Matsya’ is an incarnation of the lord Vishnu. The sculptures of lord Vishnu as ‘Matsya’ are present in many temples throughout India. Local people in Walan kond where river Savitri flow in the northern part of Western Ghats worship mahseer as goddess Parvathi.

The mahseer is also found in the ‘temple sanctuaries’ or ‘temple pools’, which are community-protected areas and looked after by local authorities, an example of effective ‘in situ’ conservation action. The devotees worship the mahseer as god. The famous Sringeri temple in Western Ghats region of Karnataka protects mahseers of the genera *Neolissochilus* and *Tor*.

The religious beliefs play an important role in the protection of the largest fish and acts as a key element in conservation. The endangered Golden Mahseer *Tor putitora* is present in many tributaries of the river Ganges. Sacred sites along the river and its tributaries act as safe haven for this charismatic species and help in their protection from anthropogenic pressure. Research suggests that sacred spaces harbor species of scientific importance in significant abundance and in many cases these are the last remaining traces of the original habitat and species.





Threats to freshwater fishes

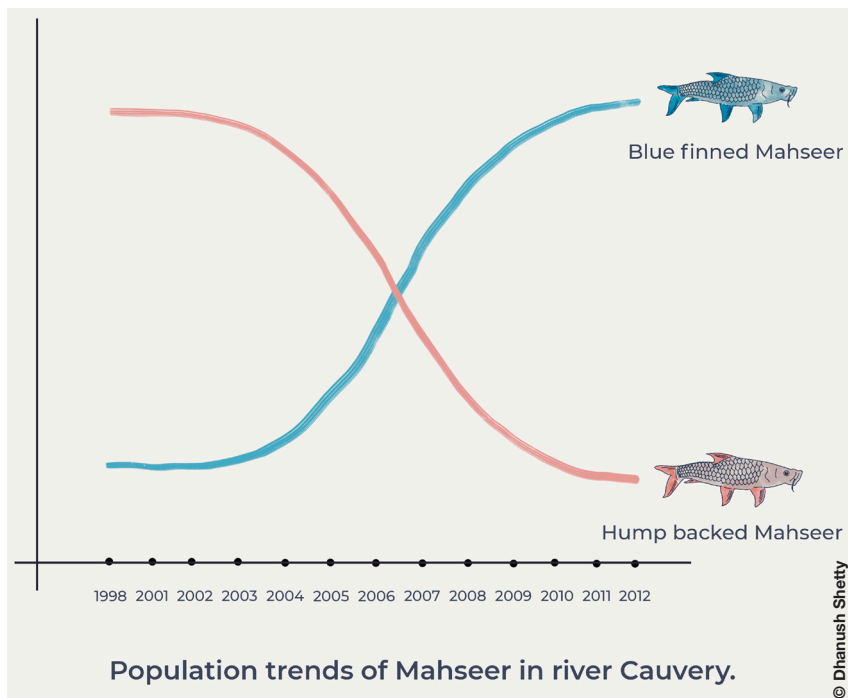
Freshwater systems are of the least studied ecosystems despite being one of the most sensitive and vulnerable. Since fishes are looked upon more for their commercial value rather than their ecological value, they are one of the taxa which are most prone to extinction. Climate change, habitat loss, overexploitation, lack of research data, construction of hydropower dams, catchment fragmentation, invasive species, illegal fishing, pollution, and other anthropogenic threats are the main factors affecting the survival of mahseer in India.

Along with these existing dangers, mahseer are also now threatened by hybridization wherein different species were artificially bred and later released in natural systems. The hybrid species compete with naturally occurring mahseer species. The hybrids not only threaten the existence of native mahseers but can cause the entire ecosystem to collapse.

The tiger of the water is now 'critically endangered'.

The Hump-backed Mahseer which was recently named as *Tor remadevii* is now 'Critically Endangered' as per the IUCN (International Union for Conservation of Nature) Red List. The need for immediate conservation action has to be the priority, else we might lose one of the top freshwater megafauna forever.

This tiger of freshwaters that was once widespread (but endemic to) throughout the river Cauvery catchment in southern India and its major tributaries is currently extremely restricted to small pockets in five or six major tributaries. There was a collapse in recruitment in the main river population during the mid-2000s. Based on its alarming reduction in population size and persistent threats, *Tor remadevii* is now recognised as the most imperilled of all *Tor* spp. and the only mahseer species to be assessed as Critically Endangered. Some efforts are



being initiated by NGOs to conserve a few local populations in the Cauvery river basin.

All mahseer captured in the Cauvery before 1993 were hump-backed; since then, a blue-fin phenotype appeared in catches and subsequently dominated them. Such results triggered further studies indicating that the Hump-backed Mahseer was the endemic *Tor remadevii* and that the blue-fin was the invasive *Tor khudree*, introduced in 1976 and then stocked periodically from hatcheries.

Records of angling data from 1998 to 2012 showed

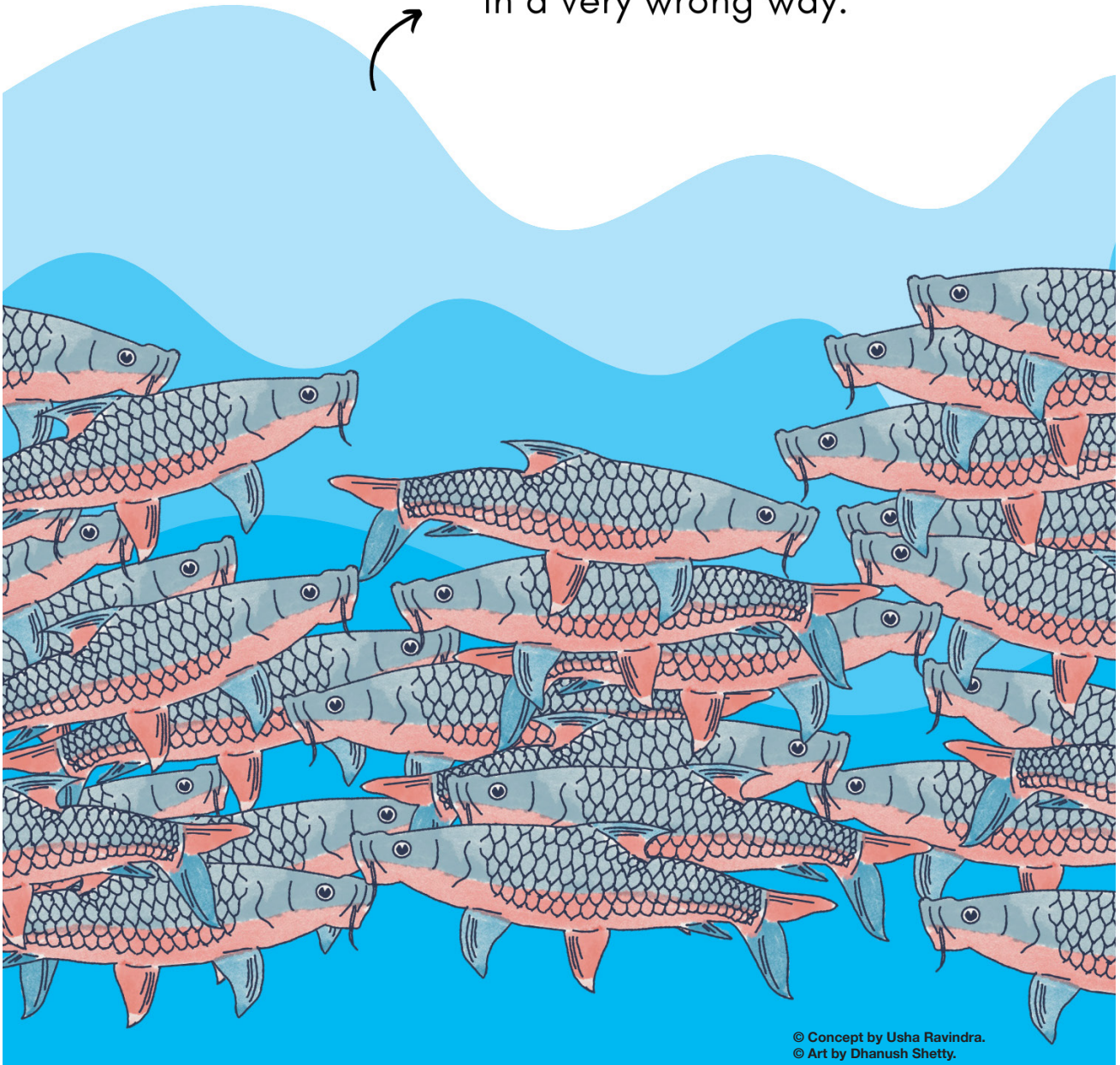
that mahseer catch rates had increased in this period. Surprisingly, two distinct phenotypes were caught. The positive role of catch-and-release angling in providing information on data-poor species was highlighted in a paper by Adrian Pinder and colleagues in the journal Aquatic Conservation (AQC). *Tor khudree* which was not to be found in the natural population is possibly the result of hybridization between two species from the breeding stock that was subsequently introduced in 1976 in the river Cauvery. Regular artificial stocking of the hybrid *Tor khudree* has led to decrease in the

native species population of *Tor remadevii* which is now Critically Endangered.

Recreational angling which is still a debatable topic in conservation community, has played a vital role in protecting the fish of the Cauvery Wildlife Sanctuary from illegal fishing using indiscriminate and highly destructive methods such as dynamite and poisons, which had impacted all aquatic fauna until the closure of the Cauvery fishery in 2012. Anecdotal evidence suggests that illegal fishing is now high within this 27 km section of river, that is now known to be one of the remaining habitats of the Hump-backed Mahseer since the closure of the fishery. However, recreational anglers have collected quality data to monitor mahseer populations.

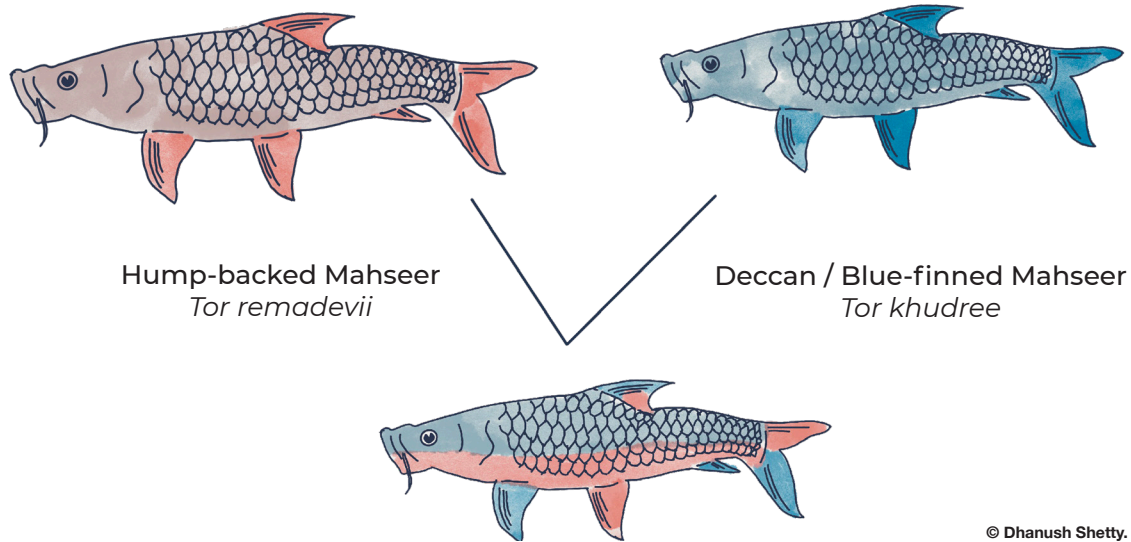
The contribution of long term data collected by anglers has helped in assessing the critical status of the Hump-backed Mahseer, with a high risk of this species going extinct before being afforded a valid scientific name. To maximise conservation benefits, one must also

You fishes look very anomalous biologically, &
are expanding a lot faster.
I know I am famous for anomalous expansion*.
But you are taking up after me,
in a very wrong way.



*Anomalous Expansion of water:

Commonly, substances contract as it gets colder, however, water expands as temperature falls to 0°C from 4°C .



© Dhanush Shetty.

consider and evaluate site specific holistic threats versus resources to mitigate these threats.

Hybridization and its adverse effects

Hybridization in biology is simply defined as interbreeding of two unrelated species to create a hybrid that may be used for commercial use. Hybridization also occurs naturally that may lead to the transfer of adaptive alleles from one species to another. Introgressive hybridization is the spread of genes of one species into the gene complex of another as a result of hybridization between numerically dissimilar populations in which extensive backcrossing prevents formation of a single stable population.

Hybridization is one of the most simple, inexpensive, and potential tools of aquaculture which are more common in fishes than any other vertebrate groups. Hybridization with introduced species might not previously have been identified as a threat to freshwater fish species due to the lack of research. However, it is clear that introduction of fishes from breeding stock

which is a result of human assisted movement can result in introgressive hybridization which is a major threat to native species. So fishes from one region should not be released outside its natural range. More studies need to be done to confirm the vulnerability of a native fish species to hybridization with an introduced species using aquaria trials. However, we can predict that it is not good to release them in the wild based on the principles of conservation biology. There has been a documented case of an Australian fish facing extinction solely due to hybridization. Hybridization may also happen in situations when there is widespread fish stocking, river diversions, and potential aquarium escapes that have occurred in a few places, but remain largely undocumented.

But hybridization not only disrupts natural food chains but also threatens long term survival of other freshwater species that are consumed. We need to think whether we need short term benefits that put the future generations at risk or long term benefits that are sustainable.

Many native fish have been introduced outside their natural range. Studies have shown that the introduction of 'native' fish species outside their natural range poses a higher risk of hybridization than previously thought.

We now know from the studies that range-restricted species are at the risk of extinction, which is further increased by introgressive hybridization if they are closely related to a widespread, dispersal-oriented species. Without community-based education programmes, the extinction of other fish

species due to hybridization and replacement from competition with introduced species will be inevitable. There needs to be a management plan and a rapid response system to deal with recently established introduced populations of fish species in order to prevent future extinctions due to hybridization.

Ashritha Anoop, Shweta Madgulkar, Dhanush Shetty, Usha Ravindra, Nilesh Murmu, Trisa Bhattacharjee, Supriya Samanta, Aakanksha Komanduri, Vardhini Suresh & Arpan Joshi
RHATC Fellows, 2021–22, Zoo Outreach Organization, Coimbatore, Tamil Nadu, India.

