

EX-SITU CONSERVATION OF ENDANGERED MAHSEERS (*TOR SPP*) THROUGH RANCHING IN INDRAYANI RIVER, PUNE (MS), INDIA

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ABSTRACT

The iconic Indian sport fish known as the Mahseer (*Tor spp.*) has a very high table value. Previously thought to be a single species, the mahseer is now represented by six valid species found all over India. Despite of their abundance, during 1980's, Mahseers were reported to be declining in size and numbers from their habitat like rivers, particularly the Indrayani river of Western Ghats (Deccan plateau), and a biodiversity Hot Spot in Maharashtra, India. Considering the importance of Mahseers, there is an urgent need for restoration and conservation as their catches have dwindled considerably due to various anthropogenic activities leading to extinction and declared as endangered fish in Indrayani River, Pune district, Maharashtra. Present study focuses on the restoration and conservation of two species of Mahseers *Tor putitora* and *Tor khudree* which are commonly known as Golden Mahseer and Deccan Mahseer respectively by using ex-situ conservation strategy in Indrayani River at Dehu. In the present work, the brood Mahseer fishes were reared in earthen and cemented ponds and bred by adopting captive breeding methods developed by Tata Electric Company's at Lonavala, Pune. The young fishes at semi fingerling size were reared up to fingerling stage in the floating cages in river, thus using ranching and imprinting method. Total 34508 fingerling were released in the river and rehabilitated in the said area during the years 2011-14. Presently, the adult fishes are seen in the stretch of the river wherein Mahseers were not observed during last 3 to 4 decades. In India, this is the first attempt made using ex-situ conservation strategy for the restoration of Mahseer through river ranching programme at Indrayani River.

Keywords: Mahseer, *Tor sp.* Captive breeding, River ranching, Ex-situ conservation.

Introduction

Mahseer is recognized as the excellent game fish that is widely known around the world and can be found in rivers all along the Himalayan Belt in countries like India, Pakistan, Bangladesh, Sri Lanka, and even Thailand (Thomas, 1897). Despite being abundant once, the Mahseer population in India has been dropping in size and number in natural waters, and it is in serious risk of becoming extinct. In its report on Fisheries from 1976, the National Commission on Agriculture noted that the Mahseer fishery in India had declined due to indiscriminate fishing of juveniles and broods as well as negative consequences of river valley projects. With many indigenous fish species, the Western Ghats are a significant biodiversity hot spot in the world. Six valid species and three subspecies of Mahseer are found in various river systems of India (WWF – India, 2013). Out of these six valid species of Mahseer, three species are declared as endangered by IUCN. Due to water pollution and river valley projects in Maharashtra. The Deccan Mahseer (*Tor khudree* and *Tormussulah*) have been decimated from

Bhima, Krishna and Koyana river systems (Ogale 2006).

Dehu is an ancient town located at the shore of the Indrayani River. Famed as the birth place of the poet Saint Tukaram. The town is a popular pilgrimage destination in Pune district, Maharashtra (18.72°N 73.77°E). Gathamandir (Plate 1 and 2) is the prominent attraction of the town. This temple is located on the bank of Indrayani river which originates in the Northern Western Ghats of India at Kurwande Village (18.731°N 73.382°E) near Lonawala, Pune district, Maharashtra. It is one of the tributaries of Bhimariver, which in turn is a major tributary of the Krishna River system. Earlier at Dehu in the Indrayani river just behind the Gathamandir (Plate No – 3 and 4) there was a Matsyadoha. It was like a fish sanctuary and various pilgrims enjoyed feeding the Mahseer. In 1982 because of decreased water levels due to indiscriminate pumping and illegal release of obnoxious industrial effluents in river, the entire population of fish in the river was wiped out. According to villagers in one week 17 truck load (Appx. 25.5 tones) of dead Mahseer was taken in procession in organized funeral and

cremated as per Hindu rites. An old fisherman who was interviewed said, "Those dead Mahseer were measuring about the size of a buffalo (Apprx 4 to 5 feet).

This fish also has religious touch. The villagers of Dehu, call Mahseer as "God-fish". It was one of the fish species which supported the livelihood of tribal. Therefore, there was an urgent need of restoration and conservation of Mahseer in this stretch of Indrayani river.

Conservation techniques can be grouped into two basic, complementary strategies: *insitu* and *ex-situ*. The *ex-situ* conservation technique received the most attention. *Ex situ* conservation techniques are used for the conservation of endangered

species, species with a past, present or future local importance, and species of interest for the restoration of local ecosystems, symbolic local species and taxonomically isolated species. Intensive conservation and management of populations and individuals can come in many different forms, like translocation, breeding in a fenced wild habitat, supplementary feeding, captive hand rearing of young of the wild parents for further maturing and propagation and captive breeding (Mohammed Kasso et al. 2013). *Ex-situ* conservation literally means, "off-site conservation". It is the process of protecting an endangered species outside its natural habitat.

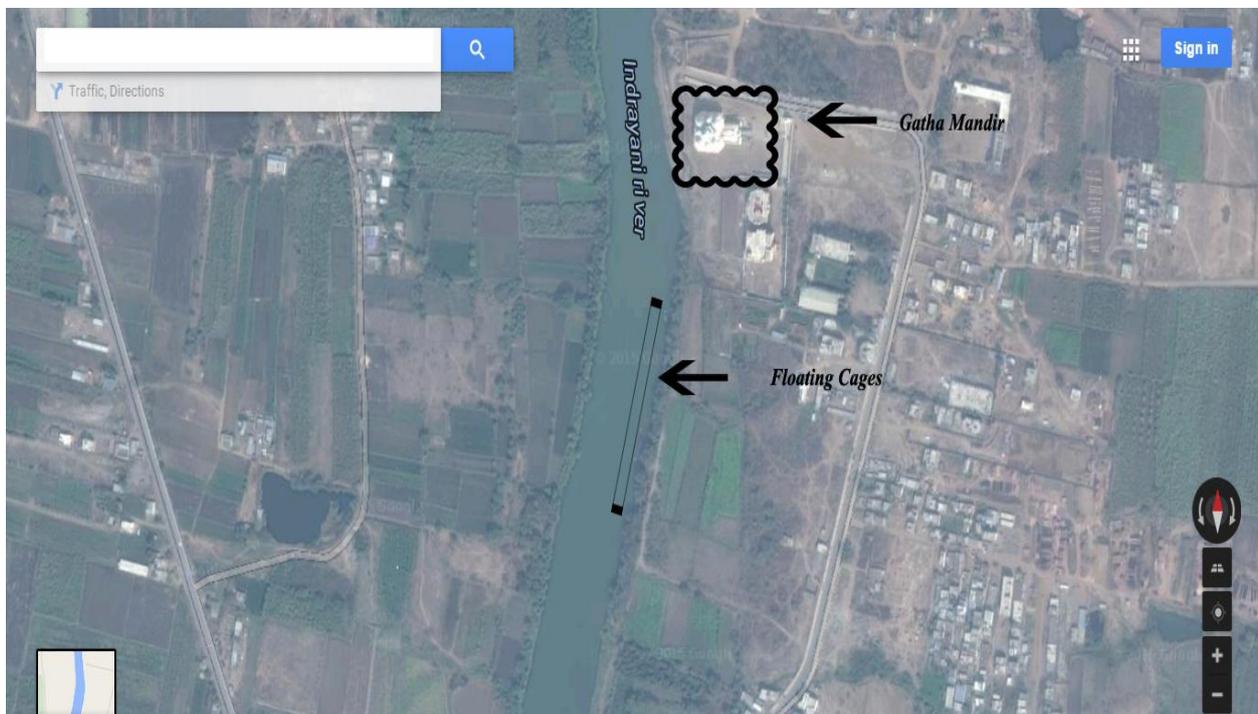


Plate – 1. Location Of Site

In this context, efforts were made for *ex-situ* conservation of two important Mahseer species *Torputitora* and *Tor Khudree* in the Indrayani river by river ranching after imprinting during 2011 to 2014 years.

Material And Methods

Before restoration of Mahseer in Indrayani river, survey was done by using the interview method. During this survey, the Dehu villagers and trustees of temple were interviewed to know the historical background as well as the reasons of extinction of Mahseer at Dehu. All

the interviewees were above the age of 65 years, who have survived through the transition and witnessed the process leading to the extinction of the fish in that area. The captive breeding of Mahseers and production of fish fingerlings were undertaken by adopting captive breeding method of *ex-situ* conservation strategy developed by Kulkarni and Ogale (1978).

Captivebreeding and rearing (Ex-situ conservation strategy)

Initially the seed was obtained from TATA Power, Walvan, Lonavala in 2011 and then reared in brood tank (60 × 40 feet) for three years. About 150 fish were reared in the brood tank for maturation and gonadal development. The matured brood fish were selected for breeding purpose. The ripe fish were collected carefully from brood tank by using drag net. Stripped eggs and milt were collected by exerting pressure on the caudal portion of the fish in a prescribed manner. The stripped eggs were collected in the plastic trays and the milt was spread over the eggs. The eggs and milt were thoroughly mixed and allowed to stand for a few minutes. After that the eggs were washed with clean oxygenated water 3 – 4 times to remove the excess milt. The trays containing eggs were then filled with fresh water and allowed to stand for 15 – 20 minutes in shade for the eggs to swell and harden before releasing in the hatching trays. The percentage of fertilization was about 90 – 95%. After successful fertilization, hatchlings were

out of the eggs on the 4th day. After yolk sac absorption, the frywere reared in hatcheries for one month and then released in rearing tanks and cages to grow for 6 months till they attained the size of 15 to 20 cm. Observations on feeding and other parameters were made regularly.

Cage Culture and Ranching

Initially the survey was conducted for the water quality parameters and flow of the river from Dehu to down town to ascertain the suitability of water and other parameters of area. Based on the survey and availability of water level, the site was finalized for cages installation. In the beginning two cages (45 × 15 feet) were installed in the Indrayani River(Plate 2) in which Mahseer semi-fingerlings were released. In these cages,almost for the 6 months the fish were reared and trained to a particular sound during feeding and then they were released in the river. The cages were floated in a protected area so that when the fish are released,theyremain in the same area where they were to be fed later.



Plate No. – 2. Floating Cages InIndrayani River, Dehu Gathamandir.

Simultaneously, awareness drive was organized to make people aware of the importance of conservation of Mahseer in the river. The awareness program was conducted for the stake holders, local farmers, villagers and panchayat personnel's in presence of religious leaders and trustees of the temple.

Results

About 150 fish were reared in the brood tank for maturation and development of brood stock. These farm reared Mahseer were bred with 90 to 95 percent success in fertilization. During the period of three years (2011-14), Total 34508 numbers of young Golden Mahseer (*Tor putitora*) and Deccan Mahseer (*Tor khudree*) were released in the Indrayani

River (Table 1). The length and weight range of released fish were 15 to 20 cm and 125 to 150 g respectively. Before releasing in the river the fish were reared for six months in floating cages in Indrayani to train and acclimatize in the river conditions and were trained to condition feeding and then released in river. Though like in reservoir and in protected area

when conditioned the fish respond to the sound any time of the day in river there was no response. But the fish has survived and responded to the feeding during the day time and even after 3 floods in 3 years have remained near the place where the cages were floated.



Plate- 3. *Tor putitora* (Golden Mahseer)



Plate 4. *Tor khudree* (Deccan Mahseer)

Though rivers are the last priority for stocking, the technology for effective stocking has been established and could be used for development of livelihood across the length and breadth of the country. Captive breeding of Golden and

Deccan Mahseer (Plate – 3 and 4) was successful in Talegaon immediately after females' age of 3 years. This also demonstrates the potential of development of functional hatcheries in other parts of the country where

local and endemic fishes may be bred for restoration and conservation. The success of this work can encourage other agencies which are involved in restoration and conservation of Mahseer in various rivers.

Ex-situ conservation strategy for Mahseer is a need of the hour and the task is certainly of great importance. It consist of collection of the brood stock, stripping of eggs, fertilization, hatching of eggs, rearing of fry and fingerlings and then ranching water bodies with fingerlings. Fecundity rate of Mahseer is very low, it is near about 12000 to 15000. Thus ex-situ conservation strategy is very important for the restoration of Mahseer in Indrayani river of Pune, Maharashtra State.

Table 01: Number of Mahseer fingerlings released in the Indrayani river during 2011 to 2014

Sr. No	Date of release	Total nos released
		Length range: 15 to 20 cm Weight range: 125 to 150 g
1	8/12/2011	260
2	9/21/2011	1500
3	9/29/2011	1000
4	10/2/2011	1500
5	10/15/2011	1500
6	10/16/2011	1000
7	11/5/2011	2000
8	12/3/2011	476
9	1/20/2012	352
10	1/29/2012	880
11	2/8/2012	1200
12	3/3/2012	1500
13	3/21/2012	2500
14	5/28/2012	1800
15	11/13/2012	1400
16	1/15/2013	1600
17	2/26/2013	700
18	4/9/2013	1000
19	6/26/2013	1440
20	12/15/2013	600
21	3/14/2014	2800
22	6/14/2014	3200
23	6/26/2014	2300
24	11/18/2014	2000
	Total	34508

During the awareness program, the scientific side of the fish was explained to fishermen who were informed how and when to fish

without disturbing the reproductive cycle of the fish. They were also made aware of the period when fishing should be carried out to help and maintain the life cycle of Mahseer in Indrayani River. In future we are planning to form an angling association at Dehu with the help of fishermen and local boat club. This will creat job opportunities for fishermen and also provide the protection to the Mahseer of this stretch of Indrayani River.

Discussion

In the majority of the Trans-Himalayan nations, studies for creating protocols for the propagation of *Tor spp.* have been conducted over a number of years to improve fisheries and aquaculture. This has improved our understanding of the biology of spawning, management of hatcheries, ecological factors, and behavior of *Tor putitora* in its natural habitats. (Ingram et al. 2007; Nautiyal et al. 2008; Sarma et al. 2010; Raghavana et al. 2011). Although, seed production and hatchery technology has been developed at the Directorate of Coldwater Fisheries Research, Bhimtal or elsewhere, the availability of Golden Mahseer gravid brooders in captivity has always been the major bottleneck for its successful seed production. Therefore, seed production programme of this species has always been dependent on the wild collection of brooders from natural habitat. As little is known about spawning of Mahseer in captivity, the present work aims at inducing maturity of Golden Mahseer in captivity.

Despite having several reports on biology and population dynamics of Deccan Mahseer (Kulkarni, 1978; Badapanda, 2011; Basavraja, 2011), there remain significant knowledge gaps. The report of the National Commission on Agriculture in 1976 was the first to highlight plight of Mahseer and the need for their conservation (Kulkarni, 1979a&b; Ogale, &Kulkarni, 1987, 2002). Several studies have revealed that overfishing and habitat alteration has resulted in severe population decline of Deccan Mahseer, *Tor khudree* in the Western Ghats (Nandeesh et al. 1993). It is opined that catchment fragmentation, water and aggregate abstraction, and the prevalence of illegal and highly destructive fishing are immediate research priorities (Ogale, 2013) for efficient

management of Deccan Mahseer resources. Due to the fact that many of the areas where Mahseer are distributed either physically remote or dispersed, often falling within protected forest areas, the involvement of local communities and other relevant stakeholders is, therefore, vital for advancing both science and conservation (Nandeesh et al. 1993; Ogale, 2006; Basavraj, 2005). Engaging community and stakeholder participation in research is not only cost-effective, but also lays the foundation for co-management (Kurup&Radhakrishnan, 2010; Raghavan et al. 2011). Hence, efficient brood stock management and participative restoration programmes would help to conserve the Deccan Mahseer in Western Ghats.

A technique for preserving biological diversity called ex-situ conservation concentrates on all dimensions of biodiversity at the genetic, species, and ecosystem levels. This concept was established prior to being formally adopted by the Convention on Biological Diversity, which was signed in Rio de Janeiro in 1992. In addition to in situ conservation, ex-situ conservation, which refers to the preservation of biological variety in its natural habitats, is frequently employed. Some conservation plans will heavily rely on ex situ management, while others would just use it as a supplementary tactic. Ex-situ conservation covers a wide range of activities, including managing captive populations, educating the public, sponsoring research projects, and working with in situ initiatives. It is used as a valuable tool in studying and conserving biological resources (plants, animals, and microorganisms) for different purposes through different techniques such as captive breeding, aquarium, and gene banks.

Ex situ conservation is a sort of captive breeding. It is a crucial component of the entire conservation action plan for a species that works to keep populations of a particular species, subspecies, or species from going extinct. It is a stringent management technique for species, populations, and people that are in danger due to anthropogenic and natural reasons. Even if the human-caused dangers could somehow be eliminated, the species would still be at high risk of going extinct in small and scattered populations due to unforeseen demographic and genetic changes,

environmental changes, and natural disasters. Thus, captive breeding extends the relative safety of captivity, under expert care and sound management, by offering an insurance against extinction, provided there is sufficient understanding of the biology and husbandry of the species. Stock for reintroduction or reinforcement efforts, opportunities for education, raising of awareness, scientific and husbandry research and other contributions to conservation are also possible through captive breeding

Conclusion

Mahseer is the King of game fishes, it is on the way of extinction due to anthropogenic activities. This requires conservation of Mahseer either in situ or ex-situ or by both methods in combination, based on the situation and its objectives. Ex-situ conservation is recommended as it complements through different techniques like captive breeding, aquarium, and gene bank. Ex-situ conservation has its own advantages and challenges. Although, India is rich in biodiversity resources, large amount of population depends on it for livelihood, directly or indirectly causing a great loss. Even if the conservation of biodiversity in India has long-time history, its progress, coverage, and enforcement of the rule for conservation seem to be weak. Despite of good progress made in gene bank conservation, it is yet to be developed. In the same way, attention should be given for developing ex-situ conservation methods. Captive breeding is now possible and it is the only way for the conservation of Mahseer. Through ex-situ conservation, multiple breeding of Mahseer is possible. We can breed *Tor khudree* three times in year and *Tor putitora* throughout the year by the technology developed by Ogale S N (2013). Captive breeding with cage culture, ranching and imprinting, transport of eggs in moist cotton and restoration are some of the ways because of ex-situ conservation. All this leads to effective ex-situ conservation of Mahseer in reservoirs and rivers. Ex-situ conservation provides excellent research opportunities on the components of biological diversity. Research institutions can also play a central role in public education and awareness rising by bringing members of the public into contact

with Mahseer conservation which they may not normally.

In conclusion it is a highly valuable food fish and could contribute to the food and nutritional security in the context of ever-increasing demand for fish as a protein rich food. It is a source of livelihood for many fishers inhabiting uplands in the vicinity of hill-streams, lakes and rivers. It offers great potential as a sport fish for promotion of eco-tourism and earning foreign exchange. It is helpful in humankind's efforts to sustain and protect our environment and to save a species from extinction. Thus ex-situ conservation of endangered Mahseer, *Tor putitora* and *Tor*

khudree attempted at Dehu in the Indrayaniriver is an important step to address the issue of extinction of Mahseers.

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