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ORIGINAL ARTICLE **OPEN ACCESS**

Rehabilitation and Conservation of Endangered Fish Mahseer at Indrayani River by Using River Ranching and Imprinting Technique.

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ABSTRACT
The present study focuses on the rehabilitation and conservation of Mahseer (Tor putitora and Tor khudree) in the Indrayani river at Dehu of Maharashtra state. Mahseer is one of the largest freshwater cyprinid. It is an excellent game and food fish. This fish had been extinct in 1983 from the Indrayani river due to various factors. It was also reported by ZSI. Now, there is an urgent need for rehabilitation and conservation to save this precious fish. This fish has a religious touch. The villagers ofDehu, call the mahseer a fish of god. In the present work, the mahseer fishes are bred by using the artificial breeding technique. Then they are reared into the floating cages in the river by using river ranching and imprinting method. In India, this is the first attempt for conservation and rehabilitation of mahseer by using the river ranching method at the Indrayani river. The study also suggests a conservation method to protect endangered fish Mahseer.
Key words: *Indrayani river, Mahseer, Ranching, Imprinting.*

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INTRODUCTION

Mahseer is a world-famous, outstanding game fish found all along the Himalayan belt inhabiting different rivers throughout the India, Pakistan, Bangladesh, Sri Lanka, and even Thailand.[1] The long, slender fish species known as Mahseer is the uncontested monarch of Indian rivers and is regarded as the strongest combatant among freshwater sporting fish. Mahseer is the world's largest member of the cyprinid family, measuring 2.75 meters (9 feet) in length and weighing 54 kilograms (118 pounds) in its natural habitat.[2]They have a reputation for being one of the strongest fighting game fish, attracting anglers from all across the world and demonstrating improved eco-tourism and livelihood opportunities for local communities. Mahseer is important in the headwater stream ecology, where it is capable of stabilizing the ecological pyramids and occupying a wide range of food webs.[3]The mahseer population within natural water bodies has been threatened by several anthropogenic hazards to aquatic ecosystems, the most severe of which being poisoning and dynamiting in the headwaters and streams within, and it is currently declared an endangered species..[4]Degradation of the river's ecological conditions, industrial and human pollution, indiscriminate fishing of broodstock and juveniles, the impact of river valley projects, electrofishing by poachers, the use of explosives, poisons, and the introduction of exotic species are the main factors contributing to Mahseer's depletion. [5]

Regardless of their abundance at one time, the mahseer population in natural waters in India has been dwindling and is on the verge of extinction. In its report on fisheries, the National Commission on Agriculture (1976) stated that the mahseer fishery has declined in India due to indiscriminate fishing of broods and juveniles, as well as the negative impacts of dams.With numerous indigenous fish species, the Western Ghats are a significant biodiversity hotspot in the world. There are 46 species of mahseer in the worldwide, including six recognised species found in India's river systems. [6] Due to water pollution and river valley projects in Maharashtra, The Deccan mahseer (*Tor khudree*) and Golden mahseer (*Tor putitora*) have been decimated from Bhima, Krishna, and Koyana rivers.[7]

Water is where life is thought to have begun, and it has since grown into a beautiful world of rich and diverse flora and animals. The dependence of man on the biological wealth of rivers, lakes, oceans, etc could not be over-emphasized. But the rapid growth of the human population and increased demand for water and its bioresources have been resulting in further loss of stream habitat which has led to aquatic organisms becoming less abundant. An integrated and accelerated effort is essential towards

environmental restoration and preservation, and to stop further degradation of the fragile ecosystem.[8]India is one of the world's twelve mega-biodiversity countries, ranking ninth in terms of freshwater mega-biodiversity.[9]

Mahseers opt for rocky pools and low temperatures of the headwaters of rivers shifting up and down the circulation relying upon flood conditions.[10] It has been revealed that mahseer exists in deep and stony waters among many rocks and snags and is generally not approachable via the nets.[11] Nearby fishermen have reported that Tor khudree catches have dropped significantly in recent years, with only tiny juveniles showing up in nets, compared to the adults that were commonly caught in the 1980s.[12]

Earlier at Dehu in the Indrayani river, Dist- Pune, Maharashtra, it was like a fish sanctuary and various devotees enjoyed feeding the mahseer; but because of various reasons, there was severe mortality of fish in the river. They have vanished completely in 1983.[13] This fish also has a religious touch. The villagers of Dehu, call Mahseer "God-fish". It was one of the fish species which supported the livelihood of the tribal. Therefore, there was an urgent need for restoration and conservation of Mahseer in this stretch of the Indrayani river.

The river ranching technique received the most attention. The techniques are used for the conservation of endangered species, species of past, present, or future local significance, and species of relevance for local ecosystem restoration, symbolic local species, and taxonomically isolated species. In this context, efforts were made for rehabilitation and conservation of two important Mahseer species *Tor putitora* (Golden Mahseer) and *Tor Khudree* (Deccan Mahseer) in the Indrayani river by river ranching. River ranching is a type of aquaculture in which a fish population is kept in captivity for the first few stages of their lives. After that, they are released into the river. In the Indrayani river, this is the first rehabilitation attempt in India in a flowing water stream.

Study Area

During this Mahseer rehabilitation work, floating cages were fixed in the Indrayani River just behind the GathaMandir, Dehu, Pune, Maharashtra, India. Earlier in this area, there was a Matsya Doha where devotees use to feed Mahseer. It was just like a fish sanctuary. Before the installation of cages in this stretch of river, a survey was carried out to check the depth of the river. During the survey, we have observed the maximum depth of water in this particular area just behind the Gatha Mandir. Depth was near about 90 feet which were measured by releasing nylon rope which was tied to a 25kg iron anchor. We have also observed that this area is having a rocky river basin which is the perfect habitat for Mahseer. That's why this area is selected for rehabilitation of Mahseer by River ranching and imprinting method. After rearing in cages for 6 months, those ranched and imprinted Mahseers are released in this area only. In the below topographical map we can observe the depth of the river and the exact location of cages in the Indrayani River.

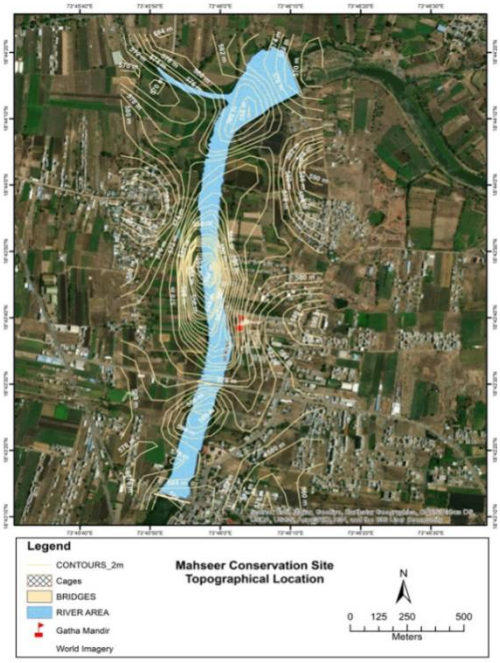

Fig No. 1 : Site Map Of Cage Culture in Indrayani River.

MATERIAL AND METHODS

Mahseers are omnivorous and feed on algae, crustaceans, insects, aquatic weeds, etc. Additionally, they receive artificial pelleted feed very well made by rice bran, groundnut cake and offered by devotees at temple pools are also accepted as feed. Their voracious feeding habit attracts a large number of tourists and devotees to temple pools. In this work, mainly the Artificial breeding technique of mahseer is used to produce the fingerlings. This technique was developed by Kulkarni and Ogale. [14]

Artificial Breeding and Rearing

Initially, the seeds are obtained from TATA Power, Walvan, Lonavala in 2011, and then they are reared in a brooding tank for 3 years. The ripe fish were collected carefully from the brood tank by using a dragnet. The selected ones are stripped for their milt and eggs by applying pressure on the caudal region of the fish in a particular manner. The stripped eggs are placed in plastic trays, and the milt is applied to them.The eggs and milt are properly mixed and then set aside for a few minutes.The eggs are then washed 3–4 times with clean oxygenated water to eliminate all excess milt. The tray containing eggs are then filled with fresh water and placed in the shade for 15–20 minutes to allow them to swell and harden before being released onto hatching trays.The percentage of fertilization is about 90 – 95%.

After successful fertilization fries come out of the eggs on the 4th day. Then fries are reared in hatcheries for one month then they are released in rearing tanks and kept for 6 months till they attain the size near about 2 – 3 inches.

Stripping Eggs from Female Stripping Milt from Male

Figure No. 2 Figure No. 3

Fertilized Eggs & Hatchlings

Figure No. 4 Figure No. 5

Cage Culture and River Ranching

Initially, the survey was conducted for the water quality parameters, the flow of the river, and fish fauna of the stretch of the river from Dehu to downtown to ascertain the suitability of the area and availability of the fish. Based on the survey and availability of water level, the site was finalized where the cages could be installed. In the beginning, 2 cages were installed in the Indrayani river in which mahseer fingerlings were released in each cage. In these cages, almost for 6 months the fish were reared and trained to a particular noise during feeding, and then they are released into the river. The cages were floated in a protected area so that when the fish is released it remains in the same area where they were fed after.

Culturing Mahseer in floating net cages is being tried at Indrayani river i.e. in flowing water for the first time in India with Golden Mahseer and Deccan Mahseer. The net cage measures 9 square meters in size (3m x 3m). With a 3 metre depth. The net is made of synthetic fibre and is supported by a G.I. pipe frame that is floated by 16 Nos. 200 Lts. drums per cage. To restrict the fish from jumping out of the cage and to protect them from predatory birds, the top of the cage is covered. As a precaution, double-walled

synthetic netting on the side and bottom is recommended to prevent fish from escaping. The sides of the cages are anchored to the river's bottom and fixed to the shore. The net cages are anchored in the river at a depth of at least 4 meters.Fingerlings each weighing 35 to 40 grams are stalked in each cage at the number of 500 per cage.The stocking density is about 5 lakhs/hectare. The fish are being fed two times a day for 10 to 15 minutes with granular floating feed. In just six months, the Mahseer has grown to an average weight of 170 grams. These Cage Culture experiments are being combined with ranching and sound imprinting.

Imprinting

Fish imprinting is the process of raising fish in a controlled system with water supplied by a nearby river or creek. Imprinting is an irreversible learning process in which an animal receives a permanent imprint of any chemical or sound to which it is exposed at a vital impressionable age in its life span, which influences its future behavior. There are two methods for doing so. Imprinting could be a) sound or b) chemicals. Because of the huge aquatic habitat in which ranched fish stocks may migrate to feed or for other reasons, it may be necessary to train and recall them in some way. It has been proven that some fish use their sense of smell to understand the waters in which they hatched and from which they migrate to sea. This behavior is known as 'imprinting.'

Imprinting with Sound

It is a mode of recall using sound. At the Indrayani River, the Mahseer was trained to congregate near the sound source in the cages.A stainless steel plate was tapped with the hand for 30 seconds to produce sound, after which feed was provided. Though, this technique is crude, proved successful. Further various experiments demonstrated the successful use of this technique in cages, ponds, lakes, and reservoirs.

RESULT AND DISCUSSION

About 150 fish were reared in the brood tank for the maturation and development of bloodstock. This farm-reared Mahseer was bred successfully. In floating cages into the Indrayani river, the fishes were trained to feed almost for 6 months and then released in the river. This was continued for 3 years and a total of 32000 trained (imprinted) fish of 6 – 8 inches were released in Indrayani. The fish has survived and responded to the feeding during the daytime and even after 3 floods in 3 years have remained at the place near the cages were floated.

Though rivers are the last priority for stocking, the technology for effective stocking has been established and could be used for the development of livelihood across the length and breadth of the country. Captive breeding of Deccan and Golden mahseer was successful in Talegaon immediately after the female's age was 3 years. This also demonstrates the potential of the development of functional hatcheries in other parts of the country where local and endemic fishes may be bred for rehabilitation and conservation.

River ranching program in Indrayani River was undertaken jointly by CIFE Mumbai, Friends Of Nature Association (FONA), Talegaon, was funded by NFDB. The Tata Power Company initially supplied the semi-fingerlings of Mahseer which were grown fingerling size at FONA farm and then released in cages floated in Indrayani River. After six months they have grown up yearlings (6'' - 8'') were imprinted with sound and then released in the River. Mahseer can be

seen now in small groups responding to feeding by devotees. Incidentally, this was the first successful experiment of ranching and rehabilitation of the Mahseer population in the River. The success of this work is an example for all agencies which are involved in the rehabilitation and conservation of mahseer in the river.

Figure No. 6 Figure No. 7

Floating Cages in the Indrayani River




Figure No. 8 **Figure No. 9**
Fish Releasing in Indrayani river **Size and Weight of fish at the time of release**

CONCLUSION

The mahseer is a world-famous game fish that is on the verge of extinction because to anthropogenic activities. This necessitates Mahseer's conservation and rehabilitation. Ex-situ conservation is recommended for mahseer rehabilitation since it improves through remarkable procedures like as captive breeding, aquariums, and gene banks. Ex-situ conservation has both advantages and disadvantages.Captive breeding is now possible and it is the only way for the rehabilitation of Mahseer by river ranching method to restore Mahseer population in a natural stream. We can breed *Tor khudree* three times a year and *Tor putitora* throughout the year by the technology developed by Ogale S N. Ex-situ conservation methods include captive breeding with cage culture, ranching, and imprinting, as well as restoration. River ranching provides excellent research opportunities on biological diversity components. Public education and awareness-raising by bringing local people and fishermen into contact with the Mahseer conservation project are very important.

In conclusion, it is a highly valuable food fish and could contribute to the food and nutritional security in the context of the ever-increasing demand for fish as protein-rich food. It is a source of livelihood for many fisherman inhabiting uplands in the vicinity of hill-streams, lakes, and rivers. It offers great potential as a sport fish for the 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. Rehabilitation and conservation of endangered fish Mahseer by using river ranching and imprinting technique attempted at Dehu in the Indrayani river is an important step to Mahseer conservation. As a result, if river ranching and imprinting techniques are used for restoration, India's magnificent mahseer can be returned to its former splendour, much to the delight of anglers and scientists alike.

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