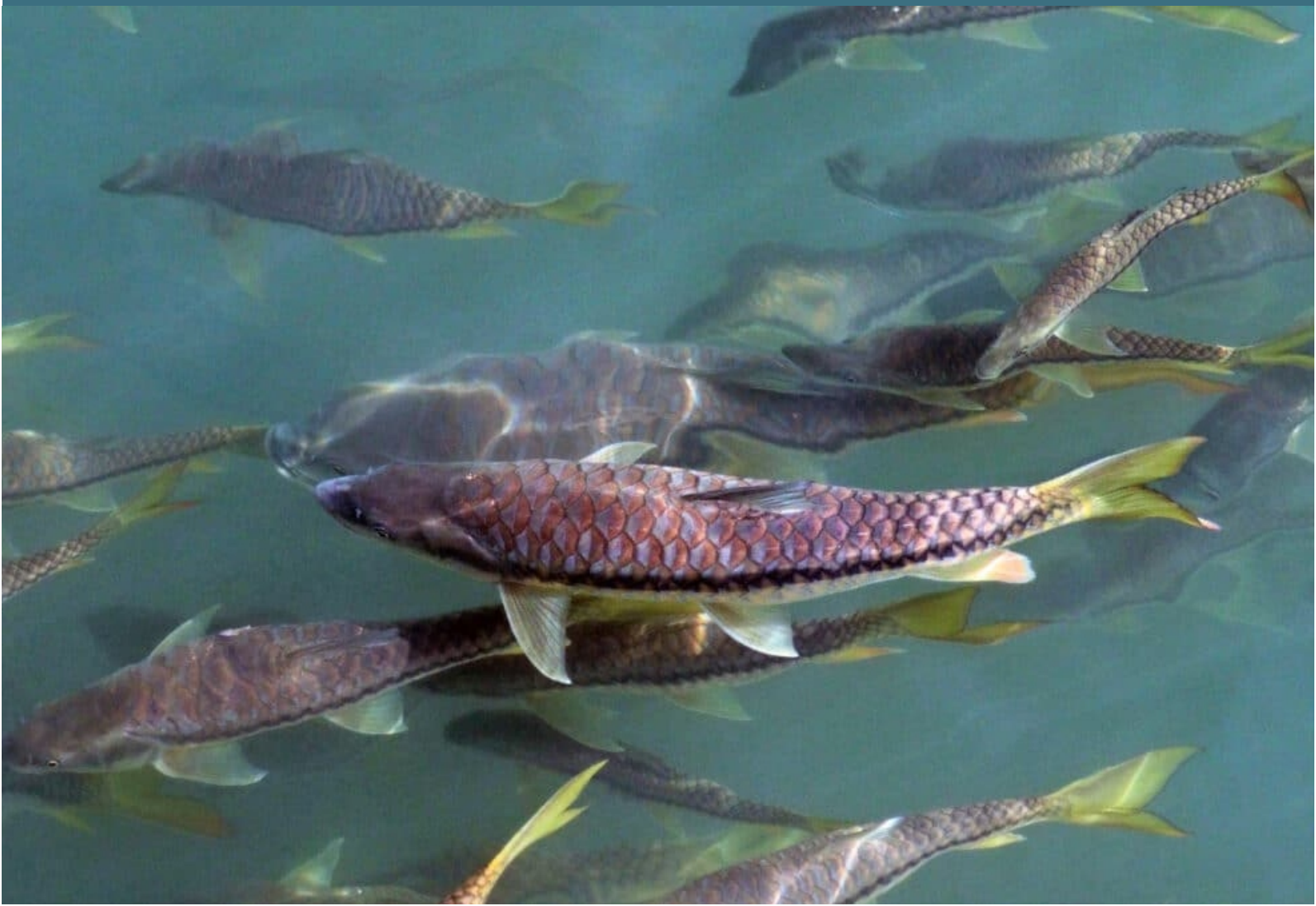
TREATISE ON MAHSEER FISHES

A. H Barbhuiya
Devashish Kar
Shakuli Saxena



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Knowledge is Our Business

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By A. H Barbhuiya, Devashish Kar, Shakuli Saxena

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e-mail: dominantbooks@gmail.com
info@dominantbooks.com

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CHAPTER 1

INTRODUCTION TO THE WORLD OF MAHSEER FISHES

Shakuli Saxena, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- shakuli2803@gmail.com

ABSTRACT:
The world of Mahseer fishes is a very interesting and varied environment in the water ecosystem. This chapter gives an interesting introduction to these amazing fish species that are known for their special characteristics and importance in the environment.Mahseer fish are a type of fish that are usually found in clean rivers and streams in South and Southeast Asia. They are part of a family of fish called Cyprinidae. Famous for being great in sports, they are desired by people who like fishing because they are very strong and like to fight. This chapter explores why Mahseer are important in the culture and history of the places they live. It looks at how they are talked about in stories and customs.In addition, the chapter talks about the types and where Mahseer live, giving information about their different sub-species and how they are especially suited for different environments. Their movements, what they eat, and how they have babies are studied closely. This shows how important they are to the food chain and the habitats in rivers and oceans.This chapter is mainly about protecting Mahseer species because they are easily harmed by habitat destruction and too much fishing. This chapter talks about how important it is to use sustainable methods and take precautions to protect these special fish and where they live.In simple words, "Introduction to the World of Mahseer Fishes" is a book that gives a detailed look into the interesting world of Mahseer fishes. It emphasizes why these fishes are important for the environment and culture, and why we must protect them from modern environmental problems.

KEYWORDS:

Fish, Mahseer, Neoclassicists, Species, World.

INTRODUCTION

India has a lot of water resources with different environmental zones, which have a lot of different types of fish. In our country, there are 11% of all the different kinds of fish in the world. The National Bureau of Fish Genetic Resources has found around 2200 different types of freshwater fish. Out of these, 73 species (3. 32%) live in cold water, 544 species (24. 72%) prefer warm freshwater, 143 species (6. 51%) live in brackish water, and 1440 species (65. 45%) are found in our large marine bodies of water. Statistics show that India has a lot of fishery resources. It has rivers that are about 29,000 km long and canals that are about 1,13,000 km long. There are also reservoirs that cover about 1. 75 million hectares and lakes and ponds that cover about one million hectares. In this important water source, Carps are a significant type of fish from the Cyprinidae family. The Mahseer fishes are different from the carps of Europe in terms of their size, taste, and behavior. It is the most important type of fish found in India for playing games. The fish called Mahseer brings back memories of the enjoyable experience of fishing for it in peaceful and scenic locations in the Himalayas, Western Ghats, and Eastern Ghats. Many people who love and enjoy fishing for game fish can tell you about the excitement they have felt when catching a fish that weighs ten pounds[1], [2].

They can also tell you about the fish that put up a strong fight but managed to escape. There have been many reports of catching big mahseer fish, and it's been difficult to reel them in. The feeling of excitement when a large fish takes your bait and the fishing line rapidly moves

away is a unique and hard to explain experience. Information about the size of Mahseer fish has been recorded. There are some animals that are about 1. 7 meters tall and weigh about 100 kilograms. The PutitorMahseer or Golden Mahseer can grow up to 2. 7 meters long The Mussullah fish from the Deccan region weighs 54. 1 kg in rivers in Karnataka. Sadly, because of the quickly changing environment and the shrinking habitats in our country, Mahseers are now in danger of becoming extinct. This is mainly because they are being caught too much and the streams where they live are changing in a way that is no longer suitable for them to thrive. In a report about Fisheries, the National Committee on Agriculture said that there has been a decrease in Mahseer fishing. This is because people have been catching breeding fish without thinking and our river projects are causing negative impacts. Some dishonest people are using different destructive ways while pretending to fish. They are using homemade explosives and even electric shocks to steal from the rivers[3], [4].

This happens when something like a forest or a remote river is not owned by anyone. People rush to use and destroy it, causing irreversible damage. Because of unwanted activities, the Mahseer fishes are now at risk of becoming nearly extinct. It is rare to see big and heavy mahseer fish. In certain places like Dehu and Alandi near the IndrayID river, Sringeri near the ThungaID river, and Ramanathapura near the Cauvery River in Karnataka, there are protected areas next to temples. These areas, along with the water bodies in Sacred Groves, are carefully protected and preserved. Even if animals are taken away from their homes, they are usually in a small size range. People have started to realize that we are in danger of losing these important resources forever, but it is happening slowly. The governments of Karnataka, Himachal Pradesh, and Maharashtra have taken some actions and made efforts. The Tata Electric company in Lonavla has also provided excellent service as NGO groups. To bring back the populations of animals and plants to how they used to be in the past, in their natural habitat. Having habitats that are perfect would be amazing, but right now it's just a dream that can't happen[5], [6].

The word Mahsir, Mahseer or Mahseer can have several different meanings. We have known about the existence of a large game fish since ancient Vedic times. He used information from Seal to show that Hindu writers like Caraka, Prasatpada, Susruta, Sankara, and Omasvali knew a lot about different types of animals and their body parts. King Someswara, in his book called Matsyavinoda or a chapter on Angling in the Manasollasa, talked about a fish called Mahasila. This text means that the oldest name given to these fishes was 'Mahasila' by King Someswara in 1127 AD. This means that other words like 'Mahasir', Mahseer', 'Mahasher', etc., may have come from this. Researchers believed that the word Mahseer comes from the Hindustani words maha meaning great and sir meaning head. It is pronounced as seerand refers to the fish having a big head, which is accurate because their heads are quite large. A Persian word for fish is mahi and for lion is sh~r because they want to show that fish are strong fighters. This is not suitable because it is unrealistic and implausible. The word Mahseer comes from the term 'mahasiras', which refers to the fish's large mouth and also its head and snout. Some people think that the word comes from "mahasirsha" but they don't want to change the gender of the word. It is possible for the last 'sha' in a corrupt word to disappear over time. Siras' or sirsha' have the same meaning. It could be that the word Mahseer is a casual way of saying 'Mahasirsha' or 'Mahasiras'.

The people in some parts of Maharashtra still use the word 'Mahsol' to refer to fish. It is true that mahseer fish have larger scales than any other type of freshwater fish found in India. The large size. One of the simple ways to tell apart different fish is by using this method. A fully grown mahseer fish can have scales that are as large as the size of your hand. Some people in India use scales as playing cards. Another type of derivative, named Dhu, was derived from

the Sanskrit word Matsya, which means fish and is mentioned in the Vedas. The Mahseer fish is considered sacred in India. It is more probable that Mahseer is just a mistake or altered version of the word Matsya. Regardless of where it comes from, the common and widely used name for this group of nine species found in the Indian subcontinent is Mahseer. The different types of animals are mentioned in another place. Out of the nine species, except for Tor mosal and Tor progenius, all the other species are well-established. Only three types of animals and plants live only in the Deccan peninsula, especially along the Western Ghats. We know that the Western Ghats, Assam, and some eastern areas are very biodiverse. These three types of animals have been spread out a lot, which has caused them to become at risk of dying out to different extents. On the next pages, we will only talk about and deal with these three types of animals[7], [8].

DISCUSSION

Mahseer is a name for a group of fish that belong to the carp family. This group includes fish from the genera Tor, Neolissochilus, Naziritor, and Parator. However, the name Mahseer is mostly used for fish in the genus Tor. These fish can be found in Vietnam, China, Laos, Cambodia, Thailand, Malaysia, Brunei, Indonesia, India, Nepal, Bhutan, Bangladesh, Sri Lanka, Pakistan, and Afghanistan. They are important for fishing and are also popular for eating. Mahseer fish are valuable and could be raised by humans for food. Some types of mahseer fish have become very rare because of pollution, losing their homes, too much fishing, and worries about releasing artificially bred fish into the wild without any regulations.The classification of the mahseers is difficult because they look different from one another. In order to develop strategies for farming and helping to increase the population of mahseer fish, we need to figure out exactly what species of mahseer we are dealing with and follow the guidelines from the IUCN on how to introduce new fish into their natural habitat.

Mahseers are a type of fish that can be found in both rivers and lakes. Some kinds of mahseers are known to go to fast-moving streams with rocky bottoms to reproduce. Similar to other types of carps, they eat various foods such as algae, crustaceans, insects, frogs, and other fish. They also eat fruits that drop from trees above them.The first type of fish from this group was discovered by Francis Buchanan-Hamilton in 1822. It was later mentioned as a popular fish for angling in a magazine in 1833 and became a favorite target for British anglers in India.The golden mahseer fish, also known as Tor putitora, was believed to be the biggest fish in its group and one of the largest in the cyprinid family. It could grow up to 2. 75 meters long and weigh 54 kilograms. However, it is rare to find fish of this size these days.In 2011, a fisherman named Ken Loughran from the UK caught a fish that was too heavy for the 120-pound scales he was using. This fish was said to be the biggest ever caught in the world, weighing 130lb 10oz. However, some people are unsure about the accuracy of the weighing method used. Besides being caught for fun, mahseer are also caught for selling as food or for keeping them as pet fish in tanks[7], [9].

The Hindi and Kumaoni people call a group of fishes mahāsir, mahāser, or mahāsaulā. There are different ideas about where the common name mahseer comes from. Some say it comes from Sanskrit, while others think it comes from Indo-Persian. Some people think it means "fish tiger" in Persian. Another suggestion is that it comes from mahā-śalka, which means large-scaled. The scales of the mahseer are so big that they were used to make playing cards in Dacca. Another idea by Henry Sullivan Thomas suggests that the fish called mahasher gets its name from two words in local languages. In Urdu, Punjabi, and Kashmiri, mahasher means big lion because it is found in the brave and mountainous rivers and streams of the Himalayas. Sadhale and Nene believe that the word mahashila, which is written in Sanskrit in

certain texts, can be translated as stone-like. They also think that this word refers to a fish that has a lot of strength.In Indonesia, there are many different names for Mahseers because the country has many different ethnic groups. In Java, they are called ikandewa, which means God-Fish or Fish of the Gods.

Species are different types of living organisms. They can be plants, animals, or microorganisms. Each species has unique characteristics and traits that distinguish them from others. Species can reproduce and produce offspring of their own kind. They also evolve and adapt over time to survive in their environment. The study of different species is important in understanding biodiversity and the interconnectedness of all living things.Sen and Jayaram only use the term mahseer to refer to specific kinds of fish in the Tor genus. However, some types of fish called mahseers, like Neolissochilus, Naziritor, and Parator, have big scales and share other traits.Scientists are trying to use the terms 'true mahseer' for species in the Tor group, and 'lesser mahseers' for species in the Neolissochilus, Naziritor, and Parator groups[10], [11].

Mahseer's Characteristics

The mahseer has broad scales, lateral lines, and two pairs of barbels. Male mahseer are distinguished by their large pectoral fins that measure 2.7 m in length and weigh well over 100 pounds. Because mahseers are migratory, they begin travelling upstream during the wet season. Mahseer often favours fast-flowing, clear, and oxygenated waters. Mahseers lay eggs dependent on their body weight, and their egg count is higher than that of carps. Similarly, mahseer species like gravel/sandy stream bottoms to breed and would travel a long distance to locate appropriate mating grounds. Mahseer fish spawn between April and September, while some smaller fish may spawn sooner. Mahseer species eat a variety of foods. They will have insatiable appetites and will eat frogs, insects, crabs, algae, other fishes, and tree fruits, among other things. Mahseer fishes are known for their sportsman's joy and cultural and religious importance. They are the toughest battling freshwater sport fish in the world because to their strength and agility. As a result, its reproduction generates a lot of money. They are also thought to be a bio-indicator of river basins.

As the name implies, the mahseer is the tiger among all other fishes. Mahi means for fish and seer stands for tiger. It is the biggest fish in the cyprinid family and is regarded as the hardest freshwater sportfish. A mature golden mahseer will have golden dorsal sides and reddish-yellow fins. Golden mahseer, like mahseer fish, has huge scales and muscular lips with significantly larger barbels. Barbels are hair-like sensory organs located in front of the mouth. These fish often prefer ephemeral headwaters. Furthermore, during its sexual production, it generates 6,000 - 10,000 eggs per kilogram. Every person will grow 10cm every year. The majority of mahseer species are omnivorous. During migration, and older fishes remain carnivorous, whereas fishes smaller than 46 cm long exhibit piscivorous tendencies.

Mahseer has a humpback.

Tor remadevii is the scientific name for Humpback mahseer. It is a fascinating fish species that is commonly distributed in the Cauvery River and is on the endangered species list. The humpback mahseer is one among the world's top 20 freshwater megafaunas. They are also known as the Tiger of the Cauvery River. The IUCN has retained this species on its red list, indicating that it need urgent protection. NGOs have made some attempts to keep a portion of its population in the Cauvery River basin. Migratory fishes are encountering increased challenges as a result of habitat alteration, overfishing, and competition from other fish species. Scientists have recently been interested in this species' taxonomy and ecological system.

1. The Humpback Mahseer was the biggest mahseer on the globe, with the greatest specimen weighing in at 54 kilograms and was discovered in the Cauvery River.
2. The Cauvery river system contains the Humpback Mahseer: formerly, these species were restricted to the upper and middle Cauvery Basins and were not found elsewhere.
3. The Humpback Mahseer population was designated as severely endangered in 2018 and was added to the IUCN Red List as a vulnerable species.
4. In India, the Mahseer fish is regarded as a holy species. People have been preserving and safeguarding mahseers in temple ponds since the Vedic times.
5. Other endangered species that benefit from mahseer habitat protection are the marsh crocodile, Grizzled giant squirrel, smooth-coated otter, tiger, leopard, and the magnificent.
6. Humpback mahseers are an essential bio-indicator for the health of rivers, which provide lifelines for living species.
7. Humpback Mahseers are a well-known species and are regarded as one of the best fighting fish in the world.
8. Trophy specimens of some of the world's record captures are kept at Mysore Palace by the legendary taxidermists, the Van Ingen's of Mysore.

Mahseer's Conservation Concerns

Translocation movements of mahseer species have been documented all throughout India since the 1850s. However, throughout that time, the species' identity and integrity were unknown. This may result in inadvertent hybridization between species or competition from invading species. The best-documented location is the Lakes of Kumaon Hills. Because of fish migrations, boosting angling sport, or trying to supplement diminishing populations. Sir H. Ramsey filled the mahseer from Uttarakhand's Kumaon lakes, Nainital Lake, Bhimtal Lake, Sattal Lake, and Naukuchiatal Lake, with stock from the rivers Gaula and Kali in 1858. The Walker investigation found that the Bhimtal stocking was less effective until the second batch of fish was released in 1878. This was explained in 'Angling in the Kumaon Lakes'. Dr. Raj, a fisheries development official from the United Provinces, submitted a report on the loss of mahseer fish populations in the lakes in 1945. And it was said, From all reports, these isolated lakes had hardly any fish in them before the introduction of mahseer. This demonstrates Walker's prior ignorance of the history of mahseers in the lakes: When I first angled in Nainital Lake, in 1863 and 1864, there were comparatively few large mahsir in it.Even though the National Bureau of Fish Genetic Resources classified golden mahseer as an endangered species in 1992, the depletion rate was quicker in Himachal Pradesh.In general, the geographical area covered by mahseers varies due to anthropogenic river distortions such as multipurpose dams, river valley project construction, shrinking habitats, poaching and other stock exploitation, and some invasion of other species. The purposeful stocking of mahseer fishes in India is taking place in the trans-Himalayan areas and has been going on for many years. Since 2014, hundreds of golden mahseers have been observed from the Teesta River in Sikkim and West Bengal. This occurred amid a campaign to encourage angling in those areas. India had fifteen Mahseer species out of the world's 47 existent species. Tor remadevi is the most recently discovered species. Tor moyarensis is also restricted to the Moyar river in Tamil Nadu.

WWF Conservation Initiatives for Mahseer

Mahseer fishes have been identified as critically endangered by the World Wildlife Fund. They later called a national summit in New Delhi to identify the root causes of issues, examine existing conservation measures, and devise several strategies for mahseer

conservation and improving the condition of mahseer species in lakes, rivers, and other freshwater resources. The conference was attended by all government officials, civil society groups, scientists, and other non-governmental organizations (NGOs) concerned in the protection of Mahseer fishes in India. In addition, the World Wildlife Fund India undertook a Golden Mahseer study and developed a species management plan for 30 km of the Kosi River in Uttarakhand.

Reason for Mahseer Population Decline

The majority of mahseer populations are towards the end of their lives. The fall in Mahseer populations is caused by a variety of man-made and natural calamities. Several variables are included here.

1. Degradation of its Natural Environment.
2. These environments have modest water flow rates.
3. Dams between rivers impede fish movement.
4. Invasion of alien species and competition amongst species.
5. Pollution brought generated by human activity.
6. Agriculture and industrial activities contribute to pollution.
7. Poisoning and gill netting are examples of unsustainable and illegal fishing tactics.
8. The local population is unaware of unlawful commercial fishing.
9. Take action against those who violate the law.
10. There is no bigger conservation community to support mahseer conservation.

Mahseer are beautiful fish that live in fast-flowing river settings, particularly those that originate in the Himalayas and run into the Bay of Bengal. This magnificent fish can swim upstream against rapids at speeds of up to 20 knots and weigh up to 125 pounds. Because of the swift water of the river, they are very powerful and put up a tremendous battle when hooked.The endangered mahseer fish has a lifespan of 20-25 years. It is a cold-water fish that thrives in well-oxygenated water on a rocky bottom. It migrates to warmer waters throughout the winter since it is a migratory fish. It also has a keen sense of smell, allowing it to find food from a long distance. The Mahseer fish is an excellent swimmer, with the heaviest specimen ever taken weighing 121 pounds. It is regarded as the hardest of the fresh water sport fish. It puts up a great fight and has earned the moniker underwater tiger.

The 'Barbus tor putitora' is the sole kind of Golden Mahseer, and it exclusively dwells in the Himalayas. The fish has a long body with a pointed snout. Its inter-orbital region is flat, and its jaws are all the same size. Barbels are found in pairs, with the rostral barbel being shorter than the maxillary barbel. It is a picky and grumpy fish. The body is golden, with grey on the dorsal side and reddish-yellow fins.The greatest fishing spots are in less travelled rural places, mostly in northern India. For the anglers, many camps have been arranged. Mahseer fishing is best in rivers that flow from the high snow-capped Himalayas. There are also a lot of Goonch, sometimes known as Catfish.The Ganges and its tributaries in northern India are popular places for Mahseer fishing.The breathtaking scenery of the Deccan in southern India. Southern India's Cauvery River. The Kali River flows through the Western Ghats 150 km from the Goa River. JiaBhoroli River is a tributary of the Brahmaputra River in Assam.The Nayar River and the Ganges meet at Vyas Ghat in Garhwal.Pancheshwar, Kumaon, is the confluence of the Sarju and Kali rivers.Rameshwar, Kumaon, Sarju River and Eastern Ramganga confluence. There are various angling sanctuaries in India that provide instruction to the locals.The greatest seasons for Mahseer fishing in India are autumn, when the rivers clear after the monsoon, and spring, when the early monsoon rains boost the river levels again.

CONCLUSION

In short, the world of Mahseer fishes is a fascinating and diverse place that includes beautiful natural features and cultural importance. In this chapter, we have learned about their amazing qualities, such as their powerful strength as fish used for sports, and how they play an important role in water environments. We have discovered the stories and customs that are connected to these amazing animals in the places where they live.However, our research has also shown that Mahseer species are easily harmed by the destruction of their environment and being caught too much.

This highlights the pressing need for actions to protect them. As we think about the dangers they encounter, it reminds us of the bigger problems our planet's diversity of life faces, and the fragile equilibrium that supports life on Earth.The story of Mahseer fishes is not only about fish biology, but also our duty to take care of the environment. It shows how important it is to protect the environment, keep habitats safe, and involve communities and governments in protecting these valuable species.As we finish this part, let's understand the important lessons we learn from Mahseer fishes. These lessons teach us about how everything is connected, how to bounce back from difficult situations, and why it's so important to take care of the beautiful natural things on Earth. Let's learn about Mahseer fishes so we can protect their home and make sure future generations can enjoy the amazing aquatic world too.

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CHAPTER 2

TAXONOMY AND CLASSIFICATION OF MAHSEER SPECIES

Praveen Kumar Singh, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- dr.pksnd@gmail.com

ABSTRACT:

The scientific study of Mahseer species and how they are classified is of great interest to scientists because these fish are diverse and important to the environment. This summary gives a short explanation of the different types of Mahseer fish and how they are classified.Mahseer fishes are mainly categorized in the Tor genus, which belongs to the Cyprinidae family. This chapter looks at different levels of taxonomy. It starts with a general classification in the Cyprinidae family and then goes into more specific classifications of subgenus and species. This chapter talks about the different kinds of Mahseer fish found in South and Southeast Asia. There are many different species and types of Mahseer.The main things we look at to group Mahseer are how they look, where they live, and their genes. The chapter talks about these factors in a lot of detail, explaining how they have helped to find and distinguish different kinds of Mahseer fish.Moreover, this chapter discusses the past and current difficulties in categorizing organisms, such as arguments about what counts as a different species and finding new types of Mahseer fish. This is about how molecular techniques and genetic studies can help us figure out taxonomic uncertainties.In simple terms, studying the different types of Mahseer fish and how they are categorized and classified is complicated and always changing. This chapter explains how these famous fish are classified and why it is important. It also looks at the difficulties involved in studying and protecting them.

KEYWORDS:

Cyprinidae Family, Evolutionary History, Fish, Mahseer Taxonomy, Mahseer Species.

INTRODUCTION

Mahseer taxonomy and categorization constitute a complex and dynamic topic of scientific inquiry that has captivated academics and environmentalists for decades. These renowned freshwater fish, which belong to the Cyprinidae family and belong to the genus Tor, are revered not just for their exceptional ecological value, but also for their cultural and sports appeal. We begin on a voyage into the world of Mahseer fishes in this detailed examination, unravelling their taxonomic complexities, evolutionary history, and the difficulty that researchers confront in describing and classifying these varied and intriguing species.The Mahseer, a species of enormous and strong freshwater fish, has long captivated the minds of fishermen, scientists, and nature lovers alike. Their name, derived from the Hindi words mah (fish) and ra (head), accurately characterizes their appearance, which is distinguished by a big head and a strong body. Mahseer species are found mostly in South and Southeast Asia, notably in clear, fast-flowing rivers and streams that characterize their native habitats.The attraction with Mahseer fishes extends beyond their physical characteristics. They have enormous cultural and historical value in the areas where they live. Mahseer stories and mythology have been handed down through centuries, and these fish are often regarded as symbols of power, tenacity, and the vitality of pure aquatic habitats.

The taxonomy and categorization of Mahseer species is essential to our investigation. The study of identifying, classifying, and categorizing living species is known as taxonomy, while classification entails grouping these organisms into hierarchical groups based on common

traits and evolutionary links. Mahseer fishes are classified under the family Cyprinidae, which is a varied group of freshwater fish generally known as carps and minnows.The Cyprinidae family is one of the most diverse fish families, with approximately 3,000 species. The lack of real teeth and the presence of a single dorsal fin distinguish these fishes. Mahseer fishes are members of the subfamily Cyprininae, which contains numerous other closely related taxa. This subfamily is further classified into tribes, subtribes, and genera, showing the Cyprininae's rich variety.The genus Tor, which includes the Mahseer species, is of great relevance in our investigation. Tor has a distinctive morphology that includes a highly forked tail, a scaleless region between the dorsal fin and the tail, and a noticeable and powerful body structure. This genus contains the Mahseer fishes, which have won fisherman' hearts due to their remarkable strength and tenacity when hooked.

There are several species and sub-species within the genus Tor, each with its own set of adaptations and traits. In this situation, taxonomy becomes a critical tool for scientists and conservationists to study Mahseer variety and design effective measures for their preservation and management.Mahseer fishes are further divided into species and sub-species based on a variety of parameters such as geographical distribution, physical characteristics, and genetic analysis. The variety of habitats occupied by these species may be linked to the large range of ecological difficulties and chances for adaptation.The Golden Mahseer, for example, is regarded as one of the most iconic animals. Because of its striking golden colour, fearsome size, and extraordinary strength, it has become a popular target for fisherman. However, several sub-populations of this species exist, each suited to the peculiar circumstances of their individual river systems. These sub-populations, also known as sub-species, are critical to understanding Mahseer's evolutionary history and genetic diversity[1], [2].

Morphological characteristics are important in distinguishing Mahseer species and sub-species. To precisely identify and categorize these fish, scientists examined traits such as fin ray counts, scale form and size, lateral line arrangement, and colouring.Another important factor in Mahseer species categorization is their geographical distribution. different Mahseer populations live in different rivers and basins around South and Southeast Asia, each individually suited to its native habitat. Understanding the distribution of these species is critical for conservation efforts and the creation of appropriate management strategies.Genetic analysis has emerged as an effective method for categorizing Mahseer species and sub-species in recent years. Researchers have used DNA sequencing and molecular tools to uncover the genetic variety among Mahseer populations, giving information on their evolutionary history and linkages.Exploring the taxonomy and categorization of Mahseer species reveals important information about their evolutionary history. Mahseer fishes have evolved significantly to flourish in a variety of riverine habitats. Scientists can put together the riddle of how these extraordinary fish originated and diversified through time by researching their taxonomy and genetic links.Adaptive radiation is a fascinating element of Mahseer development. When a single ancestral species diversifies into numerous descendant species, each adapted for a particular ecological niche, this is referred to as adaptive radiation. In the case of Mahseer, this radiation has resulted in the emergence of several species and sub-species, each of which has adapted to the unique environmental circumstances of its different river systems.

Mahseer fishes are classified as old lineages within the Cyprinidae family, implying that they have a deep evolutionary history. Their physical characteristics and genetic diversity reflect this past. Understanding the evolutionary links between Mahseer species may give insights into the larger evolutionary history of Asian freshwater fish.While taxonomy is an important tool for comprehending the natural world, it is not without its difficulties and disagreements.

The categorization of Mahseer species is always being debated and revised as new data and approaches become available.One of the most difficult aspects of Mahseer taxonomy is determining species boundaries. Based on genetic study, several populations of Mahseer that were formerly deemed sub-species have been raised to full species classification in certain situations. This reclassification emphasizes the fluid nature of taxonomy and the need of continuous study.Another problem that affects Mahseer taxonomy is hybridization, or the interbreeding of distinct species or sub-species. Hybridization may obfuscate the distinctions between populations, making it difficult to discern their taxonomic position. Genetic study is critical for detecting hybridization occurrences and their categorization consequences[3], [4].

The taxonomy and categorization of Mahseer species have major conservation significance. Identifying unique species and subspecies is critical for designing focused conservation measures. Here, we look at the importance of taxonomy in the protection of Mahseer fishes.On international conservation lists, several Mahseer species and subspecies are categorized as vulnerable or endangered. The correct categorization of these populations is critical for properly evaluating their conservation status and prioritizing conservation actions.Understanding the taxonomy of Mahseer species also helps with habitat conservation and restoration considerations. Different populations may have different habitat needs, and identifying them as distinct entities is critical for adapting conservation measures.Mahseer fishes are essential not just for their ecological activities, but also for their cultural and economic importance in many areas. Accurate taxonomy helps guarantee that fishing tactics are sustainable and do not endanger certain populations' existence.As we negotiate the complicated terrain of Mahseer taxonomy and categorization, it becomes clear that continued study is critical. Future research should concentrate on the following areas. Taxonomy is being transformed by advances in molecular technology. These strategies should be used in future studies to improve our knowledge of Mahseer species and their interactions.

Conservation genetics is a new area that may provide light on the genetic diversity and health of Mahseer populations. It is vital to apply these concepts to Mahseer conservation initiatives.Integrating traditional knowledge and local experience, in addition to scientific study, is critical for a complete understanding of Mahseer taxonomy and conservation.Comprehensive range-wide surveys and monitoring initiatives may contribute to more accurate taxonomy and conservation assessments by filling gaps in our understanding of Mahseer distribution and abundance.Finally, Mahseer taxonomy and categorization provide an insight into the intriguing world of these renowned freshwater fish. These initiatives not only aid in categorizing and understanding the variety of Mahseer, but they also have far-reaching consequences for conservation and management.We get significant insights into the evolutionary history, genetic diversity, and unique adaptations that have enabled Mahseer fishes to flourish in varied riverine habitats as we dig further into the rich taxonomy of Mahseer fishes. The problems and disputes in this subject remind us of science's dynamic character and the need of continual research and cooperation.Finally, the taxonomy and categorization of Mahseer species serve as a monument to our desire for knowledge about the natural world, as well as our obligation to safeguard and conserve our planet's incredible biodiversity. By improving our knowledge of Mahseer taxonomy, we can ensure the continuing survival of these iconic fish and the preservation of the environments in which they live.

DISCUSSION

This type of mahseer was called a different species because it had some differences compared to other mahseers in the area called the trans-Himalayan region. The other mahseers are called Tor putitora, Tor tor, and Tor mosal. In the paper, they compared different features of

species. Instead of using the original descriptions of those species, they used information from recent studies by Menon, an Indian fish scientist. But when we compare Hamilton's original descriptions of the mahseers of trans-Himalaya, we should pay attention to the number of parts in the pectoral fin. Tor barakae has 14 rays in its fin, while Tor putitora has 15, Tor tor has 18, and Tor mosal has 17.Distribution means the process of delivering products or goods to different places or locations.Until now, only a small amount of research has been done on this mahseer species. Most of the research has taken place in the Barak River, primarily in the Indian state of Manipur. Since Tor barakae lives in both India and Bangladesh, it can be assumed that this river is shared by them. We are still not sure about the larger areas where the Brahmaputra River basin is spread[5], [6].

In the Barak Bridge area, the fish is called 'Nungnga'.Ecology is the study of how living things, including plants and animals, interact with each other and their environment.The Tor barakae fish is probably like other mahseer species because it eats both plants and animals. It likely eats things like bugs, fruit, plants, small frogs, and other fish. Adult fish are likely to go to the beginning of rivers to lay their eggs when there is a lot of water.Conservation is the act of protecting and preserving natural resources and the environment. It involves taking steps to avoid excessive use or waste of resources, such as water, energy, and materials. Conservation is important for maintaining a sustainable way of life and preventing damage to the planet.This type of animal is currently categorized as being at risk of becoming endangered by the IUCN. Because only five specimens have been captured and little research has been conducted, the main obstacle to creating a conservation plan is the lack of knowledge about where this species can be found, how it interacts with other local mahseer species, and its ecology. Other types of mahseer face major dangers. These include losing their homes because of cities expanding, people taking over their flood areas, building dams, taking sand from their environment, and polluting their surroundings. In South and Southeast Asia, people often use harmful ways to catch fish, like using dynamite, poison, and electricity. These methods can seriously harm the fish populations and make it difficult for them to survive in the long run[7], [8].

Some research has been done on whether the river system is suitable for mahseers and other fish. The Barak River is known to be constantly changing, so if we straighten and dredge the river for the national water highway system, it could harm these fish.The humpback mahseer is a big kind of fish that has a body that is squashed from the sides and is a little more than a quarter as deep as it is long. It has a steep back that forms a hump and goes all the way to the top of its back fin and then slopes gently down to its tail fin. This fish has a small mouth with thick lips that points downward. It has two pairs of short barbels behind its mouth, which makes it different from other similar species. The fin on its back starts just before the fins on its belly. The back fin is curved on the top and has a strong, smooth, and stiff spine. The tail fin is split in two and has small bumps on the rays. The fish is mostly brown but has a lighter belly and its fins may have dark ends. It can grow up to 150 cm long and weigh up to 90 kg. The biggest fish ever caught using a rod and reel weighed about 59 kg and was 169 cm long. Another fish caught using different methods weighed 93 kg and was 183 cm long[1], [2].

Sykes first described the fish as having a noticeable bulge between its upper lip and nostrils, which made it look like it had a Roman nose. He also noted that the fish had 16 rays in its pectoral fin, 9 rays in its ventral fin, 12 rays in its dorsal fin with the first ray branched, and 8 rays in its anal fin.In a 2013 paper called on the identities of Barbusmussulah, they found that the fish known as Hypselobarbusmussulah is different from Tor remadevii. They counted the scales on the fish's lateral line and found there were 42, which proves it is not a mahseer a type of fish in the Tor genus.The humpback mahseer is a type of fish that is only found in the

Western Ghats region of southern India. It has been seen in the Krishna and, possibly, the Godavari rivers in the states of Karnataka, Maharashtra, and Kerala. It is found in small areas that are far apart from each other. The species is spread out and not concentrated in one large area, and the total area it covers is likely less than 500 square kilometers.The natural environment where an organism lives and how it interacts with its surroundings is called its habitat and ecology.

The humpback mahseer likes to live in deep parts of big streams and rivers in the jungle. It eats a lot of different things like fish, crabs, snails, frogs, fruits, and plants.The humpback mahseer is a fish that has been popular among anglers since the British colonial era. However, the specific type of fish was not officially identified because the description of Barbusmussulah was not considered accurate. It is the main example of the Hypselobarbus group of fish. When scientists first identified this species as Tor mussulah, they thought it was the same as the orange-finned mahseer. The orange-finned mahseer is a rare type of fish found only in the Kaveri River area and is in danger of disappearing. However, the humpback, which is a different species, is only found in the Krishna River area. When the humpback fish was changed to a new name, the orange-finned mahseer fish was separated from it because of this.The Tor remadevii is a type of fish that is in danger of disappearing. It has orange fins and is familiar by different names like the hump-backed mahseer. This fish only lives in the Western Ghats of India, specifically in the Kaveri river basin[9], [10].

This fish is different from other mahseer because it has a noticeable bump above its gill cover, a bend in another part of the gill cover, a mouth at the end of its face, and a bright orange tail fin. Many people think this fish is very good for fishing and it is known as the biggest and strongest fish in freshwater.One of the reasons why the species is in extreme danger is because non-native fish called Tor khudree and Himalayan golden mahseer have been brought into the bigger Kaveri River area. The hump-backed mahseer fish species is being put in danger by the building of dams and the practice of dynamite fishing. Other things that harm the fish are the loss of plants along the river's edge, pollution from industry and cities, taking too much water for farming, and changes in the weather. These factors caused a big decrease in the number of hump-backed mahseer fish around 2004.Because there was no official scientific name, it was difficult to protect the species. This means that the species now has a scientific name and its status has been updated. Both of these will assist in future conservation efforts[4], [11].

CONCLUSION

Scientists are interested in the scientific research of Mahseer species and how they are categorized since these fish are varied and vital to the ecosystem. This review provides a brief overview of the several varieties of Mahseer fish and how they are categorized.Mahseer fishes are classified mostly in the Tor genus, which is part of the Cyprinidae family. This chapter examines taxonomy at several levels. It begins with a broad categorization in the Cyprinidae family and then moves on to more precise subgenus and species classifications. This chapter discusses the several types of Mahseer fish found in South and Southeast Asia. Mahseer come in a variety of species and varieties.We categorize Mahseer based on their appearance, where they reside, and their DNA. The chapter goes into great length regarding these variables, discussing how they have aided in the discovery and identification of several types of Mahseer fish.Furthermore, this chapter highlights previous and contemporary issues in classifying creatures, such as disagreements over what constitutes a separate species and the discovery of new forms of Mahseer fish. This article discusses how molecular methods and genetic research may assist us in determining taxonomy ambiguities.In layman's words, examining the many species of Mahseer fish and how they are classed and categorised is

intricate and ever-changing. This chapter describes how and why some well-known fish are categorized. It also looks at the challenges of researching and safeguarding them.

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CHAPTER 3

DISTRIBUTION AND BIOGEOGRAPHY OF MAHSEER POPULATIONS

Sunil Kumar, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- sunilagro.chaudhary@gmail.com

ABSTRACT:

The distribution and biogeography of Mahseer populations are of great ecological interest since these famous freshwater fish live in a variety of environments throughout South and Southeast Asia. This abstract gives a comprehensive summary of Mahseer distribution patterns and biogeographical characteristics, offering light on their global range, habitat preferences, and the variables that influence their dispersion.Mahseer species, which are members of the Cyprinidae family and belong to the genus Tor, are mostly found in clean, fast-flowing rivers and streams throughout South and Southeast Asia. These areas include a large and varied environment, and Mahseer populations may be found in many countries, including India, Nepal, Bhutan, Myanmar, Thailand, Malaysia, and Indonesia.The distribution of Mahseer is directly related to their habitat preferences. They are usually associated with pure freshwater environments with fast-flowing rivers, stony substrates, and well-oxygenated waters. These habitats are suitable for Mahseer since they are tailored to their specific biological requirements.The biogeographical distribution of Mahseer populations exhibits fascinating biogeographical characteristics. Different Mahseer species and subspecies have distinct affinities for certain river systems and areas. This demonstrates their versatility and capacity to survive in a variety of environmental circumstances.

KEYWORDS:

Climate Change, Distribution Biogeography, Mahseer Populations, Mahseer Fish, River Streams, Water Quality.

INTRODUCTION

River flow regimes and water quality are important in influencing Mahseer distribution. They are often found in fast-flowing, clear rivers, and their presence may be affected by changes in river flow caused by dam building or water diversion.Water temperature has a significant impact on Mahseer dispersion. They prefer colder waters, and their range may alter due to temperature changes caused by seasonal fluctuations or climate change.Human activities such as deforestation, urbanization, and agriculture may contribute to habitat degradation and fragmentation, affecting Mahseer populations. Conservation efforts are often focused on reducing these hazards in order to preserve appropriate ecosystems.Unsustainable fishing techniques have the potential to decrease Mahseer populations, especially in locations where they are widely sought for recreational or commercial fishing.Understanding the range and biogeography of Mahseer populations is critical for conservation. Mahseer are often seen as flagship species for freshwater conservation, and conserving their habitats may have a good knock-on impact on other aquatic biodiversity.It is vital to protect the rivers and streams where Mahseer live[1], [2].

This involves conserving riparian vegetation as well as ensuring water quality and natural flow regimes.Implementing sustainable fishing techniques and laws will assist preserve the long-term survival of Mahseer populations while allowing for responsible angling and local livelihoods. As climate change continues to modify water temperatures and flow patterns,

conservation efforts must include adaptive techniques to assist Mahseer populations in adapting to changing circumstances.Continued study into Mahseer population distribution and biogeography is critical for their conservation and knowledge of freshwater habitats. Widespread surveys to map the range of Mahseer species and subspecies, particularly in less-studied areas, might give significant data for conservation strategy.Genetic studies may assist in the identification of separate populations and the direction of conservation efforts by elucidating population connectedness and genetic diversity.It is critical to assess the effect of climate change on Mahseer populations and habitats in order to establish adaptive conservation measures.To summarize, Mahseer population dispersion and biogeography are complicated and dynamic features of their ecosystem. Understanding where and why this iconic freshwater fish flourish is critical for their protection as well as the preservation of the freshwater habitats in which they live. We can endeavour to preserve the long-term survival of Mahseer and the health of their unique and critical habitats by doing extensive study and coordinating conservation activities[3], [4].

The Mahseer fish is part of a group called Tor, and it can be found in different types in India and other countries in South Asia. There are problems with classifying the Mahseer fish, and scientists don't fully agree on how many different kinds there are, even with the help of DNA analysis tools.The Mahseer is a big fish that is part of the carp family. It has big scales running down its side and two pairs of whisker-like organs. Male fish can be recognized by their long chest fins and sometimes they can grow up to 2. 7 meters long and weigh more than 100 pounds, but this is not very common anymore. This species moves from one place to another during rainy seasons. It likes clean and fast-moving water that has a lot of oxygen. It doesn't lay as many eggs as most carps do, in relation to its body weight. It needs gravel or sandy stream beds to have babies and can travel long distances to find a good place to have babies. The usual time when fish lay their eggs is from April to September, but sometimes younger fish lay their eggs earlier than that. Mahseer eat both plants and animals. They eat a lot and their food includes different types of plants and animals like algae, small shellfish, bugs, frogs, other fish, and even fruits that fall from trees. Besides being important to culture and religion[5], [6].

Mahseer fish are protected in special places called 'temple sanctuaries' in India, these fish are a favorite for people who enjoy sports. They are very fast and powerful, which makes them some of the toughest fighting fish in the sub-continent's fresh water. So, when people go fishing for fun, it can make a lot of money to help protect Mahseer fish. When there are Mahseer fish in a river, it means that the river's ecosystem is healthy. This is why Mahseer are important as a symbol of a healthy river. In Karnataka, people call the Mahseer fish 'Bili Meenu'.Mahseer translates approximately as mahi fish and sheer tiger, and is hence also known as tiger among fish. It is a huge cyprinid and is regarded as the hardest fresh water sport fish. The dorsal side of an adult Golden Mahseer is golden, while the fins are reddish-yellow. The fish is further distinguished by its huge scales and thick, muscular lips, which have considerably longer barbels sensory hair-like structures in front of the mouth.Generally, the fish reproduce during floods and spawn on rocky, gravel substrates, frequently in ephemeral headwaters. The sexual production is poor (6,000 - 10,000 eggs per kilogram). Individuals in the population grow at a pace of 10cm each year on average. Its eating habits are omnivorous. During migration, fish of all ages remain carnivorous, although fish larger than 46 cm become piscivorous.

Conservation Concerns

Because to pollution, habitat degradation, and overfishing, the species' population has declined dramatically over most of its range, and it is now considered vulnerable. There is a

scarcity of data on the species' habitat, feeding, and breeding ecology. The Mahseer is a fragile animal that can only withstand a little altered aquatic habitat. This is evidenced from the fall in its size over the previous century, size composition, and lower proportion of capture as low as 5% from 40-50% from its geographical areas.India is home to fifteen of the 47 Mahseer species found worldwide. Tor remadevi is one of the most recently discovered species, while Tor moyarensis, which is only found in Tamil Nadu's Moyar river, is another.Recognizing the gravity of the stated threats, WWF-India called a national conference in New Delhi to identify the issues, examine existing conservation efforts, and formulate a conservation strategy to enhance the condition of this and other Mahseer species in India's reservoirs and rivers. The gathering was attended by government officials, scientists, civil society organizations, and fishermen interested in Mahseer conservation. WWF-India has performed a Golden Mahseer study and is now developing a species management plan for a 30km length of the Kosi River in Uttarakhand[7], [8].

DISCUSSION

The Humpback Mahseer is a special type of fish that is only found in the Cauvery River. This fish is in danger of disappearing forever. It is considered one of the biggest animals in freshwater and is called the Tiger of the Cauvery River. This species is listed as endangered by IUCN and urgently requires protection efforts. We have found only a small number of groups of animals or plants living separately in the Cauvery River basin. This fish that moves around a lot is in danger because people are changing where it lives, catching too many of them, and other fish are fighting them for food.The next thing to do is to create a plan to protect the species throughout the Cauvery River area including Karnataka, Tamil Nadu, and Kerala.

This will need the help of many different organizations working together.This species is only found in the Cauvery River system. It has always been found in the upper and middle parts of the Cauvery Basins and not anywhere else.In India, Mahseer fish have been seen as very important and special since a long time ago. Even now, they are looked after and kept safe in ponds near temples.The Mahseer fish is a very important species. When we protect their home, it also helps protect other animals and plants that are in danger, like the otter, crocodile, eagle, squirrel, leopard, tiger, and the Hiremath trees.

Watershed management is keeping the Cauvery River healthy, which is very important for the southern states. The Humpback Mahseer is a helpful fish that shows us how healthy the river is.The Humpback Mahseer is well-known around the world. Anglers especially admire it because it is known to be one of the best fish for fighting.There are some special fish at the Mysore Palace that were caught and preserved by the famous taxidermists, the Van Ingen's of Mysore.

These fish are so nice that even a Maharaja would like them.Because of their extraordinary characteristics and unusual distribution throughout South and Southeast Asia, the Mahseer, a group of enormous and famous freshwater fish, have long attracted biologists, fishermen, and environmentalists. This in-depth examination digs into the complexities of Mahseer distribution and biogeography, offering insights into their global range, habitat requirements, factors affecting their distribution, and the conservation implications of their distribution patterns.

Geographic Area

Mahseer species, which are members of the Cyprinidae family and belong to the genus Tor, are found predominantly in clean, fast-flowing rivers and streams throughout South and

Southeast Asia. These territories include a large and varied environment, and Mahseer populations may be found in a variety of nations, including India, Nepal, Bhutan, Myanmar, Thailand, Malaysia, and Indonesia. Mahseer's broad geographic distribution demonstrates their flexibility and the magnitude of their ecological relevance in the area.

India: A Mahseer Mecca

India is a major hub for Mahseer variety, with various species and subspecies found in its rivers. The Western Ghats area in particular is well-known for its diverse Mahseer populations, with species such as Tor khudree, Tor remadevii, and Tor malabaricus found in a variety of river systems. The Himalayan rivers, such as the Ganges and its tributaries, are also home to considerable Mahseer populations, including the valued Golden Mahseer.

Additional Range Countries

Mahseer populations thrive in Nepal, Bhutan, and Myanmar as well. Several Mahseer species, notably Tor putitora, may be found in Nepal's rivers, such as the Karnali and Gandaki.

The Punatsangchhu and Wangchhu rivers in Bhutan are crucial habitats for the Golden Mahseer. Myanmar, with its wide river systems, hosts a variety of Mahseer species, making it a biogeographically important location.

Southeast Asian Distribution

Thailand, Malaysia, and Indonesia are well-known for their Mahseer populations in Southeast Asia. Tor tambroides, often known as the Giant Snakehead, is found in Thailand and is closely related to Mahseer. Tor douronensis lives in Malaysia, whereas Tor soro and Tor tambra live in Indonesia.

Preferences for Habitat

The spread of Mahseer is tightly tied to their environmental preferences. These fish are usually found in clear, swift-flowing rivers and streams with stony bottoms and well-oxygenated waters. Understanding these environmental preferences is critical for understanding their dispersion patterns.

Natural Freshwater Ecosystems

Mahseer flourish in clean freshwater environments with intact natural flow regimes. These environments often have little pollution and siltation, resulting in great water quality. Mahseer may also find plenty of prey and foraging possibilities in pristine rivers and streams.

Rivers that flow quickly

The propensity for swift-flowing rivers is a distinguishing feature of Mahseer habitats. Because these fish are evolved to swimming against the tide, swift currents provide optimal circumstances. This adaptability is crucial for their survival, particularly during their upstream breeding excursions.

Rocky Substrates

Mahseer are closely related to riverbeds with rocky substrates. These soils are great spawning grounds, offering optimum conditions for egg incubation and protection. Furthermore, the rough ground provides Mahseer with hiding spots and ambush locations while they seek for food.

Waters that are well-oxygenated

Mahseer populations are often concentrated in well-oxygenated waters. The existence of dissolved oxygen is critical for their survival, and it is connected to the fast currents found in their favoured environments.

Patterns of Biogeographical Distribution

Mahseer population distribution reveals unique biogeographical patterns that demonstrate their resilience and reaction to certain environmental situations. Different Mahseer species and subspecies often have varied preferences for certain river systems and areas, underlining the complexities of their biogeography.

Variability of Species and Sub-Species

The heterogeneity within and between species and sub-species further complicates Mahseer's biogeographical patterns. The Golden Mahseer (Tor putitora), for example, is found in many river systems across the Himalayas, with different subpopulations suited to their specific surroundings.

These sub-populations, which are sometimes referred to as sub-species, have developed distinct characteristics to flourish in certain river circumstances.Some Mahseer populations have endemism, which means they can only be found in particular river systems or locations. Their biogeography is complicated by their restricted distribution. The Tor remadevii, sometimes known as the Deccan Mahseer, is native to select river basins in India's Deccan Plateau[9], [10].

Distribution Influencing Factors

A variety of natural and manmade causes impact the spread of Mahseer populations. Understanding these characteristics is critical for conservation efforts and projecting how Mahseer distribution will evolve in the future.

Hydrological Elements

The distribution of Mahseer is heavily influenced by river flow regimes and water quality. Changes in river flow caused by dam building, water diversion, or other human activity might disturb Mahseer's natural habitats and migratory habits. Water quality changes, such as increased siltation and pollution, may also have a detrimental influence on their populations.The temperature of the water is important in Mahseer dispersal. Temperature oscillations linked with seasonal variations or climate change might alter the distribution of these fish, which favour colder waters. Climate change may cause Mahseer populations to migrate to higher altitudes or cooler environments.

Habitat Alteration

Human activities such as deforestation, urbanization, and agriculture are often responsible for habitat alteration and deterioration. These changes have the potential to disrupt Mahseer ecosystems, limiting their access to adequate spawning and feeding sites. To offset these challenges, conservation efforts must focus on habitat restoration and preservation.

Overfishing

Unsustainable fishing activities, whether for recreational or commercial reasons, may reduce Mahseer populations, especially in highly targeted locations. Overfishing may disturb natural population dynamics and diminish these fish's reproductive success.

Implications for Conservation

Understanding the distribution and biogeography of Mahseer populations has significant conservation implications, since these fish are sometimes regarded as freshwater conservation flagship species. It is critical to protect Mahseer habitats not just for their survival but also for the overall health of freshwater ecosystems.Efforts to protect the rivers and streams where Mahseer live are vital. This involves sustaining natural flow regimes, safeguarding riparian vegetation, and maintaining water quality. The designation of protected areas and conservation zones may aid in the long-term survival of Mahseer habitats.

Sustainable Fishing Methods

Sustainable fishing techniques and laws are critical for balancing Mahseer conservation with the interests of fishermen and local communities. Measures that encourage responsible angling while maintaining Mahseer populations include catch-and-release programs, size limitations, and seasonal closures.

As climate change alters water temperatures and flow patterns, conservation programs must include adaptive techniques to assist Mahseer populations in adapting to changing circumstances. This might involve habitat restoration and aided migrations to colder environments.Continued study into Mahseer population distribution and biogeography is critical for conservation and a better understanding of freshwater environments. Possible future research avenues include:Comprehensive range-wide surveys are required to correctly map the distribution of Mahseer species and subspecies. These surveys may aid in the identification of essential habitats and locations where conservation efforts should be focused[11], [12].

Genetic Testing

Genetic research may provide light on population connections, genetic diversity, and the identification of separate populations. The influence of hybridization and introgression on Mahseer populations may also be assessed via genetic analysis.It is critical to assess the effect of climate change on Mahseer populations and habitats. Climate forecasts may be used to model future situations, which can help with conservation planning and adaption methods.In order to have a comprehensive understanding of Mahseer distribution and conservation, it is essential to use traditional knowledge and the experience of local people. Indigenous knowledge may help us understand past distribution patterns and changes throughout time.To summarize, Mahseer population dispersion and biogeography are complex and dynamic features of their ecology. These distinctive freshwater fish are inextricably related to their environments, preferring clean, fast-flowing rivers with stony bottoms and well-oxygenated water. Understanding the variables determining their distribution is critical for conservation, from hydrological considerations to habitat alteration and overfishing. Mahseer, which are sometimes regarded as flagship species for freshwater conservation, play an important role in preserving the health and biodiversity of their ecosystems. Protecting their habitats, supporting sustainable fishing techniques, and tackling climate change problems are all critical components of Mahseer conservation.As we continue to untangle the complexities of Mahseer distribution and biogeography via study and conservation initiatives, we not only contribute to the preservation of these magnificent fish, but also to the larger objective of protecting the freshwater environments in which they live. The protection of Mahseer demonstrates our dedication to biodiversity conservation and our understanding of the inherent worth of these iconic fish and the vital habitats in which they live[13], [14].

CONCLUSION

In simple terms, studying where Mahseer fish live and how they are spread out can teach us a lot about their connection with the rivers and lakes in South and Southeast Asia. Mahseer can be found in many countries and different types of environments, which shows that they can adjust to different places and are important in various river landscapes.It is important to understand the things that affect where Mahseer fish are found, like water flow, temperature, changes to their homes, and how much they are fished. This helps us protect them. These ideas help us protect where they live, support fishing methods that can be continued for a long time, and deal with the difficult things caused by changes in weather.Protecting mahseer is not only about keeping one type of fish safe, but also about taking care of the entire environment in freshwater. These fish are very important for keeping their habitats healthy and diverse. Therefore, efforts to safeguard Mahseer fish have important consequences for both the environment and the community's economy.In the future, we can do more research to better protect Mahseer populations. This can include doing surveys across their entire range, studying their genetics, and examining how climate change affects them.In simple words, saving Mahseer and their homes is important for protecting biodiversity and showing that we value these special fish and their environments. By protecting Mahseer fish, we help save the diverse life found in freshwater.

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CHAPTER 4

HABITAT REQUIREMENTS AND ECOLOGY OF MAHSEER FISHES

Devendra Pal Singh, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- dpsinghevs@gmail.com

ABSTRACT:
Mahseer fish habitat needs and ecology are critical components of their survival in freshwater habitats. Mahseer are members of the Cyprinid family and belong to the genus Tor. They enjoy pristine settings with swift-flowing rivers, rocky bottoms, and clear, well-oxygenated waters. Their ecological responsibilities are diverse, including apex predator status, nutrient cycling facilitation, indicator species representation, and biodiversity enhancement.Mahseer, being apex predators, manage prey numbers, so ensuring environmental equilibrium. Their foraging efforts help to cycle nutrients and benefit downstream creatures. Furthermore, they function as indicators of water quality and ecological health. Conservation activities aimed at Mahseer ensure not just their survival but also the entire ecological integrity of freshwater ecosystems. Recognizing the importance of Mahseer in these environments demonstrates our commitment to biodiversity protection and the preservation of the fragile ecological web of which they are a part.

KEYWORDS:

Apex Predators, Fresh Water Ecosystems, Habitat, Indicator Species, Mahseer Fishes.

INTRODUCTION

Mahseer fishes are among the most famous and sought-after freshwater species in South and Southeast Asia, owing to their amazing size, strength, and stunning appearance. These unique fish, belonging to the Cyprinid family's genus Tor, retain a particular place in the hearts of fishermen, researchers, and environmentalists. Their fascinating ecology and habitat choices provide important insights into the region's fragile balance of aquatic ecosystems.We begin on a voyage into the world of Mahseer fishes in this extensive examination, unravelling the complexities of their habitat needs and ecological responsibilities. We look at the climatic circumstances that Mahseer prefer, the unusual adaptations that allow them to survive, and the important ecological services they serve in their watery environments[1], [2].

Mahseer Fish Taxonomy and Diversity

Before getting into their habitat needs and ecological responsibilities, a basic grasp of Mahseer taxonomy and the variety of species and sub-species that lie under this umbrella is required.

Mahseer's Taxonomy

Mahseer fishes are members of the Cyprinidae family, which includes a wide range of freshwater fish known as carps and minnows. Mahseer are classed as members of the subfamily Cyprininae within this family. The Mahseer species is included in the genus Tor, with multiple unique species and sub-species identified throughout its geographic range.

Mahseer Species Diversity

Tor, the Mahseer genus, has a diverse range of species and sub-species, each with its own set of features and adaptations. These fish are mostly found in South and Southeast Asia, including India, Nepal, Bhutan, Myanmar, Thailand, Malaysia, and Indonesia. Among the notable species are the Golden Mahseer (Tor putitora), Deccan Mahseer (Tor remadevii), and

Giant Barb (Catlocarpiosiamensis).The wide variety of Mahseer species reflects their resilience and ecological flexibility, as do the many environmental environments they occupy. Understanding this taxonomic variety is critical for deciphering the complex interactions that exist between Mahseer and their environments[3], [4].

Mahseer Fish Habitat Requirements

The habitat requirements of Mahseer are inextricably tied to their survival and ecological function in freshwater environments. These fish have special needs that govern their dispersal and ecological functions. To understand the importance of Mahseer in their habitats, we must first investigate these basic habitat needs in depth.

Rapid-flowing rivers and streams

The presence of swift-flowing rivers and streams is one of the distinguishing features of Mahseer ecosystems. These fish are well-adapted to living in rapid currents, navigating and thriving in such conditions thanks to their muscular bodies and streamlined forms.Swift-flowing rivers provide various benefits for Mahseer. They offer a steady supply of oxygen, which is essential for their respiration, as well as an abundance of prey species blown along by the currents. The tumultuous seas also help their eggs disperse during spawning, increasing their reproductive success.

Rocky Substrates

Mahseer are closely related to riverbeds with rocky substrates. Rocky bottoms are suitable for spawning because they have cracks and interstitial places where their eggs may be securely placed and preserved. The rugged terrain also provides natural hiding spots for young Mahseer and ambush locations for prey hunters.Furthermore, rocky substrates help to water oxygenation by encouraging water flow and improving aeration. This benefits the general health of the aquatic environment and the well-being of Mahseer populations.

Crystal Clear Waters

Clear, unpolluted water is a distinguishing feature of Mahseer ecosystems. High water purity is not just a beautiful quality, but it is also critical to their existence. Clear waters allow Mahseer to successfully deploy their excellent visual hunting methods.These fish depend on strong vision to detect and chase prey, which often consists of smaller fish and aquatic insects. They can recognize and target their prey with more accuracy in clear waters, increasing their foraging efficiency.The availability of well-dissolved oxygen is critical for Mahseer populations, especially in fast-flowing water environments. Mahseer's fondness for such settings is intimately related to their breathing requirements.Swift currents churn the water, boosting its oxygen concentration and maintaining a steady supply of this essential ingredient. Their high-energy lives are supported by adequate oxygen levels, which contribute to their amazing strength and endurance.Mahseer fishes are more than just residents of their watery environments; they perform critical roles in these ecosystems, influencing different ecological processes and contributing to the overall balance and health of aquatic populations. To understand the ecological importance of Mahseer, we must look at the many functions they play[5], [6].

Apex Predators

Mahseer have an important ecological function as apex predators in their environments. They inhabit the highest trophic level in freshwater food systems as apex predators, exerting top-down control on prey species.Mahseer helps manage the numbers of various prey species by

feeding on smaller fish and aquatic invertebrates. This predation pressure is essential for maintaining ecological balance, limiting prey species overpopulation, and indirectly benefitting other creatures in the environment.

Facilitators of Nutrient Cycling

Mahseer play an important role in nutrient cycling in rivers and streams. As they forage for prey, their foraging behaviours include altering sediments and substrate components. This disruption causes nutrients trapped in the substrate to be released, making them accessible to other aquatic creatures.Furthermore, Mahseer excretions, which are high in nutrients, add to the total nutritional burden of their environments. These nutrients, which include nitrogen and phosphorus, may increase primary production in aquatic habitats, so aiding algal and plant development and, eventually, the whole food web.

Species of Indicators

Mahseer are often regarded as indicator species, since they reflect the general health and water quality of their habitats. Their existence or absence may be used to gauge the ecological health of rivers and streams.Mahseer populations that are healthy are indications of pure and well-maintained freshwater habitats. A drop in Mahseer numbers, on the other hand, might indicate environmental deterioration, water pollution, or habitat modification, raising attention to concerns that need conservation intervention.

Promotion of Biodiversity

Mahseer and their habitat protection indirectly supports biodiversity in freshwater settings. Conservation efforts produce adequate settings for a range of other aquatic species by preserving the circumstances that sustain Mahseer populations.These ecosystems often support a rich array of fish, amphibians, crustaceans, and aquatic plants. Conservation of mahseer helps to the total richness and variety of freshwater communities, promoting healthy and resilient ecosystems.

Importance of Conservation

Understanding the environmental needs and biological functions of Mahseer fishes is critical for conservation. These famous fish are not only culturally and commercially significant, but they also serve as flagship species for freshwater ecosystem conservation in South and Southeast Asia.Mahseer are culturally and economically significant in the areas where they live. Local people adore them, and they are an important resource for traditional fisheries and recreational angling. The sport of Mahseer fishing draws fans from all around the globe, boosting local businesses.Mahseer's position as a flagship species makes them effective advocates for freshwater conservation. Their attractiveness brings attention to the significance of protecting their habitats, which helps a broad variety of other species.Conservation activities centred on Mahseer habitats often include wider efforts to maintain whole river systems and encourage sustainable land use practices, eventually protecting the integrity of entire watersheds.

Finally, the habitat needs and ecological responsibilities of Mahseer fishes highlight their immense significance within the complicated fabric of freshwater ecosystems in South and Southeast Asia. These famous fish have evolved to flourish under particular circumstances, as seen by their swift-flowing river habitats, preference for rocky surfaces, dependency on clean waters, and need for well-oxygenated settings.The ecological functions of Mahseer as apex predators, nutrient cycle facilitators, indicator species, and biodiversity boosters highlight their importance within aquatic ecosystems. Mahseer contribute to the general well-being and

resilience of freshwater ecosystems by managing prey populations, improving nutrient cycling, acting as environmental health indicators, and supporting biodiversity.Recognizing Mahseer's cultural, economic, and environmental importance highlights the need of collaborative efforts to maintain their habitats and assure their continuing existence in the region's rivers and streams. By protecting Mahseer and the settings in which they live, we not only honour a long-standing fishing heritage, but we also pledge to the protection of the vital freshwater ecosystems that support life throughout their vast geographies[4].

DISCUSSION

The habitat needs and ecology of Mahseer fishes are important ecological topics because they offer insight on the complicated linkages that exist between these unique freshwater species and their environment. This abstract offers a brief review of Mahseer habitat preferences and ecological responsibilities, stressing their importance in aquatic environments.Mahseer fishes, which belong to the Cyprinidae family's genus Tor, have certain ecological needs that are crucial for their survival and reproduction. They are mostly linked with pure freshwater settings that are distinguished by:

1. **Fast-Flowing Rivers and Streams:** Mahseer flourish in fast-flowing rivers and streams, which are often located in mountainous areas and steep terrain. Swift-flowing waterways assist their particular adaptations for swimming against the current by providing oxygen-rich conditions.
2. **Rocky Substrates:** These fish are drawn to riverbeds with rocky substrates. Rocky bottoms are great spawning habitats, providing shelter and sufficient circumstances for egg incubation.
3. **Clear Waters:** Mahseer populations are often concentrated in locations with clean, unpolluted water. High water clarity not only maintains adequate oxygen levels but also helps them with their visual hunting methods.
4. **Well-Oxygenated streams:** Because Mahseer like fast-flowing streams, the availability of dissolved oxygen is critical. Their breathing demands need well-oxygenated settings.

Ecological Functions

Mahseer fishes perform important roles in aquatic environments, contributing to the biological balance of their surroundings in a variety of ways:

1. **Apex Predators:** Mahseer, being apex predators, are critical for managing prey species numbers throughout their habitats. Their presence serves to preserve general ecosystem health by controlling the population of smaller fish.
2. **Nutrient Cycling:** Mahseer contribute to nutrient cycling in rivers and streams via their eating patterns. Their excretions and sediment disturbance while foraging alter nutrient dynamics, benefiting other creatures downstream.
3. **Indicator Species:** Mahseer are often regarded as indicator species since they reflect the general health and water quality of their habitats. Monitoring their populations may offer information on the ecological health of rivers and streams.
4. **Biodiversity Conservation:** By protecting Mahseer habitats, we indirectly safeguard a variety of other aquatic species that share same ecosystems. Mahseer conservation benefits the total biodiversity of freshwater habitats.

Finally, the habitat needs and ecological responsibilities of Mahseer fishes are linked, demonstrating their importance within the complex web of aquatic life. Understanding and protecting the pristine environments on which they rely is critical not just for their survival

but also for the overall health and biodiversity of freshwater ecosystems. The protection of Mahseer demonstrates our dedication to protecting the natural environment and understanding the critical role these iconic fish play in maintaining the ecological balance of their ecosystems.The habitat needs and ecology of Mahseer fishes, including their unique adaptations, ecological functions, and conservation importance, provide an intriguing peek into the complex interactions that regulate freshwater ecosystems in South and Southeast Asia. This extensive discussion delves into these details, offering insight on the significance of Mahseer in aquatic ecosystems.Understanding Mahseer habitat preferences is critical to comprehending their significance in freshwater ecosystems. These amazing fish have developed adaptations that allow them to flourish in a variety of environmental circumstances.Mahseer ecosystems are distinguished by swift-flowing rivers and streams. These fish have evolved to flourish in swift currents, navigating and surviving in such conditions thanks to their streamlined body and strong muscles[7], [8].

Mahseer species have hydrodynamic characteristics that let them survive in rapid currents. Their streamlined body forms decrease drag, helping them to swim against the current effectively. This adaptability is especially important during their upstream breeding travels.Fast-moving waters are high in dissolved oxygen, which is essential for fish respiration. The predilection of Mahseer for such settings guarantees a consistent and sufficient supply of oxygen, which supports their high-energy lives.These ecosystems support an abundance of prey species, which are often swept along by swift currents. Mahseer take advantage of this constant supply of food by feeding on smaller fish and aquatic invertebrates washed downstream.During spawning, the tumultuous waters help in the dispersal of Mahseer eggs. The rapid currents aid in the prevention of egg sedimentation, increasing their chances of survival and guaranteeing successful reproduction.Another distinguishing aspect of Mahseer ecosystems is the presence of rocky substrates. These fish like stony riverbeds and substrates because they are essential to their survival and reproduction. Rocky substrates are good for Mahseer spawning. Their eggs are protected and protected by the fissures and interstitial spaces between rocks. These habitats provide a safe setting for Mahseer to lay eggs, lowering the chance of predation.

The stony substrates also offer a safe haven and home for young Mahseer. Young Mahseer may locate safe havens amid the rocks, away from possible predators. This is critical for their survival throughout the critical early stages of life.Rocky substrates help to oxygenate water by causing turbulence and boosting water flow. This improves aeration and ensures that oxygen levels stay enough for Mahseer populations.The presence of rocky bottoms attracts smaller fish and invertebrates, enhancing Mahseer prey availability. These fish often employ rocky formations as ambush spots while hunting for food.Another important component of Mahseer habitat needs is their love for pure, unpolluted waterways. High water purity is not only an aesthetic attribute for these fish; it also has significant biological implications. Mahseer are visual predators, depending on good vision to identify and catch their prey. They can successfully locate and hunt tiny fish and aquatic insects in clear waters. This optical advantage helps them forage more efficiently.Clear waterways are indicative of good environmental health and the lack of contamination. The existence of Mahseer in such environments indicates the general health of the aquatic ecosystem. A decrease in water clarity, on the other hand, might raise worries about water quality and habitat destruction[9], [10].

Clear waters are required to maintain appropriate water quality standards. Temperature, pH, and nutrient levels are frequently more consistent in clear surroundings, adding to the ecosystem's general health and stability.Well-oxygenated waters are critical for Mahseer

populations, particularly in areas with swift-flowing currents. The importance of well-dissolved oxygen may be investigated in a variety of contexts. Mahseer's fondness for well-oxygenated waters is intimately related to their respiratory needs. These fish have high oxygen requirements, especially in environments with strong currents and active activity that might increase oxygen use.Oxygen-rich conditions aid in the prevention of hypoxia, a condition in which oxygen levels in the water fall to dangerously low levels. Mahseer can sustain their metabolic processes without stress in areas with plenty of oxygen.Adequate oxygen levels are critical for Mahseer populations to preserve their vigour and vitality. Their exceptional strength, endurance, and general fitness are aided by their high oxygen availability.To summarize, Mahseer requires swift-flowing rivers and streams with rocky bottoms, clean and unpolluted waters, and well-dissolved oxygen. These modifications reflect their ecological niche as formidable predators and emphasize their adaption to living in particular freshwater habitats.

Mahseer fishes have important ecological functions in their environments, in addition to being visually appealing and environmentally appropriate. Their interactions with other creatures, as well as their contributions to ecosystem function, have far-reaching consequences for freshwater environments.Mahseer have an important ecological function as apex predators in their environments. Apex predators are species that occupy the highest trophic level in food chains and govern prey populations from the top down. The relevance of Mahseer as apex predators may be examined in many ways. Mahseer's predation on smaller fish and aquatic creatures aids in the regulation of these prey species' populations. Mahseer play an important role in preserving ecological balance within their environments by limiting prey quantity.Without the predation pressure provided by apex predators like as Mahseer, prey populations may rise uncontrollably, possibly leading to overpopulation. Overpopulation may have a negative impact on resource availability and the general health of the ecosystem.The existence of apex predators such as Mahseer aids in the equilibrium of trophic levels within aquatic food webs. This equilibrium adds to the ecosystem's variety and stability.Mahseer indirectly benefits other creatures in the environment that depend on these prey species for sustenance by managing prey numbers. Beyond their immediate interactions, their interconnection reveals their ecological relevance.

Mahseer fishes play an important role in nitrogen cycling within their ecosystems. The transport and modification of critical nutrients such as nitrogen and phosphorus via diverse ecosystem components is referred to as nutrient cycling. Mahseer's involvement in nutrient cycling may be interpreted from the following angles. Mahseer's foraging habits include disrupting sediments and substrate components as they hunt for prey. This disruption causes nutrients trapped in the substrate to be released, making them accessible to other aquatic creatures.Mahseer's excretions are nutrient-rich, including substances like as nitrogen and phosphorus. These excretions add to the total nutritional load of their environments, thereby fertilizing the ecosystem.Mahseer's nutrients promote primary production in aquatic habitats. Increased nitrogen availability benefits algae and aquatic plants, increasing their development. As a result, herbivorous species have a food supply.Mahseer's function in nutrient cycling helps to maintain the flow of energy throughout the environment. The transmission of energy from lower to higher trophic levels is ensured by the flow of nutrients across distinct trophic levels, maintaining the whole food web.

Mahseer fishes are often used as indicator species, providing information on the general health and water quality of their habitats. The presence or absence of indicator species indicates the environmental conditions of a certain ecosystem. Mahseer's indicator role may be analyzed using the following criteria. Mahseer populations that are healthy are indications

of pure and well-maintained freshwater habitats. Their existence indicates that adequate habitat characteristics, including as water quality, flow regimes, and prey abundance, exist.A fall or disappearance of Mahseer populations might indicate environmental deterioration, water pollution, or habitat modification. Water quality changes, such as increased sedimentation or chemical contaminants, may have a severe influence on Mahseer and the greater environment.The designation of Mahseer as an indicator species emphasizes the significance of their protection. Efforts to maintain Mahseer habitats are often part of larger efforts to protect whole river systems, guaranteeing watershed integrity.The iconic position of Mahseer as an indicator species may further increase public awareness about the necessity of protecting freshwater habitats. Their existence or absence is a real and relevant indicator of environmental health.

Conservation activities aimed towards Mahseer and their habitats boost biodiversity in freshwater environments indirectly. Conservation efforts produce favourable settings for a varied variety of other aquatic species by preserving the circumstances that sustain Mahseer populations. Conservation of Mahseer environments often include keeping natural flow regimes, maintaining water quality, and safeguarding riparian vegetation. These initiatives aim to establish and preserve varied habitats that can sustain a wide range of aquatic species.Riverbank and riparian ecosystem preservation is a critical component of Mahseer conservation. Many species, including birds, amphibians, reptiles, and mammals, rely on healthy riparian zones for habitat and food.When Mahseer habitats have been altered or degraded as a result of human activity, restoration efforts may help to promote biodiversity. River habitat restoration may assist restore optimal circumstances for a variety of aquatic and terrestrial species.Mahseer are keystone species in their own environments. The presence or absence of keystone species has a disproportionately substantial influence on the structure and function of the ecosystem. We promote the overall biodiversity and ecological balance of these areas by protecting Mahseer.In conclusion, Mahseer fishes have important ecological functions as apex predators, nitrogen cycle facilitators, indicator species, and biodiversity boosters. Their interactions with prey populations, nutrient dynamics, and position as ecosystem health indicators highlight their importance in freshwater environments. Recognizing their ecological importance helps to inspire conservation plans that seek to protect not just Mahseer but also the larger web of life in these pristine areas.

Mahseer fish habitat needs and biological responsibilities have substantial conservation implications, covering cultural, economic, and ecological elements. These factors highlight the need of coordinating efforts to conserve Mahseer and their habitats.Mahseer fish have great cultural and economic importance in the areas where they live. Their existence is intricately entwined with local populations' traditions and lives. Mahseer's cultural and economic significance may be studied in the following ways. Mahseer are respected by local communities and are often associated with cultural importance. They appear in folklore, mythologies, and traditional storytelling, representing the connection between communities and their riverine settings.For years, mahseer have been a significant resource for traditional fisheries. Local fisherman depends on this fish for nutrition and cash, helping to support many communities' lives.

Mahseer fishing draws fans from all over the globe. Anglers frequent this fish's habitats, boosting tourism and contributing to the local economy. This leisure pastime has both cultural and economic implications.Mahseer's position as a flagship species makes them effective advocates for freshwater conservation. Flagship species are iconic and charismatic species that represent the protection of whole ecosystems. The function of Mahseer as conservation ambassadors may be examined in numerous ways. Mahseer's charm and cultural

significance raise awareness about the necessity of protecting their habitats. Conservation projects aimed towards Mahseer often get public attention and support.Conservation efforts centred on Mahseer often include larger efforts to save whole river systems and encourage sustainable land use practices. Conservationists indirectly preserve the whole aquatic environment by protecting these unique fish.The protection of Mahseer has the potential to affect freshwater ecosystem policy and management practices. In response, governments and regulatory organizations may prioritize habitat preservation and restoration activities.

CONCLUSION

In simple words, Mahseer fishes are very important for freshwater ecosystems because they need a specific habitat to live in and they play an important role in the environment. They like to live in fast-moving, clear water with rocks. This shows they have special ways of surviving and are very affected by the environment. Mahseer fish are very important in the food chain of water. They eat other animals and help maintain the balance of nutrients in the water.

They also help determine the health of the ecosystem.Protecting Mahseer habitats is important because it helps to keep freshwater ecosystems healthy and diverse, not just for the Mahseer fish but for all the plants and animals that live there. Mahseer are important for conservation and help protect their habitats.

This also helps in making policies and actions to preserve these environments.Conserving Mahseer helps us protect different kinds of living things in nature. It also shows that we understand how everything in water ecosystems is connected. By making the well-being of Mahseer a top priority, we help ensure the overall health and strength of our freshwater environments. This will ensure that these famous fish can continue to live and grow in their natural homes in the future.

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CHAPTER 5

REPRODUCTIVE BIOLOGY AND LIFE HISTORY STRATEGIES OF MAHSEER

Upasana, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- upasana35954@gmail.com

ABSTRACT:

Understanding the life history traits of fish and their habitat needs is crucial for things like managing fisheries, raising fish in captivity, determining fish populations, developing breeding technology, assessing conservation status, using fish for biological control, and protecting them in their natural environment or in controlled environments. The way fish live their lives, such as how big they can get, how fast they grow and when they can have babies, how many babies they can have, and if they move around, can affect how many fish there are and if they might die out. Even though differences in physical characteristics and life patterns do not prove that fish populations are genetically isolated, they can suggest that the fish have been separate from each other for a long time. These differences also provide a solid reason to manage each group separately. The differences in how fish grow and live can show that they can adapt to changes in their environment throughout their lives. This is really important because it helps them survive in different habitats. The literature review shows that there is not a lot of information available on the life history characteristics of many freshwater fish found in fast-moving and still waters. This paper looks at how studying the life history traits of fish populations can help with conservation of biodiversity. It summarizes the most recent findings, identifies areas where more research is needed, and raises important concerns about managing and protecting freshwater fish species.

KEYWORDS:

Biology Life, Life Cycle, Mahseer fishes, Mahseer Species, Parental Care.

INTRODUCTION

The Mahseer fishes, which belong to the genus Tor of the Cyprinidae family, are a captivating and iconic freshwater species found in South and Southeast Asia's pristine rivers and streams. These extraordinary fish have captivated the minds of fishermen, scholars, and environmentalists alike, not only because of their astounding size and power, but also because of their unique reproductive biology and life cycle methods. We go on a voyage into the intriguing world of Mahseer in this detailed examination, unravelling the complexities of their reproductive biology and life cycle, giving light on the unique adaptations, behaviours, and ecological functions that distinguish this exceptional fish[1], [2].

Mahseer Fish Taxonomy and Diversity

Before getting into the complexities of Mahseer's reproductive biology and life cycle, it is critical to first grasp their taxonomy and the variety of species and sub-species that comprise this genus.

1. **Mahseer's Taxonomy:** Mahseer fishes are members of the Cyprinidae family's subfamily Cyprininae. The taxonomic categorization for the many Mahseer species is the genus Tor. Understanding this classification lays the groundwork for investigating the distinct reproductive adaptations and life histories of various Mahseer species.

2. **Mahseer Species Diversity:** The genus Tor is home to a great array of Mahseer species and sub-species, each of which has evolved to its own natural niche. These fish are mostly found in South and Southeast Asia, including India, Nepal, Bhutan, Myanmar, Thailand, Malaysia, and Indonesia. Among the notable Mahseer species are the Golden Mahseer (Tor putitora), the Deccan Mahseer (Tor remadevii), and the Giant Barb (Catlocarpiosiamensis). The variety of Mahseer species reflects their resilience and ecological flexibility, as well as the many environmental settings they occupy. Because various species have developed diverse adaptations to their individual environments, this diversity has a substantial impact on their reproductive biology and life cycle tactics[3], [4].

Mahseer Reproductive Biology

Mahseer reproductive biology is an enthralling component of their life cycle, involving a variety of reproductive behaviours, adaptations, and ecological responsibilities. Understanding their reproductive cycle sheds light on the extraordinary journey these fish go on to secure the survival of their species.

1. **Spawning Patterns:** Mahseer species have diverse spawning behaviours, which are often defined by upstream migrations to spawning areas. These behaviours differ amongst species;however they always have the following characteristics:
2. **Upstream Migrations:** Mahseer make lengthy and difficult upstream migrations when environmental circumstances are favourable for reproduction. These movements often need them overcoming numerous barriers, like as waterfalls and rapids, demonstrating their desire to reach reproductive areas.
3. **Rocky Substrates:** When it comes to spawning places, Mahseer have a significant predilection for rocky substrates. The stony riverbeds offer a suitable setting for egg deposition. Crevices and interstitial gaps between rocks provide a sheltered and protected environment for egg laying.
4. **Adhesive Eggs:** Mahseer eggs have adhesive qualities that enable them to stick to the substrate of choice. Because of this sticky characteristic, eggs are less likely to be swept away by powerful currents, boosting their chances of survival.

Parental Support

Parental care is important in guaranteeing the survival of certain Mahseer species' progeny. This paternal commitment varies in intensity across species and groups, but in general, male fish defend the nest and safeguard the eggs.

The following are important characteristics of parental care in Mahseer:

1. **Male Guardianship:** Male Mahseer function as guardians in species where parental care is observed. They actively guard the nest location, warding off any dangers and predators that could try to devour the eggs.
2. Improved Survival: Parental care improves the survival of Mahseer eggs and young fish. Male guardianship contributes to the preservation of appropriate environmental conditions surrounding the nest, protecting the health of growing embryos.
3. **Behavioural Adaptations:** Behavioural adaptations like as nest-building and alertness are also involved in parental care. These modifications represent male Mahseer's expenditure of time and energy in protecting their children.

Environmental Triggers

Mahseer species' reproductive time is often linked with certain environmental cues. Seasonal fluctuations in temperature, water flow, and other environmental signals impact these triggers. Understanding these triggers is vital for forecasting Mahseer spawning occurrences and putting conservation measures in place during key times.

Mahseer's Life History Strategies

Mahseer have life histories that are precisely adapted to their unique habitat needs and ecological functions in freshwater environments.

These life history tactics include a number of critical components that influence their development, reproduction, and overall survival.

1. **Reproductive Timetable:** Mahseer species have precise reproductive timing, often synchronizing their spawning behaviours with favourable climatic circumstances. Temperature, water flow, and photoperiod all impact reproductive time, ensuring that the following generation has the highest chance of surviving.
2. **Seasonal Spawning:** Many Mahseer species have seasonal spawning patterns that are induced by temperature and water flow variations. These patterns are often related with monsoons or certain seasons when circumstances for egg development and fry survival are best.
3. **Migration time:** Mahseer migration time to spawning areas is crucial. These fish migrate upstream at specified times when environmental signals indicate the commencement of spawning conditions.
4. **Cooperative Spawning:** Mahseer sometimes participate in cooperative spawning, in which numerous individuals spawn together. Extreme competition and complicated social behaviours may occur during cooperative spawning events.

Longevity and Development

Mahseer are famed for their longevity, with some people surviving for decades. This increased lifetime adds to their ecological relevance and emphasizes the urgency of conservation efforts to safeguard older, reproducing individuals.

1. **Moderate Growth:** Mahseer have rather moderate growth rates, especially when compared to other fish species. Food availability, environmental circumstances, and individual genetics all impact their development patterns.
2. **Size Variation:** Mahseer species and populations vary in size, with some individuals reaching astonishing proportions. The availability of adequate prey, the quality of the habitat, and the environmental conditions all have a part in influencing Mahseer's development potential.

Vulnerabilities

Mahseer are vulnerable at several phases of their lives, from predation on eggs and juveniles to environmental challenges like as habitat deterioration and water pollution. Recognizing these vulnerabilities is critical for putting conservation measures in place that target particular threats.

1. **Predation on Eggs and Juveniles:** Eggs and juvenile Mahseer are subject to predation by a variety of aquatic and avian predators. These dangers may be mitigated by protecting spawning areas and improving nest guarding behaviours. Human activities such as dam building, deforestation, and agricultural runoff may all contribute to habitat modification and deterioration. Changes in habitat quality and water conditions have a substantial impact on mahseer numbers.
2. **Overfishing:** Overfishing is a major danger to Mahseer populations, especially when traditional and recreational fisheries are not managed in a sustainable manner. Measures to encourage appropriate fishing techniques are often included in conservation initiatives.

Conservation Importance

The reproductive biology and life cycle strategies of Mahseer are critical for conservation. These characteristics emphasize the distinct adaptations and behaviours that make Mahseer essential components of freshwater ecosystems in South and Southeast Asia.

Conservation Issues: Despite their extraordinary adaptations and ecological responsibilities, Mahseer suffer several conservation difficulties. These difficulties include habitat degradation, overfishing, water pollution, habitat fragmentation as a result of dam building, and climate change-related effects such as changed flow regimes.

Priorities for Conservation

Several conservation objectives must be addressed to guarantee the continuing survival of Mahseer populations:

1. **Habitat Protection:** It is critical to protect and restore Mahseer ecosystems, especially spawning grounds and migratory routes. This includes protecting water quality, preserving natural flow regimes, and conserving riparian habitats.
2. **Sustainable Fisheries:** It is critical to implement sustainable fishing techniques and laws in order to avoid overexploitation of Mahseer populations. It is a sensitive but vital undertaking to balance the interests of traditional fisheries, recreational angling, and conservation.
3. **Education and knowledge:** It is critical to raise knowledge about the ecological value of Mahseer and their conservation requirements. Local communities, anglers, and lawmakers may all be involved in efforts to safeguard these historic species via educational campaigns.
4. **Study and Monitoring:** Ongoing study on Mahseer species, habitats, and threats is critical. Monitoring programs may aid in the assessment of population health, the identification of conservation priorities, and the tracking of the effectiveness of conservation activities. Mahseer fish reproductive biology and life cycle techniques provide an enthralling peek into the complicated world of these renowned freshwater species. Their reproductive behaviours and adaptations demonstrate their desire to secure the survival of their young, while their life cycle methods demonstrate their ecological flexibility and longevity. Mahseer perform critical roles in the health and balance of their aquatic habitats as guardians of stony substrates and swift-flowing rivers. However, in the contemporary world, these magnificent fish confront several threats ranging from habitat deterioration to overfishing. Conservation efforts must focus habitat preservation, sustainable fisheries management, education, and research. By preserving Mahseer's reproductive biology and life cycle techniques, we not only save these iconic fish, but also the complex tapestry of life that relies on their survival in South and Southeast Asia's valuable freshwater settings[2].

DISCUSSION

Mahseer fishes' reproductive biology and life cycle tactics are critical to their ecological success and protection. This abstract gives a concise review of these crucial characteristics, giving insight on the specific adaptations and difficulties that define Mahseer's reproductive journey.

Biology of Reproduction

The reproductive biology of Mahseer, which belongs to the genus Tor in the Cyprinidae family, is intriguing. The following are important aspects of their reproductive biology:

1. **Spawning Behaviour:** Mahseer species have diverse spawning behaviours, often travelling upstream to spawn. They favour stony surfaces for egg deposition, hiding in cracks and interstitial gaps.
2. **Egg Properties:** Mahseer eggs are sticky, ensuring that they attach to the substrate of choice. This sticky characteristic improves egg survival by lowering the likelihood of being swept away by powerful currents.
3. **Parental Care:** Different Mahseer species show varied degrees of parental care. Males may defend the nest and safeguard the eggs until they hatch, so ensuring the next generation's survival.

Life History Techniques

Mahseer use life cycle methods that are tailored to their individual habitat needs and ecological responsibilities. These techniques include numerous critical components:

1. **Reproductive Timing:** Mahseer species often time their reproductive periods to coincide with favourable environmental circumstances. They may make extensive migrations to reach spawning areas at specified seasons, increasing the likelihood of successful reproduction.
2. **Longevity:** The Mahseer are noted for their longevity, with some people surviving for decades. This increased lifetime adds to their ecological relevance and emphasizes the urgency of conservation efforts to safeguard older, reproducing individuals.
3. **Growth Rates and Patterns:** Growth rates and patterns differ across Mahseer species and populations, and are governed by variables like as food availability and environmental circumstances. Understanding these development patterns is essential for long-term management.
4. **Vulnerabilities:** Mahseer are vulnerable at several phases of their lives, including predation on eggs and juveniles. To guarantee the sustainability of Mahseer populations, conservation initiatives must take these vulnerabilities into account.

Finally, Mahseer fishes' reproductive biology and life cycle tactics are critical to their ecological functions and conservation. From spawning behaviours to development patterns, these fish have developed distinct adaptations to manage the obstacles of their watery surroundings. Understanding and conserving these traits is critical for the survival of these iconic and ecologically important species in South and Southeast Asia[5], [6].Mahseer fish reproductive biology and life cycle techniques are deep and intriguing components of their existence. These traits are inextricably linked to the biological activities of these iconic species in freshwater ecosystems in South and Southeast Asia. In this extensive conversation, we dig into the complexities of Mahseer's reproductive biology and life cycle, discussing the fascinating fish's unique adaptations, behaviours, and conservation problems.Mahseer species have amazing spawning behaviours and adaptations that are carefully adapted to their individual environmental needs and ecological niches. Understanding these behaviours might help you understand the obstacles and possibilities that characterize their reproductive journeys.

Upstream migrations are one of the most distinguishing elements of Mahseer reproductive biology. To reach their favoured breeding areas, these fish must make lengthy and difficult travels. These migrations are usually coordinated with certain seasons or environmental signals, such as monsoons or temperature shifts. Mahseer's resolve throughout these travels emphasizes the vital need of attaining optimal spawning places for effective reproduction.Mahseer spawn on rocky substrates with a considerable predilection. The stony riverbeds offer a suitable setting for egg deposition. The eggs find refuge and safety in the

fissures and interstitial spaces between rocks. This modification reduces the danger of predation and improves egg survival in turbulent river conditions.Mahseer eggs have sticky characteristics, which is a unique adaption that helps them survive. These sticky eggs stick to the substrate of choice, keeping them from being carried away by powerful currents. The sticky property keeps growing embryos close to their protected rocky nests, where they may benefit from ideal environmental circumstances.Parental care is an important element of the reproductive biology of several Mahseer species. While not all Mahseer species engage in this behaviour, those that do show various degrees of parental involvement in protecting their progeny.

Male Mahseer function as guardians in species where parental care is observed. They actively guard the nest location, warding off any dangers and predators that could try to devour the eggs. Male guardianship entails being watchful to guarantee the safety and well-being of growing embryos.Parental care considerably improves the survival of Mahseer eggs and young fish. Male Mahseer may reduce predation threats and maintain ideal environmental conditions surrounding developing embryos by protecting the nest and providing a protective atmosphere. This parental investment emphasizes the significance of offspring survival in the survival of the species.Parental care necessitates behavioural adaptations like as nest-building and territorial defence. Male Mahseer actively participate in nest preparation and upkeep, ensuring that the nest is fit for egg incubation. These behaviours demonstrate male Mahseer's expenditure of time and energy in protecting their children.

Mahseer's reproductive activity are often timed to coincide with certain environmental cues. Seasonal variations and environmental signals regulate these triggers, ensuring that reproduction happens when circumstances are best for the survival of the next generation.Seasonal spawning patterns are seen in several Mahseer species. Temperature, water flow, and monsoon seasons are often connected with these patterns. Spawning events are carefully scheduled to increase the likelihood of successful egg development and fry survival. The synchronization of spawning with seasonal signals demonstrates Mahseer's adaptation to their changeable riverine settings.Mahseer migration time to spawning sites is critical for successful reproduction. These migrations often correspond with particular environmental signals, like as increasing water levels or temperature changes in the sea. The exact scheduling guarantees that Mahseer arrive at their preferred spawning places at the optimal time for egg deposition and fry survival.Mahseer sometimes participate in cooperative spawning behaviours. Cooperative spawning includes numerous individuals spawning in the same place. These events may be complicated social interactions with individuals competing for access to partners and nesting places. The social dynamics and techniques used by Mahseer to achieve reproductive success are highlighted via cooperative spawning[7], [8].

The life histories of Mahseer are precisely adapted to their unique habitat needs and ecological functions within freshwater environments. These tactics include a variety of factors that influence their development, reproduction, and general survival.Mahseer's life cycle methods rely heavily on reproductive time. These fish time their reproductive processes precisely, matching them with favourable environmental circumstances and signals.Many Mahseer species have seasonal reproductive cycles that are induced by temperature and water flow fluctuations. Spawning episodes are often coordinated with times of increased food availability, such as the appearance of aquatic insects or the availability of plant materials.The timing of Mahseer migrations to spawning areas is critical. These migrations are timed to coincide with certain environmental signals, ensuring that fish arrive at their preferred spawning locations when circumstances are ideal for egg development and fry

survival. If observed, cooperative spawning episodes entail individual collaboration to optimize reproductive success.Mahseer are famed for their longevity, with some people surviving for decades. This increased lifetime contributes significantly to their ecological relevance and emphasizes the urgency of conservation efforts to conserve older, reproductive individuals[9], [10].

Mahseer develop at a rather sluggish pace, especially when compared to other fish species. Food supply, ecological circumstances, and individual genetics all impact the rate of development. Slow development rates reflect their adaption to changing and frequently difficult riverine habitats.Mahseer species and populations vary significantly in size, with some individuals reaching astonishing proportions. A mix of genetic variables, habitat quality, and food availability determine size variation. Larger individuals often play critical roles in group reproductive success.There is evidence of size-dependent reproduction in several Mahseer species, with bigger individuals more likely to participate in spawning activities. This size-based reproductive strategy guarantees that mature individuals have enough energy reserves to contribute to the following generation.Mahseer are vulnerable at several times of their lives, emphasizing the conservation issues that these famous fish confront. Recognizing these vulnerabilities is critical for putting effective conservation measures in place.Eggs and juvenile Mahseer are subject to predation by a variety of aquatic and avian predators. Protecting spawning locations and improving nest guarding behaviours may help reduce these challenges and increase egg and fry survival.

Human activities such as dam building, deforestation, and agricultural runoff may modify and degrade habitat. Changes in habitat quality and water conditions have a substantial impact on mahseer numbers. Conservation efforts for Mahseer must prioritize habitat maintenance and restoration.Overfishing is a major danger to Mahseer populations, especially when traditional and recreational fisheries are not managed in a sustainable manner. Conservation initiatives often involve steps to encourage and enforce appropriate fishing practices and fishing restrictions.Water pollution from a variety of causes, including industrial runoff and agricultural contaminants, may have a harmful influence on Mahseer populations and habitats. Pollution reduction measures are critical for preserving the water quality of Mahseer habitats. Climate change-related issues such changed river regimes, temperature changes, and habitat destruction offer new threats to Mahseer populations. Strategies for climate adaptation and mitigation are critical components of conservation efforts.Mahseer's reproductive biology and life cycle techniques have significant conservation concerns. Recognizing these fish's ecological and cultural importance emphasizes the need of conservation efforts.

Protecting and rehabilitating Mahseer habitats is critical to their survival. This involves maintaining natural flow regimes, ensuring water quality, and safeguarding riparian habitats. Efforts to protect spawning grounds and migratory routes are vital to guaranteeing the survival of these famous species.It is critical to implement sustainable fishing techniques and laws in order to minimize overexploitation of Mahseer populations. Balancing the demands of traditional fisheries, recreational angling, and conservation necessitates a comprehensive strategy that takes into account these fish's ecological needs.It is critical to raise awareness about the ecological value of Mahseer and their conservation requirements. Local communities, anglers, and lawmakers may all be involved in efforts to safeguard these historic species via educational campaigns. Mahseer's cultural relevance should be recognized in education and awareness initiatives.It is critical to do ongoing study on Mahseer species, their habitats, and the risks they face. Monitoring programs may aid in the assessment of population health, the identification of conservation priorities, and the tracking of the effectiveness of conservation activities. Insights into the individual behaviours and

adaptations of distinct Mahseer species may also be gained via research, leading tailored conservation measures.

To summarize, Mahseer fish reproductive biology and life cycle tactics are fascinating and diverse parts of their existence. These fish have developed special adaptations and behaviours that allow them to flourish in South and Southeast Asia's dynamic riverine habitats. Their reproductive behaviours, like as upstream migrations, nest building, and parental care, demonstrate their resolve to secure the survival of their progeny.Mahseer's life cycle methods emphasize their ecological adaptation and longevity, including precise reproductive timing, modest growth rates, and size-dependent reproduction. These magnificent fish, however, confront severe conservation concerns, including habitat deterioration, exploitation, water pollution, and the effects of climate change.Conservation efforts must focus habitat preservation, sustainable fisheries management, education, and research. By preserving Mahseer's reproductive biology and life cycle techniques, we not only save these iconic fish, but also the delicate web of life that relies on their survival in South and Southeast Asia's unique freshwater settings.

CONCLUSION

In short, the way Mahseer fishes reproduce and live their lives is fascinating. It is closely connected to their important roles in the environment and the need to protect them. These special fish called Tor fish have adapted to survive in fast-moving rivers and rocky areas in South and Southeast Asia.Their way of reproducing, which involves unique behaviors during mating and eggs that stick together, shows that they are well adapted to living in rivers that always change. Some Mahseer species take care of their babies, which shows how much they care about making sure their babies survive.Mahseer's life choices, like when they reproduce, how long they live, how they grow, and what makes them vulnerable, show why they are important in the environment.

Their job as top predators, helping with the recycling of nutrients, showing how healthy an ecosystem is, and increasing the variety of life, shows how important they are in freshwater environments.It's important to protect the way Mahseer fish reproduce and live because it helps keep the rivers and lakes in South and Southeast Asia healthy and diverse. We need to keep working on conserving their homes to make sure that people in the future can still enjoy the amazing Mahseer fishes and their environment.

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CHAPTER 6

THREATS TO MAHSEER FISHERIES AND THEIR MITIGATION

Ashutosh Awasthi, Associate Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- ashuaw@yahoo.in

ABSTRACT:

The Mahseer fisheries are very important for people, the economy, and the environment, but they are in danger because of many threats. This summary gives a brief summary of the dangers to Mahseer populations and explains important ways to protect them and the ecosystems they live in.Mahseer fish face many problems, like their homes being destroyed, too many fish being caught, water getting dirty, dams cutting off their homes, and strange weather causing problems. These dangers harm the health of Mahseer fish groups, putting their future survival at risk.To protect Mahseer fisheries, it is crucial to use a comprehensive approach. This means protecting where Mahseer live by keeping the water clean and making sure it flows naturally. It also means managing fishing in a way that doesn't harm Mahseer, and making sure people follow the rules. We also need to reduce pollution in the water, prepare for changes in the climate, and help people understand why Mahseer are important for the environment. Working together is very important for protecting Mahseer fish and their homes. This means that the local communities, policymakers, and conservation organizations need to collaborate and work together. By doing this, we can successfully reduce the threats to Mahseer and help them live in a sustainable way with their environment.

KEYWORDS:

Climate Change, Early Life, Environmental Variation, Generation Time, Mahseer Fisheries.

INTRODUCTION

Various terminologies have been created by the international community for both animals and plants to categorize and arrange them into manageable complexes depending on the amount of danger perceptions. It becomes clear that the endangered categories are preserved and conserved for the sake of their survival and eventual human prosperity. Since the Vedic and historical periods (1500 BC-800 AD), conservation methods have been popular in our nation. A examination of references to fish in Kautilya'sArthasastra reveals that fishing was a well-established enterprise at the period, and fish was recognized as a basic meal. The ancient Indians had a broad understanding of fish behaviour and used it to practical applications. Conservation of animal groups or even the natural environment may be divided into four categories: ethical, aesthetic, scientific, and economic. Freshwater fish conservation has become a top issue in our nation. Rapid industrialization, urbanization construction of dams and hydroelectric projects, buildings, rail, roads, and encroachment of enormous swaths of forestland for agricultural expansion with monocultureand the encroachment of vast expanses of forestland for agricultural extension with monoculture have caused unique and direct disruptions in our natural ecology[1], [2].

Canalization of streams as a consequence of dam constructions and diversion of water via cemented canals, which deny these waterways leaf litter and forest trash in addition to foliage coverings since most of them are exposed to the sky without any cover, has caused enormous damage. The smooth ottom is primarily concreated and lacks bottom biota of plant or animal life, which influences fish development. Eroded streams suffocate stream bottom life, decrease plant growth, and interfere with fish gills and egg development. It transforms a natural habitat rich in plants and food creatures into an artificial one devoid of these

fundamental prerequisites for fish population preservation. Furthermore, the water body has high summer temperatures, which are seldom favourable to fish life. These changes in the environmental context, as well as the accompanying habitat loss, have rendered mahseers endangered. Overfishing and changes in stream ecology have also led to their extinction[3], [4].

The History of the Criteria Process

The vulnerable species categories presently used in Red Data Books and Red Lists have been in effect for about 30 years, with occasional modifications. Since their inception, these categories have gained worldwide recognition, and they are utilized in a variety of publications and listings issued by the IUCN as well as several governmental and non-governmental organizations. The need to modify the categories has long been acknowledged. The SSC (Species Survival Commission) conducted a zoo in 1984.The vulnerable species categories presently used in Red Data Books and Red Lists have been in effect for about 30 years, with occasional modifications. Since their inception, these categories have gained worldwide recognition, and they are utilized in a variety of publications and listings issued by the IUCN as well as several governmental and non-governmental organizations. The need to modify the categories has long been acknowledged. The SSC (Species Survival Commission) sponsored a conference in 1984. 'The Road to Extinction', which studied the challenges in depth and proposed a variety of redesigned system solutions. However, no one suggestion was made. The present phase of development started in 1989 with a request from the SSC Steering Committee to establish a new strategy that would give helpful information for action planning to the conservation community[5].

The first publication described new categories and presented numerical criteria that were particularly significant for big vertebrates. Following significant conversation within SSC, a number of revisions were made to the contents of the criteria, as well as a more thorough description of core ideas. The relevance of the non-threatened groups was clarified by a more precise structure. More improvements to the criteria were made in response to new feedback and validation activities. Furthermore, the susceptible category from versions 2.0 and 2.1 was merged into the Vulnerable category. The system's preventive application was underlined. The IUCN accepted this final version in 2001, which comprises modifications resulting from IUCN and sse membership comments, as well as a final meeting of the Criteria Review Working Group (CRWG) in February 2000. After January 2001, all new evaluations must utilize the most recent accepted version and provide the year of publication and version number. The final version is released as a document by the IUCN. Categories and Criteria of the IUCN Red List: IUCN Species Survival Commission, Gland, Switzerland and Cambridge, UK. There are 80 Extinct (EX) species, 11 Extinct in the Wild (EW), 152 Critically Endangered (CR), and 421 Vulnerable (VU). Many agencies and management authorities are interested in the new method because it is an excellent tool for observing changes in the status of animals over time and providing a more systematic and transparent approach to listing. India has agreed to examine sites and species and establish conservation plans for biodiversity. In a session in May 1997, the Endangered Species Prioritization Working Group on Biodiversity Conservation Prioritization Project (BCPP) identified the necessity to examine the condition of all species in seven key groupings, including freshwater fishes. As a preliminary start, I used the Deccan Mahseers as a quantifiable section[6], [7].

The IUCN 2001 criteria for assessing species extinction threats are used to evaluate the Deccan Mahseer species. As in the case of the DecranMahseers, categorization was carried out in order to verify all wild populations within their natural area. Populations brought into new places, such as Tor khudree, are not evaluated. The many categories presently accepted

and recommended. The Taxon Data Sheet Categories from the CAMP process are utilized. Workshops are organized by the Conservation Assessment and Management Plan (CAMP) to give strategic advice for the use of intensive management and information gathering strategies to vulnerable species. CAMPs offer a coherent and comprehensive method of determining priorities for intense management within the context of vulnerable taxa's larger conservation requirements. For this process, the CAMP brings together a diverse range of experts in both wild and captive management of the species under consideration. CAMPs are held in our country as a collaborative venture of CBSG (Conservation Breeding Specialist Group) with Indian Governmental and non-governmental agencies, institutions, organizations, and individuals, with technical assistance from CBSG, CBSG India members, and IUCN/SSC specialist group members from India and others. Around 10-40 specialists from academia and/or the commercial sector are brought together to evaluate the danger status of all taxa in a large group, nation, or geographic area in order to define conservation action and information collection priorities[8], [9].

The CAMP approach also allows for the testing of the application of the new IUCN Red List Categories. With the above as context, and using the most recent IUCN version, the eco-status of the three species has been evaluated separately. Before beginning this project, it is vital to identify the habitat of these species in the Western Ghats. The Western Ghat Mountains stretch for 1600 km from Surat Dangs in Gujarat to the mouth of the river Tapi as a continuous chain of mountains, unbroken save at Palghat Gap, which is 13 kilometres wide at its narrowest point. The mountains climb 170 m above sea level and extend parallel to India's west coast and the Arabian Sea from the Tapi estuary at 21°N to the Mahendragiri BON in Kanyakumari. They range in elevation from 900 to 1500 meters above sea level, with Anaimalai standing at 2965 meters. The hill ranges average 100 km in breadth, with the highest point approximately 1500m to the north and 2600m to the south, with rainfall ranging from 3000 mm near the coast to 7500 mm on the crest line, which drops fast to the east. These mountains block the monsoon winds to the southwest, casting a rain shadow to the east. The Western Ghats are one of 25 biodiversity hotspots extending over 1,40,000 km2 in the five southern states of Maharashtra, Karnataka, Kerala, Andhra Pradesh, and Tamil Nadu. These states are home to 35 million people, and 17 rivers flow from the highlands, the majority of which enter the Arabian Sea. Only the Cauvery, Krishna, and Godavari rivers begin in the Western Ghats and travel eastward to enter the Bay of Bengal.

DISCUSSION

Life history theories attempt to explain organism characteristic development as adaptive reactions to environmental variation and differential mortality or resource allocation to life phases. Life history theories also investigate how attributes are connected and limited by environmental circumstances. Reproductive effort varies with mortality schedules, and reproductive allocation to maximize offspring size versus numbers is influenced by the scale of environmental variation, the availability of resources for early life stages, and the degree of environmental stress. Life history theories anticipate population responses to disruptions on a variety of geographical and temporal dimensions. To enhance reproductive success in fluctuating surroundings, organisms may use iteroparity or migratory strategies, for example. Life history theories have been used to predict the relative effects of density-dependent vs density-independent ecological impacts on different life stages and age classes[10], [11].

The most notable example is the theory of rand K-selection, which predicts that populations with the K-selected set of traits delayed reproduction, low fecundity, large parental investment in individual offspring, long life-span will have higher fitness under density-dependent influences than species with the opposite set of r-selected traits. Interactions

between species traits, ecological influences, and population dynamics can be simulated using matrix-based and individual-based models. The fact that variables are often adjusted separately without understanding of the nature of functional constraints within suites of life history features is a shortcoming of these models. Environmental assessment, extinction risk, and resilience to harvest and other human-induced sources of mortality have all been studied in relation to species life history attributes. My goal here is to investigate the implications for fisheries management of a triangular model of life history evolution that finds adaptable suites of traits while accounting for functional restrictions.Several approaches classify species based on patterns of life cycle variation. The r-K selection model is perhaps the most well-known. This model's tests seem to have produced as much negative as positive evidence.

Some of these experiments argued that K-selection should favour higher population carrying capacity (K). However, the original K-selection model simply proposed that selection in chronically resource-limited and/or predator-rich habitats should favour certain traits, such as parental care and higher juvenile and adult survival, at the expense of early reproductive effort and large clutches of small offspring. Another issue is that the r-K continuum fails to detect other axes of variation needed to understand interspecific variation patterns in nature. Several two-dimensional, triangular life history evolution models have been presented. Life history theories anticipate population responses to disruptions on a variety of geographical and temporal dimensions. To enhance reproductive success in fluctuating surroundings, organisms may use iteroparity or migratory strategies, for example. Life history theories have been used to predict the relative effects of density-dependent vs density-independent ecological impacts on different life stages and age classes. The most notable example is the theory of rand K-selection, which predicts that populations with the K-selected set of traits delayed reproduction, low fecundity, large parental investment in individual offspring, long life-span will have higher fitness under density-dependent influences than species with the opposite set of r-selected traits. Interactions between species traits, ecological influences, and population dynamics can be simulated using matrix-based and individual-based models. The fact that variables are often adjusted separately without understanding of the nature of functional constraints within suites of life history features is a shortcoming of these models.

Environmental assessment, extinction risk, and resilience to harvest and other human-induced sources of mortality have all been studied in relation to species life history attributes. My goal here is to investigate the implications for fisheries management of a triangular model of life history evolution that finds adaptable suites of traits while accounting for functional restrictions. A major life history strategy model Several models rank species based on patterns of life history variation. The r-K selection model is perhaps the most well-known. This model's tests seem to have produced as much negative as positive evidence. Some of these experiments argued that K-selection should favour higher population carrying capacity (K). However, the original K-selection model simply proposed that selection in chronically resource-limited and/or predator-rich habitats should favour certain traits, such as parental care and higher juvenile and adult survival, at the expense of early reproductive effort and large clutches of small offspring. Another issue is that the r-K continuum fails to detect other axes of variation needed to understand interspecific variation patterns in nature. Several two-dimensional, triangular life history evolution models have been presented[12], [13]. Stress-resistant species' characteristics are simply more severe manifestations of those determining the competitive strategy. A triangular model of fish life history strategies based on evidence from Pacific fishes that contrasts small, early maturing species with high reproductive effort and low batch fecundity (Type IA) with larger species with later maturation, longer life-spans, and high fecundity (Type II). The third technique (Type IB) has basically intermediate characteristics.

Type IA species are favoured when environmental variation is irregular, and recruitment dynamics are likewise irregular. When environmental variation occurs over longer time periods, Type IB species are preferred, whereas Type II species are preferred when environmental fluctuation is limited and predictable. A triangular model of life history evolution was proposed to explain adaptive response to environmental variation in terms of predictability and scale relative to generation time based on patterns of life history variation in tropical freshwater fishes and North American freshwater and marine fishes. The Winemiller and Rose (W&R) model distinguishes three endpoint strategiesopportunistic short generation time, high reproductive effort, small body size, low batch fecundity, and low investment per offspring periodic (long generation time, moderate reproductive effort, large body size, high batch fecundity, and low investment per offspring, and equilibrium moderate to long generation time[14], [15].

Each W&R model endpoint strategy can be thought of as an adaptive set of attributes associated with maximizing the per capita rate of population increase, r, according to the demographic relationship r ln (lxmx)/T, where lx is age-specific survivorship, mx is age-specific fecundity, and T is generation time. This connection truly determines a series of trade-offs in one's life history. Relative investment in tissues-activities that increase survivorship decreases lifetime fecundity more allocation to soma and maintenance functions decreases allocation to gametes and associated reproductive tissues and functions and increases generation time more investment in somatic growth prior to maturation increases the interval to maturation. Greater fecundity would reduce survivorship due to lower relative investment in soma and maintenance processesand increase generation time high fecundity can only be achieved by delaying reproduction until a sufficiently large size has been attained. Reducing generation time to increase r would decrease both survivorship because reproduction occurs sooner with less investment in soma and maintenance and fecundity because earlier maturing organisms are smaller, with less biomass and energy available to produce large clutches of eggs.

These functional trade-offs result in species ordination based on suites of life history features that create an adaptive surface within the space defined by juvenile lx, mx, and T. Environmental gradients that are anticipated to favour each endpoint method are shown. Given constant other parameters, the intrinsic rate of growth is more sensitive to generation time changes than to changes in fecundity or survival. As a result, the opportunistic combination of characteristics might be seen as a colonizing strategy that should optimize fitness in environments controlled by density-independent, ecological effects. Such circumstances are possible in productive environments exposed to frequent and strong disturbances, such as ephemeral pools, intermittent streams, and salt marshes. Indeed, these environments are often dominated by species with short generation periods, such as poeciliids and fundulids. When environmental variable impacting early life stage survival is periodic (roughly predictable) and large scale, the periodic approach optimizes fitness. In some ways, the periodic method is an intergenerational type of bet-hedging in which reproductive effort is dispersed across many reproductive bouts when variance in juvenile survival is larger than variation in adult survival.

By distributing reproductive output throughout tons and lengthens generation time a higher investment in somatic development before to maturity lengthens the maturation gap. Greater fecundity would reduce survivorship due to lower relative investment in soma and maintenance processes and increase generation time high fecundity can only be achieved by delaying reproduction until a sufficiently large size has been attained. Reducing generation time to increase r would decrease both survivorship because reproduction occurs sooner with

less investment in soma and maintenanceand fecundity because earlier maturing organisms are smaller, with less biomass and energy available to produce large clutches of eggs. These functional trade-offs result in species ordination based on suites of life history features that create an adaptive surface within the space defined by juvenile lx, mx, and T. Environmental gradients that are anticipated to favour each endpoint method are shown. Given constant other parameters, the intrinsic rate of growth is more sensitive to generation time changes than to changes in fecundity or survival. As a result, the opportunistic combination of characteristics might be seen as a colonizing strategy that should optimize fitness in environments controlled by density-independent, ecological effects. Such circumstances are possible in productive environments exposed to frequent and strong disturbances, such as ephemeral pools, intermittent streams, and salt marshes. Indeed, these environments are often dominated by species with short generation periods, such as poeciliids and fundulids. When environmental variable impacting early life stage survival is periodic and large scale, the periodic approach optimizes fitness. In some ways, the periodic method is an intergenerational type of bet-hedging in which reproductive effort is dispersed across many reproductive bouts when variance in juvenile survival is larger than variation in adult survival. Some individuals accomplish reproductive success despite protracted gaps with unfavourable environmental circumstances for early life stage survival by distributing reproductive output over numerous years. The periodic technique seems to be the prevalent strategy seen in fishes, arthropods, mollusks, and plants, which most likely reflects the widespread large-scale spatial and temporal variation of ecosystems. Tropical marine systems are marked by spatial variability across broad scales e.g., convergence zones, gyres, coastal currents, and coastal depth and salinity gradients or are vulnerable to climatic phenomena such as hurricanes and El Nios. Variation in early life stage recruitment for periodic-type marine fishes is thought to be driven by large-scale environmental variation.Mahseer fishes, an iconic and culturally important species found in South and Southeast Asia's pristine rivers and streams, suffer a slew of problems that imperil their numbers and the habitats in which they live. We dig into the complex issues affecting Mahseer fisheries and examine mitigating techniques critical to their protection in this extensive discussion.

Degradation of Habitat

Dam Building and Habitat Fragmentation: The development of dams and hydroelectric projects is one of the most serious dangers to Mahseer fisheries. These projects have the potential to split riverine habitats, affecting natural flow regimes critical for Mahseer reproduction and migration. Dams hinder Mahseer access to spawning areas, hamper upstream migrations, and modify river ecosystems, all of which have negative repercussions for this famous fish.

Deforestation and the Degradation of Riparian Ecosystems: Deforestation and habitat degradation along riverbanks lead to Mahseer habitat decline. The destruction of vegetation may result in increased sedimentation, changed water quality, and decreased food availability, all of which are detrimental to Mahseer populations. Riparian ecosystems must be healthy in order to sustain the biological balance of riverine habitats.

Habitat Degradation Mitigation Strategies

Mitigating habitat deterioration requires a multifaceted approach

1. **River Restoration:** Efforts should be directed at restoring natural flow regimes and river system connectivity. This involves decommissioning or retrofitting dams to allow for fish passage, as well as encouraging environmentally friendly hydropower operations.

2. **Riparian Habitat Protection:** Riparian vegetation should be protected and restored using strong means. This involves riverbank replanting, erosion management, and the protection of vital ecosystems.
3. **Environmental Impact studies:** Dam projects should undergo rigorous environmental impact studies to ensure that any dangers to Mahseer and other aquatic species are properly examined before construction starts.
4. **Development and Adoption of Sustainable Hydropower techniques:** The development and adoption of sustainable hydropower techniques, such as run-of-river projects that limit ecological impact, may aid in striking a balance between energy production and conservation.

Excessive fishing

Unsustainable Fishing Methods

Overfishing is a severe concern to Mahseer fisheries, especially when traditional and recreational fisheries are not properly governed. The attractiveness of Mahseer for both subsistence and recreational fishing has resulted in overfishing in certain areas. Unsustainable fishing techniques, such as using illegal gear and capturing undersized people, aggravate the situation.Overfishing is exacerbated by insufficient or poorly implemented fishing laws. Many areas do not have adequate management plans or guidelines for Mahseer fisheries. This regulatory void allows for unchecked exploitation, putting more strain on already vulnerable communities.

Overfishing Mitigation Strategies

Overfishing must be addressed via a mix of governmental and community-based approaches:

Sustainable Fisheries Management:

It is critical to create and execute sustainable fisheries management programs suited to Mahseer species. To ensure that fishing stays below sustainable limitations, these plans should include size and bag limits, seasonal closures, and gear restrictions.

Regulatory Enforcement:

It is critical to strengthen enforcement systems and penalties for illicit fishing activities. This might include greater surveillance, community participation in monitoring, and collaboration with law enforcement authorities.

Community Involvement:

Including local communities in fisheries management and conservation initiatives may be quite beneficial. Economic incentives for conservation may be provided through community-based initiatives such as catch-and-release programs and ecotourism.

Education and Awareness:

Public awareness campaigns and educational initiatives may instill in anglers, local communities, and legislators a feeling of responsibility for Mahseer conservation.

Pollution of Water

Runoff from Industry and Agriculture:

Water contamination from industrial discharge and agricultural runoff is a major danger to Mahseer fisheries. Heavy metals, herbicides, and fertilizers may contaminate water, disturb

aquatic habitats, and affect Mahseer populations.Untreated effluents and sewage discharged into rivers may introduce diseases and contaminants, further affecting water quality. This pollution has the potential to have both direct and indirect effects on Mahseer health and habitat appropriateness.

Water Pollution Mitigation Strategies

Water Quality Monitoring: Developing rigorous water quality monitoring systems may assist in tracking pollution sources and trends. Early detection enables prompt action.Pollution control methods, such as wastewater treatment and appropriate chemical usage, may help to limit contamination of aquatic habitats at industrial and agricultural locations.It is critical to strengthen and enforce rules governing effluent discharge and sewage treatment. Setting and enforcing water quality standards and discharge restrictions is part of this.Public education campaigns should stress the necessity of safe chemical usage, waste management, and aquatic environment conservation.Climate change may alter river flow regimes, harming Mahseer habitats. Changes in precipitation, temperature, and snowmelt may disturb natural flow patterns, thereby affecting spawning migration time and the availability of appropriate habitat.Rising temperatures may have a severe impact on Mahseer populations, especially those acclimated to colder habitats. Temperature increases may have an impact on food behaviours, metabolism, and overall habitat appropriateness, thereby affecting reproductive success.

Climate Change Impact Mitigation Strategies

Increasing habitat resilience via riparian restoration and protection may help mitigate the consequences of climate change. Some Mahseer species may depend on cooler, higher-elevation settings for life.Adaptive flow management measures, such as reservoir operations that mirror natural flow regimes, may help reduce the effects of changed flow patterns on Mahseer habitats.It is critical for adaptive management to continuously monitor Mahseer populations and their reactions to climate change. The creation of solutions to safeguard these fish in a changing environment may be aided by research.Collaboration among stakeholders, including local people, governments, conservation groups, and researchers, is critical for effective mitigation of Mahseer fisheries hazards.

Conservation goals may be achieved via shared responsibility and collaboration.Recognizing Mahseer's cultural value may be a great motivator for conservation. Many societies cherish these fish in their traditions and beliefs. Using cultural respect to develop a feeling of stewardship.Ecotourism and sustainable lifestyles, such as catch-and-release angling and guided fishing trips, may offer economic incentives for Mahseer fisheries protection. These activities may produce revenue for local communities while also fostering responsible and long-term behaviour.

CONCLUSION

Finally, the Mahseer fisheries, which are distinguished by their distinct reproductive biology, life cycle techniques, and cultural value, are facing a slew of significant dangers that threaten their existence. These iconic fish are threatened by habitat deterioration, overfishing, pollution, dam-induced habitat fragmentation, and climate change. However, there is still hope for their survival.Mitigation techniques such as habitat conservation, sustainable fisheries management, pollution control, climate adaptation, and education campaigns are critical to ensuring Mahseer populations' long-term viability. Local communities, governments, conservation groups, and researchers must work together to ensure their success.Preserving Mahseer is critical not only for the survival of an iconic species, but also

for the health and integrity of South and Southeast Asia's freshwater ecosystems. We can guarantee that future generations are charmed by the beauty and ecological value of Mahseer fishes by addressing these challenges and adopting conservation efforts.

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CHAPTER 7

MAHSEER FISHERIES MANAGEMENT: POLICIES AND REGULATIONS

Anil Kumar, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- anilsingh2929@gmail.com

ABSTRACT:

The problem of managing Mahseer fisheries is very complicated and urgent because these special fish are in danger from many different dangers. This summary talks about rules and laws that are meant to protect Mahseer fish and make sure everyone's wants and needs are considered.There are different rules and guidelines for Mahseer fishing, which depend on the region and the status of Mahseer species. Good rules and restrictions are often needed to protect different kinds of Mahseer fish. These rules might include limits on how big the fish can be, times of the year when fishing is not allowed, and limits on what kind of equipment can be used. These rules are made to take into account the specific needs and environments of each type of Mahseer fish. It is extremely important to make these frameworks work well together. This can be done by using information to make decisions, being flexible in managing things, having the community participate, and working together across borders.There are big problems that make it difficult to enforce the rules properly. One problem is that there are not enough resources, like money or people, to do a good job. Another problem is that some people break the fishing rules, which makes it even harder to regulate properly.

KEYWORDS:

Fish Species, Fish Passage, Local Communities, Mahseer Conservation, Upstream Fish.

INTRODUCTION

Deterrent penalties mean strong punishments that will discourage people from doing something. Public awareness campaigns mean making sure people are informed about something to help enforce it better. The goal of all these strategies is to make sure rules and laws are followed more effectively.In addition, Mahseer fisheries provide great chances for conservation and ecotourism. Using sustainable practices like catch-and-release fishing and getting the community involved can make money and help protect the environment. This way of doing things requires building things like roads and buildings, working with community groups, teaching people, and making sure everyone understands and respects each other's cultures.Collecting information and doing research are very important in managing Mahseer fisheries. It helps fill in the gaps in knowledge and helps make decisions based on evidence. To improve research, it is important to get money for research, work together with others, keep track of things for a long time, and involve the public in science projects that regular people can help with.In summary, it is important to have good rules and laws, involve the community, and do research to protect Mahseer fish and keep the freshwater ecosystems in South and Southeast Asia healthy.

The building of a dam on a river inhibits or slows upstream fish migration, contributing to the extinction of species, particularly potamodromous fishes, whose full life cycle is completed within inland waters. Migratory fishes are very valuable both commercially and recreationally. The fish passages are advised for these reasons, as well as to limit the negative affects. Various hydroelectric dam projects throughout the globe have developed and adapted fish passage with appropriate water flow to support fish movement. Upstream passage

methods are regarded well-developed in the majority of dams, particularly for a few anadromous species. However, the downstream migration is currently being tested. Some fish passes, such as vertical slot passes with multiple pools in the case of a smaller dam, are more suited to targeting a range of migratory species. The following are examples of possible dams and site-specific upstream connection developed as part of different hydroelectric dam projects across the globe. There have been no systematic studies conducted to evaluate the fisheries in the project river Gola and its tributaries. Except for indigenous hill-stream fishes, the river water was determined to be unsuitable for coldwater fishes such as Schizothorax sp. and Mahseer Tor sp[1], [2].

Tor sp. and Schizothorax sp. are only found in Nainitalgadera, Bhimtalgadera, and Barajallagadera owing to the lakes. The most frequent fishes are Barilius sp. and Garra sp., while others are uncommon. The prevalence of mahseer and snow trout fish may be owing to a river bottleneck downstream at the Gola barrage. As there is no provision for fish migration from downstream to upstream, the river valley projects have damaged a broader span of rivers in India. Potential upstream links to enable fish migrations that are implemented globally are mentioned below, dependent on the type of the dam. The general principle of upstream fish passage facilities is to attract migrants at a specific point downstream of the obstruction and induce or force them to pass upstream by the waterway or by trapping them in a tank and transferring them upstream. The Denil fishways are designed for low head dams and are used to accommodate fish species greater than 30 cm in length, such as salmon, sea-run trout, marine lamprey, and large rheophilic potamodromous species. The design may be changed to accommodate weak swimmers. Vertical slot fishways are appropriate for small dams. It is a rectangular channel divided into resting pools by baffles, with the channel floor lined with pebbles to give varying water levels that support bottom living species. Bypass channels are alternate routes made with wires similar to natural streams and flow control devices.

These channels have a relatively low gradient, often 1 to 5%, and even less in lowland rivers. The biggest downside of this pass is that it takes up a lot of room and cannot be changed upstream. Hydraulic conditions are created by the control mechanisms, making fish navigation difficult. A fish lock is made up of a huge holding chamber situated downstream that is connected to an upstream chamber positioned at the fore bay level by a sloping or vertical shaft that is closed and filled with the sloping shaft. Fish drawn into the downstream holding pool enter the upstream chamber via the gate that has been opened. The establishment of a downstream flow inside the shaft through a bypass positioned in the downstream chamber stimulates the fish to depart the lock. The major disadvantage of the lock is its limited capacity as compared to a regular fish pass, as well as its discontinuous style of operation due to the confined volume of the bottom chamber. A fish lift is a mechanical device that transports directly captured fish in a V-shaped entry upstream over a dam. When the trap is raised, fish and water are hoisted until they reach the dam's crest. The biggest downside is the greater operating and maintenance costs. Downstream fish passage is less developed than upstream fish passage, and no nation has discovered a suitable solution to downstream migratory issues, particularly for big dams.

The planned dam is a run-of-river project designed to utilize the surface running water potential for incidental hydropower output of 30MW. As a result, the only option to prevent fish from being washed downstream is to physically block them from going through turbines by employing mesh screens. The efficiency of a fish pass varies greatly depending on the circumstances. Because hydrological regime, water quality, increased predation, and loss or degradation of habitat upstream and downstream are species and site specific, the 100%

effective fish pass may be useless in the long term. As a result, various mitigating measures, including hatchery management, may become necessary. However, a rise in captures subsequently indicated that the Mahseer had discovered a mechanism to create fresh stocks under the changing circumstances. Failures of fish passes have been reported all over the world due to a lack of attraction flow, an unsuitable entrance location, insufficient maintenance, and hydraulic conditions. The projected dam would stand 130 meters above the riverbed. According to studies, a fish ladder/fish pass is not physically viable in locations where the diversion structure's height is large and the local terrain does not permit the building of a fish ladder/fish pass. The biological uncertainty caused by fish lift in the case of Scizothoracine fish has also been recorded as a result of the sudden loss of habitat on the dam's top side[3], [4].

To safeguard the endemic fish in this condition, the remaining portion of tiny channels/tributaries above and downstream from the dam site should be protected in order to retain the biological integrity of the aquatic environment for the maintenance of the Mahseer population. Ex situ conservation in the neighbourhood is the only possibility available for Mahseer propagation. A suitable fish hatchery for the generation of yearlings and fish seed to be deposited in the reservoir for future fish development should be constructed. Traps may be used to temporarily trap fish in order to strip them of spawn in the hatchery, as well as to steer fish to favoured streams by placing fish breaks or obstacles on other streams. Trapping and transportation may be a long-term solution in the case of high dams when installing a fish pass makes it impossible for fish to access crucial breeding habitat. Trapping and moving migrants is a common temporary solution for both downstream and upstream flow of fish. A container vessel that can be put anywhere in the tailrace and in the route of migratory fish must be erected and self-propelled or carried to take fish upstream. Fish may be released downstream and upstream on the river in breeding areas, or they can be brought to a hatchery. Streams are the lifeblood of each river system, ensuring its biological integrity. In addition to the numerous plans provided in the management plan for aquatic ecosystem restoration, the following suggestions will enhance riverbank stability for aquatic ecosystem restorationRiparian plant roots penetrate and bond the soils of stream banks, giving stability and resilience.

For the Jamrani project to improve fisheries, it would be preferable to classify the downstream Gola River as a Mahaseer zone under the Wildlife Protection Act. For conservation purposes, the downstream canals should be rebuilt. Along the Gola River, the reserve might include its own hatcheries, fishing ponds, seed collecting centres, reservoir management, and reservoir stocking cells. The details of such an infrastructure would be worked up in partnership with the State Fisheries Department and the National Research Centre Coldwater Fisheries (NRCCWP) in Bhimtal, Nanital District, as well as research institutes/universities/expert agencies. The National Research Centre Coldwater Fisheries (NRCCWP) Bhimtal has successfully stocked Mahseer in the size range of 1200-1500 g in the Shyamlatal Lake, which is being developed as a mahseer conservation site (>70%). The Uttarakhand State Government is establishing a state fish farm at Satpuli to ensure the long-term management of the mahseer fisheries stock on the Nayar River. The planned dam site's habitat The Gola River is a low gradient river with water flowing all the way down save for a few pools and riffles that may be found along the way. During the monsoon season, several little pocket lakes were discovered along the riverbank.

These pools were mostly populated by fingerlings of several fish species such as Garra spp. and Barilius spp., with the golden mahseer Tor putitora and Schizothopraxrichardsonii being unusual occurrences. The presence of fish species was studied over a 20-kilometer stretch of

river from the planned dam location. During the pre-monsoon season, the Gola River basin was surveyed in order to develop appropriate mitigating measures. Three tributaries on the right bank of the river Gola run through Kumaun highlands and are spring water streams, while one tributary on the left bank of the river Gola flows via Siwalik hill and is a warm climatic zone, joining the main river Gola in the length evaluated. It also comprises a 2 km stretch of Nainitalgadera, a 1 km stretch of Bhimtal, and a 500m stretch of Barajalla stream. A hatchery will be built for the protection and development of mahseer and other fish in the reservoir. The hatchery units may be established with the assistance of the local fisheries department. Brooders from the river will be gathered and hatched in the hatchery. After growing the spawn at the hatchery for a certain amount of time, the young fish must be refilled in the river Gola above and downstream of the Jamrani dam, as well as adjoining streams. This will be monitored to determine the effectiveness of survival. The hatchery seed will also be distributed to private businesses and fish farmers in the area in order to encourage fish culture. As a result, it will not only assist to provide jobs and money, but it will also help to reduce the impact on natural fish populations. In the current circumstances, one viable location for a hatchery has been identified downstream near Jamrani hamlet along the Barajallagadera.

Sound management tactics are required for effective spawning and raising. Artificial spawning and rearing technologies is extensively accessible in the nation. The research region was also discovered to be appropriate for reservoir fisheries. Labeo sp., Grass carp, silver carp, Common carp, Catla sp., and other fish species may be placed in the reservoir with Mahseer. All of these fish can be readily raised in a hatchery. Stocking fish seed in reservoirs is critical for reservoir management. Before stocking the reservoir with fish seed, a thorough limnological research is required to determine the physicochemical and biological condition of the water. This will aid in the introduction of fingerlings into the reservoir for culture. For a successful implementation of the hatchery and ponds, the expertise of the National Cold Water Fisheries Research Centre, Bhimtal, and Dr. S.N. Ogale Tec, Lonavla, as well as other specialists, may be requested. The state fishing department already manages the Mahseer hatchery in Satpuli, PauriGarhwal. To support aquatic life and water quality, artificial propagation has been recommended to protect, restore natural fisheries, and stock reservoirs with indigenous species Schizothorax sp. A preliminary expenditure of Rs. 80.0 lac (INR) has been suggested for recording of aquatic variety, building of a composite fish hatchery at Barajalla stream near Jamrani village, and stocking of rivers and reservoirs. It is advised for downstream fisheries to restore and conserve downstream channel habitat via a lower channel augmentation program biological and engineering features such as the installation of weirs, logs, minor barrages, and substratum with stones, pebbles, cobbles, gravels, and so on.

DISCUSSION

Effective rules and regulations are critical for the protection and management of Mahseer fisheries. In this in-depth discussion, we will look at the important features and problems in developing and implementing laws and regulations that balance Mahseer's ecological demands with the interests of many stakeholders.Regulatory regimes for Mahseer fisheries range greatly among nations and regions, reflecting disparities in governance systems, cultural norms, and Mahseer population status. Some places have strong rules in place to conserve these iconic species, while others have regulatory gaps and issues.The creation of species-specific rules is one successful method to Mahseer fisheries management. Size and bag limitations, restricted seasons to safeguard spawning times, and gear restrictions suited to the biological demands and vulnerabilities of various Mahseer species are examples of these

laws.Scientific data and research should be used to inform policies and laws. Comprehensive evaluations of Mahseer populations may help guide management decisions[5], [6].

Adopting adaptive management concepts enables for the flexible modification of rules in response to new knowledge and changing environmental circumstances.Involving local communities in the creation of rules generates a feeling of ownership and compliance. Traditional knowledge and insights may be obtained from communities.Cross-border cooperation is required when Mahseer populations transcend international borders. Harmonizing rules and enforcement activities has the potential to improve conservation results.The effective implementation of Mahseer fishery laws is sometimes hampered by a lack of resources. Inadequate people, equipment, and financial assistance may make it difficult to monitor and implement rules, especially in distant places.Illegal fishing methods, such as using illegal equipment or catching undersized fish, provide a substantial difficulty. Illegal acts might be difficult to identify and punish due to their covert nature.Investing in training and providing law enforcement with the appropriate tools and technology may improve their effectiveness.Including local communities in the monitoring and reporting of criminal activity may help enhance police operations. Local fishing methods are often well known by members of the community.Implementing deterrent consequences for infractions, such as fines and equipment seizure, may serve as a deterrent to illegal fishing[7], [8].

Public awareness campaigns may educate communities and fishermen about the need of following legislation and reporting unlawful activity.Mahseer fisheries have significant ecotourism potential. Catch-and-release fishing, guided fishing trips, and eco-friendly lodging may all attract visitors, earning cash for local communities while also helping Mahseer conservation.Local people may benefit from being involved in sustainable livelihoods related to Mahseer conservation. Opportunities may include ecotourism jobs, habitat restoration projects, and cultural tourism efforts highlighting Mahseer's cultural value.Eco-friendly infrastructure development, such as fishing cottages and nature paths, may improve the ecotourism experience.Working with local communities to achieve fair benefit-sharing and community-based conservation projects may help develop support for Mahseer conservation.Educating visitors about responsible fishing and the ecological significance of Mahseer may encourage ethical actions and long-term conservation support.Highlighting Mahseer's cultural importance in educational programs and excursions helps encourage cultural awareness and respect for these famous fish.Accurate data and research are required for effective fisheries management. However, there are often data gaps in our knowledge of Mahseer numbers, habitats, and the effects of different threats[9], [10].

Prioritizing Mahseer research is critical for evidence-based decision-making. Population assessments, habitat monitoring, genetic studies, and the evaluation of conservation actions should all be part of the research.Obtaining money for Mahseer research activities may help with data gathering, analysis, and dissemination.Collaborating with academic institutions, conservation groups, and government agencies may aid in the conduct of thorough research.Long-term monitoring initiatives may give useful insights on Mahseer population dynamics and the efficacy of conservation efforts.Involving the public in citizen science programs may help to increase data collecting efforts and develop a feeling of engagement in Mahseer conservation.Effective rules and regulations are required to ensure the long-term management and protection of Mahseer fisheries. To address regulation variability, enforcement issues, and data shortages, governments, local communities, conservation groups, and academics must work together.The protection of Mahseer is critical not only for the survival of these iconic fish, but also for the health and integrity of South and Southeast Asia's freshwater ecosystems. We can guarantee that future generations continue to

appreciate the beauty and ecological relevance of Mahseer fishes by adopting and enforcing solid laws and regulations[1], [11].

Additionally, it is important to use sensible and logical strategies to manage all resources, including marine animals. Rational long-term management plans rely on data that accurately represents what's happening in the sea. These plans also rely on agreed-upon systems for monitoring and regulating important fish populations. Unregistered catches are also a big problem. Furthermore, a good conservation principle suggests that rules and the action of enforcing them should focus on the actual act of fishing as the main concern. This means there are rules about who can come in, what equipment can be used, and how many things can be caught or thrown away.

CONCLUSION

The ocean and everything in it have always been important to the countries that are near the coast in Europe and their nearby countries. The rich ocean ecosystem has allowed many communities to survive for hundreds of years. The current problems in managing fisheries are due to our reliance on seafood as a source of food. Another important point to remember is that fishing is also unique in a different way. The areas where people go fishing are important to all of us and some of them, we use directly. A fisherman from one country can be in a different country the next day, and then another country the day after that. No other industry has a workplace and food source like this. International management is very important. The results of applying fishery policy tools do not just rely on the tools themselves. They also depend on the features of the fishery system and factors outside of the government's control. So, it's hard to figure out how well each instrument works. There are a lot of living things in the oceans that can be collected. These living things rely on each other and interact with other living things in a way that affects the whole world. So, we need a worldwide plan for collecting them. We now know that different species are connected to each other in various ways. This means that when we use different species, we need to consider how they are connected and rely on each other, as well as how they are affected by technical, biological, and economic factors when making decisions about how to manage them. Some countries have started using "effort management" to deal with having too much capacity. This means they are controlling the amount of work being done instead of the amount of work being produced. This means to limit the amount of fishing done, not based on the size of a boat, but based on its fishing ability. This method may make you work harder when you can fish for a longer time, but you can overcome it by focusing on fish that are endangered. There are two experiments happening in Denmark to manage fishing efforts. They are worth keeping an eye on for future reports.

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CHAPTER 8

TRADITIONAL KNOWLEDGE AND PRACTICES IN MAHSEER FISHING

Kusum Farswan, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- kusumfarswan.14feb@gmail.com

ABSTRACT:

Traditional knowledge and practices in fishing for Mahseer are important because they connect cultural heritage with taking care of the environment. Indigenous communities in South and Southeast Asia have become very skilled at catching Mahseer fish. They have learned a lot about the local environment, how rivers work, and how these special fish behave, which helps them in their fishing.This summary examines the importance of traditional Mahseer fishing practices for culture and the environment, showing how humans and nature work together in harmony. Indigenous ways of fishing, like using a fishing line and traps made from bamboo, and understanding when fish move during different seasons, show how communities can live in harmony with Mahseer populations for a long time.However, keeping these practices alive is becoming harder because the places where these practices happen are becoming worse and there are too many fish being caught. Therefore, the summary highlights how it is essential to connect old knowledge with current efforts to protect Mahseer fish and where they live. This means that we need to work together and support local communities in order to protect the Mahseer fish. We should also include the knowledge and practices of the people who have been fishing for Mahseer for a long time in our conservation efforts. This will help preserve Mahseer fishing as an important part of our culture and environment.

KEYWORDS:

Fish, Farm, Conservation, Mahseer, Stripped Eggs.

INTRODUCTION

The impoundment of select rivers in Maharashtra, such as in Koyana, Venna, and Wama, for the protection of mahseers, is a beneficial move. The significance of such locations stems from the fact that the present ecology is conserved despite changes in stream structure, such as the transition from a lotic to a lentic pattern. Infringement is best avoided, particularly in the higher levels, such as in Krishna, where the natural route has been deviated. It is preferable to safeguard the whole catchment region rather than interfering with the higher reaches, which might constrain storage and flow spans. In the case of the Cauvery, numerous higher reaches tributaries have been imputed, resulting in insufficient flow in the Delta regions. Further beneficial interventions cannot be proposed in such natural ecosystems as described above. However, fish culture methods must be used to replenish unproductive areas and populations that have become rare; it is often the case that fishes like the Deccan mahseers, which have become rare and occur in limited numbers, may not be able to succeed in creating new types of living habitats in such newly created water bodies as new reservoirs and artificial lakes in a natural way. Artificial species settlement in such places must be implemented not just for general ecological reasons, but also for conservation[1], [2].

The cultivation and stocking of mahseers in Walwahn Lake, Lonavla, Maharashtra, is one example. Re-naturalization or resettlement of such species into their normal and typical habitats should be the final method and goal of any conservation action. The initial implantation in newly developed places or habitats should be closely monitored and

safeguarded from any detrimental impacts. What is to be ranched in a particular water-face must be planned well in advance. Exotic species, as well as weed fishes that interfere with food availability, should be eradicated. These must be completely and completely removed. Management of manmade water bodies, as opposed to natural lakes, would be simpler. All animal creatures settle on their own. It is impossible to settle endangered animals such as mahseers without human intervention. Settlement of many endangered species may also be considered to bring them closer to natural settings, like in artificial lakes. Natural species previously known from such places are should be chosen in such cases[3], [4].

Biological observations on mahseers have piqued the interest of fishermen and scientists throughout the nineteenth century, but anglers have their own set of constraints. Following the recommendations of the Agricultural Commission (1976), research on the biology of mahseer fishes began in many centres, mostly in north India, such as the Kumaun Lakes and Garhwal districts, by various universities and institutions. The cold-water fisheries center of Central Inland fisheries commenced studies on Tor p"titora and Tor tor mostly on their biology. In respect of the Deccan Mahseers the Lonavla Fish farm of the Tata Electric Company initiated work, developed definite methodology and perfected the techniques. Methods of Conservation. In respect of sport fish as that of the Deccan mahseers that are endangered obtaining quantitative data of catches in regular sequence for comparison is not easy. It is necessary therefore to analyze the situation objectively from the information available and work out strategies for conservation of existing natural stocks and take steps for continued propagation of the concerned species. An extensive technique used in Europe and North America is the construction of fish ladders and passes especially for Salmon[5].

This is not practicable in the case of the Deccan mahseers because of the very same passes or ladders may become traps for capture of the brooders by unscrupulous fishermen and locals. Moreover, the Deccan mahseers species are yet to be found widely distributed. The Indian Fisheries Act, 1897 is a landmark for the conservation of fishes in India. According to this, among other things the use of explosives or poison in any water body is liable for punishment including fine and imprisonment. The wiid. Life Act 1972 does not include fish. The FAO (1980) proposed essential and complimentpi criteria for aquatic resources. These are in situ and ex situ conservation measures. In situ conservation Mahseers being large sized fish and is capable of getting accustomed to taking artificial feeds thrive well in lakes and reservoirs. As such in situ conservation is recommended. In situ conservation is useful where genetic diversity exists and where wild forms are present. This is done through their maintenance within natural or man-made eco-systems in which they occur. The many advantages of conservation are continued evolution of the wild populations along with other forms natural parks and biosphere reserves may provide less expensive protection for the wild relatives than in ex situ practics. Further in situ conservation allows the adaptation to the changed environment, which is not feasible in ex situ conservation[6], [7].

Genetic resources must be preserved. It is an undeniable reality that our biological resources are a capital asset with enormous potential for long-term advantages. Despite increased efforts over the last two decades, the primary causes of biological variety loss include habitat degradation, overfishing, pollution, and the introduction of foreign species. Since the beginning of time, species variety has steadily risen, resulting in a remarkable array of living forms. No one knows for definite how many species exist today;however, it has recently been estimated that there are between ten and thirty million. Around one million of these are expected to go extinct by the turn of the century. Criteria for defining biological boundary limitations are required for identifying endangered species or ecosystems, as well as differentiating crucial ecological processes and keystone species. It's not simple to be urgent.

It is thus required to conduct an objective analysis of the situation based on the available facts, develop plans for the protection of existing natural populations, and take efforts to ensure the continuous propagation of the concerned species. The building of fish ladders and passages, particularly for salmon, is a widespread method in Europe and North America. This is not feasible for the Deccan mahseers since the same routes or ladders may be used as traps for the capture of the brooders by unscrupulous fishermen and villagers.

Furthermore, the Deccan mahseers have yet to be extensively diffused. The Indian Fisheries Act of 1897 represents a watershed moment in Indian fish protection. This includes, among other things, the use of explosives or poison. in any body of water is punishable by fines and imprisonment. The idiot. Fish are not covered under the Life Act of 1972. The FAO developed essential and supplementary criteria for aquatic resources in 1980. There are two types of conservation measures: in situ and ex situ. Mahseers flourish in lakes and reservoirs due to their big size and ability to get acclimated to accepting artificial feeds. As a result, in-situ conservation is advised. In situ conservation is beneficial when genetic diversity exists and wild forms survive. This is accomplished by maintaining them inside the natural or man-made eco-systems in which they exist. The various benefits of su conservation includeongoing evolution of wild populations with other types of conservation, and natural parks and biosphere reserves may offer less costly protection for wild relatives than ex situ practices. In situ conservation also enables for adaptability to changing environments, which is not possible with ex situ conservation.

Despite mounting efforts over the past 20 years, loss of biological diversity is mainly due to habitat destruction, over harvesting, pollution and introduction of exotic fishes. Since the origin of earth, species diversity has increased regularly to produce a fantastic array of living forms. No one knows for certain how many species exist at present but the number has recently estimated to be between ten and thirty million. Of this about one million are predicted to become extinct by the turn of the century. We need criteria for recognizing the biological boundary limits for identifying species or ecosystems in trouble and for distinguishing critical ecological processes and keystone species. Urgent for useful trial. Ex situ conservation represents last resort for species as the Deccan mahseers, which have died out in their natural habitats. The in situ and ex situ conservation techniques need a basic requirement of adult brooders and fish from their natural environment. To keep a sustained and continued availability of seeds is a prerequisite, more so when the chances of availability in nature of threatened species is remote. Towards this direction the efforts of the late Dr. C. v. Kulkarni and his team in the Fish Farm of the Tata Electric Company at Lonavla needs elaboration. The procedures they developed are simple and unsophisticated so that even junior scientists working in remote centre can follow them easily. In August 1986, a workshop was organized where several fishery scientists of the country participated and were demonstrated different farm practices and actual artificial breeding operations.

A set of recommendations for the conservation and propagation of mahseers were drawn up and forwarded to different states. Again, in August 1987, a training program was arranged for middle level scientists where the participants individually took part in actual hands-on fishing operations under the guidance of the experts. Breeding habits. Close studies of different biological aspects and behavioral patterns of mahseers in recent years have contributed to an understanding of the shortcomings in their life cycle and also as to the methods of conservation, which can be effectively practiced. It has been found that raising large number of fly and fingerlings in fish farm for restocking the depleted waters, preventing illegal fishing and improvement of the habitat are major criteria. These have been done at Lonavla. Determination of the extent of the breeding season is an essential factor in knowing the

capacity of the mahseer to propagate its race. It has been found that July to September is the commonest peak period for most of the mahseer species. At Lonavla T khudreemahseer were found to breed on a small scale near the out gate of adjoining stream into the lakes. This covered a period from the middle of July to end of August particularly when the temperature of water was 21 to 22°C and rain swelled the stream. In order to avoid natural mortality at different stages and obtain a large number of eggs, ripe fish, which congregated at the surface of stream, were carefully collected and the selected ones were stripped of their eggs and milt by exerting pressure on the caudal portion in a particular manner.

It was found that Tor khudree has three sizes of eggs in the ovary. If stripping was done in the early monsoon period only the ripe eggs were obtained. On opening the ovary however two other size groups of immature ova were seen which mature and spawn out in the lake partly in monsoon season. The stripped eggs were then collected in enamel trays and the milt of the male spread over it as is usually done in the case of trout and salmon for the fertilizing the eggs. The fertilized eggs are demersal, lemon yellow or brownish golden in colour. They measure 2.8 to for useful trial. Ex situ conservation represents last resort for species as the Deccan mahseers, which have died out in their natural habitats. The in situ and ex situ conservation techniques need a basic requirement of adult brooders and fish from their natural environment. To keep a sustained and continued availiability of seeds is a prerequisite, more so when the chances of availability in nature of threatened species is remote. Towards this direction the efforts of the late Dr. C. v. Kulkarni and his team in the Fish Farm of the Tata Electric Company at Lonavla needs elaboration. The procedures they developed are simple and unsophisticated so that even junior scientists working in remote centre can follow them easily. In August 1986, a workshop was organized where several fishery scientists of the country participated and were demonstrated different farm practices and actual artificial breeding operations. A

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eggs. The fertilized eggs are demersal, lemon yellow or brownish golden in colour. They measure 2.8 to aperture constantly removed dead and defective eggs. Limitations of the stripping method. Stripping the spawners, artificial fertilization of eggs and their rearing afterwards as outlined have some limitations. The collection of ripe and oozing specimens is the crux of the problem.

Unlike in Walwahn and Shirwada lake, Lonavla, in many mahseer streams favorable conditions as in the above lakes do not prevail and gravid fish keep on migrating into remote streams which are very much dispersed in the forest area resulting in dispersal rather than concentration of breeding population. Collection of specimens for stripping then becomes a problem and sometimes disappointing. Breeding of fish in farm ponds therefore assumes greater importance. In some areas the configuration of the lake or the river and its surrounding land itself may not be conducive for collection of spawners for stripping and artificial fertilization as detailed above. In such cases recourse has to be taken by breeding the fish by hormone injections. Efforts made in this direction at Lonavla on Tor khudree indicate that the pond-raised fish can be bred in the third year when the female is about 900 gms or more in body weight. In this case stripping is done a~ter administering a second dose to the female, the male requiring only one dose. The dosages are 6 and 12 mgs per kg of body weight. In some cases, the pair breed normally without stripping in the cloth. In this type of breeding, diet and oxygenation of water play important roles. Food should contain more protein than usual and oxygenation effected by running water or by mechanical means. Inherent biological constraints in Natural Breeding. The mahseers require specialized biological conditions for its breeding and juvenile development.

With a low fecundity and a long hatching period the extended semi quiescent state after hatching are all-inherent obstacles for its easy breeding and development. In Nature mahseer spawners try to reach their favoured spawning grounds, which may be in the vicinity, or far away traversing smoothly or enduring the overflowing monsoon streams. The actual spawning area has to be comparatively calm, having well oxygenated water and a bed of sand or gravel. The journey to these grounds may be safe or fraught with risks and dangers but their inner instinct drives the spawners to meet the challenges in order to breed and propagate their race.

DISCUSSION

The rivers of the world are home to a wide variety of life, including the well-known Mahseer fishes. These amazing and mysterious freshwater giants live in the rivers and streams of South and Southeast Asia, and greatly impact the natural scenery around them. Mahseer fishes are more than just water creatures; they protect Asia's rivers and represent the cultural heritage and ecological importance of these flowing ecosystems.A Taxonomic Tapestry can be simplified to A collection of different organisms classified in a specific way. The group of fish called Tor,"which includes different kinds of Mahseer, is very interesting and full of things that we don't know yet. Scientists have sorted many different types of Mahseer fish into groups based on their special qualities and how they have changed to survive. Some notable examples include the Himalayan Mahseer, Golden Mahseer, and Red-Fin Mahseer. These fish are famous for their beautiful colors and impressive sizes.Cultural significance refers to the importance or value that a particular object, practice, or event holds within a specific culture or society. It is a way to understand and appreciate the meaning and impact of various cultural elements on people's lives.For many generations, Mahseer fishes have been highly respected in the culture of South and Southeast Asia. Mahseer fish are respected and celebrated in many different cultures and communities[6], [7]. They are often seen as important figures in festivals and are included in local customs and traditions. Their cultural

importance is shown through stories, artwork, and religious ceremonies that highlight their essential role in the area's identity.Besides being culturally important, Mahseer fish are also very important for the environment as they help to shape the way rivers and their ecosystems work. These fish play an important role in the ecosystem by affecting the number and location of other water-dwelling organisms. Their eating habits, especially their liking for insects that live in water, help keep insect numbers balanced and nutrients moving around in rivers. Furthermore, Mahseer are important signs of the overall health of rivers. When Mahseer are found in a river, it means that the freshwater ecosystem is in good condition.Despite being well-known and important, Mahseer fishes are in danger of being harmed and may not survive because of many different dangers they face. The future of these animals is threatened because their homes are being destroyed, there is too much fishing, the water is becoming polluted, dams are being built, and the changing climate is causing problems[8], [9].

These dangers don't just hurt Mahseer populations, but also harm the overall health and balance of the freshwater environments they live in.Conservationists, scientists, and people who live nearby are working together to keep Mahseer fish and the rivers they live in safe. Conservation efforts involve making habitats healthy again, managing fisheries in a way that can be continued in the long term, controlling pollution, adapting to climate change, and getting communities involved. These comprehensive methods understand that protecting Mahseer is closely connected to the health of whole river systems and the livelihoods of the people who rely on them.This study looks closely at Mahseer fishes and why they are important to our culture and the environment. It also shows why we need to protect them right away. In this book, we will learn about the different parts of Mahseer. This includes their classification, how they live and what they need in their environment, their life story, and the problems they are facing in terms of conservation. At the end of the trip, we want to emphasize the importance of protecting these river guardians and their homes, making sure that the Mahseer fish continue to exist for many future generations[10], [11].

CONCLUSION

In summary, exploring the world of Mahseer fishes helps us understand their importance to the culture, ecology, and conservation efforts in South and Southeast Asia's rivers.The Mahseer fish are highly respected in the region and have been a part of their culture for a long time. The fact that these fish are included in folklore, festivals, and traditions shows that they are very important to the local communities and a big part of their culture. Mahseer are fish that live in rivers and help keep the river's ecosystem balanced. River health is really important and these animals have a big part to play.

They are key to making sure everything in the river works properly.However, there are many dangers that could harm Mahseer. The homes, overfishing, pollution, dams, and climate change are putting them in danger. Conservation efforts are very important and cannot be emphasized enough. To protect the future of Mahseer and the rivers they live in, it is important to use holistic approaches.

These approaches include restoring their habitats, managing fisheries sustainably, controlling pollution, and involving the local community.The future involves working together, taking care of things, and protecting them. By protecting Mahseer fishes and where they live, we don't just keep a special kind of fish safe, but we also make sure that the freshwater places where they live stay healthy and strong in Asia. The heritage of Mahseer fish shows how everything in the rivers is connected, and it is our duty to make sure this heritage continues for future generations.

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CHAPTER 9

MAHSEER AQUACULTURE: OPPORTUNITIES AND CHALLENGES

Kuldeep Mishra, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- mishraypikuldeep@gmail.com

ABSTRACT:

Mahseer aquaculture is a viable way to conserve these historic fish species while providing the demand for their valued meat in a sustainable way. This abstract captures the essence of Mahseer aquaculture as well as its potential for reconciling conservation and commercial goals.Mahseer aquaculture is a sustainable alternative to wild harvesting that addresses the risks to natural populations. This strategy, which is guided by ecological principles and current aquaculture technology, aims to grow Mahseer species in controlled surroundings, therefore reducing stresses on their natural habitats.The abstract delves into the ecological aspects required for effective Mahseer aquaculture, including as breeding, feeding, and habitat replication. It also covers the economic advantages and opportunities for local livelihood development, as well as how to relieve pressure on declining wild populations.While Mahseer aquaculture shows potential, it has genetic, disease control, and environmental problems. Addressing these difficulties would need a multidisciplinary strategy that combines ancient knowledge with modern scientific advances.Finally, Mahseer aquaculture provides a sustainable method to protect these culturally important and ecologically critical species, highlighting the possibility to align conservation goals with commercial goals in the changing landscapes of South and Southeast Asia's rivers.

KEYWORDS:

Aquaculture Potential, Breeding Feeding, Disease Control, Mahseer Aquaculture, Wild Populations.

INTRODUCTION

Malaysian mahseer is a highly prized game, food, and decorative fish found across Southeast Asia, from Indonesia to southern China. This fish is a member of an important species of freshwater cyprinids known as mahseers, which live in highland rivers and lakes from Afghanistan to Indonesia and Myanmar. Mahseers are an important indigenous fish population in India, Nepal, Bangladesh, and Pakistan with freshwater aquaculture potential.Malaysia's three mahseer species T. tambroides, T. douronensis, and T. tambradwell in highland rivers' headwaters and fast-flowing, chilly, and clear water. Malaysian mahseers' natural stock, like mahseers in other nations, has dropped quickly in recent years owing to environmental changes, human disruption of aquatic habitats, and overfishing.Following the reduction in natural population numbers, market prices for this species have risen to as much as $80 and $240/kg when marketed as food or ornamental fish, respectively. Malaysian mahseer dishes are allegedly sold for high to $260/kg in Kuala Lumpur restaurants. As a result, there is now a lot of interest in this fish's biology and artificial propagation, both for conservation and aquaculture production[1], [2].

Production of seedlings

Female mahseers above 2.5 kg in weight are sexually mature, whereas males over 0.75 kg in weight attain maturity in 20 months. The breeding season lasts from July through September. after this time and after floods, fish move to the clearer side of rivers to breed. The fish, on the other hand, travel downstream to huge regions of the river to feed immediately after

spawning or during low-flow times. Their eggs are laid amid rocks, where the fry feed on the algae that grows on the rock surfaces.In 2005, the first successful artificial breeding of this species was recorded. However, the first commercial breeding happened in 2006 at the Malaysian Department of Fisheries' Aquaculture Extension Centre in Perlok, Jerantut, Pahang. Females were successfully spawned with hormone treatment, yielding around 5,000 eggs. 4,500 larvae were collected after 72 hours.The scientists demonstrated that the larvae should be able to consume, digest, and absorb a 287-diameter designed food seven days after hatching. Following this accomplishment, the government and commercial sector have worked together to cultivate T. tambroides in order to fulfill the strong market demand.Despite recent successes in induced spawning of T. tambroidesbroodstock, hatchery-reared fingerlings are still primarily produced by two government hatcheries. Their numbers are still insufficient to satisfy the needs of the aquaculture sector. As a result, most Malaysian mahseer farms continue to depend on wild-caught fingerlings. This approach cannot be continued or developed in the long term unless a significant fraction of the cultured fish is preserved for breeding initiatives[3], [4].

Feed, nutrition

Malaysian mahseers are bottom feeders in the wild, but they may be taught to eat artificial floating feed in captivity. In addition to algae, water plants, insects, crustaceans, snails, earthworms, and some tiny fish, the fish cluster on river banks under overhanging branches of trees to dine on falling fruits. Toxic fruits found in flooded woods may render mahseer meat temporarily inedible.Balanced nutrition is essential in a successful animal production system since it leads to the production of healthy, high-quality products. Feed accounts for 40 to 50 percent of the production cost in fish farming. Feeding the fish an optimal diet that matches their nutritional needs is vital to the success of commercial Malaysian mahseer aquaculture. Understanding the important nutrients, their sources, and their impact on the physiological characteristics of target species is critical for developing an optimum diet.Protein, lipids, and carbohydrates are the three most important macronutrients. Ng Wing Keong and colleagues presented the first information on the nutritional needs of Malaysian mahseers in 2008. For the optimal fish development, they advised a dietary protein level of 48 percent and a protein:energy ratio of roughly 26 mg protein/kJ gross energy.However, there was no significant difference in the growth performances of fish given dietary protein levels ranging from 35 to 50%, according to their findings. In 2011, Josephine DorinMisieng and colleagues demonstrated that a dietary protein level of 40% covered this fish's protein needs.Lipids are the primary energy source in diets, providing almost twice as much energy as protein and carbohydrates. Lipids may be used by certain fish to save food protein for development. Consumption of protein as an energy source as a consequence of insufficient dietary lipid might result in protein deficit for fish development.Moreover, lipids are a necessary supplier of important fats, phospholipids, and vitamins that dissolve in fats. So, lipid was the second nutrient requirement that they found out about[3], [4].

DISCUSSION

Mahseer fishes, treasured for their cultural and ecological importance, are under danger from habitat deterioration and exploitation. Mahseer aquaculture seems to be a viable option for conserving these unique species while providing the demand for their valued meat in a sustainable manner. This debate delves into the world of Mahseer aquaculture, including ecological issues, economic rewards, obstacles, and the critical role it plays in Mahseer population conservation.Strong breeding strategies are the foundation of successful Mahseer aquaculture. It is vital to understand the genetic diversity of Mahseer populations in order to prevent genetic bottlenecks and inbreeding depression. The goal of captive breeding should

be to preserve the genetic integrity of wild populations.Mahseer are well suited to riverine settings. These circumstances must be replicated as nearly as possible in aquaculture facilities. Water quality, flow rates, temperature, and substrate all play important roles in Mahseer health and development.Nutrition is critical to the success of Mahseer aquaculture. It is critical to create meals that mirror their natural foraging behaviours. Aqua-culturists must consider various Mahseer species' feeding requirements, which may include water insects, crustaceans, and plant stuff[5], [6].

Mahseer aquaculture alleviates strain on wild populations, allowing for long-term harvests. It assures a steady supply of Mahseer for markets while also protecting natural habitats. Mahseer aquaculture has the potential to provide economic benefits for local people. Communities may diversify their revenue sources and minimize their reliance on wild catches by participating in aquaculture ventures.Aquaculture facilities may function as ecotourism attractions, attracting nature lovers and enthusiasts. Revenue from guided tours and recreational fishing may contribute to the economic sustainability of Mahseer aquaculture.Disease outbreaks pose serious threats to aquaculture. Pathogens do not discriminate between mahseer, and disease control is a vital component of successful aquaculture operations. Disease prevention, early identification, and treatment strategies are critical.Aquaculture operations may have an influence on the environment, including fertilizer contamination and water consumption. To mitigate these consequences, sustainable techniques like as efficient feed usage and careful waste management are required.

If not adequately controlled, the release of captive-bred Mahseer into the wild might result in genetic dilution. Interbreeding between captive and wild populations has the potential to change the genetic makeup of natural stocks. Traditional wisdom, which is often retained by local populations with a thorough grasp of Mahseer environments, may be quite important in Mahseer aquaculture. To establish a comprehensive approach to conservation, indigenous ways for producing and preserving Mahseer should be blended into contemporary aquaculture systems.Best management practices (BMPs) for Mahseer aquaculture must be developed and implemented. BMPs include breeding, feeding, disease control, and environmental sustainability criteria.Aquaculture education initiatives for aqua-culturists, communities, and consumers are critical. These initiatives may improve knowledge of the cultural and ecological significance of Mahseer while also encouraging ethical usage.Continuous research is required to enhance Mahseer aquaculture methods and solve new issues. Aquaculture facility monitoring, including environmental effect and Mahseer health, should be regular practice.Investigating successful Mahseer aquaculture programs from various places gives insights into the practical use of conservation-oriented aquaculture methods.The Himalayan Mahseer is the topic of this case study, which looks at a conservation-oriented aquaculture operation. It emphasizes the integration of traditional knowledge, breeding techniques, and community participation in northern India[7], [8].

In this case study, sustainable aquaculture approaches for Mahseer species in Southeast Asia are highlighted. It stresses the economic and environmental advantages of ethical aquaculture projects.Efforts should be taken to ensure that captive breeding programs retain genetic variety, minimize inbreeding, and protect wild population genetic integrity.Mahseer disease research should be emphasized in order to develop effective preventative measures and treatments, lowering the risks associated with disease outbreaks in aquaculture operations.The creation of certification and labelling programs may assist customers in identifying sustainably produced Mahseer items, therefore encouraging responsible consumption.Local communities should be actively involved in Mahseer aquaculture programs in order to profit economically while also helping to conservation efforts.Mahseer

aquaculture provides a possible approach for conserving these culturally important and environmentally critical fish while satisfying commercial goals. We can guarantee that Mahseer aquaculture plays a critical role in protecting these unique river guardians for future generations by addressing ecological concerns, incorporating traditional knowledge, and applying sustainable techniques[9], [10].

CONCLUSION

Finally, Mahseer aquaculture offers a potential and unique solution to conserve these historic fish species while addressing the demand for their meat in a sustainable manner. This strategy tackles not only the risks that wild species face, but it also provides economic possibilities and the opportunity for local livelihood development.The tour through the Mahseer aquaculture world has emphasized the ecological concerns required for effective breeding, feeding, and habitat reproduction in controlled circumstances. It has also stressed the significance of a multidisciplinary approach to overcoming issues linked to genetics, illness management, and environmental concerns.Mahseer aquaculture exemplifies how it is feasible to maintain culturally important and ecologically critical species while still sustaining the livelihoods of people who rely on these fish. We are prepared to contribute to the long-term viability of these renowned river guardians as we continue to investigate the possibilities of Mahseer aquaculture.

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CHAPTER 10

MAHSEER GENETICS AND BREEDING PROGRAMS: A COMPREHENSIVE REVIEW

Heejeebu Shanmukha Viswanath, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- shanmukhaviswanath92@gmail.com

ABSTRACT:

Mahseer fishes, which are important symbols of the rivers in South and Southeast Asia, are in danger of dying out because their existence is being increasingly threatened. Having different genetic traits is really important for these species to be able to survive and adjust to different environments. It's really necessary to have programs that focus on the genetics and breeding of Mahseer fish in order to protect them.

This summary explains the main points of Mahseer genetics and breeding programs, why they are important, the difficulties in carrying them out, and new methods being used.Mahseer breeding programs have goals to help increase numbers of fish that are decreasing, keep the different types of genes in the population, and improve what we know about these fish scientifically.

They use techniques like making fish lay eggs, mimicking how parents care for their young, and managing the genes of animals to make sure captive breeding is successful.Breeding Mahseer fish is difficult because it involves using hormones to stimulate reproduction, making sure the parents take care of the offspring, and managing the genetic variety of the fish.

These challenges need a combination of different knowledge and techniques.Case studies show examples of successful breeding programs, like Bhutan's efforts to protect the Golden Mahseer fish, and the work of conservation organizations. New and creative methods like freezing cells, identifying organisms through DNA, and helping with reproduction have the potential to solve problems.

One way to protect Mahseer fish is by setting them free from captive breeding programs and moving them to places where they can survive. Additionally, efforts are made to restore their natural habitats.In the future, we need to focus on genetic monitoring, working together, sharing knowledge, and providing continued funding to help protect Mahseer fish.

KEYWORDS:

Breeding, Genetic, Mahseer fishes, Programs, Species.

INTRODUCTION

Murrells are vital air-breathing freshwater fishes native to India. Because of its elongated and cylindrical body, flattened head, and presence of eyes on the front section of the head, they are widely known as snakehead or serpent-headed fish. Channa striatus, C. marulius, and C. punctatus are the commercially important Murrel species in India; they fetch high prices in many states such as Madhya Pradesh, Bihar, Uttar Pradesh, Haryana, Andhra Pradesh, Karnataka, Tamil Nadu, and all North-East states.

They are popular among consumers because to their pleasant taste, meaty flesh with few intramuscular bones, and therapeutic potential. These fish are considered high-value food fish and are sold live since they can be maintained alive for many hours outside of water. They

are attractive candidate species for freshwater aquaculture due to their fast growth rate, strong consumer preferences, profitable market value, and capacity to endure unfavorable water conditions[1].

Development of Captive Broadstock

Management of Habitat and Feed

The cement tank bottom has a 15 cm thick layer of earth. To replicate a natural habitat, floating aquatic macrophytes are introduced and maintained in roughly 20% of the water-spread area. Fish are fed 3% of their biomass, with 1% made up of live insects/prawns/small fish and 2% made up of garbage fish and rice bran (3:1). ICAR-CIFA has created and manufactured pellet feed with high acceptance for brood fishes. To ensure water quality, total water replacement is performed at weekly intervals. Preparation and Implantation Pellet Form of Hormone Hormone-containing pellets are implanted in the fish for prolonged hormone release in order to promote and synchronize gonad development. Using a mortar and pestle, thoroughly combine twenty parts cholesterol and one part binder. The needed amount of HCG hormone is introduced and carefully mixed. To get a gel-like consistency, ethyl alcohol (50%) is added and constantly stirred[2], [3].

Handcrafted HCG Hormone

Pellets measuring 2 mm x 4 mm (oval/rice-grain shaped) and weighing 15-20 mg. The hormone content of the pellets is changed according to the needs and might vary between 200 and 1000 IU of HCG. The GnRHa Pellet is manufactured in the same way, except that the mixture is dried at 35 °C to achieve a gel-like consistency. The pellet is implanted intramuscularly on the female and male fish's dorsal side. A small incision is created on the skin, and the Sustained-release Hormone Pellet is manually inserted into the muscle. After the pellet has been properly inserted, an antibiotic cream is administered to the wound. It has been noticed that the incision heals entirely in a week, with just a little black scar remaining after two weeks. The oval/rice-grain shaped pellets are simple to implant, and a very tiny incision in the fish muscle is required. As a result, the fish are less stressed, and the likelihood of rejection is reduced. In the month of February, brooder fish are implanted with hormone pellets at a rate of 500-1000 IU HCG/kg body weight. By the end of April, the gonads had completely grown and would stay so until September. The gonad development was excellent, with around 80-90% of brood fishes reaching gonadal maturity. During induced breeding under hatchery conditions, these brooders demonstrated improved spawning performance. Striped Murrel brooders are difficult to gather from clay ponds for induced breeding because the fish experience stress, which results in poor breeding response. As a result, a procedure for developing brood stock in cement concrete cisterns/ tanks has been developed, which includes supplying habitat conditions, diet, and altering hormone levels for improved breeding response under hatchery circumstances[4], [5].

Hatchery Induced Breeding

Murrells breed naturally in India during the southwest monsoon (June-August) and the northeast monsoon in flooded rivers. The spawning season varies by area and is determined by rainfall patterns. During the spawning season, men and females may be recognized by their secondary sexual characteristics. Females have a slightly bulged belly, a round and reddish vent, and an anal papilla that is wide and blunt with reddish spots, whilst males have a pale vent and an anal papilla with a pointed tip. Under hatchery conditions, Channa striatus females weighing 300-600 g and males weighing 400-800 g perform better in terms of reproductive performance. The Striped Murrel does not need water movement in its breeding

pool and may spawn in stagnant waters. The breeding pool is filled with water (26-30 °C), and a floating aquatic macrophyte covers one-fifth of the water surface area. To discourage fish leaping out during spawning, leave at least two feet of free board in a breeding pool with a net covering. The injection is administered near the base of the pectoral fins. They migrate in pairs and pursue each other before spawning. Spawning occurs between 16 and 18 hours. The eggs are round, non-adhesive, and straw yellow in appearance. Fertilized eggs are clear, whereas unfertilized eggs are opaque or whitish. The fertilized eggs vary in size from 1.1 to 1.4 mm. Eggs are caught using a plankton net and placed in FRP tanks to hatch. The usual fecundity is 10,000-15,000 eggs per kilogram body weight. The incubation period is 16-18 hours. Fertilization and hatching rates range from 75-98% to 70-95%, respectively; success rates were higher with Carp pituitary gland extract. The freshly born larvae measure 3.0-3.5 mm in length. 72 hours after hatching, feeding begins. Hatchlings enjoy microzooplankton, particularly rotifers[6], [7].

Nursing Fry to Spawn

The larvae should be reared in indoor concrete or fibre reinforced plastic (FRP) tanks. Larval eating begins 72 hours after hatching because the yolk sac in larvae acts as stored food throughout this time. Following yolk sac absorption, the larvae are fed zooplankton or Artemia nauplii ad libitum. For optimal development and survival, a stocking density of 2,500 no/m3 of water is recommended. During the nursery period, water should be exchanged regularly to ensure optimal water quality. They grow to a size of 25-30 mm in 20-25 days. Survival rates in nursery rearing vary between 50 and 60%. Fry should be moved to outdoor tanks after three weeks of indoor nursing.

Fry to Fingerlings Rearing

Striped Murrel fry are raised in outdoor concrete tanks of 5-15 m2 for the development of fingerlings. A stocking density of 200-250 no/m2 is thought to be optimal for development and survival. Small crustaceans, mostly aquatic insects, tubifex, sliced earthworms, and so on should be given to fry. Because of their proclivity for chasing food, they favour watery insects. In addition to live feed, powdered fish meal and soya flour (3:1) at 5-10% of their body weight should be sprinkled twice daily. C. striatus fingerlings love live feed, although its availability in bulk is a limitation in growing them. To address this issue, moist boiling garbage fish/poultry offal and oil cake and rice bran (3:1) is provided. Trash fish, properly minced, combined with rice bran, is highly received by fingerlings; however, in the absence of trash fish, cooked and minced fowl offal combined with rice bran and vitamin-mineral mix may also be provided. A pellet meal for Striped Murrel fingerlings has been developed and tested, and it has resulted in excellent development and survival. The protein requirement for fingerlings is around 44%. Survival from fry to fingerlings is 30-40% on average. Cannibalism and size heterogeneity are key concerns that cause to poor survival throughout the raising of fry to fingerlings. During raising, 2-3% of the fry transformed into shoot-fry, which has a significant impact on the smaller size fry. As a result, it is required to net the rearing tank at least once a week, check for shoot-fry/fingerling, and raise them separately. To obtain improved survival and returns, shooters must be separated on a regular basis and reared separately[8], [9].

DISCUSSION

Mahseer fishes, known for their cultural importance and ecological responsibilities, are under danger from a variety of factors. Genetics and breeding programs have developed as critical strategies for preserving and recovering Mahseer species in response to these problems. This talk digs into the realm of Mahseer genetics, looking at breeding programs, their importance,

problems, and the creative tactics used to assure the survival of this famous fish.The foundation of population health and adaptation is genetic variety. Across their geographical ranges, mahseer species demonstrate significant genetic variability. Understanding this variability is critical for developing successful breeding strategies.Maintaining genetic variety is critical for Mahseer populations' long-term survival. Genetic variety increases resilience to environmental changes, improves disease resistance, and aids in adaptability to changing river conditions.Captive breeding initiatives seek to reproduce Mahseer species in confined spaces[10], [11].

Restoring declining Mahseer populations by the production of young fish for reintroduction into the wild.Genetic preservation is the preservation of genetic variation via the maintenance of healthy captive populations.To inform conservation efforts, researchers are studying the biology, genetics, and behaviour of Mahseer species.In Mahseer breeding operations, induced spawning is a prevalent approach. Hormones are administered to induce the release of eggs and sperm in fish. The obstacles, however, include finding the best hormone treatments for each Mahseer species and limiting stress throughout the procedure.The parental care behaviours of Mahseer species vary, with some defending their eggs and young. To guarantee that newborn fish survive, breeding programs must reproduce these behaviours. Among the difficulties are simulating natural settings and preventing stress-induced parental desertion.The preservation of genetic variety is a major concern. It is vital to maintain diverse breeding lines and prevent inbreeding depression. To maintain genetic variety, strategies such as genetic monitoring and pedigree records are used.

This case study delves into Bhutan's successful Golden Mahseer breeding program, emphasizing the blending of traditional and contemporary practices. The program's goals, accomplishments, and lessons learned are addressed.Conservation groups are critical to Mahseer breeding initiatives. Case examples of actions done by organizations like as WWF and local NGOs demonstrate the need of working together to protect Mahseer species.Cryopreservation, or freezing gametes (eggs and sperm), is a new technology that may help with genetic preservation. It enables long-term preservation of genetic material, which reduces the danger of genetic loss.Mahseer species are identified and authenticated using DNA barcoding, which aids in monitoring and conservation efforts. DNA barcoding methods aid in the identification of Mahseer specimens that have been caught or sold.Advances in assisted reproductive technologies, like as in-vitro fertilization (IVF) and artificial insemination, may provide viable answers to the issues associated with breeding Mahseer in captivity. These technologies have the potential to increase breeding success rates as well as genetic management. A typical conservation method is to release captive-bred Mahseer into the wild. The success of these projects, however, is contingent on rigorous acclimation, monitoring, and habitat restoration activities.Mahseer populations are relocated to appropriate but vacant environments. This method has the potential to help them increase their range and lessen the danger of local extinction.Continued genetic monitoring and study are required to understand the genetic health of Mahseer populations and alter breeding plans appropriately.The success of Mahseer breeding initiatives is dependent on collaboration among researchers, conservation groups, and local populations. Sharing information, strategies, and experiences may help to improve conservation results.To maintain Mahseer genetics and breeding efforts, long-term financing is essential. Governments, non-governmental organizations, and foreign donors should prioritize and invest in these efforts.Mahseer genetics and breeding initiatives are critical in the effort to save these culturally and environmentally important fish species. These approaches not only help with population recovery, but they also help to maintain genetic variety and give important insights into Mahseer biology. We can guarantee that Mahseer continue to flourish in their

native habitats and enhance the rivers of South and Southeast Asia for future generations by solving problems, adopting new technology, and promoting cooperation.

CONCLUSION

In summary, it is important to have programs that focus on the genetics and breeding of Mahseer fish to protect their cultural value and ecological importance. These efforts help both to increase the population of Mahseer fish and to protect their genetic diversity. They also improve scientific understanding of Mahseer fish, ensuring that they continue to exist in rivers in Asia for a long time.In summary, Mahseer genetics and breeding programs offer hope for saving these important fish species that are respected culturally and crucial for the environment. We have discovered the importance of keeping different genes in Mahseer fish, the many problems we face, and the creative ways we are trying to make sure they survive.Genetic diversity is really important for Mahseer fish. It helps them to adapt to different environments and live in rivers that constantly change. Breeding programs are efforts to help endangered Mahseer fish by increasing their numbers, keeping their genetic makeup intact, and learning more about their biology.But these programs have difficulties. The complicated processes of induced spawning, taking care of parents, and managing genetics need to be continuously improved and adjusted. Combining traditional knowledge with modern techniques is very important for achieving success.

Case studies show how Mahseer breeding projects actually make a difference in the real world. They outline the accomplishments and things that were learned from these initiatives. New ways of preserving and studying genes, like freezing them, using DNA codes, and using technology to help reproduce them, are looking hopeful.As we think about the future, we need to focus on checking genes, working together, sharing information, and getting continuous funding. These actions will strengthen the genetics and breeding programs of Mahseer fish, making sure that these important river protectors continue to improve the rivers of South and Southeast Asia for many future generations. In the end, the importance of Mahseer can be seen not just in where they live but also in the efforts of people who work to protect them.

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CHAPTER 11

HEALTH AND DISEASE MANAGEMENT IN MAHSEER AQUACULTURE

Shakuli Saxena, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- shakuli2803@gmail.com

ABSTRACT:
A thorough approach to health and disease control is required for mahseer aquaculture, which is a vital component of conservation efforts for these iconic species. This abstract captures the core of health and disease management in Mahseer aquaculture, stressing its importance, problems, and novel approaches.Although mahseer aquaculture is a more sustainable option to wild harvesting, it is not without dangers. The management of health and illness in captive populations is critical to the success of breeding programs, the preservation of genetic diversity, and the protection of wild populations from dangerous diseases.This abstract delves into the many facets of health and illness management in Mahseer aquaculture, including as preventative methods, early identification, and treatment options. It emphasizes the need of preserving water quality, reducing stress, and applying biosecurity policies to reduce disease risks.Health management challenges include the variety of Mahseer species, variable illness susceptibilities, and the scarcity of vaccinations and treatments. Addressing these difficulties requires continual study, professional cooperation, and adaptive management solutions.Innovative techniques such as disease-resistant breeding, genetic selection, and disease modelling hold great promise. Furthermore, community participation, education, and outreach are critical in creating knowledge about disease prevention and sustainable aquaculture methods.Finally, in Mahseer aquaculture, health and disease control are critical to ensure the well-being of captive populations and the conservation of these culturally important and ecologically crucial fish. We can ensure the long-term viability of Mahseer and the rivers they inhabit by adopting preventative measures, funding research, and encouraging community involvement.

KEYWORDS:

Aquaculture, Disease, Fish, Health, Management.

INTRODUCTION

Sicknesses are a big danger to fish farming. Disease problems may cause a loss of 10-15% of the production cost. Therefore, it is important to make sure that ponds and hatcheries are looked after properly so that diseases don't spread. In this article, we talk about common illnesses that affect fish. We learn how to diagnose these diseases by looking at obvious signs, and we also discuss how farmers can prevent, treat, and control these illnesses. Fish often die because ponds and hatcheries are not managed well. The condition of the pond and the quality of the water in ponds and hatcheries are very important in causing death and starting infections. To avoid diseases or deaths, it's important to keep the water at certain levels. The pH should be between 7. 5 and 85, the dissolved oxygen should be above 5. 0 parts per million, the temperature should be between 25 and 30 degrees Celsius, the total alkalinity should be between 75 and 175 parts per million, and the total hardness should be between 75 and 150 parts per million. Ponds must be treated with lime and fertilizer regularly to keep the water quality and amount of food for fish at the best level. These are the common problems that managers face in taking care of farms, which can result in many animals dying. We also provide ways to prevent these problems from happening. Additionally, fish farmers should reach out to fish health experts if they notice any signs of disease or if there are any

deaths in their pond. This will help stop the infection from spreading to other nearby ponds. The main types of diseases found in aquaculture ponds are caused by parasites, fungi, and bacteria. Some common diseases that fish can get include argulosis, lerneasis, and diseases caused by protozoa like Trichodina, Costia, Ichthyobodo, and Myxosporidea. Other diseases are caused by gill flukes like Dactylogyrus and Gyrodactylus, fungi like saprolegniasis and branchiomycosis, and bacteria like aeromoniasis, edwardsiellosis, and Columnaris. Algal blooms in ponds are a big problem because they take away the oxygen in the water[1], [2].

The following are common signs that can be observed in sick fish due to various diseases. In simple words, these are signs that fish are not feeling well. They may not want to eat, not grow properly, gulp air and come up to the water surface often. They might also move around quickly, rub themselves against hard things, and float on the water strangely. Their fins and tails may also look damaged, and they may move slowly in a pond. Sometimes, they may have bleeding on their body or gills. Add lime and fertilizer to keep the pond clean. Make sure there aren't too many fish in the pond. Give the fish well-balanced food. Check the pond regularly for any signs of illness or parasites. Keep the pond smelling fresh by removing any unwanted fish or snails. Occasionally dry out the pond and disinfect it before adding new fish. Only stock the pond with high-quality fish. If using yearlings, get them from a pond that has been treated for parasites. Always stock the pond when the water quality is good and there is enough food for the fish. Remove any sick or infected fish and report it to a fish health worker. Check the water quality regularly. Use clean water in fish hatcheries. Get rid of any weeds and prevent excessive plant growth. Clean nets before sampling with sun-dried net. Don't use equipment from infected ponds in other ponds. Prevent birds, dogs, and other animals from entering the pond area. Use bamboo poles to check for parasite eggs and treat them right away if found. Dry out and dispose of weeds and snails away from the pond. Properly dispose of dead fish away from the pond. Avoid leaves from plants falling into the pond. Send any sick fish samples to a diagnostic laboratory for testing and advice[3], [4].

While it is impossible to entirely eradicate the illnesses from aquaculture, they may be controlled and avoided on a regular basis. Because illness in aquaculture is caused by the interplay of the host, pathogen, and environment, it is critical to regulate all three elements. The most crucial step in the fight against illnesses is to maintain appropriate water quality. Controlling the introduction of obligatory pathogens into culture systems and decreasing the accumulation of opportunistic infections are also critical. Protecting the host's immunological condition is also crucial, as it may boost the fish or shrimp's resistance to infectious infections. Aside from optimal feeding, various preventative steps are essential for disease-free aquaculture.One possible approach of disease management in aquaculture is the selection of a species that can survive infections comparatively well in comparison. Disease management may also be achieved by selecting healthy larvae or juveniles and preventing contamination during culture. illness avoidance via the use of specific pathogen free (SPF) stock is a very effective way of illness prevention. Quarantining imported or transferred goods across a vast geographic region, in particular, must be practiced.The measures listed below may also help control the condition[3], [4].

1. Utilization of a closed or semi-closed recycling system.
2. Build reservoirs to store water instead of obtaining it straight from the sea or natural bodies of water.
3. Reduce water exchange.
4. Before using reservoir water in the ponds, treat it with chlorine 30 ppm calcium hypochlorite - 60% active component.
5. Prevent wild shrimp, crabs, and fish from entering the ponds.

6. In the event of a disease epidemic, clean polluted water before releasing it.
7. Maintain appropriate pond preparation by drying the bottom of the pond and removing the top layer of silt.
8. Do not overstock.
9. Maintain high water quality.
10. Feed a nutritionally balanced food in the appropriate amount, avoiding extra feed.

DISCUSSION

The single most potentially destructive hazard in shrimp cultivation is infectious illness. One possible approach of disease management in penaeids is the selection of a species that can survive infections comparatively well in comparison. Disease control may also be achieved by selecting healthy larvae and preventing contamination during culture. illness avoidance via the use of specific pathogen free (SPF) stock is a very effective way of illness prevention. Quarantining imported or transferred goods across a vast geographic region, in particular, must be practised.Chemotherapy and other traditional approaches for reducing aquatic animal infections are less successful in dealing with newly developing pathogens. Molecular biotechnological techniques are now playing an increasingly important role in disease control by improving the effectiveness of pathogen screening and detection, pathogenicity elucidation, development of effective control and preventive measures, and disease treatment. One of the most significant uses of biotechnology has arisen as the advancement of diagnostic approaches for disease prevention, management, and control in farmed shrimp[5], [6]. Unlike old chemotherapeutic approaches, which have been hampered by pathogen resistance, modern technologies allow for preventative intervention to reduce disease outbreaks.Various workers have recommended the following approaches for reducing infections in shrimp aquaculture, particularly viral diseases:

1. Early and effective pathogen identification utilizing enhanced diagnostic technologies to screen and confine affected populations to avoid disease spread.
2. Use of bio-secured, closed or semi-closed recycle systems with low water exchange and high water-reuse culture systems.
3. Maintain excellent water quality and treat water before to usage, particularly in hatcheries. To treat the entering water, 30 ppm calcium hypochlorite for 12 hours followed by neutralization with soda and vigorous aeration might be employed.
4. Build reservoirs to store water instead of drawing it straight from the sea, and treat reservoir water chlorine at a rate of 30 ppm calcium hypochlorite - 60% active componentbefore utilizing it in the ponds.
5. Biosecurity strategy for preventing disease introduction by screening infected hosts, such as wild shrimps, and non-host biological carriers, such as crabs, fish, or birds, into ponds and avoiding the usage of pathogen-contaminated inanimate items. Stray dogs should be kept away from the ponds since they may potentially transmit the infection.
6. In the event of a disease epidemic, clean polluted water before releasing it. To avoid pollution of nearby waterways, hatchery effluents should be treated on a regular basis.
7. Maintain appropriate pond preparation by drying the bottom of the pond and removing the top layer of silt. After each harvest, pond preparation should include applying 100 ppm CaO, exposing the pond bottom to sunshine for thorough drying, and ploughing the soil.
8. Do not overstock. Maximum stocking density will decrease animal stress and the likelihood of water quality degradation.

9. The creation of specific pathogen resistant (SPR) strains and the production of specified pathogen free (SPF) shrimps are two prospective techniques that will be very useful in broodstock management programs. SPF animals are created by choosing animals that are free of known and detectable diseases and growing them under tight sanitary controls. SPR animals are created through selective breeding of animals that are known to be less sensitive to particular infections. With P. vannamei and P. stylirostris, these notions are now being employed in nations such as the United States, Venezuela, and French Polynesia. The primary advantage of this approach is the creation of high health (HH) post-larvae that are devoid of or resistant to recognized infections.
10. According to reports, Penaeusmerguiensis is more resistant to WSSV than P. monodon. A possible technique for limiting disease outbreaks is the selection of animals with reinforced non-specific defence or greater tolerance of external infection threats. However, it is believed that in certain circumstances, many SPF stocks that have not been exposed to particular or generic pathogens would perform badly when exposed to pathogens in the field.
    Feed a nutritionally balanced food in the appropriate amount, avoiding extra feed.
11. Using immunostimulants and vaccinations to harness shrimps' particular and non-specific defensive systems. This approach has a lot of promise for shrimp farming health management. In order to lower shrimp vulnerability to illness, biotechnological breakthroughs in the realm of immunostimulants and modulators are being created.
12. Creating collaborative disease control methods. Farmers, health care professionals, scientists, and government organizations work together to trace the movement of a possible disease, notify nearby farms of an outbreak, and properly cleanse sick animals and water before release.
13. The hatchery should be positioned far enough away from the shrimp farm to avoid cross-contamination of hatchery supply water and airborne pathogen contamination from the sick farm.
14. To avoid vertical transmission of viral infections in particular, use only virus-free broodstock.
15. Prevent the importation of broodstock and larvae. This might lead to an increase in the unintentional transfer of potential infections across borders.
16. To avoid cross contamination, keep broodstocks from various sources in separate holding tanks and raise the larval population in separate batches.
17. Avoid feeding garbage fish and shellfish to broodstock since they might behave as carriers of viral infections. When feeding garbage fish, care must be taken to ensure that the feed is thoroughly cooked before usage.

Mahseer aquaculture, regarded as the iconic protectors of rivers in South and Southeast Asia, shows enormous potential for conservation and sustainable fishing. However, it brings with it its own set of concerns, the most obvious of which are health and illness management. This in-depth discussion delves into the complex realm of health and disease management in Mahseer aquaculture, emphasizing its significance, complexities, evolving strategies, and critical role in ensuring the success of breeding programs and the conservation of these culturally significant and ecologically vital fish species[7], [8].The dwindling of wild Mahseer populations as a result of habitat degradation and overfishing emphasizes the need of conservation measures. Mahseer aquaculture provides an alternative to wild stock hunting, perhaps lessening pressure on these already endangered species.Mahseer aquaculture is important for conserving the genetic variety of different Mahseer species. Aquaculture initiatives help to the long-term sustainability of Mahseer populations by maintaining

separate breeding lines and avoiding genetic bottlenecks.Disease outbreaks may be facilitated in aquaculture environments. High stocking numbers, variations in water quality, and stresses associated with captivity may all make Mahseer more susceptible to illness.In Mahseer aquaculture, prevention is everything. To reduce illness risks, proper diet, frequent health exams, and maintaining appropriate water quality are essential. Implementing strict biosecurity standards may aid in the prevention of disease introduction into aquaculture operations.Early illness identification is critical for timely action. Monitoring behaviours, clinical symptoms, and physiological data in captive Mahseer populations might help identify health concerns sooner[9], [10].

Histopathology, molecular tests, and immunological assays are among the laboratory-based diagnostic procedures used to confirm illness diagnoses. Aquaculturists may use these tools to detect particular infections and modify treatment regimens appropriately.Because therapy choices for Mahseer disorders are limited, disease prevention is even more important. Antibiotics, antiparasitic medicines, and supportive care may be used as treatments, but their use should be limited to minimize the development of antibiotic resistance.Stress reduction in captive Mahseer populations is an important part of illness treatment. Maintaining steady water conditions, limiting handling, and providing sufficient substrate and shelter are all stress-reduction techniques.The variety of Mahseer species provides issues in disease control since various species may be susceptible to different illnesses. Understanding the variations between species is critical for good management.The scarcity of Mahseer-specific vaccinations and therapies emphasizes the need of research and development in this field. The discovery of Mahseer-specific vaccinations and treatments might greatly improve disease management.In aquaculture environments, environmental stresses like as shifting water temperatures and pollutants may enhance disease risks. It is critical to address these pressures via habitat replication and environmental management.

In Mahseer aquaculture, selective breeding for disease resistance is a potential strategy. Identifying individuals with inherent disease resistance and putting them into breeding programs may improve captive populations' overall disease resilience.Genetic selection approaches, such as marker-assisted selection, may aid in the breeding of disease-resistant Mahseer. These methods depend on the discovery of genetic markers linked to disease resistance features.The use of mathematical models in aquaculture operations to anticipate disease outbreaks and evaluate disease risk is gaining popularity. illness modelling provides illness management and resource allocation that is proactive.In order to raise knowledge about ethical aquaculture techniques and disease control, community engagement and education activities are critical. Local communities are empowered to actively engage in Mahseer conservation when they are involved.Indigenous tribes often provide vital information regarding Mahseer habitats and behaviours. Integrating traditional knowledge with contemporary aquaculture operations has the potential to improve disease control tactics.A case study looks at disease control techniques used in the Himalayan Mahseer conservation initiative. This program illustrates how illness prevention, monitoring, and community involvement may all be integrated into captive breeding initiatives. International cooperation in Mahseer disease management, such as those involving research institutions and conservation groups, highlight the necessity of sharing information and resources in dealing with disease concerns[11], [12].

It is critical to continue researching Mahseer illnesses and therapy alternatives. Collaboration among aquaculturists, veterinarians, and researchers may promote disease control innovation.Supporting disease control strategies in Mahseer aquaculture requires long-term financing. Governments, non-governmental organizations (NGOs), and foreign donors should

prioritize expenditures in disease research, prevention, and treatment.Creating regulatory frameworks for Mahseer aquaculture may help to guarantee that disease control measures are standardized and followed. Regulations should promote appropriate aquaculture operations and put disease prevention first.We can reduce illness risks and increase the general well-being of captive Mahseer populations by prioritizing disease prevention, early identification, and effective management measures. Furthermore, advances in disease-resistant breeding, genetic selection, and disease modelling provide potential paths for increasing disease resilience. Local communities are empowered to actively participate to Mahseer conservation efforts via community engagement and education activities. We are set to assure the continuing prospering of these culturally important and ecologically critical fish species in the rivers of South and Southeast Asia as we negotiate the difficult terrain of Mahseer health and disease management.

CONCLUSION

Finally, health and disease control in Mahseer aquaculture is a vital pillar in conservation efforts to preserve these unique fish species. This conversation has shed light on the importance of good health management measures, the difficulties of sustaining Mahseer people' well-being, and the creative ways used to decrease illness risks.Mahseer aquaculture not only helps with population recovery and genetic preservation, but it also requires close monitoring for disease prevention, early identification, and treatment. Water quality preservation, stress reduction, and strict biosecurity controls are critical components of this endeavour.Health management challenges, such as species variety, variable susceptibility, and limited therapy alternatives, demand continual study and cooperation among professionals. Adaptive tactics and the use of novel approaches like as disease-resistant breeding and genetic selection have the potential to improve Mahseer health and disease resistance.Community engagement, education, and outreach programs are critical in distributing information about disease prevention and sustainable aquaculture methods. These activities are critical for increasing community knowledge and encouraging responsible care of Mahseer populations and habitats.To summarize, the viability of Mahseer aquaculture, and hence the survival of these culturally important and ecologically critical fish species, is dependent on adequate disease and health management. We might seek to assure the continuous prospering of Mahseer in the rivers of South and Southeast Asia by a coordinated and multidisciplinary approach, safeguarding their heritage for future generations.

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CHAPTER 12

MAHSEER IN SPORT FISHING AND ANGLING: A GLOBAL PERSPECTIVE

Devendra Pal Singh, Assistant Professor
College of Agriculture Sciences, TeerthankerMahaveer University, Moradabad, Uttar Pradesh, India
Email Id- dpsinghevs@gmail.com

ABSTRACT:

The fabled river fighters of South and Southeast Asia, the Mahseer, have captured the hearts of fishermen all around the globe. This abstract offers a worldwide perspective on the importance, problems, and conservation consequences of chasing these iconic species in some of the world's most pristine river environments, providing a view into the exciting world of Mahseer sport fishing and angling.Mahseer sport fishing crosses borders, luring anglers from all over the world to the rivers of India, Nepal, Malaysia, Thailand, and beyond. The Mahseer's powerful strength, elusive character, and magnificent surroundings combine to provide an outstanding angling experience.However, pursuing Mahseer in sport fishing presents major conservation concerns. Overfishing, habitat degradation, and climate change all pose threats to this cherished species, emphasizing the need of sustainable angling techniques, catch-and-release programs, and joint conservation efforts.This abstract provides a tantalizing look into the pleasure of Mahseer sport fishing, recognizing its worldwide appeal while emphasizing fishermen' and conservationists' shared duty for maintaining the continuing well-being of these majestic river guardians.

KEYWORDS:

Angling, Conservation, Fishing, Sport, Species.

INTRODUCTION

Recreational fishing, or sport fishing, is when people fish for fun or to compete against others. It is different from fishing to make money, or fishing to survive. Recreational fishing means fishing for fun, not to make money or to get food. The most popular way to go fishing for fun is using a long stick, a spinning wheel, a string, hooks, and different types of bait. Other tools called terminal tackle are also used to change or enhance how the bait is presented to the fish being caught. Some examples of terminal tackle include objects like weights, floats, and swivels that are used in fishing. People often use lures instead of bait. Some people who like hobbies make their own fishing gear, like plastic fishing baits and fake flies. Angling is the act of using a hook to catch fish. Big-game fishing is when people go out on boats to catch big fish like tuna, shark, and marlin in the open water. Noodling is a way to catch big catfish without using any tools, just your hands. Trout tickling is also a fun activity where you catch trout with your hands. Sport or game fish are the fish that are caught using a fishing rod and line, and they put up a fight when being caught. These fish are not thrown back into the water by the angler or sportsman because they don't like them. In sport fishing, the type of gear you use and the type of fish you go after both make the activity exciting[1], [2].

The person fishing has to battle with the fish until they either catch it or it gets away. A classification separates sport fishes into two groups based on their weight when caught. If the weight is 50kg or more, the fish is considered big, while if it weighs less than 50kg, it is classified as small. Mahseers, trouts, and snow-trouts are in one group, while big mahseers, goonch catfish, and others are in another group. belongs to the following. There are different names depending on the methods used. Fly-fishing means using a special fishing technique

where you use artificial flies to attract fish. Still-fishing is when you stay in one place and wait for the fish to come to you. Plug-casting involves throwing a lure called a plug into the water to catch fish. Surf-casting is when you fish from the shore into the ocean waves. Trolling is a method where you drag bait or lures behind a moving boat to catch fish. Launch fishing is when you go out in a boat to fish. Shore fishing spinning is a type of fishing from the shore using a spinning reel. India has a lot of fish in the Himalayan and peninsular region. Some important types of fish are mahseer, snow trout, exotic trout, and common carp. There is also a lot of different types of weather in the cold-water areas, which is good for fishing and keeping fish as pets. This has made people more interested in fish farming, keeping pretty fish, and going on fishing trips[3], [4].

The rules of fishing are important for the game of fishing. Fishing has been a popular activity in India since ancient times, mentioned in the Ramayana and Mahabharata stories. Rules and actions aimed at protecting fish began in the year 300 B. CDuring the Maurya Dynasty, fishing was not allowed from mid-June to mid-December. This was done to allow the fish to reproduce and protect the young ones. In the past, when King Asoka was ruling, people were not allowed to go fishing in July and November. This was because fish were reproducing during these months. In sport fishing, the type of equipment used and the type of fish targeted are both important for making the activity fun. The angler plays with the fish until they can either catch it or it gets away.Sport fishing usually follows a specific set of rules and regulations made by organizations like the International Game Fish Association. The IGFA has now included lagoon, estuarine and freshwater species as game fish. This means that the definition of game fish now includes more than just the blue water species that are usually considered game fish in the Pacific. The important rules in the regulation are that fishermen should use fishing methods that are gentle to fish and release them after catching to reduce their chances of dying[5], [6].

Additionally, for the tourism business to be successful, it should help protect different types of plants and animals while also helping to reduce poverty by providing new ways for people to make money and have more money. So, by protecting living fish and the place where they live, it helps the people who live nearby. Ecotourism is seen as a way for families to make more money, but we shouldn't rely only on it because it can be easily affected by global financial problems. Instead, it is important to encourage a range of different ways for people to make a living. This will help protect them from difficult times in the economy. They can then switch to activities that are not affected by sudden changes in the market. Sport fishing projects should promote different ways for people to make a living and have choices in order to reduce the chance of something going wrong. New fishing techniques and methods used for recreational fishing could also be used by local fishermen to catch other types of fish, which would lead to more successful fishing and increase the demand for fish. This could put more strain on fish populations. Recreational fishing, especially angling, has been accepted as a healthy activity by many medical experts in the Western countries. It has become a popular activity for people to go fishing outdoors during vacations, which has led to the growth of tourism businesses. Trout and mahseer fishing in the hills of northern and southern India is popular among tourists because it offers different tastes and activities for recreation. We know that fishing for fun can bring good things to both society and the economy. This is true all around the world. It is particularly helpful for developing countries. Nevertheless, there is very little information available about the problems and opportunities for anger associations and participants. This is because the national survey ignores the needs of anglers and stakeholders[4].

Fishing for fun in India began during British rule when anglers from different countries came with their fishing skills. Recreational fishing has brought money to local and national economies. However, it has also harmed biodiversity and ecosystems by affecting the preservation of endangered species. So, people who fish for fun need to be aware of specific species and use better ways to manage them Unfortunately, India has not made good policies about recreational fishing. Because of this, there is potential for improving the way this new fishing industry is managed. Fishing and releasing fish back into the water can benefit local people, make money for countries, and help protect fish and the environment. The beginning of fishing for sport in India is very old. People have been fishing for a very long time, and we can find some of the first mentions of fishing in ancient times. In ancient Greece, famous thinkers like Aristotle and Plato talked about fishing, and a historian named Plutarch gave advice on fishing lines. Fishing was very important in ancient societies like Greece, Rome, India, and Egypt. It became part of their beliefs and culture. The beginning of recreational fishing is not clear in the history of sports fishing.

Angling and fishing in Arunachal Pradesh, India provides great chances for people who love fishing. Because there is a lot of water and the sport is easy, it has become popular in Arunachal Pradesh, India. Arunachal Pradesh has many opportunities to catch different types of fish, especially trout and Mahseer. All over the world, people who enjoy fishing consider catching a Golden Mahseer fish to be a significant achievement. Mahseer is very difficult to catch because it fights back strongly once it is caught on a hook. Mahseer is a fish that challenges the abilities of fishermen. Fishing in this area lets you explore untouched and beautiful land where not many people go. The wilderness goes on for hundreds of kilometers and it's carefully taken care of. You can make your own plan. In addition to having fun while fishing, you can keep memories that will stay with you forever. In Arunachal Pradesh, there are five rivers that are well-known for catching a lot of fish. These places include the areas surrounding Siang River and Subansiri River. These provide more satisfying experiences for casual relationships. Because the rivers are very clean, there is a lot of oxygen in the water, which results in a good catch of fish or other aquatic animals.The Golden Mahseer is a species that is in danger of disappearing, and it deserves a lot of respect because of its amazing body and its ability to challenge even the most skilled fishermen. This special fish, which is a leader among the fish in the Himalayan Rivers, is also thought of as very important in the Hindu religion. There are many stories and myths connected to it.

Mahseer is a local term that meaning The Big Mouth. It is a fish that is linked to European Bardel and Carp. This critter is regarded as the hardest fresh water sport fish. The fish has a long body and a pointy snout.The inter-orbital space is flat, and the jaws are all the same size. Barbels are found in pairs, with the rostral barbel being shorter than the maxillary barbel. It is a fussy and melancholy fish with a golden body, grey dorsal side, and reddish-yellow fins.It's a cold-water fish. Mahseer's habitat consists of highly oxygenated water with a stony substrate. Once found from Afghanistan to Southeast Asia, The Mahseeris the most magnificent fish found in many of the Himalayan rivers. This fish may now be found in the Indian Himalayas and in certain parts of Nepal. Mahseer is a migratory fish that migrates to warmer waters during the winter. Because this fish has a keen sense of smell, it can find food from a long distance. Its diet consists mostly of fish and aquatic arthropods.This fish goes upstream and can go over rapids of 20-25 knots since its environment includes strong currents and rapidly flowing water. Although little is known about the life span of this fish, experts believe it may live for 20-25 years, with the biggest specimen ever taken weighing 121 pounds.

The angling season for Mahseer may be divided into two parts: spring and autumn. During the pre- and post-monsoon seasons, the water is clear and the level is high. Fishing is strictly restricted during the monsoon season because the fish are reproducing.Spinning is the greatest method of Mahseer fishing. It is a fish known for its struggle, and after hooking one would realize the amount of power. It is the world's biggest member of the carp family.However, like other species, this fish is struggling to endure the effects of urbanization and development. Parching is another serious hazard to Mahseer. Parching techniques include blasting, electric current, bleaching powder, and others. In these conditions, we at The Wildlife Travels believe that this magnificent fish can only survive if angling vacations are marketed to isolated places and people are made aware of the value of this species.

DISCUSSION

The mahseer is considered the strongest fish in freshwater sports. This fish lives in cold water. Mahseer lives in places with a lot of oxygen in the water and rocks on the bottom. It can be located in the mountains of India. The mahseer fish migrates and goes to warmer water during the winter season. This fish has a really good sense of smell, so it can find food even if it's far away. The best time to go fishing for Mahseer is during two parts of the year: Spring and Autumn. Fishing is not allowed during monsoon because it is the time when fish have babies. The most effective methods for catching Mahseer fish are using a spinning technique. Mahseer fish are well-known for their strong resistance and struggle during the fishing process. It is the biggest fish in the carp family worldwide. Mahseer is a fish that anglers really want to catch. However, similar to other animals, this fish is facing difficulties in staying alive due to urbanization and development. Another big problem for Mahseer is illegal hunting. Different methods are used to capture animals illegally, such as bombing, using electric current, or using bleaching powder[2], [7].

Mahseer, often known as water tigers, are mythical fish species found in South and Southeast Asia's pristine rivers. Their incredible power, elusive character, and beautiful environments have made them a sought-after prey for sport fishing and angling aficionados all over the globe. This detailed debate examines Mahseer sport fishing from a worldwide perspective, looking into its importance, the issues it provides, and the critical conservation consequences linked with this wonderful hobby.Mahseer are culturally and historically significant in the areas where they live. They are venerated as symbols of power and purity, and their existence is inextricably linked to local folklore, rituals, and celebrations.Mahseer sport fishing provides an unforgettable angling experience. Anglers are attracted to these famous fish because of their size, strength, and demanding behaviour, making each capture an exciting experience.Sport fishing has a high economic benefit for Mahseer. It draws visitors and anglers, promoting ecotourism and producing revenue for local communities.Mahseer sport fishing is not limited to their own waters. Anglers from all over the globe flock to India, Nepal, Malaysia, and Thailand to catch these elusive river monsters.The worldwide scope of Mahseer sport fishing entails a duty to maintain sustainable techniques. Conservation-minded fishermen and groups are lobbying for catch-and-release methods and habitat protection to safeguard Mahseer populations' long-term survival.Mahseer sport fishing provides anglers with access to a varied range of Mahseer species, each with its own distinct traits and difficulties[6], [8].

Mahseer are recognized for their enigmatic personality and incredible power. They are known for their explosive runs and acrobatic displays, making every encounter an adrenaline rush.The chase of Mahseer brings anglers to some of the most spectacular river habitats on the planet. An immersive and awe-inspiring fishing atmosphere is created by pristine lakes, thick woods, and gorgeous vistas.The growing popularity of Mahseer sport fishing may put

extra strain on already endangered populations. Overfishing, habitat degradation, and climate change all pose serious dangers to Mahseer, demanding appropriate fishing techniques.To reduce the damage on Mahseer populations, anglers and sport fishing groups are actively adopting catch-and-release methods. Catch-and-release guarantees that Mahseer are returned to their original habitats uninjured, helping to conserve the species.Mahseer sport fishing has the potential to be a conservation force. Anglers, local communities, environmental groups, and governments may work together to develop successful conservation measures.It is critical to preserve the clean river ecosystems where Mahseer flourish. Conservation efforts often include habitat restoration and preservation to guarantee the long-term survival of these important species.

Anglers and academics work together to collect important data about Mahseer populations, behaviour, and health. This knowledge helps in making educated conservation choices.The Mahseer Trust, situated in the United Kingdom, has been a driving force in Mahseer conservation via research, education, and angler participation. This case study focuses on their efforts and results in protecting Mahseer populations.Community-based tourism efforts in Bhutan have included Mahseer sport fishing into their ecotourism programs. This case study looks at how local people have profited financially by actively engaging in Mahseer conservation.It is a constant struggle to strike a careful balance between boosting sport fishing tourists and protecting Mahseer populations and ecosystems. To achieve this equilibrium, strict administration and control are required.Climate change consequences, such as changing river flows and temperatures, provide new hurdles for Mahseer conservation. Mitigation strategies for these hazards are critical.For the survival of Mahseer sport fishing, further efforts to encourage catch-and-release techniques, educate fishermen, and enforce sustainable angling rules are critical[5], [9].

Collaborations between anglers, local communities, governments, and conservation groups must be strengthened in order to establish successful conservation measures to preserve Mahseer populations.Investing in habitat restoration and preservation projects is critical to preserving pristine river environments for Mahseer and future generations of anglers.With its worldwide appeal, Mahseer sport fishing represents the exhilarating chase of these legendary river protectors. The relevance of Mahseer sport fishing goes beyond enjoyment to include cultural, economic, and environmental aspects[7], [10].

The Mahseer is a freshwater fish and a species of carp that used to be abundant in the Himalayan Rivers and other rivers that flow from the Sahyadri Mountains. The resilient Mahseers live in both rivers and lakes, climbing swift streams with stony bottoms in search of more food and oxygen, as well as to reproduce. It is one of the world's 20 mega fishes, growing to around nine feet in length and weighing up to 35-40 kilograms. The Mahseer is both a commercially valuable game fish and a highly appreciated culinary fish.

A fantastic game fishes

Anglers who see the Mahseer as a tiger of the waters enjoy unequalled delight. This is due to their exceptional fighting ability, which make them the world's most difficult to catch. Anglers routinely visit to rivers in Uttarakhand and Himachal Pradesh to catch and release fish for fun.The Mahseer has an important place in commercial fisheries because to its high quality. Because of its great size, the Mahseer is very important to fisherman. It is highly valued as a food fish and commands the highest market price in India's north and northeast.The Mahseer is now struggling for its existence for a multitude of reasons. The Mahseer population has decreased by more than 50% in recent years, and the percentage is predicted to rise to 80% in the next years. Poaching and unregulated angling, contaminated

and poisonous waterways, and river building projects are all contributing to the Mahseer's demise. The International Union for the Conservation of Nature (IUCN) lists five Mahseer species as endangered.

The Tata company takes the initiative Act for Mahseer, a long-term conservation effort for the Mahseer. Tata Power has been devoted to the ecological development and protection of natural resources in the Western Ghats for almost six decades. Tata Power has affirmed its commitment to safeguarding the Mahseer in accordance with its fundamental sustainability pillars of "Care for the Environment" and Care for the Community.The initiative will include Tata Power staff and customers, as well as the general public, in encouraging appropriate behaviour toward these endangered species and working for their protection. The Company encourages everyone to contribute to this endeavour by actively engaging in the 'Act for Mahseer' Campaign and committing to save the Mahseer.

The Mahseer breeding program is in its 42nd year and is India's most successful Mahseer breeding facility. Tata Power has established breeding procedures for all legitimate endangered Mahseer species by stripping and artificial fertilization. A cutting-edge hatchery for Mahseer has been built at Walwan, Lonavla, with the capability to hatch over 5 lakh eggs at a time and the ability to produce over 3.6 lakh semi-fingerlings yearly. about the previous 40 years, about 13 million fertilized eggs have been acquired, and over seven million Mahseer fingerlings have been generated for stocking water bodies across India and throughout the world. However, there are two requirements that must be met before the hatchlings are moved to separate rivers.

1. The hatchlings should be indigenous to the area.
2. There must be a suitable procedure in place to release the Mahseer into the wild.

This is critical for the hatchling's survival, since it only has a 30% chance of surviving in the wild.The company has also successfully carried out cage culture and ranching programs and proved the applicability of such research programs for replication throughout the nation. To date, about 300 Fishery Scientists have been educated to continue conservation work.

Why the Mahseer's survival is important

The survival of the majestic Mahseer, one of the world's 20 mega fishes, is critical for the maintenance of our eco-system. This fish's health is connected to the health of India's major rivers, especially the Ganges. With the 'Save Ganga Movement' gaining traction in recent years, one might anticipate the Mahseer to benefit from this high-profile effort. Clean rivers would undoubtedly aid the 'Act for Mahseer' program, since contaminated and poisonous waterways are one of the primary causes of its decline.Tata Power has enthusiastically embraced the Mahseer conservation scheme. Efforts are being made to persuade the locals that if the initiative fails, they would miss out on a valuable tourist sector. There is an effort to sensitize and urge people to 'Act for Mahseer' and work together to ensure the Mahseer's survival. The Mahseer is noted for its toughness and has always preferred to go upstream in high flowing waterways and against the tide; unfortunately, it is also battling extinction.

Sport fisheries in India are restricted to certain locations, and the growth pattern is uneven. As the sport fishing industry in India is still in its infancy, a variety of difficulties such as river ranching, genetic viability and stability, fish diversity, species protection, stakeholder awareness, and so on arise. Sport or recreational fishing has a significant impact on the local fishing community since it creates job opportunities via ecotourism business operations and the production of social capital. Furthermore, since the nation is exceptionally rich in such knowledge with various topography and ecosystems, there is much possibility for

documenting of indigenous traditional and technological knowledge, notably in designing gears, bait formulas, and so forth. To preserve the ecology and biodiversity as a whole, stakeholders must be aware of the consequences of overall human activity in the fishing ground. As a result, collaboration and coordination among stakeholders would be the ideal method for the development and promotion of sport fishing in different Indian states.

The Mahseer Fish is a tiger among freshwater fish. The rapid flowing waters of the Himalayan rivers provide it with enormous power, allowing it to fight much beyond what any other fish of the same size would be expected to achieve. This combination provides fishermen with an exciting experience every time they hook a Golden Mahseer Fishing. The southwest monsoon empties the Himalayan Rivers every year, producing a harsh habitat for the Mahseer for over three months. This period is marked by landslides and flash floods, requiring Mahseer to be a highly developed fish in order to live.Mahseer fishing armour is made of the biggest scales seen in freshwater fish. They are very swift and nimble because to their high fin-to-body ratio. They are excruciatingly picky and aware of what is going on in their surroundings due to large volumes of outer-body slime and a highly developed lateral line.They reside in fast-flowing rivers and slick riverbeds covered with boulders. As you can expect, casting consistently under these circumstances is difficult, which is why this is not a sport for beginners.

Mahseer may be found in a number of rivers. These include anything from pure spring-fed streams to enormous glacier torrents. Some of the most recent exploration for these magnificent species has taken place in some of our major rivers. Fish of 30 to 50 pounds have been caught here on a regular basis. It’s not often that a prize Mahseer approaches a fly. As a result, presentations must be deep, typically in quicker water, similar to steelhead fishing.The majority of the bigger fish are caught with heavy-streamers dressed on tubes as well as clouser-like minnows. These are often provided with rapid sink-type firing heads. Most fly-lines we use have short 30' heads, and apart from swiftly loading the rod, these lines provide huge shooting capability without requiring much back-cast area, which is important considering that we are fishing with rocky Himalayan banks behind us.

The majority of talks are 65' or longer. Mahseer are said to be incredibly clever and fussy feeders; they have excellent lateral lines that alert them to any movement in the water, thus covering a large area is particularly crucial. As a result, fast line speed and a well-executed double-haul are essential for a successful day of Mahseer fishing. This might be difficult at times, particularly if you are not accustomed to casting short belly lines with heavy flies at a distance.The majority of nice Golden Mahseer are caught on the swing, frequently striking hard as they speed downstream! The initial run is similar to an aggressive saltwater fish, tearing the fly line from your hand at breakneck speed. This magnificent course is nearly always complemented by a rapid river, a boulder-strewn riverbed, and the stunning environment of northern India's Himalayan foothills.THO has spent the last 15 years seeking new locations for the greatest spots to fish in India, notably for the Golden Mahseer. Our exploratory expeditions have taken us to some of the greatest fishing spots in India, and we now offer Mahseer fishing tours throughout the states of Uttrakhand, Arunachal, and Himachal.

The magnificent mountainous state of Uttarakhand has multiple rivers that run through it, including the famous Ganges, which originates here. Uttarakhand has it everything, from lakes to reservoirs, tiny fast flowing tributaries to big river systems, and is therefore one of the greatest sites in India for Mahseer Fishing Trips.This lovely river passes through Jim Corbett National Park, providing anglers with several possibilities for Mahseer fly fishing. These waterways are home to the Goonch catfish, which may weigh up to 250 pounds.In

India, the confluence of the Saryu and Mahakali rivers is regarded as the Mahseer's Mecca. THO has been running visits to this region for over a decade and is regularly teaching communities about the long-term advantages of Mahseer conservation.The Mahakali River serves as a natural dividing line between India and Nepal. In India, this river is a paradise for Mahseer fishing. We've taken float excursions down this river and have always been rewarded with prize Mahseer.The state of Arunachal in India's north-eastern portion is an untapped frontier for Mahseer fishing. Arunachal Pradesh has borders with Bhutan, China, and Myanmar. Arunachal, inhabited by tribes that have preserved their culture to this day, gives the daring fisherman some beautiful vistas and the chance to fish in pristine settings.The rivers here have a lot of water and are home to both the golden and chocolate Mahseer. THO has been doing tours in this area for the last several years.You will be fishing with a team of some of India's most experienced guides, including our head guide, who presently holds the world record for Golden Mahseer on the Fly.Only single barbless hooks are allowed on our Mahseer fishing expeditions in India. Furthermore, we strictly adhere to the "Catch & Release" philosophy.The Himalayan outback has a reputation for delivering all of the luxuries at our isolated camps, even in the most difficult of settings. Our chefs will make sure you receive a range of cuisines in the wilderness, along with our unique high-quality service. Join us on an incredible Mahseer fishing adventure in India.

CONCLUSION

The Mahseer, the famous river combatants of South and Southeast Asia, have won the hearts of fisherman all over the world. This abstract provides a global perspective on the significance, challenges, and conservation implications of pursuing these iconic species in some of the world's most pristine river habitats, as well as a glimpse into the thrilling world of Mahseer sport fishing and angling.Anglers from all over the globe go to the rivers of India, Nepal, Malaysia, Thailand, and beyond for Mahseer sport fishing. The Mahseer's strong strength, elusive personality, and breathtaking surroundings combine to create an unforgettable fishing experience.Sport fishing for Mahseer, on the other hand, raises serious conservation problems.

Overfishing, habitat degradation, and climate change all pose risks to this beloved species, highlighting the need of sustainable angling practices, catch-and-release programs, and collaborative conservation efforts.This abstract offers a tantalizing glimpse into the joys of Mahseer sport fishing, acknowledging its global appeal while highlighting fishermen's and conservationists' joint responsibility for the long-term well-being of these spectacular river guardians.

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