

GOLDEN MAHSEER CONSERVATION ACTION PLAN FOR BHUTAN (2022-2032)

Securing “Tigers of the Rivers”



**NATURE CONSERVATION DIVISION
Department of Forests and Park Services
Ministry of Agriculture and Forests
Royal Government of Bhutan**

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SECRETARY

FOREWORD

Bhutan has propelled into the 21st century as the champion and leader in environmental conservation, owing to the conservation efforts guided by our visionary monarchs. Today, more than 50% of the country is secured for conservation by designating them as protected areas, surpassing the global goal of protecting 30% of the planet by 2030.

Until recently conservation efforts were mostly concerted towards safeguarding the terrestrial ecosystems and charismatic mammalian species such as tiger, snow leopard, and elephants. In 2015, Bhutan embarked on a new journey to study the movement and ecology of Golden mahseer, and the results revealed many interesting facts about this endangered, magnificent freshwater fish. Those findings renewed our approach towards conservation of the Golden Mahseer and riverine ecosystems in general and this plan, the first of its kind targeting aquatic species in Bhutan, is expected to further bolster our overall conservation efforts substantially.

This conservation action plan, which has a planned duration for the next ten years, will serve as a guiding document to address the multifarious threats and challenges faced by the Golden Mahseer and aquatic biodiversity alike. Guided by the National Forests Policy of Bhutan 2011, and aligned to various conservation milestones of the Bhutan for Life project, Bhutan will further cascade towards fulfilling the global goals of 2030 Agenda for Sustainable Development. These actions will also contribute immensely to the aims of post-2020 global biodiversity framework, i.e., to halt biodiversity loss by 2030 and achieve recovery by 2050.

To realize these goals, however, it is imperative that adequate conservation funding is secured and actions effectively implemented. As a result, I urge the conservation partners of Bhutan such as the Bhutan for Life, WWF Bhutan, Fisheries Conservation Foundation-USA, Bhutan Foundation, RSPN Bhutan, Bhutan Trust Fund for Environmental Conservation, Global Environment Facility and United Nations Environment Programme to help realize these funding requirements. I also request all stakeholders to render their support in implementing the actions on the group.

Lastly, I express my heartfelt appreciation to the Department of Forests and Park Services and all other stakeholders engaged for formulating this action plan, and wish them good luck for the successful implementation of the proposed actions.

Tashj Delek

(Thinley Namgyel)

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Congregation of Golden mahseer in Punatshangchhu.





DIRECTOR

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Royal Government of Bhutan
Ministry of Agriculture and Forests
Department of Forests and Park Services



ACKNOWLEDGEMENT

The Conservation Action Plan for Golden Mahseer is the much-needed document to reinforce conservation of the riverine ecosystem in general and Golden Mahseer in particular. This important document would not have taken its current shape without the support and contribution of different stakeholders and individuals, so I would like to extend my appreciation and gratitude to all those involved. Because the overall task of coordinating and planning this conservation action plan is led by Nature Conservation Division, I would like to convey my appreciation for their commendable job in bringing out the first Mahseer Conservation Action Plan for Bhutan.

I also would like to thank all the participants from various conservation partners and stakeholders such as the National Research Centre for Riverine and Lake Fisheries, Haa; Centre for Bhutan and GNH Studies; Tourism Council of Bhutan; College of Natural Resources, Lobesa; WWF Bhutan; Tall Pines Tours, and Explore Bhutan representing the Association of Bhutanese Tour Operators for their active participation and contribution in developing the action plan.

I also would like to wholeheartedly thank David Phillippe and Julie Clausen from the Fisheries Conservation Foundation for their remarkable efforts in studying and conserving the Golden Mahseer in Bhutan, and for your constant guidance in conserving this species. I am also thankful to both of you for thoroughly reviewing this important document.

The officials from most of the field divisions having Mahseer waters and UWICER also took part actively in sharing their field experiences and knowledges in the formulation of this plan, for which I am thankful.

The action planning and publication has been supported through the Bhutan for Life project, for which the Department will remain grateful always. The Department also looks forward to continued support from various donor agencies and conservation partners in effective implementation of the actions identified in the plan for securing the “Tigers of the Rivers”.

Thank you,

(Lobzang Dorji)





Mahseer spawning site at Changchey, Tsirang.



EXECUTIVE SUMMARY

Golden Mahseer *Tor putitora*, commonly known as the ‘Tigers of the Rivers’, is an endangered freshwater fish species. In Bhutan it is found in all the major rivers and is expected to be present at elevations as high as 1000 meters during the summer spawning season. Being a migratory fish, the Golden Mahseer migrates back to its wintering habitats at the lower elevations, near the southern border. Historically, throughout its full range across the Himalayas, Golden Mahseer conservation in general has had a significant knowledge gap regarding their taxonomy, ecology, distribution and population status, which has hindered conservation action planning. The species is also faced with considerable threats from habitat destruction, illegal fishing, river pollution, and obstruction of its migratory routes by dams. Socio-culturally, it is also the most sought-after fish for both food and recreational fishing and the various species of *Tor* also have high religious and cultural significance throughout South and Southeast Asia. In Bhutan, the Golden Mahseer is one of the eight auspicious symbols in Buddhism (locally known as “*Sernya*”) and has great cultural, religious, and historical significance.

Until 2015, not much was known about the ecology and behaviour of Golden Mahseers in Bhutan. The ground breaking research on the species conducted in Bhutan from 2015 – 2018, however has shed much light on its population status, movement ecology, and life history, as well as on the many threats facing the species in Bhutan. The research findings translated into some very strong policy decisions such as the revision of Forests and Nature Conservation Rules and Regulations of Bhutan 2017, which legalized recreational fishing for Golden Mahseer. It was also felt that a holistic plan was required to streamline conservation and protection of this globally threatened fish species.

The Golden Mahseer Conservation Action Plan (2022- 2032) spanning the next ten years outline the key threats that need to be addressed to achieve the vision of ensuring thriving wild populations of Golden Mahseer in the rivers, symbolizing the pristine nature of Bhutan’s freshwater ecosystem. Illegal fishing was found to be the key immediate threat to Golden Mahseer while hydropower dams being a substantial long-term threat. In addition, weak protection of spawning areas, climate change, pollution, dredging of river bed materials and the introduction of exotic fish species are also ranked in the high-risk category. Threats such as river diversion, unauthorized feeding, and sedimentation fell under the medium risk category and irrigation weirs and disturbance from recreational activities were in the low-risk category.



Along with these direct threats, there is an array of challenges that can hamper the implementation of effective conservation works. Limited financial resources and technical capacity hinder the conservation implementation efforts, and the limitation in data available on Golden Mahseer across all of Bhutan poses a challenge for initiating new needed mahseer studies. Lack of adequate facilities and tailored programme is slowing down the roll out and promotion of high-end recreational fishing. Other challenges are weak community engagement, lack of community support and poor conservation ethics, poor stakeholder coordination and engagement, and weak transboundary collaboration and international linkages.

The strategic direction towards achieving the plan's goal of conserving a viable population of Golden Mahseer and sustaining conservation benefits in the form of ecological services are ground under four objectives as follows;

Objective 1: Secure the habitats and ensure viable wild populations of Golden Mahseer

Output 1.1. Key habitats of Golden Mahseer conserved and protected

Output 1.2. Stable populations of Golden Mahseer maintained

Objective 2. Increase science-based information on ecology, threats, and conservation of Golden Mahseer

Output 2.1. Information on distribution, behaviour and ecology of Golden Mahseer across Bhutan generated

Output 2.2. Threats and significance of Golden Mahseer documented

Objective 3. Enhance community livelihoods through promotion of high-end Golden Mahseer recreational fishing

Output 3.1. Sustainable recreational fishing programs implemented

Output 3.2. Community-Based Conservation Ethic establish among river communities

Objective 4. Strengthen awareness, education and communication on Mahseer conservation

Output 4.1. Collaboration on Golden Mahseer conservation initiated

Output 4.2. Outreach programs on Golden Mahseer conservation conducted

Towards achieving these objectives and outputs, 37 key actions are outlined. The implementation of all the prioritized actions is expected to incur a cost of Nu. 120 million, which needs to be sourced from various conservation projects such as Bhutan for Life, GEF 7 project, and other conservation partners. The implementation of these activities will also require support and coordination from different stakeholders. The monitoring of the implementation of this action plan is to be guided by the monitoring framework.



CONTENTS

FOREWORD.....	iii
ACKNOWLEDGMENT.....	v
EXECUTIVE SUMMARY.....	vii
CHAPTER 1: BACKGROUND AND CONTEXT.....	1
1.1. Golden Mahseer in a global context.....	1
1.2. Distribution and cultural significance of Golden Mahseer in Bhutan.....	2
1.3. Conservation status of Golden Mahseer in Bhutan.....	2
1.4. Recent developments on Golden Mahseer conservation in Bhutan.....	3
CHAPTER 2: THREATS AND CHALLENGES.....	5
2.1. Threats.....	5
2.1.1. Illegal fishing.....	6
2.1.2. Hydropower dams.....	6
2.1.3. Weak protection of spawning areas.....	7
2.1.4. Climate change.....	7
2.1.5. Pollution.....	7
2.1.6. Dredging of river bed materials.....	7
2.1.7. Introduction of exotic fish species.....	8
2.1.8. River training.....	9
2.1.9. Unauthorized feeding.....	9
2.1.10. Sedimentation.....	10
2.1.11. Irrigation weirs.....	10
2.1.12. Human disturbance to mahseer and their habitats.....	11
2.2. Challenges.....	11
2.2.1. Limited resources and technical capacity.....	11
2.2.2. Limited studies and data on Golden Mahseer.....	12
2.2.3. Lack of adequate facilities and tailored programme to promote high-end recreational fishing.....	13
2.2.4. Weak community engagement, community support and conservation ethics.....	15
2.2.5. Poor stakeholder coordination and engagement.....	16
2.2.6. Weak transboundary collaboration and international linkages.....	15
CHAPTER 3: OPPORTUNITIES FOR CONSERVATION OF GOLDEN MAHSEER IN BHUTAN.....	19
3.1. Bhutan's conservation commitments.....	19
3.2. Stakeholder and conservation partners.....	19
3.3. National policies and regulations.....	20
3.4. Institutional mechanisms.....	20



CHAPTER 4: ACTION PLAN	23
4.1. Vision and Goal.....	23
4.2. Objectives.....	23
4.2.1. Objective 1. Secure the habitats and ensure viable wild populations of Golden Mahseer.....	23
4.2.2. Objective 2. Increase science-based information on ecology, threats and conservation of Golden Mahseer.....	25
4.2.3. Objective 3. Enhance community livelihoods through promotion of high-end Golden Mahseer recreational fishing.....	26
4.2.4. Objective 4. Strengthen awareness, education and communication on Mahseer conservation.....	27
CHAPTER 5: PLAN IMPLEMENTATION AND MONITORING	33
5.1. Funding and timeline.....	33
5.2. Implementation mechanism.....	33
5.3. Monitoring and Evaluation.....	33
Bibliography	39
Annexure I: Miradi Threat Ranking Principles	41



CHAPTER 1: BACKGROUND AND CONTEXT

1.1. Golden Mahseer in a global context

Freshwater systems in the world harbour a diverse fish fauna of almost 16,000 species. There are 47 species of mahseer in the world and 16 recognized species are under the genus *Tor* (Pinder et al., 2019). *Tor putitora* (Hamilton, 1822) commonly known as the Golden Mahseer is an endangered fish species that is also known by various common names such as the tigers of the rivers, king mahseer, mighty mahseer, putitor mahseer and Himalayan mahseer (Bhatt & Pandit, 2016; Jha et al., 2018; Pinder et al., 2019). *Tor putitora*, which is one of the largest (weighing about 50 kilograms) freshwater cyprinid fish species has also been known by synonyms such as *Barbus microcephalus*, *Tor macrolepsis*, *Tor mosal mahanadicus* and *Tor progeneius*. Golden Mahseer are found in rapid flowing rivers and their tributaries. They migrate upstream for spawning in the tributaries during monsoon season and downstream during winter season (Bhatt & Pandit, 2016). It is also one of the fish species that is most highly considered as a source of food and as a game fish (Philipp et al., 2015).

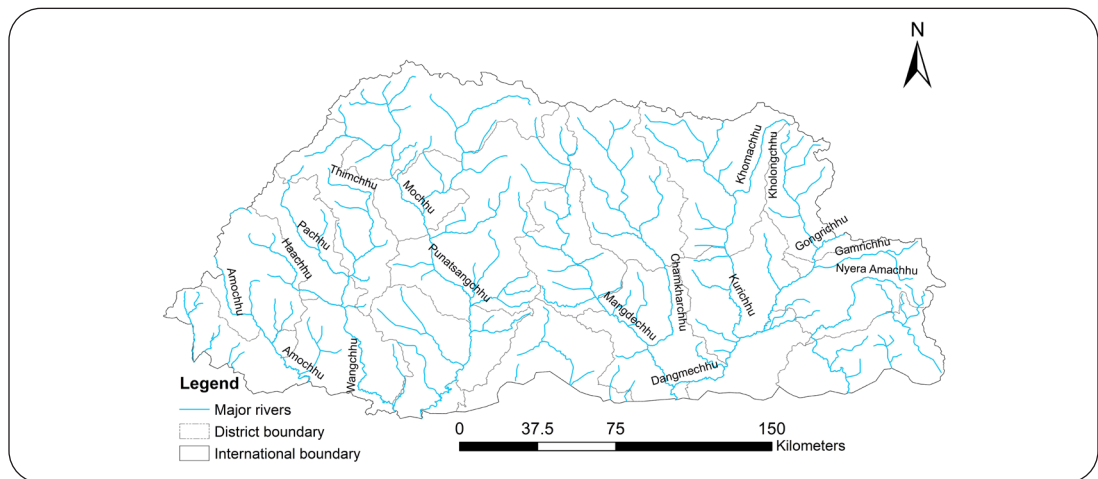


Figure 1. Map of Bhutan showing the major river systems of Bhutan.

The freshwater systems in South and Southeast Asia are considered as one of the ‘hot-spots’ for fish diversity in the world and are also the native range for mahseers under Cyprinidae family (Dudgeon et al., 2006; Pinder et al., 2019). The native range of Golden Mahseer includes Afghanistan, Pakistan, India, Nepal, Bhutan, Myanmar, and Bangladesh (Jha et al., 2018) mainly encompassing all the river systems at the Himalayan foothills. Mahseer conservation efforts in general suffer from a significant knowledge gap regarding their taxonomy, ecology, distribution, and population status (Pinder et al., 2019), that currently hinders effective conservation action planning in the native range countries especially taking into consideration the transboundary nature of the fish.



1.2. Distribution and cultural significance of Golden Mahseer in Bhutan

Bhutan is endowed with rich natural water bodies in the form of rivers, streams, and lakes. There are a number of major rivers in Bhutan, namely Amochhu, Wangchhu, Punatsangchhu/Sunkosh, Manas River (tributaries including Mangdechhu, Chamkharchhu, Kurichhu and Dangmechhu), Nyeru Amachhu, Jomochuu, and many other minor rivers with the total length of the rivers and their tributaries estimated to be about 7,200 km (Fig. 1). There are also over 2,674 lakes of various size, mostly being glacial lakes. These water bodies are a repository of freshwater biodiversity that includes fishes. There have been over 125 species of fishes documented to have been found in the waters of Bhutan (Gurung & Thoni, 2014), including the endangered Golden Mahseer *Tor putitora*.

Tor species also generally have high religious and cultural significance throughout South and Southeast Asia (Pinder et al., 2019). The Golden Mahseer is one of the eight auspicious symbols in Buddhism (locally known as “*Sernya*”; Fig. 2) and has great cultural, religious, historical and economic significance to the Bhutanese. As a result, it could serve as a focal species to drive conservation strategies for the riverine ecosystem in Bhutan (Philipp et al., 2015).



Figure 2. Cultural significance of Golden fish (Golden fish in the Bhutanese stamp; Golden fish art by Azha Karma).

1.3. Conservation status of Golden Mahseer in Bhutan

Conservation of natural resources has been deeply engrained in Bhutanese way of life since time immemorial, and over the course of time, our strong conservation policies have helped further strengthen the conservation of our diverse ecosystems with their rich flora and fauna. For the endangered Golden Mahseer, the species has been listed as a Schedule I species in the Forests and Nature Conservation Act of Bhutan 1995 and has been strictly protected (RGoB, 1995). The Forests and Nature Conservation Rules and Regulation 2017 prohibits people from possessing Golden Mahseer and imposes a fine of Nu. 5000.00 for breaching this clause (RGoB, 2017). Like many lesser-known species, however, the Golden Mahseer



didn't receive the science-based conservation priority it deserved, mainly due to a lack of adequate knowledge about the species and its distribution, limited technical expertise, and limited funding sources. Prior to 2015, almost nothing was known in Bhutan or across the region about mahseer biology, especially aspects about their movement patterns, critical habitats, reproductive activities and population status (Philipp et al., 2015).

The current knowledge on Golden Mahseer from the wild has been greatly enriched by the information documented from the telemetry research conducted from 2015 – 2018 in the Manas River basin. The joint field research project using radio telemetry techniques on Golden Mahseer and Chocolate Mahseer conducted by the Ministry of Agriculture and Forests (MoAF), World Wildlife Fund – Bhutan (WWF – Bhutan), and the Fisheries Conservation Foundation (FCF), USA, found that the river basin has a thriving population of Golden Mahseer, that mostly remain resident in Bhutan and do not migrate into India. It was also found that both mahseers have a consistent pattern of seasonal movements with upstream migration during the spring (starting in February) and downstream migration during the autumn season (October onwards) to overwinter in the lowest 8-10 km of the Manas River, with only a few moving into India. These migrations can be up to 100 km in length, reaching up to elevations as high as 1000 meters for spawning in the side tributaries when they flood during the summer rains. The mouths of the tributaries were, therefore, found to be very important staging grounds both for movement up river and for holding before the rains opened the tributaries for spawning. It was also found that there was a high rate of illegal harvest of both species of mahseer throughout the watershed, with approximately half of the translocated mahseers likely being removed via gill-netting, trapping, hook-and-line, or other illegal means (Philipp et al., 2015).

1.4. Recent developments on Golden Mahseer conservation in Bhutan

This ground breaking research on Golden Mahseer played a pivotal in setting up the first International Mahseer Conference, which was also hosted by Bhutan in December 2018 (WWF Bhutan, 2019), during which key recommendations from the research were also presented for wider outreach and policy actions. It also brought together, for the first time, all the international community engaged in Mahseer conservation. For Bhutan, the recommendations from the research and proceedings from the conference have helped us revisit the way we view large rivers and the fish that depend on them. It also brought a paradigm shift in policy and legislation concerning mahseer conservation.

The Forests and Nature Conservation Rules and Regulations 2017 has been amended in 2021 and rolled out in 2022 (MoAF, 2022) and some of the key changes in the regulation were the delineation of Bhutan's rivers into two categories, Mahseer waters and Trout waters, classifying high-end recreational fishing sites in Mahseer waters, setting out clear directions for promoting recreational fishing of Golden Mahseer, and strengthening community-based fishery conservation programmes.



On the basis that Mahseer move to elevations only as high as 1000 meters, delineation of Mahseer waters were completed for eight major rivers (Manas, Drangmechhu, Mangdechhu, Punatshangchhu, Wangchhu, Amochhu, Nyera Amochhu, Jomochhu) and 80 tributaries covering the districts of Samtse, Chukha, Dagana, Sarpang, Tsirang, Wangdue Phodrang, Zhemgang, Pemagatshel, Monggar, Trashigang and Samdrup Jongkhar (Fig. 3) (DoFPS, 2022b). Mahseer water as defined in the FNCRR 2022 is “all so delineated water bodies in Bhutan, that is, where Mahseer are believed to be present for at least part of the year”. ‘Mahseer’ as defined in the amended regulation shall mean “*Tor putitora*, commonly referred to as Golden Mahseer or Sernya and *Neolissochilus hexagonolepis*, commonly referred to Chocolate (or Copper) Mahseer or Katla, unless otherwise specified”. On the eight major rivers specified above, high-end recreational fishing sites were mapped (DoFPS, 2022a) to promote high-end recreational fishing of Golden Mahseer, as areas set aside for highly controlled access only by rafting and restricted to catch and immediate release of all fish caught.

In order to strengthen protection of the entire riverine ecosystem, the Department has rolled out SMART patrolling across the country since 2016 (WWF Bhutan, 2016). Most of the parks and divisions in the mahseer range are also provided with drones to monitor wildlife. With funding support from WWF Bhutan, a “River Ranger” programme was also launched in 2021 to strengthen river patrolling to curb illegal fishing. Nevertheless, a lack of any strategic plan for conservation of Golden Mahseer or riverine ecosystem has been a hindrance towards effective conservation planning for securing the future of the Golden Mahseer of Bhutan. A conservation action plan will serve as a guiding document towards this goal.

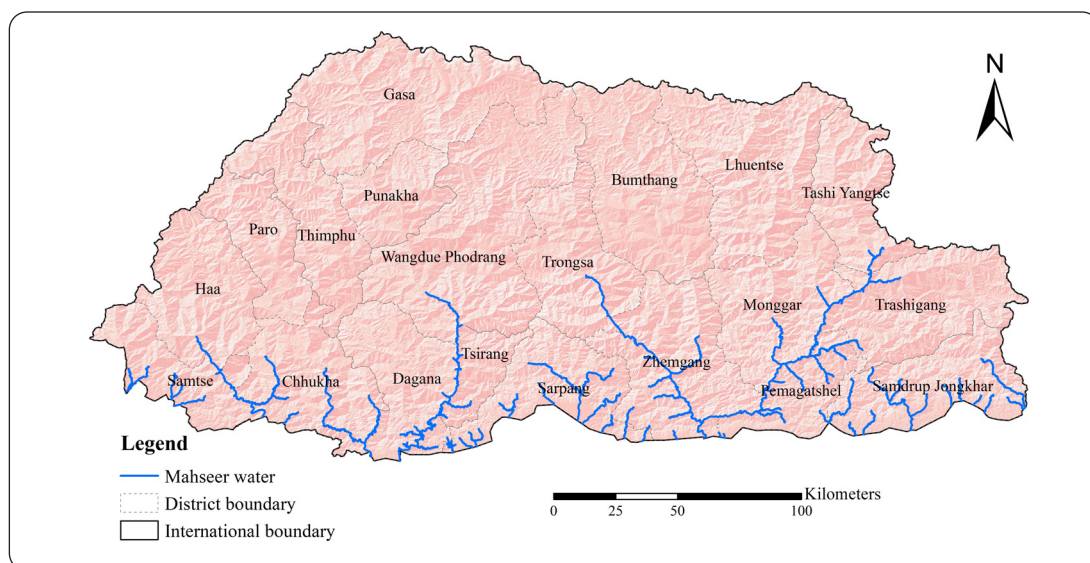


Figure 3: Delineated Mahseer waters of Bhutan.



CHAPTER 2: THREATS AND CHALLENGES

2.1. Threats

Golden Mahseer and its habitats in Bhutan are faced with numerous direct threats, which are the major deterrent factors towards its conservation. Using the Miradi threat ranking principle, the various threats identified were ranked based on a score for three dimensions of scope, severity, and irreversibility, culminating to final score. Threats were ranked as Very high (score 11-16), high (score 7-11), medium (4-6) and low (<4). Illegal fishing was found to be the most severe threat to conservation of Golden Mahseer, the only threat falling under very high category. The high severity ranking for illegal fishing is reflective of its immediate and ongoing nature. Seven other threats fall under High category and three under medium category. Threats from irrigation weirs and disturbances from recreational activities were the lowest ranked threats being under low category (Table 1).

Table 1. Direct threats to Golden Mahseer and its habitats and rank of threats as determined through Miradi Threat Ranking Principle (See Annexure I).

Sl. No.	Threats	Scope	Severity	Irreversibility	Total	Overall Threat Rating
1	Illegal fishing	3	4	2	16	Very High
2	Hydropower dam	3	3	3	15	High
3	Weak protection of spawning areas	3	3	3	15	High
4	Climate change	3	2	3	13	High
5	Non-point source pollution	2	3	3	13	High
6	Point source pollution	2	3	2	12	High
7	Dredging of river bed materials	2	3	2	12	High
8	Introduction of exotic fish species	2	2	3	11	High
9	River training	1	2	3	9	Medium
10	Unauthorized feeding	1	2	2	8	Medium
11	Sedimentation	2	1	1	7	Medium
12	Irrigation weirs	1	1	1	5	Low
13	Disturbance from recreational activities	1	1	1	5	Low



2.1.1. *Illegal fishing*

Illegal fishing is one of the major threats to the survival of fish (Österblom et al., 2011). Illegal fishing leads to overharvesting and also disturbs the river ecosystem in other ways. People conduct illegal fishing either due to a lack of awareness of legal provisions available for fishing and the importance of conservation needs of such endangered species and for their livelihood (both personal consumption and commercial demands). The use of unauthorized destructive fishing gear (e.g., improvised electric shockers (Fig. 4), cast nets, gill nets, river diversion, dynamite, poisoning, etc...) during illegal fishing have a direct and immediate threat to the survival of fish. At present illegal fishing is rampant in all Mahseer waters, and there are immediately visible threats to Golden Mahseer survivability and its habitats (Philipp et al., 2015). The use of improvised electric shockers is now common to all illegal fishermen because it is easy to catch more fish in a short duration of time. This method has detrimental effect not only to fish but to the entire aquatic ecosystem.



Figure 4. *Improvised electric shocker and nets used for illegal fishing.*

2.1.2. *Hydropower dams*

Bhutan is heavily dependent upon hydroelectric power for revenue generation that contributes about 14% of the total GDP of the country (NSB, 2018). Currently, there are dams operating in the Wangchuu in the west, the Kurichhu in the east, and Mangdechhu in the central part of the country. There are also several smaller dams in smaller rivers like Nikachhu and Jomori. Construction of dams is currently in progress on the Punatsangchhu river, and there are plans for dams on other major rivers in the coming years. The dams once constructed disrupt migratory routes and restrict the movement of fishes to their natal grounds for spawning during the breeding season, often causing a change in fish behaviour (Gehrke et al., 2002) and result in reduced or eliminated reproduction, followed by population extirpation. Dams also lead to habitat fragmentation and isolation of populations resulting in inbreeding depression and a decrease in fitness, especially in small populations.



2.1.3. Weak protection of spawning areas

The spawning sites of Golden Mahseer are not identified throughout most of the mahseer waters and, therefore, they are not adequately protected. Most of the time, illegal fishing is focused at the mouth of the tributaries where fish congregate for spawning up in the tributaries. There is also a need to adopt measures to reduce sedimentation and flooding of the tributaries during the spawning season, including the activities of gravel crushing operations on the banks of key tributaries such as the Sherichu. Identifying and mapping the spawning sites and determining which tributaries contribute most to annual recruitment is necessary to protect the key sites particularly during the spawning season.

2.1.4. Climate change

Fishes in general are very susceptible to the predicted impacts of climate change. Changes in water temperature, precipitation, and water availability, increase in frequency/intensity of storms and drought can affect numerous aspects of a fish's life history (WorldFish Center, 2007). Climate change can affect patterns and timings of migration, and cause range shift and phenology of mahseers. Flash floods because of Glacial Lake Outburst Floods (GLOFs) and heavy downpours cause a lot of fish mortality.

2.1.5. Pollution

Pollution is the release of foreign substances into the water bodies, making aquatic ecosystems unhealthy for humans and aquatic organisms alike. Pollutants such as heavy metals accumulate in fresh water and elevate through food chain, and fishes are badly affected (Ali et al., 2013; Austin, 1999; Tashi et al., 2022). In Bhutan, point sources are mostly industrial effluent directly released into the water system, including the waste from the stone crushers located mostly along the riverbanks. It has direct adverse effects on the habitat and life of the aquatic ecosystem. Non-point sources arise from agriculture using fertilizer and pesticides, and from dumping of solid waste along the riverside. Though found negligible in the current ranking scenario, this threat will likely have serious adverse effects in the long run.

2.1.6. Dredging of river bed materials

Dredging of riverbed materials (RBM) includes the extraction of stones, gravel, and sand from the riverbed down to a depth of 3m. The area allotted for extraction depends upon feasibility and can usually be about an acre or more. The extracted materials are used for domestic as well as commercial purposes (export). Commercial extraction is currently allowed on Amochu in the Phuntsholing and Samtse areas, Maokhola in Gelephu, and recently on a Drangmechhu stretch in Pemagatshel dzongkhag. Extraction for domestic purposes exists across the country and is carried out in the large rivers as well as in the tributaries. Most riverine areas with an elevation of less than 1000 meters in the country are prime habitats of the Golden Mahseer and have been designated as Mahseer waters. Surface



collection and river dredging in these waters, however, can have detrimental effects on the survival of Golden Mahseer. It can lead to destruction and disturbance of spawning areas, feeding grounds, and holding grounds as well as affect the migration of the fishes directly. Dredging sites are often at risk from pollution from waste and noise and can easily serve as illegal fishing sites (Fig. 5). While setting up dredging sites, riparian vegetation around the dredging areas is also affected.



Figure 5. Dredging evidence by the side of Mahseer water.

2.1.7. Introduction of exotic fish species

Exotic fish species are introduced to Bhutan's water bodies. Prime ways of exotic fish introduction are through aquaculture (food production) and 'Tsethar' - on religious grounds.

During the process of food production, there are cases of accidental escapement of fishes into the nearby water bodies. Because some of these escaped fishes are aggressive and carnivorous, they feed on the native species, thereby, causing fatal impacts. At the same time, they also compete for food and space, leading to the competition of native species. In addition, the fishes released as 'Tsethar' are never certified as disease-free. All of these impacts combined can lead to the local extirpation of mahseer and other native fishes.

The following are fish species currently being allowed to be introduced in Bhutan in the current aquaculture scenario, a number of which are infamous for their ability to become established as self-sustaining naturalized populations of dangerously invasive non-native species, a threat to all native aquatic biodiversity in Bhutan:



A. Exotic species introduced for food purposes:

- i. *Catla catla* (Catla)
- ii. *Labeo rohita* (Rohu)
- iii. *Cirrhinus mrigala* (Mrigal)
- iv. *Hypophthalmichthys molitrix* (Silver carp)
- v. *Ctenopharyngodon idella* (Grass carp)
- vi. *Cyprinus carpio* (Common carp)
- vii. *Oncorhynchus mykiss* (Rainbow trout)

B. Other exotic species recorded in Bhutan (wild/confinement):

- i. *Clarias gariepinus* (African sharptooth catfish)
- ii. *Salmo trutta* (Brown trout)
- iii. *Oreochromis mossambicus* (Mozambique tilapia)

2.1.8. River training

The river training works are performed for the management of the watershed areas and implementation of mitigation measures to reduce negative impacts from the flow of the river. There are various mitigation measures (riverbank protection walls, reclamation of flooded areas, constructions of spurs, etc) in river training designed to protect riverbank areas and avoid outflanking due to geomorphological processes. Unfortunately, there are likely negative impacts from the river training works on the aquatic fauna, particularly in relation to the change in velocity of the flow of rivers (Wang et al., 2007). River training approaches are more aimed at social safety aspects and thereby compromise the survival of the aquafauna via destruction and disturbance to their habitat. There are also instances of illegal fishing by river diversion and training (Fig. 6).

2.1.9. Unauthorized feeding

Out of sheer compassion and at times as a recreation, people tend to feed wild fish from the riverbanks or bridges. However, scientific evidence suggests that such practices cause negative impacts on the digestive system and reproductive capacity of aquatic biodiversity. In addition to the biological impacts, there is a high probability of changing the dietary habits of the fishes, as they become dependent on easy external feeding. Through this process, mahseers can become prone to easy predation/poisoning/catching thereby harming their wild population and could possibly affect the behavioural biology of the mahseers (Ullah et al., 2017).





Figure 6. Illegal river training works executed by the local communities.

2.1.10. Sedimentation

The sediments from the higher water catchment areas are washed down during the precipitation and get deposited on the river/stream banks and floodplain, potentially damaging and disturbing spawning areas and holding areas of Golden Mahseer. Road widening and farm road construction are major sources of extra sediments that get dumped into the valleys and ultimately into the river system.

2.1.11. Irrigation weirs

The goal of food security will be a key area in Bhutan's road to economic recovery and food self-sufficiency. Achieving this goal will require setting up irrigation weirs and channels, which in turn will cause water (river and stream) flow alterations that impact the Golden Mahseer. While the country has only 2.4% arable land, most of these lands are adjacent to the fertile plains in the southern foothills of the country, next to the rivers in Mahseer habitats. Therefore, such activities like this in the future will pose a threat to the wild mahseer population.



2.1.12. Human disturbance to mahseer and their habitats

Recreational activities such as rafting and licensed fishing on the river, and picnicking along the riverbanks can produce ecosystem stresses (e.g., ecosystem degradation) and species stresses (such as species mortality and disturbance). Waste produced during recreational activities can also contribute to pollution while noise pollution by river rafters/high-end recreational fishing could cause disturbance to the fish. Luckily, there are ways to minimize these disturbances, such as closing the rafting and fishing seasons during the reproduction period.

2.2. Challenges

Six broad challenges were also identified, which hampers the conservation of Golden mahseer and its habitats.

2.2.1. Limited resources and technical capacity

Resources both in terms of human and financial capital is vital for effective implementation of conservation actions. Department of Forests and Park Services oversees conservation, enforcement, and public service facilitation works, and there has always been shortage of staff with diverse expertise under the department, especially in the field offices. With public service delivery through the Government to Citizen (G2C) initiatives being given utmost priority, the forestry officials are left with limited time for conservation actions and river patrolling works to curb illegal fishing and habitat destruction by the local communities and developmental works.

The lack of funding, which hinders the procurement of effective tools for conservation such as drones, patrolling rafts and kayaks, and other smart tools results from the fact that conservation actions in Bhutan are mostly donor driven with very limited funding are available for conservation of lesser-known taxa such as fish. Even if tools are available, officials often lack the technical capacity to operate the drones and rafts. For example, nine of the 12 parks and divisions falling in Golden Mahseer range have drones available, but there are no certified drone operators. That situation certainly limits the utility of the technology for patrolling and monitoring. With the institution of the River Rangers programme in 2021, 20 rangers from the Mahseer range divisions and parks were trained (Fig. 7), but only four offices currently have rafts for patrolling.

Although the conservation journey in Bhutan started a long time ago, many species are yet to get the conservation attention they deserve. That situation especially applies to aquatic biodiversity, keeping it as one of the least explored biodiversity taxa, mainly due to limited technical capacity and expertise to study these lesser-known taxa. Even though the Golden Mahseer is an endangered species and a species with cultural significances, nothing much was done concerning its conservation until 2015, when the first mahseer radio-telemetry



research were initiated in Bhutan with technical guidance and assistances from experts from abroad. The research project helped train a few nationals and officials from the ministry but overall, the number of people with passion and adequate knowledge on Golden Mahseer is very low.



Figure 7. River rangers programme launched in 2021.

2.2.2. Limited studies and data on Golden Mahseer

The population of Golden Mahseer in Bhutan are considered to one of the healthiest and genetically pure among the world as a result of its historically minimal anthropogenic influences. In this era of growing anthropogenic developments, however, limited information and knowledge on its ecology, biology, and genetics is one of the major challenges undermining our conservation efforts in Bhutan. The current information on Golden Mahseer from the wild is restricted to the what was documented from the telemetry research conducted from 2015 – 2018 in the Manas River basin (Fig. 8). While that study yielded good result and laid the groundwork for developing mahseer conservation strategies, similar parallel studies were not conducted on rest of the major river basins housing Golden Mahseer. In developing effective conservation efforts that cover all of Bhutan, information gaps assessing similarities and differences among each of the major Golden Mahseer populations need to be addressed from each river that are potential habitats of Golden Mahseer (e.g., Punatshangchhu, Wangchhu, Amochhu, Nyera Amachhu, Jomochhu, Moachhu and various others small tributaries that are not a direct part of these major river basins). Although, potential mahseer sites are well known to many stakeholders, they need





Figure 8. Snippets from the Mahseer telemetry research 2015-2018 in Bhutan.

documentation and adequate protection. Furthermore, information on ecology (habitat and feeding preferences), migration (timing), isolated populations upstream of dams, e.g., from Kurichhu) and reproductive biology (which tributaries are key producers) all need documentation. In addition, although mahseer are known to spawn throughout the extended summer period, perhaps routinely more than once, a comprehensive understanding on their breeding cycles and what triggers actual spawning events are critical. Identifying which of the potential tributaries in each major river system actually supports spawning and recruitment of juveniles is also critical to conservation planning. Information on the genetic diversity of golden mahseer populations among different rivers, among upstream and downstream of hydropower affected area (e.g., Kurichhu) and hatchery and wild populations is also necessary for effective conservation and management plans. The currently available occurrence data are inadequate, scattered, and in need of proper documentation, especially with reference to critical habitats (spawning, refuge etc.). Similarly, baseline information on abundance, and population structure (prior to any major human interference) is necessary for long-term monitoring and adaptive management. Moreover, the high altitudinal gradient, difficult terrain and rugged topography demands requirement and usage of proper equipment and technologies, making information generation expensive and challenging.

2.2.3. Lack of adequate facilities and tailored programme to promote high-end recreational fishing

The Golden Mahseer is a much sought-after game fish by the recreational anglers and is one of the world's most prized catches. The Telemetry Research Study affirmed that populations of Golden Mahseer in Bhutan are viable for introducing high-end recreational fishing, especially on the Manas and Punatsngchhu River Basins. Based on this recommendation,



the new Forests and Nature Conservation Rules and Regulations (amendment) 2022 allows recreational fishing for Golden Mahseer restricted to catch and immediate release of all fish caught, only using rod and reel angling with fly fishing and spin fishing techniques and artificial flies with a single barbless hook. In order to kickstart this programme, exploratory assessments of the potential fishery (i.e., rafting locations, potential campsites, community involvement, trip itineraries, fishing quality, etc.) in each of the other major river systems needs to be completed prior to opening up the angling in that river systems at the earliest. A well-managed recreational fishing programme is expected to help generate revenue that can assist both the communities' livelihoods and the conservation of the species.

With this recreational product being fairly new in Bhutan, several components of the industry's infrastructure need to be developed to ensure that the product provides best experiences to the high-end anglers. Except for some community ecolodges along the Mangdechhu basin and a lone youth-based jungle lodge in Panbang, there are no proper camping sites identified, raft take off points marked, or prime fishing sites mapped. While the recreational fishing regulations require Bhutanese fishing guides to accompany the foreign anglers, there are no standards to train, certify, and issue fishing guide licenses. Such gaps need to be filled immediately to allow recreational fishing flourish now. A mechanism for controlling recreational fishing is also necessary to ensure that rivers are not over crowded with anglers, which would damage the quality fishing experience. To accomplish that, there needs to be a system for licensing rafting companies capable of safely and expertly conducting fishing trips and for permitting these companies to operate on specified rivers at



Figure 9. A potential campsite at Zarkabla along the Drangmechhu Mahseer water



specific times. For each river system, there needs to be a season defined for the rafting/fishing activities, as well as a system by which trips are scheduled at some predetermined frequency that prevents overuse of the river/campsites and overexploitation of the fish populations.

2.2.4. Weak community engagement, community support and conservation ethics

Engagement of local communities is considered vital for the success of conservation programmes, and community-based conservation is the future of biodiversity protection. The programme entails effort to protect biodiversity in which the local community participates as much as possible together with the conservationists and scientists. This holds true for the conservation of Golden Mahseer as well. The prime habitats of Golden Mahseer in Bhutan connect diverse community groups such as the major settlements and towns with far flung remote villages amidst the thick forests. Implementation by the conservation agencies of programmes that focus on the participation of local communities, women's groups and youth groups as well as promote active participation by the targeted local communities are vital.

Because conservation efforts for Golden Mahseer are getting the limelight only recently in Bhutan, both engagement with the communities and active participation by the communities are weak. Local communities have been dependent on water and its resources since time immemorial through fishing, river water extraction, extraction of sands, boulders and other river-bed materials and collection of drift woods and often these actions are unsustainable. Of these, illegal fishing through the use of locally fabricated fishing gears has been a major issue. The communities are, therefore, usually more resource extraction centric than conservation centric, thereby lacking a fundamental conservation ethic. Rolling out programmes such as recreational fishing that allows some legalized fishing for personal consumption by the communities makes it vital to effectively make the locals conservation stewards. Besides, it is also vital that other livelihood enhancement programmes such as aquaponics, aquaculture, traditional farming and improved opportunities for microfinancing and private sector investment are initiated for the communities dependent on mahseer rivers in a way that coordinates those activities with the Golden Mahseer conservation plan.

2.2.4. Poor stakeholder coordination and engagement

Stakeholder coordination and partnership are key to achieving impact conservation outcomes and this implies to the conservation of endangered Golden Mahseer. The fact that water is a common resource for all, humans and fish alike, stakeholders are diverse. Key stakeholders can be grouped into five categories viz., Government Agencies, Non-government agencies, Academia and Research Institutions, anglers, and the local communities. Within government agencies also there are conservation centric agencies and development centric agencies, which creates friction in successful conservation planning and implementation. For instance, dams are vital for socio-economic development but in the wrong places, they





Figure 10. Traditional methods of fishing.

are barriers to mahseer movement, for which dialogue and collaboration is a must to identify a balanced approach.

Often key stakeholders come from different backgrounds and cultures, and hence have a diverse viewpoint, the culmination of which will hopefully result in developing holistic conservation programmes. While communities can add value on how they can partner with the conservationists, engagement of academia and research institutions will help plan science-based actions. Events such as stakeholder coordination meetings and establishing diverse working groups will help us identify key solutions to diverse challenges. In addition, research symposia will bring researchers from different agencies together to share diverse findings. Data and information sharing also can be strengthened through dialogues amongst the relevant stakeholders. For instance, research on Golden Mahseer is conducted by different agencies such as Department of Forests and Park Services, Department of Livestock, Colleges of the Royal University of Bhutan, but often data sharing is lacking. This not only affects prioritizing research actions for the Golden Mahseer but also leads to duplication of efforts. These stakeholder coordination issues need to be resolved to have impactful conservation actions for golden mahseer.

2.2.5. Weak transboundary collaboration and international linkages

Transboundary collaboration and intranational linkages are important to realize effective conservation goals at broader spatial scale. Strong mechanism of collaboration, coordination and linkages among the transboundary river basins and countries are therefore vital. However,





Figure 11. Participants during the drafting of conservation action plan.

limited collaboration among the transboundary nations of Bhutan, India and China is one of the major challenges that can hinder Golden Mahseer conservation in Bhutan. All the major important Golden Mahseer rivers from Bhutan drain into the Brahmaputra in India (which with present limited knowledge is also considered to be a potential migratory corridor for Golden Mahseer). In addition, as some of the rivers are transboundary in origin (e.g., Amochhu, Kurichhu and Drangmechhu), conservation efforts initiated by Bhutan in such rivers may get compromised due to economic development activity by the transboundary nations (e.g., hydropower development, irrigation etc.). This requires strong sense of transboundary collaboration and in addition, a proper system of conservation prioritization system in Bhutan to avoid such consequences in Bhutan.

Limited transboundary collaboration and platform for the conduct of research and sharing of scientific findings curtails sharing of expertise and knowledge among the conservationist. Existing international collaboration like Transboundary Manas Conservation Area (TraMCA) is most focused on conservation of large mammals and therefore requires integration of aquatic components, at least large migratory fishes. Therefore, to realize effective implementation of aquatic biodiversity conservation plans, and Golden Mahseer in particular adequate linkage and collaboration with relevant transboundary institutions by addressing gaps in existing collaboration mechanisms are crucial.

It will be vitally important to collaborate with international mahseer conservation groups such as International Joint Partnership for Mahseer Conservation (IJPMC) for sharing of mahseer conservation knowledges and best practices.





Section of Mahseer water on the Punatsbangchhu



CHAPTER 3: OPPORTUNITIES FOR CONSERVATION OF GOLDEN MAHSEER IN BHUTAN.

Bhutan's path to socio-economic development has always placed conservation and sustainable use of natural resources at its core. Such strong conservation policies stem from our visionary leadership, in addition to our reverence and respect for nature, and the species present therein. Species such as the Golden Mahseer play a critical role in all aspects of science (river ecology) and society (culture), making it an extremely important target for conservation.

3.1. Bhutan's conservation commitments

Bhutan is a party to several international commitments to biodiversity conservation and environmental protection. The commitments relevant to the conservation of Golden Mahseer in Bhutan includes the UN Convention on Biological Diversity (CBD), the UN Framework Convention on Climate Change (UNFCCC), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Bhutan ratified CBD in 1995 and under the convention, the country is expected to conserve biological diversity, ensure sustainable utilization of biological resources, and equal and fair sharing of benefits arising from genetic resources. As required by the convention, Bhutan developed the National Biodiversity Strategies and Action Plan in 1997 which was later updated in 2014.

The UNFCCC is a landmark achievement in the fight against climate change, and 197 countries are currently party to the convention. The main objective of the convention is to stabilize global greenhouse gas concentrations in the atmosphere at a level that “prevents dangerous interference with the climate system”. Bhutan ratified the convention in August 1995 and since then, has contributed immensely towards reducing greenhouse gases. At the recent Paris Agreement in 2015, Bhutan pledged to remain carbon neutral for all times to come.

The CITES is a multilateral treaty that regulates international trade in wildlife species particularly threatened ones. CITES came into force globally in 1975, and Bhutan joined the convention in 2002.

3.2. Stakeholder and conservation partners

Successful conservation will require proper collaboration and coordination among stakeholders and conservation partners. Stakeholders include governmental and non-governmental agencies, donors, enforcement agencies, and local people.



The NCD under the DoFPS coordinates and monitors species conservation activities at the national level and develops species action plans. Institutions such as the UWICER and the College of Natural Resources conduct research on biodiversity and generate science-based information on species ecology and human-wildlife dynamics.

WWF Bhutan Program Office and Bhutan Trust Fund for Environmental Conservation (BT FEC) have long been conservation partners in Bhutan, helping to fund research and activities that uplift the socio-economic status of communities living with wildlife.

Besides DoFPS, Royal Bhutan Police and Royal Bhutan Army play a crucial role in curbing the illegal wildlife trade.

Going forward, the Tourism Council of Bhutan will be a very important partner in developing and promoting recreational fishing. There is a huge opportunity for local communities to generate additional income from ecotourism activities and recreational fishing can be a big attraction to foreigners. The Department of Livestock and the Department of Agriculture are also very essential partners. Because Golden Mahseer is a freshwater species, coordination with the Druk Green Power Corporation will also be important to see that Mahseer waters are protected and provide support for Mahseer conservation.

3.3. National policies and regulations

Empowered by the Constitution of the Kingdom of Bhutan, the Royal Government of Bhutan (RGoB) caters strong administrative and policy support towards conservation of aquatic wildlife. The DoFPS guided by the National Forest Policy of Bhutan 2011 (DoFPS, 2011) strives to ‘maintain species persistence and ensure long-term sustainability of Bhutan’s biodiversity and natural habitats through a network of protected areas, biological corridors and management of other landscape for positive environmental outcomes. And the Forest Act of Bhutan 1995 accords highest protection status to the Golden Mahseer by listing it under Schedule I species.

In addition, other sectoral laws and regulations such as National Environment Protection Act of Bhutan, 2007 and Water Act of Bhutan, 2011 strives for maintaining water quality and environmental flow (river flow) standards for the survival of Golden Mahseer. These policies provide the legal and administrative support for conservation of Golden Mahseers in Bhutan.

3.4. Institutional mechanisms

The MoAF plays a key role in formulating and executing policies and legislations related to forests, biodiversity, livestock and agriculture in close coordination with the relevant



stakeholders. The DoFPS under MoAF is responsible for management of forest resources and wild biodiversity.

Within the DoFPS, the Nature Conservation Division (NCD) is tasked with the conservation of plants and animals including aquatic fauna, and nature recreation, both within and outside of the protected areas. The research wing of the DoFPS, Ugyen Wangchuck Institute for Conservation and Environmental Research (UWICER) is mandated to conduct research and training in areas of forestry and wildlife.

In the field, trained forest personnel at the protected areas and forest division serve as ambassadors of biodiversity conservation and carry out protection works in close coordination with the local community. Such strong institutional set-up and network offers a conducive enabling environment in implementing the conservation action plan for Golden Mahseers in Bhutan. The newly introduced River Rangers can play a key role in integrating formal conservation actions into the lives of community members.



Fly fishing and fish handling technique displayed by an angler.



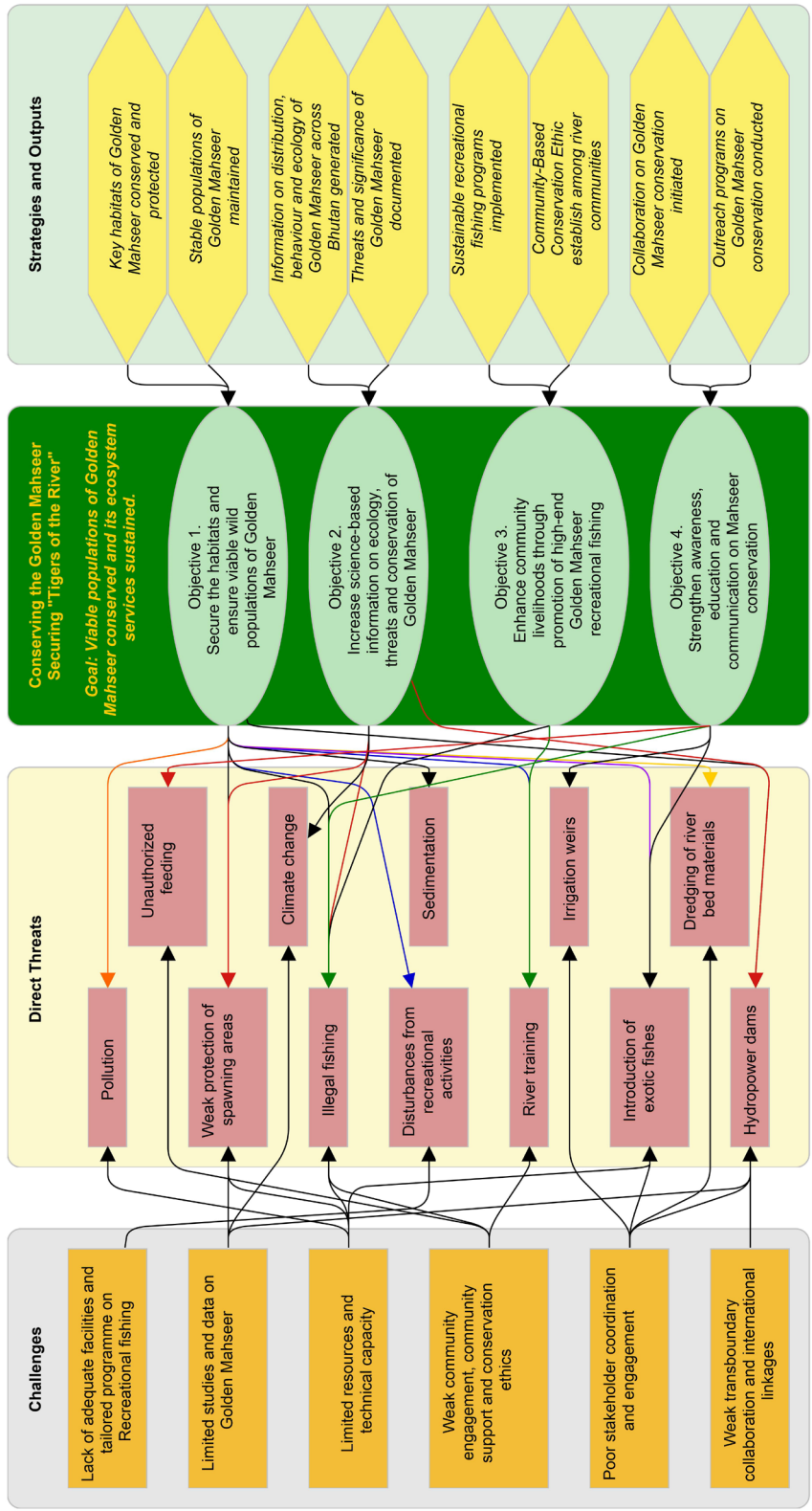


Figure 10. Conceptual model for Mahseer conservation in Bhutan



CHAPTER 4: ACTION PLAN

4.1. Vision and Goal

Vision: Thriving wild populations of Golden Mahseer in healthy rivers symbolizing pristine freshwater ecosystem of Bhutan.

Goal: By 2033, viable populations of Golden Mahseer conserved and its ecosystem services sustained.

4.2. Objectives

4.2.1. Objective 1. Secure the habitats and ensure viable wild populations of Golden Mahseer

A secure native habitat is vital for any species to persist, and that certainly pertains to the Golden Mahseer. Fish species are the most imperilled of the vertebrate groups, and any adverse alteration in the properties of their main habitat component, the water, will cause considerable risk of population collapse. For the endangered Golden Mahseer, which is migratory by its behaviour, both wintering sites in the warmer, lower elevation regions and spawning sites on the upper tributaries are crucial sites that require protection. Moreover, it is vital that spawning sites are adequately protected during the spawning season to ensure adequate supply of fingerlings for recruitment. Alteration and degradation of the critical habitats of this fish will compromise the ability of the habitat to support its life processes. As a result, for fulfilling this objective, two key outputs are identified: (1) to conserve and protect key habitats of the Golden Mahseer and (2) to maintain stable populations of Golden Mahseer in those native habitats.

Key actions include identifying and mapping the key habitats of the Golden Mahseer to devise conservation and protection measures backed by national policies and regulations. These actions can also be backed by available scientific data and information. For instance, the results from the first telemetry study clearly shows that the Golden Mahseer requires cooler tributaries at elevations up to 1000 meters for spawning as well as warmer deep rivers near the border with India for overwintering. It is vital that there are limited disturbances between the spawning areas and overwintering areas for which maintaining free flowing stretch of rivers are vital. On the Mahseer water stretches where there are dams already, it is crucial that required E-Flows as per standards are maintained.

With illegal fishing identified as the most serious threat, a key action towards maintaining stable populations of Golden Mahseer is the mapping of illegal fishing hotspots and regular monitoring using modern technologies such as camera traps and drones, through river



ranger programmes and heightened river patrolling especially during the spawning seasons. Stakeholder coordination and partnering with local communities are vital. Partnering with institutions such as religious bodies is crucial not only for advocating on illegal fishing, but also to reduce the risk to species from unauthorized feeding and release of exotic species through ‘*Tshethar*’ programmes.

Output 1.1. Key habitats of Golden Mahseer conserved and protected

Activity 1.1.1. Identify and map key habitats (spawning, congregation and overwintering areas) of Golden Mahseer and determine which of the potential spawning tributaries are the greatest contributors to annual recruitment.

Activity 1.1.2. Develop and implement guidelines on protection of spawning areas

Activity 1.1.3. Implement erosion and land management measures in the spawning tributaries

Activity 1.1.4. Implement habitat conservation measures as per Environment Management Plan in RBM collection sites

Activity 1.1.5. Assess and ensure minimum environment flow (E-Flow) from the dams and weirs in Mahseer water

Activity 1.1.6. Strengthen point-source water pollution control measures

Activity 1.1.7. Regulate river training works in Golden Mahseer hotspots

Activity 1.1.8. Conserve and maintain Chamkharchhu as a free-flowing critical Mahseer habitat to ensure connectivity with Manas basin

Output 1.2. Stable populations of Golden Mahseer maintained

Activity 1.2.1. Identify, map and monitor illegal fishing hotspots, develop and implement an effective enforcement strategy for each

Activity 1.2.2. Intensify river monitoring during the spawning and migration seasons

Activity 1.2.3. Provide additional training and equipment to the field staff for river monitoring

Activity 1.2.4. Monitor unauthorized feeding of Mahseer

Activity 1.2.5. Strengthen coordination and monitoring to control introduction of exotic species

Activity 1.2.6. Strengthen monitoring to reduce river sedimentation as per existing rules and guidelines

Activity 1.2.7. Establish a National Fish Stocking Policy and Fish Hatchery Culture Guidelines.



4.2.2. Objective 2. Increase science-based information on ecology, threats and conservation of Golden Mahseer

Species conservation initiatives should be based on sound science and reliable evidence, yet too often this is not the case. Scientific research may play a vital role in conserving threatened species in at least two important ways; firstly, it provides information about the species biology and ecology, as well as fill knowledge gaps and secondly, scientific information and public awareness generates supports for conservation from stakeholders and the wider public. As described in the challenges, scientific information on Golden Mahseer are limited from most of the major mahseer waters and the majority of the conservation priorities are based on studies done only on the Manas river basin. Illegal fishing is ranked among the highest raked threats to Golden Mahseer, but actually figures of illegal fishing incidences are lacking. Through this objective of increasing science-based information, the action plan has set out actions targeting two outputs and key actions include understanding the habitat preferences of Golden Mahseer, population structure, genetic diversity between wild populations in different river basins, above and below dam populations, recruitment dynamics, and movement ecology, and genetic diversity of Golden Mahseer. Understanding the threat of disease to Golden Mahseer has also been prioritized.

Output 2.1. Information on distribution, behaviour and ecology of Golden Mahseer across Bhutan generated

Activity 2.1.1. Conduct population level genetic analyses on genetic diversity, gene flow, and sub-structure.

The samples should be collected from different habitats such as between wild populations in different river basins, upper and below dam populations, between wild populations and hatchery stock.

Activity 2.1.2. Estimate population/stock status/abundance using latest state-of-the-art monitoring techniques such as mark recapture through tagging/genetics.

Activity 2.1.3. Carry out habitat preference study of Golden Mahseer.

Activity 2.1.4. Assess the effectiveness of fish ladder for Golden Mahseer migration in Bhutan through pit tagging experiments.

Activity 2.1.5. Monitor the threats of disease to Golden Mahseer.

Activity 2.1.6. Carry out telemetry studies to understand mahseer migration pattern in all major Mahseer waters (except Manas, which has been done).



Under output 2.2, which targets documenting conservation threats and their significance to Golden Mahseer, the action plan guides to document the factual evidences of illegal fishing (by developing standard data collection format, data management and reporting), socio-cultural significances of Golden Mahseer and threats arising from the climate change.

Output 2.2. Threats and significance of Golden Mahseer documented

Activity 2.2.1. Assess the extent and severity of illegal fishing of Golden Mahseer in Bhutan

Activity 2.2.2. Predict and document the impacts of climate change and anthropogenic activities on Golden Mahseer

Activity 2.2.3. Document socio-economic and cultural significance of Golden Mahseer

4.2.3. Objective 3. Enhance community livelihoods through promotion of high-end Golden Mahseer recreational fishing

One of the key recommendations from the Telemetry study on the Manas basin was to promote high-end recreational fishing of Golden Mahseer as a tool to generate Community-based Conservation (CBC). The recommendation has been taken up for policy action and the provisions on fishing in the Forests and Nature Conservation Rules and Regulations were amended to legalize the recreational fishing of Golden Mahseer in Bhutan. The current status of recreational fishing is that there has been limited groundwork done to enable that high-end experience to the anglers. Lack of proper infrastructure (rafting companies, fishing guides, community partners to run camping sites, etc...), no designated high-end fishing locations, prevalence of illegal fishing by the local people are some of the challenges. Towards fulfilling this objective, two outputs targeting the implementation of sustainable recreational fishing programme in Bhutan and establishing community-based conservation ethics are identified and the actions prioritized in this action plan are expected to make Bhutan a most preferred destination when it comes to mahseer fly fishing.

Output 3.1. Sustainable recreational fishing programs implemented

Activity 3.1.1. Develop guideline for recreational fishing to regulate intensity of recreational activities in Golden Mahseer hotspots.

The guidelines should capture permitting processes to avoid overcrowding and overexploitation of the rivers, camping sites and fish and certification process for rafting companies.

Activity 3.1.2. Regulate intensity of recreational activities in Golden Mahseer hotspots.

Activity 3.1.3. Re-assess the high-end recreational fishing sites in all Mahseer waters.

Activity 3.1.4. Develop curriculum, train and certify fishing guides.



Activity 3.1.5. Develop and promote recreational fishing tour packages.

Output 3.2. Community-Based Conservation Ethic established among river communities

Activity 3.2.1. Identify and develop community managed ecotourism products.

Activity 3.2.2. Build community capacity on hospitality for the river communities

Activity 3.2.3. Engage the communities directly in the Recreational Fishing activities through running campsites, as fishing guides, interaction with anglers, etc...

4.2.4. Objective 4. Strengthen awareness, education and communication on Mahseer conservation

The local communities play a vital role in safeguarding and conserving the resources surrounding them by virtue of the fact that they have been living in close harmony with their surrounding for generations. This applies to the conservation of endangered Golden Mahseer as well. In the current situation, however, threats to natural resources are looming in the face of modern development, for a resource such as fish, unsustainable harvesting of fish through illegal fishing has been a big challenge. In contrary to what conservationists may perceive, long-standing residents of local communities are usually not the ones that resort to illegal fishing but rather it is individuals who migrate to the communities that do. With conservation priorities changing and local peoples deprived of the traditional practices, they too resort to illegal practices. Therefore, for every conservation programme and action, one of the key challenges is to capture the imagination, interest, and support of local people in a way that stimulates cooperation and conservation action. Stakeholder engagement including the local communities as outlined in output 4.1. and outreach and awareness education programmes to the local communities as outlined in output 4.2. are identified as key areas that are needed for strengthening awareness, education and communication on Mahseer conservation.

Output 4.1. Collaboration on Golden Mahseer conservation initiated

Activity 4.1.1. Institute national and regional task force to conduct regular stakeholder coordination meetings

Activity 4.1.2. Initiate transboundary collaboration on mahseer conservation

Activity 4.1.3. Observe and participate in international events related to Mahseer conservation

Output 4.2. Outreach programs on Golden Mahseer conservation conducted

Activity 4.2.1. Conduct awareness, training and educational programs to local communities, youth and end users

Activity 4.2.2. Promote citizen science initiative to collect data as part of recreational fishing programme.





Drangmechbu Mabseer water amidst the thick sub-tropical forests.



Table 2. Activity implementation plan and budget outline

Objectives	Output	Action	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Sub-total	
Objective 1. Secure the habitats and ensure viable wild populations of Golden Mahseer.	Output 1.1. Key habitats of Golden Mahseer conserved and protected.	Identify and map key habitats (spawning, congregation and overwintering areas) of Golden Mahseer.	1.5	1.5									3	
		Develop and implement guidelines on protection of spawning areas.			0.5									0.5
		Implement erosion and land management measures in the spawning tributaries.			0.3	0.3				0.3	0.3			1.2
			Implement habitat conservation measures as per Environment Management Plan in RBM collection sites.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
			Assess and ensure minimum environment flow (E-Flow) from the dams and weirs in Mahseer water.	0	0	0.25	0	0	0.25	0	0	0.25	0	0.75
			Strengthen point-source water pollution control measures.			0.3								0.3
			Regulate river training works in Golden Mahseer hotspots.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
			Conserve and maintain Chamkharchhu as a free-flowing critical Mahseer habitat to ensure connectivity with Manas basin.					1						1





Objective 3. Enhance community livelihood through promotion of high-end Golden Mahseer recreational fishing.	Identify and develop community managed ecotourism products.	3				3				3					3				15
		0.5				0.5				0.5					0.5				2.5
Objective 4. Strengthen awareness, education and communication on Mahseer conservation.	Activity 3.2.3. Engage the communities directly in the Recreational Fishing activities through running campsites, as fishing guides, interaction with anglers, etc...	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
		0.5				0.5				0.5					0.5				1.5
Objective 4. Strengthen awareness, education and communication on Mahseer conservation.	Output 4.1. Collaboration on Golden Mahseer conservation initiated.		2							2									4
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1
Objective 4. Strengthen awareness, education and communication on Mahseer conservation.	Output 4.2. Outreach programs on Golden Mahseer conservation conducted.		0.25							0.25					0.25				2.25
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	22.8	19.55	6.5	8.95	6.15	11.2	21.65	7.65	7.4	8.15	3	0.5	15					

CHAPTER 5: PLAN IMPLEMENTATION AND MONITORING

5.1. Funding and timeline

This conservation action plan is developed for a plan period of ten years from July 2022-June 2032. The development of the plan is guided by the National Forest Policy 2011 and the 12th Five Year Plan of the Ministry of Agriculture and Forests. The action plan is also guided by the Bhutan for Life conservation milestones that will extend until 2032 and the GEF 7 eco-tourism conservation project. Over the next ten years, the Department of Forests and the conservation partners will implement 35 key actions and will incur an estimated cost of Nu. 115.5 million.

The major portion of funding for this ten-year conservation action plan will be from the RGoB and the BFL as most of the activities are aligned with 12 FYP and BFL plan, and the GEF 7 ecotourism project. However, funding from other donors like WWF, BT FEC, UNDP, Bhutan Foundation, FCF, and other international donors will be sourced.

5.2. Implementation mechanism

The Department of Forests and Park Services will be the lead agency for the implementation of this conservation action plan, supported by the conservation partners from other agencies such as Department of Livestock and Tourism Council of Bhutan. The research component can also be taken up by researchers from the Royal University of Bhutan. Within the Department of Forests and Park Services, policy actions and centrally coordinated activities that require the support of external stakeholders will be led by NCD and all field-based activities such as surveys, monitoring, surveillances and community-based activities will be implemented by the field offices. At the present scenario, most of the rivers under the elevation of 1000 meters falls under mahseer water and, therefore, most of the field divisions in the southern half of the country will be responsible for implementing the actions. For all the research components, NCD and UWICER will coordinate the implementation of the activities.

5.3. Monitoring and Evaluation

Implementation of the plan will be monitored annually by NCD in collaboration with the field offices. A mid-tern review of the plan will be carried towards the end of the five years of plan implementation. Progress will be monitored from periodic reports submitted by the focal persons from the field offices and present to the Department. The logical framework (Table 3) will be used for monitoring and evaluation, using indicators provided. This conservation action plan is a living document and the activities prescribed above are dynamic and should change as per the change of policy, priorities or field situations. The annual monitoring and mid-term review should consider any addition or deletion of actions wherever necessary and relevant.



Table 3: Monitoring and Evaluation Logical Framework

Objectives	Output	Action	Indicator	MoV	Lead	Collaborator
Objective 1. Secure the habitats and ensure viable wild populations of Golden Mahseer.	Output 1.1. Key habitats of Golden Mahseer conserved and protected.	Identify and map key habitats (spawning, congregation and overwintering areas) of Golden Mahseer.	No. of critical habitats mapped	Mapping report	DoFPS	DoL
		Develop and implement guidelines on protection of spawning areas.	Guidelines developed and implemented	Guideline	DoFPS	DoL/NECS
		Implement erosion and land management measures in the spawning tributaries.	Area of land managed	Implementation report	DoFPS	DoA/ DoR/ NECS/ DGPC
		Implement habitat conservation measures as per Environment Management Plan in RBM collection sites.	Area of land managed	Implementation report	DoFPS	NECS/ NRDCL/ Private Entities
		Assess and ensure minimum environment flow (E-Flow) from the dams and weirs in Mahseer water.	No. of dams and weirs with e-flow maintained	Monitoring report	NECS	DoFPS/ DGPC
		Strengthen point-source water pollution control measures.	No. of control measures implemented	Monitoring report	NECS	DoFPS/ Private Entities
		Regulate river training works in Golden Mahseer hotspots.	No. of sites monitored	Monitoring report	DoFPS	NECS/ MoWHS
		Conserve and maintain Chamkharchhu as a free-flowing critical Mahseer habitat to ensure connectivity with Manas basin.	Technical report produced and submitted	Technical report	DoFPS	MoAF/ WWF



Objective 1. Secure the habitats and ensure viable wild populations of Golden Mahseer.	Output 1.2. Stable population of Golden Mahseer maintained.	Identify, map and monitor illegal fishing hotspots. Intensify river monitoring during the spawning and migration seasons. Provide additional training and equipment to the field staff for river monitoring. Monitor unauthorized feeding of Mahseer. Strengthen coordination and monitoring to control introduction of exotic species. Strengthen monitoring to reduce river sedimentation as per existing rules and guidelines. Establish a National Fish Stocking Policy and Fish Hatchery Culture Guidelines. Conduct population level genetic analyses on genetic diversity, gene flow, and sub-structure.	No. of illegal fishing hotspots mapped and monitored No. of monitoring carried out No. of equipment procured and people trained No. of sites monitored No. of meetings conducted No. of sites monitored No. of publication No. of publication	Hotspot map/ Monitoring report Monitoring report GIMS report/ Training report Monitoring report Meeting resolution Monitoring report Policy and guidelines. Reports/ Papers	DoFPS DoFPS DoFPS DoFPS DoFPS DoFPS DoL DoFPS	Anglers Anglers DoL/ BAFRA/ Monastic body/ Private Entities/ Tshethar Tshogpa NECS DoFPS DoL/ RUB
Objective 2. Increase science-based information on ecology, threats and conservation of Golden Mahseer.	Output 2.1. Information on distribution, behaviour and ecology of Golden Mahseer in Bhutan generated.	Estimate population/stock status/abundance using latest state-of-the-art monitoring techniques such as mark recapture through tagging/genetics. Carry out habitat preference study of Golden Mahseer.	Population estimated Habitat preference documented	Reports/ Papers Reports/ Papers	DoFPS DoFPS	DoL/ RUB DoL/ RUB





Objective 2. Increase science-based information on ecology, threats and conservation of Golden Mahseer.	Output 2.2. Threats and significance of Golden Mahseer documented.	Assess the effectiveness of fish ladder for Golden Mahseer migration in Bhutan through pit tagging. Monitor the threat of disease to Golden Mahseer. Carry out telemetry studies to understand mahseer migration pattern in all major Mahseer waters. Assess the extent and severity of illegal fishing of golden Mahseer in Bhutan. Document the impacts of climate change and anthropogenic activities on Golden Mahseer. Document socio-economic and cultural significance of Golden Mahseer.	Fish ladder effectiveness documented Disease threat documented Migration pattern documented Extent and severity of illegal fishing documented Impacts of climate change and anthropogenic activities documented Socio-economic and cultural significance documented	Reports/ Papers Reports/ Papers Reports/ Papers Reports/ Papers Reports/ Papers Reports/ Papers	DoFPS DoFPS DoFPS DoFPS DoFPS DoFPS	DoL/WWF DoL/ RUB DoL/WWF LG NCHM/ RUB RUB/ CBS
Objective 3. Enhance community livelihood through promotion of high-end Golden Mahseer recreational fishing.	Output 3.1. Sustainable recreational fishing programs implemented.	Develop guideline for recreational fishing. Regulate intensity of recreational activities in Golden Mahseer hotspots. Re-assess the high-end fishing sites in Mahseer water. Develop curriculum, train and certify fishing guides. Develop and promote recreational fishing tour packages	Guidelines developed Intensity monitored Re-assessment done No. of guides trained No. of tour packages promoted	Guideline Monitoring report Assessment report Training certificates Advertisement	DoFPS DoFPS DoFPS DoFPS TCB/ ABTO	TCB/ ABTO TCB TCB/ABTO TCB/ ABTO/ GAB DoFPS

Objective 3. Enhance community livelihood through promotion of high-end Golden Mahseer recreational fishing.	Output 3.2. Community-Based Conservation Ethic established among river communities.	Identify and develop community managed ecotourism products.	No. of ecotourism products developed	Physical verification/ Product inventory	DoFPS	TCB/ LG
		Build community capacity on hospitality.	No. of people trained	Training certificates	DoFPS	TCB/ ABTO
Objective 4. Strengthen awareness, education and communication on Mahseer conservation.	Output 4.1. Collaboration on Golden Mahseer conservation initiated.	Engage the communities directly in the Recreational Fishing activities through running campsites, as fishing guides, interaction with anglers, etc...	No. of communities engaged in different programmes	Monitoring report	TCB/ ABTO	DoFPS
		Institute national and regional task force to conduct regular stakeholder coordination meeting.	No. of coordination meeting	Meeting resolution	DoFPS	
		Initiate transboundary collaboration on mahseer conservation.	No. of coordination meeting	Meeting resolution	DoFPS	MoFA/ NGOs
		Observe and participate in international events related to Mahseer conservation.	No. of events organized/ participated	Event proceedings	DoFPS	DoL/ RUB/ WWF
Objective 4. Strengthen awareness, education and communication on Mahseer conservation.	Output 4.2. Outreach programs on Golden Mahseer conservation conducted.	Conduct awareness, training and educational programs to local communities, youth and end users.	No. of outreach programs conducted	Program report	DoFPS	TCB/LG/RUB/ DoL
		Promote citizen science initiative to collect data as part of recreational fishing programme.	Citizen science information generated	Reports/ Data	DoFPS	TCB/ ABTO





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Annexure I: Miradi Threat Ranking Principles

A. Definitions

1. **Scope** refers to the proportion of the target (area for ecosystems, population for species) that is likely to be affected within 10 years under current circumstances.
2. **Severity** attempts to categorize the level of damage to the biodiversity target expected within that particular scope and in the specified time frame.
3. **Irreversibility** is the degree to which the effects of a given threat can be undone and the targets affected by the threat restored, if the threat is stopped.

B. Criteria

1. **Scope:** The proportion of the target that can reasonably be expected to be affected by the threat within ten years, given the continuation of current circumstances and trends. For ecosystems and ecological communities, measured as the proportion of the target's occurrence. For species, measured as the proportion of the target's population.

4 = Very High: The threat is likely to be pervasive in its scope, affecting the target across all or most (71-100%) of its occurrence/population.

3 = High: The threat is likely to be widespread in its scope, affecting the target across much (31–70%) of its occurrence/population.

2 = Medium: The threat is likely to be restricted in its scope, affecting the target across some (11–30%) of its occurrence/population.

1 = Low: The threat is likely to be very narrow in its scope, affecting the target across a small proportion (1-10%) of its occurrence/population.

2. **Severity** – Within the scope, the level of damage to the target from the threat that can reasonably be expected given the continuation of current circumstances and trends. For ecosystems and ecological communities, typically measured as the degree of destruction or degradation of the target within the scope. For species, usually measured as the degree of reduction of the target population within the scope.

4 = Very High: Within the scope, the threat is likely to destroy or eliminate the target, or reduce its population by 71-100% within ten years or three generations.



3 = High: Within the scope, the threat is likely to seriously degrade/reduce the target or reduce its population by 31-70% within ten years or three generations.

2 = Medium: Within the scope, the threat is likely to moderately degrade/reduce the target or reduce its population by 11-30% within ten years or three generations.

1 = Low: Within the scope, the threat is likely to only slightly degrade/reduce the target or reduce its population by 1-10% within ten years or three generations.

3. Irreversibility (Permanence) – the degree to which the effects of a threat can be reversed and the target affected by the threat restored. It is assessed for the impact of the threat on the target, not the threat itself.

4 = Very High: The effects of the threat cannot be reversed, it is very unlikely the target can be restored, and/or it would take more than 100 years to achieve this (e.g., wetlands converted to a shopping centre).

3 = High: The effects of the threat can technically be reversed and the target restored, but it is not practically affordable and/or it would take 21–100 years to achieve this (e.g., wetland converted to agriculture).

2 = Medium: The effects of the threat can be reversed and the target restored with a reasonable commitment of resources and/or within 6–20 years (e.g., ditching and draining of wetland)

1 = Low: The effects of the threat are easily reversible and the target can be easily restored at a relatively low cost and/or within 0–5 years (e.g., off-road vehicles trespassing in wetland).



C. Scoring Criteria

Scoring criteria			
Rank	Scope	Severity	Irreversibility
Very high	4	4	4
High	3	3	3
Medium	2	2	2
Low	1	1	1

D. Overall Threat Ranking

Rank	Score range
Very high	16-20
High	11-15
Medium	6-10
Low	1-5





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