BIODIVERSITY OF TANGUAR HAOR: A RAMSAR SITE OF BANGLADESH

Volume III: Fish

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A Ramsar Site of Bangladesh

Volume III: Fish

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PREFACE

Wetlands are amongst the Earth's most productive ecosystems. In Bangladesh these are of great importance because of the extensive food webs and rich biodiversity they support. In the past, wetlands have been undervalued. However, in recent times, awareness increases of the fact that natural wetlands provide many services toward mankind through various functions, products e.g., fish, fuel wood, timber, rice, and attributes i.e., biodiversity, aesthetic beauty, cultural heritage and archaeology.

Bangladesh's most important freshwater wetlands occur in the Haor Basin apart from the Ganges-Brahmaputra delta, which is low lying plains in eastern Mymensingh and western Sylhet Divisions, in the north-eastern part of the country. Tanguar Haor is located in two upazilas (sub-districts) namely Tahirpur and Dharmapasha of Sunamganj district in Sylhet Division. The Tanguar Haor basin, which is an area of 10,000 hectares of land, also supports about 60,000 people with its resources.

Tanguar Haor has outstanding conservation value, being a natural freshwater wetland in the country, seasonally harbouring up to 60,000 migratory waterfowl along with many resident birds, more than 140 fish species and last vestiges of swamp forest. But the floral and faunal diversity of Tanguar Haor is under extensive threat because of unsustainable use of resources.

In 1999, Government of Bangladesh declared the Tanguar Haor Basin as an "Ecologically Critical Area" to highlight its ecological importance and to monitor its environmental quality. In 2000, the haor basin was declared as the country's second Ramsar site – wetland of international importance.

With the declaration of Tanguar Haor as a Ramsar site, government has its commitment to preserve the ecosystem and floral and faunal diversity including its migratory birds from illegal hunters. Government developed a comprehensive management plan – the Tanguar Haor Management Plan (THMP), which envisaged 'wise use' of its natural resources *vis-a-vis* a plan to uplift economic conditions of the local people. Importance was given to aware local community for preserving the natural resources and biodiversity and eventually protects it from degradation and overexploitation.

In the above context, IUCN Bangladesh has taken an initiative to carry out this recent study on biodiversity under the project "Community Based Sustainable Management of Tanguar Haor". The project is being implemented by the Ministry of Environment and Forests through IUCN Bangladesh Country Office with financial assistance from Swiss Agency for Development and Cooperation (SDC). As an outcome of the project, this book aims to share information on threatened and important fish diversity of Tanguar Haor.

This is an expectation of IUCN Bangladesh that the book will be of immense help to monitor changes of important fish diversity of the Tanguar Haor. We also hope that this book help local people of Tanguar Haor to categorize, understand fish resources, watch and take conservation initiatives by reducing over-exploitation, hunting, poaching of natural resources. This book will further be a great source of material for the researchers who are currently or in future will continue their study on fish resources of Tanguar Haor.

Dhaka
June 2015

Ishtiaq Uddin Ahmad
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We express our sincere gratitude to the Ministry of Environment and Forests for giving us the opportunity for conducting this study on biodiversity under this project.

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Dhaka
June 2015

Research Team

LIST OF ABBREVIATIONS

Beel	More or less permanent bodies of water that remain in *haors* or floodplains during the dry season
BNH	Bangladesh National Herbarium
CBD	Conservation on Biological Diversity
CBSMTHP	Community Based Sustainable Management of Tanguar Haor Project
CCC	Central Co-management Committee
CFH	Commercial Fish Harvesting
CPUA	Catch Per Unit Area
CPUE	Catch Per Unit Effort
CWBMP	Coastal and Wetland Biodiversity Management Project
ECMU	Ecologically Critically Management Unit
FGD	Focus Group Discussion
GoB	Government of Bangladesh
GRIS	Global Resistance on Invasive Species
Haor	Backswamps or bowl shaped depressions between the natural levees of a river, that are submerged every year by monsoonal floods from April to October
Haor Basin	A low lying region in north-eastern Bangladesh where most of the country's *haors* occur
IUCN	International Union for Conservation of Nature
Kandas	Levees or ridges, often used for habitation
Khal	Small channel (natural/ artificial); canal
Khas land	Government owned land
MFI	Micro Finance Institute
MoEF	Ministry of Environment and Forests
NCS	National Conservation Strategy
NCSIP	National Conservation Strategy Implementation Programme
NERP	North-East Regional Project
NGO	Non-Governmental Organization
PSC	Project Steering Committee
Ramsar site	Wetland of International Importance (Under the 'Convention of Wetlands of International Importance, especially with regard to waterfowl', also known as the Ramsar Convention after the Iranian city of Ramsar, where it was launched in 1971)
RCS	Ramsar Convention Strategy
RCSP	Ramsar Convention Strategic Plan
Reeds	Tall, robust grass like vegetation of swamps; usually refers to the species *Phragmites karka*, common reed
SDC	Swiss Agency for Development and Cooperation
SYL	Sustainable Yield Level
Swamp forest	Forest that is seasonally flooded with fresh water
THMC	Tanguar Haor Management Committee
UCC	Union Co-management Committee
Ujja	The upward fish movement or migration in the pursuit of dispersion and breeding occurs from *haor* to another water body during pre-monsoon
Union	Smallest unit of local government in Bangladesh
VCC	Village Co-management Committee
VMT	Village Market based Traders
WI	Wetland International

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Chapter 1
Introduction

Bangladesh, located in the delta of one of the world's major river systems, is a land crisscrossed with vast water reservoirs and wetlands. More than two thirds of the country's land mass could be classified as wetlands according to the definition enunciated in the Ramsar Convention. Wetland ecosystems are of great importance to Bangladesh due to their extent and of the critical economic and ecological role that they play in sustaining life and livelihoods in the country.

Tanguar Haor is one of the most important wetlands not only of Bangladesh but also of South Asia (BirdLife International, 2012). It is a unique wetland ecosystem of great national importance in Bangladesh and has now gained international focus.

There are three prominent seasons found in Tanguar Haor. **During full-flood**, when huge water inundates all the Zones of *haor* excepts the settlements, every micro-habitats within Tanguar Haor and adjacent areas becomes deeply flooded. All the reeds, grass and other plant communities in the *haor* go under water and remain submerged for nearly five months. During this time, some resident birds are often seen: Spot-billed Duck, Purple Swamphen, Cinnamon Bittern, Yellow Bittern, Little Cormorant, etc. Nest of rats, ants and other insects have been seen on the tree tops and their branches. Rats, Toads and Frogs in good numbers have been seen within the terrestrial zones. **During post monsoon**, after gradual recession of water from the area, all the microhabitats (Swamp, Reed land, Grassland, Mudflats, Canals, Natural levees, Rivers) take

their shapes and expose with their identical morphological features in a gradual process. At that movement, some early visitors are observed; Grey-headed Fish Eagle, Pallas's Fish Eagle, Brown headed Gull, Lesser Sandplover and some passage migrant birds such as Eurasian Curlews, Whimbrels, Little Stint, etc. **During winter**, with all the dominant ecological features of wetland in Tanguar Haor becomes a paradise of birds. This is the prime time when almost all the winter visitor birds are congregated in the *haor* areas.

The Government of Bangladesh declared Tanguar Haor as an Ecologically Critical Area in 1999 considering its critical condition due to over-exploitation of its natural resources, and in the next year it was declared as a Ramsar site (GoB, 2004). The rich biodiversity, notable occurrence of wildlife especially waterfowl is one of the most significant features that allowed this area to gain the designation as a Ramsar site. Tanguar Haor is also extremely rich in terms of fisheries resources that play a critical role in Bangladesh's economy. It directly sustains the livelihoods of about 60,000 people from 88 surrounding villages and largely contributes to the country's food production and food security.

A project entitled 'Community Based Sustainable Management of Tanguar Haor' is being implemented by the Ministry of Environment and Forests through the IUCN Bangladesh Country Office with financial assistance from Swiss Agency for Development and Cooperation (SDC).

The project strategy undertook a programmatic approach, and proposed to be implemented in three stages, as follows:

1. Preparatory Stage (18 months), activities focused on building the knowledge base on *haor* resources and resource users, in particular resource inventorying, social situation, villages, population, user groups, location and types of resources used; current access practices and community-resource connections; determining maximum harvest limits of resources; community mobilization and organization; and awareness raising, some service delivery to community, piloting resource harvesting and initiate outlining a model for collaborative management; and providing the preliminary elements of institutional structures. The major expected output of the Preparatory Stage was a detailed action strategy for the Development Stage.

2. In the **Development Stage (3 years)**, models outlined for collaborative management, different piloting activities initiated and action plan developed in the Preparatory Stage were to be further implemented and scaled up. It was expected, as a consequence, capacity of CBOs and

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District Administration will be sufficiently built to establish a Tanguar Haor authority.

3. In the **Consolidation Stage (about 3 years),** results obtained in the previous stages would be consolidated and the overall goal is achieved.

To achieve the wise use principle of the Ramsar Convention, the project aims at setting up and completing a series of activities, one of which most importantly, is to conduct a study on biodiversity assessment and a study to improve ecosystem integrity. Among the other essentials, floral assessment is an integral part of the management plan to improve and restore ecosystem functions.

The most intensive series of studies carried out at Tanguar Haor prior to the NCSIP-1 (National Conservation Strategy Implementation Project) was a project named North-East Regional Project (NERP, 1990-93) under the Flood Action Plan. Under this study (Wetland Specialist Study by FAP 6), the whole *haor* basin in greater Sylhet and Mymensingh districts was studied in detail. Moreover, it had also studied hydrology, fisheries and socio-economics of the region as well as producing a portfolio of investment plans for the wetlands. Subsequently, NCSIP-1 studied the biodiversity of Tanguar Haor in late 1990s. Under this project small scale winter bird census was carried out by the 'Wetland International' voluntarily assisted by Bangladesh bird club. But, no single study has been conducted on wildlife and flora involving the community people in Tanguar Haor.

Considering the lack of sufficient knowledge on wetland biodiversity of this region, an initiative has been taken through this present study to collate all the information available in literature and incorporate the results of research so far conducted by IUCN and its partners. A comprehensive survey on biodiversity of Tanguar Haor has been conducted to understand the present status,

habitat classification, population density and diversity of wildlife. During the wildlife survey, conducted between March and April 2011, the status of wildlife (focusing on waterfowl) including habitat condition, comparative analysis of some *beels* (*beels*- smaller wetlands, some of which combine forming a *haor*, in terms of water birds diversity) was studied (Alam *et al.*, 2012). Consequently, another study on flora has been carried out during November 2011 which depicts a clear view on the status of this wetland (Sobhan *et al.,* 2012).

Between 2012 and 2014, a detailed study on fish resources and its sustainable management was conducted in the Tanguar Haor. The survey findings will act as a baseline which would be monitored time to time with some specific monitoring indicators. Biodiversity monitoring will be done by biodiversity experts (baseline survey) and trained community people. A user friendly monitoring format (Chapter 6) has been developed for the community to perform biodiversity monitoring.

1.1 Diversity of Fauna in Tanguar Haor

The wetland ecosystem of Tanguar Haor is largely characterized by the faunal diversity. Vast numbers of faunal species inhabit in this *haor*.

1.1.1 Fisheries resources in Tanguar Haor

The fisheries resources of Tanguar Haor is very rich and has high importance in terms of fish production, fish habitat, breeding support, national economy and livelihood support. It is one of the 'Mother Fisheries' of a total of six of the country. The *haor* is very important in terms of fish species diversity. Based on DoZ (1997), Nurazzaman (1997) and Khan (1997) estimated that the number of fish species is 141 under 35 families. The number is around half of Bangladesh's total 260 freshwater fish species. Apart from this large number of fish species, the *haor* supports several fish species of conservation interests — several


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rare and threatened fish species. It supports 84 IUCN Red Data Book listed and 22 CITES listed species. For example, some critically endangered species like *Bagarius bagarius, Clupisoma garua, Crossocheilus latius, Ctenops nobilis, Eutropiichthys vacha, Labeo boga, Mystus seenghala, Chitala chitala, Pangasius pangasius, Rasbora elanga, Rasbora, Rita rita, Rohtee cotio, Silonia silondia* and *Tor tor* are available in Tanguar Haor.

1.1.2 Present status of wildlife in Tanguar Haor

Tanguar Haor resources especially reeds and swamps support birds and wildlife. Based on Nishat (1993), Karim (1993), and NERP (1993a), it is estimated that a total of 141 fish species, 11 amphibians, 34 reptiles (6 turtles, 7 lizards and 21 snakes), 206 birds and 31 mammals occur in Tanguar Haor (Gieson and Rashid, 1997). A total of 12 butterfly species have also been identified (DoZ, 1997) from Tanguar Haor. However, the most recent survey (2011) of IUCN has recorded 19 species of mammals, 24 species of reptiles and 8 species of amphibians in this wetland (Alam *et al.*, 2012).

1.2 Diversity of Flora in Tanguar Haor

Tanguar Haor supports a wide variety of floral species. Based on Karim (1993) and BNH (1997), it is estimated that a total of 200 wetland plant species occurred in Tanguar Haor. The most recent survey (2011) of IUCN has recorded 104 plant species under 88 genera and 51 families in this wetland (Sobhan *et al.*, 2012). Principal wetland habitats of Tanguar Haor include open water (with submerged and floating aquatic vegetation), seasonally-inundated mixed herbaceous vegetation, reed beds and rice fields. Hijol (*Barringtonia acutangula*) and Koroch (*Millettia pinnata*) are dominant tree species in swamp forest, but these have now disappeared except for an occasional isolated tree and nearly a pure formation in the Rongchi 'forest', which is an 8-hectare stand of 800+ severely-lopped and old trees (Gieson and Rashid, 1997). During last couple of years a large number of *Barringtonia acutangula* and *Millettia pinnata* were planted on different *kandas*.

Different types of habitat and vegetation communities found in Tanguar Haor are as follows:

- **Submerged vegetations** (e.g., *Hydrilla verticillata, Potamogeton crispus, Najas* spp., and *Ottelia alismoides*) are fully under water vegetations. Migratory dabbling ducks and some resident aquatic birds feed on parts of these vegetations.
- **Free floating vegetations** (e.g., *Eichhornia crassipes, Utricularia aurea* and *Sylvania natans*), found in Tanguar Haor are used as nesting sites by some aquatic birds such as Pheasant-tailed Jacana, Bronze-winged Jacana, Purple Swamphen, Whiskered Tern, etc. Rodents found in *haor* also live in and build nests inside such floating vegetation, especially *E. crassipes*.
- **Rooted floating vegetations** (e.g., *Trapa maximowiczii, Echinochloa colona, Hygrorhyza aristata* and *Limnophila indica*). Fish fingerlings often take refuge in such plants while others feed on algae growing on these plants. Aquatic insects and snails also feed on these plants.
- **Sedges and meadows vegetations** (e.g., *Alternanthera philoxeroides, Schumannianthus dichotomus, Eclipta alba, Enhydra fluctuans* and *Scirpus juncoides*). These types of vegetation provide shelter and food source of some aquatic animals. Local people also take some vegetation as food and some are used for making mats of various types.

- **Reed vegetations** (e.g., *Asclepias curassavica, Asparagus racemosus, Ficus heterophylla, Lippia alba* and *Phragmatis karka*) are the main nesting ground of some resident ducks *viz.*, Spot-billed Duck, Cotton Pygmy Goose and some other aquatic resident birds.
- **Freshwater swamp forest vegetations** (e.g., *Barringtonia acutangula, Millettia pinnata, Crataeva magna, Phyllanthus distichus* and *Trewia nudiflora*) are natural and locally introduced species consist of evergreen trees forming dense canopy. Some birds and mammals use this type of forest as roosting and nesting places.
- **Crop field vegetations** (e.g., *Alternanthera sessilis, Cotula hemisphaerica, Cynodon dactylon* and *Cyperus cephalotes*) have been found around the Tanguar Haor which are important source of food for migratory ducks and fodder for cattle.
- **Homestead vegetations** (e.g., *Barringtonia acutangula, Bambusa arundinacea, Dendrocalamus strictus, Musa paradisiaca, Areca catechu, Calamus tenuis, Caryota urens, Cocos nucifera* and *Albizia procera*) have been found in Tanguar Haor with rich species diversity. Many species of terrestrial birds take shelter in such vegetation and build nest or roost on the trees and bamboos.

1.3 Diversity of Phytoplankton in Tanguar Haor

In any aquatic ecosystem the phytoplankton works as the backbone of food chain that in turn keep the predatory animals alive in wetlands and other aquatic environments. The phytoplankton communities of the Tanguar Haor are very much linked with zooplankton and fish productivity. Muzaffar and Ahmed (2006) so far found 107 genera of phytoplankton representing six classes. These are as follows:

- **Chlorophyceae:** *Radiofilum, Eudorina, Gonium, Pandorina, Pleodorina, Platydorina, Volvox, Pyrobotrys, Sphaerocystis, Gloeocystis, Palmodictyon, Nannochloris, Ulothrix, Chlorococcum, Mycanthococcus, Golenkinia, Dictyosphaerium, Characium, Pediastrum, Euastropsis, Ankistrodesmus, Cerasterias, Glaucocystis, Kirchneriella, Pachycladon, Selenestrum, Trochiscia, Westella, Coelastrum, Crucigenia, Scenedesmus, Mougeotia, Eremosphera, Spirogyra, Gonatozygon, Closterium, Pleurotaenium, Cosmarium, Sirocladium, Micrasterias, Staurastrum, Xanthidium, Arthrodesmus, Spondylosium, Desmidium, Hyalotheca, Sphaerosozma, Euglenoidea, Trachelomonas* and *Pyrobotrys.*
- **Xanthophyceae:** *Botryococcus.*

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- **Chrysophyceae:** *Synura, Uroglenopsis, Dinobryon,Gloeobotrys* and *Phaeosphaera*.
- **Bacillariophyceae:** *Melosira, Coscinodiscus, Biddulphia, Fragilaria, Synedra, Navicula, Pinnularia, Nitzschia, Amphora, Cymbella* and *Suriella.*
- **Dinophyceae:** *Gonyaulax, Ceratium, Peridinium, Glenodinium* and *Attheya.*
- **Cyanophyceae:** *Chrooccus, Gloeocapsa, Synechocystis, Aphanocapsa, Synechococcus, Microcystis, Merismopedia, Eucapsis, Dactylococcopsis, Coelosphaerium, Spirulina, Oscillatoria, Borzia, Lyngbia, Schizothrix, Trichodesmium, Anabaena, Nostoc, Anabaenopsis, Nodularia, Tolypothrix, Rivularia* and *Gloeotrichia.* Blooms of *Microcystis* dominated the phytoplankton community throughout the study period, but were particularly acute during the early part of the high water period.

1.4 Threats to Tanguar Haor

Tanguar Haor supports a spectacular array of flora and fauna but these are now facing serious threats due to natural resource depletion, habitat degradation, soil erosion, water pollution, forest degradation, and poaching of wildlife.

1.4.1 Threats to fisheries

Tanguar Haor is extremely rich in fisheries resources. The varied number of fish species is linked with a complex network of food web in the entire ecosystem and so maintaining the integrity of the food web is a must for ecological balance of the *haor* and to increase fish production in Bangladesh.

Harvesting of the last fish, use of unauthorized and destructive gears, drying out water bodies, commercial fish harvest practice in every year as well as over-harvesting had been the most unsustainable methods used

for fishing in Tanguar Haor. These had probably contributed to disappearance of a large number of fish in the natural system which would have led to genetic erosion and had been a threat to indigenous fish species (GoB, 2004).

On the other hand, unsustainable use and destruction of swamp forests and reeds, can bring a negative effect to fisheries resources as these habitats provide food and shelter to fish and other aquatic organisms. Water pollution is another threat to floral and faunal species which sometimes occurs due to coal storage and transportation at Tekerghat point. Thousands of boats continuously pollute the water through oil spill which is ultimately affecting the fish population. Another concerning issue is the illegal fishing by local people using the monofilament net and other illegal fishing gears.

1.4.2 Threats to swamp forest and reed beds

The swamp forests that once used to be common in Tanguar Haor have now become very rare due to clearing, cutting and other anthropogenic pressures, though vestiges remain. Except at the bank of Foillar beel, natural regeneration of this forest type is hardly visible in the wetland.

The reed beds have also been severely reduced because of continued over-harvesting for fuel and converting land into agricultural fields. As a result, certain aquatic species that used to be common in the area, became very rare. This process threatened the integrity of the *haor* ecosystem as a whole (GoB, 2004).

Degradation of the conditions of swamp forests and reed beds had led to several impacts on resource use and livelihoods of the local people. Swamp forest provides food and shelter for fish population and therefore, a reduction in fish production; species diversity and the waterfowl population was observed over the past few decades.

1.4.3 Threats to wildlife

Tanguar Haor is well recognized and acknowledged as home to a large number of waterfowls, both resident and migratory. It provides a breeding area for many birds and other wildlife. The interplay of huge flocks of water birds and luxuriant swamp vegetation used to attract naturalists and tourists. Each year about 60,000-1,20,000 waterfowls visit Tanguar Haor. They are mostly the migratory bird species. But this number had dropped due to a combination of factors: habitat degradation (e.g., decrease of swamp forest

and reed beds), shortages of food, human pressure and illegal hunting (GoB, 2004).

Many species of wildlife have disappeared over the past few decades. Some are threatened nationally and globally. For example, the globally threatened Pallas's Fish Eagle (*Haliaeetus leucoryphus*) has a global population of about 2,500 to 10,000. This species was included in 2009 IUCN Red List Category (as evaluated by BirdLife International — the official Red List Authority for birds for IUCN) as a vulnerable one. The Pallas's Fish Eagle can only be found in Tanguar Haor area and a few other areas of Bangladesh, builds nests only in *haor* basin and adjacent areas on tall trees along the periphery of *haor* during the winter season. This species is threatened due to the destruction of its nesting sites. Conservation efforts can help to increase the number of this bird as well as other wildlife species.

In addition, the migrant fisher folk sometimes harvest turtles and tortoises for consumption and lead to over-exploitation of fish resources as well. At the same time, these temporary migrants build fishing camps which collect fuel wood from swamp forests and use the swamp vegetation (reeds) for the construction of temporary hamlets within the reed beds and pose threats to birds and other wildlife species.

1.4.4 Threats to conservation implementation

The conservation strategy should include a balanced approach to fishing (through restrictions in space and time) and must also protect swamp forests, reed beds as well as provide shelter for all the migratory birds which take refuge during the winter months. But there are some limitations in implementing any conservation initiative. According to the presentation by Ecologically Critical Area Management Unit (ECAMU) - Coastal and Wetland Biodiversity Management Project (CWBMP)[1] and Bevanger *et al.,* (2001), the main challenges for biodiversity conservation at Tanguar Haor are:

- illiteracy of local *haor* dependent people;
- lack of community participation;
- poverty of the local *haor* dependant people;
- biodiversity status may be disrupted after termination of the existing management system, because community motivation and system involvement are absent; and
- insufficient policy frameworks and legislative provisions for biodiversity conservation and protected wetland management.

1.5 Economic Value of Tanguar Haor

Tanguar Haor systems have a great economic value as they provide various services without any investment towards nature — making a vital contribution to human health and well-being. Wetland ecosystems of this *haor* are a part of our natural wealth. The set of Ramsar Factsheets outlined (2011) the 'ecosystem services' — the benefits of people obtained from wetlands ecosystems. They illustrate the great diversity of ecosystem services delivered by wetlands and their values which covers: flood control, groundwater replenishment, shoreline stabilization and storm protection, sediment and nutrient retention and export, water purification, reservoirs of biodiversity, wetland products, cultural values, recreation and tourism, climate change mitigation and adaptation. However, not all wetlands provide all of the services at one time. Different wetlands provide a range of services according to their type, size and location. Economic evaluation of Tanguar Haor could be assessed as below through evaluation of services which the *haor* ecosystem provides.

[1] ECAMU-CWBMP, <http://www.undp.org.bd/projects/prodocs/CWBMP/Study%20Tour%20Tanguar%20Haor%20Draft%20ppt.pdf> accessed on 8 January 2012

1.5.1 Biological set up

Tanguar Haor is a large back-water swamp and an association of many smaller saucer shaped depressions between ridges or banks of river systems at the foothill of the Meghalayan-Joyanti Hills of India. Water is available here all year round, but varies from 7,000 cubic meter/sec to 220 cubic meter/sec in July and February respectively. The *haor* is enriched with clear water which is mainly due to low sediment load in the water. In case of a river the water flows constantly, but in a *haor* the water flow is subdued which provides a relatively stable and shallow depth of water in most areas - a unique ecosystem.

Tanguar Haor is different from other wetlands as no large rivers pass through it which is one of the major causes of low sedimentation rate. However, in the monsoon, hill streams contribute some sedimentation in the upper edge of the *haor* and in adjacent cluster villages. This also creates a unique character to the *beels* which provides a good breeding ground and habitat for the shallow water fish. Siltation trends are not significant, hence it is not considered as threat to the habitat of fish species, instead adds some nutrients to the soil which has a positive impact on agricultural activity. The ridges, known locally as *kanda*, located in between *beels* which supports swamp forests and reed beds. In *kandas*, some agricultural practices/activities are done by the local community but primarily used as grazing land for cows, buffalos and birds. Fishes are known to breed here when these become submerged. Tanguar Haor also includes rice-field habitats that play important ecological roles and support a range of biodiversity, including internationally important populations of migratory waterbirds.

1.5.2 Large fishing ground

There is a great importance of Tanguar Haor for fish production, maintaining biodiversity, meeting local and regional demands and also serve as a good source of fish fry supply for other water bodies. Perennially flooded parts of Tanguar Haor are rich in fish resources. The relatively clear water of Tanguar Haor provides good habitat for aquatic macrophytes which support a good breeding ground for fish and act as a shelter for brood fish. Submerged vegetation is a good habitat for small and medium size fish, whereas natural reeds and other vegetations provide a natural ecological balance for shelter for mother fish. Moreover, there is a good abundance of food and biological environment to boost up the maturity of fishes that is greatly augmented by the supply of additional water from hill streams which keeps the reservoir on flow even during the dry season. The recent trend shows that about 70% of households depend on fish resources of the Tanguar Haor (Table 1.1).

Table 1.1: Type of involvement in fishing activities

Type of involvement	% of household
Fish catch	55.50
Wholesale fish business	3.90
Retail fish business	21.60
Dry fishing activities	0.50
Trap making activities	0.50
Net/trap selling	0.40
Boatman	6
Fishing labour	1.90
Ice selling	0.10
Others	9.50
Total	100

Source: IUCN Survey (2008)

1.5.3 Occupational status of the *haor* people

Wetland resources play a critical role in the lives of those residing in and around Tanguar Haor. Most economic activity carried out in the area, including commercial fishing, trade in fuelwood, hunting and trapping waterfowl,

harvesting and sale of grasses and reeds and farming is based on these resources. Earlier studies confirmed that more than two-thirds of households in Tanguar Haor are either directly or indirectly dependent on the *haor*. Fishing and farming are the principal occupations of people living in Tanguar Haor. An estimation of economic activities of local community of Tanguar Haor area has been given in Table 1.2. It is clear from this that occupational status is largely dependent on fish resources and people of Tanguar Haor have been gradually becoming more and more engaged in fishing than ever before.

According to the Bangladesh Bureau of Statistics the national average size of household is 4.9 (BBS, 2007), but in Tanguar Haor it is nearly 6, for a population living in poverty this is not very high compared to the national average. About 67 percent of the households reported that their occupation is agriculture (including both primary and secondary occupation) and despite the fact that it is a major fishing area, about 48 percent of the households had fishing income. In this connection, it should be noted that households in *haor* regions need at least two income sources because during the monsoon the entire *haor* system becomes a large single water body and during dry winter months water recedes and large part of the *haor* primarily becomes cropland.

Table 1.2: Involvement of local community in different occupation

Occupation	Percentage (%) of involved household head		
	According to NCS fisheries report (1987)	According to Kabir and Amin (2007) from field survey of 2005	According to household survey, IUCN (2008)
Agriculture	62	56	36.78
Fishing	8	15.70	21.56
Day labour	18	7.30	21.07
Businessman	2	2	7.55
Sand and coal	-	-	3.40
Collection	-	19 .30	9.87
Others	10	-	-

Source: IUCN Survey (2008)

Traditionally, in the winter season residents of Tanguar Haor were able to graze their cattle in fallow land or *kandas*. Grasses, reeds, twigs and leaves were harvested for fuel and thatching. Branches or whole tree-tops were collected from swamp forests for use


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in constructing enclosures, called *khola* or *katha*, which entice fish to breed in them. The Hijol (*Barringtonia acutangula*), a wetland tree species, is widely favored for this purpose.

1.5.4 Recreation, tourism and research

The natural beauty as well as the diversity of wildlife and plant life in Tanguar Haor make it an ideal location for recreational activities, tourism and research work. Hundreds of ornithologists and bird watchers visit this area every year. There is a whole range of recreational activities associated with this wetland. Local community can generate income by boating and other water sports, watching wildlife and even art and literature/ cultural show.

1.5.5 Food and nutrition status

The main food items are rice, vegetables, and fish. However, average intake per person is much lower than the daily calorie needs. Only 49 percent households eat potato weekly, only 2.80 percent eat red meat, 12.55 percent eat poultry, 21 percent use milk or milk based products, 42 percent eat eggs and only 5 percent take fruits per week (Sobhan *et al.*, 2012).

1.5.6 Indirect value of Tanguar Haor

There are some activities which do not have direct value but play an important ecological role. The ecological diversity of Tanguar Haor indirectly provides intangible benefits to local communities and tribal minorities those are partially/completely dependent on this wetland for their livelihoods. These benefits mainly come from grazing of cows, buffaloes, goats, harvesting reeds and other vegetations, collecting fuelwood and other food materials. Duck rearing is also a good option in this area. Local habitants have these privileges without providing any fee. Besides, the indirect use value includes functions such as water storage, floodwater buffering, flood control or hydrological services, natural filtration, waste recycling, water quality improvement, recharging of groundwater, and wildlife habitat.

However, over-harvesting of the resources of Tanguar Haor is a major problem and unlimited access to these valuable resources should be kept under control to help restore biodiversity for future uses.

1.6 Conservation Importance of Tanguar Haor

Tanguar Haor, listed in the Directory of Asian Wetlands (Scott, 1989) has been identified by Rasid & Scott (1992) as a key wetland site of international importance, especially because of its vital link in an international network of sites for migratory water birds. Tanguar Haor fulfills at least three of the criteria needed for declaring a wetland of international importance, as adopted by the Montreux Conference of the contracting parties (Davis,1994), each of which alone is sufficient for proposing a Ramsar site. The three criteria met by Tanguar Haor are:

Criterion 1: *A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.* Tanguar Haor qualifies for this criterion based on it hosting a critically endangered bird, several endangered, vulnerable and threatened floral and faunal species such as Barca Snakehead, Giant Featherback, Indian Grass Barb, Baer's Pochard, Pallas's Fish Eagle, Fishing Cats, Bengal Rose, and Ferruginous Pochard.

Criterion 2: *A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.* Tanguar Haor supports around 50,000 waterfowl, on average, during the winter migratory season.

Criterion 3: *A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.* In 2001, a minimum of 2500 Baer's Pochard was counted, which represents 50% (estimated global population is 5000 by BirdLife International, 2001) and 90,900 (2002) Ferruginous Poachard from Tanguar Haor,

which represents 90% of the global population estimate (100,000) by BirdLife International, 2002 (Alam *et al.*, 2012).

1.7 Wise Use of Ramsar Site

According to RCS (2010) an updated definition of "wise use" is "Wise use of wetlands is the maintenance of their ecological character, achieved through the implementation of ecosystem approaches[2], within the context of sustainable development[3]."

According to the Ramsar Convention Strategic Plan (RCSP) 2009-2015, Goal 1 covers wise use of wetlands and the related benefits for biodiversity and human well-being. The strategies for wise use of all wetlands have been expressed as below.

1.7.1 RCSP 2009-15: GOAL 1. Wise Use

To work towards achieving the wise use of all wetlands by ensuring that all Contracting Parties (CPs) develop, adopt and use the necessary and appropriate instruments and measures, with the participation of the local indigenous and non-indigenous population and making use of traditional knowledge, while at the same time ensuring that conservation and wise use of wetlands contribute to poverty eradication, mitigation of and adaptation to climate change, as well as prevention of disease and of natural disasters.

STRATEGY 1.1 Wetland inventory and assessment
Describe, assess and monitor the extent and condition of all types of wetlands as defined by the Ramsar Convention and wetland resources at relevant scales, in order to inform and underpin implementation of the Convention, in particular in the application of its provisions concerning the wise use of all wetlands. (CPs, advised by STRP and assisted by IOPs)

STRATEGY 1.2 Global wetland information
Develop a global wetland information system, through partnerships, to be covered by voluntary contributions, to increase accessibility of data and information on wetlands. (CPs, Secretariat, advised by STRP and assisted by IOPs)

STRATEGY 1.3 Policy, legislation and institutions
Develop and implement policies, legislation, and practices, including growth and development of appropriate institutions, in all Contracting Parties to ensure that the wise use provisions of the Convention are being effectively applied. (CPs, Secretariat)

STRATEGY 1.4 Cross-sectoral recognition of wetland services
Increase recognition of and attention in decision-making to the significance of wetlands for reasons of biodiversity conservation, water supply, coastal protection, integrated coastal zone management, flood defence, climate change mitigation and/or adaptation, food security, poverty eradication, tourism, cultural heritage, and scientific research, by developing and disseminating methodologies to achieve wise use of wetlands. (CPs, Secretariat, STRP, IOPs)

STRATEGY 1.5 Recognition of role of the Convention
Raise the profile of the Convention by highlighting its capacity as a unique mechanism for wetland ecosystem

[2] Including inter alia the Convention on Biological Diversity's "Ecosystem Approach" (CBD COP5 Decision V/6) and that applied by HELCOM and OSPAR (Declaration of the First Joint Ministerial Meeting of the Helsinki and OSPAR Commissions, Bremen 25-26 June 2003).

[3] The phrase "in the context of sustainable development" is intended to recognize that whilst some wetland development is inevitable and that many developments have important benefits to society, developments can be facilitated in sustainable ways by approaches elaborated under the Convention, and it is not appropriate to imply that 'development' is an objective for every wetland.

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management at all levels, promote the usefulness of the Convention as a possible implementation mechanism to meet the goals and targets of other global conventions and processes. (CPs, Secretariat, STRP, IOPs)

STRATEGY 1.6 Science-based management of wetlands
Promote successful implementation of the wise use concept by ensuring that national policies and wetland management plans are based on the best available scientific knowledge, including technical and traditional knowledge. (CPs, Secretariat, STRP, IOPs)

STRATEGY 1.7 Integrated Water Resources Management
Ensure that policies and implementation of Integrated Water Resources Management (IWRM), applying an ecosystem-based approach are included in the planning activities in all Contracting Parties and in their decision-making processes, particularly concerning groundwater management, catchment/river basin management, coastal and nearshore marine zone planning, and climate change mitigation and/or adaptation activities. (CPs, STRP, IOPs)

STRATEGY 1.8 Wetland restoration
Identify priority wetlands and wetland systems where restoration or rehabilitation would be beneficial and yield long-term environmental, social, or economic benefits, and implement the necessary measures to recover these sites and systems. (CPs, Secretariat, IOPs)

STRATEGY 1.9 Invasive alien species
Encourage Contracting Parties to develop a national inventory of invasive alien species that currently and/or potentially impact the ecological character of wetlands, especially Ramsar sites, and ensure mutual supportiveness between the national inventory and IUCN's Global Register on Invasive Species (GRIS); develop guidance and promote procedures and actions to prevent, control or eradicate such species in wetland systems. (CPs, STRP, other agencies, IOPs)

STRATEGY 1.10 Private sector
Promote the involvement of the private sector in the conservation and wise use of wetlands. (CPs, Secretariat)

STRATEGY 1.11 Incentive measures
Promote incentive measures that encourage the application of the wise use provisions of the Convention. (CPs, Secretariat, IOPs)

1.7.2 Additional guidance on the implementation of the wise use concept (1993)

Research
Research can be anything that expands upon basic knowledge. Particular areas that may deserve attention are both identification and quantification of wetland values, sustainability of wetland use, and landscape functioning and modification. Contracting Parties should take positive steps to acquire and, when possible, share any knowledge developed on wetland values, functions and uses.

Training
Training activities and transfer of appropriate knowledge should be an integrated component of all wise use projects. Those activities should be as catalytic as possible, and seek to train potential trainers at regional level who can then pass on their expertise to lower levels, and involve the cooperation of governmental and non-governmental organizations, using local resources and institutions whenever possible. Three broad types of training appear to be of particular relevance for wetland professionals:

- Courses on integrated management;
- Courses on wetland management techniques; and
- Courses for field staff.

1.8 Preceding Exploration in Tanguar Haor

In the study report on "Resource Rights, Sustainable Livelihoods, Environmental Security and Conflict Mitigation in South Asia" of IUCN Asia, the management system of wetland in pre-colonial Bangladesh has been described as below (Waliuzzaman *et al.*, undated):

"Fisheries were traditionally managed and dominated as common property resources through complex systems of rights evolved in and enforced by local communities. It was during this period that the traditional property rights of fishers and non-fishers began to be regulated and restricted through statutory law. Leasing was often short-term, with few incentives to protect fish stocks and every incentive to maximise income by intensive fishing. Some fishers managed to become lessees but the majority did not and throughout the colonial period had practically no property rights in water or in fish.

Leasing in Tanguar Haor was abolished by law in 2001 when the area was designated an ecologically critical area, and the lessee was removed in 2003. Tanguar Haor, currently and until 2006, is being managed by the Ministry of Environment and Forests. The role of local communities in this new arrangement is in the process of being defined but it appears that the new regime will involve a measure of exclusion and further curtailment of their rights to access and use the wetland resources."

In another study on Tanguar Haor, Kabir and Amin (2007) stated that most of the villagers depend on the *haor* for fishing, grazing, farming, and wetland vegetation for fuel. Most importantly, the *haor* is also used for rice (staple food) cultivation during the winter flood-free season. Total exclusion of local people from the current management practices greatly impacted the local people's whose livelihood depends on the resources of the *haor*. This study illustrates the importance of Tanguar Haor resources on local people's, livelihoods and their willingness, constraints and opportunities to participation in the *haor* management.

A case study of Boateng (2010) explained that a formal institutional framework and management plan for Tanguar Haor wetland has been developed through the effort of local Environmental NGOs, some government agencies and with the financial support from IUCN. The local community, commercial leaseholders, and all stakeholders involved were brought together to develop sustainable and community based resource management for Tanguar Haor. Analysis of the institutional arrangements and interactions of Tanguar Haor resource management revealed a "bottom up" institutional framework. The implementation of the plan in its short term of five years paved the way for the envisaged long-term option of community based management in Bangladesh. Both the local communities and the elites are benefiting from Tanguar Haor natural resources and thus the long-term survival of the unique biodiversity of Tanguar Haor is guaranteed.

A brief review of the existing laws, plans and policies related to the wetland management of Bangladesh are provided by Huq (1993) and, Giesen and Rashid (1997). For the management of Tanguar Haor, the most relevant of these are in the Table 1.3.

Table 1.3: Laws, policies and legislation on sustainable *haor* resource management

Year	Sectoral laws, policies and legislations	Specification of the laws
1977	The Haor Development Board Ordinance	It requires the Board to prepare projects and schemes to develop the haors and other depressed low lying areas. Very short duration of the Board mainly executed a few project related to flood control, land reclamation and extension of agriculture fisheries
1982	Protection and Conservation of Fish (Amendment) Ordinance	Prohibits unsustainable fishing techniques, and calls for conservation of fish resources.
1985	Land Management Manual	Guidelines for leaseholders, for sustainable exploitation of fisheries resources.
1992	National Conservation Strategy	Recommendations for achieving sustainable development in all sectors. NCSIP -1 is implementation mechanism.
1992	Ramsar Convention (Ratified by Bangladesh)	Sustainable (wise) use of wetland resources, if appropriate, with community based management.
1995	National Environmental Management Action Plan	Halt degradation: promote sustainable use, conservation of biodiversity.
1997	Environment Conservation Act (1995) and Environment Conservation Rules (1997)	Focus on EIA and protection of Ecologically Critical Areas.
1997	Tanguar Haor Management Plan	Sustainable Management (wise use) of the haor dealing with community based haor management.
1999	Notification of Ecologically Critical Area (ECA)	Enactment of the ECA clause in the Environmental Conservation Act (1995) and Rules (1997).
2000	Tanguar Haor Management Plan (revised)	Emphasis on implementation of wise use principle prescribed in Ramsar guidelines and community based haor management.
2004	National Biodiversity Strategy and Action Plan	A framework for conservation, sustainable use and sharing the benefits of biodiversity with social and economic development of the country.
2009	Bangladesh Climate Change Strategy and Action Plan (BCCSAP)	Emphasis on food security, social protection & health, comprehensive disaster management, infrastructure, research & knowledge management, mitigation & low carbon development, capacity building & institutional strengthening.
2012	Wildlife (Preservation and Security) Acts	Focus on conservation and protection of biodiversity, forests and wildlife.
2015	Tanguar Haor Management Plan Framework and Guidelines	This book documents the results and insights of a compilation, review and collation exercise towards developing and formulating a planning framework including resource management guidelines for Tanguar Haor.

Source: Huq (1993); Giesen and Rashid (1997); Kabir and Amin (2007); IUCN Bangladesh (2015)

1.9 Organization of the Book

The main target of this book is to share the information on fisheries resources of Tanguar Haor, and its changes due to various threats, which will ultimately alert local communities to improve their knowledge in biodiversity conservation.

After this introductory chapter, Salient Geographical Features of Tanguar Haor, Biodiversity Assessment Methods and Fish and its management of Tanguar Haor are described in chapers 2 to 4. The Species Profile (chapter 5) represents the most important and popular fish species in reference to Tanguar Haor. This section of the book helps enthusiastic community people to identify fishes easily.

The last chapter of this book describes community-led monitoring of biodiversity and conservation practices. In the Appendix section, a complete checklist of fisheries resources of Tanguar Haor with national status, as per IUCN Red List of IUCN Bangladesh (2000) has been provided.

This book is Volume III for fisheries resources of Tanguar Haor, which is part of a series "Biodiversity of Tanguar Haor". Volume I of this series is on wildlife and Volume II is on flora. It is hoped that this initiative will enhance the awareness of people living in Tanguar Haor and beyond. This book will also contribute to the policy level issues of Bangladesh such as the development of any future legislation and establishment of conservation priorities.

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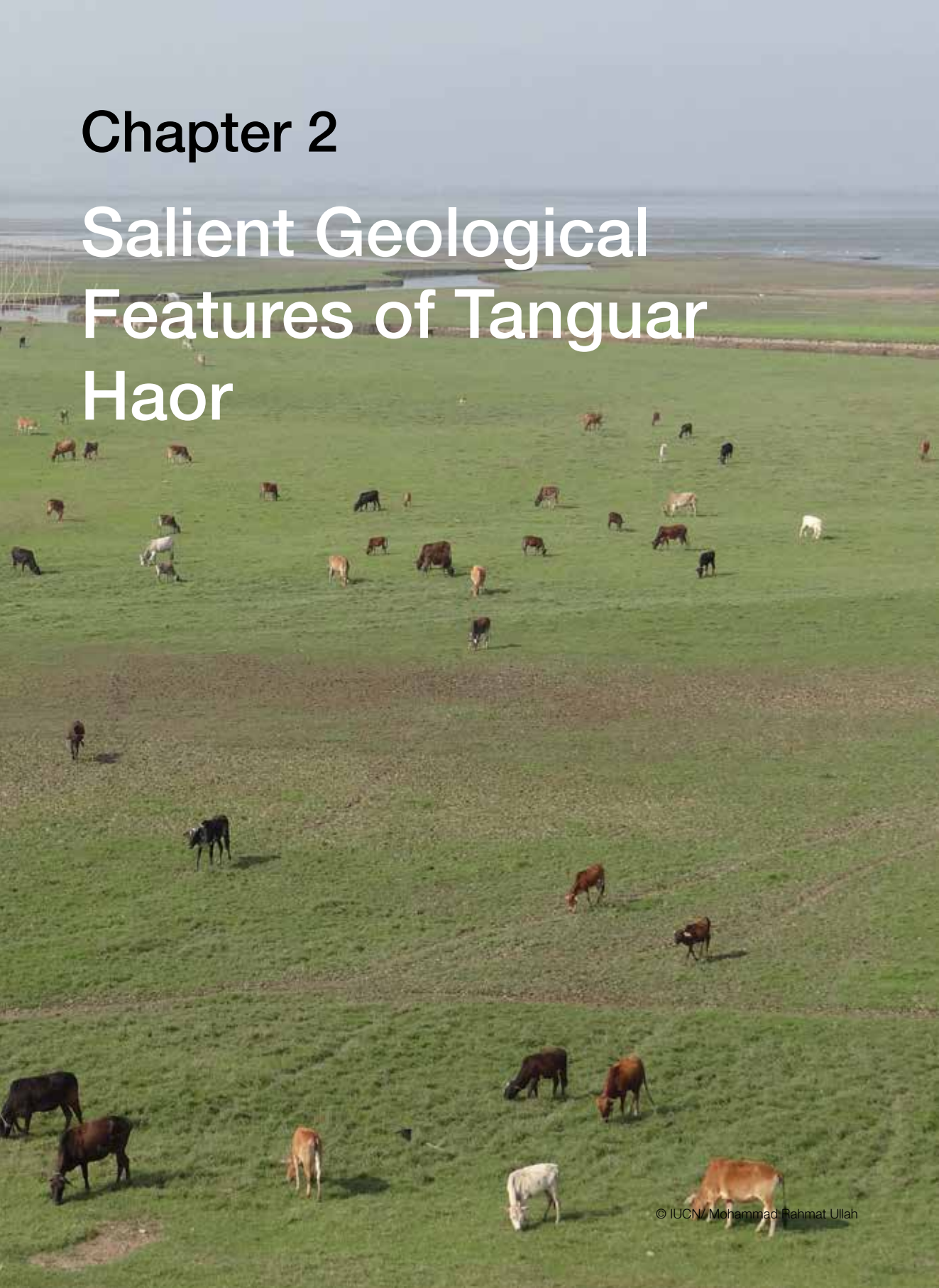
Chapter 2

Salient Geological Features of Tanguar Haor



Tanguar Haor is one of the largest wetland systems in the northeast region of Bangladesh with relative natural state. Approximately, one-third of it lies in Tahirpur upazila and two-thirds lie in Dharmapasha upazila, both of which are located in Sunamgonj District of Sylhet Division (Figure 2.1(a)). The *haor* consists of 46-50 *beels* of various sizes (Akonda, 1989; BFD, 2012). The total area of Tanguar Haor is approximately 160 square kilometers of which 2802.36 ha is permanent waterbodies (Alam *et al.*, 2012). The *haor* is located at an altitude of only 2.5-5.5 meters above mean sea level.

2.1 Geomorphology

The wetland is bounded on the north by the Shillong Plateau, an elevated block of Pre-Cambrian Basement rock which has been draped over by late Mesozoic and Cenozoic sediments. The south face of the plateau has been dissected by steep, V-shaped canyon that follows structurally through controlled valleys. The southern escarpment of the plateau is bordered by the east-west rending Dauki Fault, which forms a distinct lineament separating the lowlands in Bangladesh from the mountains in India (NERP, 1993b).

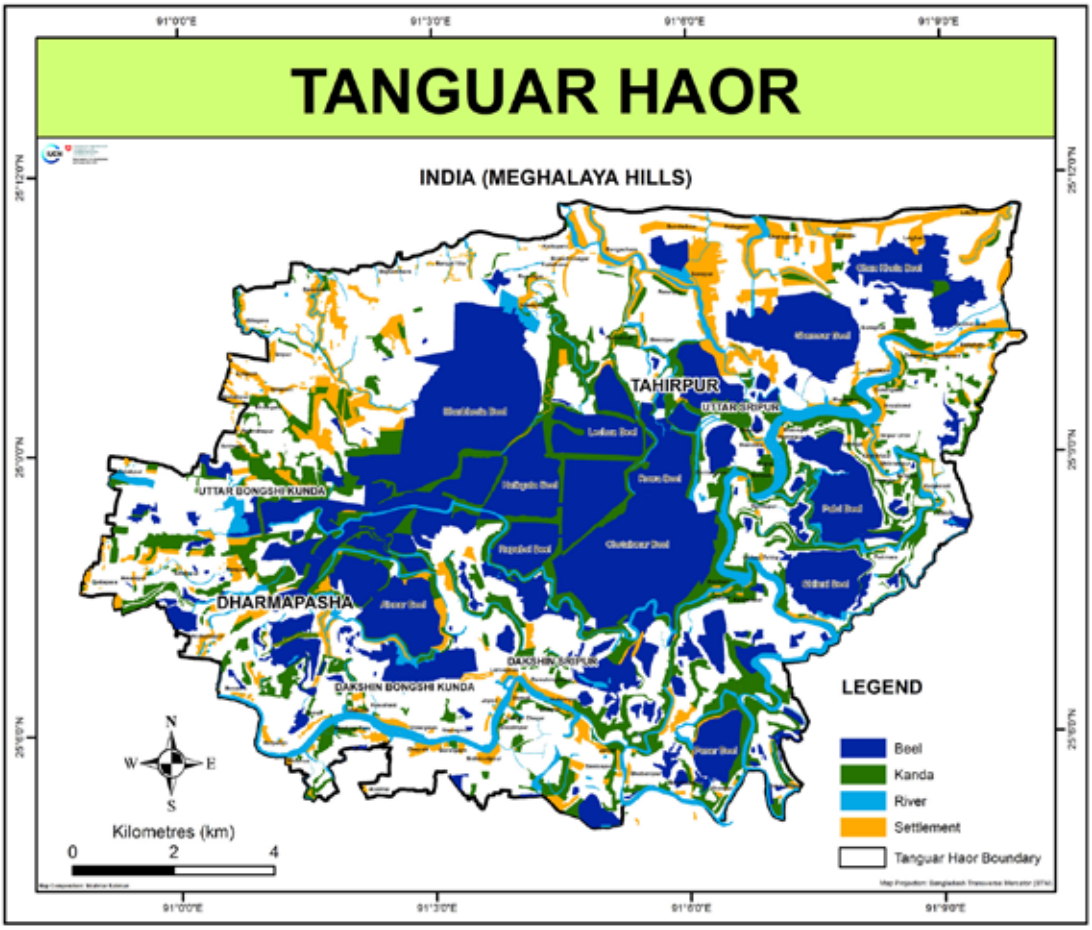


Figure 2.1(a): Map of Tanguar Haor

* This chapter mainly draws on IUCN's Publication (2012) - Biodiversity of Tanguar Haor: A Ramsar Site of Bangladesh, Volume I: Wildlife (Amphibians, Reptiles, Birds and Mammals) and Volume II: Flora

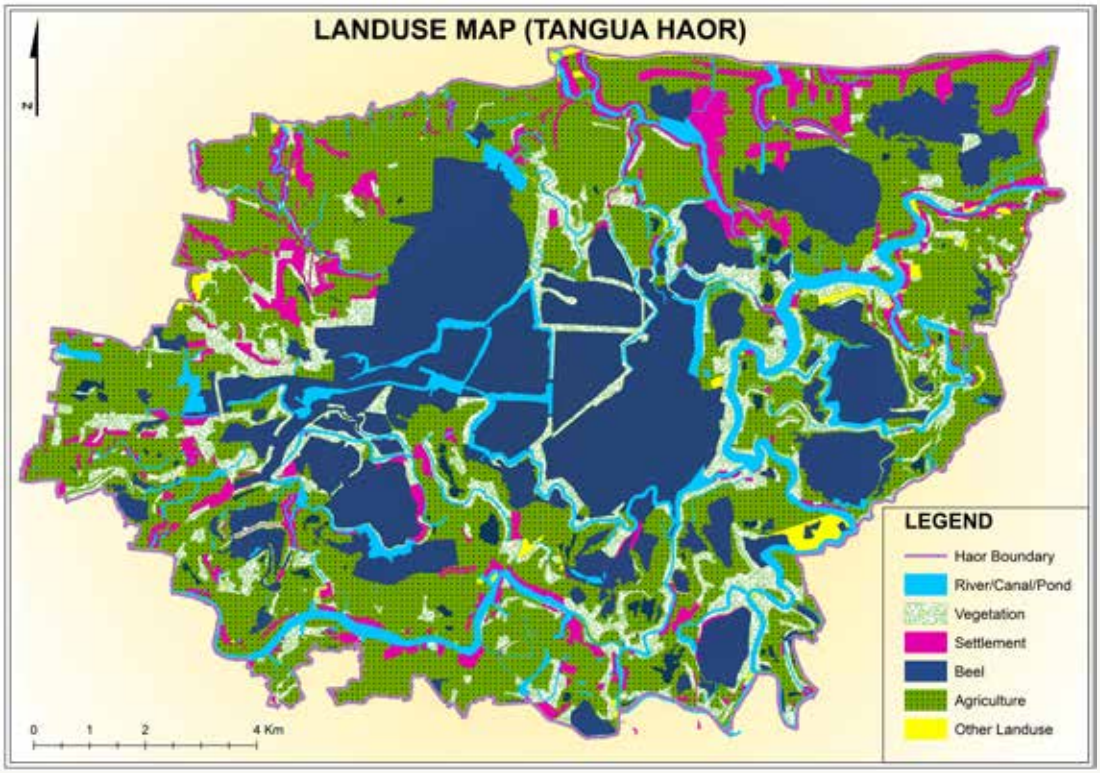


Figure 2.1(b): Landuse Map of Tanguar Haor

Most of the *haor* area is covered by the Young Piedmont. Alluvial plain which comprises the alluvial fans of the Shillong plateau and also the adjoining basins and basin depressions. The fan soils are poorly to imperfectly drained, strongly mottled brown, loamy sands to clay loams, poorly structured to strongly to very strongly acid reaction. The very poorly drained basin deposits comprise strongly reduced heavy clay lacking any sign of profile development.

Tanguar Haor is located right at the foothills of the Meghalaya Hills. Apart from these features, location of this *haor* is another factor for its high biomass production. The *haor* system is mainly rendered with the blackflow of river waters from the Baulai, Patnai and Jadukata Rivers. Few hill streams flow into the *haor* system but the major water thrust comes from the south because of the back flow. The hill streams do bring in some sediment but considering the volume of water held in the *haor* and the area of the *haor* itself. It is significant that because of the low quantity of silt plus its dissemination during flooding season this *haor* is still deep enough compared to the other *haor*s where the rate of sedimentation is comparatively higher Figure 2.1(b).

Due to this backflow the water is relatively clean, free from suspending materials and with less residual matter. As a result the water is transparent and sunlight can penetrate to quite a considerable depth. This increases the lotic area of the waterbody facilitating photosynthesis and making it the most productive area (with high biomass) within the northeastern *haor* basin. It is because of these important physical features that this wetland is still capable of maintaining the ecosystem to its near-natural state resulting in high biomass production.

The area of Tanguar Haor harbors some of the last vestiges of natural swamp forest and is totally flooded in the monsoon season. The floral diversity in this *haor* is very rich which makes it an ideal place for the migratory birds. As a result, every winter about 100 types of migratory birds come to this *haor* who make their temporary habitat here and some of these birds also find this area suitable for their breeding.

Tanguar Haor is also extremely rich in terms of fisheries resources and is considered as one of the largest and most important "mother fishery" (centre for recruitment and dispersal of fish and thus influence the fish production in adjacent floodplains) in the country for floodplain freshwater species.

2.1.1 Geographical Location

The location of Tanguar Haor can be described in three ways e.g. Absolute Geographic location, Relative location and Physiographic location.

Absolute Geographic Location

Tanguar Haor is located in the northeastern part of Bangladesh, between 25°12′10.572″ and 25°5′47.989″ north latitude and 90°58′49.426″ and 91°10′0.018″ east longitude. The total area of Tanguar Haor is approximately 160 sq km including all geographic features and landuse (Figure 2.1.1(a).

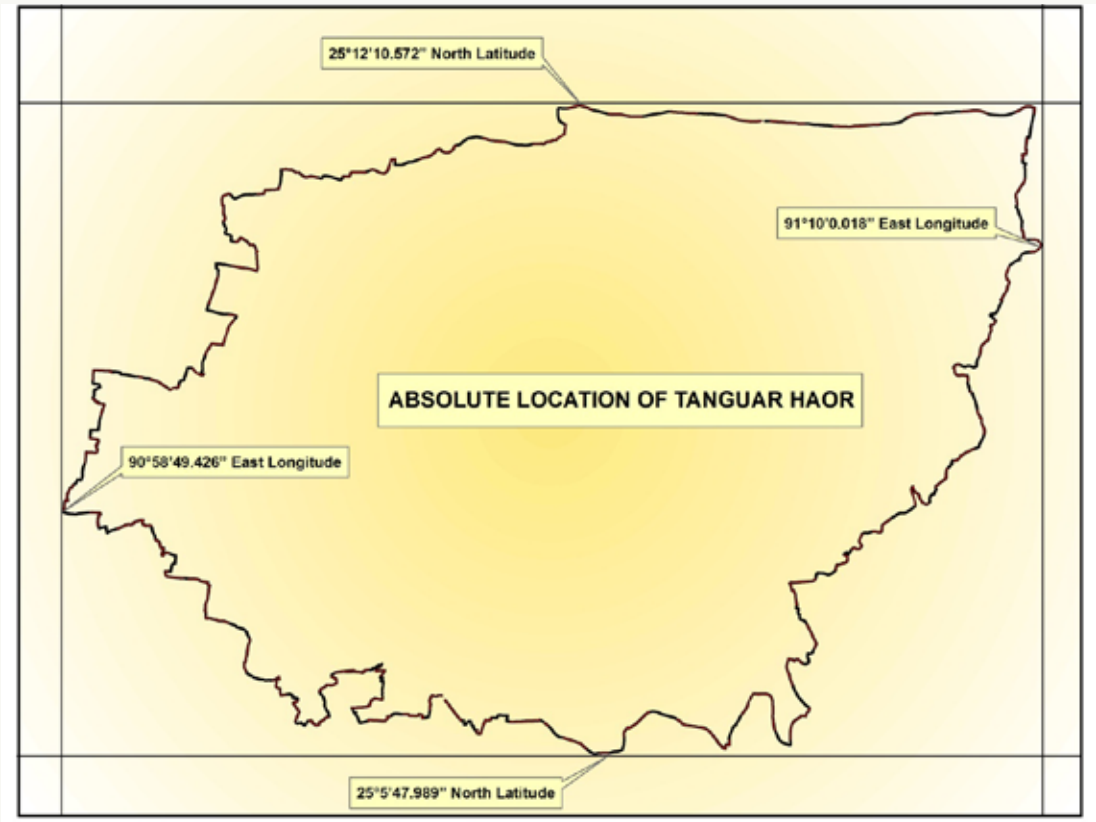


Figure 2.1.1(a): Map of Absolute Geographic Location of Tanguar Haor

Relative Location

Tanguar Haor is located in northwestern part of Sunamganj district of Sylhet division. It shares a border of approximately 17 km with Nongstoin, India in its north. The *haor* is almost 2.5 km away from neighbouring Netrokona district in the west.

Within total area of Tanguar Haor there are two upazilas of Sunamganj district, namely Tahirpur and Dharmapasha and four unions, namely Uttar Bangshikunda, Dakshin Bangshikunda, Uttar Sreepur, and Dakshin Sreepur. Within its geographic boundary Tanguar Haor possesses 88 villages (Figure 2.1.1(b)).

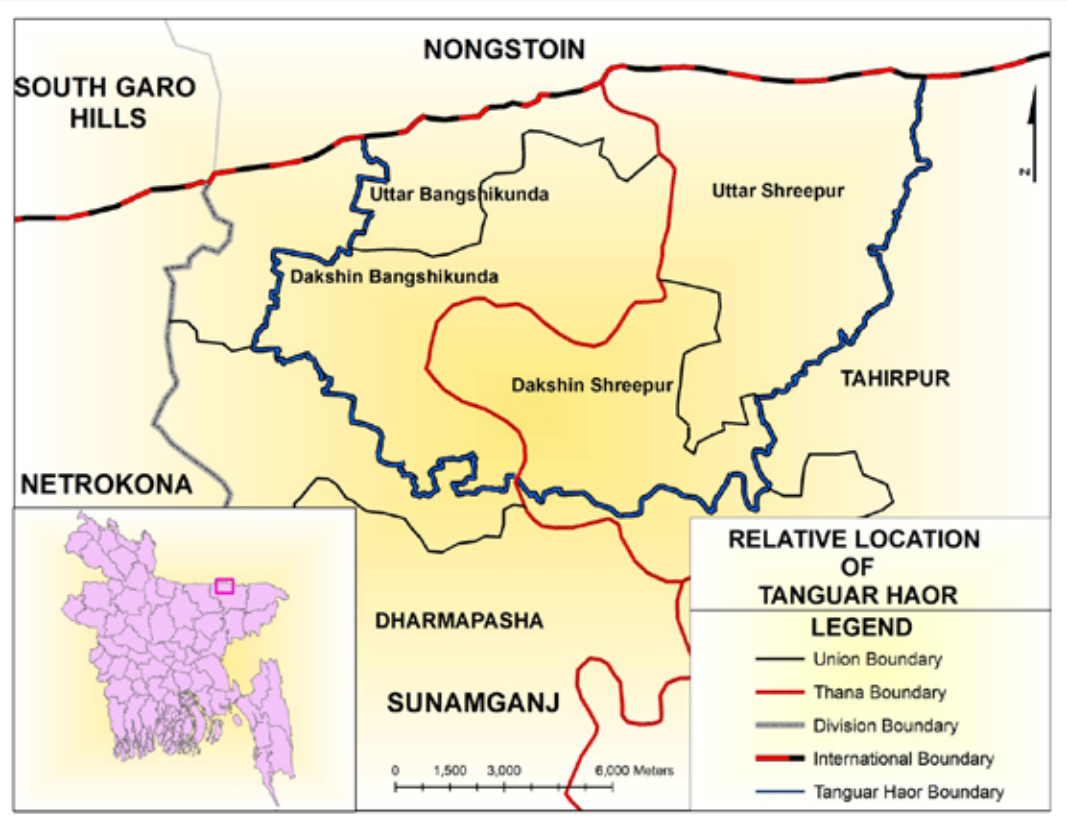


Figure 2.1.1(b): Map of Relative Geographic Location of Tanguar Haor

Physiographic Location

The entire Bangladesh has been divided into three major classes, namely Hills of Pleistocene epoch, terraces, and floodplain. On the basis of physical features, drainage pattern and land levels, Bangladesh has been divided into 55 sub-regions. According to this classification, Tanguar Haor is situated in Meghalaya Piedmont Depression under *haor* basin.

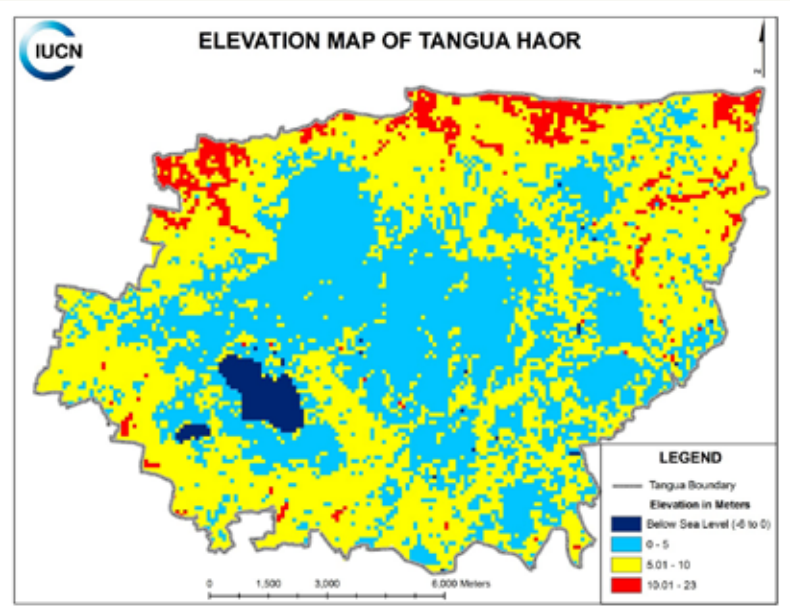


Figure 2.1.1(c): Elevation Map of Tanguar Haor

From the major three classifications, the floodplain division can again be classified into nine classes. The location of Tanguar Haor falls in Surma-Kusiyara floodplain under this sub-classification (Sobhan *et al.,* 2012) (Figure 2.1.1 (c & d)).

Considering bio-ecological zones entire Bangladesh is divided into 25 sub-divisions and Tanguar Haor falls in the division of *haor* basin (Nishat *et al.,* 2002).

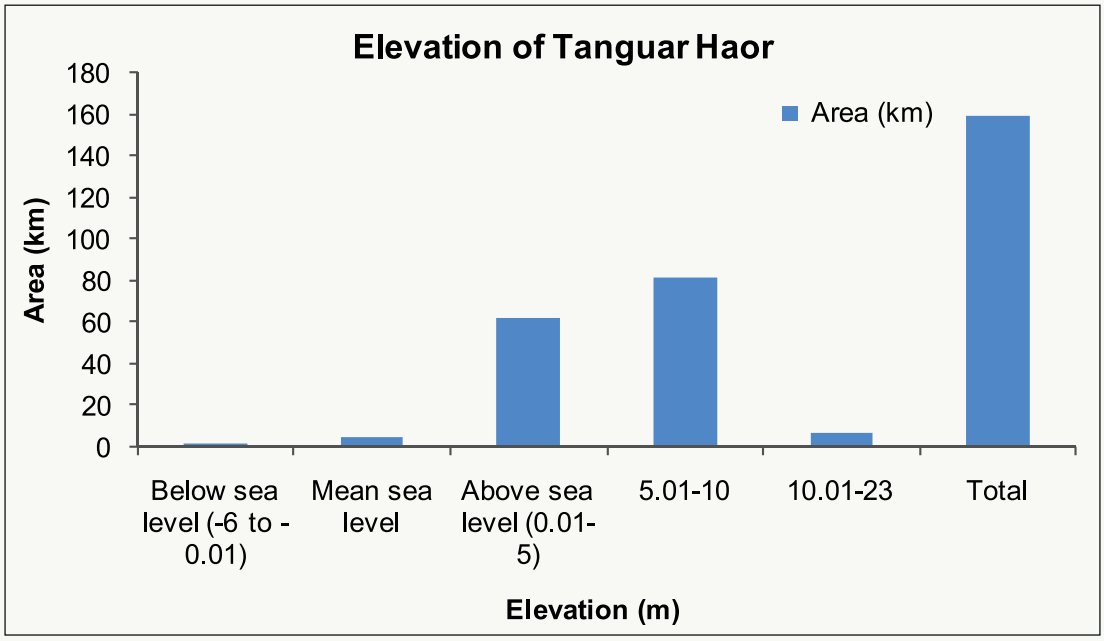


Figure 2.1.1(d): Elevation of Tanguar Haor

2.2 Habitation

Tanguar Haor is a unique habitat for wetland plants, freshwater fish and wetland associated wildlife. It is made up of 54 small, medium and large interconnecting *beels* some of which are perennial and others seasonal. The higher grounds located in between *beels* are locally known as *kanda*. In the rainy season all the *beels* are united as one large lake, or *haor*, making Tanguar Haor one of the largest freshwater wetlands in Bangladesh. Deeper *beels* are connected with rivers in some places but these *beels* are also interlinked with each other which make a unique character of these *beels* elsewhere in the country. Additional information on some important habitation statuses and the status of land ownership mentioned in Table 2.1.


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Table 2.1: Status of land ownership and its distribution in Tanguar Haor area

Distribution of land ownership				
Land category	Area in ha			
	Khash land	Private land	Distributed land from *khash* land	Total
Beel	524.07	4.64	3123.16	3651.87
Reed	163.49	47.25	265.02	475.76
River	348.41	1.01	0	349.42
Fallow land	13.07	0.52	46.54	60.13
Seasonal fallow land	1168.23	3617.21	783.19	5568.63
Cultivated	93.47	3097.34	141.62	3332.43
Seed bed	114.07	141.47	4.76	260.30
Human settlement area	7.30	94.10	1.57	102.97
Khal/Nala/Chara	203.91	1.47	2.33	207.71
Pond/*Doba*	45.16	37.96	0.45	83.57

Source: Sobhan *et al.* (2012)

2.2.1 *Beel*

Beels of Tanguar Haor are unique because of good combination between floral and faunal distribution. There are 54 *beels* (Tanguar Haor Resource Mapping, 2007, CBS & TSP, IUCN) in Tanguar Haor. Among these 16 are perennial. Total area of the *beel* is 3651.87 hectares. Some major *beels* are as follows which will represent the whole Tanguar Haor:

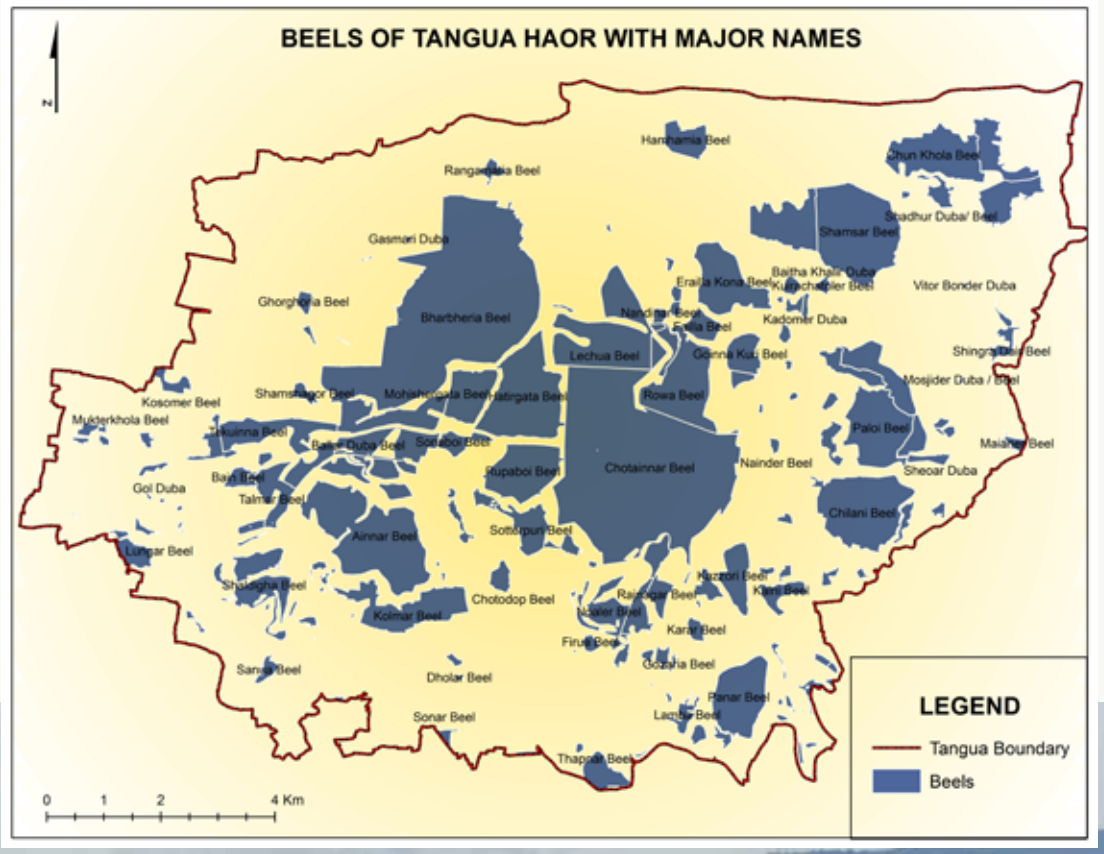

Figure 2.3.1(a): Major *Beels* of Tanguar Haor

Hatirgatha beel

The *beel* is located (25°08'54"N, 91º04'3.8"E) almost in the middle of the Tanguar Haor and north-west of Tahirpur upazila. Its area is 180.20 acres (Gieson, 2000). The *beel* has been declared a micro fish sanctuary and may also be declared as a bird sanctuary (Sobhan *et al.,* 2012).

Major fish species are Rui, Gonia, Boal, Ayre, Gojar, Grass carp, Kalibaush, Catla, Laacho and Mrigel. Rare and globally threatened Baer's Pochard and Baikal Teal are found at this *beel*. The *beel* is home to a few submerged, free-floating and rooted-floating plants which is also a receptive feature for these wetland birds. Newly planted Hijol and Koroch on the banks (locally known as *kanda*) of the *beel* will be an added advantage for the birds and other aquatic wildlife. Gadwalls (51.82%) are found as dominant species of the *beel* and among the other duck species, presence of Tufted duck, Garganey and Eurasian Wigeon in this *beel* is remarkable.

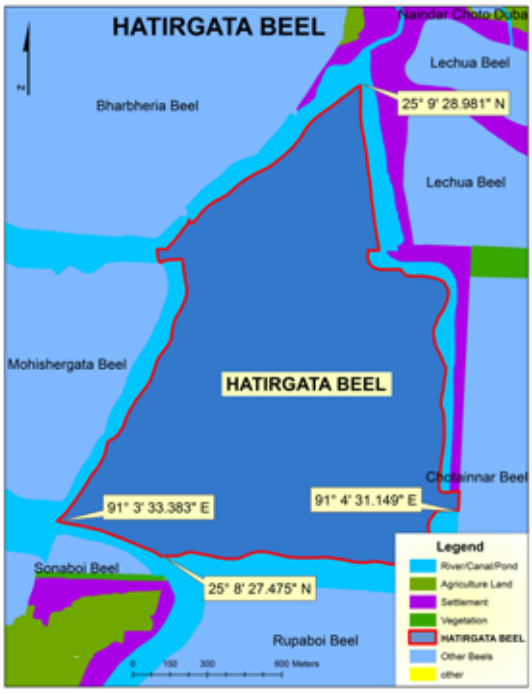

Figure 2.2.1(b): Hatirgatha beel of Tanguar Haor

Lechuamara beel

This *beel* (25°8'33"N, 91º04'23"E) is closely associated with the Hatirgatha beel and also situated in Tahirpur upazila. Its area is 530 acres (Gieson, 2000). This *beel* is a micro fish and bird sanctuary declared by Tanguar Haor project authority. Rui, Catla, Gonia, Ayre, Boal, Gojar, Meni, Foli, Mrigel, and Shol are the major fish species of this *beel*. Appropriate shallowness of water, presence of adequate submerged, free-floating, rooted-floating, sedges and meadows, reed swamps plants along with other phytoplankton and zooplankton. make this *beel* paradise for winter visitors as well as resident waterbirds. The *beel* provides breeding grounds and roosting habitat viz. *kandas* and reed lands with particular vegetation, e.g. Nal, Khagra, Hogla, Chailla ghash, and Binnya, for thousands of ducks, geese and other water-loving bird and wildlife species.

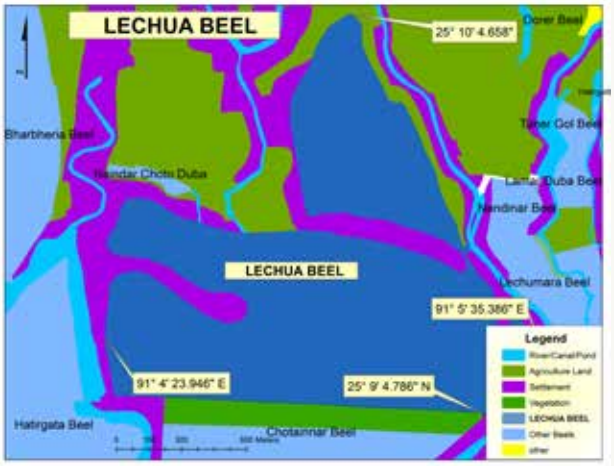

Figure 2.2.1(c): Lechuamara beel of Tanguar Haor

Rupaboi beel

This *beel* (25°8'8.7"N, 91º04'17.2"E) is surrounded by Hatirgatha to the north, to the east by Chotainna canal, to the south by Sotterpuri beel and to the west by a few agricultural lands. It is also in the upazila of Tahirpur. The area of Rupaboi beel is

316.80 acres (Gieson, 2000). It is a micro fish sanctuary. Rupaboi fish sanctuary stands first among the sanctuaries established in Tanguar Haor in terms of availability of Rui fish. Apart from Rui fish, Catla, Gonia, Grass carp, Ayre, Boal, Shol, Gojar, Kalibaush, Laacho, Meni, Foli, and Mrigel are available in this sanctuary (Ahmed, 2013). Nal, Khagra, grasslands and bushy undergrowth makes this *beel* a suitable habitat for water birds. Red-crested Pochard, Spotted Redshank, Great-crested Grebe and Oriental Darter are some rare birds recorded from the *beel* while the survey was conducted by IUCN (2011).

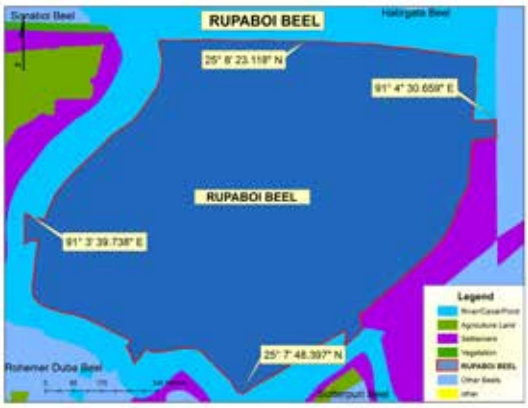

Figure 2.2.1(d): Rupaboi beel of Tanguar Haor

Rowa beel

The geo-position of Rowa beel is 25°8'20.2"N, 91º04'17"E and area is 686.03 acre. It is considered as a micro fish sanctuary, especially famous for Rui fish (next to Rupaboi fish sanctuary). Other fish species are Ghonia, Kalibaush, Gojar, Ayre, Boal, Puti, Pabda, Tengra, and Kakila (Ahmed, 2013). Although the *beel* is not a designated bird sanctuary, but it represents a large number of water birds. Nal, Khagra and other reed swamp vegetation species allow the habitat to be suitable for water birds and other wildlife. Ruff, Common Redshank, Eurasian Coot and Oriental Darter are some rare birds seen in this *beel* (4,222 individual) (Alam *et al.*, 2012).

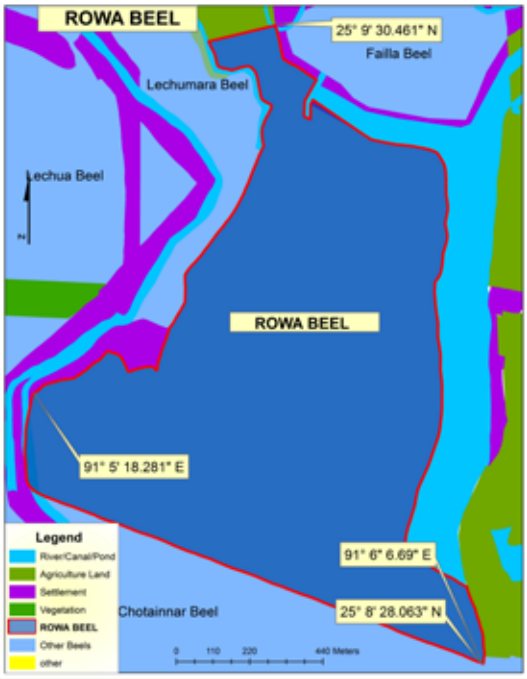

Figure 2.2.1(e): Rowa beel of Tanguar Haor

Ballardubi beel

The *beel* (25°8'12.9"N, 91º05'28"E) is situated partly in both Tahirpur and Dharmapasha upazilas and is connected to Tekunna beel through a channel. The area of this *beel* is 59.55 acres. Major fish species are Rui, Catla, Gonia, Boal, Ayre, Gojar, Grass carp, Kalibaush, Laacho, Meni, Foli, Mrigel, and Shol. It has been also declared as a fish sanctuary.

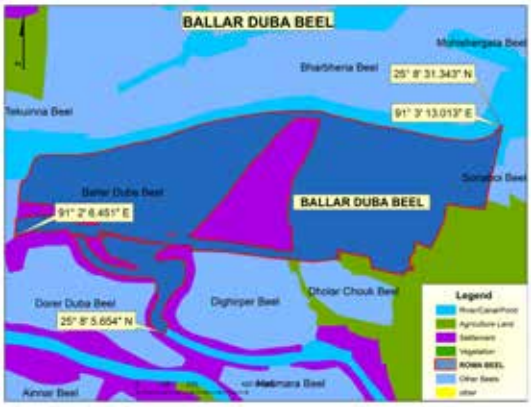

Figure 2.2.1(f): Ballardubi beel of Tanguar Haor

Tekunna beel

This large shallow *beel* (25°8'34.1"N, 91º01'43"E) is situated in Dharmapasha upazila. Area of this *beel* is 88.71 acres. It is a fish sanctuary and directly connected with Ballardubi and Sonadubi beels. Rui, Gonia, Boal, Gojar, Kalibaush, and Mrigel fish species are very common in this *beel*. The *kandas* of Tekunna beel is a suitable roosting and nesting ground for water birds. Different varieties of herbs viz. Khagra (*Phragmites karka*), Binnya (*Vetiveria zizaniodes*) and Chailla ghash existed on the *kanda*, which attracted water birds to nest inside the patch.

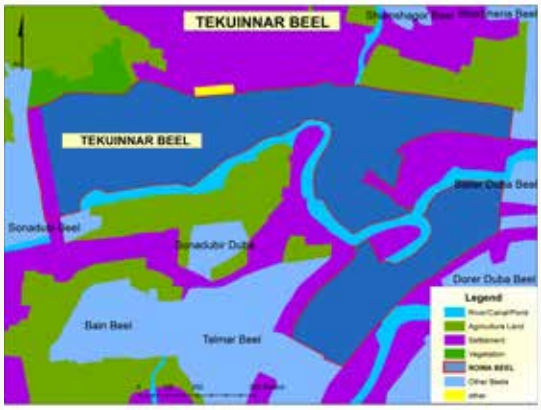

Figure 2.2.1(g): Tekunna beel of Tanguar Haor

Annar beel

This *beel* (25º07.384´N, 91º02.029´E) is connected with Tekunna beel through a narrow strip like canal. It is also situated in Dharmapasha upazila. The *beel* is covered by 245.89 acres. Gonia, Rui, Ayre, Boal, Gojar, Grass carp, Kalibaush, Mrigel, and Shol fish species are very common in this *beel*. The *beel* supports few submerged, free-floating and rooted-floating plants, which attract ducks, egrets, herons, etc. The surrounding *kandas* of this *beel* provide some nesting and roosting amenities for a few waders and other grassbirds.

Berberia beel

This *beel* (25°9′15″N, 91º03′37.3″E) is a bird

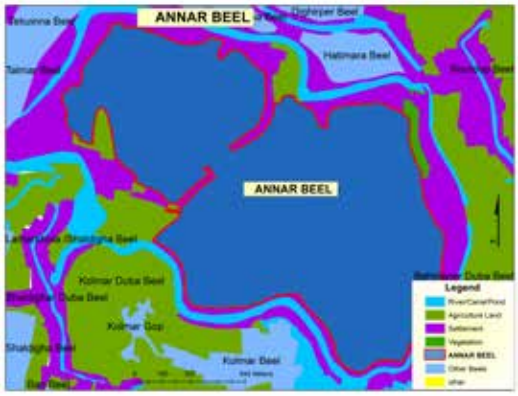

Figure 2.2.1(h): Annar beel of Tanguar Haor

sanctuary declared by the CBSMTH project. It is located partly at Tahirpur and Dharmapasha upazilas. Its area is 771.20 acres. This *beel* is declared as micro fish sanctuary. Available fish species are Gonia, Rui, Catla, Shol, Ayre, Boal, Gojar, Grass carp, and Mrigel. It is also an excellent site for fish spawning too. Jhaji, Pata sheola, Kochuripana, Khudipana, Shingara, Panchuli, Joina, Shada shapla, Chandmala, and Ichadal make this *beel* a unique habitat for water birds, frogs and other wildlife. The *beel* has the desirable depth for dabbling ducks like Eurasian wigeon, Gadwall, Mallard and Northern Shoveler. This is an ideal habitat for the migratory waterfowl. Among the rare sightings from this *beel* is the significant presence of Falcated Duck and Common Pochard.

2.2.2 Kanda

Beels of Tanguar Haor retain water throughout the year. Intermediate place between the *haor* basin and homestead land are called *kanda*. There are about 180 *kandas* in Tanguar Haor. These *kandas* support the major plant communities during dry months. At the onset of monsoon or floods, all these *kandas* go under water transforming the entire wetland into a single water body changing the whole scenario. The depth of flooding during monsoon ranging from 2 to 10 meters depending on the ground elevation. Usually reed swamp plants are found in these *kandas*.

Kanda is fairly flooded during the rainy season and dries out during the dry season. There are many *kandas* in the Tanguar Haor area which are *khas* land. Although some agricultural practices are done, but *kandas* mainly work as grazing land for cows, buffaloes, birds and also fish to breed once they start getting submerged.

The major *kandas* of Tanguar Haor are Lechuamara, Rupaboi, Rowa beel, interconnected *kanda*, Ballardubi beel *kanda*, Tekunna and Annar beel *kanda*, Hatirghatha beel *kanda* and Berberia beel *kanda*.

2.2.3 River

Tanguar Haor is in the north-eastern part of Bangladesh, adjacent to the Indian border, and is part of a wetland/floodplain complex of the Meghna and Surma River basin. These two rivers are among the main tributaries of the Meghna River. This site is also influenced by Dhanu, Baulai and Jadukata Rivers. Meghalayan Hills are in the north from where a number of hill streams flow into the *haor*. Other important *haors* like Matian, Shanir and Gurmar are very closely and have some dependency and connectivity with some degree of variation. Total river area within the Tanguar Haor is 359.39 ha (Figure 2.2.3).

2.2.4 Canal/*Khal*

About 44 narrow water canals slope down to the Tanguar Haor from Indian Territory and 30% of these have constant flow throughout the year while rest only remain alive in the monsoon. These hill streams (narrow canals and rivers) bring in huge sediment to the *beels* and adjacent upland (villages).

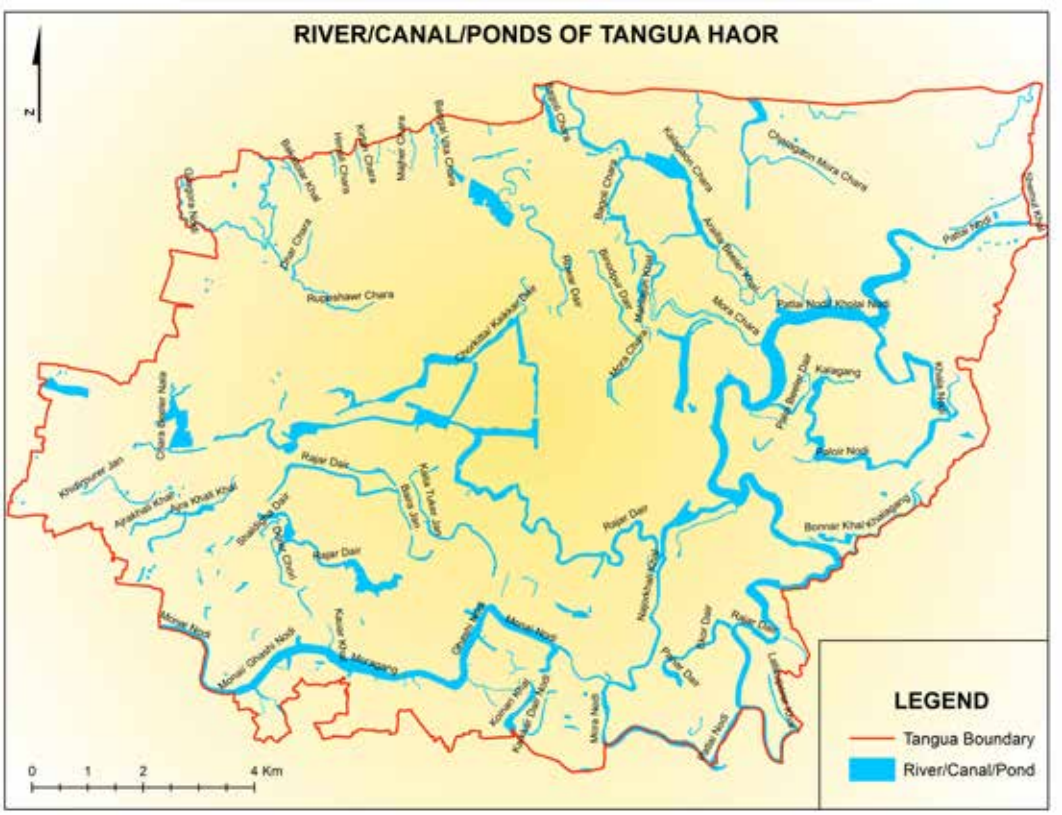

Figure 2.2.3: Map of Rivers/Canals/Ponds of Tanguar Haor

Chattainna Canal

This canal is located (25°8'22.3"N, 91º05'12.3"E) at Tahirpur upazila and is directly connected to Rupaboi beel. Area covered by 177.80 acres. Rui, Gonia, Ayre, Boal, Gojar, Grass carp, Meni, and Foli are the most common fish species in this canal. Reed swamps, Nal, Khagra, Dholkalmi, Phutki and other herbs/shrubs are seen to have existed on both sides of the canal, which supports a number of rare birds like Ruddy-breasted Crake, Indian Spot-billed Duck and other wildlife. Presence of rare Glossy ibis has attracted focus on this canal. A big Koroch forest patch was observed at the Joypur village end adjacent to this canal.

2.3 Climatic Feature

The climatic condition of Tanguar Haor is sub-tropical monsoon with three dominating seasons, summer, monsoon and winter. Average annual rainfall is about 4,196 mm in the northern part of Sunamganj with 65-69 % of the total rainfall occurs in the summer. Evaporation enhances rainfall during the spring causing flash floods in Tanguar Haor. Summer starts from the month of April to June with the temperature ranging from 30.9 ~ 33.4°C, monsoon from May to September and winter from October to February where the temperature ranges from 8.5 ~ 16.6ºC. Humidity is about 83% in wet season and 64% in dry season. Climatic data (Rainfall, Evaporation and Temperature) for the following Bangladesh Meteorological Departments (BMD) meteorological stations have been collected for this study (Table 2.2).

2.3.1 Rainfall

The north-eastern part of Bangladesh experiences higher rainfall than other parts of the country due to its physiographic features. Total number of rainy days in Sylhet is less than that of Sunamganj with higher annual normal rainfall (4,195.9 mm in Sylhet, 5,990.3 mm in Sunamganj). More than 80% of annual total rainfall occurs during the May to October period in both Sylhet and Sunamganj area. The rainfall distributions in March to October, April to October and May to October for Sylhet and Sunamganj stations show similar percentages (Table 2.3).

Table 2.2: Rainfall, evaporation and temperature stations with periods of records

Data Type	Station No. (Name)	District	Periods of Records
Rainfall	CL 121 (Mohanganj)	Netrokona	1980-2006
	CL 127 (Sunamganj)	Sunamganj	1980-2008
	CL 49 (Laurergarh)	Sunamganj	1996-2010
	CL 124 (Pagla)	Sunamganj	1980-2004
	CL 123 (Netrokona)	Netrokona	2007-2011
Evaporation	CL 127 (Sunamganj)	Sunamganj	2007-2010
	CL --- (Sreemongal)		
Temperature	Sylhet	Sylhet	1981-2010

Source: BMD & BWMD (2010)

According to the rainfall analysis, highest rainfall occurs in the months from June to August occurring at Laurerghar (CL 49), Sunamganj (CL 127) and Mohanganj (CL 121) stations [Figure 2.3.1 (a,b,c)]. Highest average rainfall (1242.47 mm in August) was found at the Laurerghar station. The Mohanganj station shows peak during the months of June and July with a sudden rise in the months of August and September. Sunamganj station records show general trend of rainfall distribution similar to the other parts of the country.


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Table 2.3: Average Normal Rainfall (mm) at Sylhet and Sunamganj

Month	Sylhet	Sunamganj
	Amount of Rainfall (mm)	Amount of Rainfall (mm)
January	9.40	18.47
February	36.20	42.15
March	155.30	121.34
April	375.60	358.14
May	569.60	643.80
June	818.40	1015.13
July	819.20	1421.70
August	612.60	1184.17
September	535.90	885.40
October	223.90	274.15
November	30.40	22.53
December	9.40	13.32
Annual Total	4195.90	5990.30

Source: BMD & BWMD (2010)

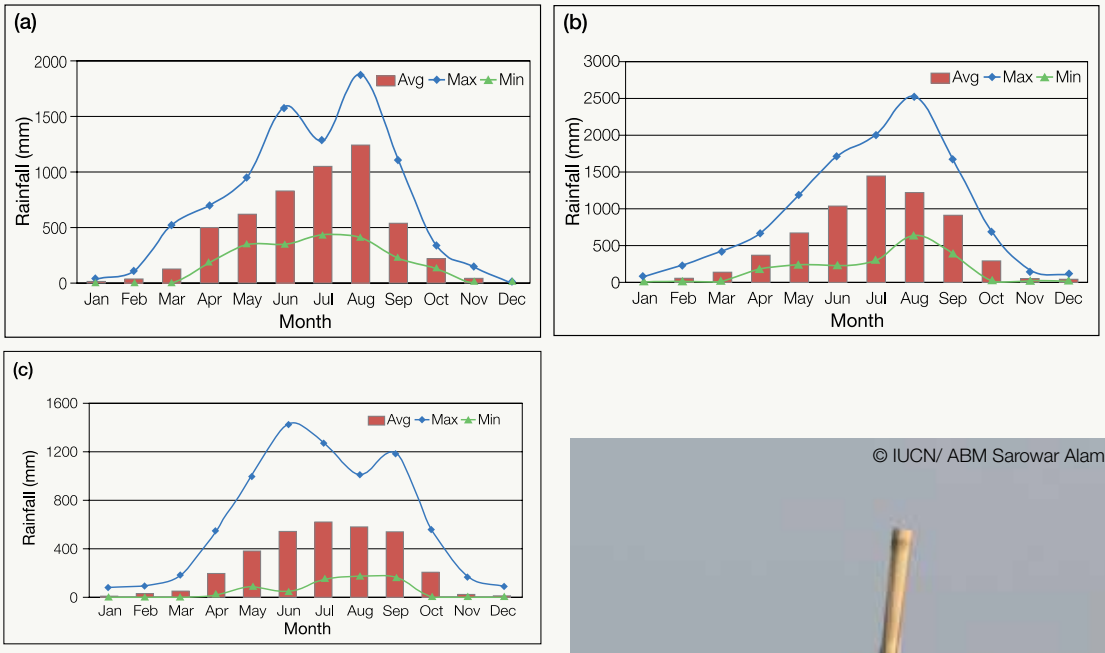


Figure 2.3.1 (a, b & c): Monthly, maximum and average total rainfall (mm) at (a) Laurerghar (CL 49), (b) Sunamganj (CL 127) and (c) Mohanganj (CL 121) stations from 1980 to 2008

2.3.2 Evaporation

Balance amongst rainfall, temperature and evaporation maintains the hydro-meteorological system in Tanguar Haor area. Evaporation from open water and transpiration from vegetation are functions of solar radiation, temperature, wind speed, humidity and atmospheric pressure, characteristics of the surrounding environment, and type and condition of vegetation. Monthly distributions of evaporation for Sunamganj shows average monthly evaporation of about 522.19 mm. Highest monthly evaporation at Sunamganj station has been observed during the months of March to June and lowest during the months from December to February (Figure 2.3.2a).

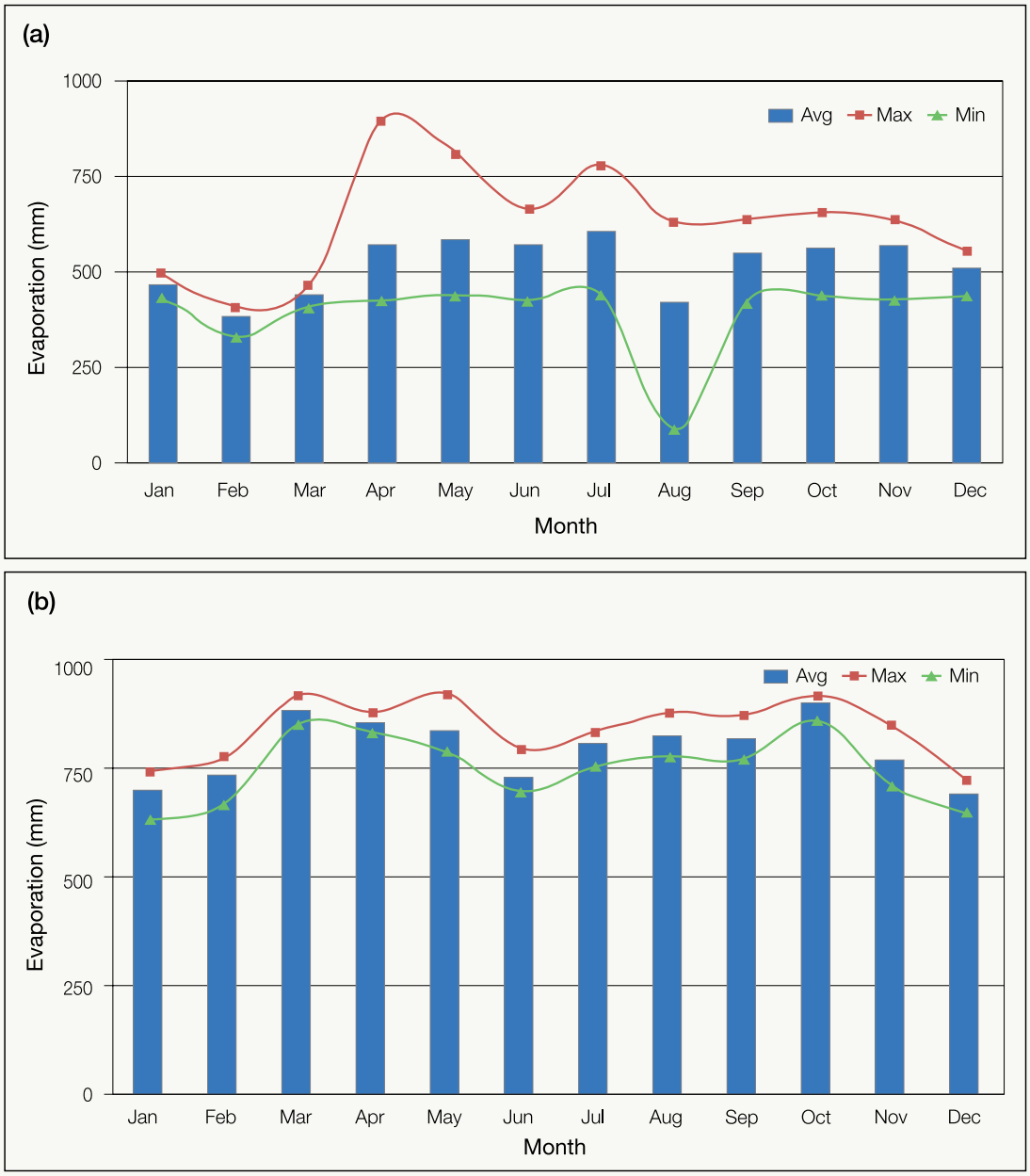


Figure 2.3.2 (a, b): Monthly average evaporation (mm) at (a) Sunamganj (CL 127) and (b) Netrokona (CL 123) Station from 2007 to 2010

Monthly average evaporation at Netrokona station (CL 123) shows the similar pattern as the Sunamganj station. The evaporation ranges from 647.19 ~ 940.73 mm with an average monthly evaporation of about 812.29 mm from the year 2007 to 2010 (Figure 2.3.2b).

2.3.3 Temperature

Temperature is an important meteorological parameter for maintaining ecological balance in Tanguar Haor. The Sylhet area has been experiencing temperature range from 9.68 ~ 35.7°C (from January to December).

According to the historical monthly maximum and minimum temperature analysis (from 1981 to 2010), maximum temperature occurs in the month of March-April while minimum temperature occurs in December and January (Figure 2.3.3).

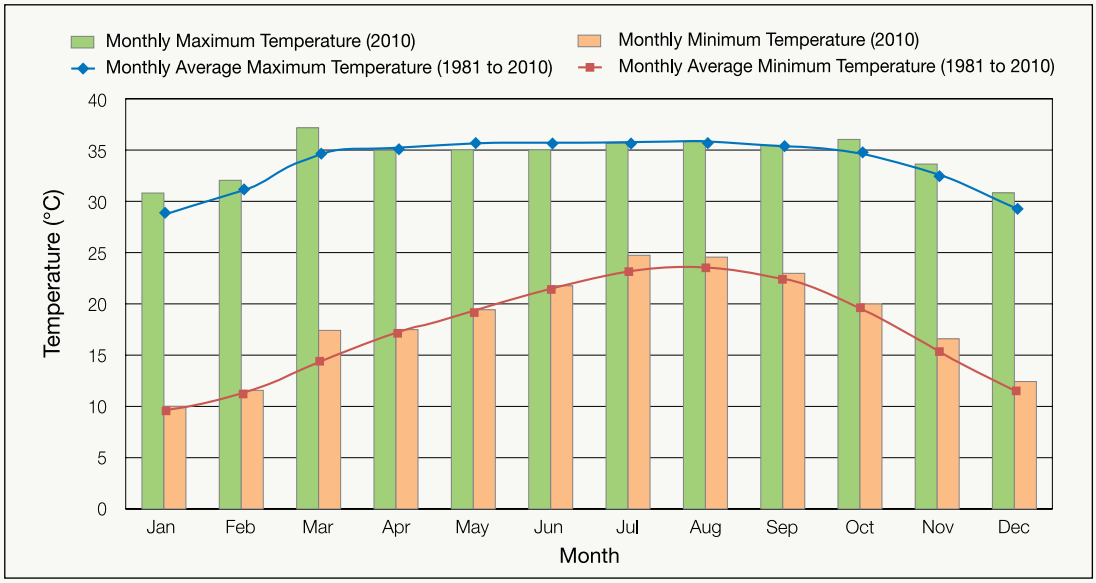


Figure 2.3.3: Maximum and minimum temperature (°C) at Sylhet station from 1981 to 2010

Chapter 3
Biodiversity Assessment Methods

Biodiversity is a broad term and commonly defined through three different components: intraspecific genes (genetic diversity), interspecific species (species diversity) and ecosystems (ecological diversity) (UNEP, 2003). Each of these have structural, compositional, and functional attributes. Identifying, measuring and monitoring of these are complex. To overcome this problem national and international initiatives are needed to identify simplified and significant methodologies of biodiversity assessment. During the study in Tanguar Haor, with special emphasis to species diversity, three main rationales were identified for biodiversity assessment, are as follows:

- Firstly, conducting biodiversity surveys for establishing inventories;
- Secondly, to conduct a gap analysis in our knowledge pertaining to Tanguar Haor; and
- Thirdly, for monitoring biodiversity changes.

A survey of biodiversity has been conducted in the major sites of Tanguar Haor. Different methodologies were undertaken to study faunal diversity (birds, mammals, amphibians, reptiles & fishes) and also for floral diversity (Alam *et al*., 2012; Sobhan *et al.,* 2012) Collection of data was based on the direct observation of the faunal and floral diversity in the field. Further interviews with local people were taken to gather information regarding past records of fishes, some birds and other wildlife.

3.1 Study Sites

According to the statistics of Government of Bangladesh 54 *beels* occupy the *haor*, out of which major 12 *beels* were selected through a random primary assessment that involves identification of fish sanctuaries (e.g. Rupaboi and Rowa), no fishing zone, fishing zone, bird sanctuaries (e.g. Berberia and Lechuamara), which represent the whole scenario of Tanguar Haor. The selected *beels* were Hatirgatha, Lechuamara, Rupaboi, Rowa, Ballardubi, Tekunna, Bagmara, Chatainna, Berberia, Anna-paglakona and Kolma are the major *beels* of Tanguar Haor. The survey also includes some terrestrial grounds of Indrapur, Birendranagar, Ratanpur, Binodpur, Paniakhali, Rupnagar, Bakatola, Banglavita, Lamagaon, Noagaon and Rongchi. The flow chart (Figure 3.1) summarizes the approach and methodologies for this assignment shows the study areas where the survey was conducted on flora and wildlife.

3.2 Fish Survey Methods

Literature review

An extensive review of literature mainly CBSMTH project reports, commercial and non-commercial fishing reports, etc. was carried out to understand the sustainable yield, fish production, fish harvest, fishing gear, fish sanctuary, etc. in Tanguar Haor.

Focus Group Discussion

Focus group discussions and questionnaire survey were carried out to understand past and recent years fish resources, and the quantity of different fishes collected in fish landing centres of Tanguar Haor area.

1. Review commercial fish harvest and data collection and development of framework section (including laps/ gaps if any) of fisheries and reeds.
2. Review non-commercial fish harvest and data collection and development of framework section (including laps/ gaps if any) of fisheries and reeds.
3. Review illegal fish harvest and data collection and development of framework section of fisheries and reeds.
4. Review fish harvest status and prescribe harvest limit of fish species (mainly based on local knowledge) and data collection and development of framework section.
5. Field trial/test of the community-led data collection (blending comfortable and workable approach: technical and social convenience).

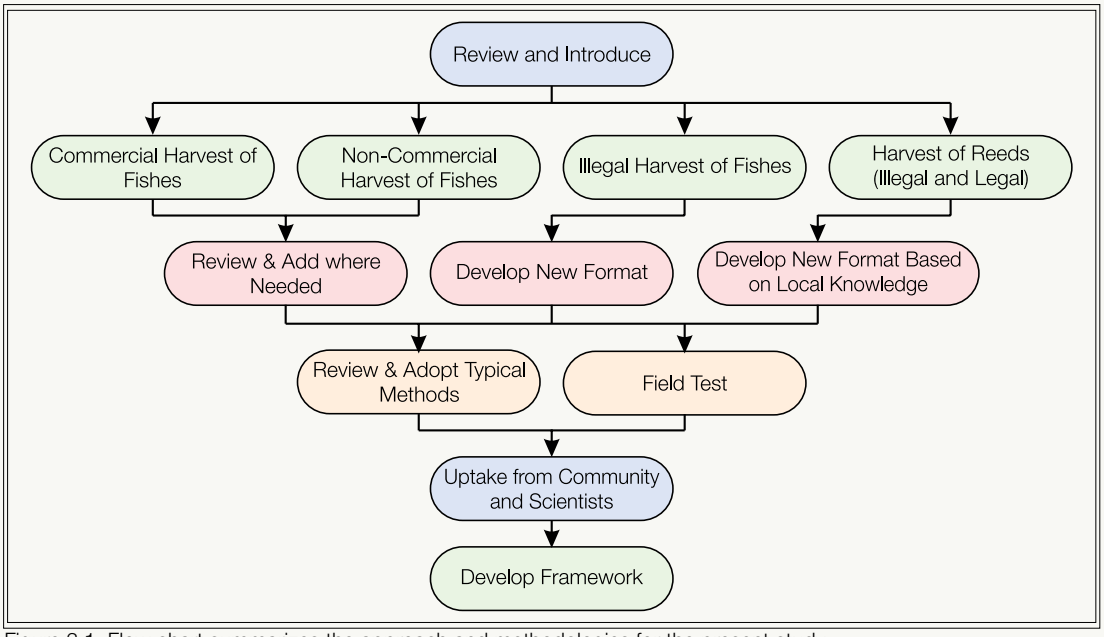


Figure 3.1: Flow chart summarizes the approach and methodologies for the present study

Present Status of Fish in Tanguar Haor

A checklist was developed during the project period for identifying the diversity of fish species in Tanguar Haor. This checklist was based on a general assessment of fish presence in all *beels* of Tanguar Haor. The abundance, distribution and habitat utilization of fish species within a water body in Tanguar Haor has been used to categorize those into mainly four groups: vulnerable, endangered, critically endangered and not threatened. The indigenous, exotic and newly introduced species which are either not listed or data deficient in the Red List of IUCN 2000 have also been included into fish categories. The number of fish species under each category is shown in this book (in percentage) out of the total fish population in Tanguar Haor. Different fish species status particularly the target species status has been identified in this study. Furthermore, TARA's report based on fish resource studies in the Tanguar Haor produced in 2011, 2013 and 2015 has been extensively considered for this study for analysis of fish status in this *haor*.

Estimation of Fish Stock and SYL

Stock is how much fish is available usually per year and thus simply fish stock is how much harvested plus how much used by other organisms plus how much go for un-authorized fishing and how much remain in the *beel* after catching. Thus, simply fish stock is following equation.

Fish stock= Catch + Mortality + Non-catch fish

During the project period, assessment of fish stock in Tanguar Haor has been conducted on basis of measuring the quantity of fish harvested officially and legally, caught for subsistence, fish used by other organisms, natural and hazardous deaths, outgoing migration imbalance (if any) in different seasons. Quantity of fish species were recorded during 'Commercial Fish Harvesting', from January to April when the local fishermen catch fishes in core zone of *beels*, which mainly cover all perennial *beels* of Tanguar Haor. A tally sheet was used by the community enumerators who later converted data into a fish information collection form as per variety and grade (weight range) of

fish species. Data was also collected during 'Non-commercial Fish Harvesting,' in the wet season except the three months ban period *Baishak*, *Jyasthya* and *Aashar* (from mid April to mid July). Besides, fish stock of Tanguar Haor was estimated from the harvesting data of commercial fishing during December–March. Assessment for the quantity of un-authorized fishes was done during field visit to specific spots in Tanguar Haor area. The *haor* patrolling groups (Community Guard and Ansar under the supervision of an Executive Magistrate) of Tanguar Haor provided support to measure the quantity of seized fishes, as harvested illegally.

Sustainable Yield Level (SYL) is an estimation —out of the "stock" what proportion and which way can be harvested that would not affect sustainability of resources by regenerating the depletion. This is in general which would vary with category/group of species based on state of the balance of recruitment and harvest/depletion. Fish harvest level may be as high as 60% for local and maximum 30% for non-local breeder fish. However, for small fish group SYL may be considered 50% or even 60% as recruitment is mainly from the Tanguar Haor area and lot of small fish's juveniles also enter to this *haor* from the adjoining areas. The overall SYL (first level) that is estimated for Tanguar Haor is based on scientific method with reference. However, further estimations on individual aspects are conceptual basis and not necessarily on first level and based on experts judgments.

Estimated SYL is about within 50% of the Stock
Stock is the authorized, un-authorized fishing, fish use by other organisms and fish which could not be harvested

Fish Sanctuaries Establishment

Considering conservation issues of Tanguar Haor, a total of five fish sanctuaries were established in 2011 under the 'Community Based Sustainable Management of Tanguar Haor Project, Phase-II'. Out of these sanctuaries, four sanctuaries were in four *beels* and another one at Alamer Duar of the Patlai River. These sanctuaries were designed based on field experiences of different projects in different wetlands including under the earlier phase of this project (TARA's report, 2013 research conducted in the Tanguar Haor). As part of sanctuary design, an integrated conservation approach was followed to cover:

- 60 percent of dry season area of deep *beels,*
- In between two ridges/*kandas,* sanctuary cover gradual slope (shore to middle concept),
- Rupaboi was considered for Rui fish,
- Rowa was considered for Ghonia and Carps,
- Tekuinna for Catfish, and
- Alamer Duar for Chital fish.

During that time, the interlinking (*beel* to *beel*) canals were identified and proposed for conservation. These fish sanctuaries were mainly constructed in the deeper water areas of the selected *beels*, as large number of fingerlings and other fish species is known to congregate in these sections of the water bodies for breeding. The declared sanctuaries were marked through indigenous structural devices using bamboo and tree branches (Hijol) which create a convenient artificial habitat during the dry season and also serve to protect a high diversity of fish species as well as provide more spawning areas for many fish species. Impact information of established sanctuaries was collected from project staff, fishermen, local people and committee representatives.

Out of five existing fish sanctuaries of Tanguar Haor, the Rowa beel Fish Sanctuary has been selected for Advance Fish Sanctuary. Design of the Advance Fish Sanctuary is given as follows:

Middle to shore, linkage with ecotone and adjoining *kanda* environment, Conservation *Katha* (CK), CK Frame, CK Materials, Placement of CK Materials, Predator Prevention Device (PPD), Wave Breaker, Markings: Improved signboard, Pena flex flags, and floating signboards.

Use of Different Fishing Gears and Fish Harvesting Systems

For all kinds of fish harvesting in Tanguar Haor, community fishermen use different gears in different *beels*. The use of different gears is subject to diversity of fish species, number of fishermen, size & water depth of *beels*. During project period, a series of consultations were held with the community people of Tanguar Haor to identify various types of gears locally used there for harvesting of fishes. Particularly, the local fishers' community took part in Focus Group Discussion (FGD) and contributed to find the measurement (height, breadth, wide & mesh size) of different gears which are presented in this book. Information was also collected from different fishing spots during fish harvesting in Tanguar Haor. Besides, District Fisheries Officer (DFO) Sunamganj and CBSMTH Project office provided support for categorizing gears. Most of the photographs were taken at the time of using fishing gears.

Commercial Fish Harvesting System

To conduct commercial fish harvesting under the CBSMTH project since 2009, facilitated a temporary camp is set usually from January to April at the Hatirgatha *kanda*. The fishing camp is jointly managed by the local administration, community organization and project management. Only the community fisherman either individually or in a group can participate in commercial fish harvesting. Before that, the interested fishermen from different villages of Tanguar Haor need to receive permit with mentioning specific gears; e.g. Chowhanda or Garojal/Chackjal, as issued by the Deputy Commissioner (DC) of Sunamganj. Following an annual fishermen gathering programme, community fishermen start fish harvesting in different *beels* under core zone but except the sanctuaries.
The grade-wise fish price and vendor are previously selected through a tender process, as conducted by the DC office of Sunamganj. At the presence of community leaders, project officials and local administration official different species of the harvested fishes are weighted separately (grade-wise) by another community group called (Lion Force). The sold value is distributed among three stakeholders - Community fishermen 40%, Tanguar Haor Somaj Bhittik Soho-beyabostapona Society 36% and Government treasury 24% - as per government gazette notification of benefit-sharing mechanism.

Non-commercial Fish Harvesting System

Non-commercial fish harvesting continues over the year, i) wet season and ii) dry season. According to this system, a fisherman needs to buy a seasonal license/permit at a cost of Taka 300 – 500 (US$ 1 = 78 Taka) depending upon the type of fishing gear/trap. This license allows 2-3 persons (depending on gear type) to enter into *haor* with a boat. Each of them needs to pay Taka 50-100 (depending on gear type) every month to catch fish in the sustainable use zone. The community fishermen of Tanguar Haor usually catch small fishes in wet season using Lar borsi and Burchunga chai (trap). In dry season (November to March) they harvest fish using *beel*-based chai and Daitta borsi (hook). The CBSMTH Project introduced Remote *Beel* Fishing in 2012. But this competitive system of fishermen selection did not bring the equal benefit for the poor fishermen. Therefore, the project designed an integrated harvesting modality that brought 40 remote *beels* under the buffer zone. A modality for buffer zone fish harvesting has already been developed which allows community fishermen to use some selective gears like Chowhanda, Chai

(trap), Garojal for specific *beels* considering geographical location & water depth of *beels* as well as diversity of fish species. Three different committees are working for the management and supervision of buffer zone fish harvesting in Tanguar Haor. These iii are a) One buffer zone fishing management committee, b) Four buffer zones fishing monitoring committees at union level (for four unions), and c) Community watch group at *beel* base (as much as required). Seventy-six percent of the earned money from buffer zone fishing goes to Tanguar Haor Society central committee fund while the rest 24% is deposited into the government treasury.

Traditional Fish Harvesting Method

At the end of commercial fish harvesting, group/s of community fishermen, who sit in a meeting in the beginning of fishing activities, go for fishing in some *beels* (usually deeper portion of the core zone *beels*) of Tanguar Haor by piling *kathas*. Normally 8-12 fishermen participate in *katha* fishing while headed by a leader. Firstly, few spots of the selected *beels* are selected by the fishermen. Prior to fishing the fishermen set some bamboos and put water hyacinths in the selected spot for some days. They encircle the harvesting ground with the nylon net before fishing. On the fishing day, fishermen set Seine net (locally called Kona/Bel Jal) in the encircled area. They gradually pull the lower and upper part of the net from all sides; enclose the both parts of the net and catch the fished got trapped in the net. This local technique thus helps to aggregate fish into the specific area by creating shelters. Though *katha* fishing is different, the harvested fishes are recorded with commercial harvesting. A modality has already been developed which ensures *katha* fishing in Tanguar Haor at the sustainable level. However, leader of each fishermen group from some particular villages of the *haor* were interviewed in order to gather information about the technique and background of (traditional value) *katha* fish harvesting.

Fish Value Chain Assessment

During project period, a study has been conducted on assessment of the fish value chain and its' market extension in Tanguar Haor. The value chain assessment was done following three steps: i) secondary information collection, ii) rapid assessment, and iii) data analysis and reporting. In this study, secondary information about fish resources of Bangladesh was collected from different printed and electronic sources.

Three sets of questionnaires were developed for different market actors: one for the producer, one for buyer (different level buyer/ trader), and one for the input seller. Primary research was conducted in two phases. First, interviews were conducted in different locations. Different types of actors were interviewed such as producers like *beel* lease owners, fishermen, and buyer (including local level mobile collector, wholesaler, exporter and retailer).

Focus group discussions were made with 15 fishermen groups and one input producer (gui-a type of bamboo made fish trap) group. Besides, several interviews based on semi-structured questionnaire were conducted with two local level mobile buyers (locally called *Bepari*), three *Aratdar*, (buyers at fixed place), and three input sellers. Moreover, seven Key Informant Interviews (KII) were conducted for cross-checking and verification of the information. In addition, visits were made to fish markets/fish landing stations of Tahirpur upazila, Dharmpasha upazila, Sunamganj district, and Mohanganj upazila to collect complementary information and to validate the information given by the local fishermen and traders. Finally, an interview was done with the Euro Food who involved in exporting fish to the UK and the USA.

Besides fish resources, flora and wildlife both are considered as cardinal and pervasive components of biodiversity in Tanguar Haor.

In this chapter, a compendium of flora and wildlife survey methods are delineated, moreover, it was expatiated on IUCN's Publication (2012) – Biodiversity of Tanguar Haor: A Ramsar Site of Bangladesh, Volume I: Wildlife (Amphibians, Reptiles, Birds and Mammals) and Volume II: Flora.

3.3 Floral Survey Methods

Vegetation analysis of a particular area needs several things. First of all, observation of the floristic composition of the area is necessary. Then data should be collected for the determination of the quantitative analysis of the diversity. For the total species documentation field screening is required. Random sampling is the best for the reliable result, but it does not always work well. Total random sampling may not represent the diversity.

3.3.1 Determination Survey Method

There are two common methods which usually used for the vegetation survey. They are:
1. Quadrate method, and
2. Line transects method.

Application of the method depends of the research area. Quadrate method is the most applied method for the collection of quantitative data for vegetation analysis. We selected quadrate method for the analysis because it covered most of the species. Generally the line transects method was used for the vegetation analysis of sloppy area of hilly regions.

3.3.2 Determining Size of Quadrate

The number of species obtained per quadrate is plotted against the size of the quadrate as follows. This curve is known as species-area curve. It is seen that the number of species recorded in 1x1m quadrate is same as 4x4m and also with 6x6m quadrate. The species recorded in .5x.5m quadrate is less than 1x1m. This indicates that the optimum size for the survey is 1x1m quadrate, which will be economical as well.

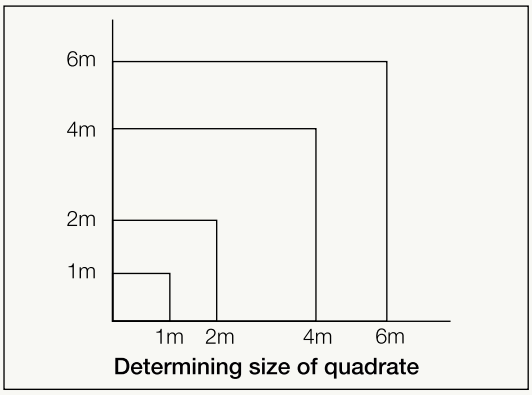


Figure 3.2: Determining size of Quadrate in flora study

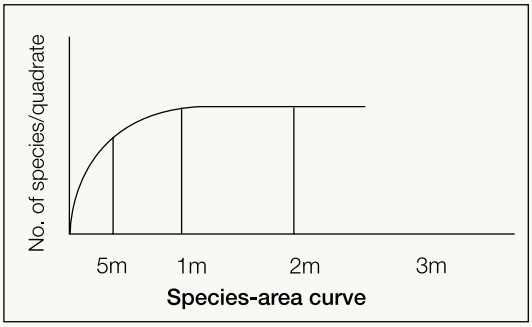


Figure 3.3: Species – area curve for study of flora

Analysis of Data

$$\text{Density} = \frac{\text{Total number of individuals in all quadrates}}{\text{Total number of quadrate studied}}$$

$$\text{Frequency} = \frac{\text{Number of quadrate in which species occurred}}{\text{Total number of quadrate studied}} \times 100$$

$$\text{Abundance} = \frac{\text{Total number of individuals of species in all quadrates}}{\text{Total number of quadrate in which the species occurred}} \times 100$$

There are two methods for the determination of the diversity index of the species of the study area. These are

1. Shannon-Wiener index (H) =

$$-\Sigma Pi \log_n Pi$$

2. Simpson Index =

$$D = \frac{\Sigma n\,(n-1)}{N\,(N-1)}$$

n = the total number of organisms of a particular species
N = the total number of organisms of all species

Simpson's Index of Diversity = 1 – D

The value of this index also ranges between 0 and 1, but now, the greater the value, the greater the sample diversity. This makes more sense. In this case, the index represents the probability that two individuals randomly selected from a sample will belong to different species.

3.4 Wildlife Survey Methodology

The survey was focused primarily on waterfowls. In addition, other species of amphibians, reptiles and mammals were also surveyed during the field visits.

3.4.1 Mammal Survey Methods

Transect line
Transect line (1 km) has been used during the survey of mammals, as strip transect sampling (Buckland *et al.,* 2001) is the most suitable to estimate the population status and relative abundance of wildlife. Observation of all individuals at the line and estimation of the proportion has been completed.

In this method the observer(s) slowly walks on a relatively straight line through the study area and counts the objects from both sides. For Tanguar Haor, boat surveys were conducted on the *beels*, *kandas* and some terrestrial areas. The initial location of the object is always needed to be considered, as the object might move after watching the observer(s). If any object is observed beyond the pre-decided observation-range, or if the object is coming from the back (in order to avoid duplication), the observation was not recorded.

Focus Group Discussion
Focus group discussion was carried out through questionnaire surveys to collect data which was used in clarification of information obtained.

Literature review
An extensive review of literature on mammals of the Tanguar Haor was carried out to find a list of all species historically known to occur here.

Individual recorded
Individual number of mammals was recorded through direct field visits and surveys.

3.4.2. Bird Survey Methods

Data was collected by strip transect sampling, opportunistic survey and visual observation. The methods are briefly described below:

Strip transect sampling
This method assumes that all objects in the strip are recorded, so the observer(s) is very careful in observing and recording the objects. Even then, the observer(s) may miss some of the objects in the strip, but it should not be more than 5% of the total objects, so that the error is statistically insignificant. The more areas covered in strip transects subsequently leads to a lower error in the result. Transects should be located predominately in places of the study sites where there is a probability of high biodiversity and hence a high number of objects. Even if any centre line of transect is slightly undulated, the observation-strip is maintained roughly straight by manipulating the observation distance to that particular area. The birds will observe and identify properly and carefully, so that there is no misidentification.

Opportunistic survey
In the opportunistic survey, any important or interesting observation/information was recorded at any time while in the field.

This method is suitable for recording the occurrences, relative abundance and distribution of different species of birds and other wildlife, especially for those species which are rare or uncommon.

The birds were observed either through a pair of wide angle binoculars, telescope or by the naked eye. Notes were taken on ecological and ethological aspects of all observations. The identification was based mainly on external morphology, calling, flight and sitting postures and behaviours. Birds were identified with the help of key characteristics and illustrations guide Birds of Indian Subcontinent by Grimmett, *et al.* (1999), Birds of South Asia The Ripley Guide by Rasmussen and Anderton (2005), etc.

Population status of birds
The status of birds was determined by direct field visit-method (Khan, 1980). The relative abundance of birds was assessed as: 'Very Common' (seen in 80-100% of visits), 'Common' (seen in 50-79% of visits), 'Uncommon' (seen in 20-49% of visits), or 'Rare' (seen in <19% of visits). For wintering migrants, abundance was assessed only during the months they were present.
The global threat status was done following the 2000 Red List of Threatened Species and National Threat Status which was done following the Encyclopedia of Flora and Fauna of Bangladesh (Asiatic Society, 2008), Volume 26. The taxonomy and scientific nomenclature of the birds was given according to Grimmett *et al.*, (1999) when checklists have been arranged following Khan (2010).

Diversity of birds
After collecting data by using the strip transect method to analyze bird community diversity, Shannon-Wiener's (H) and Simpson's diversity indices were used. The Shannon-Wiener index is generally used in ecological studies concerned with the number and abundance of rare species while Simpson's index considers more abundant or common species (Peet, 1974).

Shannon-Wiener's diversity index (H) =
$\sum$ **Pi In Pi**

Where,
$\mathbf{P_i}$ = ni/N is the Proportion of all the birds individuals to the ith species.
$\mathbf{n_i}$ = number of individuals or amount (e.g. biomass) of each species (the ith species)
N = total number of individuals (or amount) for the site, and ln = the natural log of the number. Values range from 0 to 5, usually ranging from 1.5 to 3.5.

3.4.3 Reptiles and Amphibians Survey Methods

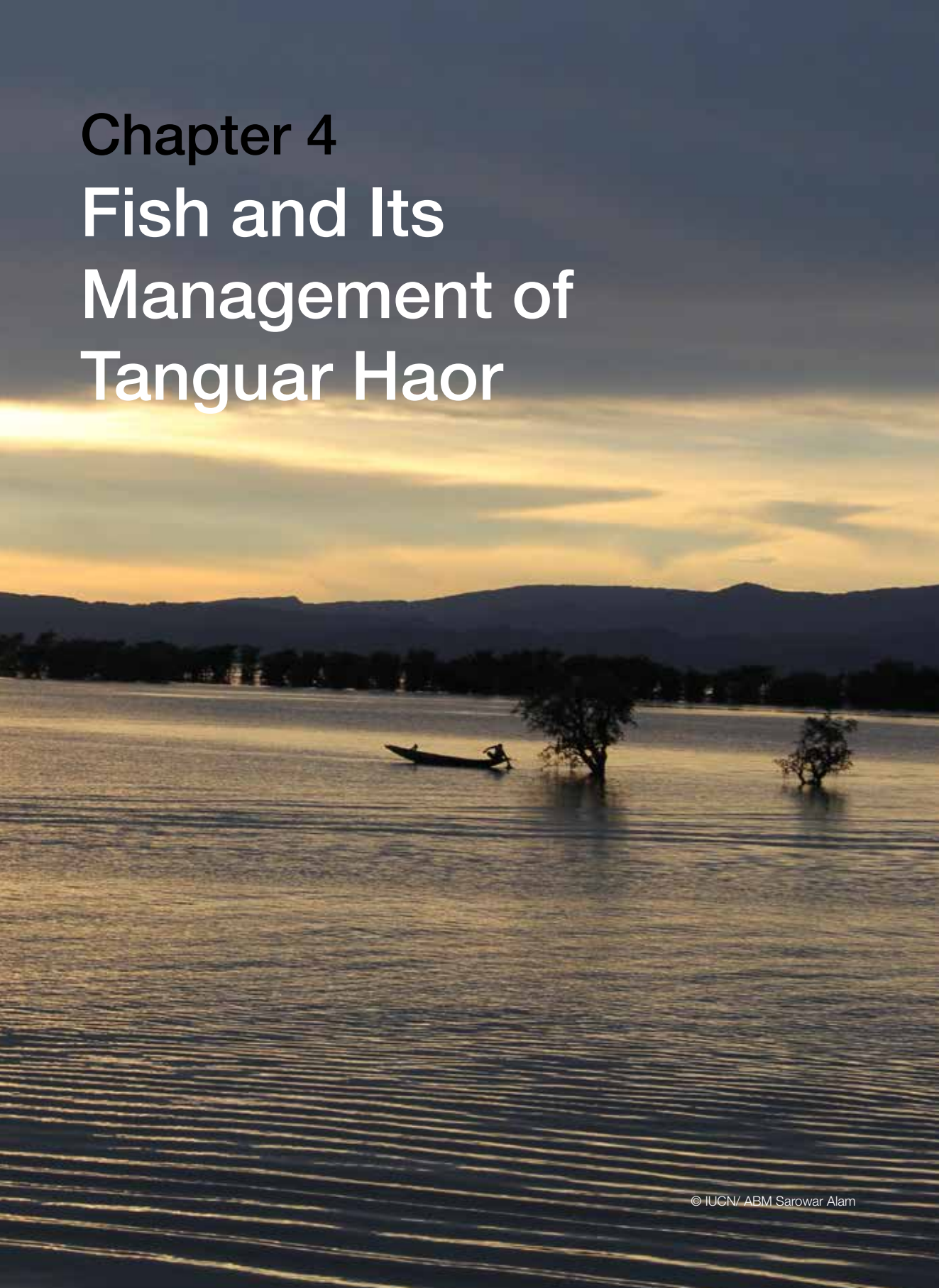
A variety of methods were employed to survey the herpetofauna:

Transect lines (1km long) were establish at 6 sites. Diurnal censuses were conducted for herpetofauna along each transect. This involved slowly walking along the transect line, pausing at regular intervals and recording the number of each species were observed. Each transact was examined five times during the following daytime intervals: early morning and late afternoon and sometimes during the evening.

Opportunistic searches were conducted for reptiles and amphibians over a wider area. The search generally comprised walking slowly through various habitats.

Nocturnal searches were conducted for frogs and reptiles. These searches were mostly targeted at, or near, aquatic environments but nocturnal searches, specifically targeting geckos, frogs and snakes were also conducted in bushy habitats and holes, hollows or burrows.

Chapter 4
Fish and Its Management of Tanguar Haor



To understand the available fish resources and its population status in Tanguar Haor and adjacent *beels*, a field-based survey and intensive study was conducted under the "Community Based Sustainable Management of Tanguar Haor Project (CBSMTHP)" during 2012 to 2014. As known, Tanguar Haor is a good reservoir of indigenous fish species; therefore, adjacent community depends on these resources for their livelihoods. Considering biodiversity conservation, natural resource management and livelihood improvements of community people in Tanguar Haor, a detail accounts of observation and finding have been presented in this part of this book.

4.1 Fish Resources of Tanguar Haor

Tanguar Haor is considered one of the important wetlands for its rich fish resources along with diversified flora and fauna. According to NCS Fisheries Report (2001), Tanguar Haor supports nearly 141 fish species which represent more than half (out of total 260 freshwater fish species available) of freshwater fish species in Bangladesh. Most importantly, a large number of nationally declared threatened species is interestingly available here. Out of 55 threatened fish taxa, 23 are found endangered in Tanguar Haor. Of these 23 endangered fish species, 17 are found only in Tanguar Haor. It gives this region a different dimension to think about the conservation strategy and develop action plan in local and global contexts. Moreover, this unique feature, accommodating many Red Listed species, indicates the importance of this *haor* for protecting its fish biodiversity and ecosystem.

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In the context of taxonomical distribution, all the available species fall under 35 families (Appendix 1). These families are Ambassidae (Glass perches), Anguillidae (Freshwater eels), Anabantidae (Climbing perches), Bagridae (Bagrid catfishes), Cyprinodontidae (Killifishes), Channidae (Shakeheads), Cyprinidae (Carps, minnows, barbs), Cobitidae (Loaches), Clariidae (Airbreathing catfishes), Chacidae (Square-head catfishes), Clupeidae (Shads), Engraulidae (Anchovies), Gobiidae, Heteropneustidae (Stinging catfishes), Leuciscinae (Minnows), Mastacembelidae (Spiny eels), Mugilidae (Mullets), Notopteridae (Featherbacks), Nandidae (Mud perches), Schilbeidae (Schilbid catfishes), Sisoridae (Sisorid catfishes), Siluridae (Freshwater sharks), Syngnathidae (Pipe fish), Synbranchidae (Mud eels), Belonidae (Gars), and Tetraodontidae (Puffers).

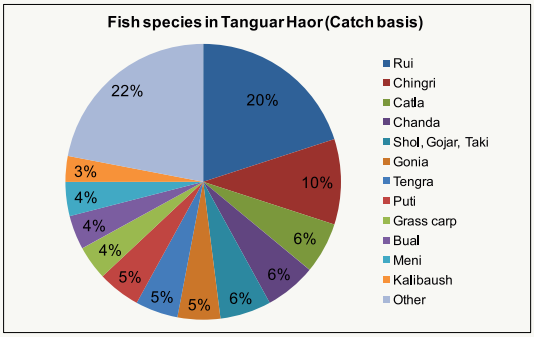


Figure 4.1: Species composition pattern in Tanguar Haor on Catch Basis

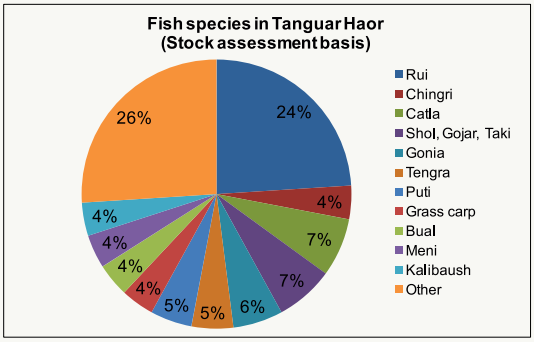


Figure 4.2: Species composition pattern in Tanguar Haor on Estimated Stock Basis

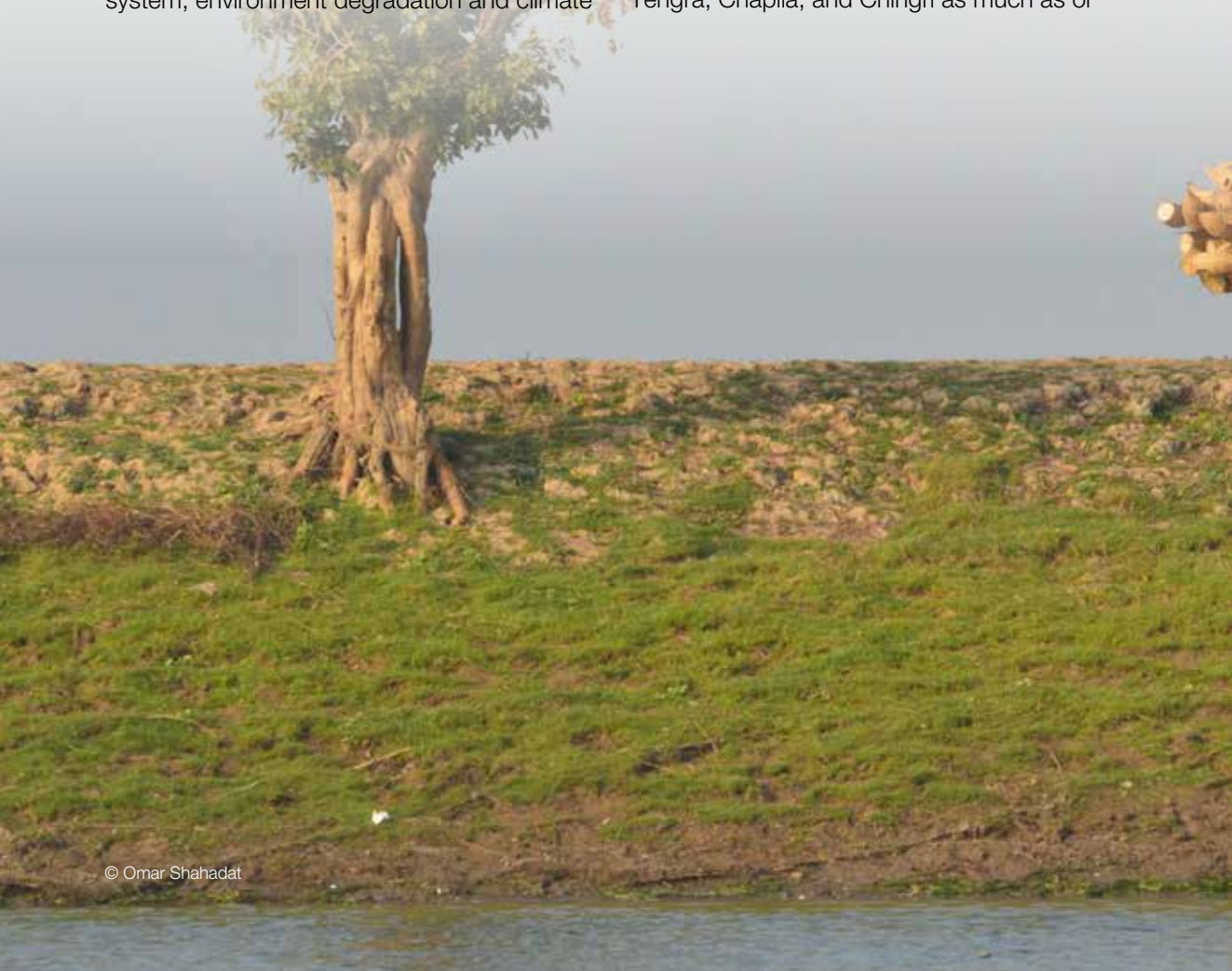
According to species composition pattern on catch basis (Figure 4.1) and estimated stock basis (Figure 4.2) in Tanguar Haor, Rui is the most dominated species. In the catch basis assessment, other dominating species are Catla, Chanda, Taki, Puti, Gonia, Tengra and Meni in ascending order[1]. However the estimated stock assessment shows different dominating order than the catch data. In this case, Rui, Catla, Gonia, Tengra, Puti and Boal are the dominating species in ascending order. Other fishes such as Shol, Gojar, Taki and Grass Carp are also prominent in the total fish composition. Here, the abundance of small prawn (Chingri) is significant. Though it is not a fish, nevertheless small prawn is the second most dominating species in the total composition of both catch basis and estimated stock basis data. Being an

[1] For scientific names and English names see Appendix.

open water fisheries, some exotic fishes are available in Tanguar Haor. Among them Grass Carp (*Ctenophyaryngodon idellus*) and Carpio (*Cyprinus carpio*) are dominant. Other exotic species may come out from ponds into the *haor* ecosystem but do not sustain here. It is, however, not sure if the exotic species breed in this open water body.

The studies, conducted about two decades ago by NCS, NERP and others, reported 141 fish species from Tanguar Haor. The present scenario, however, is different to some extents from the previous reports. Important indigenous fish species are declining, and survey from fish market reveals that not all of 141 fish species are seen frequently. Ecologists opine that loss of wetland sites, current wetland management system, environment degradation and climate variability affect the current fish stock and fish habitat in the northeast region of Bangladesh.

Dominated and co-dominated fish resources available in different *beels*, *khals* and rivers of Tanguar Haor mentioned in Table 4.1. Rupaboi beel, Rowa beel, Berberia beel, Tekunna beel, Gonia Kuri beel, Alam Duar River, Kawer khal, Annar beel, Samsa beel, and Lechuamara beel, passing in and around of the Tanguar Haor, are rich in fish resources. In these water bodies, in percentage, the dominated and co-dominated fish species are found in different percentages. Rui is the dominated fish species available in the Rupaboai beel (20%), Rowa beel (35%), Berberia beel (20%), Kawer khal (10%), and Annar beel (18%). In these water bodies, co-dominated species are Catla, Meni, Mrigal, Tengra, Chapila, and Chingri as much as or



less than 10%. Although, Rui is the dominated fish species in several above-mentioned *beels* and *khals*, but, in Tekunna (availability 15%), Gonia Kuri (10%) and Samsa (5%) beels and Alam Duar River (10%), it is found as the co-dominated fish species.

Interestingly, in the Lechuamara beel, Catla is not categorized as either dominant or co-dominant fish species. Chapila and Chingri are respectively considered as the dominant and co-dominant species in Lechuamara beel. Tengra is the most dominating fish in Tekunna (17%), Gonia Kuri (14%) and Samsa (15%) beels respectively, where co-dominated species are Rui, Catla, Chapila and Meni (Table 4.1).

The research team under CBSMTH Project communicated with relevant departments, local government officials, local level stakeholders and other partner agencies to collect information in order to get an idea of maximum fish production of Tanguar Haor. Besides, secondary information sources have been checked.

In Tanguar Haor, the maximum fish production was recorded for Rowa and Berberia beels which stand for 1603 and 1042 tons, respectively (Table 4.2). However, lower fish production (less than 100 ton) was found in several *beels* such as Chatainna, Kaizzaura, Chunkhola, etc., *kanda*/floodplains, Alamer Duar & Patnai Rivers, Hashmara & downstream, etc.

Table 4.1: Dominant species of different beels in Tanguar Haor

Sl	*Beel* Name	Fish Name	% of Fish Caught
1	Rupaboi beel	Rui	20
		Catla	5
		Meni	5
2	Rowa beel	Rui	35
		Mrigal	5
		Tengra	4
3	Berberia beel	Rui	20
		Meni	8
		Chapila	10
4	Tekunna beel	Rui	15
		Catla	5
		Tengra	17
5	Gonia Kuri beel	Rui	10
		Tengra	14
		Chapila	7
6	Alam Duar River	Kalibaush	15
		Rui	10
		Chapila	8
7	Kawer khal	Rui	10
		Meni	8
		Chingri	8
8	Annar beel	Rui	18
		Chingri	10
		Meni	10
9	Samsa beel	Tengra	15
		Rui	5
		Meni	5
10	Lechuamara beel	Gonia	8
		Chapila	13
		Chingri	12

Source: Ahmed (2015)

Table 4.2: Estimated fish production from different perennial beels in Tanguar Haor

Sl	*Beel* Name	Ton
1	Rowa beel	1603
2	Rupaboi beel	655
3	Berberia beel	1042
4	Hatirgatha beel	468
5	Tekunna beel	468
6	Ballardubi beel	234
7	Mohishergatha beel	100
8	Samsa beel	267
9	Arailla Kona beel	160
10	Lechuamara beel	120
11	Chatainna beel	80
12	Nohal beel	107
13	Kaizzaura beel	67
14	Annar beel	568
15	Kulma beel	301
16	Chunkhola beel	61
17	Other *beels*	66
18	*Kanda*/Floodplains	20
19	Alamer Duar & Patnai Rivers	40
20	Hashmara & Down-stream Rivers	37
21	Other Rivers/*Khals*/ Dairs	37

Source: Ahmed (2015)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4.2 Fish Population Dynamics in Tanguar Haor

Tanguar Haor still maintains its fisheries stock through the natural recruitment process, growth rate, in and out migrations, and fishing and natural mortality rates. Fish recruitment, growth and migration pattern are still little known technically for Tanguar Haor because of lack of proper scientific studies. However, some assessments and studies carried out under the CBSMTHP revealed some significant features of fish population dynamics of this mother fishery. However, some assessments and studies revealed some fish population dynamics of this mother fishery ground. Field observations accompanying the perception of local people, particularly those traditionally associated with Tanguar Haor fish resources at different levels, helped to understand the dynamic of fish population and abundance in this wetland.

4.2.1 Bio-physical features

Availability of food, climate and hydrology have the direct influence on population dynamics in Tanguar Haor ecosystem. Nutrient concentrations and predation also shape the pattern of fish density in Tanguar Haor. In addition, temperature (25-27ºC) or good oxygen content (5-5.6 mg/l) has a direct influence on the reproductive success of fish species in this wetland.

The fish population dynamics of Tanguar Haor is intensively influenced with the hydrological regime of this wetland. Hydrological disturbance shapes spatio-temporal pattern of fish in the *haor*. Backwater from the Surma-Jadukata-Baulai River system intrudes the *haor* in pre-monsoon. Simultaneously, rain water from the Meghalayan hilly areas flows into the *haor* through a good number of small streams. Its morphological shape, topography, inter-connectivity among the water bodies, shallow and deep levees/ridges, emergent vegetation, reed lands and swamp forest serve as the most prolific ground for breeding, nursing, grazing and sheltering place for fish species. Its low sediment, less turbid and transparent water facilitates photosynthesis process that promotes huge phytoplankton growth. The rich nutrient content with good water quality of this wetland promotes the growth of zooplankton, bentho-zooplankton

and periphyton. The reeds, grass, and emergent vegetation, rivers and streams facilitate breeding and hatching process of the fish species.

4.2.2 Nature of breeding, migration and *Ujja*

Small fishes of Tanguar Haor breed early (March-April). The nature of breeding is to use *khals*, connecting channels, hill streams and inlet channels. Big and medium-sized fishes also breed in the *haor* naturally. Medium-sized fishes breed in the connecting channel or near to that in Tanguar Haor. Carps and big fishes breed in late May to early June though carp breeds outside Tanguar Haor. Mrigel in May whereas Kalibaush, Boal, Ghonia breed in April to May. Carnivorous fishes carry out their breeding in May to June for the abundance of huge food in *beel* fisheries. Chital breeds in early April to early May but Shol and Gazar breed in June.

Field observation shows that the Jadukata River is a special breeding ground for many fishes of Tanguar Haor. Big fishes use the Jadukata River for breeding, and Rui and Catla go long distances for breeding. It is believed that Alamer Duar at Patlai River is an important breeding ground for Chital (Humped Featherback). As per sayings of the fishermen in Tanguar Haor, Chital is also found in Tekunna, Kulma and Annya Paglakona beels. However, other fishes that breed in the Patlai River are Baila (Bar-eyed Goby), Baghaayre (Gangetic Goonch), Ayre (Long-whiskered catfish), Bacha (River Catfish), Pabda (Pabo Catfish), Kajuli (Jamuna Ailia), Baim (One-striped Spiny Eel, Barred Spiny Eel, Zig-zag Eel), and Rani (Bengal Loach). Some fish species such as Gonia (Kuria Labeo), Lasso (Reba Carp), and Baim breed in the *beel*, floodplain and canal of the *haor*. It reveals that Kalibaush (Orangefin Labeo), Boal (River Shark) and Shal Baim (Zig-zag Eel) fish spawn in the flowing major hill streams (Rupnagar Chara, Koraibari Chara, and Bagli Chara) fall into Tanguar Haor. Some minor carps breed in the rivers/streams/canals/immersed levees of this wetland. Some carnivorous fish [e.g. Boal (Helicopter Catfish), Chital (Humped Featherback), Gazar (Giant Snakehead), and Shol (Striped Snakehead)] lay eggs in the suitable ground of the *haor* linked to the flowing canal/hill stream/river from April to June. Gonadal development of minor catfish occurs in the pre-monsoon, and they [e.g. Kajoli (Jamuna Ailia), Batashi (Indian Potasi), and Bacha (River Catfish)] are said to breed in the Patlai River when backflow comes into Tanguar Haor (Table 4.3).

Table 4.3: Preliminarily identified few spawning ground in Tanguar Haor

Sl	Possible Breeding Spot	Location of the Spot in Relation to nearby *Kanda*/ Village/ *Beel*/ River name	Reported Fishes that may perform breeding	Possible Breeding Period	Condition of Breeding
1	Nazarkhali Khalerbak/ Bhanga	Nazarkhali *Kanda*, Rowa beel, Patlai River, near Golabari village	Ghonia, Boal, Ayre	May-June	River flow is high and grasses are more in the adjoining *kanda* on which gets higher velocity when inundated and Ghonia may breed on that and on that condition
2	Bagmara *Kanda*	*Kanda* of Rupaboi beel, near Lamargaon village	Gonia, Boal, Gazar, Shol, Puti	May-June for Gazar and Shol	High velocity on grassy *kanda* when inundated during flash flood
3	Near the right bank where bend and deeper part is there- Alamer Duar	Alamer Duar, Patlai River near Joypur-Golabari	Kalibaush		During high velocity and inundation
4	Shoshan *Kanda*, Chhara beel-Koraibari stream	Near Tekunna beel, Chhara beel, Ronchi	Ghonia, Boal, Kalibaush, Baim and many other small-medium sized fishes	May-June	During high velocity flowing over the *kanda*

Source: Ahmed (2015)

Fish movement from *beel* to *beel* also common in the Tanguar Haor. Different types of migration occur or migratory fishes stay in Tanguar Haor which supports movement and migration of fishes. Movement occurs *beel* to *beel* and migration occurs *beel* to river or vice-versa. In Tanguar Haor, migration takes place *beel* to *beel* through a river, Tanguar Haor to the Surma River, Tanguar Haor to the Jadukata River or vice-versa (Figure 4.3).

Different types of fish migration are:

- *Ujja* or pre-monsoon migration;
- Breeding of fishes within Tanguar Haor; and
- Return migration in September and October.

In the pre-monsoon, major carps like Rui, Catla and Mrigel go long distances to find suitable place and environment for breeding. The fertilized eggs roll down with river current and within 4 days' time they enter into the floodplain adjacent to the river (Ahmed, 2015). Minor carps, catfishes and barbed fish species move to the flowing rivers/streams/ canals and breed in the shrubs/grasses of the adjacent levees/ridges in the early monsoon.

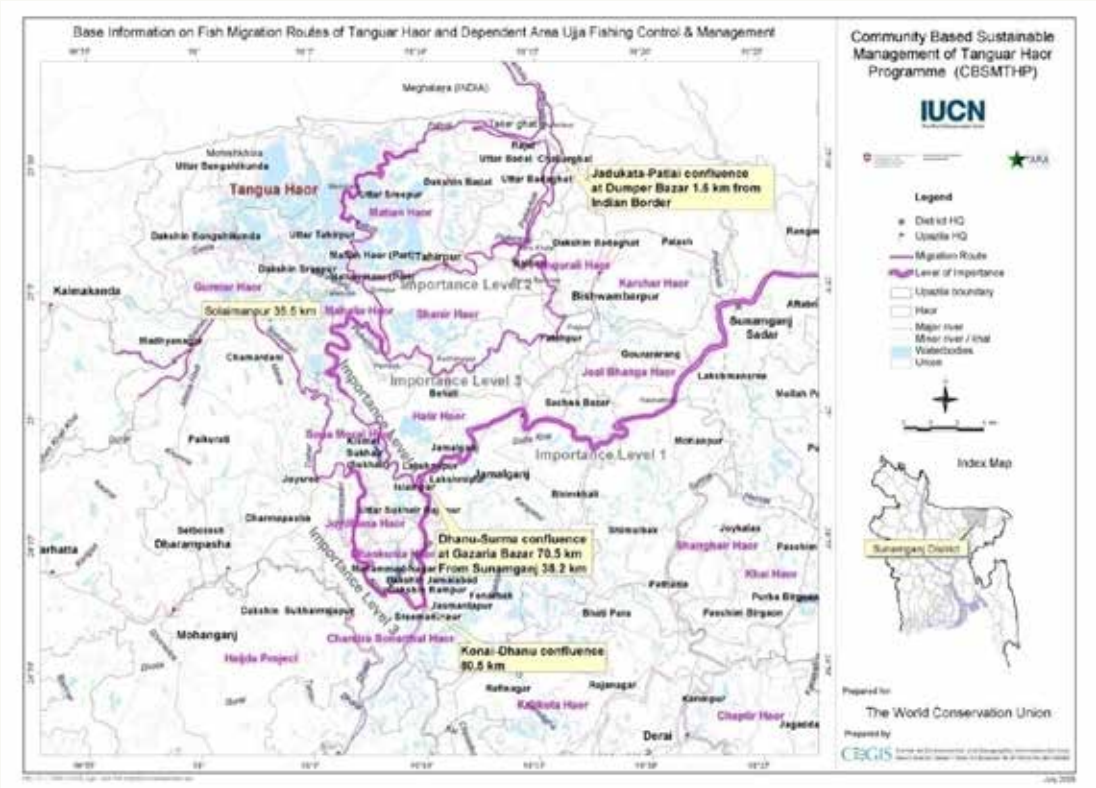

Figure 4.3: Major migration routes of Tanguar Haor fish species

4.2.3 Natural recruitment

Recruitment of fish takes place both within and outside Tanguar Haor. After spawning in Tanguar Haor how much hatchlings/larvae/juveniles disperse to the other *haors* in a season is still little known. Yet it is believed by the fishers that a remarkable number of fingerlings/juveniles scatter to the other *haor* ecosystems every year. It is assumed that dispersal of larvae/juveniles from Tanguar Haor contributes to enrich the fish stock of eight districts in Bangladesh. The perception of Tanguar Haor community is that after passing some period in other water bodies some portions of the dispersed larvae/fingerlings come back to this native wetland at the end of the monsoon/post-monsoon for food and habitat.

The juveniles and carp fishes come back, after breeding at suitable places elsewhere, to the domicile for grazing and sheltering at the end of the monsoon. Simultaneously, non-native juveniles and adult groups of various fish species from other water bodies immigrate to this habitat for their growth and shelter. Though the rate of immigration of fish species to the recruitment process of this wetland cannot be assessed thoroughly it is inferred from the harvesting data that the juveniles of Rui (*L. rohita*) fish are the highest number compared to other fishes caught.

4.2.4 Fish growth

Growth rates of fish in a population are intricately linked with mortality and recruitment rates. Natural mortality of fish in Tanguar Haor could not be assessed to date. Natural mortality of fish in Tanguar Haor assessed to date. Current management body conducts three kinds of fish harvesting system regularly. During the harvesting, it is observed that

Table 4.4: Contributions to Natural Recruitment in Tanguar Haor

Sl	Type of Breeding, Movement and Migration	Contribution to the Stock of Tanguar Haor (Pre-harvesting Basis) in %	
		Estimated Contribution of that Activity	Estimated Contribution in Total
1	Feeding Migration	10	5
2	Breeding Migration	70	30
3	*Ujja* (seasonal movement)	80	30
4	Hatchling Migration	40	10
5	Return Migration	75	20
6	Other	15	5

Source: Ahmed (2015)

growth rate is attributable to hydrological period, and food and nutrition concentrations available in the *haor*. Juveniles of major and minor carp contribute to sizeable annual harvesting of adult class (> 2 kg, >1 kg) every year. It is observed that the recruited fingerlings of *Catla catla* which were collected from Halda River — can attain their growth > 3 kg at the age of one year in this wetland. It indicates that fish growth rate is high in this aquatic ecosystem. Natural mortality and fishing mortality are currently at good state that contributes in maintaining a good standing stock in Tanguar Haor.

4.2.5 Changing equilibrium

The enriched population stock may be affected in the near future due to a range of natural and anthropogenic hazards. Enclosure made for crop dam in the mouth of the Razar Dair River at Joypur village is posing significant threats by hindering entry and exit of fish species from the *beel* to the Patlai River and vice versa. The disconnection among Sumeshwari-Ghashi River-Kawerkhal channel is disrupting the natural fish movement and recruitment process. Land degradation in upper riparian region and sediment loading through the Jadukata River are gradually accelerating in the northeast part of the *haor* and are altering bottom topography of the water bodies (*beels*, canals). The embankments on the connecting channel between the Jadukata River, Matian Haor, the Patlai River, and Tanguar Haor and sluice gate at Boalmari of the Patlai River retard the breeding system of many migratory species and pose threats to absolute abundance of fishes.

Navigation of shipping cargoes in the Patlai River is also restricting fish migration, and altering bottom topography. Increasing agriculture runoff will affect the breeding system of some species spawned in this *haor* (Table 4.4).

4.3 Conservation Status of Fish in Tanguar Haor

4.3.1 Present status of fish in Tanguar Haor

There are 134 species listed in the checklist of the fishes found in Tanguar Haor (Appendix 1). Forty-six (out of total 134) fish species, representing 34%, have not categorized as threatened in the Red List of IUCN Bangladesh (2000). Some of those are *Channa striatus, Channa puntatus, Catla catla, Labeo rohita, Puntis sophore, Amblypharyngodon mola, Gudusia chapra, Anabas testudineus, Corica soborna, Xenentodon cancila, Tetraodon cutcutia, Mystus bleekeri, Mystus tengara, Wallago*

attu, Heteropneustes fossilis, and *Clarius batrachus*. Twenty-three fish species found in Tanguar Haor are listed as Endangered in the Red List of IUCN (2000). This category comprises about 17% of the total fish species found in Tanguar Haor. Among these *Channa marulius, Chitala chitala, Osteobrama cotio, Rasbora rasbora, Labeo gonius, Labeo bata, Labeo calbasu, Badis badis, Mastacembelus armatus, Batasio tengana, Sperata seenghala, Ompok pabda, Chaca chaca* and *Crossocheilus latius* are still found in the fishers' catch. From the checklist we formulated, the number of Vulnerable and Critically Endangered species is 13 and 10, respectively. The 13 Vulnerable species are *Channa orientalis, Notopterus notopterus, Cirrhinus reba, Puntis ticto, Chanda nama, Nandus nandus, Macrognathus aculeatus, Sperata aor, Mystus cavasius, Ailia Punctata, Monopterus cuchia, Anguilla bengalensis* and *Pseudambassis ranga*. Names of the Critically Endangered species are *Puntis sarana, Rita rita, Clupisoma garua, Pangasius pangasius, Channa barca, Labeo pangusia, Tor tor, Eutropiichthys vacha, Bagarius bagarius* and *Conta conta*. Lastly, there are around 42 indigenous and exotic species which are either not listed or Data Deficient in the Red List of IUCN 2000. This group composes 31% of the total fish found in Tanguar Haor (Figure 4.4).

In this book, 101 fish species details are described in Chapter 5 out of total 134 fish species in Tanguar Haor. Detailed information regarding of these available fish species were collected through sample collection, fish market survey, availability in *haor*, gear wise fish catching, consultation meeting with fishermen and fish-traders, photo collection and previous publication sources. Other 33 fish species status is mentioned in Appendix.

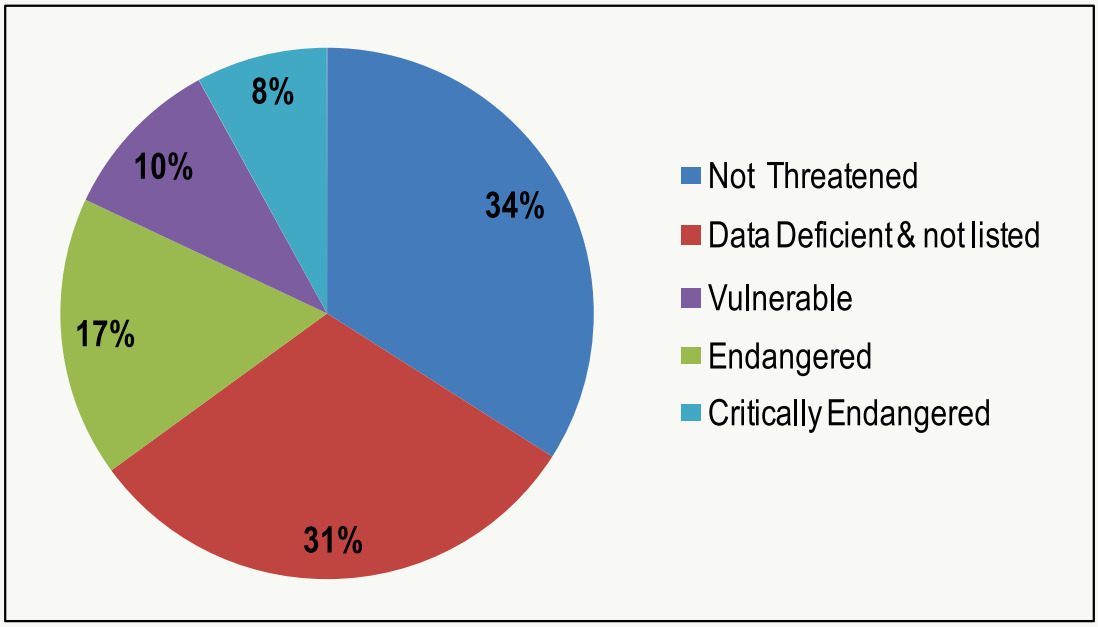

Figure 4.4: Conservation status of 134 species of fish in Tanguar Haor on the basis of Red List of IUCN Bangladesh, 2000

4.3.2 Estimated fish stock of Tanguar Haor

The estimated fish stock of Tanguar Haor is 6,701 tons (Ahmed, 2015). This figure presents the quantity of fish harvested officially, harvested legally, caught for subsistence, fish used by other organisms, natural and hazardous deaths, outgoing migration imbalance (if any) and quantity which is estimated to be remained in water as standing crop (Table 4.5). Commercial and non-commercial quantity is also considered for estimation as these are not high and production rate of Tanguar Haor would be higher than the averages. However, the estimated production or harvestable quantity is about 5,204 tons (Ahmed, 2015).

Table 4.5: Estimated fish stock of Tanguar Haor

Sl	Categories	Estimated Quantity (Ton)
1	Commercial fishing of *beels* of the core zone	4*
2	Fishing of buffer zone *beels*	38*
3	Estimated quantity of un-authorized fishing	69
4	Outside clusters (out of core zone *beels* & buffer zone *beels*)	70
5	Harvested size through approved non-commercial fishing	25
6	Outsiders	10
7	Long-distance poaching	30
8	Estimated quantity of use by different animals/organisms	111
9	Estimated migration balance	68
10	Estimated harvestable fish	4,804
11	Estimated non-fished fishes (non-harvestable)	1,472
	Total	6,701

*Marked figures are not estimated but the exact quantity from the CBSMTH Project. Source: Ahmed (2015)

4.3.2.1 Estimated non-harvested stock

Based on the information collected from the Tanguar Haor area through group discussion from different places/locations, it is estimated that the fish that could not or was not harvested or not used (including death and migration) is 1472 tons (Table 4.5).

4.3.2.2 Fish harvest quantity

The harvesting quantity refers to commercial harvesting with direct supervision and permission within core area, and non-commercial harvesting without permission and supervision other than the core area (refer to buffer area) within the Tanguar Haor boundary. There are five types of commercial and twenty two types of non-commercial harvesting in the Tanguar Haor (Table 4.6). Moreover, in total, the commercial and non-commercial harvesting is found 4,423 and 37,584 tons, respectively. Under the commercial harvesting, the highest harvesting recorded for Ballardubi beel (1,443 kg) and the lowest for Tekunna beel (51 kg). In Tanguar Haor water bodies, the highest non-commercial harvesting was found in the Nohal beel (6,653 kg) whereas nil harvesting found in Bagmara Ghop. More than 4,000 kg harvesting occurred in Annar and Paglakona (4,376 kg), and Kawer *Khal* (4,538 kg) (Table 4.6).


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Table 4.6: Fish Harvesting from Beels of the Core Zone (Commercial) and Buffer Zone (Non-commercial)

Sl	Name of the *beels*	Harvest quantity (in kg)
Commercial fishing		
1	Hatirgatha	1,365
2	Tekunna	51
3	Rupaboi	1,183
4	Berberia	382
5	Ballardubi	1,443
	Total	4,423
Non-commercial fishing		
6	Araillakona	2,042
7	Annar and Paglakona	4,376
8	Kawer *Khal*	4,538
9	Khaijjauri	2,145
10	Golgoilla	1,344
11	Goldoba Beshkhali	1,671
12	Goldoba Ronchi	813
13	Goinnakuri	1,374
14	Chara	220
15	Chunkhola	354
16	Chattar	2,762
17	Nohal	6,653
18	Sonadubi	1708
19	Hatimara	1332
20	Panaikor Dair	326
21	Rajnagar	1434
22	Lamar	853
23	Bagmara Ghop	0
24	Ban	1329
25	Shyamsagar	1050
26	Rajardair	560
27	Kalirkheo	700
	Total	37,584

Source: Ahmed (2015)

4.3.2.3 Estimated un-authorized fishing quantity

Un-authorized fishing includes poaching, subsistence fishing, and fishing for one meal. Un-authorized (or so called illegal) fishing occurs round the year but the intensity of such fishing varies considerably depending on places and seasons. Five major areas have been identified within the Tanguar Haor where people are mostly engaged with fish poaching. So, un-authorized fishing was used to find out the catch rate and estimate the quantity of poached fish.

Detailed village/cluster map is prepared during survey and used to show all the paras of the village and from which para people go for more or less poaching. For each of the cluster/village the gears used for fishing are listed and grouped in to wet season and dry season basis and also day and night basis. Gear-wise fishing rate is estimated for each gear, depending seasons and also day and night basis. Variation of Catch Per Unit Area and Effort (CPUAE) due to use of same gear for poaching and permitted fishing were also assessed. The estimated quantity of un-authorized fishing was found 69 tons (Table 4.5).

4.3.2.4 Estimated subsistence level fishing quantity

The communities, living around the periphery of Tanguar Haor, seasonally, occasionally and even daily catch fish for their daily means or meal from the adjacent *beels*. The survey reveals that a huge chunk of fish is caught by the communities every year. Subsistence fishing (one kind of un-authorized fishing) is considered of two types: a) Subsistence fishing b) Subsistence fishing for one meal. The estimated quantity was found 70 tons (Table 4.5).

4.3.2.5 Quantity of natural mortality and fishing related mortality

The estimated loss of fish in Tanguar Haor due to natural death of fisheries resources is about 5 tons (Table 4.5).

4.3.2.6 Estimated out and in-migration balance

State of balance between outgoing and in-migration is about equal. However, natural recruitment of Tanguar Haor fisheries, mostly governed by the Jadukata and nearby the Surma River, is putting the balance of the fish stock to a positive trend. Considering about a dozen of criteria the estimated migration balance is 68 tons (Table 4.5).

4.3.3 Estimation of sustainable yield level for Tanguar Haor

Sustainable Yield Level (SYL) is an estimation of stock, if drawn out, would not affect the sustainability. It also refers to the number of times and the way of harvesting that allows the regeneration of the harvested resources.

The estimated SYL of the fishes of Tanguar Haor is 2,680 tons that is 40% of the estimated total stock of 6,700 tons (Ahmed, 2015). However, the estimated figure is subjected to vary within different groups of fish species given that the balance between recruitment and harvest is different for different species.

Scientifically sustainable harvest limit is 50%. This is true where recruitment is ensured. In the Tanguar Haor context, it can also be considered 50%, but it is preferred to 40% for following reason:

a) Recruitment of major carps is not sure as their migratory routes are shrinking and increasing hindrances are posing as threats;
b) The breeding grounds of Rui and Catla are not nearby;
c) Development interventions are increasing and migration path for ensuring recruitment of major carps may get disturbed in coming days;
d) In Tanguar Haor major carps are still dominant species, but their recruitment depend on outside spawning ground.

However, the SYL for small fishes can be considered 50% or even 60% as recruitment of these fish species mainly occurs from the Tanguar Haor area along with other adjacent areas (Ahmed, 2015).

4.4 Fish Sanctuary Management

Considering conservation issues, fish sanctuary establishment is an integral part of resource management. A plan for establishing fish sanctuary was made during NCS period in 2000. A total of five fish sanctuaries were established in Tanguar Haor in 2011 under the CBSMTH Project (Table 4.7). Out of these, four sanctuaries were in four *beels* and another one at Alamer Duar of the Patlai River. These fish sanctuaries play an important role for maintaining the fish stock and fish diversity in this wetland. For increasing the stock size, an advanced fish sanctuary (address the different needs and requirements of various fishes, non-fish organisms, aquatic vegetation and their different life stages) has been proposed for some of the *beels* in Tanguar Haor. If implemented successfully, it is believed that the fish sanctuaries of Tanguar Haor can contribute to increase the stock size and fish diversity in Tanguar Haor. Table 4.7 provides the sanctuary maintenance and impact related information.

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Table 4.7: Status of fish sanctuaries established in Tanguar Haor under the CBSMTH Project in 2011

Rank	Name of the Fish Sanctuary	Name of the *Katha* Materials	Impact (in case of production)
1	Rupaboi beel Fish Sanctuary	Hijol, bamboo, other tree branches	Rui, Catla, and Puti increased
2	Rowa beel Fish Sanctuary	Hijol, bamboo, bamboo roots	40% increased, increased brood fish
3	Tekunna beel Fish Sanctuary	Hijol, bamboo, bamboo branches	Different fishes increased
4	Ballardubi beel Fish Sanctuary	Hijol and Bamboo	Different fishes increased
5	Alamer Duar River Fish Sanctuary	Hijol and Bamboo	Chital, Pabda, Small snails increased

Note: Date of last renovation of five fish sanctuaries10.10.2013
Source: Ahmed (2013)

During the process of sanctuary establishment, a considerable number of conservation *katha* were established in different parts of the different *beels* within Tanguar Haor. The area of the *katha* was about 0.50 acre and with buffer zone is about 5–7 acres (Ahmed, 2011). *Katha* were established mainly in the *beels* of Berberia, Mohishergatha, Tekunna, Rowa, Hatirgatha, Ballardubi, Lechuamara and Rupaboi.

4.4.1 Present situation

Cross section of people within Tanguar Haor was interviewed to get their opinion regarding impact or benefit of fish sanctuaries established. Most of them mentioned that the establishment of fish sanctuary had a positive impact on fish production. Although, these impacts and benefits does not properly realized the people living in distant places of Tanguar Haor. Comments on Alamer Duar sanctuary was mixed, this may also be a reason as benefit of a sanctuary of a river is not solely for local area.

Sanctuary 1: Rowa Beel Fish Sanctuary
The sanctuary was first given in a semi-oval shape in the deeper part to the Rowa beel which was more or less in the south-western side of the *beel*. Later followed by a recommendation of the Fish and Reeds Report (Ahmed, 2011) the western side of the sanctuary was extended to shore. Last time *katha* material (Hijol tree branches, bamboo) was set at the sanctuary in 2013.

According to the people, the benefit observed due to this sanctuary was second (next to Rupaboi Sanctuary). They reported that about 40% fish production increased due to establishment of this sanctuary. According to them, the quantity of Rui fish increased. It may be mentioned that this *beel* is famous for Rui fish. Staff of the project also opined that much quantity of fish along with rare ones also increased. The available fishes are Ghonia, Kalibaush, Rui, Gazar, Ayre, Boal, Puti, Pabda, Tengra, and Kaikla. The sanctuary also supported to increase the number of non-fish organisms.

Sanctuary 2: Rupaboi Beel Fish Sanctuary
According to the community people Rupaboi Fish Sanctuary stands first among the sanctuaries established in Tanguar Haor in terms of fish production. Rui fish also increased in Rupaboi Sanctuary. Sanctuary was extended and maintained with Hijol tree branches and bamboos in 2013. Apart from Rui, Catla, Shol, Gazar and Puti increased significantly. The conservation *katha* is set nearly at the centre of this *beel*.

Sanctuary 3: Tekunna Beel Fish Sanctuary
The sanctuary of this *beel* is nearly at the centre of the Tekunna beel. This sanctuary was also repaired and Hijol branches along with bamboo were set in 2013. Asking about the impact of this sanctuary establishment, people ranked this sanctuary at the 3rd position. Fish production and diversity were increased for sanctuary establishment. Bigger fishes were also increased due to the sanctuary as opined by several people.

Sanctuary 4: Ballardubi Beel Fish Sanctuary
The conservation *katha* of the sanctuary of this *beel* is on the western side. This sanctuary was also renovated with Hijol and bamboo branches in 2013. According to the local people fish production was increased for establishing sanctuary.

Sanctuary 5: Alamer Duar River Fish Sanctuary
This sanctuary is the only fish sanctuary of river type in Tanguar Haor Fisheries Management. In fact this sanctuary is situated at a river shore locally called it duar or Alamer Duar. This was famous for Chital and it is believed that Chital breeds here. The sanctuary was extended and *katha* material was set at this sanctuary in 2013. Depth of different part of this sanctuary shore was taken by normal weight and rope method by the study team. Later, GPS was used to identify the boundary of the sanctuary.

It may be mentioned that the sanctuary was established along the right bank side keeping left side for navigation. However, excessive water transportation of coal appears interfering factor for this sanctuary. This sanctuary supports both fish and non-fish organisms. Considering this aspect, another fish sanctuary need to establish near to Boalmari *Khal* to

protect and assist in propagation of a number of riverine fishes.

4.4.2 Birds sanctuary and benefits to the fishes

During a survey conducted by IUCN in 2013, three study sites (Lechuamara, Hatirgatha/ Berberia and Chattainna Khal in Figure 4.5) were selected as sanctuaries for birds and other wildlife in Tanguar Haor. As per the study, total number of birds (species richness) was substantially stable both between years and seasons within a given year in these three *beels* than the others. Information on the location and justification of the proposed sanctuary were shared with the local community representatives. There is logic behind direct and indirect benefit of bird sanctuary in maintaining and enhancement of fish biodiversity and production. Therefore, It is expected that, the proposed three sanctuaries would assist local community and resource managers to avoid any kind of anthropocentric disturbance in clearly defined areas allocated for wildlife and will allow locals to harvest natural resources sustainably outside the sanctuary boundaries.

4.4.3 Limitations observed and need for development of advanced design

Under the CBSMTH project, a fish sanctuary establishment plan for resource protection was developed at the end of 2008. In 2010, a fish sanctuary design was developed and conservation effort planned for Conservation *Katha* in twenty-one spots. Conceptually, the design was based on to cover sixty percent of dry season area of small *beels* and forty percent of large beels; to cover gradual slope in two *beels* sanctuary (shore to middle); and to consider Rupaboi, Rowa and Berberia beel for Ghonia, large catfish and carps, and Shol

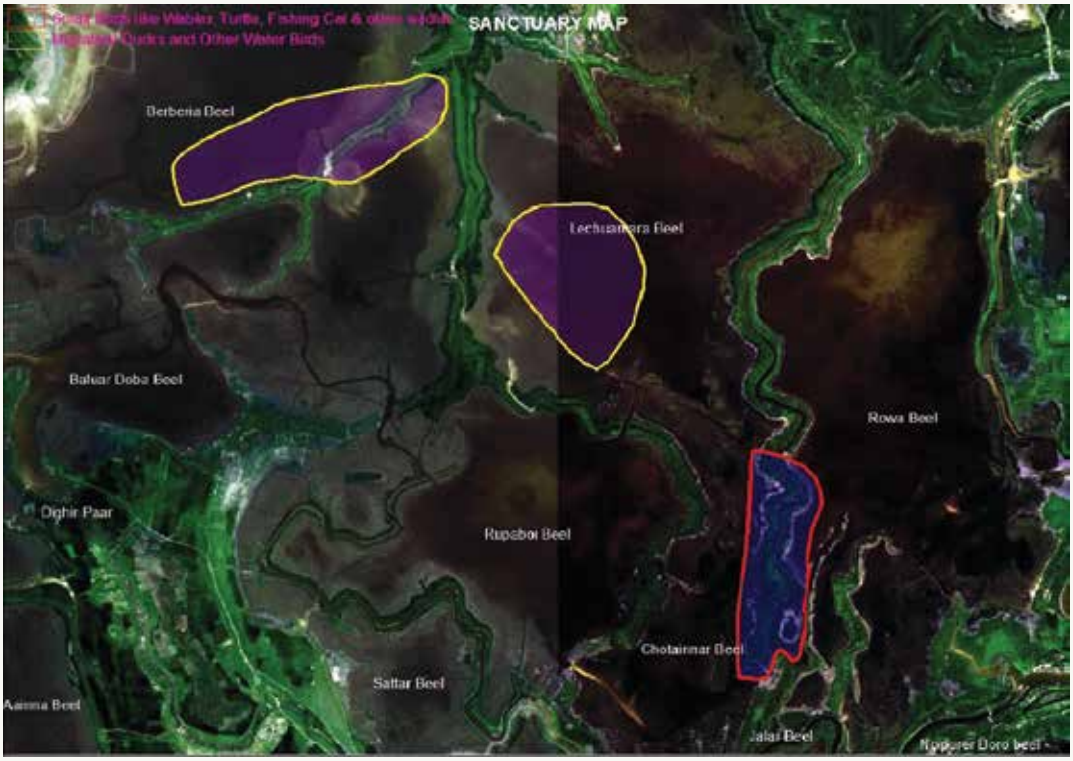


Figure 4.5: GIS based map of the proposed sanctuaries: Berberia/Hatirgatha, Lechuamara and Chatainnar beels

and Gozar, respectively. During that time, the interlinking (*beel* to *beel*) canals were identified and proposed for conservation. These are important for fish movement, migration, breeding and recruitment (Ahmed, 2013).

However, absence of legal identity of established fish sanctuary and without proper declaration from the respective government department/line ministry negate sustainability of the fish sanctuaries beyond the Project period. Moreover, there are several practical problems for which quality of sanctuary could not be maintained under CBSMTHP, Phase II. Substantial water depth in wet season, high wind and water velocity, pre-monsoon *Kalboishakhi* storm in open area causes damage the conservation katha every year. There is an argument also not to put physical materials in deeper part of the sanctuary. Rather, conservation can be achieved by controlling fish catch and landing. However, considering water depth reduction in dry season and risk of overfishing in sanctuary a pragmatic solution is required to maintaining these fish sanctuaries effectively.

From the establishment period, fish sanctuaries had got improvements for three times (in 2011, 2013 and 2014). Moreover, a conservation effort under CBSMTH project, Phase III planned for Advanced Fish Sanctuary to address benefit for fish population.

Figure 4.6: Sketch map showing location of proposed advanced type of fish sanctuary

4.4.4 Proposed advancement in Rowa Beel Fish Sanctuary

4.4.4.1 Description of advancement

There was some advancement made in Rowa beel Fish Sanctuary especially in 2013 (first initiative was taken in 2011). Three options were addressed, one is connecting the sanctuary to north direction, another is to link it to the canal, and the third one is to extend it to *kanda*. Still it is not an advance type of fish sanctuary. In this context a design has been developed which is incorporated Figure 4.6. For an advanced fish sanctuary it is divided into two parts, one is core area and another is buffer area. Although in a normal sanctuary, this ecological division is included, but usually less than three percent sanctuary has this advance criterion.

Criteria of advanced fish sanctuary are:

- Sub-habitat to cover under protection;
- Gradual slope;
- Conservation *Katha* (CK)*;*
- Diversification in Conservation *Katha* materials;
- Placement of *katha* material;
- Horizontal to vertical placement of materials; and
- Linkage with ecotone and biome.

Core area is comparatively deep where big fishes or large species of fishes can take shelter. The floating frames with branches of Hijol tree and bamboo are set along the water column in the sanctuary. There is some vegetation also available in buffer area mainly for growth and shelter of small fish, young fish and non-fish organisms. In circular pattern the buffer zone has not only the species of small sized fishes, but many juveniles and non-fish organisms grow there. More juveniles of fish and aquatic life prefer the shallow area to shore area to the middle of a sanctuary.

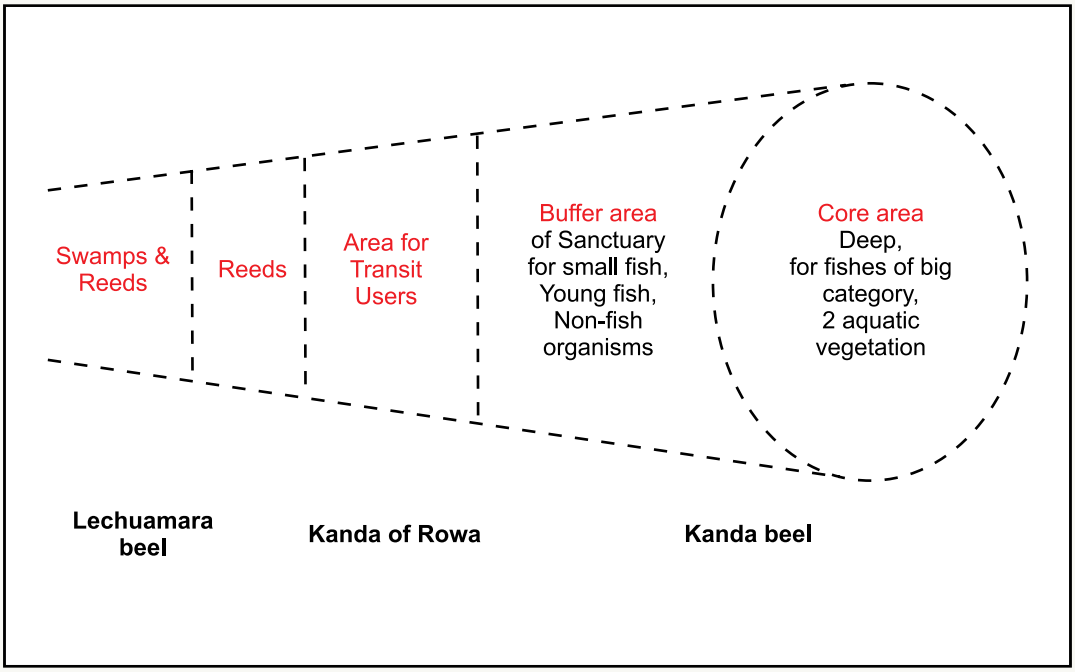


Figure 4.7: Top view of advanced fish sanctuary in Rowa Beel, Tanguar Haor

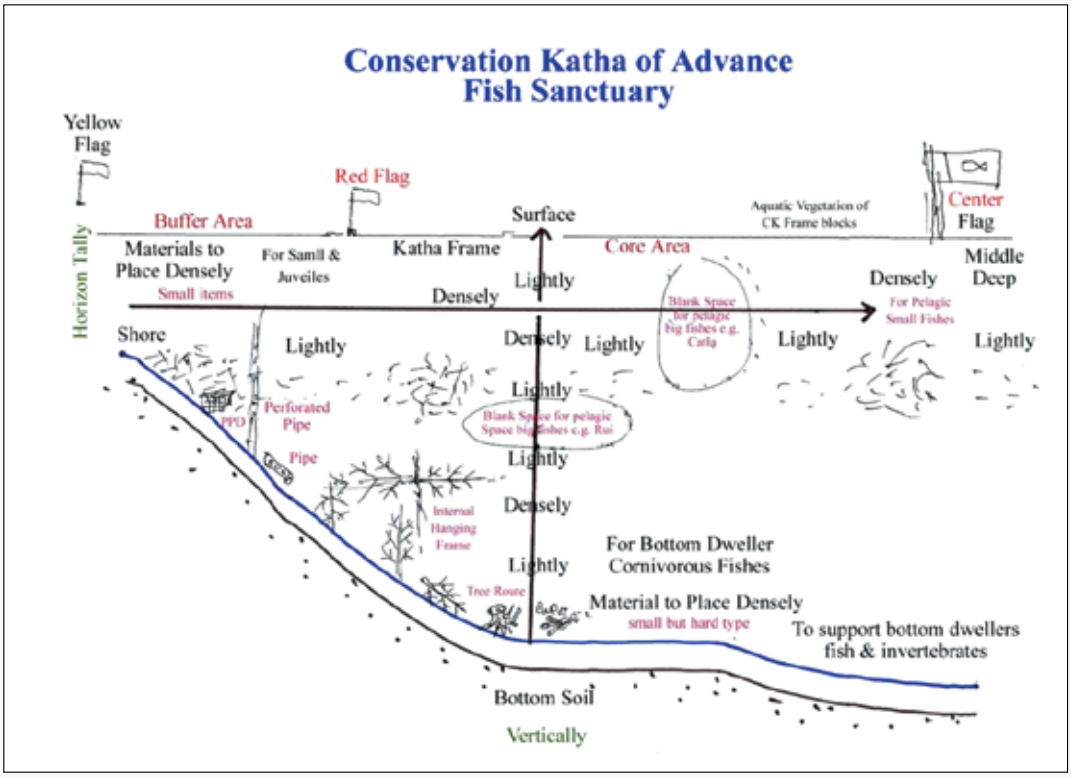


Figure 4.8: Design of advanced type fish sanctuary

For advanced type sanctuary, when it is said big fish is in deeper or core area and small fish is in buffer or in shallow part, it does not mean there is a sudden change of depth, rather it is graduated. Thus, the more deep is the more bigger fish. Hence, the shallower area provides protection and proliferations for the smaller fish, young stage of fishes and non-fish organisms.

In fact, the shallow areas are the area of primary productivity where food chain start with phytoplankton. Planktons, benthos and may be rotifers are abundant in this area (Ahmed, 2013). It should be noted that this area move up or down with changes of water level thus it is a dynamic area.

Once swamps are linked with sanctuaries of shallow depth. Vegetations of such formation possess resources, like grassland and reed beds. Therefore, graduation of slope and shallow water works as ecotone for transit users.

4.4.4.2 Protection of middle as well as shallow parts

The design of middle to shore (or shore to middle) in Rowa beel would ensure protection of fish and aquatic life in deep, medium deep and shallow areas. Shallow part creates an environment where productivity is high and young fish will gather and grow further.

4.4.4.3 Linkage with ecotone and adjoining *kanda* environment

Linkage with the ecotone and adjoining *kanda* environment is very important. In between the Rowa beel Advance Sanctuary's shallow part and reedbed part of the proposed demonstration block of seasonally flooded terrestrial *kanda* near Lechuamara beel, is the ecotone. This ecotone works as transition area between two environment where food chain start and crucial for birds and aquatic food chain starting.

4.4.4.4 Improved Conservation *Katha*

Quality of Conservation *Katha* materials and its placement in advance fish sanctuary ensure the preferences of different fish species.

4.5 Fish Harvesting in Tanguar Haor

Sustainable use of natural resources is ensured when the users take part actively in the process of resource management. Considering the livelihood of the fishermen and sustainability of Tanguar Haor fisheries, CBSMTH Project makes room for sustainable harvesting and management of fisheries resources. The project has designed different fish harvesting modalities following the 'Ramsar Wise Use Principle' and community-driven approach. The eligible fishermen can catch fisheries resources following the terms and conditions set in those modalities. Therefore, fish harvesting in Tanguar Haor can be divided into different types as described below.

a) Commercial Fish Harvesting

To ensure sustainable fish harvesting in Tanguar Haor, a number of perennial *beels* including the five fish sanctuaries, have been brought under 'Core Zone'. All these *beels* are also locally known as '*Tanguar Navi*'. Core zone fishing (except sanctuaries) is alternatively termed as 'Commercial fish harvesting'. Under the CBSMTH Project, this kind of fishing has been regularly held in every year since 2009, hence contributing to the government revenue and income for the community as well as community fishermen.

The following Table 4.8 depicts a summary of commercial fish harvesting from 2009 to 2014. It reveals that the maximum amount of fish (55,580 kg) was harvested in 2012. On the other hand, the year 2011 witnessed fish catching in Tanguar Haor at the lowest level (6,195 kg) following the minimum days (16) of fishing.

Table 4.8: Commercial fish harvesting summary of 2009-2014, during January-April each year

Year	No. of *Beels*	Harvested Fish (kg)	Fish Price (Taka)	No. of Days of Fishing
2014	8	13,920	25,50,714	26
2013	8	8,316	7,24,010	52
2012	12	55,580	59,86,976	75
2011	5	6,195	6,59,325	16
2010	10	18,738	39,31,813	54
2009	7	20,218	22,86,057	26

But it is interesting to note that the year 2013 had small amount (8,316 kg) of fish harvested, despite having a good number of days (52) fishing comparing for other years. This was mainly caused by the reduced number of fisherman participated in fish harvesting as well as lack of appropriate gear for commercial purposes.

b) Non-commercial Fish Harvesting

Non-commercial fish harvesting in Tanguar Haor can be categorized into two types. One is *chai* (one kind of fishing gear) based fishing and another is remote *beel*/buffer zone fishing. Most of the poor community fishermen depend on *chai*-based fishing all round the year (except the ban period May to October). The district administration of Sunamganj for the first time introduced license and permits in 2009 to test the modality of non-commercial fish harvesting at a sustainable level. Later, *beels* in the periphery of Tanguar Haor, also known as remote *beels* (buffer zone) began to be used for fish harvesting in winter season, as these become dried out and detached from the core zone due to some natural causes in every year. The introduction of non-commercial fish harvest in Tanguar Haor has established legal fishing rights for the full-time fishermen to survive with subsistence income. Table 4.9 shows the quantity of fishes (in kg) harvested in different remote *beels* (buffer zone) of Tanguar Haor in the year 2013 and 2014 .

Table 4.9: Remote *beel*/buffer zone fish harvesting in 2013 and 2014

Year	No. of *Beels*	Harvested Fish (kg)
2014	28	53,926
2013	21	36,884

c) Traditional Fish Harvesting

Katha fishing is a traditional fish harvesting in Tanguar Haor where some selected groups of fishermen harvest fish in a few core *beels* by pilling *kathas*. This kind of fishing is usually held under the commercial fish harvesting activity. But during first two years of commercial fish harvesting the fishermen of the community used to catch fish individually from the *beels*, using selected fishing gears. It was 2012, the community of Tanguar Haor first decided to go for collective fishing by the traditional fishers, skilled in this kind of different fishing. The Table 4.10 gives a summary of *katha* fishing during the year of 2012 and 2013. There was no *katha* set up during commercial fish harvesting in 2014.

A few affordable groups of fishermen belonging to the Hindu community hold '*Ganga Puja*' on the occasion of *katha* fishing. As a traditional practice, they offer puja with the belief that the worship will bring them good fortune with harvesting abundance of fishes. Fishermen, particularly other than the Hindu community also hold different occasions like '*Shirni*' (one kind of sweetmeat) distribution in the event of traditional fish harvesting. Thus, a good harmony is present among the fishermen communities of Tanguar Haor with cultural diversity.

Table 4.10: *Katha* fish harvesting summary in 2012 and 2013

Year	No. of *Beels*	No. of Fish Caught	Harvested Fish (kg)	Fish Price (Taka)	No. of Days of Fishing
2013	8	845	711	1,30,676	5
2012	10	1,17,880	55,580	59,86,976	75

4.6 Fishing Gears Used in Tanguar Haor

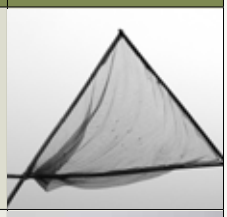
Fishermen of Tanguar Haor use different types of fishing gears. These gears which vary on size and shape are used in different seasons for fish harvesting. All the gears used in this *haor* can be classified mainly into three parts- fishing traps, hooks and nets. These include a number of fishing gears, many of which are known locally by several names. There are two major types of fishing traps usually seen for fish catching: closed traps and open traps. The local fishermen normally use 10-15 fishing traps in Tanguar Haor. Among those, some are closed traps, like Icha Chai, Banjali, Sat Muikkha, Burchunga Chai and Gui, and some are open traps, like Katha, Chai Ban, Light Trap, and Garojal.

Although most of the traps are made of bamboo sticks and plastic threads, but

these are of different sizes and shapes. Local fishermen catch fishes throughout the year by using these gears. Various kinds of large and small fish species, including small prawn, Pool Barb, Ticto Barb, Highfin Glassy Perchlet, Indian Glassy Fish, Elongate Glass-perchlet, Catfish, Zig-zag Eel and Ocellated Pufferfish are caught by fishing traps. Hooks are also commonly used for catching fishes in Tanguar Haor. Local fishermen use six types of hooks, namely Pocha hook, Tanga hook, Daitta borshi, Laar borshi, Chip borshi and Khili borshi. These hooks are known by different local names. By using hooks, fishermen catch fishes mainly from July to November. They use baits for catching various kinds of fish species, like Wallago Catfish, Spotted Snakehead, Snakehead Murrel, Climbing Perch, Kerala Mystus, and Zig-Zag Eel. The practice of using net for catching fish is widely seen in Tanguar Haor.

Local fishermen use around 15 types of nets. Some of which (e.g. Kona jal and Current jal) are absolutely banned for fishing. Most of the nets are made of nylon thread and rope with other materials. Most of the fish species of Tanguar Haor are caught by different nets. These are Rui, Catla, Barbs, Large Razor belly Minnow, Orange Fin Labeo, Wallago, Catfish, Mrigal, Kuria Labeo, Loach, Dwarf Gourami, Banded Gourami, Snakehead Murrel, Tank Gobi, Zig-Zag Eel, Elongate Glass-perchlet, and Gora-chela. Local fishermen use this type of gears for catching fish in rainy season and dry season. More details on fishing gear used for fish catching in Tanguar Haor are described in Table 4.11 and 4.12.

Table 4.11: Fishing gears used in fishing in Tanguar Haor

Sl	Group Name	English Name	Local Name	Material Used and Use Period	Species Caught	Photo*
1	Dragged net	Push net	Thela Jal/ Felun	Net, Nylon rope and bamboo Before rainy and dry season	Barbs, Large Razor-belly Minnow, Gora-chela, Prawn, Higfin Glassy Perchlet, Indian Glassy Fish, Elongate Glass-perhclet, Barred Spiny Eel, Lesser Spiny Eel, etc.	
2 (1)	Seine net	Sur-rounding net	Kona/ Ber Jal	Nylon or Plastic rope, Nylon net, Floating and Sinker Rainy Season	Mola Carplet, Spotted Snakehead, Snakehead Murrel, Great snakehead, Tank Goby, Barred Spiny Eel, Banded Gourami, Rohu, Catla, Mrigal, etc.	
2 (2)	Seine net	Sur-rounding net	Gon Jal/ Gan Jal/ Ghurai-na Jal	Nylon net, Nylon rope, Thick rope, Floating, Sinker (Iron made weight July to November	Barred Spiny Eel, Lesser Spiny Eel, Zig-zag Eel, Loach, Dwarf Gourami, Banded Gourami, Spotted Snakehead, Snakehead Murrel, Great Snakehead, Prawn, Kerala Mystus, Stripped Dwarf Catfish, etc.	
3 (1)	Gill net	Gill net	Current Jal	Mono-filament synthetic fibre net, Nylon Rope, Floats, Coin shape soil-made Sinker (weight), Pieces of narrow bamboo poles Before rainy and dry season	Barb, Kerala Mystus, Stinging Catfish, Climbibg Perch, Dwarf Gourami, Banded Gourami, Barred Spiny Eel, Zig-Zag Eel, etc.	
3 (2)	Gill net	Gill net	Koi Jal/ koiya Jal	Mono-filament fibre net, Nylon Rope, Floats, Coin shape soil-made Sinker (weight), pieces of narrow bamboo poles Before rainy and dry season	Mostly Climbing Perch. Other species are Dwarf Gourami, Banded Goura-mi, Pool Barb, Gangetic Leaffish, Barred Spiny Eel, Zlg-zag Eel, Walking Catfish, etc.	
3 (3)	Gill net	Gill net	Chela Jal	Mono-filament fibre net, Nylon Rope, Floats, Soil-made Sinker Before rainy and dry season	Mainly Large Razorbelly Minnow, Gora-chela	

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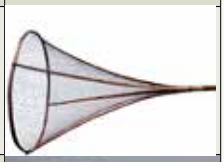
Sl	Group Name	English Name	Local Name	Material Used and Use Period	Species Caught	Photo
4 (1)	Falling net	Cast net	Koni Jal/ Jhaki Jal	Nylon or synthetic rope, Thick Rope, Sinkers (weight)	Barb, Kerala Mystus, Mola Carplet, Prawns, Stinging Catfish, Walking Catfish, Dwarf Gourami, Banded Gourami, Barred Spiny Eel, etc.	
4 (2)	Falling net	Cast net	Bachuri Jal/ Eknaia Jal/ Bichani Jal	Nylon Twine, Thick rope and Sinker (Iron made weight) July to November	Generally Rohu, Catla, Orange Fin Labeo, Wallago, Long-whiskered Catfish, Giant River Catfish, Mrigal, Kuria Labeo, Day's Mystus Tank Gobi, Zig-Zag Eel, etc.	
4 (3)	Falling net	Cast net	Utar Jal, Gaitya Utar, Naia Utar	Nulon net, Nylon rope, Thick ropes, Sinker (Iron made weight), 2 Boats and 1 Machan July to November	Rohu, Catla, orange Fin Labeo, Wallago, Long-whiskered Catfish, Giant River Catfish, Mrigal, Kuria Labeo, Silver Carp	
5	Falling net	Lantern net	Jhap Jal, Chabi Jal, Garo Jal	Nylon net, Nylon rope and Bamboo	Rohu, Catla, orange Fin Labeo, Wallago, Snakehead Murrel, Giant Snakehead, etc.	
6 (1)	Dragged net	Drag net/ Dredge net	Tana net	Net, Nylon/Plastic rope and Bamboo	Barb, Large Razorbelly Minnow, Gora-chela, Mola Carplet, Cotio, Highfin Glassy Perchlet, Indian Glassy Fish, Elongate Glass-perchlet, Shrimps, etc.	
6 (2)	Dragged net	Drag net/ Dredge net	Ichar Jal/ Ram Jal	Nylon net, Nylon rope, Bamboo, 2 pieces of Brikey or Stones and 300 feet long thick rope	Mainly Prawn. Other species are Indian Glassy Fish and Elongate Glass-perchlet	
6 (3)	Dragged net	Drag net/ Dredge net	Kodi Jal, Koti Jal, Para Jal, Horhori Jal, Horhoira Jal	Nylon net, Nylon rope, Thick rope, Float (made of sponge or plastic), Sinker (iron made weight), Pieces of Bamboo	Barred Spiny Eel, Lesser Spiny Eel, Zig-Zag Eel, Loach, Bengal Loach, Dwarf Gourami, Banded Gourami, Giant Snakehead, Snakehead Murrel, etc.	
7	Fixed net	Fixed Set Bag net	Gor Jal	Nylon rope, Numbers of Bamboo Pieces, 2 pieces of Bana, Plastic papers and a boat	All species which come through the current are caught	

Table 4.12: Hooks used in fishing in Tanguar Haor

Sl	Common Name	English Name	Local Name	Size and Use Period	Bait Used	Species Caught	Photo
1	Boal Hook/ Pocha Hook	Hook for Handling	Borshi	Hook (2-2.5 inch) and Thread (30-60 feet) July to November	Rotten Barb	Wallago, Giant River-catfish, Long-whiskered Catfish and Indian Mottled Eel	
2	Tanga Hook	Long Line	Tuni Borshi	1-1.5 inch and 12-15 inch thread is tied with 2 or more hooks July to November	Small frogs and various types of small fishes	Snakehead Murrel, Great Snakehead and Wallago	
3	Daitta Borshi	Floating Hook	Dati Borshi, Date Borshi/ Bokha	0.4-0.8 inch long July to November	Earthworm, Grasshopper or tiny Prawn, Dwarf Gourami, Blue Perch	Spotted Snakehead, Stinging Catfish, Climbing Perch, Snakehead Murrel, Great Snakehead, Walking Catfish, etc.	
4	Lar Borshi	Long Line	Dori Borshi	July to November	Earthworm, Mussels flesh, tiny Prawn, Grasshopper, Ticto barb, etc.	Orange Fin Labeo, Day's Mystus, Zig-Zag Eel, Wallago, Rita, Pabdah Catfish, Pabo Catfish, Butter Catfish, etc.	
5	Chip Borshi	Hook for Handling	Chip Borshi	July to November	Earthworm, Mussels, Snail, Caterpillar, Spiders, Grasshopper, Bread, Eggs of ants, etc.	Spotted Snakehead, Barb, Climbing Perch, Kerala Mystus, Snakehead Murrel, Zig-Zag Eel, Orange Fin Labeo, Rohu, Mrigal, etc.	
6	Khili Borshi	Floating Hook	Fol	July to November	Grasshopper's head or chest	Mainly Climbing Perch, sometimes Spotted Snakehead, Snakehead Murrel	

Table: 4.13 Indicative results on selected fishing gears' about impact on biodiversity

Sl	Name of Gear	Target Fish to Catch	Used Season and Time (Day/ Night)	Estimated CPUE (Catch Per Unit Effort)	Estimated Number of Non-Target Organisms	Photo
1	Lar Barshi	Shoal, Shing, Taki, Magur, Gazar	Wet season	150 lar (out of 400 lar at 150 gm per lar/ 12 hr	Cuchia, Snake	
2	Burchunga Chai	Chingri, Baim, Puti, Tengra	Winter November to April	200 gm/hr	Crab, Snail	
3	Chai	Chingri, Gutum, Tengra, Baim, Puti	Winter November to April	400 gm/12 hr	Crab, Snail	
4	Chouhanda Jal	Rui, Catla, Mrigel, Gozar	Last two month of the year	40 kg	-	

Source: Ahmed (2013)

4.7 Environmental Impact of Fishing Gears

The fishermen use different fishing gears to catch fish from the *beels*. A study was carried out to understand the impact of few selected fishing gears on possible threat to biodiversity. Five fishing gears, namely Lar Borshi, Burchunga Chai, Chai, Chouhanda Jal and Gher Jal were selected for the study. Table 4.13 provides some indicative observations.

4.8 Fish Value Chain Assessment in Tanguar Haor

Helvetas Swiss Inter-cooperation Bangladesh supported the CBSMTH Project as back stopper in the area of community mobilization and market development. As a part of its support, the organization conducted an assessment of the fish value chain in Tanguar Haor (2013). The assessment had the following objectives:

- Understand the market chain of fish in Tanguar Haor;
- Know the dynamics of the fish market in the region including the different actors involved;
- Develop strategic options for CBSMTH project to intervene in the fish value chain.

While assessing the fish value chain, there were following three main components: i) core functions-covering fishing, buying and selling of products; ii) supporting functions covering the relevant services which affect the value chain;

and iii) enabling environment covering rules and regulations as well as infrastructural aspects.

The core functions in the fish value chain are fishing, collection of fish, collecting and packing, and distribution to the consumer markets. There are about 10,000 households in 88 villages of Tanguar Haor of which 90% are involved in fishing. Among them, 20% are full-time fishers and the rest are part-time fishers. About 60% of the fishers are extreme poor and 30% are poor. Generally, the extreme poor are involved in full-time fishing. About 220 local people (20 collectors and 200 mobile collectors) are involved in the collection of fish from village level, and their packing and transporting to commission agents located at Dhaka whole-sale markets.

In Tanguar Haor, about 4,000 tons of fish are being harvested every year of which about 1,000 tons are being consumed by the local people. About 3,000 tons of fish are sold at national markets (Fisheries Resources of Tanguar Haor baseline report of TARA, 2008). The major supporting functions of the Tanguar Haor fish value chain consist of supply of fishing equipment and packing materials, short-term storage, and financial services. Most of the fishing equipment are being supplied by local traders (e.g. fishing nets, borshi, thread, etc). Local producers also produce and supply fishing equipment, like boat and bamboo gui (Conical Trap). Local poor men supply boat and local women of specialised villages supply bamboo gui. The fish traders buy ice from ice millers in Kolmakanda upazila of Netrokona district for short-term storage of fish. Local workshops are involved in manufacturing and supplying ice boxes. Truck agents provide services for the arrangement of trucks for the transport to Dhaka. Micro-finance institutes and money lenders provide financial services.

The enabling environment of Tanguar Haor fish value chain is mainly influenced by a co-management plan of fisher communities and government organizations facilitated by the CBSMTH Project. The model has different levels of functions from village to district: Village Co-management Committee (VCC), Union Co-management Committee (UCC), Central Co-management Committee (CCC), Tanguar Haor Management Committee (THMC), and Project Steering Committee (PSC). The THMC has been developing modalities for fishing in Tanguar Haor. The district administration is implementing, monitoring and following up the rules. The Ministry of Environment and Forests endorsed a resource sharing modality through a gazette notification in April 2008.

Characteristics of supply and demand

Total estimated fish production in Tanguar Haor is about 6,701 tons (Table 4.5) which is about 14% of the fish production of Sunamganj and 0.67% of Bangladesh (IUCN baseline survey, 2008). Due to the introduction of the co-management system in 2009, about 4,000 tons of fishes are harvested by fishermen now-a-days of which about 1,000 tons are consumed by the local people while the rest is sold at the national markets. At the moment, each mobile collector collects only about 35 kg of fish per day from fishers and supplies to wholesalers at the national markets. However, the demand would allow each of the mobile collectors to sell more than 200 kg a day. The most demanded species are Shrimps (Chingri), Bajura, Tengra, Koi and Shing. Currently, the annual Simplified Gross Margin (SGM) are Taka 30,000 (86%) for part-time fishes, 60,000 (87%) for full-time fishers, Taka 375,000 (2%) for wholesalers, and Taka 92,750 (7%) for mobile collectors. In terms of the SGM, the margin distribution in the chain is very favourable for the poor fishermen. However, because every individual fisherman only harvests very small amount of fish, the income from fishing is still not sufficient to overcome poverty.

Value chain functions and the actors

The main functions in the fish value chain

are fishing, collecting, sorting, packing, transporting, brokering and distributing to the consumer markets. These are described below along with the range of participants who fulfil the various functions.

Fishermen: Around 9,000 fishermen are involved with fishing from Tanguar Haor. There are two types of fishermen; on the one hand the full-time fishers (2,070) and on the other hand the part-time fishers (6,930). The main profession of the part-time fishers is agriculture. Full-time fishermen catch around 2-3 kg/day and then sell most often to Village Market based Traders (VMT) who are looking for fish as commission agents of Dhaka market actors. Sometimes the full-time fishers also sell fish to mobile collectors. On the other hand, part-time fishermen sell their fish to the mobile collectors who are collecting fish for VMTs. Sometimes, mobile collectors give advance money to part-time fishers for buying boat, traps, etc. Therefore, the fishers are bound to sell their fish to the specific collectors from whom they have taken the advance money.

Mobile collector: There are 200 mobile collectors in Tanguar Haor. Each mobile collector collects about 35 kg fish per day. Mobile collectors collect fish from fishermen and normally sell them to a specific fish collector located at a nearby village market. The mobile collectors generally grade the fish based on species and size. They use ice for storing and transporting the fish. They store the fish in cool boxes made of cork-sheet covered by tin containing around 180 kg of fish each.

Wholesalers cum commission agents: There are 20 wholesalers in Dhaka Karwan Bazar who directly buy fish either from fishermen or mobile collectors at Tanguar Haor. The wholesalers provide various kinds of supports to mobile collectors like advance money for buying boat, ice at a discounted price, and advance money as working capital for buying fish.

Commission agents: Commission agents of Mohanganj are involved with the management of buying and selling fish of Netrokona district. This is a bidding place between mobile collector and agents for selling fish. Considering sales, a commission agent receives 10% commission from mobile collectors and 10% from the agents. If commission agents provide advance money to the mobile collectors, they charge additional 5% commission from them. Generally, the agents purchase fish from commission agents on credit basis. Agents sell fish to Dhaka and other district markets.

Retailer: There are several types of retailers such as;
1) Sitting in a fixed market place;
2) Selling door to door;
3) Carrying cool van in street; and
4) Supermarket.

The retailers who sit in a fixed market place or sell door to door hardly use ices to keep fish fresh. This type of individual retailer buys 25-75 kg of fish per day from the wholesalers and finally sells to the consumers. The cool van users and supermarkets are able to keep fish fresh due to the refrigeration system.

Exporter: Saidowla Enterprise of the Euro Food Group in Sunamganj exports fish to different countries. Euro Food maintains international standards of certification. They collect fish from commission agents. The *haor* fish have a high demand due to their special taste. Euro Food is interested in creating awareness of the people of *haor* area on environmental issues associated with fish production. At present, fish of Tanguar Haor are not exported due to their blackish colour.

Big buyers during commercial fishing: As part of commercial fishing, Tanguar Haor Management Committee (THMC) invite for bidding for buying rights through an open tender process. This open tender is announced through website, tender notice in

daily newspapers and notice to the important and big fish markets. Usually, every year in the month of December, THMC publishes the tender.

Fish distribution points and major market places

The major geographical points from where fish of Tanguar Haor are distributed:

Tanguar Haor fish collection points: There are seven collection points in Tanguar Haor, namely Santar and Ranshika in Dakshin Bangshikunda union, Tarun and Naya Bazar in Uttar Sreepur union and Pondu, Joysree and Solaimanpur in Dakshin Sreepur union. All the fish harvested in the 88 villages of Tanguar Haor is collected and packed in ice boxes by the fish collectors in these points.

Kalmakanda and Mohanganj upazila market: Kalmakanda and Mohanganj upazilla under Netrokona district are two major important landing stations for shifting fish from water to road transport. All the fish of Tanguar Haor packed in trunks with ice is transported from the *haor* to these two landing stations by engine boat. Then the trunks are loaded onto trucks and transported to Dhaka. These two landing stations are also used as market places for trading fish of Netrokona district for selling to Dhaka market and other districts such as Sherpur, Jamalpur, and Mymensingh. There are around 100 *arots* at Mohanganj and 5 *arots* at Kalmakanda.

Dhaka Karwan Bazar: Karwan Bazar is one of the largest fish market places of Dhaka City Corporation. There are five fish markets at Karwan Bazar, Jasim market, Muktijaddha market, Dhaka matsha market and Ekota fish market. There are on an average 100 *arotders* (whole-seller) in each market.

Supporting functions

The major supporting functions of Tanguar Haor fish value chain are the following.

Bamboo *gui* producers: There are some villages like Nischintapur of Dakshin Bangshikunda union and Binothpur, Indropur, and Muzrai of Uttar Sreepur union where women are involved in producing bamboo *gui* (Conical Trap) and garojal (Falling net). The male members of the villages sale bamboo *gui* to the fishermen at the village market. The fishermen use bamboo *gui* for fishing throughout the year. Each fisherman requires 15-20 bamboo *gui* per year.

Fishing boat producers: Boats are generally produced and sold by local people. Both engine and non-engine boats are used for catching and transporting fish to the market places.

Local inputs suppliers: Local traders sell light fishing inputs like lar borshi, thread, hook, bamboo stick, small net, and light.

Transport agents: Transport agents are located at Mohanganj and Kalmakanda. Each transport agent hires at least one truck regularly for 30-35 traders. Transport agents unload fish boxes from boat and deliver the fish boxes to the market places in Dhaka. Agents charge a flat rate of Taka 500 for each box of fish as transportation cost.

MFI and Money lenders: Very few Micro Finance Institutes (MFIs) are entering the *haor* area due to high transaction costs. However, ASA and Grameen Bank are present in this area. Besides the big MFIs, the Village Co-management Committee (VCC) also provide credit support to their members. As the conditions for the loans, especially the repayment schedule, from MFIs or VCC are not very convenient for them; the fishermen usually take loan from money lenders at high interest rates (10-15% per month).

Ice millers: There are ice mills at fish market places in Tahirpur, Kalmakanda and Mohanganj upazilas. Wholesalers and mobile collectors generally purchase ice from local

ice mills for transporting fish from collection point to retailers. Sometimes, the wholesalers carry ice from Dhaka market if the local ice mills are unable to produce required quantity of ices within the stipulated period of time due to lack of electricity. Wholesalers also provide ice to mobile collectors at subsidised rates. Sometimes, generators are used for ice production.

Workshops (ice box producers): Local workshops at fish market places in Karwan Bazar, Mohanganj produce and repair ice boxes according to the demand of wholesalers. Wholesalers use locally made ice boxes for carrying fish to retailers. Each wholesaler purchases on average 5-10 boxes per year and regularly repairs part of them. Mobile collectors also use locally made small ice boxes for collecting fish from fishermen.

Fish drying: Women are involved in fish drying. Generally, insignificant quantities of fish are dried using sun drying technique. The dried fish are used for own consumption.

Constraints analysis
Several constraints were found during the assessment of the fish value chain of Tanguar Haor:

- Lack or limited scope for alternate livelihood options;
- Lack of knowledge about environmental pollution;
- Limited opportunity for women to be engaged with fish value chain;
- Limited access to pro-poor financial support;
- Lack of market information;
- Difficult communication inside the *haor;* and
- Poor market infrastructure.

Strategic options
The following strategic options can be considered in order to address the mentioned constraints:

- Fostering alternative livelihood strategies and economic activities;
- Improve marketing capacity of poor fishermen;
- Include local traders in commercial fishing activities;
- Improved communication between different tiers of the management system;
- Exploration of feasibility for fish export;
- Building of human and institutional and technical capacities; and
- Dialogue and policy advocacy.

4.9 Major Challenges to Conserve Fish in Tanguar Haor

The sustainability of the fisheries management practices in Tanguar Haor may face the associated challenges arisen due to anthropogenic, environmental or climate change/climate variability, and trans-boundary effects in the upcoming days. It is challenging to maintain the wetland confluent in natural.

- Illegal fishing during the breeding season and contumacious to strictly follow the sustainable fish harvesting modality developed under CBSMTH project are considered major threats to conserve fish species in Tanguar Haor;
- Use of banned fishing gears such as Gill net exacerbated loss of fish species diversity in Tanguar Haor;
- Establishment of crop dams around this haor is disrupting the water flow and fish movement that may affect natural recruitment and dispersal pattern of this mother fishery;
- Land use change in upper riparian region may increase sedimentation in the haor and alter the Jadukata-Patlai River discourse;
- Coal mining, polder abstraction and carrying by water vessel can deteriorate water quality and may change the bottom topography of Patlai River

which serves as significant fish pass;

- Addressing the needs of the growing human population will be another critical issue for Tanguar Haor fisheries management in future.

Hence, the locally appropriate adaptive measures are required to addressing these social, environmental and climatic challenges of this fishery. Strong synchronization among government relevant line agencies, development actors and stakeholders will be future direction for addressing these challenges, sustaining the ecosystem and conservation of this rich fish biodiversity.

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Chapter 5
Species Profile

Humped Featherback

Order: Osteoglossiformes
Family: Notopteridae
Scientific name: *Chitala chitala* (Hamilton, 1822)
English name: Clown Knife Fish/Humped Featherback
Local name: Chital/Chetol/Chitna
National status: Endangered
Fin formula: D 9; P_1 15-16; P_2 6; A 115-120

Description: Body is elongated and deeply compressed. Back is strongly humped in front of the dorsal, and ventral profile is almost straight. Complete lateral line present. A small tuft like dorsal fin inserted near the middle of long back. Small caudal fin is confluent with the anal. Both side of the dorsal ridge is coppery-green above with about 15 silvery bars, but side and belly is silvery in colour. Around 5-9 round black spots near the end of the tail clearly distinguishes the species from *Notopterus notopterus*.

Feeding: The fish is carnivore and predator in nature. It feeds on aquatic insects, molluscs, shrimps and small fishes takes insects and tender roots of aquatic plants during its earlier stage of life.

Breeding: Once a year during June–July by building nest. Young receives parental care.

Distribution: Bangladesh, India, Malaysia, Myanmar, Pakistan, Philippines and Thailand.

Size: Over 100 cm in total length; 103 cm recorded by from Gacher Dahar Beel of Sylhet district.

Chital in Tanguar Haor: The fish is demersal in habit; i.e., living on or near the bottom and feeding on benthic organisms. This fish is marketed in fresh and sometimes in live condition with high market value in the *haor* area. Flesh is of good flavour but full of small bones. The Humped Featherback plays an important role in the aquatic food chain by their predatory behaviour. It is also used to remove the unwanted fish in the culture pond.

Grey Featherback

Order: Osteoglossiformes
Family: Notopteridae
Scientific name: *Notopterus notopterus* (Pallas, 1769)
English name: Grey Featherback
Local name: Foli/Pholui/Haila/Kanla
National status: Vulnerable
Fin formula: D 7-8; P_1 15-17; P_2 5-6; A 99-104

Description: Body is deeply compressed. Dorsal and ventral profile is almost equally convex. Mouth is terminal. Scales are minute. Lateral line is complete, with 230–340 scales in lateral series. A small tuft like dorsal fin is present and anal one is very long and ribbon-like, confluent with the small caudal fin. The colour of Foli is silvery white with numerous fine grey spots on body and head, dark along the back.

Feeding: The fish is predatory and carnivorous in nature. It feeds on insects, fish, crustaceans and some young roots of aquatic plants.

Breeding: The species breeds in rainy season at May and June both in stagnant or running water. They have less fecundity and lay eggs in small clumps or submerged vegetation.

Distribution: Bangladesh (all over), India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan and Thailand.

Size: It attains about 61 cm in total length but 25 cm is common size; 35.5 cm recorded from Gacher Dahar Beel of Sylhet District.

Foli in Tanguar Haor: The fish is carnivorous and predatory in nature. The predatory behaviour of the fish helps commercial carp fish culture as it preys on small unwanted fish in the pond. The fish is known as an ambusher in fish farm. Soup made from it is given to patients suffering from measles.


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Gangetic River-sprat

Order: Clupeiformes
Family: Clupeidae
Scientific name: *Corica soborna* Hamilton, 1822
English name: Gangetic River-sprat
Local name: Kachki/Subarna-kharika
National status: Not Threatened
Fin formula: D 14-15; P_1 12-13; P_2 8; A 13-14+ 2

Description: Body is moderately elongated with compressed and keeled belly. Scutes present before and behind the pelvic fin base. Last two anal fin rays separated from rest of the fin, forming a distinct finlet. Body colour is brownish, shot with silver. Caudal forked and lower lobe slightly longer than the upper. 40–43 scales in lateral series. Body colour is brownish with a faint lateral band running longitudinally. Caudal is with faint edges and a faint black spot at its base.

Feeding: Feeds primarily on zooplankton and also some invertebrates.

Distribution: Bangladesh, India, Indonesia and Thailand.

Size: Attains about 4 cm in standard length.

Kachki in Tanguar Haor: Kachki has the habit of moving in groups. This small fish is rich in protein and minerals and the whole fish body is taken as food which results in more nutrient intake. The species has medicinal value and used as bait for fishing.


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Gangetic Gizzard Shad

Order: Clupeiformes
Family: Clupeidae
Scientific name: *Gonialosa manmina* (Hamilton, 1822)
English name: Ganges River/Gizzard Shad
Local name: Chapila/Goni Chapila
National status: Not Threatened
Fin formula: D 3/12-13; P_1 14-15; P_2 8; A 24-25

Distribution: Bangladesh, India, Pakistan and Sri Lanka.

Size: Largest specimen collected in Karnafuli River was 14.1 cm in total length.

Chapila in Tanguar Haor: Chapila lives in the pelagic zone of the *haor* area and amphidromous in nature. The fish plays an important role in controlling the population of plankton in the *haor* ecosystem where it lives. It is not a commercially important species.

Description: Body is short and strongly compressed laterally. Abdominal profile is more convex than that of the dorsal. Mouth is small, inferior. Snout is prominent. Eyes are with broad adipose lids. Caudal fin is deeply forked, lower lobe longer than the upper. Body colour is greyish along the back, silvery on the sides and below, opercle and cheek yellow. A well defined shoulder spot is found. Fins are yellowish. Dorsal and caudal with dark edges.

Feeding: Plankton feeder. The species has numerous long gillrakers, which serve as efficient straining devices.


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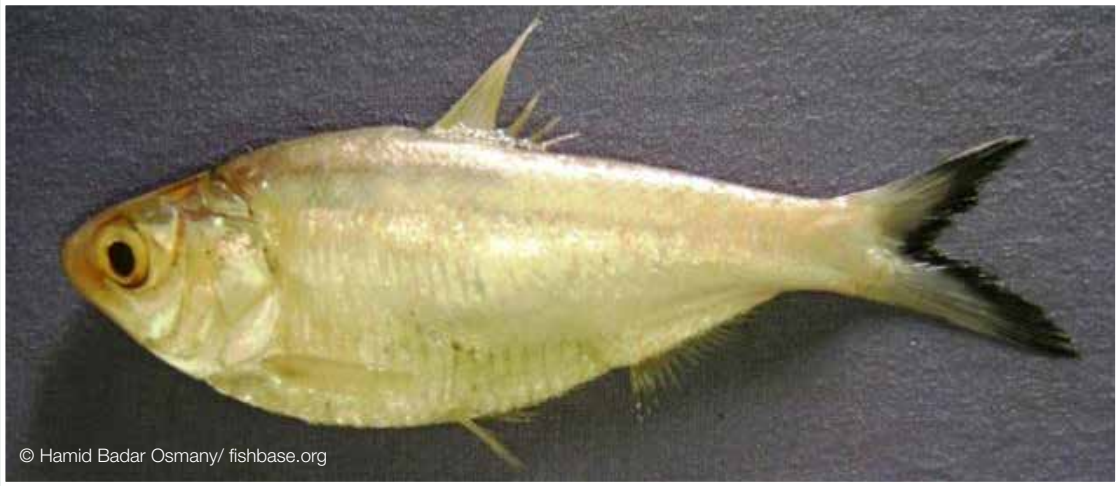
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Indian River Shad

Order: Clupeiformes
Family: Engraulidae
Scientific name: *Gudusia chapra* (Hamilton, 1822)
English name: Indian River Shad
Local name: Chapila/Suiya/Suhia/Guri/Chaipla/Khaira
National status: Not Threatened
Fin formula: D 3/11-12; P_1 1/12; P_2 7; A 2/21-23

Description: Body is strongly compressed. Ventral profile of the fish is more convex than that of the dorsal. A keel of scutes present along the belly which is the main identifying characteristics of this family. Lateral line is absent. Single dorsal and anal, paired pectoral and pelvic fin present. Dorsal fin is inserted above the pelvic fin origin. Anal fin is short which is situated well behind the dorsal base. Body colour is brown on back, silvery or golden flanks. A blackish blotch is present just behind gill-opening (shoulder spot), often followed by a series of spots along flank.

Feeding: The fish is omnivorous and surface feeder. It mainly feeds on phytoplankton, zooplankton, debris, plants and animal matters.

Breeding: Breeds during the monsoon in stagnant waters.

Distribution: Bangladesh, India, Malaysia, Myanmar, Nepal and Pakistan.

Size: It attains a standard length of about 15 cm. But, maximum length of 20 cm has been recorded in Bangladesh.

Chapila in Tanguar Haor: The fish is pelagic and potamodromous in habit. It occupies the third trophic level in the aquatic food chain of the Tanguar Haor ecosystem.


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Gangetic Hairfin Anchovy

Order: Clupeiformes
Family: Engraulidae
Scientific name: *Setipinna phasa* (Hamilton, 1822)
English name: Gangetic Hairfin Anchovy
Local name: Phasa/Phausa/Tel-tampri
National status: Not Threatened
Fin formula: D i+2-3/11-12; P_1 1/12-13; P_2 1/6; A 64-72

Description: Body is elongate, deeply compressed with an evenly arched dorsal and abdominal profile. Snout projects slightly. About 52 scales are found along the median lateral series. Pectoral fin is with a large axillary scale. Scales are deciduous. Short spine in front of the dorsal. Body colour is greenish along the back, silvery below. Dorsal and caudal fins are yellow. Upper lobe of the caudal and upper margin of the dorsal is black. Pectorals are deep blue-black expecting the elongated way which is colourless, pelvics and anal colourless.

Feeding: An omnivore.

Breeding: October–November in the estuary and March–April in the river.

Distribution: Bangladesh, India and Myanmar.

Size: Largest size recorded in Bangladesh is 29.2 cm.

Phasa in Tanguar Haor: The fish plays an important role in the aquatic food chain of the *haor* ecosystem. It also helps to control water pollution. It is a species of minor commercial importance.

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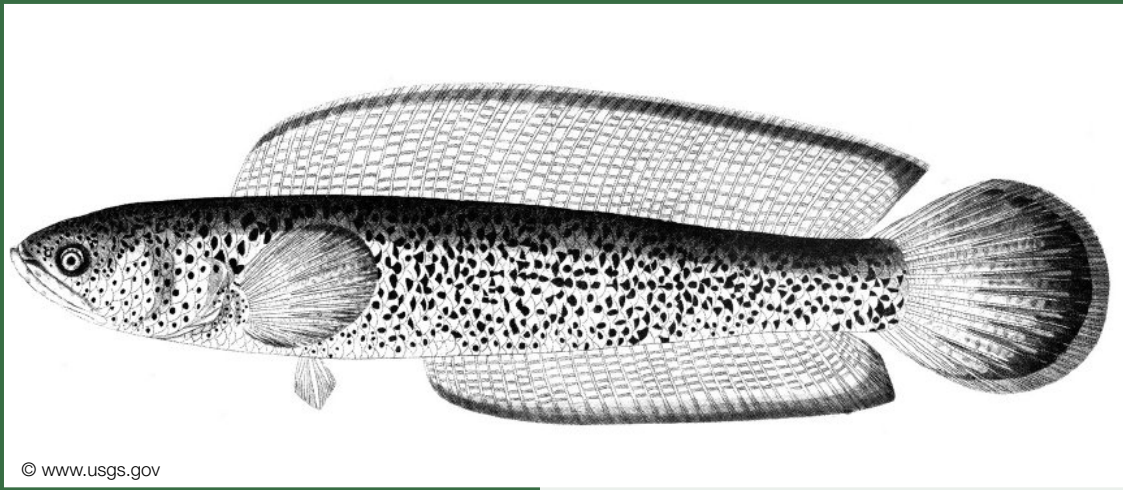

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Barca Snakehead

Order: Channiformes
Family: Channidae
Scientific name: *Channa barca* Hamilton, 1822
English name: Barca Snakehead
Local name: Pipla/Tila Shol/Tila
National status: Critically Endangered
Fin formula: D 50-51; P_1 15; P_2 6; A 34-35

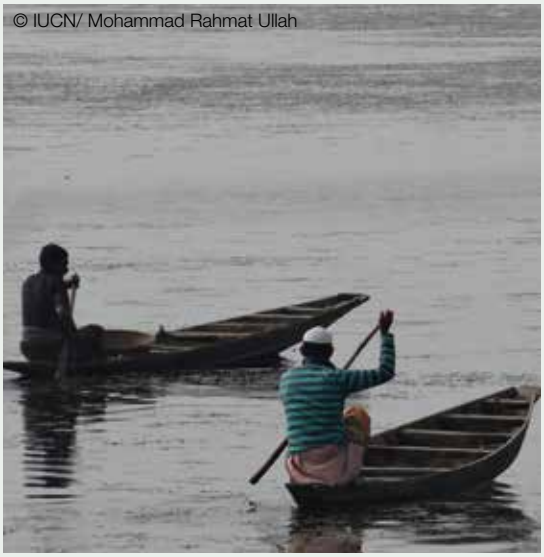
Description: Body almost cylindrical anteriorly, but laterally compressed on posterior portion. Anterior nasal opening produced into a tubular process. Mouth is large and deeply cleft. Lateral line passes for 21–23 scales, then descends for one scale and subsequently passes straight to the middle of the caudal base. Caudal fin is rounded. Body colour is dark brown above, brown below. Scales are spotted, spots most numerous along the upper half of the body and absent in the belly. Dorsal, anal and caudal fins are dark, with black blotches. Fin edges red; pectoral fins reddish, with numerous black spots.

Feeding: The species is carnivorous, prefers live food but it has a peculiar habit of travelling into mustard plant fields to eat the flowers.

Distribution: Bangladesh and India.

Size: Attains a length about 90 cm.

Pipla in Tanguar Haor: The fish lives in the benthopelagic zone and it is potamodromous in nature. The fish is found in holes of the banks of the aquatic body. This is an excellent food fish, and delicious to taste. Good sport on rod and line.



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Great Snakehead

Order: Channiformes
Family: Channidae
Scientific name: *Channa marulius* (Hamilton, 1822)
English name: Great Snakehead/Giant Snakehead/Bullseye Snakehead/Cobra Snakehead
Local name: Gajar/Gajal/Gajari
National status: Endangered
Fin formula: D 49-55; P_1 17-19; P_2 6; A 28-35

Description: This snakehead species is an elongated fish, with a long dorsal fin and tubular nostrils. Body is almost cylindrical anteriorly and compressed posteriorly. Lateral line consists of 54—64 scales. Lateral line first passes along 18—19 scales, then descends to 2 scales and subsequently passes straight to the middle of the caudal base. Young fish with a brilliant orange along the middle of the sides, but in mature forms there are 4 or 5 larger black blotches along the sides. A conspicuous black, light-edged ocellus is present at the upper base of the caudal. The fish is reported to be the largest species of the family Channidae.

Habit and Habitat: An extremely voracious predator with an ability to move overland for short distances. Parents guard the fry for about a month. The fish is found in sluggish or standing waters in rivers, canals, lakes and swamps. It tends to inhabit waters with submerged aquatic vegetation and is usually found only in deep pools in rivers and occasionally in lakes. The fish prefers deep, clean stretches of water with sandy or rocky bottoms.

Feeding: The fish consumes primarily fishes, frogs, insects, earthworms and tadepoles. The species is cannibalistic science small snakeheads often become prey for larger specimens. The fish is considered predacious, especially on other fishes. It also has the potential to impact native crustaceans through predation.

Breeding: Breeds during the wet season.

Distribution: Bangladesh, Cambodia, India, Laos, Myanmar, Nepal (southern part), Pakistan, South China, Sri Lanka and Thailand.

Size: Attains a length about 120 cm in total length.

Gajar in Tanguar Haor: It is reported that this fish is highly suitable for cage culture and culture in ponds in combination with tilapia. It is found to be an effective tool in controlling the overpopulation of tilapia and thus checks stunted growth of tilapia. They are cultured as game fish in their native range because they put up a strong fight when hooked.

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Asiatic Snakehead

Order: Channiformes
Family: Channidae
Scientific name: *Channa orientalis* Bolch and Schneider, 1801
English name: Asiatic Snakehead/Walking Snakehead
Local name: Gachua/Raga/Ragha/Cheng
National status: Endangered
Fin formula: D 31-36; P_1 14-15; P_2 6; A 20-24

Description: Body is almost cylindrical anteriorly, somewhat compressed posteriorly. Lateral first passes along 12—13 scales, then descends for one scale and subsequently passes straight to the middle of the caudal base. Lateral line with 42—45 scales. Body colour is dark brown and grey above, lighter ventrally. Dorsal, caudal, anal and pectoral fins have a narrow, sharply defined blood-red margin. A row of dark oblique bands run above and below the lateral line. Pectoral fins are with a series of distinct alternating blue and pale orange vertical bands; outer margin of the caudal fin is orange and barred. Young one is often with a large ocellus on the last five dorsal fin rays.

Feeding: It feeds largely on insects, crustaceans and small fish. It is carnivorous and destroys eggs and fries of other fishes.

Breeding: Monogamous and breed during April to June; during mating the female turns upside down and male lies above it cross-wise.

Distribution: Afghanistan, Bangladesh, Cambodia, China, India, Indonesia, Iran, Laos, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Taiwan and Vietnam.

Cheng in Tanguar Haor: The species moves along the benthopelagic zone and is potamodromous i.e., migrates between rivers. In Tanguar Haor, it also migrates between *beels*. The ability of being tolerant of stagnant, poorly oxygenated, turbid and very foul water containing city wastes permits the species to inhabit in ponds, ditches and swamps along with the *haor* area.

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Spotted Snakehead

Order: Channiformes
Family: Channidae
Scientific name: *Channa punctata* (Bloch, 1793)
English name: Spotted Snakehead
Local name: Taki/Lata/Lati/Okol/Chaitan
National status: Not Threatened.
Fin formula: D 29-32; P_1 15-18; P_2 6; A 20-22

Description: Body is almost cylindrical anteriorly and laterally compressed in posterior part. Lateral line is present with 40—41 scales. Lateral line first passes for 15 scales, then descends for one row and subsequently passes straight to the middle of the caudal base. Body colour is usually grey on the back fading to a lighter shade beneath. A series of about 8—9 vertical bands are present above the lateral line, alternating with a similar series below it. Scales on the sides in some specimens are with small black spots (Rahman, 2005).

Feeding: Young feeds primarily on zooplankton, with rotifers, insects and crustacean larvae constituting most of the diet. Adults consume fishes, insects, and aquatic vegetation (Quayyum and Qasim, 1962). The species is an opportunistic feeder. It also accepts chopped fish and shrimp in the aquarium.

Breeding: Breed throughout the year.

Distribution: Afghanistan, Pakistan, India, Sri Lanka, Nepal, Bangladesh, Myanmar and Yunnan in China.

Size: Maximum length ranges from 24 to 30 cm.

Taki in Tanguar Haor: This channidae also lives in the benthopelagic zone and potamodromous in habit. So it has the habit of migration between *beels*. The species may be in solitary or in pairs, but they are highly gregarious when young. In *haor* region, the fish is used as live bait for angling larger snakeheads. Because of their voracious, carnivorous feeding habit, snakeheads devour other fishes of the *haor*. But it is regarded as pest in ponds or culture set-ups where other desired species exist.

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Striped Snakehead

Order: Channiformes
Family: Channidae
Scientific name: *Channa striatus* (Bloch, 1793)
English name: Striped Snakehead/ Snakehead Murrel
Local name: Shol
National status: Not Threatened
Fin formula: D 42-46; P_1 15-17; P_2 6; A 24-27

Description: Anterior part of body is almost cylindrical, but compressed posteriorly. Lateral line is with 54—60 scales. Lateral line first passes for 16—18 scales; then descends for 2 or 3 scales and subsequently passes to the middle of the caudal base. Caudal fin is rounded. Colour of fish varies with age and the habitat they live in. Body is dark grey superiorly, becoming yellowish beneath. Lateral line is with penninsulas of dark colour extending into the yellow. A dark band runs obliquely upwards from the snout to the edge of the gill-cover. Caudal fin is dark with two distinct vertical bands on its base. Fries are orange-red in colour.

Feeding: The fish is carnivorous and subsists on a variety of living creatures including fishes, frogs, snakes, insects, earthworms and tadepoles.

Distribution: Bangladesh, India, Malay Archipelago, Myanmar, Nepal, Pakistan, Southern China, Sri Lanka and Thailand.

Size: The species attains a length of about 60—75 cm. The common size is 30—40 cm.

Shol in Tanguar Haor: The species remains in the benthopelagic zones of Tanguar Haor. Although the species prefers stagnant and muddy water in the plains, but it is also found in swamps and lowland rivers. The species can be domesticated and bred. Cream prepared from the flesh of *C. striatus* is reported to heal dermal wounds.

Indian Carplet

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Amblypharyngodon microlepis* (Bleeker, 1853)
English name: Indian Carplet
Local name: Mola
National status: Not Threatened
Fin formula: D 2/7; P_1 15; P_2 9; A 2/5

Description: Body is elongated and compressed. Dorsal profile is more convex than the abdominal. Abdomen is rounded. Mouth is moderate and somewhat superior. Snout is with thin skin, upper lip absent, lower jaw prominent. Eyes are large, slightly visible from the under side of the head. Scales are small. Lateral line is incomplete, ceases after a few scales; 55–60 scales in the lateral series. Body colour is bronze on the upper side, flanks brassy to golden with a broad dull greenish-silver longitudinal band from the operculum to the caudal base; belly whitish. *Amblypharyngodon microlepis* resembles *A. mola* closely but differs from the latter by the possession of 5 rows of scales between the lateral line and the pelvic base compared to 9–10 rows between the lateral line and the pelvic base in *A. mola*.

Feeding: An omnivore. Surface and column feeder. Feeds unicellular algae, protozoans, rotifers and crustaceans, debris and plant parts.

Breeding: Spawning starts with the commencement of the monsoon. Breeds during May–October.

Distribution: Bangladesh, India, Myanmar, Nepal and Pakistan.

Size: Largest size recorded in India is about 10 cm.

Mola in Tanguar Haor: The fish keeps the *haor* water body clean by consuming algae, zooplankton, debris and plant parts. Mola is a fishery of minor commercial importance. The species has high nutritional value in terms of protein, vitamins and minerals. The Mola contains available Vitamin A than any other freshwater fish. It is believed to prevent night blindness among children.

Mola Carplet

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Amblypharyngodon mola* (Hamilton, 1822)
English name: Mola Carplet/Pale Carplet
Local name: Mola/Moa/Molongi/Mowka/Moraru/Mowrala/Mouchi
National status: Not Threatened
Fin formula: D 2/9; P_1 15; P_2 9; A 2/5

Description: Body is moderately elongated and compressed. Dorsal profile is more convex than the abdominal. Abdomen is rounded. Lateral line is incomplete, ceases after 9—18 scales; 65—91 scales in the lateral series; 9 or 10 scale-rows between the lateral line and the pelvic fin base. Caudal peduncle is long. Caudal fin deeply forked; lobes pointed. Body colour is golden-yellow with a broad silvery lateral band on the body. Dorsal, anal and caudal fins are usually with dark markings; pectoral and pelvic fins are hyaline.

Feeding: An omnivore. Surface and column feeder. Feeds unicellular algae, portozoans, rotifers and crustaceans, debris and plant parts.

Breeding: Breeds during May-October.

Distribution: Bangladesh, India, Myanmar, Nepal and Pakistan.

Size: Largest size recorded in Bangladesh is 9 cm.

Mola in Tanguar Haor: Mola moves in shoals through the surface. Although it is a fishery of minor commercial importance, yet the species has high nutritional value in terms of protein, vitamins and minerals which could contribute in meeting vitamin deficiency of people from *haor* area. The Mola contains more Vitamin A than any other freshwater fish.


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Jaya

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Aspidoparia jaya* (Hamilton, 1822)
English name: Jaya
Local name: Jaya/Peali/Peashi
National status: Not Threatened
Fin formula: D 2/7; P_1 14-15; P_2 8; A 2/7

Description: Body is elongated and sub-cylindrical. Mouth is small, inferior; snout blunt. Lower lip is absent, lower jaw with a sharp cresentic body edge; no barbel. Scales are deciduous. Lateral line is greatly curved with 45–49 scales and runs along the lower half of the caudal peduncle. Dorsal fin originates above the pelvics, and situated midway between the snout and the caudal base. Pectoral as long as the head, not reaching the pelvics. Colour is silvery, black darkish.

Distribution: Afghanistan, Bangladesh, India and Nepal.

Size: The largest specimen in Bangladesh is collected from the Kuttanadi, Panchagar, Dinajpur measured 9.7 cm in total length.

Jaya in Tanguar Haor: The species lives in the benthopelagic zone of the *haor* ecosystem and never competes with other benthopelagic species. The fish is of minor commercial importance.


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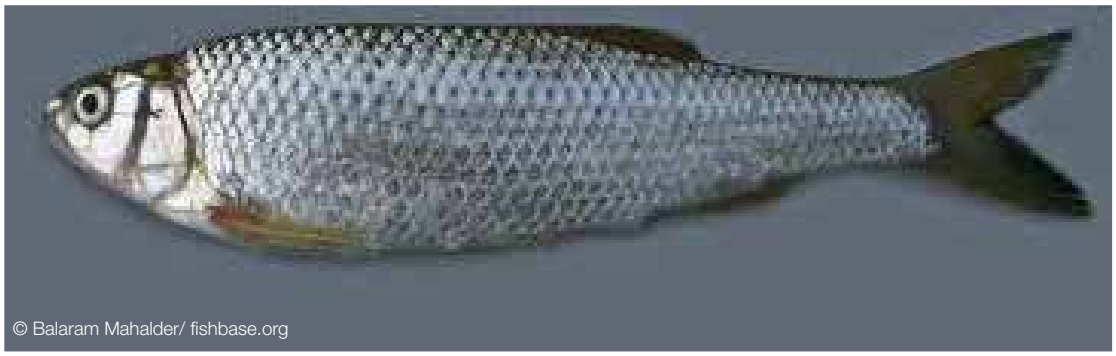

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Tileo Baril

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Barilius tileo* (Hamilton, 1822)
English name: Tileo Baril
Local name: Tila/Tila Koksa/Patharchata
National status: Data Deficient
Fin formula: D 2/7; P_1 13; P_2 8; A 3/10

Description: Head is compressed with pointed snout. Body is deep, its depth 3.4—3.7 times in standard length. Mouth is moderate with short jaws. Maxilla extends to below the middle of the orbit; barbels a rudimentary maxillary pair, or entirely absent. Scales are small. Lateral line present with 60—63 scales. Body is bluish brown on the back, becoming silvery on the flanks and the belly. 2 or 3 rows of blue spots and blotches are seen along the sides of the body.

Feeding: Feeds on algae, detritus and other benthic organisms.

Distribution: Bangladesh, India, Myanmar and Nepal.

Size: Largest size is 15.3 cm.

Tila Koksa in Tanguar Haor: The fish lives in the benthopelagic zone of the *haor* zone and feeds on benthic organisms. It plays an important role in the food chain of the Tanguar Haor ecosystem.

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Bengala Barb

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Bengala elenga* (Hamilton, 1822)
English name: Bengala Barb
Local name: Elong/Sephatia/Elanga
National status: Endangered
Fin formula: D 2/7; P_1 14-15; P_2 9; A 2/5

Description: Body is elongated and slender. Abdominal profile is more convex than the dorsal. Mouth is small, cleft of mouth oblique. Lower jaw is slightly prominent. A pair of rostral barbels present. Lateral line is complete with 40–44 scales passing along the lower half of the abdomen. Caudal fin is forked. Scales are medium. Colour is silvery, often with a leaden band along the upper portion of the side.

Feeding: Omnivorous, mainly feeds on aquatic insects, algae, and protozoans.

Distribution: Bangladesh, India, Myanmar and Nepal.

Size: Maximum size is 21 cm.

Elong in Tanguar Haor: This species is found in the pelagic zone of the aquatic water body.

It is not known as a commercially important species in Bangladesh. The species avoids competition with other species for food as it is omnivorous in habit.


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Catla

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Catla catla* (Hamilton, 1822)
English name: Catla
Local name: Catla/Katla
National status: Not Threatened
Fin formula: D 2/15-16; P_1 18-20; P_2 9; A 3/5

Description: Body is short and compressed with a broad head. Large head is an important and easy key to identify the species. Dorsal profile is more convex than that of abdomen. Origin of the dorsal is much nearer to the snout tip than to the caudal base. Pectoral nearly reaches the pelvics. Pelvics in male reach the anal. Lateral line is complete. Body colour is dark grey above, silvery on the sides and abdomen. Scales, except those on the belly, are pink or coppery at the centre. Fins are blackish. Pectorals are pale.

Feeding: Surface and mid-water feeders, mainly omnivorous with juveniles feeding on insects, detritus and phytoplankton. Main food consists of algae, crustaceans and higher plants.

Breeding: Breeds in selected parts of certain rivers in June-July. Halda River in Chittagong is the main natural spawning ground of Catla.

Distribution: Bangladesh, China, India, Myanmar, Nepal, Pakistan and Sri Lanka.

Size: Attains about 121.9 cm in length. Longest size recorded from Chandpur was 96.7 cm in total length and 9.8 kg in weight (Rahman, 2005).

Catla in Tanguar Haor: The species is a surface dweller and competes for food and shelter with other habitants in the *haor* region. It is a fast growing important commercial species and is extensively preferred to culture in tanks throughout Bangladesh.


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Chaguni

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Chagunius chagunio* (Hamilton, 1822)
English name: Chaguni /Medium Carp
Local name: Jarua/Utti
National status: Data Deficient
Fin formula: D 3/8, P_1 15; P_2 9; A 3/5

Description: Compressed head with flat sides. Abdomen is broadly rounded. Snout is overhanging, divided into a central and two lateral lobes by a groove extending upward and forward from the base of each rostral barbell. Lateral line complete, with 44–47 scales; 20–21 rows in transverse series.

Feeding: Feeds on insects, algae and detritus around rocks and boulders.

Distribution: Bangladesh, India, Myanmar, Nepal, Pakistan and Thailand.

Size: The species attains a maximum size of 20–25 cm.

Jarua in Tanguar Haor: As a bottom-dwelling detritus feeder it keeps the *haor* habitat clean. The fish also controls the insect population in the *haor* ecosystem where it occurs. The fish is not a commercial fish in Bangladesh.


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Indian Grass Barb

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Chela laubuca* (Hamilton, 1822)
English name: Indian Grass Barb/Blue Labuca
Local name: Labuca/Kash Khaira
National status: Endangered
Fin formula: D 2/8; P_1 13; P_2 7; A 3/18-19

Description: Compressed body is rhomboid in shape with a convex carinate belly. Abdominal profile is keeled from below the pelvic origin to the anus. Mouth is oblique, and maxilla reaches to below the front edge of the orbit. Lateral line is curved downwards; 34–36 lateral line scales. Caudal fin is forked, lobes equal. Body colour is bright metallic blue with hyaline fins. A green to deep black longitudinal stripe is found from the head to the caudal fin. Fins are yellowish or light orange. Two black marks are present, one at the caudal base and the other at the dorsal base.

Feeding: Larvivorous, it feeds on insects, stem and leaf tissue.

Distribution: Bangladesh, India, Indo-China, Indonesia, Myanmar, Nepal, Pakistan and Sri Lanka.

Labuca in Tanguar Haor: The fish is found to move in shoals in the Tanguar Haor region. It controls insect population and algal bloom from the bottom of water bodies of *haor* ecosystem. It is not a commercial species, but an important aquarium fish.


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Mrigal Carp

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Cirrhinus cirrhosus* (Bloch, 1975)
English name: Mrigal Carp/Mrigal
Local name: Mrigal/Mirka
National status: Not Threatened
Fin formula: D 3/13; P_1 17; P_2 1/8; A 3/5

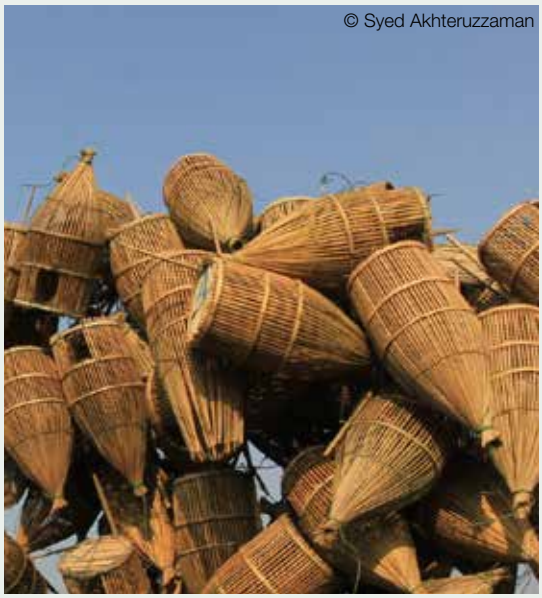
Description: Body is elongate, its depth more than the length of the head. Dorsal profile is more convex than that of the abdomen. Ventral profile is nearly straight or only slightly convex. Snout is obtusely rounded, covering upper lip and provided with pores. Lateral line with 40–43 scales. Body colour is greyish along the back, silvery on the sides and below. Anterior base of scales is black on the upper half of the body. Pectoral, pelvic and anal fins orange, stained with black.

Feeding: It is essentially a plankton feeder, but also browse on algae in marginal shallows. Juveniles are omnivorous, adults are herbivorous.

Breeding: Breeds during May–July in shallow sections of selected rivers. The species can be induced to breed in hatcheries by hypophysation.

Distribution: Bangladesh, India and Pakistan.

Mrigal in Tanguar Haor: It plays an important role in the control of the algal population in the *haor* ecosystem. The species has great demand as food and has great economic value.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Reba

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Cirrhinus reba* (Hamilton, 1822)
English name: Reba/Reba Carp
Local name: Raik/Tatkini/Bhagna/Bata/Laacho
National status: Vulnerable
Fin formula: D 2-3/8-9; P_1 16; P_2 9; A 3/5

Description: Body is elongated. Dorsal profile is slightly more convex than that of ventral. A pair of short rostral barbels is present. Dorsal fin is inserted slightly posterior to the tip of the pectoral fins, nearer to the snout tip than to the base of the caudal fin. Lateral line is with 36-38 scales; 5.5 rows of scales between the lateral line and pelvic fin base. Body colour is dark grey dorsally, silvery on the flanks and belly. Scales are darkest at the edges, forming bluish longitudinal bands above the lateral line. Anal and pelvic fins are orange-tipped.

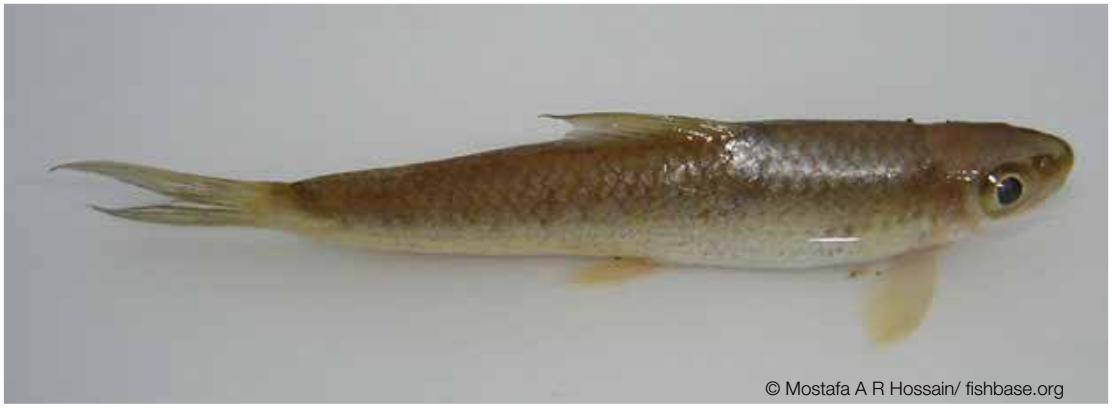
Feeding: Plankton feeder.

Breeding: Breeds in the beginning of summer when there is excessive rainfall. Breeding occurs in flooded shallows between June–September.

Distribution: Bangladesh, India, Nepal and Pakistan.

Size: Largest size recorded from Bangladesh is 32.5 cm in total length (Rahman, 2005).

Tatkini in Tanguar Haor: The species is considered as a delicious dish and in great demand not only in Tanguar Haor, but also across Bangladesh. The fish is suitable for aquaculture given its fairly rapid growth and prolific breeding. It plays an important role in the aquatic ecosystem of *haor* region as a plankton feeder. It is potamodromous in habit and remains in benthopelagic zone.



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Gangetic Latia

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Crossocheilus latius* (Hamilton, 1822)
English name: Gangetic Latia/Hill-stream Carp
Local name: Kala Bata
National status: Endangered
Fin formula: D 2-3/8; P_1 14-16; P_2 9; A 2/5

Description: Elongate body, ventral profile is nearly straight between the head and the pelvics. Head is flattened above, snout oval, blunt. Barbel 2 pairs, maxillary and rostral. Lateral line is with 36–37 scales. Caudal is deeply forked, upper lobe is slightly longer than the lower. Body colour is greyish above, yellowish below. A faint longitudinal stripe is found on the flank. Dorsal and caudal fins are yellowish-grey.

Feeding: Feeds on algae on the muddy bottoms. A bottom feeding herbivore taking more than 90% plant food, such as algae, diatoms and macrophytes as well as detritus. Inhabits streams and rivers.

Distribution: Bangladesh and India.

Size: It attains a length of about 12.5 cm.

Kala Bata in Tanguar Haor: By consuming algae, diatoms, macrophytes, detritus, etc. the species plays an important role in keeping the aquatic habitat clean. The fish is of no interest in fisheries. But it could be cultured as food as a forage fish.

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Zebra Danio

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Danio rerio* (Hamilton, 1822)
English name: Zebra Danio
Local name: Anju
Fin formula: D 2/7; P_1 13; P_2 1/6; A 2-3/11-13

Description: Body is elongated, slim and slightly compressed. Ventral profile is more arched than that of the dorsal. Mouth is oblique, opening above. Lower jaw is longer than the upper. Barbel 2 pairs, rostral pair and maxillary pair. Lateral line is absent. Dorsal fin commences opposite to the anal. Caudal is forked and equally lobed. Four metallic blue longitudinal bands are separated by three narrow silver ones. Three lower blue bands produced long caudal fin. Anal fin is with three transverse blue bands. Paired fins are colourless. Dorsal edge is darkish.

Feeding: Feeds on worms and small crustaceans, and insect larvae.

Distribution: Bangladesh, India, Myanmar, Nepal and Pakistan.

Size: Longest size recorded in Bangladesh is 2.9 cm in total length.

Anju in Tanguar Haor: The fish plays an important role in the food chain by consuming insect larvae, and small worms from the aquatic environment. The fish lives in the benthopelagic zone of the *haor* waters.

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Flying Barb

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Esomus danricus* (Hamilton, 1822)
English name: Flying Barb
Local name: Darkina, Danrika/Darka, Dadhika
National status: Data Deficient
Fin formula: D 2/6; P_1 1/11-13; P_2 1/6; A 2-3/5

Description: Body is laterally compressed body. Mouth is small and, directed obliquely upwards with a fleshy lower lip. Barbel 2 pairs, rostral pair and maxillary pair. Lower jaw is longer than the upper. Lateral line is incomplete, ceasing after 4 or 5 scales or may be absent. A broad black lateral band is present from the eye to the caudal base. Margin of the scales of the upper half of the body is dotted. Yellowish-white beneath.

Feeding: Feeds on insects, algae and detritus.

Distribution: Afghanistan, Bangladesh, India, Myanmar, Nepal, Pakistan and Sri Lanka.

Size: Largest size recorded in Bangladesh was 6 cm in total length, but it has been reported to grow over 10 cm in total length.

Darkina in Tanguar Haor: The species is largely preyed upon by snakehead, Boal and other predatory fish. It controls insect population and algal bloom in the surface layer of the *haor* environment. By eating the aquatic detritus, they keep the water clean.


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Gotyla

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Garra gotyla* (Gray, 1832)
English name: Gotyla/Suckerhead
Local name: Ghor Poia
National status: Data Deficient
Fin formula: D 2/8; P_1 15; P_2 9; A 2/5

Description: Body is elongated, sub-cylindrical to compressed. A suctorial disc is found on the chin. A deep groove is present across the snout forming a proboscis. A pair of rostral and a pair maxillary barbel present. 32 scales on the lateral series. Body colour is dark brown above and light pink below. A dusky spot in the upper edge of the opercle is easily noticable. A row of dark spots are found along the base of the dorsal.

Feeding: Algae, plants and detritus.

Breeding: Spawning takes place in June and July.

Distribution: Afghanistan, Bangladesh, Bhutan, India, Myanmar, Nepal and Pakistan.

Size: Attains a length of about 14 cm.

Ghor Poia in Tanguar Haor: The fish is found in the benthopelagic zone of the *haor* area. The species is of minor interest to fisheries of Bangladesh. It controls algal population in the *haor* ecosystem.


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Bata Labeo

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Labeo bata* (Hamilton, 1822)
English name: Bata Labeo/Bata
Local name: Bata/Bhangan Bata/Bata-Bhangan
National status: Endangered
Fin formula: D 2/9; P_1 16-17; P_2 1/8; A 2/5

Description: Body is elongated and its dorsal profile is more convex than the ventral. A pair of small maxillary barbell is hidden inside the labial fold. Dorsal fin originates midway between the snout tip and the anterior base of the anal. Pelvics originate slightly nearer to the snout tip than to the caudal base, pectoral is shorter than the head, does not reach the pelvics. Colour is golden-yellow above and on the dorsal half of the flanks, silvery on the lower half of the flanks and belly; an irregular black blotch present on the anterior scales of the lateral line, a faint blotch on the caudal peduncle. Pelvic and anal fins are dark with orange red tips; other fins with fine black dots.

Feeding: The species seems to be bottom-feeder, depends mainly on aquatic plants.

Breeding: Breeding season recorded in the months of between June and October.

Distribution: Bangladesh, India and Nepal.

Size: Medium-sized carps attain a maximum length of about 61 cm.

Bata in Tanguar Haor: The fish plays an important role in controlling the aquatic plants in the ecosystem and dwells in the benthopelagic zones. This fish has a habit of migrating between the *beels* of Tanguar Haor. Apart from the *haor* region the species also inhabits ponds, rivers and estuaries.


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Orange Fin Labeo

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Labeo calbasu* (Hamilton, 1822)
English name: Orange Fin Labeo/Black Rohu/Kalbasu
Local name: Kalibaus/Kalia/Baus
National status: Endangered
Fin formula: D 3/14-15; P_1 16-18; P_2 1/8; A 2/5

Description: Dorsal profile is more convex than that of the ventral. Mouth is moderately wide and inferior. Lateral line is well marked, and scales are moderate in size. Two pairs of barbell are found, rostral pair is longer than the maxillary pair. Body colour is black to grey above, but lighter below. Scales in the middle of the sides are usually with a scarlet spot. Some scales on the body may have black marks. Ventral surface of the head is yellowish.

Feeding: Feeds on organic matters, molluscs, diatoms, plant matter, green-algae, blue-green algae and zooplankton. The fish is selective in feeding. Juveniles prefer zooplantonic organisms, while the adults prefer organic matter and molluscs.

Breeding: Breeds during the monsoon (June—July).

Distribution: Bangladesh, India, Myanmar, Nepal, Pakistan, Southwestern China and Thailand.

Size: The largest recorded size in Bangladesh is 71 cm in total length weighing 5.5 kg.

Kalibaus in Tanguar Haor: As the fish feeds on dead and decaying matter at the bottom; it acts as scavenger in Tanguar Haor. The fish also improves the sanitation of tanks, when cultered, keeping the habitat clean by controlling the population of aquatic plants, filamentous algae, diatoms, etc. Its oil contains Vitamin A. The fish is in great demand in the market of Tanguar Haor. It is a good sport on rod and line.


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Kuria Labeo

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Labeo gonius* (Hamilton, 1822)
English name: Kuria Labeo
Local name: Goni/Kurchi/Ghonia/Ghainna
National status: Endangered
Fin formula: D 3/13-14; P_1 15-16; P_2 1/8; A 2/5

Description: Body is elongated and its dorsal profile is more convex than the ventral. Barbel two pairs (Rostral and Maxillary). Dorsal fin is inserted nearer to the snout tip than the base of the caudal fin. Pectoral fins are about as long as the head. Caudal fin is deeply forked. Body colour is greenish-black on the back, becoming dull white on the flanks and belly. Scales are with dark margins which give the impression of dark longitudinal lines.

Feeding: Feeds on phytoplankton, algae and crustaceans.

Breeding: Spawns during the southwest monsoon (May-July) in upland rivers including Halda River in Chittagong. It does not normally breeds in ponds. Artificial breeding has been successful through hypophysation.

Distribution: Afghanistan, Bangladesh, India, Myanmar and Pakistan.

Size: Largest specimen measuring 61 cm in length and weighing about 1.36 kg recorded from Nastaganga Fishery of Sylhet.

Ghannya in Tanguar Haor: The fish keeps the habitat clean by controlling the population of aquatic plants, filamentous algae, diatoms, etc. in the benthopelagic zone of *haor*. *Labeo gonius* is one of the major carp species for aquaculture in Bangladesh. Fries and fingerlings of the species are now available from commercial hatcheries in Jossore, Mymensingh, Comilla and other parts of Bangladesh.


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Pangusia Labeo

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Labeo pangusia* (Hamilton, 1822)
English name: Pangusia Labeo
Local name: Ghora Muikkha/Ghora Machh/ Longu Rui
National status: Critically Endangered
Fin formula: D 2/10-11; P_1 15-16; P_2 1/8; A 2/7

Description: Body is elongated. Dorsal profile is more convex than stet the abdomen. Snout is obtuse, overhanging mouth, with distinct lateral lobes. A pair of small maxillary barbels concealed in labial fold. Lateral line is with 40–43 scales. Caudal fin is forked. Scales are along the lateral line is dotted. Dorsal and caudal fins are grey, pectoral and anal fins hyaline, often tinged with red.

Feeding: Feeds mostly on algae and diatoms, grazes on aquatic plants. Inhabits rivers, lakes and streams.

Distribution: Afghanistan, Bangladesh, India, Nepal and Pakistan.

Size: May attain a length of about 60 cm. Largest size recorded in Bangladesh was 35.7 cm from the Surma River near Chattak.

Ghora Muikkha in Tanguar Haor: The fish lives in the benthopelagic zone of the *haor* waterbody and is potamodromous in habit. The fish contributes a minor fishery in northern Bangladesh and Sylhet.


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Rohu

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Labeo rohita* (Hamilton, 1822)
English name: Rohu/Rohu Carp
Local name: Rui/Rohit/Rohu/Rau
National status: Not Threatened
Fin formula: D 3/12-13; P_1 1/17; P_2 1/8; A 2/5

Description: Body is moderately elongated. Dorsal profile is more convex than the ventral profile. A pair of short maxillary barbels is present. Dorsal fin is inserted midway between the snout tip and the posterior base of the anal fin; upper margin of the dorsal fin concave. Pectoral fin is shorter than the head. Lateral line is complete, with 41—42 scales; 6—6.5 rows of scales between the lateral line and the base of the pelvics; 7—7.5 rows between the lateral line and the anterior base of the dorsal; 14 rows before the dorsal origin. Colour is brownish to bluish along the back, silvery on the sides and beneath. Scales are with black margins and a red centre during the breeding season. Fins are greyish or dark, pectoral fin is dusky in colour.

Feeding: Column feeder at mid water. Prefers to feed on plant matters including decaying vegetations. Food of Rohu may contain algae, higher plants, protozoans, insect larvae, crustaceans, mud and sand.

Distribution: Bangladesh, Bhutan, China, India, Japan, Madagascar, Malaysia, Mauritius, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam, and Zimbabwe.

Size: It attains over 90 cm in total length.

Rui in Tanguar Haor: Rui is one of the most abundant carps found in Tanguar Haor. Therefore it definitely comprises most people's diet in the *haor* region. Besides, this fish has commercial value in Tanguar Haor.


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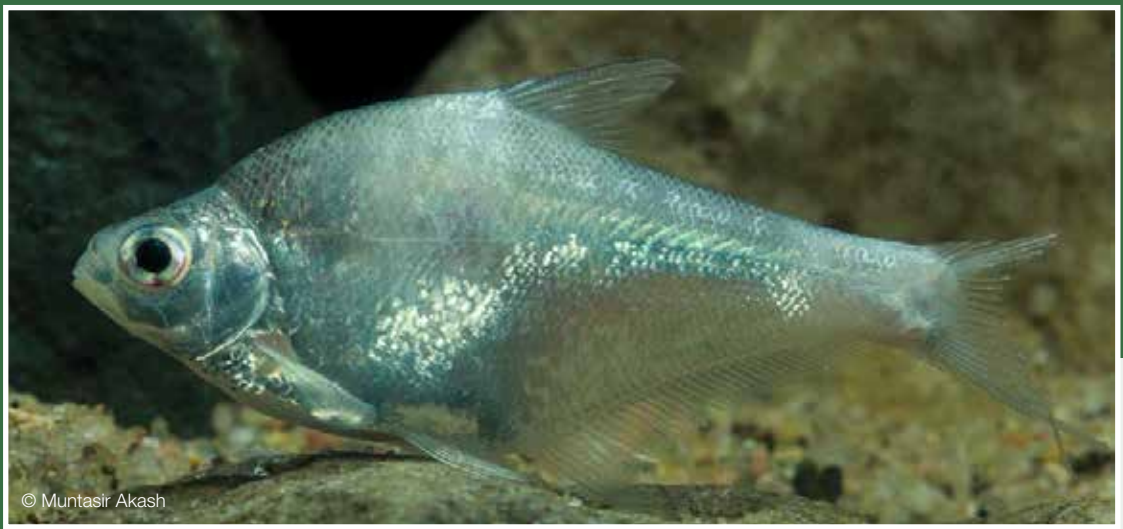
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Cotio

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Osteobrama cotio* (Hamilton, 1822)
English name: Cotio
Local name: Dhela/Keti/Lohasura/Dhipali
National status: Endangered
Fin formula: D 2/8; P_1 15; P_2 10; A 3/30-33

Description: Body is compressed and trapezoid in shape. Dorsal profile is raised to the maximum at the origin of the dorsal fin. Caudal fin is forked. The salient diagnostic features are the remarkable long anal fin, absence of barbels and a rounded abdominal edge on front of the pelvic fins. Body colour is silvery and fins are yellowish. Scales on the upper part of the body are with minute black dots. A black spot is present at the commencement of the dorsal, another over the nape. A small area around the lateral line behind the head is yellowish.

Feeding: An omnivore and surface feeder. Food consists of algae, protozoans, crustaceans and aquatic insects.

Breeding: Breeds in stagnant waters twice a year. Breeding starts in the early monsoon in June and continues until September.

Distribution: Bangladesh, India, Nepal and Pakistan.

Size: Largest recorded size in Bangladesh is 10.8 cm in total length. Usually grows to a length of approximately 5—10 cm at maturity.

Dhela in Tanguar Haor: *Osteobrama cotio* moves in shoals. The fish acts as a larvivorous species and controls some insects in the ecosystem of the *haor* region. It is a minnow with no commercial importance, however, known to supply vitamin A to a great extent.


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Two-spot Barb

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Puntius ticto* (Hamilton, 1822)
English name: Two-spot Barb/Ticto Barb/ Firefin Barb
Local name: Tit Punti/Tita Punti/Tit Puti
National status: Vulnerable
Fin formula: D 3/8; P_1 13-15; P_2 9; A 2-3/5

Description: Body is oblonged. Mouth is small and terminal. Barbel is absent. Dorsal fin is inserted behind the pelvic fin origin, its last unbranched ray osseous, fairly strong and serrated at its posterior edge. Lateral line is incomplete, ceasing after 6-8 scales; 23-25 scales in the longitudinal series, 10 rows in the transverse series, predorsal scales 9-11. Colour of the species is back grey to grassy-green, flanks brilliant shining silver, and belly whitish. Two black spots are present, a smaller one near the commencement of the lateral line above the pectoral fin and a larger one behind the base of the anal.

Feeding: Feeds on plants, benthic invertebrates and insects.

Breeding: Breeding season (May-October).

Distribution: Bangladesh, India, Myanmar, Nepal, Pakistan, Sri Lanka and Thailand.

Size: Attains a length of about 10 cm.

Tita Punti in Tanguar Haor: The fish controls water pollution of *haor* region by consuming aquatic plants and detritus. It is benthopelagic and potamodromous in habit. The species is of minor commercial importance and because of its bitter taste the fish is not liked by some people.


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Swamp Barb

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Puntius chola* (Hamilton, 1822)
English name: Swamp Barb/Chola Barb
Local name: Chalapunti/Punti
National status: Not Threatened
Fin formula: D 2-3/8; P_1 15; P_2 9; A 2-3/5

Size: Maximum size 15 cm in total length. Largest specimen collected from Dhaka measured 13.8 cm in total length.

Chalapunti in Tanguar Haor: It is a peaceful fish and mostly swims and stays in the middle layer of the *haor* habitat. The fish keeps the water surface clear by consuming floating organisms and aquatic plants. Chepa Shutki, a product prepared through drying of the species, is considered a delicacy in Bangladesh.

Description: Dorsal profile is more convex than that of the abdomen. Mouth is small, terminal, and jaws are sub-equal. A pair of maxillary barbels is present. Lateral line is complete, with 24–26 scales. Body colour is silvery, operculum is golden. A dark blotch is found on the side of the tail over 22–24 scales of the lateral line. A black blotch is seen at the base of the 2nd–5th rays of dorsal and 1 or 2 rows of dark spots along its centre.

Feeding: Feeds on worms, crustaceans, insects and plant matters. Plant matters include diatoms and algae.

Breeding: It spawns during June and July.

Distribution: Bangladesh, India, Myanmar, Nepal, Pakistan and Sri Lanka.

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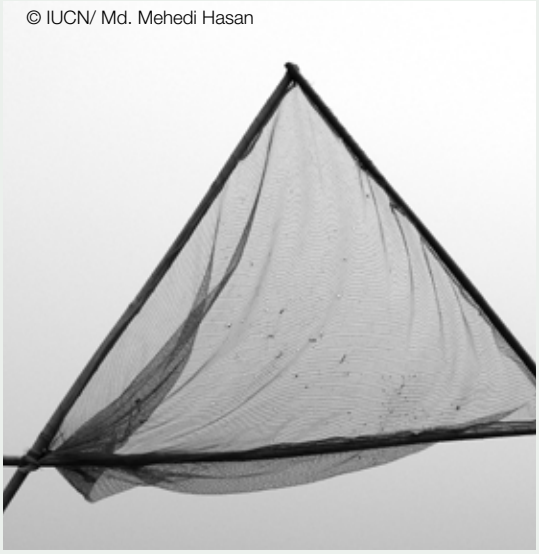


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Rosy Barb

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Puntius conchonius* (Hamilton, 1822)
English name: Rosy Barb/Red Barb
Local name: Kanchan Punti/Taka Punti/ Moyna Punti
National status: Not Threatened
Fin formula: D 3/8; P_1 13-15; P_2 1/8; A 2-3/5

Description: Body is deeper and flatter than any other species of *Puntis*. Mouth is terminal, upper jaw slightly longer than the lower. A slight concavity is found over the nape. Barbel is absent. Lateral line is complete, ceases after 6–10 scales. Body colour is silvery, dark along the back and all scales with dark bases. A large black spot is found above the posterior portion of the anal fin. A band of black marks along the middle dorsal rays. During the breeding period, the species becomes beautifully coloured with red and purple on the sides.

Feeding: Feeds on worms, crustaceans, aquatic insects and plant matters.

Breeding: May–October.

Distribution: Afghanistan, Bangladesh, India, Nepal and Pakistan.

Kanchan Punti in Tanguar Haor: The fish keeps the water surface of the *haor* ecosystem clear by feeding on the aquatic plants and muddy benthic organisms. This is one of the most important ornamental *Puntius* species and a very beautiful fish.


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Olive Barb

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Puntius sarana* (Hamilton, 1822)
English name: Olive Barb
Local name: Sarputi/Sar Punti/Sarna Puti/Saral Punti/Kurti
National status: Critically Endangered
Fin formula: D 3/8; P_1 15; P_2 9; A 3/5

Description: Body is deep and moderately compressed. Dorsal profile is elevated. Barbel 2 pairs, rostral as long as the orbit, maxillary a little longer. Origin of the dorsal is slightly nearer to the snout tip than to the caudal fin. Lateral line is complete with 32—34 scales. Body colour is silvery, darker on the back; opercle with a gold shot; sometimes a small dot behind the gill-opening. Fin grayish-white.

Feeding: Both bottom and column feeder. Feeds on plants, benthic invertebrates and insects.

Breeding: Prolific breeder and breeds during monsoon season. It spawns in shallow water from July to August.

Distribution: Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka.

Size: Largest specimen measuring 42 cm in total length and weighing 1.4 kg was recorded from Gacher Dahar Fishery of Sylhet District.

Sarputi in Tanguar Haor: Sarputi is potamodromous in habit, and it is found in the benthopelagic zone of Tanguar Haor. The species also browse to the substrate in shallow waters. As a benthic and column feeder, the species controls aquatic plants and detritus of the *haor* ecosystem.


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Pool Barb

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Puntius sophore* (Hamilton, 1822)
English name: Pool Barb/Spotfin Swamp Barb
Local name: Punti/Jat Punti/Jat Puti
National status: Not Threatened
Fin formula: D 3/8; P_1 15; P_2 9 1/8; A 3/5

Description: Body is moderately compressed. Dorsal profile is more convex than that of the abdomen. Head short, about one-fourth of the standard length. Origin of the dorsal is slightly nearer to the snout tip than to the caudal base. Lateral line is complete with 24—26 scales; 9.5—10 scales in the transverse series, 3.5 rows between the lateral line and base of the pelvics, 8—9 rows before the dorsal. Anal and pelvic fins are brick red in colour in mature males. A scarlet red band develops along the middle either side in males during the breeding season.

Feeding: Voracious feeder of floating organisms and aquatic plants.

Breeding: Can breed everywhere in its habitat during rainy season.

Distribution: Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan.

Jat Punti in Tanguar Haor: This Punti is commonly seen and found almost everywhere in irrigation canals, paddy fields and is very common in ponds, ditches, *beels* and *haors*. It keeps the water surface clean by consuming floating organisms and aquatic plants. They are observed to move in groups. The fish can live both in clear as well as foul waters and can survive even in extreme adverse conditions inside muddy bottom soil covered by aquatic weeds.


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Common Rasbora

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Rasbora daniconius* (Hamilton, 1822)
English name: Common Rasbora/Slender Rasbora
Local name: Darkina
National status: Data Deficient
Fin formula: D 2/7; P_1 14-15; P_2 9; A 2/5

Description: Abdominal profile is more convex than the dorsal profile. Cleft of mouth is oblique, and maxilla extends below the anterior margin of the eye. Lateral line is concave, running above the lower half of the sides and with 31–34 scales. Body colour is back olive, flanks and belly silvery; a fairly distinct blue black mid-lateral stripe from eye to the base of caudal fin.

Feeding: The species is a surface feeder, mainly feeds on aquatic insects and detritus.

Distribution: Bangladesh, India, Myanmar, Malaysia, Nepal, Pakistan, South China, Sri Lanka, Thailand and Vietnam.

Darkina in Tanguar Haor: Darkina lives in the benthopelagic zone of the *haor* region. The species serves largely as a food for predator fishes. It can control insect population and algal bloom from the surface layer of the *haor* environment. By eating aquatic detritus, it keeps the water clean. It is an important aquarium fish.


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Gangetic Scissortail Rasbora

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Rasbora rasbora* (Hamilton, 1822)
English name: Gangetic Scissortail Rasbora
Local name: Darkina/Leuzza Darkina
National status: Endangered
Fin formula: D 2/7; P_1 15; P_2 9; A 2/5

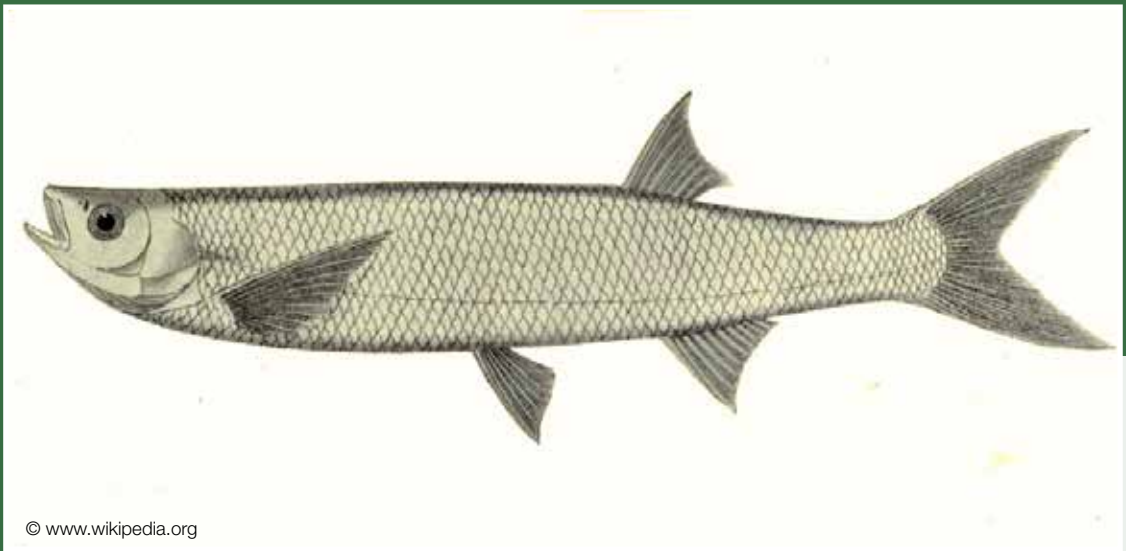
Description: Abdominal profile is more convex than the dorsal profile. Lateral line is concave with 27-29 scales which run above the lower half of the side. Dorsal fin arises midway between the anterior margin of the eye and the base of the caudal fin. Pelvics originate about midway between the snout and the caudal base. Body colour is olive-brown above, silvery below, a blue-black iridescent lateral stripe (of regular width) from the head to the base of the caudal fin, latter with a sharply defined black tip, and other fins yellowish.

Feeding: Surface feeder, mainly feeds on aquatic insects and detritus.

Distribution: Bangladesh, India, Myanmar, Nepal, Pakistan, Sri Lanka and Thailand.

Size: Attains about 8 cm in length.

Darkina in Tanguar Haor: The species wanders in the benthopelagic zone of Tanguar Haor and it is potamodromous in habit. Sometimes they form large schools. The species serves largely as food for the predator fishes. It can control the insect population and algal bloom on the surface layer of the aquatic environment. Besides, by eating aquatic detritus, it keeps the water of *haor* region clean.



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Silver Razorbelly

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Salmostoma acinaces* (Valenciennes, 1842)
English name: Silver Razorbelly Minnow
Local name: Chela
National status: Data Deficient
Fin formula: D 3/7; P_1 12; P_2 8; A 2-3/17

Description: Abdominal edge keeled from below the pectoral to the vent. Mouth is directed upward, maxilla reaches below anterior margin of the eye. Lateral line is concave, 45—48 scales in lateral series. Origin of the dorsal fin is just above the origin of the anal. Pectorals are slightly larger than the head. Pelvics origin nearer to the anal origin than to the pectoral origin. Pectorals and pelvics are with axillary scales. Lower lobe of the caudal is longer than the upper. Body colour is silvery with a bright lateral band.

Feeding: Surface feeders and feeds mainly on aquatic insects and detritus.

Distribution: Bangladesh, India, Nepal and Pakistan.

Size: The largest specimen recorded from Bangladesh is 8.2 cm in total length.

Chela in Tanguar Haor: This Minnow is widely distributed in the lower reaches of rivers, ponds, *beels*, ditches and canals wherever it is found. In Tanguar Haor, this fish serves largely as food for the predator fishes as well as controls the insect population and algal bloom on the surface layer of aquatic environment. By eating aquatic detritus, it keeps the water clean.

Large Razorbelly Minnow

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Salmostoma bacaila* (Hamilton, 1822)
English name: Large Razorbelly Minnow
Local name: Naraklichela/Katari/Narkeli Chela
National status: Not Threatened
Fin formula: D 2/8; P_1 12-13; P_2 9; A 2/12-13

Description: Abdominal edge is keeled from below the pectoral to the anus. Mouth is oblique, lower jaw is longer; a prominent knob at the symphysis of the lower jaw. Lateral line is concave, 7-8 rows of scales between the lateral line and the base of the pelvics. Anal fin origins from below the middle of the dorsal base. Body is bright silvery with back greenish. A light grey lateral band may exist in some juveniles.

Feeding: Surface feeders and feeds mainly on aquatic insects and detritus.

Distribution: Bangladesh, India, Nepal and Pakistan.

Size: Largest specimen recorded from Bangladesh is 14.2 cm in total length.

Katari in Tanguar Haor: It is widely found in the lower reaches of aquatic body, but it has the habit of jumping above the water surface. The fish also moves in schools of 15–30 individuals. It can control insect population in the *haor* ecosystem.


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Finescale Razorbelly Minnow

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Salmostoma phulo* (Hamilton, 1822)
English name: Finescale Razorbelly Minnow
Local name: Fulchela
National status: Not Threatened
Fin formula: D 2/7; P_1 11; P_2 8; A 2/16-18

Description: Elongated body is laterally compressed. Abdominal edge is keeled from below the pectoral to the anus. Lateral line is concave. Origin of the dorsal is above the origin of the anal with some variations in either direction. Pectorals are longer than the head, pelvics origin nearer to the anal origin than to the pectoral origin. Pectorals and pelvics are with axillary scales. Lower lobe of caudal is longer than upper. Colour is silvery with a bright silvery lateral band.

Feeding: Surface feeders and feeds mainly on aquatic insects and detritus.

Distribution: Bangladesh and India.

Fulchela in Tanguar Haor: It is also available in the lower reaches of the *haor* region. Fulchela serves largely as food for the predator fishes. It controls the insect population and algal bloom on the surface layer of aquatic environment. By eating aquatic detritus, it also keeps the water clean.


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Gora-cela

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Securicula gora* (Hamilton, 1822)
English name: Gora-cela
Local name: Ghora Chela
National status: Not Threatened
Fin formula: D 3/7; P_1 13-14; P_2 8; A 2/13-16

Description: Body is fairly elongated and compressed. Abdominal edge is keeled from below the pectoral to the anus. Lower jaw is with a prominent knob. Mouth is oblique, and its cleft extending to front edge of the eye. Maxilla reaches below middle of the orbit. Scales are minute. Concave lateral line present with 120–160 scales. Body is bright and uniform silvery in colour.

Feeding: Surface feeder, feeds regularly on insects, insect larvae, crustaceans, etc. Occurs in ponds, canals, beels and rivers in the middle and lower reaches.

Distribution: Bangladesh, India, Nepal and Pakistan.

Ghora Chela in Tanguar Haor: The species controls the insect population in the *haor* ecosystem. It is of no commercial importance.


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Tor Masheer

Order: Cypriniformes
Family: Cyprinidae
Scientific name: *Tor tor* (Hamilton, 1822)
English name: Tor Masheer/Mahseer
Local name: Mohashol/Mohal
National status: Critically Endangered
Fin formula: D 3/9; P_1 16-17; P_2 9; A 2/7

Description: Body is stout and fairly deep. Head is relatively small. Dorsal profile is arched. Mouth is small, and its gape does not extend below the eye. Barbel 2 pairs; maxillary and a short rostral pair. Complete lateral line with 25–26 scales. Dorsal side is greyish-green, the flanks pinkish with greenish–gold above and light olive-green below; belly silvery; head light orange above the eyes and light sky-blue on the operculum. Dorsal fins are reddish; pelvic, pectoral and anal fins deep orange.

Feeding: Omnivorous, feeds on filamentous algae, submerged plants, chironomoid larvae, water beetles and crustaceans.

Breeding: It breeds during August-September and continues up to December.

Distribution: Bangladesh, India and Pakistan.

Size: Reported to attain about 150 cm.

Mohashol in Tanguar Haor: It is an important food fish. As a voracious feeder of submerged plants, the species plays an important role in the biological control of aquatic weeds in the *haor* ecosystem. This species is a popular source of sport for anglers.


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Mottled Loach

Order: Cypriniformes
Family: Balitoridae
Scientific name: *Acanthocobitis botia* (Hamilton, 1822)
English name: Mottled Loach/Zipper Loach/ Sand Loach
Local name: Bilturi/Natwa/Balichata
National status: Data Deficient
Fin formula: D 2/11; P_1 10; P_2 1/7; A 1/5

Distribution: Bangladesh, Bhutan, China, India, Myanmar, Nepal and Thailand.

Size: Attains a size of 7 cm in standard length.

Bilturi in Tanguar Haor: The species controls insect population in the *haor* ecosystem. The species is of minor commercial importance. It is a much loved aquarium fish and is reared in many countries of the world.

Description: Body is slender in shape, cylindrical anteriorly, and compressed posteriorly. Dorsal profile is slightly arched, ventral profile flat. Eyes are small, not visible from the underside of the head. Barbel 3 pairs, well-developed. Dorsal fin inserted ahead of the pelvic fin. Edge of the dorsal fin is straight, nearly as long as the head, reaching below the origin of the dorsal. Caudal fin is slightly emarginated. Scales are continuous, imbricate, considerably reduced on the breast. Lateral line is usually complete. A black ocellus present at the upper corner of the caudal base. A narrow dark band is found from the snout tip to the anterior margin of the eye.

Feeding: Feeds on zoobenthos and insect larvae.


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Corica Loach

Order: Cypriniformes
Family: Balitoridae
Scientific name: *Schistura corica* (Hamilton, 1822)
English name: Corica Loach
Local name: Koroka/Korica/Khorica
National status: Data Deficient
Fin formula: D 1/9; P_1 12; P_2 1/5; A 2/4

Description: Dorsal surface of the head curved downward. Mouth is crescentic, surrounded by weakly developed lips. Snout is pointed, conical. Barbel 3 pairs– 2 rostral and 1 maxillary pairs. Front rostral extend below the middle of the eye. A short median longitudinal groove exists on the head behind the eye. Body is yellowish in colour, 8–9 brown bands on the back descending partly to the sides; 9–11 brown blotches or short bands along the lateral line. Snout is with 2 longitudinal and one transverse brown band.
Feeding: Feed on insect larvae, shrimps, aquatic vegetations, etc.

Distribution: Bangladesh, India , Nepal and Pakistan.

Size: The species attains a standard length of about 4.2 cm.

Koroka in Tanguar Haor: This beautifully coloured species is of minor interest to fisheries, but can be reared in aquaria. Sexual dimorphism exists. The fish plays an important role in controlling the population of some aquatic organisms by feeding on insect larvae, shrimps, aquatic vegetation, etc. in Tanguar Haor ecosystem.

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Savona Loach

Order: Cypriniformes
Family: Balitoridae
Scientific name: *Schistura savona* (Hamilton, 1822)
English name: Savona Loach/Half Banded Loach/Bicolour Loach
Local name: Savon Khorka
National status: Not Threatened
Fin formula: D 2/8; P_1 10; P_2 7; A 2/5

Description: Slender body, dorsal profile is greatly arched, ventral profile is concave. Head and body is compressed. Mouth is small, crescentic, surrounded by thin lips. Lower lip not notched at the middle. Eyes are large, situated at the middle of the head touching the dorsal surface. Barbel 3 pairs– 2 rostral and 1 maxillary pairs, about equal in size. Caudal is forked. Brownish above, yellowish below, 10–12 narrow vertical white bands on the body. Base of the caudal is black. Bands only one-sixth in width of the ground colour.

Feeding: Generally feeds on mosquito larvae, shrimps, tubifex, *Daphnia* and some algae.

Distribution: Bangladesh, India and Nepal.

Size: Largest size recorded in India is 2.4 cm.

Savon Khorka in Tanguar Haor: This fish is of no interest to fisheries, but it is an excellent species for rearing in aquarium. It is an omnivorous species and consumes benthic organisms underneath the rocks and boulders. The fish keeps the aquatic habitat of Tanguar Haor clean.


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Scaturigina Loach

Order: Cypriniformes
Family: Balitoridae
Scientific name: *Schistura scaturigina* McClelland, 1839
English name: Scaturigina Loach, Victory Loach
Local name: Dari
National status: Not Threatened
Fin formula: D 2/8; P_1 10; P_2 7-8; A 7

Description: Body is cylindrical, head depressed, and tail compressed. Dorsal profile is arched, ventral profile is nearly straight. Snout is conical, and rounded abdomen. Mouth is crescentic, surrounded by thin lips; lower lip with a notch at the middle. Barbel 3 pairs, outer roatral and 1 maxillary pairs. Outer rostral pair extends below the anterior third of the eye, maxillary pair nearly equals in the eye-diameter. Caudal fin is clearly forked. Scales are distinct; 11–12 rows between the lateral line and the dorsal origin. Body colour is greyish above, olive below, 9 –12 vertical bands narrower than the ground colour descended from the dorsal ridge to below the lateral line. Body is yellowish, fins colourless. Upper surface of the head is pinkish. Surface of the snout is with 4 dark marks.

Feeding: Feeds on worms, insect larvae, aquatic vegetation, etc.

Distribution: Bangladesh, Bhutan, India and Nepal.

Size: Attains a standard length of about 5 cm.

Dari in Tanguar Haor: This species plays an important role in keeping the Tanguar Haor water clean by consuming different types of aquatic organisms. The fish is of minor important to fisheries. As it is a beautifully coloured species, so it can be reared in aquarium.


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Bengal Loach

Order: Cypriniformes
Family: Cobitidae
Scientific name: *Botia dario* (Hamilton, 1822)
English name: Bengal Loach/Necktie Loach/ Queen Loach
Local name: Rani/Putul
National status: Endangered
Fin formula: D 2-3/9-10; P_1 14; P_2 8; A 2/5-6

Description: Body is elongated, laterally compressed. Dorsal profile is more arched than that of the ventral. Head is flattened at sides. Barbel 4 pairs, 2 rostral, 1 maxillary and 1 mandibular pair. A strong bifid spine present in a groove below the eye. Lateral line is absent. Caudal fin is forked. Scales minute and hardly noticeable. Body is encircled by 7 oblique brown or black bands. Caudal with 2—4 broken black bands.

Feeding: They prefer worms, small shrimps, snails, etc. as food.

Distribution: Bangladesh, Bhutan, India and Myanmar.

Size: In the wild they exceed no more than 8.9 cm in length. In the aquariums, they have not been known to grow larger than 7.5 cm.

Rani in Tanguar Haor: The fish is known to control snail population in the *haor* ecosystem in which they occur. Watching a small group of *B. dario* is a good sport.


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Peppered Loach

Order: Cypriniformes
Family: Cobitidae
Scientific name: *Lepidocephalichthys guntea* (Hamilton, 1822)
English name: Peppered Loach/Guntea Loach
Local name: Gutum/Puiya
National status: Not Threatened
Fin formula: D 2/6; P_1 8-9; P_2 7-8; A 2/5

Description: Body is compressed. Dorsal and ventral profile is nearly compressed. Body deepest near the origin of the dorsal. Barbel 3 pairs, 2 rostral and 1 maxillary; mandibular flaps with barbels. An erectile, strong bifid spine is present below at the orbit. Lateral line is absent. Colour is variable. Generally the ground colour is dirty yellowish. A light band extends from the snout to the caudal fin. Below and above this band are a series of dark blotches. A black ocellus is found on the upper half of the caudal base. Dorsal and caudal barred with spots.

Feeding: Feeds on insect larvae and bottom detritus.

Distribution: Bangladesh, India , Myanmar, Nepal, Pakistan and Thailand.

Size: Attains a length of about 15 cm. Largest specimen examined was 9.6 cm in total length.

Gutum in Tanguar Haor: Gutum is demersal and potamodromous in habit. The fish is a scavenger and cleans up organic debris from the *haor* ecosystem.

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Loktak Loach

Order: Cypriniformes
Family: Cobitidae
Scientific name: *Lepidocephalichthys irrorata* Hora, 1921
English name: Loktak Loach
Local name: Puiya
National status: Data Deficient
Fin formula: D 2/7; P_1 1/6; P_2 1/6; A 2/5

Description: Dorsal profile is greatly arched above the pectoral fin, ventral profile nearly straight. Snout is curved downward, mouth ventral. Eyes are minute, situated above the in the anterior half of the head. Barbel 4 pairs – 2 rostral, 1 maxillary and 1 mandibular pairs. Caudal is slightly forked. Young specimen are yellowish, adults are pale olive. A gleaning pale streak found from the snout to the caudal base. Above this streak there are several rows of dark blotches. The row below the streak is composed of large black spots. Another black streak is seen from the eye to the snout. A deep black spot is present on the upper part of the caudal base. Dorsal and caudal fins are with rows of dark spots.

Feeding: Feeds on bottom organisms and detritus.

Distribution: Bangladesh and India.

Size: Longest specimen examined was 3 cm in total length.

Puiya in Tanguar Haor: The species keeps the water of Tanguar Haor clean from pollution as they consume the mud at the bottom. The species is of minor commercial importance. It also has the habit of burying itself rapidly in sand when frightened.


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Gongota Loach

Order: Cypriniformes
Family: Cobitidae
Scientific name: *Somileptes gongota* (Hamilton, 1822)
English name: Gongota Loach, Mooseface Loach
Local name: Poia, Ghar Poia, Pahari Gutum, Puiya
National status: Not Threatened
Fin formula: D 2/8; P_1 10; P_2 7; A 2/5

Description: Body is subcylindrical, and tapering posteriorly. Upper profile of the snout is nearly straight. Barbel 3 pairs, 2 rostral and 1 maxillary pairs. A small flap is found above the nostrils. Scales are large, head naked. Lateral line is present. Caudal fin is truncate. Body colour is greenish above, yellowish-white below. A variable pattern along the sides usually consists of a series of about 5 large brown blotches. Back is usually with irregular bands descending up to the lateral line. A dark patch is found on cheek below the eye.

Feeding: Feeds on worms, crustaceans, insects, etc.

Distribution: Bangladesh, India and Nepal.

Poia in Tanguar Haor: The fish occurs in shallow water and demersal in habit. It plays an important role in controlling the insect population in the Tanguar Haor ecosystem where it lives. It is also used as aquarium trade but is of little interest to fisheries.


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Dwarf Catfish

Order: Siluriformes
Family: Bagridae
Scientific name: *Batasio tengana* (Hamilton,1822)
English name: Dwarf Catfish
Local name: Tengra/Batasi Tengra
National status: Endangered
Fin formula: D ii/7; P_1 1/7-8; P_2 1/5; A 3/11-12; C 15

Description: Body is compressed markedly at the tail region. Dorsal profile is arched, but ventral profile is horizontal, flattened. Head is flattened ventrally, broadly pointed. Median groove on the head is long, moderately wide, continued to the end of the occipital process. 4 pairs of barbell are present, the nasal pair extends to the anterior margin of the eye, maxillary pair reaches beyond the posterior margin of the eye, mandibular pairs short, inner pair placed in advance of the outer pair. Body colour is transparent white with a large spot divided into 4 lobes on the occiput. Tip and base of the caudal and dorsal is with black marks. The fish can be distinguished from its congeners in having 5-6 vertical dark brown on a light-brown body.

Feeding: Detritus feeder in the upper reaches of riverine habitats.

Distribution: Bangladesh, India and Nepal.

Size: Longest specimen in the collection was 4.5 cm in total length.

Tengra in Tanguar Haor: By feeding decomposing matter at the bottom of Tanguar Haor, the fish reduces water pollution. It also controls the population of mosquitoes by feeding on larvae. The species is caught in winter season along with other species of *Batasio* and *Mystus*.

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Kerala Mystus

Order: Siluriformes
Family: Bagridae
Scientific name: *Mystus armatus* (Day, 1865)
English name: Kerala Mystus
Local name: Tengra
National status: Data Deficient
Fin formula: D i/7; P_1 i/9; P_2 1/5; A 10-11

Description: Body is elongated and compressed with a depressed head. Mouth is terminal, and upper jaw is slightly longer than the lower. Median groove on the head is very shallow and does not reach the base of the occipital process. Barbel 4 pairs, nasal pair reaches up to the gill-opening. Maxillary pair extends up to the anal fin. Dorsal fin is considerably shorter than the head; caudal deeply forked, lobes are equal. Adipose is much longer than the anal. Body colour is dark above, light brown below. A narrow dark band runs along the lateral line, a round black blotch present at the middle of the caudal peduncle.

Feeding: Consumes benthos and aquatic insects.

Distribution: Bangladesh, India and Myanmar.

Size: Maximum size recorded is 8 cm in total length.

Tengra in Tanguar Haor: The fish plays an important role in the aquatic food chain of *haor* region as a detritus feeder although it has very little commercial value. The species is extremely rare in the fisher's catch.

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Day's Mystus

Order: Siluriformes
Family: Bagridae
Scientific name: *Mystus bleekeri* (Day, 1877)
English name: Day's Mystus
Local name: Gulsha Tengra/Tengra
National status: Not Threatened
Fin formula: D i/7; P_1 i/9-10; P_2 6; A 9-10

Description: Body is elongated and compressed. Median longitudinal groove on the head is shallow and reaches the base of the occipital process. Mouth is terminal. It has four pairs barbels. Its maxillary pair is long upto anal fin, sometimes goes beyond anal fin. Dorsal spine smooth, rarely finely serrated. Adipose fin is large and inserted just behind the rayed dorsal fin. Caudal fin is forked; upper lobe of the caudal longer. Pectoral spine is with 11–12 serrations. No spot at the base of the dorsal. Colour is laden above, yellowish beneath. A dark spot along the lateral line; also two light longitudinal bands, one above and other below the lateral line. A dark shoulder spot is present behind the head. Fins are grayish-white, darkest at their edges. *M. bleekeri* resembles *M. cavasius* closely but is differentiated by the length of the maxillary barbel which reaches up to anal base while the same reaches beyond the caudal base in *M. cavasius*.

Feeding: Feeds on insect larvae, zooplankton and small fishes.

Breeding: Breeds during May—June with the onset of the monsoon.

Distribution: Bangladesh, Bhutan, India, Indonesia, Myanmar, Nepal and Pakistan.

Size: Attains a length of about 15.5 cm in total length.

Tengra in Tanguar Haor: The fish has minor commercial importance in case of fishery but has demand as an aquarium fish. It is normally caught by gill nets, bamboo traps and cast nets in the *haor* region. The fish is demersal and potamodromous in habit.


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Gangetic Mystus

Order: Siluriformes
Family: Bagridae
Scientific name: *Mystus cavasius* (Hamilton, 1822)
English name: Gangetic Mystus
Local name: Gulsha Tengra/Gulsha/Kabashi Tengra
National status: Vulnerable
Fin formula: D i/7; P_1 i/8; P_2 6; A 11

Description: Body is elongated and compressed. Occipital process is narrow which extends to the basal bone of the dorsal fin. Median longitudinal groove is on the head extends to the base of the occipital process. Lateral line is present and straight. Barbel 4 pairs, maxillary barbels extend posteriorly beyond the caudal fin base. Dorsal spine is non-denticulated. Adipose fin is large, inserted close behind the base of the rayed dorsal fin. Caudal fin is deeply forked. A black spot is present covering the basal bone of the dorsal fin. No distinct bluish longitudinal band is present along the side. Fins are grayish-white in colour.

Feeding: Feeds on insect larvae, zooplankton and small fish.

Distribution: Bangladesh, India, Myanmar, Nepal, Pakistan, Sri Lanka and Thailand.

Size: Maximum size recorded is 40 cm in standard length.

Kabashi Tengra in Tanguar Haor: It controls the water pollution of Tanguar Haor by consuming aquatic detritus. The fish is demersal and amphidromous in habit. Kabashi Tengra is a commercially important species, and a common food fish in Bangladesh. The species is also famous for its sport fishing.


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Tengara Mystus

Order: Siluriformes
Family: Bagridae
Scientific name: *Mystus tengara* (Hamilton, 1822)
English name: Tengara Mystus/Striped Dwarf Catfish/Pearl Catfish
Local name: Bajuri/Bajari Tengra/Ghuitta Tengra/Bujri/Bojja
National status: Not Threatened.
Fin formula: D i/7; P_1 i/8; P_2 6; A 10-13

Description: Body is elongated and slightly compressed. Median longitudinal groove on the head is short, not extending to the base of the occipital process. Dorsal spine is with 2–3 teeth anteriorly, finely serrated posteriorly. Adipose originates in advance of the anal origin. Caudal fin is forked, upper lobe of the caudal barely longer than the lower. Lateral line is distinct. Body colour is usually greyish-silvery to shining golden body with 5 pale blue or dark brown to black longitudinal bands, 3 above and 2 below lateral lines on the body. A dark shoulder spot is present. Fins are yellowish-grey. This species closely resembles *M. vittatus* in colour pattern but may be easily distinguished from it by the presence of a median longitudinal groove on its head which reaches the base of the occipital process.

Feeding: Feeds on plants, shrimps, insects, molluscs and fishes.

Breeding: Breeds in marginal waters during the onset of the monsoon.

Distribution: Bangladesh, India, Myanmar, Nepal, Pakistan and Sri Lanka.

Size: Largest size recorded on Bangladesh is 11.7 cm in total length.

Bajuri in Tanguar Haor: This is a species of minor importance. It can be reared in aquaria as an ornamental fish. This catfish is commonly caught by dip nets, push nets and bamboo traps. By feeding on decomposed matter at bottom of its *haor* habitat, it reduces water pollution. It also controls the production of mosquitoes by feeding on the larvae. Besides, the fish is very good to taste and useful in calcium deficiency.


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Striped Dwarf Catfish

Order: Siluriformes
Family: Bagridae
Scientific name: *Mystus vittatus* (Bloch, 1797)
English name: Striped Dwarf Catfish/Asian Striped Catfish/Striped River Catfish
Local name: Tengra
National status: Not Threatened
Fin formula: D i/7; P_1 i/9; P_2 6; A 11

Description: Body is elongated and compressed. Head is depressed, occipital process large, more than twice as long as the broad as its base, reaching the basal bone of the dorsal fin. Median longitudinal groove on the head is short, does not extend to the base of the occipital process. Dorsal spine is with 2–3 teeth anteriorly, finely serrated posteriorly. Caudal fin is forked, upper lobe of the caudal barely longer than the lower. Lateral line is distinct. Body colour is usually greyish-silvery to shining golden with 5 pale blue or dark brown to black longitudinal bands, 3 above and 2 below lateral lines on the body. A dark shoulder spot is found. Fins are yellowish-grey in colour.

Feeding: Feeds on plants, shrimps, insects, molluscs and fishes.

Breeding: Breeds in the marginal waters during the onset of monsoon.

Distribution: Bangladesh, India, Myanmar, Nepal, Pakistan and Sri Lanka.

Size: Largest size recorded in Bangladesh is 11.7 cm in total length.

Tengra in Tanguar Haor: The species is demersal in habit and by eating algae and plants the species keeps the *haor* ecosystem clean. The fish is of minor commercial importance. The viscera of the fish is used in the bamboo trap to attract more fish. The fish is also reared in aquaria.


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Asian Cory

Order: Siluriformes
Family: Bagridae
Scientific name: *Rama chandramara* (Hamilton, 1822)
English name: Asian Cory/Gold Shadow Catfish/Hovering Catfish/Humming Bird Catfish
Local name: Gura Tengra/Futki Bujurii/ Bajaria Tengra
National status: Data Deficient
Fin formula: D i/6-7; P_1 i/5; P_2 6; A 14-16

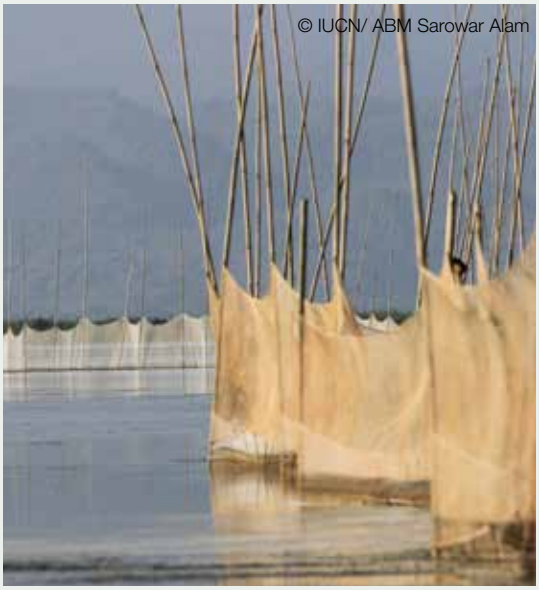
Description: Body is elongated in shape. Dorsal profile is moderately arched, but ventral profile is nearly straight from below the pectoral to the anal. Mouth is small, anterior, upper jaw slightly longer than lower. Median groove on the head is wide, and extends to the middle of the occipital process. Barbel 4 pairs, 1 pair of maxillary, 1 pair of nasal and 2 pairs of the mandibular, all shorter than the head. Base of the adipose is shorter than that of the anal. Dorsal spine is moderately strong and non-serrated. Pectoral fins reach the pelvic base. Caudal is deeply forked. Lateral spine is complete with a few pores above the pectoral fin base. Body colour is yellowish and dull white on belly. Numerous black dots are found all over the body. A black spot present on shoulder and nape. Some individual may be brown in colour. It inhabits in mountain streams.

Feeding: Omnivorous, mainly animal feeder.

Distribution: Bangladesh and India.

Size: Largest size recorded is 5.7 cm in total length.

Gura Tengra in Tanguar Haor: The bottom-dweller fish feeds on the decomposed matter of the bottom and keeps the *haor* habitat clean. This species is of rare occurrence and does not have any economic value.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Whale Catfish

Order: Siluriformes
Family: Bagridae
Scientific name: *Rita rita* (Hamilton, 1822)
English name: Rita/Whale Catfish
Local name: Rita
National status: Critically Endangered
Fin formula: D i/6; P_1 i/10; P_2 8; A 11-13

Description: Body is elongated with depressed head. 3 pairs of barbells are found. Maxillary pair extends posteriorly to the operculum, mandibular pair to the pre-operculum, nasal pair minute or small with a valve-like base. Dorsal spine very stout, hollow as long as longer than the head in adults. Pectoral spine is stout and hollow, shorter than the dorsal spine, denticulated on both edges. Lateral line is straight. Body colour is greenish-brown above and on the flanks, brownish-white on the abdomen.

Feeding: Feeds on insects, molluscs, shrimps, fishes and roots of aquatic plants, also putrid carcass or flesh of animals.

Distribution: Afghanistan, Bangladesh, India, Myanmar, Nepal and Pakistan.

Size: It may attain up to 150 cm in length. The longest specimen was 60 cm in total length captured from the Meghna near Chandpur, Bangladesh.

Rita in Tanguar Haor: The fish plays an important role in the aquatic ecosystem of Tanguar Haor as a detritus feeder and carnivore. The fish is potamodromous and bottom-dweller in nature. The species prefers muddy to clean water.


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Long-whiskered Catfish

Order: Siluriformes
Family: Bagridae
Scientific name: *Sperata aor* (Hamilton, 1822)
English name: Long-whiskered Catfish
Local name: Ayre/Bhangat/Talla Ayre/Aor
National status: Vulnerable
Fin formula: D i/7; P_1 i/9-10; P_2 1/5; A 12-13

Description: Head is depressed and snout rounded. 4 pairs of barbells are present. Maxillary pair extends to the end of the anal or the caudal base or beyond, outer mandibular pair reaches the base of the pectoral and inner mandibular pair is one-third of that distance and nasal pair to the anterior half of the eye. Median longitudinal groove on the head reaches the base of the occipital process. Adipose fin usually equals the head length. Body colour is bluish superiorly, white below. Fins are yellowish with dark edges. A well-defined black blotch is present at posterior edge of the adipose dorsal.

Feeding: Preys on smaller fishes, large insects and worms.

Breeding: Breeds normally before the onset of monsoon.

Distribution: Bangladesh, India, Nepal and Pakistan.

Size: Longest specimen measuring 94 cm in total length and weighing about 5 kg was recorded from the Gacher Dahar Beel of Sylhet.

Ayre in Tanguar Haor: It feeds on bottom-dwelling organisms and plays an important role in the food chain of *haor* ecosystem. The fish has a good market demand and always marketed in fresh condition. The fish along with *S. seenghala* is a commercially important species and contribute 2.25% of the total inland fish produced in the country.


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Giant River-catfish

Order: Siluriformes
Family: Bagridae
Scientific name: *Sperata seenghala* (Skyes, 1839)
English name: Giant river-catfish/Tengara/Seenghari
Local name: Guizza/Guizza Aor/Guijja/Guizza Ayre/Bhangat/Talla Ayre
National status: Endangered
Fin formula: D i/7; P_1 i/9; P_2 1/5; A 11-12

Description: Head is depressed and snout spatulate. Median groove is present on the head and reaches the base of the occipital process. 4 pairs of barbels are present, maxillary pair extends to the base of the pelvics. Outer mandibualr does not quite reach the pectoral base and nasal pair to the anterior margin. Dorsal spine is as long as the head excluding the snout. Lateral line is present and complete. Pectoral spine is half as long as the head, with 19–20 denticulations posteriorly. Adipose fin is present and contains a black coloured spot at the end portion. Caudal fin deeply forked and upper lobe is longer than lower. Body colour is bluish on the back, silvery on the sides and beneath. A well-defined round black spot is present at the adipose fin. *S. seenghala* differs from *S. aor* by the presence of a spatulate snout and a shorter maxillary barbel.

Feeding: Feeds on benthos, larvae of fish and algae, destructive to tender carp fry.

Breeding: They spawn during the commencement of monsoon.

Distribution: Afghanistan, Bangladesh, India, Nepal and Pakistan.

Size: Largest recorded size in Bangladesh is 112.3 cm in total length.

Guizza in Tanguar Haor: The fish is mainly bottom-feeder and acts as a predator in the bottom of the *haor* environment. The fish provides good sport on rod and line, taking both dead baits and worms. The oil of fish contains 200 units of Vitamin A per gram which could be used in decreasing Vitamin A deficiency of local children of *haor* area.


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Butter Catfish

Order: Siluriformes
Family: Siluridae
Scientific name: *Ompok bimaculatus* (Bloch, 1797)
English name: Butter Catfish/Two Spot Glass Catfish
Local name: Kani Pabda/Boali Pabda/Pupta, Pafta
National status: Endangered
Fin formula: D 4; P_1 i/11-13; P_2 7-8; A 66-71

Description: Elongated body is laterally compressed. Head is depressed and snout is rounded. Mouth is superior, which ends in front of the eye. Lower jaw is slightly longer than the upper. Barbel 2 pairs; maxillary barbels extend to beyond the middle of the body, mandibular pair is small, as long as the snout. Lateral line is nearly straight. Small, spineless dorsal fin is situated above the last half of the pectoral. Anal fin is long, which inserts well behind the dorsal fin. Caudal fin is deeply forked with pointed lobes. A large dusky spot is seen on the shoulder; a small black spot on the caudal peduncle just above the lateral line. Fins are pale golden in colour.

Feeding: Omnivorous. Feeds on crustacean larvae, fish fries, zooplankton, algae and portions of sand and mud.

Breeding: It spawns during monsoon, which extends from June to the middle of August.

Distribution: Bangladesh and India.

Size: The largest specimen recorded in Bangladesh was 25 cm.

Kani Pabda in Tanguar Haor: The species is predatory in nature. It also swims around in shallow and often muddy waters of the *haor* region. It is a relatively peaceful species that is compatiable with most fish of equal size or larger.


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Pabo Catfish

Order: Siluriformes
Family: Siluridae
Scientific name: *Ompok pabda* (Hamilton, 1822)
English name: Pabo Catfish/Pabdah Catfish/ Two Striped Gulper Catfish
Local name: Pabda/Madhu Pabda
National status: Endangered
Fin formula: D 4; P_1 i/11-13; P_2 8; A 53-59

Description: Body is laterally compressed and elongated with depressed head. Snout is rounded. 2 pairs of barbels are present. Maxillary pair reaches to the end of the pectoral fin. Dorsal fin is situated above the last half of the pectoral. Pectoral spine is smooth. Caudal forked, both lobes are rounded or arching rather than tapering to a point. The whole fin is directed slightly downward. Body colour is generally silvery-grey, darker on the back and fading to white on the belly. In some, there are two longitudinal lighter bands, one above and one below the lateral line. A dark oval shoulder spot is present. Body is cloudy, on the sides with black dots.

Feeding: Feeds on crustacean larvae, fish fry, zooplankton, algae and small portion of sand and mud.

Breeding: Breeds during May—July. Induced breeding is recorded in hatcheries of Jessore district, Bangladesh.

Distribution: Afghanistan, Bangladesh, India, Myanmar and Pakistan.

Pabda in Tanguar Haor: A relatively peaceful species that is compatible with most fish of equal size or larger, but not safe with small fishes/shrimps as it is omnivorous and predatory in nature. It is a very tasty fish and always fetches a high market price in the *haor* region.


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Freshwater Shark

Order: Siluriformes
Family: Siluridae
Scientific name: *Wallago attu* (Bolch & Schneider, 1801)
English name: Wallago/Freshwater Shark/ Boal/Helicopter Catfish
Local name: Boal/Boali/Boyari/Keyali/Boil
National status: Not Threatened
Fin formula: D 5; P_1 i/13-14; P_2 10; A 85-89

Description: Body is elongated and laterally compressed with depressed head. Dorsal profile is nearly straight. Barbel 2 pairs, maxillary pair extends well beyond the origin of the anal fin, mandibular pair short, as long as the snout. Snout is bluntly pointed. Dorsal fin is small and spineless. Pectoral is with a finely serrated spine. Anal long, not confluented with the caudal, latter deeply forked, with pointed lobes, upper lobe longer. Body colour is uniform silvery or olive with golden gloss above, sides dull white. Anal and caudal fins are dusky.

Feeding: Juvenile feeds mainly on insects, crustaceans, molluscs and small fishes, adult feeds predominately on cyprinid fishes.

Breeding: Spawns during the pre monsoon season from June to August.

Distribution: Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Sri Lanka, Pakistan and Thailand.

Size: The species may attain 200 cm in total length and weigh more than 45 kg.

Boal in Tanguar Haor: The fish acts as a great predator and consumes different fish species in the *haor* ecosystem. It is a commercially important species and an important food fish in Bangladesh. Liver oil contains Vitamin A. Fishing is done with live bait, in rod and line. It is a good sport fish.


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Gangetic Ailia

Order: Siluriformes
Family: Schilbeidae
Scientific name: *Ailia coila* (Hamilton, 1822)
English name: Gangetic Ailia
Local name: Kajoli/Kajuli/Bashpata
National status: Not Threatened
Fin formula: D absent; P_1 i/14; P_2 6; A 67-75

Description: Body is elongated and deeply compressed. Upper jaw is longer. 4 pairs of long barbells are found. Dorsal fin absent; small adipose inserted above the last 6th ray of the anal fin. Caudal fin is forked and lower lobe is larger than the upper. Pectoral fin is well developed and pelvic fin is small with 6 rays. Caudal fin forked. Pectoral spine is slender, finely serrated along its inner edge. Body colour is silvery. Anal and caudal bases are slightly yellowish. Occiput is often with black spots.

Feeding: The fish takes food from two layers (surface and middle) of water body. It is a carnivore but occasionally feeds on algae, plant materials and debris.

Breeding: It breeds during the monsoon (July–September) in the shallow waters of large rivers.

Distribution: Bangladesh, India and Nepal.

Size: It may attain a length of about 30 cm. The common available size found in Bangladesh is about 15—18 cm.

Kajoli or Bashpata in Tanguar Haor: Kajoli is found living in the pelagic zone of Tanguar Haor region. It lives in shoals. The species controls water pollution of the *haor* area by feeding on the algal bloom and other plant materials along with debris.


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Jamuna Ailia

Order: Siluriformes
Family: Schilbeidae
Scientific name: *Ailia punctata* (Day, 1871)
English name: Jamuna Ailia
Local name: Kajuli/Bashpata
National status: Vulnerable
Fin formula: D absent; P_1 i/12; P_2 absent; A 77-84

Description: Body is elongated and ventral profile is arched. 4 pairs of well-developed barbels are present. Adipose dorsal fin is minute, inserted above the last-fourth of the anal fin. Pectoral spine is slender, not serrated on its inner edge; pelvic fins are absent. Body colour is silvery with the upper surface of the head nearly black; a large spot on the base of the caudal fin. The species resembles *A. colia* very closely but differs from it by the absence of the pelvic fin though both are locally known as Kajuli or Bashpata.

Feeding: Feeds on algae, plant materials and debris.

Distribution: Bangladesh, India and Pakistan

Size: Largest recorded size in Bangladesh is 11 cm in total length.

Kajuli in Tanguar Haor: The fish lives in shoals in the *haor* region. The fish plays an important role in keeping the water clean by feeding on algal bloom and debris in the *haor* ecosystem where it lives. Cast net, drag net and dharma net are generally used to catch this fish.


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Garua Bacha

Order: Siluriformes
Family: Schilbeidae
Scientific name: *Clupisoma garua* (Hamilton, 1822)
English name: Garua Bacha/Guarachcha/Gagra
Local name: Ghaura/Gharua/Gagra/Garua Bacha
National status: Critically Endangered
Fin formula: D i/7; P_1 i/11; P_2 6; A 3/21-50

Description: Body is elongated and compressed. Abdominal edge is keeled between the pelvic fin and vent. 4 pairs of barbells are found. Nasal ones do not reach the eye, maxillary ones extend to the base of the pelvic fins (to the middle of the pelvic fins in young specimen), while both mandibular pairs extend to the pectoral fins. Median groove on the head extends to the middle or end of the occipital process. Single dorsal fin, dorsal spine shorter than the head, weak, rugose anteriorly, serrated posteriorly. Adipose fin is absent in adults. Body colour is silvery with the yellowish-green. Head and shoulder with a golden gloss. Fins hyaline, dorsal and pectoral fins dotted with black, caudal fin pale yellow.

Feeding: Bottom-feeder; feeds on insects, shrimps, other crustaceans and small fishes. It is a foul feeder. Known to take human faeces as food.

Distribution: Bangladesh, India, Nepal and Pakistan.

Size: Maximum length recorded is 60 cm.

Ghaura in Tanguar Haor: Although Ghaura has popularity both as a food and as a game fish, many people avoid eating this fish because of its filthy feeding habit. The fish controls water pollution of *haor* region by consuming filthy materials.

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Murius Vacha

Order: Siluriformes
Family: Schilbeidae
Scientific name: *Eutropiichthys murius* (Hamilton, 1822)
English name: Murius Vacha
Local name: Muri Bacha/Motus
National status: Not Threatened
Fin formula: D i/7; P_1 i/13; P_2 6; A 3/35-37

Description: Body is elongated and laterally compressed. Mouth is moderate, and maxilla extends below the front margin of the eye. Snout is rounded, upper jaw slightly longer than the lower. Barbel 4 pairs, nasal pair extends to the posterior end of the eye, maxillary pair to the base of the pectorals, inner mandibular pair as long as the head excluding snout, slightly longer than the outer pair. Median groove on the head extends to the end of the occipital process. Occipital process is thin and narrow in shape. Abdominal edge is keeled between the pelvics and anal opening.

Feeding: A voracious feeder, feeding on small fishes, aquatic weeds and insects.

Distribution: Bangladesh, India and Nepal.

Size: Maximum length of 20 cm. Largest specimen in Bangladesh examined was 15.3 cm in total length.

Muri Bacha in Tanguar Haor: The fish keeps the aquatic ecosystem of Tanguar Haor clean as a voracious feeder. The species is of minor commercial importance, but people prefer it for its good taste and flavour.

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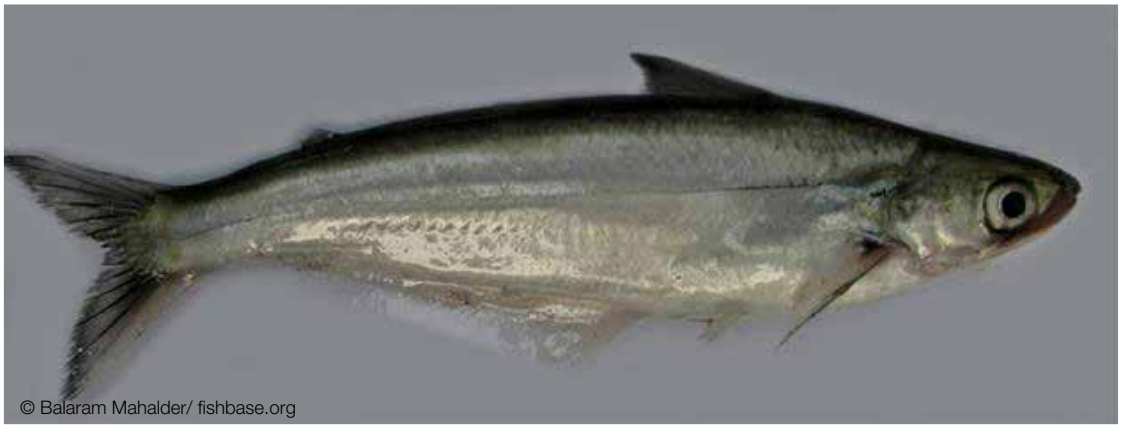

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Batchwa Vacha

Order: Siluriformes
Family: Schilbeidae
Scientific name: *Eutropiichthys vacha* (Hamilton, 1822)
English name: Batchwa Vacha/Bacha
Local name: Bacha/Gaura Bacha
National status: Critically Endangered
Fin formula: D i/7; P_1 i/13-14; P_2 1/5; A 3-2/46-48

Distribution: Bangladesh, India, Myanmar, Nepal, Pakistan and Thailand.

Size: Largest size recorded is 42 cm.

Bacha in Tanguar Haor: Bacha is found in the pelagic zone of the *haor* area. The species keeps the aquatic ecosystem clean as a voracious feeder. It is an excellent table fish with a sweet flesh. The peak fishing season is the summer months.

Description: Body is compressed. Dorsal and ventral profiles are about equally convex. Snout is compressed and pointed. Mouth is large, and the gap extends below the posterior margin of the eye. Barbel 4 pairs, nasal pair extends to the posterior margin of the orbit, maxillary pair extends to alittle beyond the eye, mandibular pairs up to the gill-opening below. Median groove on the head shallow, reaches the end of the occipital process. Body colour is silvery, greyish along the back with a tint of cobalt-blue. Pectorals, dorsal and caudal are black edged. The fish resembles the other catfish, namely *Clupisoma gaura. E. vacha* has a very large mouth, while the mouth of *C. garua* is much smaller.

Feeding: A voracious feeder.

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Indian Potasi

Order: Siluriformes
Family: Schilbeidae
Scientific name: *Pseudotropius atherinoides* (Bloch, 1794)
English name: Indian Potasi
Local name: Batasi/Bataiya/Batais
National status: Not Threatened
Fin formula: D i/5-6; P_1 i/7; P_2 6; A 33-40

Description: Body is elongated and deeply compressed. Median longitudinal groove is on the head reaches the base of the occipital process. Upper jaw is longer a little than the lower one. Barbel 4 pairs, nasal pair extends to the end of the opercle, maxillary pair to the middle of the pelvics or the first third of the anal, outer mandibular pair to the middle of the pectoral, inner mandibular pair shorter. Caudal fin forked.

Feeding: Feeds on algae, plant materials and debris.

Breeding: Breeds during mid-May—mid-July.

Distribution: Bangladesh, India, Myanmar, Nepal and Pakistan.

Size: Maximum length reported 12.7 cm.

Batasi in Tanguar Haor: Although the fish is of minor economic importance, but it plays an important role in the aquatic food chain as an omnivore. The fish moves in shoals.

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Silond Catfish

Order: Siluriformes
Family: Schilbeidae
Scientific name: *Silonia silondia* (Hamilton, 1822)
English name: Silond Catfish/Silondia Vacha
Local name: Shilong/Silond/Dhain/Siloin/Jilang
National status: Endangered
Fin formula: D i/7; P_1 i/12-13; P_2 6; A 41-46

Description: Body is elongated as well as compressed. Mouth is wide and terminal, obliquely directed upwards. A pair of small maxillary barbels present. Dorsal fin with spine, is placed considerably in advance of the pelvic fins. Back is dusky-green in colour, flanks and abdomen silvery; opercle shot with orange and yellow. Dorsal and pectoral fins are of a light neutral tint, the pectorals with orange band at its base; anal fin light purplish with an orange band at the base. Caudal fin is much darker, with a reddish band at the base.

Feeding: It is carnivorous and voracious.

Breeding: During the monsoon period.

Distribution: Bangladesh, India, Myanmar, Nepal and Pakistan.

Size: Longest specimen recorded from the Gacer Dahar *beel* in Sylhet, measuring 79 cm in total length and weighing nearly 3.9 kg.

Shilong in Tanguar Haor: The fish prefers strong, well-oxygeneted strems and clear waters. The species plays a noteworthy role in the Tanguar Haor ecosystem as it is voracious in its feeding habits. It provides considerable sport to anglers and is considered an excellent game fish.

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Yellowtail Catfish

Order: Siluriformes
Family: Pangasiidae
Scientific name: *Pangasius pangasius* (Hamilton, 1822)
English name: Yellowtail Catfish/Pungas/ Pungas Catfish
Local name: Pangas/Pangwash
National status: Critically Endangered
Fin formula: D i/7; P_1 i/12; P_2 6; A 3-4/26-29

Description: The body is elongated and laterally compressed. Snout is obtusely rounded. Median groove on the head shallow, reaches the occipital process. 2 pairs of barbells are present. Maxillary pair reaches the posterior base to the middle of the pectoral, mandibular pair shorter, reaches a little beyond the gill-opening. Dorsal spine is moderately strong. Pectoral spine is stronger than the dorsal spine. Adipose is very short. Lateral line is complete. Body colour is dusky yellowish-green on the back, glossed with silvery-purple on the flanks, side of the head with a golden tinge, fins light reddish-yellow. In normal appearance, this fish resembles the other Schilbid catfish, *Silonia silondia*, but can be readialy distinguished from it by the absence of canniform teeth on the jaws and by the presence of two pairs of well-developed barbels.

Feeding: Feeds on foul and decaying animals and vegetable matters, including amphipods, isopods and benthic crustaceans, insects and also small fishes.

Breeding: Breeds in estuary during monsoon.

Distribution: Bangladesh, India, Myanmar and Pakistan.

Size: It attains a length of about 1.5 m.

Pangas in Tanguar Haor: Pangas is benthopelagic in habit and it keeps the bottom of the *haor* ecosystem clean by feeding on foul, decaying animals and vegetable matters. It occurs in freshwater of the tidal zone as juveniles, moves to brackish water as sub-adults and finally as adults to river mouths and inshore areas.


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Gangetic Goonch

Order: Siluriformes
Family: Sisoridae
Scientific name: *Bagarius bagarius* (Hamilton, 1822)
English name: Gangetic Goonch/Devil Catfish
Local name: Baghair/Baghari/Bagh Mach
National status: Critically Endangered
Fin formula: D i/6; P1 i/13; P2 6; A 11-13; C 16

Description: Body elongated, head depressed. Mouth inferior and cresentic. Eyes are small, superior. Barbel 4 pairs; maxillary barbells with stiff and broad bases, extending to the base of the pectoral. Dorsal fin situated entirely in advance of the pelvic. Dorsal and pectoral spines are nearly half as long as the head with a soft prolongation. Pectoral spine is strong, flattened, serrated entirely. Adipose is short. Caudal fin is deeply forked, upper lobe produced onto a long filament. Body is greyish or light yellowish with large irregular black bands and markings. Base of the dorsal and adipose is found with large black patches.

Feeding: A predator, feeds mainly on small fishes, frogs and shrimps.

Breeding: Breeds during the commencement of the monsoon rains.

Distribution: Bangladesh, India, Indonesia, Laos, Myanmar, Pakistan, Thailand and Vietnam.

Baghair in Tanguar Haor: Since the fish is predatory in nature, it consumes some wild aquatic biota in its habitat. It is often termed a Freshwater Shark partly due to its voracity and partly its under hung mouth. The fish is of minor commercial importance to fisheries.


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Gangetic Gagata

Order: Siluriformes
Family: Sisoridae
Scientific name: *Gagata youssoufi* (Rahman, 1976)
English name: Gangetic Gagata
Local name: Gang Tengra
National status: Not Threatened
Fin formula: D i/6; P1 i/8-9; P2 1/5; A 3-4/11-14; C 18

Description: Body is elongated. Both dorsal and ventral profile is arched. Head is pointed anteriorly, compressed at the sides, and flattened ventrally. Median groove on the head is shallow and broad, which extends to the base of the occipital process. Mouth is small, inferior, horizontal and crescentic. Caudal fin is deeply forked; both lobes sharply pointed. Body is yellowish above, silvery below in colour. Two dark bands are seen over the head and four black bands over the body. A dark transverse mark present at the upper part of dorsal and a black blotch at the centre of each lobe of the caudal fin. Root of the caudal is with a black mark.

Feeding: Bottom feeder. Feeds on benthos and ooze.

Distribution: Bangladesh, India and Myanmar.

Size: Longest size recorded was 6.6 cm in total length.

Gang Tengra in Tanguar Haor: The species controls the pollution of the *haor* habitat on a limited scale by feeding bottom mud and detritus. It is a fisheries of minor commercial importance.


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Kosi Hara

Order: Siluriformes
Family: Sisoridae
Scientific name: *Hara hara* (Hamilton, 1822)
English name: Kosi Hara
Local name: Kutakanti
National status: Not Threatened
Fin formula: D i/5; P1 i/6; P2 6; A 9; C 14

Distribution: Bangladesh, India, Myanmar and Nepal.

Size: Largest size recorded in Bangladesh is 6.2 cm in length.

Kutakanti in Tanguar Haor: The fish is of little interest to the fisheries of Tanguar Haor. It is demersal in slow-moving freshwater rivers and streams, might have some role in controlling water pollution by consuming aquatic detritus.

Description: Body is moderately elongated. Dorsal profile is arched, but ventral profile in front of the pelvics is nearly horizontal. Head is depressed, but flattened below. Mouth is small, inferior with longer upper jaw. Barbel 4 pairs; nasal does not reach the eye; maxillary reaches the base of the pectoral; outer mandibular extends beyond the head, inner mandibular reaches to the gill-opening. Median groove present on the head shallow, does not quite reach the base of the occipital process. Body colour is yellowish brown with four broad cross bands behind the dorsal fin. A dark blotch is found at the end of the adipose fin. Fins are generally with black marks, often with black bands.

Feeding: Detritus feeder.

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Conta Catfish

Order: Siluriformes
Family: Erethistidae
Scientific name: *Conta conta* Hora, 1950
English name: Conta Catfish
Local name: Hara Mach
National status: Critically Endangered
Fin formula: D i/5; P_1 i/6; P_2 i/5; A 3/7-8

Description: Fish is small slender, with an elongated and sub-cylindrical body. Head is small and oval. Dorsal profile is arched, but ventral profile horizontal in front of the pelvics. 4 pairs of barbels are present. Caudal fin is forked, its upper lobe is often with a long filamentous prolongation. Body colour is deep brownish-grey above, dirty white below; barbels with dark and white annulations. Fins are yellowish with light bands, outer rays of the caudal fin with a whitish border.

Feeding: Feeds on mud and benthic organisms.

Distribution: Bangladesh and India.

Size: Attains about 7.8 cm in total length.

Hara Mach in Tanguar Haor: The species is a quiet species and plays a role as benthic feeder in the *haor* area.


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Gangetic Erethistes

Order: Siluriformes
Family: Erethistidae
Scientific name: *Erethistes pussilus* Muller and Troschel, 1845
English name: Gangetic Erethistes/Giant Moth Catfish
Local name: Kutakanti/Kurkati
National status: Not Threatened
Fin formula: D i/5; P_1 i/5; P_2 6; A 8; C 14-16

Description: Dorsal profile is arched. Ventral profile is nearly horizontal up to the pelvic fin. Head is depressed, and flattened ventrally. Barbel 4 pairs, which comprise maxillary and outer mandibulars, inner mandibulars and nasal pair. Body colour is black to deep brown with irregular bands. Pectoral, pelvic, anal and caudal is banded, darker and lighter across their width. Maxillary as well as mandibular barbels are banded too.

Feeding: Bottom feeder, mainly feeds on insect larvae and other benthic organisms.

Distribution: Bangladesh, India and Myanmar.

Size: Largest size of 5 cm in total length has been recorded in Bangladesh.

Kutakanti in Tanguar Haor: The fish lives in the bottom layer of the ecosystem, and feeds on the benthic organisms and clean the *haor* habitat.


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Walking Catfish

Order: Siluriformes
Family: Clariidae
Scientific name: *Clarius batrachus* (Linnaeus, 1758)
English name: Walking Catfish/Clarias Catfish/ Freshwater Catfish
Local name: Magur/Mosqur/Mojgor
National status: Not Threatened
Fin formula: D 64-70; P_1 i/9-10; P_2 6; A 45-52

Description: Body is elongated and tail is compressed. Barbel 4 pairs; nasal pair extends to near the occipital process; maxillary pair extends to the middle or end of the pectoral fins, mandibular pair is shorter. Dorsal and anal fins are long and free from the caudal fin. Pectorals are rounded and free from the vertical (dorsal and anal) fins. Body colour is uniformly grey-brown or uniformly grayish-black with minute white spots laterally. Ventral side is lighter than the dorsal. A dark spot on the dorsal fin identifies the more colourful male. The female is larger and darker.

Feeding: Consume a wide variety of prey, including eggs or larvae of other fishes, small fishes, and a number of invertebrates, such as annelids, crustaceans and insects.

Breeding: Breeds in shallow water with the approach of monsoon.

Distribution: Bangladesh, India, Indonesia, Malaysia, Myanmar, Pakistan, Philippies, Singapore, Sri Lanka and Thailand.

Size: Attains about 30.2 cm in total length.

Magur in Tanguar Haor: The fish is captured by harpoons, dip nets, push nets and traps; also good sport on rod and line. Due to scavenging behaviour the fish reduces some water pollutants from the bottom of the *haor* water body and plays a vital role in reducing pollution.


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Stinging Catfish

Order: Siluriformes
Family: Heteropneustidae
Scientific name: *Heteropneustes fossilis* (Bloch, 1794)
English name: Stinging Catfish/Fossil Catfish/ Liver Catfish
Local name: Sing/Jiol/Shingi/Jill Shinghi/ Shinghi
National status: Not Threatened
Fin formula: D 6/7; P_1 i/6-7; P_2 6; A 62-70

Description: Body is elongated and compressed. Head is depressed which is covered with osseous plate to top and sides of the head. 4 pairs of barbels are well-developed. Maxillary pairs extend to end of pectorals or to commencement to anal and mandibular pairs extend up to base of pelvics but nasal pair is considerably shorter than mandibular pairs. Dorsal fin is short and inserted usually above the tip of the pectoral fins. Pectoral fin is with a strong spine, serrated along its inner edge and with a few serrations at its anterior end. Anal fin long-based, separated by a distinct notch from the caudal fin, the latter rounded. Body colour is yellow or leaden or dark purplish-brown above, lighter below; usually with two yellowish lateral bands.

Feeding: Omnivorous and predatory in nature.

Breeding: Breeds in confined waters during the onset of the monsoon.

Distribution: Bangladesh, India, Laos, Myanmar, Nepal, Sri Lanka and Thailand.

Size: Attains about 30 cm in total length.

Sing in Tanguar Haor: The fish controls water pollution of Tanguar Haor region to some extent by consuming aquatic plants and detritus. The fish has high economic value and of great demand because of medicinal value. It is recommended for patients after recovery from malaria for its invigorating qualities.


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Squarehead Catfish

Order: Siluriformes
Family: Chacidae
Scientific name: *Chaca chaca* (Hamilton, 1822)
English name: Squarehead Catfish
Local name: Chaka/Gangainna/Chaka Veka
National status: Endangered
Fin formula: D i/4; P_1 i/5; P_2 6; A 10-11; Caudo-dorsal 20-25+8-12

Description: Body is depressed anteriorly, laterally compressed and posteriorly tapering. Head is very large, strongly depressed and rectangular in shape which suggests the name of the species. Dorsal surface of the body is with scabrous, tuberculated skin but ventral surface is smooth. 3 pairs of barbells are present. Maxillary pair small located at the corner of the mouth and mandibular pairs widely separated. Maedian groove on the head reaches the base of the occipital process. Second dorsal, caudal and second anal form the procurrent caudo-dorsal. Body colour is green and black above and on the sides, ventral surface is yellowish or brownish. Large black spots are found along the sides in the posterior half of the body. Outer edge of the pectorals, pelvics and caudal is white.

Feeding: In aquarium, this species feeds also on live food, such as other smaller fishes and fries, large earthworms, chopped beaf heart and shrimp.

Distribution: Bangladesh, India and Nepal.

Size: Attains a length of about 20 cm. Largest specimen recorded in Bangladesh was 18.6 cm in total length.

Chaka in Tanguar Haor: It usually buries itself in mud and is capable of inflicting serious wounds in the feet of fishermen with its formidable dorsal spine. The fish plays a carnivore role in the *haor* ecosystem. But the species is of no commercial importance.


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Blue Panchax

Order: Cyprinodontiformes
Family: Aplocheilidae
Scientific name: *Aplocheilus panchax* (Hamilton, 1822)
English name: Panchax Minnow/Blue Panchax/Tin Head
Local name: Techoukka/Kanpona/Choukkani
National status: Not Threatened
Fin formula: D 7-8; P_1 13-15; P_2 6; A 15-16

Description: Body elongate and compressed posteriorly, head depressed. Mouth terminal. Jaws equal, maxilla reaches near the front margin of the eye. Dorsal fin on the posterior third of the body. Anal fin almost square shaped, its base much wider than the dorsal fin base. Scales cycloid, of moderate size and 30–34 in lateral series. Lateral line absent. The fish is conspicuous by its peculiar shape as well as the shining spot on the top of the head.

Feeding: Larvivorous.

Breeding: June to August.

Distribution: Bangladesh, India, Myanmar, Pakistan and Thailand.

Size: Largest size recorded from Bangladesh is 6.2 cm in total length.

Techoukka in Tanguar Haor: The species is important as an ornamental fish for its colour and known to the aquarium fish trade all over the world. It can also be used to control mosquitoes, due to its larvivorous habit. The species renders a distinct service to mankind by its destruction of mosquito larvae, which is its chief and favourite food.


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Cuchia

Order: Synbranchiformes
Family: Synbranchidae
Scientific name: *Monopterus cuchia* (Hamilton, 1822)
English name: Cuchia/Gangetic Mud Eel/ Freshwater Mud Eel
Local name: Kuchia/Kunche/Kuicha
National status: Vulnerable
Fin formula: D very rudimentary; P_1, P_2, and C absent

Description: Body is cylindrical anteriorly and tail is tapering and compressed. Pectorals, pelvics and caudal fin absent; dorsal and anal fin folds rudimentary or reduced to the median folds. Body colour is greenish or chestnut-brown above, becoming lighter on the abdomen. Besides, there are numerous round spots on the body above the lateral line and all over the tail.

Feeding: Mainly on small fishes, tadpoles and small insects.

Distribution: Bangladesh, India, Myanmar, Nepal and Pakistan.

Size: Largest recorded size is 60 cm in total length.

Cuchia in Tanguar Haor: The fish is active at night and demersal in habit i.e. lives near the bottom and feeds on benthic organisms. It is believed that the fish has medicinal value. Adults are known to hibernate in mud during cold season. The male guards and builds nest or burrow.

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Bengal Mud Eel

Order: Synbranchiformes
Family: Synbranchidae
Scientific name: *Ophisternon bengalense* (McClelland, 1845)
English name: Bengal Mud Eel/One-gilled Eel, Asian Swamp Eel
Local name: Bamosh/Kunche
National status: Not Threatened

Description: Body is eel-like and robust with a rounded abdomen. Head is short and compressed. Snout is rounded. Lips are fleshy, upper jaw is longer than the lower. Lateral line is conspicuous. Dorsal fin low, situated ahead of the anal. Caudal fin is fairly conspicuous. Scales are absent. Body colour is brownish, greenish or greenish black along the back, and lighter in the abdomen.

Distribution: Bangladesh, India, Indonesia, Myanmar, New Guinea, the Philippines and Sri Lanka.

Size: Largest size is 100 cm in total length.

Bamosh in Tanguar Haor: It is a quiet species restricted to the bottom of the mud habitat. It is an uncommon fish and caught by various types of nets, traps, hooks and lines.


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Elongate Glass-perchlet

Order: Perciformes
Family: Ambassidae
Scientific name: *Chanda nama* Hamilton, 1822
English name: Elongate Glass-perchlet/Asian Glass Fish
Local name: Nama Chanda/Chanda
National status: Vulnerable
Fin formula: D vii+i/15-17; P_1 11-12; P_2 i/5; A iii/15-17

Description: Body is ovate shaped and strongly compressed. Mouth is large with a prominent jaw. Dorsal and ventral profile of this fish is almost equally convex. Lateral line is partly distinct, partly absent. Second dorsal spine is the longest. Spines of first dorsal, and rays of second dorsal gradually decrease in height. Scales are minute and rounded. Caudal fin is forked. A small black spot is found at the origin of the base of anal fin. Body colour is transparent yellowish-white patch with numerous tiny black dots concentrating behind the gill-cover. Crown of the head is blackish, and caudal fin is black and orange in colour.

Feeding: Feeds on larvae of mosquito. Studies show that the species feeds on the scales of the other fish species.

Breeding: Breeds everywhere from July to November. It breeds in confined water.

Distribution: Bangladesh, India, Myanmar, Nepal and Pakistan. Abundant during the rainy season in Bangladesh.

Size: Attains a length of about 11 cm.

Nama Chanda in Tanguar Haor: Chanda is benthopelagic and potamodromous in nature. It can hardly stand foul water. The presence of these species checks mosquito breeding only to a small extent while it effectively reduces the density of *Cyclops* (a kind of Zooplankton). So, this species could effectively be used in the control of guinea worms and also for malarial control. The fish is well known as a Small Indigenous Species (SIS) of fish of Bangladesh. Good source of nutrition although low price in market.

Himalayan Glassy Perchlet

Order: Perciformes
Family: Ambassidae
Scientific name: *Pseudambassis baculis* (Hamilotn, 1822)
English name: Himalayan Glassy Perchlet/ Indian Glassy Fish
Local name: Kata Chanda/Phopa Chanda
National status: Data Deficient
Fin formula: D vi+i/12-13; P_1 11-12; P_2 i/5; A iii/12-13

Description: Body is oblong and deeply compressed. Mouth is oblique. Almost 11 gillrakers are present on the lower arm of the first arch which is less than the *Pseudambassis lala*. Pectoral fin is serrated on both the edges. A sharp spine is found in the middle of the orbit. Scales are small and lateral line is complete with 90 scales. An indistinct silvery longitudinal band along the lateral line is present. Body colour is transparent yellowish-green on the back, flanks and belly silvery white and lower part of the head with bluish-silvery reflections.

Distribution: All over Bangladesh.

Size: It attains a standard length of about 5 cm.

Kata Chanda in Tanguar Haor: The fish has the habit of moving in schools. By consuming insect larvae and worms, the species reduces the insect population in the *haor* ecosystem. The species is less abundant than other species of glass fishes. It is an important fish in the aquarium. But, because of its many bones and scanty flesh the fish is not relished as food.

Indian Glassy Fish

Order: Perciformes
Family: Ambassidae
Scientific name: *Pseudambassis ranga* (Hamilotn, 1822)
English name: Indian Glassy Fish
Local name: Chanda/Ranga Chanda/Lal Chanda
National status: Vulnerable
Fin formula: D vii + i/11-4; P_1 11-12; P_2 i/5; A iii/13-15

Description: Body is stout deep and compressed. Preorbital serrated on the upper and lower edges. Peropercular hind edge smooth, with one or two serrations at an angle. Mouth is oblique. Teeth are viliform on the jaws, none caniniform. 15 or 16 gillrakers are found on the lower arm of the first arch. Scales are small and lateral line is with 47–63 scales. Body colour is transparent with a greenish-yellow tinge and a silvery gloss on the dorsum; a silvery broad lateral spine on the sides of the body; a dusky spot on the shoulder.

Feeding: Primarily feeds on zoobenthos, but also on worms and benthic crustaceans.

Breeding: The fish breeds during the monsoon.

Distribution: Bangladesh, India, Myanmar, Malaysia, Pakistan and Thailand.

Size: It attains a standard length of about 3 cm.

Lal Chanda in Tanguar Haor: The fish is very effective for combating *Angulus* species (more commonly known as fish lice) in fish hatcheries. The species feeds on scales of carps. It can compete for food and space with carp species in aquaculture farms.

Mud Perch

Order: Perciformes
Family: Nandiade
Scientific name: *Nandus nandus* (Hamilton, 1822)
English name: Mud Perch/Mottled Nandus/ Gangetic Leaffish/Mottled Nanadus
Local name: Meni/Bheda/Roina/Nandui
National status: Vulnerable
Fin formula: D xii-xiv/11-13; P_1 15; P_2 i/5; A iii/7-9

Description: Body is laterally compressed with a straight ventral profile and arched dorsal profile. Head is large and compressed with a pointed snout. Scales are of ctenoid type. Lateral line present with 46—57 scales in longitudinal series. Lateral line is interrupted at about the 36th scale. Dorsal spines strong and soft portion of the dorsal fin is rounded. Anal spines moderately strong, second spine largest, caudal fin slightly rounded, pectoral spine weak. Body colour is greenish-brown with brassy reflections; vertically marbled with three broad patchy bands. A dusky blotch on the caudal fin base is very prominent.

Feeding: Reported to consume clay, insect-larvae, fish eggs and small minnows as food. It is very destructive to larvae and small fishes.

Breeding: Breeding period of this fish ranges from April to September.

Distribution: Bangladesh, India, Myanmar, Nepal, Pakistan and Thailand.

Size: Attains a length of about 20 cm.

Meni in Tanguar Haor: This perch is benthopelagic in nature which means living and feeding near the bottom as well as in midwaters or near the surface of the Tanguar Haor. The species is considered as a tasty diet although it is highly predatory in nature. The fish can reduce the population of small fishes in its habitat largely if over-populated.


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Badis

Order: Perciformes
Family: Pristolepidae
Scientific name: *Badis badis* (Hamilton, 1822)
English name: Badis/Dwarf Chameleonfish/ Blue Perch
Local name: Koi Bandi/Napit/Napit Koi
National status: Endangered
Fin formula: D xvi-xvii/7-9; P_1 13-14; P_2 i/5; A iii/6-7

Description: Elongated and slightly compressed body is covered with ctenoid scales. A spine is present at the posterior superior angle of the opercle. 25—26 scales in lateral series which is interrupted at 20—21 scales below the posterior end of the dorsal and then continued for 5 scales up to the base of the caudal. A series of (usually 5) dark transverse bands on a round colour of dirty red, dark brown or dark green. A bluish-black spot is seen on the shoulder, another one on the opercle and a third one near the base of the caudal. The species has a series of prominent dark blotches along dorsal fin base and a series of dark blotches along middle of dorsal fin.

Feeding: Feeds on worms, crustaceans and insects.

Breeding: External fertilization is occurs and they are known to be guarder and nester. But breeding season is not known.

Distribution: Bangladesh, Bhutan, India, Nepal and Pakistan.

Size: Largest size was recorded 8 cm in total length.

Napti Koi in Tanguar Haor: Napti Koi is found living near the bottom as well as in midwaters or near the surface. It is one of the most demanding aquarium fishes. In natural habitats, it lives among vegetation in swamps and paddy fields.

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Corsula Mullet

Order: Perciformes
Family: Polynemidae
Scientific name: *Rhinomugil corsula* (Hamilton, 1822)
English name: Corsula Mullet
Local name: Khorsula/Bata/Khalla/Arwari/Halla/Hira/Khor/Pungtara/Urul
National status: Not Threatened
Fin formula: D1 iv; D2 i/7-8; P_1 15-16; P_2 i/5; A iii/9

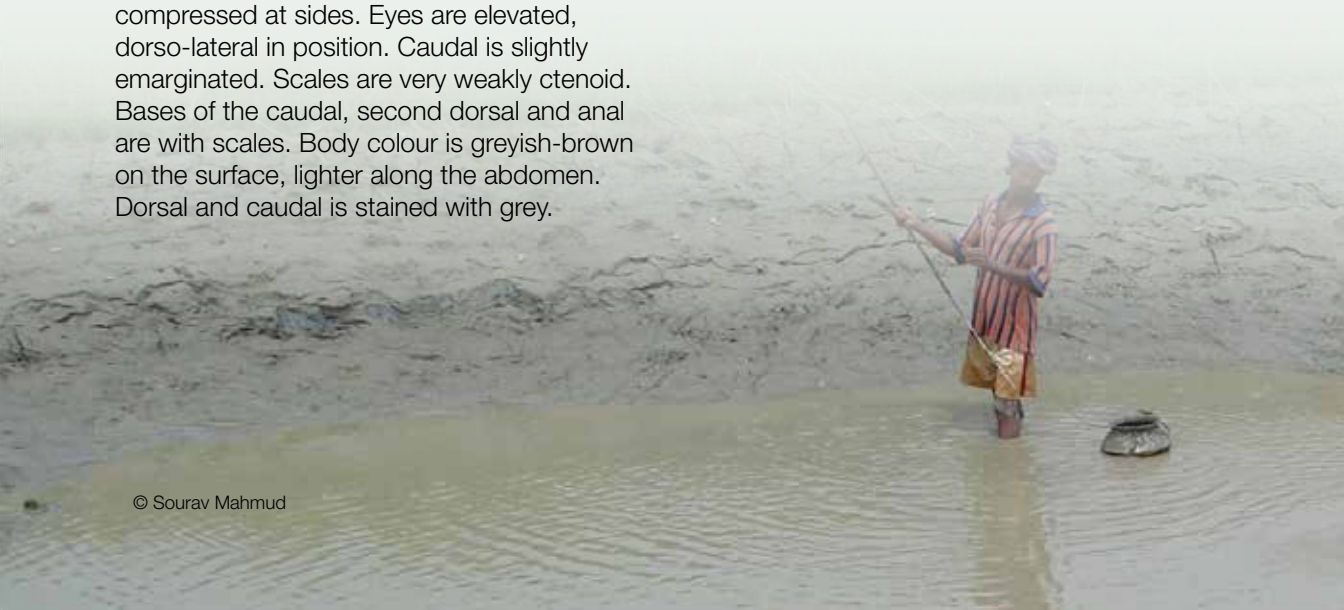
Description: Body is sub-cylindrical anteriorly, moderately compressed posteriorly. Dorsal profile is nearly straight. Head is flat above, compressed at sides. Eyes are elevated, dorso-lateral in position. Caudal is slightly emarginated. Scales are very weakly ctenoid. Bases of the caudal, second dorsal and anal are with scales. Body colour is greyish-brown on the surface, lighter along the abdomen. Dorsal and caudal is stained with grey.

Feeding: It prefers zooplankton and small fish and crustaceans as it grows.

Distribution: Bangladesh, India, Myanmar and Nepal.

Size: Largest specimen examined measured 22 cm in total length, specimens over 35 cm in total length are available in the Meghna River near Chandpur.

Khorsula in Tanguar Haor: The fish is surface-dwelling and an omnivore in its feeding habit. The species controls the surface-dwelling aquatic population of the *haor* area. The fish has the habit of swimming with their eyes on the water surface.



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Bumblebee Goby

Order: Perciformes
Family: Gobiidae
Scientific name: *Brachygobius nunus* (Hamilton, 1822)
English name: Bumblebee Goby/Golden-banded Goby
Local name: Nuna Baila
National status: Not Threatened
Fin formula: D1 vi; D2 i/7; P_1 14-16; A i/7; C 15

Description: Shape of the body is anteriorly cylindrical, posteriorly compressed. Head is obtuse, convex, and slightly depressed. Mouth is oblique, and lower jaw is longer than the upper. Maxilla reaches below the anterior third of the eye. Two dorsal fins and caudal fin are rounded in shape. Body colour is yellowish brown with 7 or 8 black bands, the first through the eye, the second through the opercle and 5 or 6 more down the body, the last being on the caudal base.

Distribution: Bangladesh, India, Indonesia, Malaysia, Myanmar and Thailand.

Size: Largest size recorded in Bangladesh is 1.7 cm in total length.

Nuna Baila in Tanguar Haor: The species plays an important role in the biological control of insects in the mangrove ecosystem. It occupies the third trophic level in the food chains both in water and mudflats. Because of its very small size, the species is of no interest to fisheries.

Tank Goby

Order: Perciformes
Family: Gobiidae
Scientific name: *Glossogobius giurus* (Hamilton, 1822)
English name: Tank Goby/Bar-eyed Goby
Local name: Bele/Bailla
National status: Not Threatened
Fin formula: D_1 V_I; D_2 I/9; P_1 17-18; A i/9

Description: Elongated body is anteriorly cylindrical and posteriorly compressed. Head is pointed and lower jaw is longer than the upper. Scales on the upper part of the head, upper parts of cheek, opercle, breast and belly are cycloid; others are ctenoid. 31—34 scales usually present in the lateral series where 25—30 rows before the base of the dorsal. Body colour is yellowish-brown with five large blotches on the flank. Dorsal, pelvic and anal fins mottled with dark spots/bars. Pectorals and caudal are grey and often hyaline.

Feeding: It preys on small fish, insect larvae, fish eggs, etc. The fish also feeds on unicellular and multicellular algae and worms. It also takes sand, clay and other decaying organic matter.

Breeding: The fish breeds in pre-monsoon period.

Distribution: Africa, Australia, Bangladesh, India, Indo-China, Myanmar, Philippines, Thailand, and the East Indies.

Size: In Bangladesh, a length of 29.2 cm has been reported. In other countries, a length of 45 cm has been reported.

Bele in Tanguar Haor: Bele plays a vital role in keeping the *haor* environment clean as the species is a voracious feeder and consumer of algae, plants, protozoans, worms and insects. The fish is known to be benthopelagic and amphidromous in habit. Living inside soil holes on the bed of *haor* area reveals the burrowing nature of the species.

Climbing Perch

Order: Perciformes
Family: Anabantidae
Scientific name: *Anabas testudineus* (Bloch, 1795)
English name: Climbing Perch/Climbing Bass/Walking Fish
Local name: Koi/Coruv/Kai
National status: Not Threatened
Fin formula: D xvii-xviii/8-9; P_1 15-17; P_2 i/5

Description: Body is oblong in shape and compressed. Scales are strongly ctenoid and large. Lower jaw slightly longer, maxilla reaches to below the middle of the eye. 21-29 scales are in the lateral series. Two lateral lines are present where lower one commencing below the end of the upper. First lateral line continues up to 16 or 17 scales; the second up to 11 or 12 scales. Body colour is greenish to dark grey on the dorsal side and flanks, fading to pale yellow on the belly. A distinct dark spot is present at the base of the caudal fin, usually a black spot at the end of the opercle is also found. Dorsal and caudal fin is dark grey; pectoral and anal fins pale yellow; and pelvic fins pale orange.

Feeding: Climbing Perches are omnivorous, feeding on invertebrates, fish and plants. Visual feeder, feeding primarily during the day.

Breeding: Breeds during April—July. Breeding stars in the month of April with the onset of monsoon and continues till July.

Distribution: Bangladesh, China, India, Malaysia, Myanmar, Philippines, Polynesia, Pakistan, Sri Lanka and Thailand.

Size: The length of the mature specimen is approximately 10 cm.

Koi in Tanguar Haor: The fish can tolerate extremely unfavourable water conditions and is associated mainly with turbid, stagnant waters. They remain buried under the mud during dry season. It possesses an accessory air-breathing organ which enables it to survive for several days or weeks out of water. During heavy rain, the fish is found to wander long distances on land. In Tanguar Haor, the species lives on or near the bottom and feeds on benthic organisms.

Dwarf Gourami

Order: Perciformes
Family: Osphronemidae
Scientific name: *Trichogaster lalius* (Hamilton, 1822)
English name: Dwarf Gourami/ Red Gourami
Local name: Baicha/Lal Khailsha/Ranga Khailsha
National status: Not Threatened
Fin formula: D xv-xvii/7-10; P_1 8-10; P_2 1; A xvii-xx/13-17

Description: Body is oblong in shape and strongly compressed. Mouth is small, strongly protrusible and directed upwards. There is a slight concavity over the nape. Scales large, 27 or 28 scales in longitudinal series; vertical fins densely scaled. Lateral line is incomplete, interrupted, and indistinct in the posterior half. The male fish have a bright orange-red body with double rows of scarlet red and light blue spots forming oblique bands on the flank. Caudal and posterior part of the anal brilliant red, pelvics orange-red. Female individuals have a duller silvery blue-grey colour. Males are slightly longer than the females.

Feeding: In nature the species eat small insects and larvae from the surface of water, and grazes algal growth on plants.

Breeding: Breeding time is monsoon season.

Distribution: Bangladesh, India and Pakistan.

Size: Grows to a size about 5 cm.

Baicha in Tanguar Haor: Dwarf Gourami is found in thickly vegetated water of Tanguar Haor. It is also found in the floodplains and jute fields in the wet season. The species is a small carnivorous fish, feeding on mosquito larvae, can be recommended for the stocking tanks and ponds as an antimalarian measure. The fish is highly satisfactory and interesting as an aquarium species.

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Stripled Gourami

Order: Perciformes
Family: Osphronemidae Belontiidae [Anabantidae]
Scientific name: *Trichogaster fasciata* Bolch & Schneider, 1801
English name: Stripled Gourami/Giant Gourami/Banded Gourami
Local name: Khailsha/Khoila/Cheli/Khoira/Kholisha
National status: Not Threatened
Fin formula: D xv-xviii/10-14; P_1 9-10; P_2 1; A xv-xviii/15-19; C 15-16

Description: Body is egg shaped and strongly compressed. Dorsal and abdominal profile is almost equally convex. Mouth is small and directed obliquely upward. Pelvics consist of a single filiform ray extending to the caudal. Caudal usually cuts square or very indistinctly notches, may be rounded in some. Lateral line is interrupted. Body colour is greenish or bluish above, dirty white below. Orange, backwardly directed oblique bands descends from back to the abdomen. A brilliant green spot is found on the gill cover. Eyes rust red. Body colour is greenish or bluish above, pelvics with yellow-white bases and brilliant red tips. Dorsal and caudal fins are spotted with orange colour. Immature specimens usually with a spot at the root of the caudal. Modified thread like pectoral fins can reach up to 10th spine of anal fin, sometimes up to caudal.

Feeding: An omnivore, prefers to feed on insect larvae living among dense aquatic vegetation of shallow waters.

Breeding: Breeds several times in the stagnant water of paddy fields during the monsoon.

Distribution: Bangladesh, India, Myanmar, Nepal and Pakistan.

Size: It attains a length about 12 cm.

Khailsa in Tanguar Haor: The species is very hardy and can survive and breed in foul water. It is small carnivorous fish, feeding on mosquito larvae, can be recommended for the stocking density tanks and ponds as an antimalarian measure.

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Honey Gourami

Order: Perciformes
Family: Osphronemidae
Scientific name: *Trichogaster chuna* (Hamilotn, 1822)
English name: Honey Gourami
Local name: Chuna Khailsha/Baicha
National status: Not Threatened
Fin formula: D xvi-xviii/6-8; P1 8-9; P2 1; A xxxxiii/12-13; C 15

Description: Body is oblong and compressed. Mouth is small and protractile. Preorbital is serrated. Dorsal spines have increasing in length posteriorly. Caudal fin is slightly emarginated. Dorsal fin is pointed. Pelvics consist of a filiform ray extended to the caudal. Lateral line is interrupted, and incomplete or absent in some; 27–28 scales in lateral series. Body colour is dull greenish above, and brownish below. A distinct dark band extends from the eye to the caudal.

Feeding: Omnivorous.

Distribution: Bangladesh and India.

Size: Maximum size of 7 cm in total length has been recorded. Largest size recorded in Bangladesh is 4.5 cm.

Baicha in Tanguar Haor: The fish keeps the haor water clean by consuming plankton, vegetation and detritus. It lives in the benthopelagic zone of the haor area. This is a tiny fish of very little commercial value. It is also used in aquaria.

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Indian Paradisefish

Order: Perciformes
Family: Osphronemidae
Scientific name: *Ctenops nobilis* (McClelland, 1854)
English name: Indian Paradisefish/Frail Gourami/Indian Gourami
Local name: Nftani/Napit Khailsha/ Modhumala
National status: Endangered
Fin formula: D iv-vi/6-8; P_1 13; P_2 i/5; A iv-v/23-28

Description: Body is elongated, relatively deep and strongly compressed. Abdomen is rounded. Head is acute with a longer lower jaw. Mouth is moderate in size; jaws are elongated and somewhat pipe-shaped. Dorsal fin is short based, inserted well back on the body. Pectoral fin has 5 rays with a strong spine. Lateral line is slightly recognizable. Body colour is brown or black with a silvery white band, usually interrupted, from eye to the base of the caudal. A black light-edged ocellus present at the upper base of the caudal.

Feeding: Larvivorous.

Distribution: Bangladesh and India.

Size: A small elegant fish, attaining a length of about 10 cm.

Nftani in Tanguar Haor: The species lives in the benthopelagic zone of the *haor* region. In winter, it usually sticks to the roots of the water hyacinth. This larvivorous fish is found in rivers and lakes with overgrown vegetation, and may sometimes become a threat to other species.

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Lesser Spiny Eel

Order: Perciformes
Family: Mastacembelidae
Scientific name: *Macrognathus aculeatus* (Bloch, 1786)
English name: Lesser Spiny Eel/One-stripe Spiny Eel/Spotted Spiny Eel/Peacock Spiny Eel/ One-striped Spinyeel
Local name: Tara Baim/Baim/Bam/Ban
National status: Vulnerable
Fin formula: D xvii-xx/45-50; P_1 23-24; P_2 absent; A iii/46-50; C 16

Description: Body is elongated and eel-like. No preorbital spine; no spine at angle of the preopercle is present like Mastacembleus armatus. Dorsal and anal fin is long but not confluent with caudal fin, but confluent in M. armatus. Caudal fin is small and rounded. Scales are small and cycloid. Lateral line is well-marked. Pelvics are absent. Body colour is greenish or brownish-grey above, yellowish beneath. A light band is found along the body above the lateral line. A series of 3—9 large black ocelli is present, along the base of the dorsal. Caudal fin is with vertical brown bars.

Feeding: Feeds on detritus and insect larvae.

Breeding: Breeds during the monsoon.

Distribution: Bangladesh, India, Malay Archipelago, Myanmar, Nepal, Pakistan, Sri Lanka, Syria, and West Africa.

Size: Largest size recorded in Bangladesh is 24 cm.

Tara Baim in Tanguar Haor: The species plays an important role in controlling the population of harmful insects in the *haor* environment through its feeding habits. It also helps to control water pollution by eating detritus. The species inhabits in the muddy bottom of Tanguar Haor.


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Striped Spiny Eel

Order: Perciformes
Family: Mastacembelidae
Scientific name: *Macrognathus pancalus* Hamilton, 1822
English name: Striped Spiny Eel/Barred spinyeel/Striped Spinyeel
Local name: Guchi Baim/Guchi/Chirka/Turi/Baim-Guchi
National status: Not Threatened
Fin formula: D xxiv-xxvi/30-42; P_1 17-19; P_2 absent; A iii/31-46; C 12

Description: Eel-like body is elongated and slightly compressed. Lateral line is complete. Scales are cycloid and minute. Preopercular spine is present like *Mastacembleus armatus* but 2-5 in number. Dorsal fin is inserted above the middle of the pectoral fin. Dorsal and anal fins separated from the caudal fin like *Macrognathus aculeatus*. Caudal fin is small and rounded. No pelvic fins. Body colour is greenish-olive along the back, yellowish on the belly, with many yellowish-white spots on the flanks and often with dark brown vertical stripes in the posterior half of the body. Soft dorsal, anal, pectoral and caudal fins are yellow, with numerous minute black spots.

Feeding: Mostly debris-feeders. Usually feeds on entomostracans and insect larvae. Some other food items include *Nymphula, Chironomus, Limnophilo, Culex, Eristalis, Ceratopogan*, etc.

Breeding: During monsoon period or rainy season. Lay eggs between May and August.

Distribution: Bangladesh, India and Pakistan.

Size: Attains a maximum length of about 18 cm.

Guchi Baim in Tanguar Haor: The species lives and feeds near the bottom as well as in midwater or near the surface of the Tanguar Haor. It also like to hide in the bottom mud. In the *haor* region, the fish is usually captured by bamboo traps and often harvested by dewatering of the habitat.

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Tire-track Spiny Eel

Order: Perciformes
Family: Mastacembelidae
Scientific name: *Mastacembelus armatus* (Lacepede, 1800)
English name: Tire-track Spiny Eel/Zig-zag Eel/tire-track Spinyeel
Local name: Sal Baim/Baim/Bain/Bamosh/Bumni/Gont
National status: Endangered
Fin formula: D xxxvii-xxxviii/78-84; P_1 21-27; P_2 absent; A iii/77-85

Description: Body is eel-like, elongated, compressed, long and pointed. Both dorsal and anal fins are broadly jointed to the caudal fin. Pelvic fin is absent. Preopercle has 2—3 conspicuous spines. A large backwardly directed spine is present above the angle of the mouth. Body colour is dull brown. A zigzag black band from the eye to the caudal fin along the upper half of the side, and a row of black spot along the base of the soft dorsal fin make the species easily identifiable.

Feeding: Juvenile feeds on crustacean and insect larvae. Adults feed on barbs, minnows, other small fishes, shrimps and prawns and tadpoles.

Breeding: Breeding time is recorded during monsoon period.

Distribution: Bangladesh, India, Myanmar, Malaysia, Nepal, Pakistan, Sri Lanka, and Thailand.

Size: Attains a length of about 75 cm.

Sal Baim in Tanguar Haor: The species inhabits within the bottom substrate of Tanguar Haor. The fish is also found in the brackish water. Baim is predatory in habit and preys on fries of other species. It is considered tasty and fetch a good price in the market of the Tanguar Haor area.


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Ocellated Pufferfish

Order: Tetraodontiformes
Family: Tetraodontidae
Scientific name: *Tetraodon cutcutia* Hamilton, 1822
English name: Ocellated Pufferfish/Commom Pufferfish
Local name: Potka/Tepa/Kutkuitta
National status: Not Threatened
Fin formula: D 10-11; P_1 20-21; P_2 absent; A 10; C 7

Description: Body is elongated with broad head and back which tapers abruptly to the tail. Eyes are large and situated slightly behind middle of the head. Two lateral lines, upper not reaching the end of the tail but meeting the lower above the anal. Lower lateral line widely interrupted at the middle. Dorsal fin is placed well back and above origin of anal. Pelvics are absent. All fins are rounded. Colour is greenish-yellow above, white in abdomen. A light band is present between the eyes. A large black ocellus is present anterior to the origin of the anal fin.

Feeding: Feeds on molluscs and crustaceans.

Distribution: Bangladesh, India, Malay Archipelago, Myanmar and Sri Lanka.

Size: Usually attains up to 8.9 cm. Largest recorded size is 13.2 cm in total length.

Potka in Tanguar Haor: The fish has less value in fisheries and is considered as a trash fish. The fish could be poisonous. The species is widely rared in aquaria.


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Needlenose Gar

Order: Beloniformes
Family: Belonidae
Scientific name: *Xenentodon cancila* (Hamilton, 1822)
English name: Freshwater Garfish/ Needlenose Gar/Silver Needle Fish
Local name: Kankila/Kaikya/Kakila/Kaika
National status: Not Threatened
Fin formula: D 15-16; P_1 10-11; P_2 6; A 17-18

Description: Extremely elongated body is cylindrical and slightly compressed. A deep longitudinal groove present on the head. Dorsal fin is inserted opposite the origin of the anal fin in the posterior region of the body. Pectoral fins short and inserted high up on the sides. Caudal fin is truncate. Lateral line is present and complete near the lower profile of the body. Body colour is greenish above, flanks greenish-silvery, grading to whitish below. A silvery lateral band with a dark margin runs along the side.

Feeding: The fish is a live feeder and feeds on live fish, tadpoles, shrimp, crickets and other insects.

Breeding: It naturally breeds in flowing water bodies, especially in rivers, and floodplains during monsoon. No artificial breeding is recorded in Bangladesh.

Distribution: Bangladesh, India, Malaysia, Myanmar, Sri Lanka and Thailand.

Size: Maximum length reported 26.1 cm.

Kankila in Tanguar Haor: The fish is predatory in nature on the surface layer of the *haor* ecosystem. In many floodplains and rivers, a special method called 'Kankila fishing' is applied to capture this fish, in which aquatic floating vegetations or other tree branches are gathered on the surface of water. The school of *X. cancila* jump onto it and then fishermen collect it.


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Chapter 6

Protocol for Biodiversity Monitoring

Biodiversity monitoring systems help us contributing to the improved conservation and sustainable use of forests, freshwater and marine wetlands. If the natural resources of an area are being maintained in accordance with the existing acts and provisions and management interventions in the area are effective in addressing biodiversity conservation issues.

6.1 Community Based Biodiversity Monitoring

This monitoring format will be used by the groups consisting of experts, project staff and local volunteers such as committee members, school teachers or students from colleges and schools. Monitoring format will be finalized through discussion with the community people, as there is a good possibility to incorporate them in future monitoring processes such as survey and data analysis. Enthusiastic and potential people from local community having interest in biodiversity conservation will be selected as 'local volunteers'. Central Committee with the help of management authority will select the local volunteers. A biodiversity monitoring team will be formed with above-mentioned people. Four monitoring teams would be formed and they would work in four unions of Tanguar Haor.

At the initial stage, the monitoring procedure is being endorsed by the experts, where the project staff and community people will be a part of the system. They would have learnt the full procedure practically from the experts. The project staff and the community people in this process can acquire the knowledge on survey procedure, data compilation, data analysis and status of the *haor* ecosystem. Indicator species have already been selected by the experts and community people become based on their identifying characteristics. This will assist them to learn the process to identify the indicator species, their habitats, impact on wetland ecosystem and finally to make decisions about further intervention in respect of biodiversity conservation and its management.

6.2 Biodiversity Monitoring Indicators and Format for Tanguar Haor

Biodiversity monitoring articulates the status of species in and around Tanguar Haor, which ultimately reflect the accomplishment of the ecosystem management. Sustainability of the monitoring mechanism after completion of the study largely depends on local volunteers. They will take over the whole biodiversity monitoring procedure and undertake it continuously throughout the year. Monitoring tools are generally used to evaluate the impact of current and past activities to a certain set of activities.

6.2.1 Indicator Species for Biodiversity Monitoring in Tanguar Haor

The most important event of community based biodiversity monitoring activities is setting up indicators. Indicators will be selected by consulting literature, talking to recognized experts on biodiversity conservation and management, local people and assessing relevance of the information gathered. The following biological indicators could be used in biodiversity monitoring:

- Dominant plant species (Hijol, Singra, Nal, etc.);
- Bird species (Purple Swamphen, Pallas's Fish Eagle; Ferruginous Pochard, Oriental Darter, etc.);
- Fish (Rui, Boal);
- Freshwater mollusks (Apple Snail);
- Frogs (Marbled toad);
- Turtle (Indian Peacock Softshell turtle).

These species are being selected as indicators for variety of reasons. Indicator species are taken from different ecological

strata, which will ultimately depict a picture of a whole ecosystem. As the ecosystem is an inter- and intra-relationship between the living and nonliving organisms, the indicators are carefully chosen to include all aspects of the *haor*. As an example, Purple Swamphen depends on reed land vegetation, so degradation of such vegetation would affect the population of this bird. Tall Hijol, Koroch, Barun trees are suitable for Pallas's Fish Eagle nesting, So decline of these plant species would be alarming for the existence of this globally vulnerable species. Fishes are integral part of the wetland, as are reptiles and amphibians.

Various fish species play a key role in the biodiversity monitoring of Tanguar Haor as all fishermen from that area solely depend on fishing. So factors like over-fishing and under-fishing must be well monitored, otherwise this community will collapse which would be suicidal to the community based biodiversity monitoring. Besides, the mentioned indicator fish species constitute the major protein supply for the local community of *haor* area. Along with this, these fish species always play a significant role in keeping the aquatic biodiversity of Tanguar Haor balanced by consuming plankton, detritus and waste materials, which in the same time permit other aquatic species to enjoy suitable aquatic environment. In considering all these issues, the species identified are preferred as indicators for biodiversity monitoring of Tanguar Haor (Sobhan *et al.*, 2012; Alam *et al.*, 2012).

6.2.2 Biodiversity monitoring format for Tanguar Haor

A species monitoring format (Table 6.1) after being designed by the researchers will be sent to the field level for analyzing. At this level, a species monitoring format is to be broadly discussed with the local people and then field work will be started following the finalization of the format.

Who will monitor?

Several teams (each comprising of three educated local people interested in fishes/birds/nature conservation from villages/union) will be formed for the monitoring task. Local school teachers or even the students of schools and colleges could be considered as alternatives for the team.

Who will scrutinize the monitoring format?

After receiving field information, researchers will examine the data of the baseline survey and will submit a comparative report to the authority and accordingly they will take the necessary steps.

6.3 Fish Species Monitoring

Few species have been selected as indicator species for monitoring purpose. If these fish species decrease in the Tanguar Haor area, Bangladesh's most prosperous breeding centre, the whole biodiversity of this area would be affected, living standards of the fishermen will decline and protein crisis might be noticed. The following Table 6.1 shows the community based fish species monitoring matrix:

Table 6.1: Identification of indicator species for fish species monitoring
Code: E - English name; S - Scientific name; L - Local name

Name of indicator fish species	Food and Feeding	Status	Breeding Season	Photo
E - Rohu S - *Labeo rohita* L Rui/ Rohit/Rohu/ Rau	Feeds on plant matters including decaying vegetations	Common	March-June	
E - Elongate Glassy-perchlet/ Asian glass fish S - *Chanda nama* L - Nama Chanda/ Chanda	Feeds on larvae of mosquito	Very Common	July-November	
E - Kuria labeo S - *Labeo gonius* L -Ghonia/ Ghainna/ Goni/ Kurchi/ Ghannya	Feeds on phytoplankton, algae and crustaceans	Few	March-June	
E - Olive Barb S - *Puntius sarana* L - Sarputi/ Sarna puti/ Saral puti/ Deshi sarputi/ Kurti	Feeds on plants, benthic invertebrates and insects	Few	February- May	
E - Reba Carp S -*Cirrhinus reba* L - Laacho	The fish feeds on plankton and detritus matter	Very Common	June-September	

Name of indicator fish species	Food and Feeding	Status	Breeding Season	Photo
E - Gangetic leaffish/ Mottled nanadus/ Mud perch/ Mottled nandus S - *Nandus nandus* L - Meni/ Bheda/ Roina/Nandui	Clay, insect-larvae, fish eggs and small minnows as food	Few	April- September	
E - Wallago/ Freshwater shark/ Boal/Helicopter catfish S - *Wallago attu* L - Boal/Boali/Boyari/Keyali/ Boil	Juvenile mainly feeds on insects, crustaceans, mollusks and small fishes, adult feeds predominately on cyprinid fishes	Very Common	March-June	

6.3.1 Fish monitoring formula

In order to assess various development interventions the following methods would be undertaken and adapted.

a) Gear/fisher-based fish catch and effort monitoring to fish stock and production by local community representatives and project personnel
b) Length frequency and control monitoring system by project personnel (project area and outside project site)
c) Monitoring by fishers/resource users to assess fish catch and their income.
d) Limnological (water quality, planktons, other natural fish foods) monitoring

The fish monitoring formula, marking guideline and interpretation from the score are shown in Table 6.2. Based on catch assessment, the dominated fish species of Rui is found 20%, between +(1 to 30)% and marking as +1 which indicates that the management system of Tanguar Haor is comparatively better than the previous year. Under the same assessment method, the results found for other species, such as Catla, Chanda, Goina, Puti, Tengra, Meni, Grass Carp, Boal and Kalibaush from 3 to 6% which on marking guideline +1 and interpretation result is same as Rui.

Table 6.2: Fish monitoring formula and marking guideline

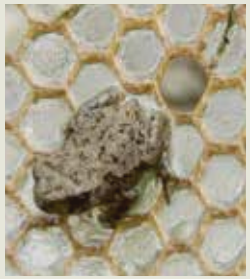
Formula	Result (%)	Marking Guideline	Guideline Interpretation
Formula for calculation = (total fish landed in present year - total fish landed in previous year)*100/ fish landed in previous year	–100%	-4	Population come down to zero or no population found
	–(61 to 99)%	-3	Management is plummeting at alarming rate
	–(31 to 60)%	-2	Management is going down
	–(1 to 30)%	-1	Management is required in respect of previous year
	0%	0	No change in population
	+(1 to 30)%	+1	Management well than previous year
	+(31 to 60)%	+2	Management very well
	+(61 to 99)%	+3	Excellent management
	≥100%	+4	Population double or more than double

Table 6.3: Identification of indicator species for floral species monitoring

Species name	Monitoring aspects	Monitoring time	How to monitor	Distribution of Monitoring Responsibility (village-wise)	Remarks	Photo
E - Indian Oak S - *Barringtonia acutangula* L - Hijol	Number of trees and area of occupancy	February	Following the monitoring information collection form (see Table 6.4.1)	Foliar beel adjacent forest: Mandiata (East side) and Binodpur (West side) Lechuamara beel adjacent forest: Paniakhali Noal beel adjacent forest: Ramshinghapur (Northwest side) and Jaypur (East side) Kajjori beel adjacent forest: Silan Tahirpur Rongchi forest: Rongchi	Different species of birds depends on this tree for nesting and roosting, branches of this tree have been used as food staff for the fishes. Increase of both the number of trees and the area of occupancy will have positive impacts on *haor* biodiversity.	
E - Water Chestnut S - *Trapa bispinosa* L - Shingara	Area of occupancy by this species in different beels	February/ March	Following the monitoring information collection form (see Table 6.4.1)	Lechuamara beel, Rupaboi beel, Rowa beel, Tekunna beel, Hatirgatha beel and Berberia beel	Small fishes and fries get nutrition from submerged portion of this species. Pheasant tailed Jacana lays their eggs on leaves of this species. Local people collect it's fruit as food staff.	
E - Tropical Reed S - *Phragmites karka* L - Nal	Number of Nalbans and area of occupancy by this species	February/ March	Following the monitoring information collection form (see Table 6.4.1)	*Kandas* of Lechuamara beel, Rupaboi beel, Rowa beel, Tekunna beel , Hatirgatha beel and Berberia beel	Reeds directly support fishes for breeding, grazing, protection, etc. They also support birds for protection, food and breeding of local wetland birds. So, increasing reeds both in terms of coverage, height and density would be beneficial for fish production, birds and other wildlife	

Table 6.4: Identification of indicator species for faunal species monitoring

Name of the Indicator bird species	Food and Habitat	Identi-fication Charac-teristics	Status	Calling	Census time	Status without this species (red line)	Photo
E - Pallas's Fish Eagle S - *Haliaeetus leucoryphus* L - Kura/Kurol/Bo-wol	- Mainly come in winter for food and breeding in Tanguar Haor - Normally live on catching large fish from the water surface - Need tall trees to build their nests	-Easily identifiable -Largest Eagle in Bangladesh	Threatened all over the world, mostly seen in Tan-guar Haor in Bangladesh	It can be eas-ily identified its frequent very loud species specific calls	Winter season	- Decreasing of this species indicates reducing the num-ber of large fish in the *haor* - Decreasing the number of large trees inside and surrounding the *haor*	
E - Ferruginous Pochard S - *Aythya nyroca* L - Bhuti Hans	- Come in winter for food in the *haor* - Lives on aquatic tender leaves of the plants - It is the representative of the migratory duck	Easily iden-tifiable	-Threatened all over the world -Mostly found in Tanguar Haor from all over the world	Difficult to identify by their calling	Winter season	Decreasing of this species indicates reducing the aquatic herbs and shrubs which are essential not only for birds but also for the survival of the fish	
E - Oriental Darter S - *Anhinga melanogaster* L - Goyar/Shapa-pakhi	-Resident bird of Bangladesh -Feed on hunting small fish by diving under water like a cormorant -They need large trees to build their nests	Easily iden-tifiable	Threatened all over the world, mostly found in Tanguar Haor, Bangladesh	Difficult to identify by their calling. As it is virtually silent	All around the year	- Decreasing of this species indicates reducing the small fish of the *haor* which are essential for the wolfish such as Striped Snakehead, Fresh-water Shark, Giant Snakehead, etc. - The number of large trees inside and surrounding the *haor* is decreasing - Water pollution is increasing	

Name of the Indicator bird species	Food and Habitat	Identi-fication Charac-teristics	Status	Calling	Census time	Status without this species (red line)	Photo
E - Purple Swam-phen S - *Porphyrio porphyrio* L- Kalim/Kayem	- Resident bird of Bangladesh - Largely feed on aquatic vegetation insects,small fishes and larvae - Builds nests inside the reed of elevated land of the *haor*	Easily iden-tifiable	-Once it was widely found in most of the wetlands of Bangladesh -Hard to be seen anywhere except in the *haor*	Can be easily identified by its calling	All around the year	- Decreasing of this species indicates reducing the reeds of the *haor* - Not only Purple Swamphen but also other birds, small mammals, frog, turtle/tortoise and fish will be re-duced in numbers as it is suitable for their breeding	
E - Peacock Soft-shelled Turtle S - *Nilssonia hurum* L - Dhum Kasim	- Both water and upland area are important for their survival. - Feed on aquatic plants and small fish - Keep the water clean by eating aquatic waste materials	Easily iden-tifiable	Threatened in Bangladesh but can be easily seen in Tanguar Haor		Winter and rainy season	- Decreasing of this species indicates reducing the aquatic plants and small fish - Increase of water pollution - Hunting increasing	
E - Marbled Toad S - *Bufo stomaticus* L - Khoshkhoshey Bang	- Important food item for birds and snakes	Easily iden-tifiable		Can be easily identified by its calling	Rainy season	- Decrease the number of birds and snakes - Acts as an im-portant indicator of climate change	

6.4 Monitoring Format for Indicator plant, bird, turtle species, hunting, hunter and other indicators*

Table 6.4.1: Plant Monitoring Information

1. Hijol (*Barringtonia acutangula*)

Sl	Present status of old/mature forest			Sl	Count of newly cultivated gardens and plants		
	Name/location	Area coverage	Tree number		Name/location	Area coverage	Tree number
Total				Total			

2. Koroch (*Millettia pinnata*)

Sl	Present status of old/mature forest			Sl	Count of newly cultivated gardens and plants		
	Name/location	Area coverage	Tree number		Name/location	Area coverage	Tree number
Total				Total			

3. Singara (*Trapa bispinosa*)

Sl	Present status of old/mature Singara vegetation		Sl	Count of newly regenerated Singara vegetation	
	Name/location	Area coverage		Name/location	Area coverage
Total			Total		

* Details methodology to develop of this monitoring format was described in IUCN's publication (2012) - Biodiversity of Tanguar Haor: A Ramsar Site of Bangladesh, Volume I: Wildlife (Amphibians, Reptiles, Birds and Mammals) and Volume II: Flora

4. Nalbon (*Phragmites karka*)

Sl	Present status of old/mature nalbon		Sl	Count of newly accreted nalbon	
	Name/location	Area coverage		Name/location	Area coverage
Total			Total		

5. Guijjakata (*Rosa clinophylla*)

Sl	Present status of old/mature Guijjakata		Sl	Count of newly regenerated Guijjakata	
	Name/location	Area coverage		Name/location	Area coverage
Total			Total		

6. Jhangi (*Hydrilla verticillata*)

Sl	Present status of old/mature Jhangi vegetation		Sl	Count of newly regenerated Jhangi vegetation	
	Name/location	Area coverage		Name/location	Area coverage
Total			Total		

7. Patseola (*Vallisneria spiralis*)

Sl	Present status of old/mature Patseola vegetation		Sl	Count of newly regenerated Patseola vegetation	
	Name/location	Area coverage		Name/location	Area coverage
Total			Total		

Table 6.4.2 Wildlife Monitoring Information

Bird's name	Number	Obtained marks
Pallas's Fish Eagle	Census data:	Marks:…….
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: 20*100/40=50%=if 10 birds seen in one census, Marks=3		
Pallas's Fish Eagle= 40 seen=100%=No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		

Bird's name	Number	Obtained marks
Nest of Pallas's Fish Eagle	Census data:	Marks:…….
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation:10*100/20=50%=if 5 nests seen in one census, Marks=3		
Pallas's Fish Eagle Nesting =20 =100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		

Bird's name	Number	Obtained marks
Ferruginous Pochard	Census data:	Marks:…….
Marking guidelines: 0%= 1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: 7500*100/15000=50%=if 7500 birds seen in one census, Marks=3		
Ferruginous Pochard= if 30,000 individuals are seen=100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		

Bird's name	Number	Obtained marks
Oriental Darter	Census data:	Marks:…….
Marking guidelines: 0%= 1,1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: 40*100/60=66.66%=if 40 birds seen in one census, Marks=4		
Oriental Darter=60 seen= 100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		

Bird's name	Number	Obtained marks
Purple Swamphen	Census data:	Marks:…….
Marking guidelines: 0%= 1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: 7000*100/10,000=70%=if 7,000 birds seen in one census, Marks=3		
Purple Swamphen= If 10,000 individuals are seen=100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		

Bird's name	Number	Obtained marks
Purple Swamphen (Nesting)	Census data:	Marks:…….
Marking guidelines: 0%=1,1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: 60*100/100=60%=if 60 birds seen in one census, Marks=3		
Purple Swamphen (Nesting)= 100=100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		

Hunting	Number	Obtained marks
Bird's Hunted	Census data:	Marks:…….
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: 40*100/100=40%=if 40 birds seen in one census, Marks=2		
If Hunting 100 individuals =100% =Management is required if the number is over 20% (2) Score 3 indicates to regular hunting Score 4 indicate that hunters are desperate or there is no monitoring from the authority Score 5 indicates very poor management		

Hunter	Number	Obtained marks
Bird hunter	Census data:	Marks:…….
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: 20*100/50=40%=if 20 birds seen in one season, Marks 2		
Bird Hunter=If 50 Bird hunters are seen=100%= Management is required if the number is over 20% (2) Score 3 indicates to regular hunting Score 4 indicates that hunters are desperate or there is no monitoring from the authority Score 5 indicates very poor management		

Turtle	Number	Obtained marks
Peacock Soft-shell Turtle	Census data:	Marks:…….
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: 30*100/50=60%=if 40 Turtles seen in one season, Marks=3		
Turtle=50=100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		

Hunting	Number	Obtained marks
Turtles hunted	Census data:	Marks:…….
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: 10*100/20=50%=if 10 Turtles seen in one season, Marks=3		
Turtle hunting=If 20 individuals are hunted=100%= Management is required if the number is over 20% (2) Score 3 indicates to regular hunting Score 4 indicate that hunters are desperate or there is no monitoring from the authority Score 5 indicates very poor management		

Hunter	Number	Obtained marks
Turtles hunter	Census data:	Marks:…….
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: 5*100/10=50%=if 5 Turtle hunters found in one season, Marks=3		
Turtle hunting=10 turtle hunters found=100%= Management is required if the number is over 20% (2) Score 3 indicates to regular hunting Score 4 indicate that hunters are desperate or there is no monitoring from the authority Score 5 indicates very poor management		

Census	Number	Obtained marks
Scientific bird census	Census data:	Marks:…….
Marking guidelines: 0%=1, 1-50%=3, 100 >=5		
Formula of result calculation: 50%=1 time census, Marks=3		
Scientifically bird census=2 times every year=100%=If score 5, research works are going on regularly Score 3 indicates that research is going on but not regular Score 1 indicates no research is going on		

Festival	Number	Obtained marks
Bird festival	Census data:	Marks:…….
Marks guidelines:0%=1,99%=5		
Formula of result calculation: If biodiversity conservation festival organize once in a =100%= Marks 5		

Festival	Number	Obtained marks
Bird festival	Census data:	Marks:…….
Festival on bird conservation=once in every year=5 marks, Awareness works is going on Score 1 indicates that there is no mass awareness on biodiversity conservation		

Committee	Number	Obtained marks
Biodiversity conservation committee	Census data:	Marks:…….
Marks guidelines: 0%=1, 1-50%=2, 51>=5		
Formula of result calculation: committee in 4 villages=100%=Marks=5, committee in two villages=50%= 3 marks		
Biodiversity conservation Committee= committee in four villages every year=100%= Marks 5, Biodiversity conservation committee is working well Biodiversity conservation committee= 2 committees in 2 villages per year=50%=Marks 2, biodiversity conservation committee is working slowly		

6.5 Importance of Sustainable Resource Management

The natural resources of Tanguar Haor are immensely important to the local community as the people are extremely dependent on *haor* resources. It provides huge ecological services. Local fishermen directly catch fish from the *haor* region and more importantly they live on that profession. As the production of fish is very high, surplus production of fish product is marketed to the other regions of Bangladesh. The whole community associated with the fish production, catching and marketing depend on this fish resource. Hence, the whole community is directly benefited from the fisheries. Therefore, to sustain flora and fauna of wetlands it needs to include the understanding of species composition, distribution patterns, productivity and direct and indirect values of resources.

Sustainable forest (swamp forest and reed beds) management will help local people to continue collecting their variety of products and services and also assist in fish breeding. These are both of considerable benefit to the community. Conservation of fish in the *haor* would increase fish production in the floodplains of Bangladesh and subsequently, directly affect the income of *haor* community as majority in Tanguar Haor are connected to fishery.

In Tanguar Haor, local people are mainly engaged in agriculture. So far, conservation of fauna will increase fertility of agricultural land, and maintain biological diversity. A thorough combination of biodiversity and sustainable management will represent a healthy ecosystem in Tanguar Haor and therefore, will help to protect the biodiversity of this *haor* for future benefits. Accordingly, it will directly or indirectly help the economy and livelihood of the Tanguar Haor local community.

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Appendix

Checklist of Fish Species in Tanguar Haor

Status Code: CR - Critically Endangered, EN - Endangered, VU - Vulnerable, LC - Least Concern, DD - Data Deficient, NO - Not Threatened. (IUCN Bangladesh, 2000)

Sl	Order	Family	English name	Scientific name	Local name	National & Global Status
1	Osteoglos-siformes	Notopteridae	Clown knife-fish/ Knife fish/ Humped feather-back	*Chitala chitala* (Hamilton,1822)	Chital/ Che-tol/ Chitna	EN NO
2			Bronze feath-erback/ Grey featherback	*Notopterus notopterus* (Pallas, 1769)	Foli/Pholui/ Haila/Kanla	VU LC
3	Clupeiformes	Clupeidae	Ganges river sprat/ Ganga river sprat/ Ganges river-sprat	*Corica soborna* (Hamilton, 1822)	Kachki/ Subarna-kharika	NO LC
4			Ganges River/Giz-zard shad	*Gonialosa manmina* (Hamilton, 1822)	Chapila, Goni Chapila	NO LC
5			Burmese river shad	*Gudusia variegata* (Day, 1870)		-
6		Engraulidae	Indian river shad	*Gudusia chapra* (Hamilton,1822)	Chapila/ Suiya/ Suhia/ Guri/ Chaipla/ Khaira	VU LC
7			Gangetic hairfin anchovy	*Setipinna phasa* (Hamilton, 1822)	Phasa, Phasa kata, Phausa, Tel-tampri	NO LC
8	Channiformes	Channidae	Baraca snake-head	*Channa barca* (Hamilton, 1822)	Pipla, Tila Shol, Tila	CR LC
9			Great snakehead/ Giant snakehead/ Bullseye Snake-head/ Cobra snakehead	*Channa marulius* (Hamilton-Bu-chanan,1822)	Gozar/ Go-jar/ Gojal/ Gojari	EN LC
10			Asiatic snake-head/ Walking snakehead	*Channa orientalis* (Block & Schneider, 1801)	Gachua/ Raga/ragha/ Cheng	VU LC
11			Spotted snake-head	*Channa puntatus* (Bloch, 1793)	Taki/ Lata/ Lati/Okol/ Chaitan	NO LC
12			Striped snake-head/ Baned snakehead/ Snakehead murrel	*Channa striatus*	Shoal/ Shol	NO LC
13			Walking snake-head	*Channa orientalis* (Block & Schneider, 1801)	Gachua, Raga	VU LC

Sl	Order	Family	English name	Scientific name	Local name	National & Global Status
14	Siluriformes	Clariidae	Walking catfish/ Clarias catfish/ Freshwater catfish	*Clarias batrachus* (Linnaeus, 1758)	Magur/ Mosqur/ Mojgor	NO LC
15	Cypriniformes	Cyprinidae	Indian carplet	*Amblypharyngo-don microlepis* (Bleeker, 1853)	Mola	NO LC
16			Mola carplet/ Pale carplet	*Amblypharyngo-don mola* (Hamilton,1822)	Mola/ Moa/ Molongi/ Mowka/ Moraru/ Mowrala/ Mouchi	NO LC
17			Jaya	*Aspidoparia jaya* (Hamilton, 1822)	Jaya, Peali, Peashi	NO LC
18			Tileo baril	*Barilius tileo* (Hamilton, 1822)	Tila, Tila koksa, Pa-tharchata	DD LC
19			Bengala barb	*Bengala elenga* (Hamilton, 1822)	Elong, Sephatia, Elanga	EN LC
20			Catla	*Catla catla* (Hamilton,1822)	Catla/ Katla/ Katol	NO LC
21			Chaguni (India), Medium carp (Nepal)	*Chagunius chagunio* (Hamilton, 1822)	Jarua, Utti	DD LC
22			Indian grass barb, Blue labuca	*Chela laubuca* (Hamilton, 1822)	Labuca, Kash Khaira	EN LC
23			Mrigal carp, Mrigal	*Cirrhinus cirrhosus* (Bloch, 1975)	Mrigal, Mirka	NO LC
24			Reba/ Reba carp	*Cirrhinus reba* (Hamilton,1822)	Raik/ Tat-kini/Bhagna/ Bata/Laa-cho	VU LC
25			Gangetic Latia, Hill-stream Carp, Stone roller	*Crossocheilus latius* (Hamilton, 1822)	Kala bata	EN LC
26			Zebra danio	*Danio rerio* (Hamilton, 1822)	Anju	NT -
27			Flying barb	*Esomus danricus* (Hamilton, 1822)	Darkina, Danrika, Darka, Da-dhika	DD LC
28			Gotyla, Sucker head	*Garra gotyla* (Gray, 1832)	Ghor poia	DD LC
29			Bata/ Bata labeo	*Labeo bata* (Hamilton,1822)	Bata-Bhangan / Bata/ Bhangan Bata	EN LC

Sl	Order	Family	English name	Scientific name	Local name	National & Global Status
30			Orangefin labeo/ Black rohu/ Kalbasu	*Labeo calbasu* (Hamilton,1822)	Kalibaus/ Kalia/ Baus	EN LC
31			Kuria labeo	*Labeo gonius* (Hamilton,1822)	Ghonia/ Ghainna/ Goni/ Kurchi/ Ghannya	EN LC
32			Pangusia labeo	*Labeo pangusia* (Hamilton, 1822)	Ghora Muik-kha, Ghora Machh, Longu Rui	CR LC
33			Rohu/Rohu carp	*Labeo rohita* (Hamilton,1822)	Rui/Rohit/ Rohu/Rau	NO LC
34			Cotio	*Osteobrama cotio* (Hamilton, 1822)	Dhela/ Keti/ Lohasura/ Dhipali	EN LC
35			Two-spot barb/ Ticto barb/ Firefin barb	*Puntis ticto* (Hamilton,1822)	Tit Puti / Tit Punti/ Tita Punti	VU LC
36			Swamp barb, Chola barb	*Puntius chola* (Hamilton, 1822)	Chalapunti, Punti	NO LC
37			Rosy barb, Red barb	*Puntius conchonius* (Hamilton, 1822)	Kanchan Punti, Taka Punti, Moyna Punti	NO LC
38			Oliver barb	*Puntius sarana* (Hamilton,1822)	Shorpunti / Sar Punti/ Sarna Puti/ Saral Punti/ Kurti	CR LC
39			Pool barb/ Spotfin swamp barb	*Puntius sophore* (Hamilton,1822)	Jat Puti/ Punti/Jat Punti	NO LC
40			Common rasbora, Slender rasbora	*Rasbora daniconius* (Hamilton, 1822)	Darkina	DD LC
41			Gangetic scissor-tail Rasbora	*Rasbora rasbora* (Hamilton,1822)	Darkina/ Leuzza Darkina	EN LC
42			Silver razorbelly minnow	*Salmostoma acinaces* (Valenciennes, 1842)	Chela	DD DD
43			Large razorbelly minnow	*Salmostoma bacaila* (Hamilton,1822)	Nar-keli Chela/ Narakli-chela/Katari	NO LC

Sl	Order	Family	English name	Scientific name	Local name	National & Global Status
44			Finescale razor-belly minnow	*Salmostoma phulo* (Hamilton,1822)	Fulchela	NO LC
45			Gora-cela	*Securicula gora* (Hamilton, 1822)	Ghora chela	NO LC
46			Tor masheer, Mahseer, Tor barb	*Tor tor* (Hamilton, 1822)	Nohashal, Mohal	CR NO
47			Annandale loach	*Lepidocephalus annandalei* (Chaudhuri, 1912)	Gutum	-
48			Cotio	*Osteobrama cotio* (Hamilton, 1822)	Keti, Dhela, Lohasura, Dhipali	EN LC
49			Bighead carp	*Aristichthys nobilis* (Richardson, 1845)	-	-
50			Silver barb	*Barbonymus gonionotus* (Bleeker, 1850)	Thai Sarpunti	-
51			Koksa, Joia	*Barilius bendelisis* (Hamilton-Buchanan, 1807)	Baril	EN -
52			Grass carp	*Ctenopharyngodon idella*	Grass carp	-
53			Common carp	*Cyprinus carpio var. communis* (Linnaeus, 1758)	Common carp	-
54			Common carp	*Cyprinus carpio var. specularis* (Linnaeus, 1758)		-
55			Sind danio	*Danio devario* (Hamilton-Buchanan, 1822)	Chap chela	-
56			Silver carp	*Hypophthalmichthys molitrix* (Valenciennes, 1844)	Silver carp	-
57			Angra labeo	*Labeo angra* (Hamilton-Buchanan, 1822)	Agun chokha	LC -
58				*Labeo boga*	Bhagan	CR -
59			Bogut labeo	*Labeo boggut* (Shyes, 1838)	Ghoria	VU -
60			-	*Labeo nandina*	Nandil	CR -
61			Golden barb	*Puntius gelius* (Hamilton-Buchanan, 1822)	Gili punti	-

Sl	Order	Family	English name	Scientific name	Local name	National & Global Status
62			Glass-barb	*Puntius guganio* (Hamilton-Buchanan, 1822)	Mola punti	-
63			Spottedsail barb	*Puntius puntio* (Hamilton-Buchanan, 1822)	Phutani punti	DD -
64			Onespot barb	*Puntius terio* (Hamilton-Buchanan, 1822)	Teri punti	LC -
65	Cypriniformes	Balitoridae	Mottled loach, Zipper loach, Sand loach	*Acanthocobitis botia* (Hamilton, 1822)	Bilturi, Natwa, Balichata	LC LC
66			Corica loach	*Schistura corica* (Hamilton, 1822)	Koroka, Korica, Khorica	DD LC
67			Savona loach, Half banded loach, Bicolor loach	*Schistura savona* (Hamilton, 1822)	Savon Khorka	NO LC
68			Scaturigina loach, Victory loach	*Scihtura scaturigina* (McClelland, 1839)	Dari	NO LC
69		Cobitidae	Bengal loach/ Necktie loach/ Queen loach	*Botia dario* (Hamilton,1822)	Rani/Putul	EN LC
70			Peppered loach/ Guntea loach	*Lepidocephalichthys guntea* (Hamilton, 1822)	Gutum/ Puiya	NO LC
71			Loktak loach	*Lepidocephalichthys irrorata* (Hora, 1921)	Puiya	DD LC
72			Gongota loach, Mooseface loach	*Somileptes gongota* (Hamilton, 1822)	Poia, Ghar Poia, Pahari Gutum, Puiya	NO LC
73	Siluriformes	Bagridae	Dwarf catfish	*Batasio tengana* (Hamilton,1822)	Batasi tengra/ Tengra	EN LC
74			Kerala mystus	*Mystus armatus* (Day, 1865)	Tengra	DD LC
75			Day's mystus	*Mystus bleekeri* (Day, 1877)	Gulsha tengra/ Tengra	NO LC
76			Gangetic mystus	*Mystus cavasius* (Hamilton,1822)	Gulsha Tengra/ Gulsha/ Kabashi Tengra	VU LC
77			Tengara mystus/ Striped dwarf catfish/ Pearl catfish/	*Mystus tengara* (Hamilton,1822)	Bajuri/ Bajari Tengra/ Ghuitta Tengra/ Bujri/ Bojja	NO LC

Sl	Order	Family	English name	Scientific name	Local name	National & Global Status
78			Striped dwarf catfish, Asian striped catfish, Striped river catfish	*Mystus vittatus* (Bloch, 1797)	Tengra	NO LC
79			Asian Cory, Gold shadow Catfish, Hovering Catfish, Humming Bird Catfish	*Rama chandramara* (Hamilton, 1822)	Gura Tengra, Futki Bujurii, Bajaria Tengra	DD LC
80			Rita	*Rita rita* (Hamilton,1822)	Rita	CR LC
81			Long-whiskered catfish	*Sperata aor* (Hamilton,1822)	Aor/Ayre/ Bhangat/ Talla Ayre	VU LC
82			Giant river-catfish/ Tengara/ Seenghari	*Sperata seenghala* (Skyes, 1839)	Guizza/ Guizza Aor/ Guijja/ Guizza Ayre/ Bhangat/ Talla Ayre	EN LC
83			Bagrid catfishes, Planet catfish	*Hemibagrus menoda* (Hamilton, 1822)	-	NT -
84		Siluridae	Butter catfish, Two spot glass Catfish	*Ompok bimaculatus* (Hamilton-Buchanan, 1822)	Kani pabda, Boali Pabda, Pupta, Pafta	EN LC
85			Pabo catfish/ Pabdah catfish/ Two striped gulper catfish	*Ompok pabda* (Hamilton,1822)	Pabda/ Madhu Pabda	EN LC
86			Wallago/ Freshwater shark/Boal/ Helicopter catfish	*Wallago attu* (Schneider, 1801)	Boal/Boali/ Boyari/ Keyali/ Boil	NO LC
87			Pabo catfish	*Ompok pabo* (Hamilton,1822)	Pabda, Pabia	CR -
88		Schilbeidae	Gangetic ailia	*Ailia coila* (Hamilton, 1822)	Kajoli/Kajuli/ Bashpata	NO NO
89			Jamuna ailia	*Ailia punctata* (Day,1871)	Kajuli/Bashpata	NO NO
90			Garua bacha/ Guarachcha / Gagra	*Clupisoma garua* (Hamilton,1822)	Ghaura/ Gharua / Gagra/ Garua Bacha	CR NO
91			Murius vacha	*Eutropiichthys murius* (Hamilton,1822)	Muri bacha, Motus	NO DD

Sl	Order	Family	English name	Scientific name	Local name	National & Global Status
92			Batchwa vacha, Bacha, River catfish	*Eutropiichthys vacha* (Hamilton,1822)	Bacha, Gaura bacha	CR NO
93			Indian potasi	*Pseudeutro-pius atherinoides* (Bloch, 1794)	Batasi, Bataiya, Batasi	NO LC
94			Silond catfish, Silondia vacha	*Silonia silondia* (Hamilton, 1822)	Shilong, Si-lond, Dhain, siloin, Jilang	EN LC
95			Indian potasi	*Neotropius atherinoides* (Bloch, 1794)	Batasi/ Bataiya/ Batais	NO LC
96		Pangasiidae	Yellowtail catfish/ Pungas / Pungas catfish	*Pangasius pangasius* (Hamilton,1822)	Pangas/ Pangwash	CR LC
97		Sisoridae	Gangetic goonch, Dvil catfish, Sand dhark	*Bagarius bagarius* (Hamilton,1822)	Baghair, Ba-ghari, Bagh Machh	CR NO
98			Gangetic gagata	*Gagata youssoufi* (Rahman, 1976)	Gang tengra	NO -
99			-	*Hara hara* (Hamilton, 1822)	Kutakanti	NO LC
100			Huddah nangra	*Gagata viridescens* (Hamilton, 1822)	Gang tengra	-
101				*Glyptothorax telchitta* (Hamilton, 1822)	Telchitta	-
102		Erethistidae	Conta catfish	*Conta conta* (Hamilton, 1822)	Hara mach	CR LC
103			Gangetic ere-thistes, Giant moth catfish	*Erethistes pusillus* (Muller and Troschel, 1845)	Kutakanti, Kurkati	NO LC
104		Clariidae	Walking Catfish/ Clarias	*Clarius batrachus* (Linnaeus, 1758)	Magur/ Mosqur/ Mojgor	NO -
105		Heteropneus-tidae	Stinging catfish/ Fossil catfish/ Liver catfish	*Heteropneustes fossilis* (Bloch, 1794)	Sing/Jiol/ Shingi/Jill Shinghi/ Shinghi	NO LC
106		Chacidae	Squarehead catfish	*Chaca chaca* (Hamilton,1822)	Chakka/ Cheka/ Gangainna/ Chaka Veka	EN LC
107	Cyprinodonti-formes	Aplocheilidae	Panchax minnow, Blue panchax, Tin head	*Aplocheilus panchax* (Hamilton, 1822)	Techoukka, Kanpona, Choukkani	NO LC

Sl	Order	Family	English name	Scientific name	Local name	National & Global Status
108	Synbranchi-formes	Synbranchidae	Cuchia/ Gangetic mudeel/ Gangetic Mud Eel/ Fresh-water Mud Eel	*Monopterus cuchia* (Hamilton,1822)	Kuchia/ Kunche/ kuicha	VU LC
109			Bengal mud eel, One-gilled eel, Asian swamp eel	*Ophisternon bengalense* (McClelland, 1845)	Bamosh, Kunche	NO LC
110			Crocodile tooth piperfish	*Microphis cuncalus* (Hamilton, 1822)	Kumirer khil, Kumirer kona	NO -
111			Deocata pipefish	*Microphis deocata* (Hamilton, 1822)	Kumirer khil	EN -
112	Perciformes	Ambassidae	Elongate glass-perchlet/ Asian glass fish	*Chanda nama* (Hamilton,1822)	Nama Chanda/ Chanda	VU LC
113			Himalayan glassy perchlet, Indian glassy fish	*Pseudambassis bacillus* (Hamilotn, 1822)	Kata Chan-da, Phopa Chanda	DD DD
114			Indian glassy fish	*Pseudambassis ranga* (Hamilotn, 1822)	Chanda, Ranga Chanda, Lal Chanda	VU LC
115		Nandidae	Gangetic leaffish/ Mottled nanadus/ Mud perch/ Mot-tled nandus	*Nandus nandus* (Hamilton,1822)	Meni/ Bhe-da/ Roina/ Nandui	VU LC
116		Pristolepidae	Badis/ Blue perch/ Dwarf chamele-onfish	*Badis badis* (Hamilton,1822)	Napit Koi/ Koi Bandi/ Napit	EN LC
117		Mugilidae	Corsula mullet	*Rhinomugil corsula* (Hamilton, 1822)	Khorsula, Bata, Khalla, Arwari, Halla, Hira, khor, Pung-tara, Urul	NO LC
118			Yellow-tail mullet	*Sicamugil cascasia* (Hamilton, 1822)	Kachki bata	-
119		Gobiidae	Tank goby/ Bar-eyed goby	*Glossogobius giuris* (Hamilton,1822)	Bele/Bailla	NO LC
120			Bimblebee goby, Golden-banded goby	*Brachygobius nunus* (Hamilton, 1822)	Nuna baila	NO LC
121		Anabantidae	Climbing perch/ Climbing bass/ Walking fish	*Anabas testudineus* (Bloch, 1795)	Koi/Coruv/ Kai	NO LC

Sl	Order	Family	English name	Scientific name	Local name	National & Global Status
122		Osphronemidae	Dwarf gourami/ Red gourami	*Tricogaster lalius* (Hamilton, 1822)	Kholisha-Lal/ Lal khailsha/ Baicha/ Ranga khailsha	NO LC
123			Indian paradise-fish, Frail gourami, Indian gourami	*Ctenops nobilis* (McClelland, 1854)	Nftani, Napit khailsha, Modhumala, Neftani	EN NO
124			Banded gourami/ Stripled gourami/ Giant gourami	*Trichogaster fasciata* (Bolch & Schneider, 1801)	Kholisha/ Khailsha/ Khoila/Cheli/ Khoira	NO LC
125			Dwarf gourami/ Red gourami	*Colisa lalia* (Hamilton, 1822)	Baicha/Lal khailsha/ Ranga khailsha	NO LC
126			Honey gourami	*Trichogaster chuna* (Hamilton, 1822)	Chuna khailsha, Baicha	NO LC
127		Mastacembelidae	One-striped Spinyeel/ Lesser Spiny Eel/ One-stripe spiny eel/ Spotted spiny eel/ Peacock spiny eel	*Macrognathus aculeatus* (Bloch, 1786)	Tara Baim/ Baim/Bam/ Ban	VU LC
128			Barred spi nyeel/ Striped Spinyeel/ Striped Spiny Eel	*Macrognathus pancalus* (Hamilton,1822)	Baim-Guchi/ Guchi baim/ Guchi/Chirka/ Turi	NO -
129			Zig-zag eel/ Tire-track spiny eel	*Mastacembelus armatus* (Lacepede, 1800)	Sal baim/ Baim/ Bain/ Bamosh/ Bumni/Gont	EN LC
130		Sciaenidae	Cuja bola	*Macrospinosa cuja* (Hamilton, 1822)	Kuizza poa	NT -
131	Tetraodontiformes	Tetraodontidae	Ocellated pufferfish/Commom pufferfish	*Tetraodon cutcutia* (Hamilton, 1822)	Potka/Tepa/ Kutkuitta	NO LC
132	Syngnathiformes	Synganthidae	Deocata pipefish	*Microphis deocata* (Hamilton, 1822)	Kumirer khil	EN -
133	Beloniformes	Belonidae	Freshwater garfish/ Needle fish/ Silver needle fish	*Xenentodon cancila* (Hamilton, 1822)	Kaika/ Kankila/ Kaikya/ Kakila	NO LC
134	Anguilliformes	Anguillidae	Indian mottled eel/ Indian longfin eel	*Anguilla bengalensis* (Gray, 1831)	Foli/Pholui/ Haila/Kanla	VU LC

INDEX

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