

Fish Wealth of Mahananda River



Dr. Mamta Singh Dr. V. P. Saini Dr. Rupam Samant Dr. N.K. Verma

Fish Wealth of Mahananda River

**Dr. Mamta Singh
Dr. V. P. Saini
Dr. Rupam Samanta
Dr. N. K. Verma**



College of Fisheries, Kishanganj
(Bihar Animal Sciences University, Patna)

Disclaimer

All possible care has been taken in the identification of fishes, DNA barcoding, writing, editing, proofreading and printing of this book, but in case of any omission/mistake which might have crept into this book, neither the author nor printer/publisher shall be held responsible for the same. The authors and publisher shall be grateful to the learned readers for their suggestions for further improvement of the book.

Copyright: College of Fisheries, Kishanganj

ISBN: 978-81-963832-0-6

First Edition: 2023

Published by

Dr. V. P. Saini
Dean, College of Fisheries, Kishanganj
Bihar Animal Sciences University, Patna



Prof Rameshwar Singh
Vice Chancellor
Bihar Animal Sciences University, Patna

FOREWORD

The history of the rivers of India is quite ancient. Some rivers in India are worshipped in almost every state. One of these is the Mahananda River. It is an ancient river flowing in India and Bangladesh. It is believed that this river originates from the Himalayan ranges about 6 km north of Kursiang in the Darjeeling district. Mahananda River would have been heard by almost everyone, but no one would have known about its fish fauna. For the investigation of fish fauna of this river, a team of researchers from the College of Fisheries, Kishanganj conducted an exploratory survey during 2020-2022 and reported 56 species under 43 genera and 24 families from this river. The outcome of two years of the fish exploratory survey is presented in the book "Fish Wealth of Mahananda River". This book presents a consolidated account of the fish fauna of the Mahananda River. Apart from a few interim reports on the fishes of the Mahananda, there is no publication describing the fishes with their classical taxonomic characters and DNA barcodes. The information on the fish fauna of the Mahananda River would be of particular interest to readers. I hope that the book will be widely used by all interested in the fish fauna of this region.

The Mahananda River harbours several endemic species suitable for aquaculture, sport fishing, and aquarium keeping. The introduction of exotic species and aquatic pollution has drastically reduced the native fish fauna in river systems. Unfortunately, a lack of information on these species and habitats has been a significant handicap in taking timely steps in conservation. Team College of Fisheries has taken the initiative for Mahananda River Fish Germplasm Inventory and barcoding to address this issue. I am sure the book "Fish Wealth of Mahananda River" would be helpful to all conservationists, researchers, and fisheries students. I complement the efforts of Dr. Mamta Singh, Dr. V. P. Saini, Dr Rupam Samanta, and Dr. N. K. Verma of the College of Fisheries Kishanganj for bringing out the publication.

A handwritten signature in blue ink, appearing to read 'Rameshwar Singh', written in a cursive style.

(Rameshwar Singh)

Preface

This is the first written document on the fish diversity of the Mahananda River system. Our goal in writing this book was to provide a text that gave an introduction to fish biodiversity, validation of fish species using modern molecular taxonomic tools, and development of a reference database on native fishes of Mahananda. Any book based on a case study is a compilation of facts; every statement of fact results from the research efforts. Readers often need to catch up on the origins of this information, namely the effort that has gone into verifying an observation, repeating an experiment, or making the countless measurements necessary to establish the validity of a fact. This book distils field research from more than two years of intensive fieldwork. We hope that as you read the chapters in this book, you will appreciate the diversity of fish in the Mahananda River.

Many people have generously helped with fish sample collection, identification, barcoding, etc. (); big thanks to them. We are grateful to our college contemporaries, YP-I, Mr. Lakhian Meena, and the students for helping in preparing this book and commenting on drafts of chapters. We are thankful for their assistance. The authors gratefully acknowledge the permission granted by the Hon'ble Vice Chancellor of BASU Patna, Prof. Rameshwar Singh, to conduct an exploratory fish survey and publish this book, "Fish Wealth of Mahananda River." We also thank the Director of Research, BASU, Dr V. K Saxena, for financial assistance to the fish exploratory survey project. The help of many others is acknowledged and deeply appreciated, although they go unmentioned here.

Authors

Contents

S.No	Particular	Page Numbers
1	Forward Message	
2	Preface	
3	Introduction	1
4	Mahananda River System	5
5	Techniques: Fish Collection, Identification & Molecular Characterization	10
6	Exploration and Characterization of Fish Germplasm	17
7	Fish Fauna of Mahananda River	24
8	References	89

Chapter- 1

Introduction

India constitutes one of the mega biodiversity centers of the world and stands ninth in terms of freshwater diversity (Malik, 2011). Biodiversity is a basic property of biome and therefore it manifests itself at all levels of the biological spectrum from single cell to complete life systems. The magnitude of biodiversity has always been habitat dependent as the diversity of terrestrial, aquatic, aerial and their sub region vary considerably. This variation is an outcome of its adaptability to the changing environ for sustainable growth. Various abiotic (physical and chemical) and biotic factors alter biological systems temporarily or permanently, leading drifts in their metabolic systems. Significant evolutionary outcomes have led to the formation of new species. The adaptability of a species largely depends on habitat therefore fluctuation in habitat alters composition in flora & fauna. Maximum variation is observed in terrestrial life as all the effective factors vary considerably along with latitude, longitude, and altitude, on the other ,hand aquatic life is compared to terrestrial flora, fauna, and microbial community, it deals with different exposure. In aquatic system some factors are constant while others fluctuate rapidly with significant amplitude. Among aquatic macrofauna species pisces has adapted more variation from micro and macro, cartilaginous to bony etc. Environmental and genetic drift has led to this diversified flash. The number of species of fishes in different water ecosystems is a part of a biological diversity of the Earth. Aquatic biodiversity

encompasses freshwater ecosystems, including lakes, ponds, reservoirs, rivers, streams, groundwater, and wetlands. It also consists of the marine ecosystem, including oceans, estuaries, salt marshes, coral reefs, and mangrove forests. Aquatic biodiversity includes all unique species, their habitats and interaction between them. It consists of phytoplankton, zooplankton, aquatic plants, insects, fish, birds, mammals, and others. Water resources and aquatic biodiversity is intimately interrelated and interdependent. Fish inhabit a wide variety of habitats from pure freshwater to salty waters. Due to fact that the volume of freshwater on earth in relation to number of fish species is several folds less than that of oceans, and because of the ample scope for isolation and habitat partitioning in freshwater volume of water available for an individual freshwater fishes are far less than that of marine fishes. About 41.2% of total numbers of fish species live in freshwater lakes and rivers, which account for less than 0.01% of the water available on earth. On the other hand, 58.2% fish species live in the oceans which account for 97% of the water available on earth (Camargo *et al.*, 2005).

India has a vast expanse of open inland waters in the form of rivers, canals, estuaries, natural and man-made lakes, backwaters impoundments and mangrove wetlands. The fish resources of India are one of the richest in the world. In Asia 30,700 fish species are reported, whereas in India total 2500 including 801 (Fishbase.org) freshwater fish species have been recorded. Aquatic resources are reported of India to consist of 29,000 km of rivers, 0.3 million ha of estuaries, 3.15 million ha of reservoirs, 0.9 million ha of backwaters and lagoons, 0.2 million ha of floodplain wetlands, 0.72 million ha of upland lake and 2.02 million km² area of an exclusive economic zone (EEZ). The seas surrounding India include 8,129 km of coastline which includes those of Andaman and Nicobar and Lakshadweep Islands. Fishes of the inland water bodies of the Indian sub-continent have been a subject of study since last Century (Day, 1889 and Jayaram, 1981&1999). Indian water resources are diversified, as they are plentiful. Ichthyofauna of a lake basically represents the fish faunal diversity and their abundance. Indian lake preserves a rich variety of fish species. Lakes and reservoirs contribute the single largest inland fishery resources both in terms of size and production potential. Indian reservoirs preserve a rich variety of fish species, based on studies conducted so far, large reservoirs on an average harbour 60 species of fishes; of which 40 species contribute to the commercial fisheries and the other contribute to ornamental fishes. Overexploitation

Fish Wealth of Mahananda River

from the wild is one of the major issues in the case of many indigenous fishes and these are categorized as "endangered" based on latest IUCN criteria, due to restricted distribution, loss of habitat, overexploitation, destructive fishing practices and trade. Habitat destruction is another reason that leads to the depletion of these natural resources. There are many factors, such as: which destroy the breeding habitats or added additional stresses to many aquatic species. Attempts to promote aquaculture practices in the area using transplanted Indian major carps and other exotic species have led to further deterioration in the situation. Ponniah and Gopalakrishnan, (2000) reported an alarming rate of depletion of the fish diversity of the region due to over-exploitation and clandestine export. There is an urgent need for the development of scientific management strategies for the sustainable utilization of these natural resources. The population of most species are composed of subpopulations, also called genetic stocks, between which limited gene flow occurs. These subpopulations maintain their genetic makeup or characteristics distinct from other subpopulations of the same species due to genetic variation within the species. A strategy thus developed for the scientific management of these resources was to identify the natural units, the 'stocks' of the fishery resources under exploitation (Altukhov, 1981). This can be done by characterizing the genetic structure of the populations being harvested. A lack of knowledge about the genetic structure of these populations may result in the differential harvest of the populations that will ultimately have a drastic and long-term effect. To overcome this, there is always a need for investigations encompassing the genetic variations at the intra and inter-population levels as well as at the intra and inter-specific levels of the fish and shellfish resources of any nation (Allendorf and Utter, 1979).

The characterization of any species using morphology and anatomical characters occasionally lead to ambiguity in proper identification of closely related species. Because of these issues, molecular markers have been used as a complementary tool for taxonomic identification. The analysis of sequence diversity in Cytochrome C Oxidase I (COI) gene can offer an effective tool for species diagnosis. It advocates that sequence diversity in this gene could be used to produce a "barcoding" system that would enable the identification of all species. Mitochondrial DNA (mtDNA) is also one of the widely used molecular markers for studying intraspecific and interspecies variation in animals. DNA barcoding surveys using partial Cytochrome C Oxidase subunit I sequences have exposed

cryptic diversity across the animal kingdom. For instance, Goswami et al. (2008) have also used mtDNA cyt b region to study the genetic stock structure of two seahorse species (*Hippocampus kuda* and *Hippocampus trimaculatus*) from the south-east and south-west coasts of India. Analysis of DNA sequence polymorphism utilizing the existing “universal primers” for mitochondrial DNA (mtDNA) provides the highest resolution of genetic variation which had been broadly applied in molecular systemic studies.

Knowledge of fish diversity of the region is essential not only for the rational management of ichthyofauna of that region but also for their conservation strategies. Additionally, for the exploitation and scientific development of aquaculture, knowledge of existing fish fauna of the area is a prerequisite. Although many workers have studied ichthyo-fauna of lotic and lentic waters, however much is not known about the status of fish diversity of Mahananda river system of Bihar. Therefore, considering the genetic and ecological conditions a study has been designed and conducted to investigate the fish fauna of Mahananda river system. The outcome of this study will help in the generation of baseline data on the availability of fishes and their genetic studies for better management of natural wealth.



Mahananda River System

The Mahananda is a notable river since the time of Mahabharata. It has also been mentioned in Mahabharata (Sabhaparba Ch.9/22-23) that the Ganga in Banga (North Bengal) has come down from the matted hair of Lord Siva in the form of 'Trisrota' (three streams), such as - 'Karatoa tathatreyyee Louhityascha Mahanandah. It is mentioned in Mahabharata if a man is controlled and non-violent and bathes in Purapartava. Nanda or Mahananda he goes to Nandana and served by Apsaras.

The river Mahananda is a large tributary of the Ganga River, originates from the Mahaldiram range, near Chimli (Latitude 26° 55' 40"N and Longitude 88° 14' 04" E) at an elevation of 2200 m. Mahananda is consisting of two different streams, one arising from mountainous region of Himalayas in Nepal traverses through the Indian state of Bihar and out falls in the Ganga in left opposite to Rajmahal in Bihar and is locally named as river Fulahar. The other stream also named as Mahananda rises in downhill in Darjeeling in West Bengal and traverses about 400 kms. through the district of



Fig. 2.1: Panoramic view of Mahananda

Darjeeling, West Dinajpur and Malda. It enters Bangladesh near Tentulia in Panchagarh District, flows for 3 kilometres after Tentulia and returns to India (Fig.2.2).

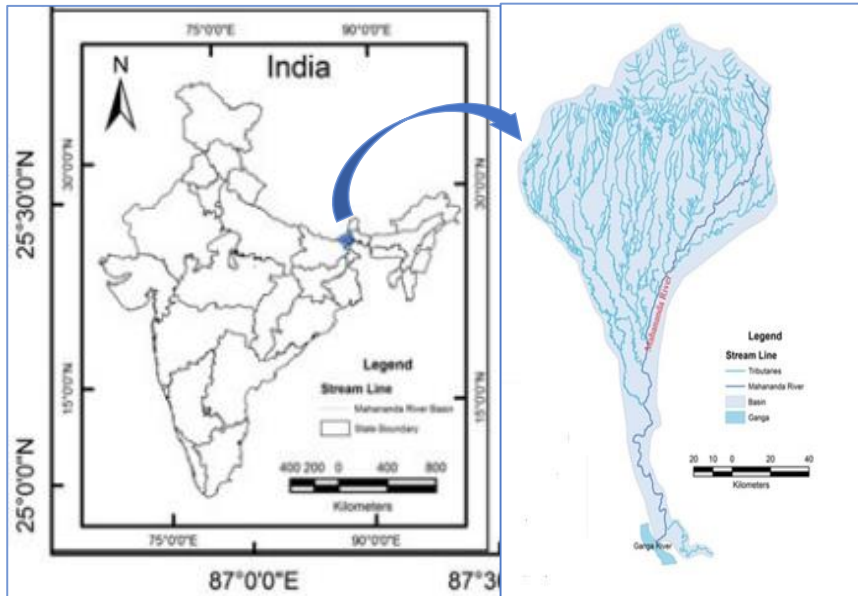


Fig. 2.2: Location and drainage pattern of Mahananda river basin

After flowing through Uttar Dinajpur district in West Bengal and Kishanganj, Purnia and Katihar districts in Bihar, it enters Malda district in West Bengal. The Mahananda divides the district into two regions — the eastern region, consisting of old alluvial and infertile soil is commonly known as Barind (Borendrovomee), and the western region, which is further subdivided by the river Kalindri into two areas, the northern area is known as "Tal". It is low-lying and vulnerable to inundation during rainy season; the southern area consists of very fertile land and is thickly populated, being commonly known as "Diara". It joins the Ganges at Godagiri in Nawabganj district in Bangladesh.

Geological formations of Mahananda river system: The geological formations of the Mahananda river system in the hilly area of Darjeeling district consist of unaltered sedimentary rocks confined to the hills on the north consisting of different grades of metamorphic rocks over the rest of the area. The outcrops of the various rocks form a series of bonds to the general line of the Himalayas, dipping



Fish Wealth of Mahananda River

one below the other into the hills. The characteristic feature of the Southern area is that the older formations rest on the younger formations, showing complete reversal of the original order of superposition. The great range was elevated during the tertiary period above the site of an ancient area that had accumulated sediments of different geological ages. The mountains are made up of folded rocks piled one over another by a series of north-south horizontal compression movements and 29 tangential thrusts which also folded the strata on the sea floor and caused their up-heaval by stages. At many places, the formations have been intruded by granites. Frequently, the strains within the range are invested due to the overturning of the folds and their dislocation. The river flows south through a rich agricultural area in Bihar state, enters West Bengal state, flows past Ingraj Bazar, and then continues south eastward into Bangladesh to join the Ganges (Ganga) River at Godagari Ghat after a 360-km course.

Basin Data

The catchment area of the Mahananda basin is shared by three nations i.e., Nepal, India, and Bangladesh. The river Mahananda is a hill-fed river as it is originated in the Darjeeling hills. After flowing about 20 km upstream, the river left the hilly terrain and enters the plains near Siliguri in West Bengal. Downstream of Siliguri city, the Mahananda flow in a south-westerly direction and finally meet the mighty Ganga. The total length of the Mahananda is 360 kilometres, out of which 324 kilometres are in India and 36 kilometres are in Bangladesh. The total drainage area of the Mahananda is 20,600 square kilometres out of which 11,530 square kilometres are in India.

The river basin extends from 24° 58' to 27° 10'N latitude and from 87° 6' to 88° 31'E longitude. The river basin has two distinct catchment area: the upper catchment consisting of part of Sikkim Himalaya and the lower Gangetic plains. The basin experiences an extremely hot and humid monsoonal type of climate. The proximity to the Bay of Bengal on the southern part and the alignment of the Himalaya and that of the Meghalaya Plateau situated on the north-eastern side determine the climatic character. January is the coldest month with a temperature range of 17–21 °C. The temperature starts rising gradually throughout the region from February. Monsoon became active by first week of June. The rainfall is widespread in the basin, i.e., 120 to more than 400 cm, with uneven seasonal and spatial distributions. The basin receives rainfall from four diverse sources namely, westerly disturbances of winter, local depressions during March–May, monsoonal rainfall, and cyclonic

disturbances. However, the last two account for the major precipitation in the region.

Tributaries: The main tributaries of the Mahananda are Balason, Mechi, Kankai and River Kalindri. At the East of the confluence of the Kalindri and the Mahananda lies the Old Malda town. In the Siliguri area it has three tributaries called the Trinai, Ranochondi and the pair of Chokor and Dauk taken as a single

Climate: Based on Rainfall, Humidity, winds, and temperature variation the year related area can be divided into four well defined seasons 1) Hot- Summer Season- March to June 2) Monsoon Season –June to September 3) Retreating Monsoon-October to November 4) Winter Season- November to February, The Mahananda river system in Darjeeling district experiences varied climatic condition. Occasionally snow falls in January and February at high altitude for a few hours. During April and May there is short lived summer accompanied by summer rain, for three months from June to August and the catchment is drenched with rain.

Maximum and minimum temperatures in the district hover around 22°C to 24°C during the Summer and around 4°C to 0°C during the Winter. The catchment in Jalpaiguri district experiences heavy rainfall. Its temperature is rarely excessive due to the proximity of the hills and so the catchment is always green. The Malda district is significantly under hot and humid monsoonal climate. The months from November to April are dry and fine, the normal rainfall of each being, under one inch. The monsoon breaks normally in the middle of June, the months of heaviest rainfall being July, August, and September. An oppressive summer season, plentiful rain, and humid atmosphere all through the year are the main characteristics of the climate of Mathe Ida district. In Kishanganj, Purnea, Katihar and Araria district experiences three different seasons. Summer from March to early June, Rainy from later part of June to September and Winter from November to February. Mean daily ambient temperature from Summer to Winter shoots up to 40°C to 4°C. Generally, the relative humidity is above 70% in most parts of the year.

Rainfall in these districts is mainly by the southwest monsoon, which sets in the month of June and continues up to September. Sometimes monsoon retreats in early October. The average annual rainfall in the Mahananda river system in India is about 2050 mm. Maximum rainfall occurs in the month of July during monsoon about 80% of the total rainfall. The usual direction of moisture laden current is generally northward. The annual rainfall in the upper catchment ranges from 100 mm to 1400 mm. As per the Bihar Statistical Handbook-2012, Annual normal rainfalls in the districts

Fish Wealth of Mahananda River

of Araria, Purnea, Kishanganj and Katihar are between 1218 mm to 2041 mm and during monsoon the average annual rainfall is between 1067 mm to 1785 mm. The average monthly rainfall during the non-monsoon period is about 110 mm. The Minimum rainfall occurs in the month of December.

Source of Water

Both the rivers received snow melt in small quantities during non-monsoon month and receive heavy amount of water from the monsoon rains. Both the streams also receive good amount of water from the various tributaries. The average rainfall in the region is about 1400 mm and 80% of the annual rain occurs during 4 to 5 months. The catchment area of these two rivers stretched over sub-Himalayan region of Nepal and West Bengal, is the second highest rainfall region in India. As both the streams run remarkably close to each other in sub-Himalayan plains which combine into single river during Peak monsoon months and inundate a huge land area in Bihar and West Bengal. The inundation takes devastating shape particularly when the mainstream Ganga is at her Peak when further drainage of water becomes impossible due to obvious reason. A vast area of Bihar and West Bengal get waterlogged by the pool of water formed by conjunct mass of undischarged water of these two streams of Mahananda. The affected districts are Purnea and Katihar in Bihar and Darjeeling, West Dinajpur and Malda district in west Bengal.

Socio-Economic Role of Mahananda: Everywhere on earth man is dependent on nature. It is nature that controls human lives every now and then. River is an important boon gifted by nature as it performed the role on the socio-economic lives of people an at present and future as it performed the role in past. The impact of

the Mahananda, on public life is immense. The Mahananda flows down across north-east boarder of the block. How much importance the human living on the banks of the Mahananda river derive for their socio-economic need has been presented in Fig 3.3. The trends of irrigation, catching of fish, and cultivation on the inhabitants dwelling on the limited space of river are mentioned worthy.

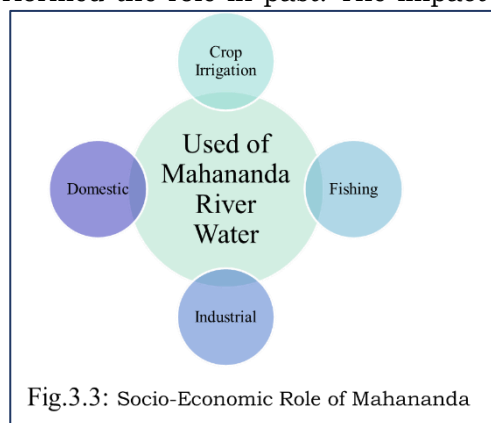


Fig.3.3: Socio-Economic Role of Mahananda



Techniques: Fish Collection, Identification & Molecular Characterization

The large river basins have been inhabited by humans for more than five millennia and have contributed to the success of some of the most important human culture and civilization centers in human history. However, human presence in the watersheds resulted in complex and highly variable impacts on lotic ecosystems. Such human impacts have altered water flows and the quality of habitats of many freshwater fish species and are a major cause of the decline in freshwater fish biodiversity. Despite the importance of these impacts, Mahananda river systems has not been adequately studied. Considering, this a study was conducted to evaluate the fish species richness in Mahananda river system. The procedures followed for collecting samples and their analysis are described in this section of this book.

Sample Collection: To collect the data on Mahananda River fishes, an investigation was conducted from April 2020 to Dec. 2022 and the sampling cycle was divided into three seasons as (a) pre-monsoon (April-June), (b) monsoon (July-September) and (c) post-monsoon (October-December). Investigation of fishes was conducted in eight selected sites of river Mahananda (Fig. 3.1) with the help of fishermen. Fishing gears applied were mostly cast net, scooping gears, encircling net, etc. (Fig.3.2). The specimens were photographed and fixed individually in formalin solution for recording their morphological characters. Fish muscles (app 50 mg)

Fish Wealth of Mahananda River

from individual fish were collected and preserved in ethanol for molecular studies.

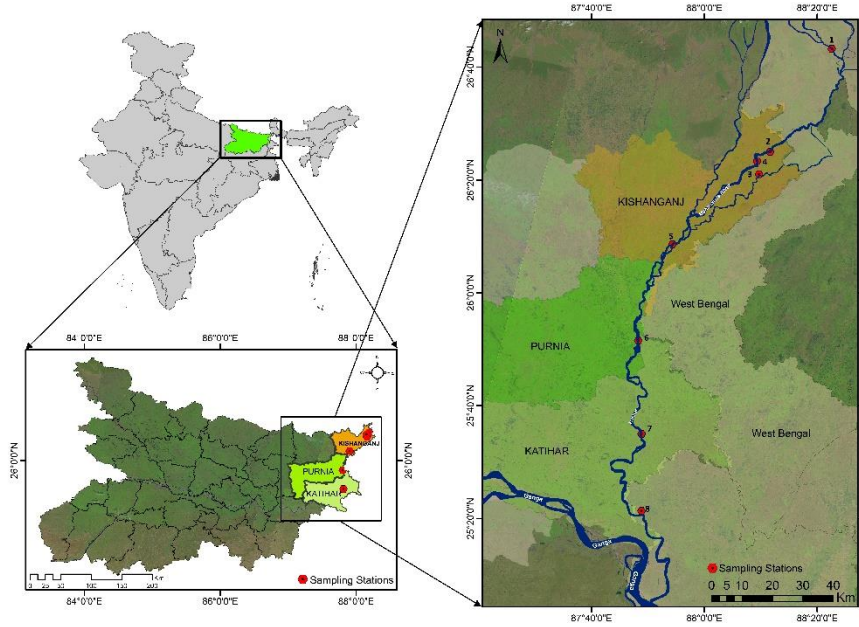


Fig. 3.1: Figure showing sampling sites in Mahananda river

Table 3.1: Details of the sampling site		
Site	GPS Coordinates	Locality
1	26°43'14.0"N, 88°22'35.6"E	Siliguri Town, West Bengal
2	26°24'59.8"N, 88°11'38.9"E	Near Jalagacch, Kishanganj, Bihar
3	26°21'02.3"N, 88°09'41.7"E	Near Pothia Bridge, Kishanganj, Bihar
4	26°23'21.5"N, 88°09'21.6"E	Near Tayabpur Bridge, Kishanganj, Bihar
5	26°08'37.1"N, 87°54'23.2"E	Near Bahadurganj Bridge, Kishanganj, Bihar
6	25°51'33.8"N, 87°48'17.7"E	Near Dhakhola Bridge, Purnea, Bihar
7	25°35'01.2"N, 87°48'53.5"E	Near Salmari, Katihar, Bihar
8	25°21'22.1"N, 87°48'51.5"E	Mihahat, Malda, West Bengal



Fig: 3.2: Sampling photographs

Preservation of Fish Specimen: The collected fish specimens were preserved in 4% formaldehyde solution at the sampling site itself. Small fish specimen (less than 10 cm in total length) was preserved directly without injection or opening the visceral cavity. But larger specimens were preserved with an injection of preservative into the visceral cavity slitting of the abdomen for about 25% of body length and were stored in plastic or glass air tide bottle in cool place.

Fish Wealth of Mahananda River

Labelling of Fish Specimen: Every sample was labelled with the details viz. locality, date and time of collection and other related information of the specimen. A strong plastic label was used with a serial number. Before preservation, the colour of the specimens were also recorded.

Identification of Fish Specimen: Identification of fish specimen was based on diagnostic characteristics such as body form, colour, size, shape and position of fins and meristic features. Identification was performed based on both fresh and preserved specimens. Fresh materials were mainly used for colour and preserved specimen for morphometric and meristic characteristics. Samples were brought to the laboratory and then identified with the help of keys provided by Day (1986), Datta Munshi and Shrivastava (1988), Talwar and Jhingran (1991) and Das et al. (2010). For further confirmation and identification, DNA barcoding was performed as detailed below:

Mitochondrial DNA analysis

Collection of Fish Samples: Total DNA was extracted from the tissue (muscles) samples collected from different points of river Mahananda. The samples were collected pre-monsoon, monsoon, and post-monsoon.

Storage of Source Material: Fish muscle samples were stored in 70% ethanol for further studies.

Genomic DNA Isolation: Total genomic DNA was isolated from 50 mg of preserved tissue. DNA extraction was carried out through the Phenol-Chloroform extraction technique (Crandall et al., 1999) as per the protocol described below:

The tissue samples (~50 mg) were placed in individual nucleic acid free 1.5 ml microcentrifuge tubes containing 340 µl of 0.2M EDTA solution (pH 8.0) with 0.5% SDS (Sodium Lauryl Sulphate, Sigma). 10 µl of 20 mg ml⁻¹ proteinase K (ABgene) was added to each tube, mixed briefly and the tubes were incubated overnight at 55°C in a hybridization oven (Techne Hybridizer HB-1). During incubation, the tubes were tumbled to ensure constant and homogenous mixing followed by addition of 10 µl of 20 mg ml⁻¹ DNase free RNase (ABgene) in each tube, which was then shaken vigorously and incubated for 60 min at 37°C in a hybridization oven. About 350-400 µl of buffered phenol (Fisher Scientific) was added to each tube and vortexed for 10 seconds followed by the gentle over-end turning of the tubes for 15-20 min. About 350-400 µl of chloroform (Fisher Scientific) was added to each tube, shaken vigorously for 10 sec and the tube was then turned for another 15-20 minutes. The tubes were centrifuged for 5 min at 10,000 rpm to separate the organic and aqueous phases. About 300 µl of the top aqueous layer was

removed to a clean tube, carefully avoiding proteins at the aqueous: organic interface. About 900 μ l of chilled 92% ethanol was added to the aqueous solution and mixed by vigorous inversion of the tubes 5-6 times to precipitate the DNA. After allowing the precipitate to stand for 2-3 minutes most of the ethanol was carefully decanted off. One ml of 70% ethanol was added to wash the DNA pellet and the tubes were then left in a rotator overnight at room temperature. The ethanol was then carefully decanted off and the DNA was allowed to partially dry for 5-10 minutes at room temperature before re-suspending in 50 μ l TE buffer (10 mM Tris.Cl, 1 mM EDTA; pH 8.0). The DNA was stored at -20°C in a deep freezer.

DNA Quantification: DNA quantification was carried out by two methods. In the first method DNA concentration was directly measured using Nano-Drop spectrophotometer as per manufacturer's protocol, while other method involved running 3 μ l of a DNA sample in a 1.2% Agarose gel for 50 min at 5 V/cm and comparing the intensity of the EtBr-stained bands against those of different amounts of marker ϕ 174 RF DNA Hae III (ABgene) viz, 50 ng, 100 ng, 150 ng, 200 ng, 250 ng run on the same gel. After quantification, the DNA solutions were brought to the desired concentration level by the addition of TE buffer (pH 8.0).

Agarose Gel Electrophoresis: Agarose gel electrophoresis (BIO-RAD) was used for checking the success of DNA extraction, PCR amplification etc. In the normalized array 1-1.2% Agarose gel was used with 0.5X TAE buffer (50X stock solution contained 242 g Tris base, 57.1 ml glacial acetic acid, 100 ml of 0.5 M EDTA (pH 0.8) in 1 liter solution) or 1X Sodium boric acid buffer (20X stock solution was prepared by dissolving 0.8 g NaOH, pH adjusted to 8.5 by boric acid). Sodium boric acid buffer was preferred over TAE because less heat was generated during electrophoresis, allowing a much higher voltage (5-35 V/cm) to be used as compared to TAE (5-10 V/cm). This drastically reduced gel run time. Gels were stained with Ethidium bromide (0.5 μ g/ml; Sigma) to visualize the DNA bands under a UV transilluminator.

DNA Barcoding: PCR Assay for DNA Barcoding COI gene fragment was amplified using the set of published primers:

FishF1-AACCAACCACAAAGACATTGGCAC

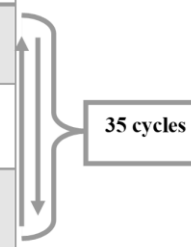
FishR1-TAGACTTCTGGGTGGCCAAAGAATCA

Amplification of Isolated DNA: The amplification was performed in 25 μ l reaction mixture of 1X PCR buffer, 2 mM MgCl₂, 10 pico moles of each primer, 0.25 mM of each dNTPs, 0.25 U high-fidelity Taq polymerase and 100 ng of DNA template. DNA amplification

Fish Wealth of Mahananda River

reaction was performed in a Thermo-cycler. PCR conditions were as below:

Pre-Denaturation	94°C for 3 minutes
Denaturation	94°C for 30 seconds
Annealing	54 °C for 30 seconds
Extension	72°C for 1 minutes
Final Extension	72°C for 10 minutes



Subsequent Amplification for Barcoding: PCR product was further amplified under barcoding conditions. Amplification was performed in a 10 µl reaction, containing 5X sequencing buffer, Ready Reaction mix (ABI), primers 10 picomoles, template DNA 10 ng. PCR cycle was as below:

Pre-Denaturation	96°C for 3 minutes
Denaturation	96°C for 30 seconds
Annealing	50 °C for 30 seconds
Extension	60°C for 1 minutes
Chill (soak)	4°C for 10-15 minutes



DNA products were amplified in a Thermocycler and then PCR products were further purified using sodium acetate purification method. Amplified products have several impurities like unused PCR salts, primer dimers and dNTP's, these impurities were removed to perform a Barcoding reaction. To remove these impurities sodium acetate purification method was used. Firstly, a master mix I of 10 µl Milli-Q and 2 µl of 125 mM EDTA per reaction was prepared and added to each reaction containing 10 µl of reaction. Contents were mixed well. Then master mix II of 2 µl of 3M

sodium acetate pH 4.6 and 50 µl of absolute ethanol per reaction was added. Contents were mixed well and incubated at room temperature for 15 minutes. After that, the whole reaction was span at a speed of 12000 g for 35 minutes at room temperature. The supernatant was discarded, and 70% ethanol was added to each reaction, which was later spanned at 200 rpm. Washing with 70% ethanol was done again. 12-15 µl of Hi-Di formamide was added to each sample. Now sample tubes were covered with septa and denatured at 95°C and snap chilled at 4°C. The amplicons were bi-directionally sequenced in an automated DNA Sequencer.

Sequence Analysis: The raw DNA sequences were edited using BioEdit sequence alignment editor version 7.0.5.2. BLASTN program was used to compare the sequences retrieved from the two chromatograms, and the fragment showing 100% alignment with no gap or indel (insertion/deletions) were selected. The selected fragments of the sequence aligned using ClustalX software. Finally, each of the sequences was compared in NCBI through BLASTN to examine the complete alignment with the partial coding sequence of fish mitochondrial COI gene. The sequences were translated using the online software ORF finder (<http://www.ncbi.nlm.nih.gov/gorf/gorf.html>) and aligned through BLASTP. In this way, the generated sequences were confirmed to be fragments of the mitochondrial COI gene. All Sequences from claimed specimens were submitted to the GenBank database with accession numbers (.....). Further, the identification of the specimen was mainly done using DNA barcode sequence by similarity match in the BOLD species identification system (BOLD-IDS, www.barcodinglife.org).



Exploration and Characterization of Fish Germplasm

Biodiversity is the quantity, variety and distribution across biological scales ranging through genetics and life forms of populations, species, communities, and ecosystems. Biodiversity affects the capacity of living systems to respond to the changes in the environment, underpins ecosystem function and provides the ecosystem goods and services that support human well-being as well as having intrinsic value, biodiversity has aesthetic value: many of us have admired the wonderful colours and shapes of fishes. Some benefits of biodiversity are not apparent today but may be unlocked in the future. Biodiversity also has cultural value when it is directly linked to the cultural fabric of human societies. In India, freshwater environments are experiencing serious threats to biodiversity, and there is an urgent priority for the search of alternative techniques to promote fish biodiversity conservation and management. With this aim, a study was undertaken to assess the fish biodiversity in Mahananda river. As such the outcome of exploratory survey is described below:

Exploration and Characterization of Germplasm: Exploratory surveys were conducted on Mahananda river and total fifty-seven fish species were recorded. A total of 57 species belonging to 9 orders, 23 families, 43 genera were recorded from 8 sampling stations (Table 4.1). The list of fish was collected with their local names, commercial values and categorized into highly ornamental

(ho), potential ornamental (po) or food fish (fo) species and relative abundance (Table 4.2). Among the orders, Cypriniformes exhibited the largest representation with 6 families, 21 genera and 30 species followed by Siluriformes with 6 families, 11 genera and 14 species. Anabantiformes with 4 family, 4 genera and 5 species. (Table 4.1). The percent share of different families and order was recorded in Mahananda is presented in Figs 4.1 & 4.2.

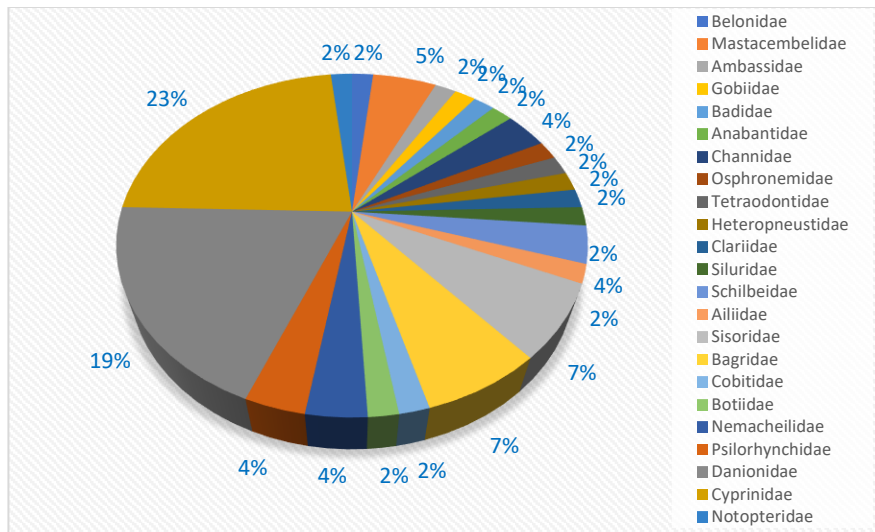


Fig 4.1: Family wise representation of fish

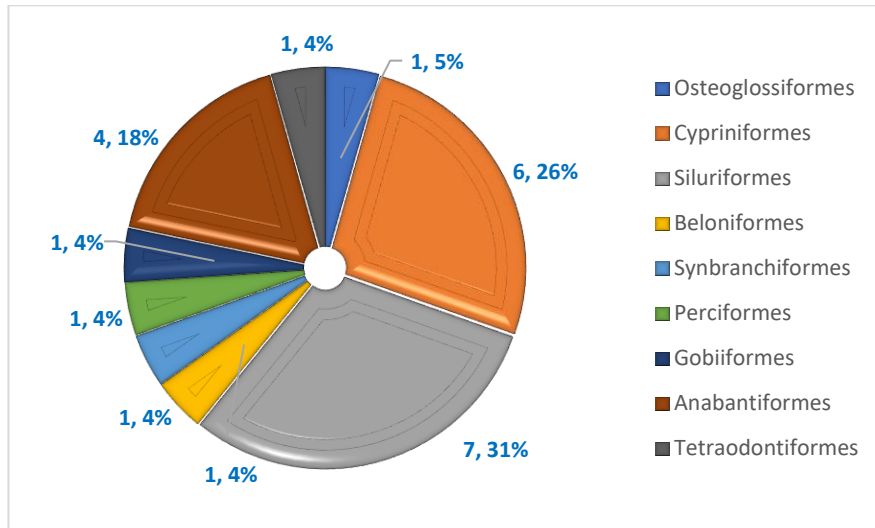


Fig.4.2: Oder wise representation of fishes

Fish Wealth of Mahananda River

Evaluation of Fish Germplasm for Commercial Utilization: While assessing the potential utilization of the collected fishes, it was realized that among 57 species, 24 species like *Chitala chitala*, *Salmostoma bacaila*, *Salmostoma phulo*, *Cabdio morar*, *Barilius barila*, *Esomus danrica*, *Danio rerio*, *Devario devario*, *Tariqilabeo latius*, *Acanthocobitis botia*, *Schistura zonata*, *Botia dario*, *Bagarius bagarius*, *Ailia coila*, *Eutropiichthys vacha*, *Eutropiichthys murius*, *Gagata sexualis*,

Table 4.1: Family and order wise representation of fish species diversity of Mahananda River

S.No	Species name	Family	Order
1	<i>Chitala chitala</i>	Notopteridae	Osteoglossiformes
2	<i>Salmostoma bacaila</i>	Danionidae	Cypriniformes
3	<i>Salmostoma phulo</i>		
4	<i>Cabdio morar</i>		
5	<i>Barilius barila</i>		
6	<i>Opsarius barna</i>		
7	<i>Opsarius bendelisis</i>		
8	<i>Raiamas bola</i>		
9	<i>Esomus danrica</i>		
10	<i>Danio rerio</i>		
11	<i>Devario devario</i>		
12	<i>Amblypharyngodon mola</i>		
13	<i>Osteobrama cotio</i>		
14	<i>Chagunius chagunio</i>		
15	<i>Puntius chola</i>		
16	<i>Puntius sophore</i>		
17	<i>Puntius terio</i>		
18	<i>Cirrhinus mrigala</i>		
19	<i>Cirrhinus reba</i>		
20	<i>Labeo bata</i>		
21	<i>Labeo calbasu</i>		
22	<i>Labeo goniis</i>		
23	<i>Labeo rohita</i>		
24	<i>Gymnostomus ariza</i>		
25	<i>Tariqilabeo latius</i>	Psilorhynchidae	
26	<i>Psilorhynchus nudithoracicus</i>		

Singh, Saini, Samanta & Verma

27	<i>Psilorhynchus sucatio</i>		
28	<i>Acanthocobitis botia</i>	Nemacheilidae	
29	<i>Schistura zonata</i>		
30	<i>Botia dario</i>	Botiidae	
31	<i>Canthophrys gongota</i>	Cobitidae	
32	<i>Sperata seenghala</i>	Bagridae	Siluriformes
33	<i>Mystus bleekeri</i>		
34	<i>Mystus cavasius</i>		
35	<i>Mystus tengra</i>		
36	<i>Bagarius bagarius</i>	Sisoridae	
37	<i>Gagata sexualis</i>		
38	<i>Erethistoides sicula</i>		
39	<i>Glyptothorax telchitta</i>		
40	<i>Ailia coila</i>	Ailiidae	
41	<i>Eutropiichthys murius</i>	Schilbeidae	
42	<i>Eutropiichthys vacha</i>		
43	<i>Wallago attu</i>	Siluridae	
44	<i>Clarias magur</i>	Clariidae	
45	<i>Heteropneustes fossilis</i>	Heteropneustidae	
46	<i>Xenentodon cancila</i>	Belonidae	Beloniformes
47	<i>Macrognathus aral</i>	Mastacembelidae	Synbranchiformes
48	<i>Mastacembelus armatus</i>		
49	<i>Macrognathus pancalus</i>		
50	<i>Parambassis lala</i>	Ambassidae	Perciformes
51	<i>Glossogobius giuris</i>	Gobiidae	Gobiiformes
52	<i>Badis badis</i>	Badidae	Anabantiformes
53	<i>Anabas testudineus</i>	Anabantidae	
54	<i>Channa punctata</i>	Channidae	
55	<i>Channa striata</i>		
56	<i>Trichogaster fasciata</i>	Osphronemidae	
57	<i>Leiodon cutcutia</i>	Tetraodontidae	Tetraodontiformes

Erethistoides sicula, *Glyptothorax telchitta*, *Parambassis lala*, *Glossogobius giuris*, *Badis badis*, *Trichogaster fasciata*, and *Leiodon cutcutia*, are of potential ornamental value (i.e. 42.11% were

Fish Wealth of Mahananda River

identified as 'Po'). Twenty three species like *Opsarius barna*, *Opsarius bendelisis*, *Raiamas bola*, *Amblypharyngodon mola*, *Osteobrama cotio*, *Chagunius chagunio*, *Puntius chola*, *Gymnostomus ariza*, *Psilorhynchus nudithoracicus*, *Psilorhynchus sucatio*, *Canthophrys gongota*, *Sperata seenghala*, *Mystus bleekeri*, *Mystus cavasius*, *Mystus tengra*, *Macrognathus aral*, *Mastacembelus armatus*, *Macrognathus pancalus*, *Anabas testudineus*, *Channa punctata* and *Channa striata*, are food and ornamental fishes and can be exploited for commercial purpose (i.e. 40.35% were identified as 'Fo'). Rest 10 Species (17.54 %) such as *Clarias magur*, *Xenentodon cancila*, *Heteropneustes fossilis*, *Wallago attu*, *Labeo bata*, *Labeo calbasu*, *Labeo gonius* & *Labeo rohita* are primarily used as food fish which can also additionally be explored for their ornamental qualities (Table 4.2).

Table 4.2: Fish Conservation status and commercial value Mahananda River

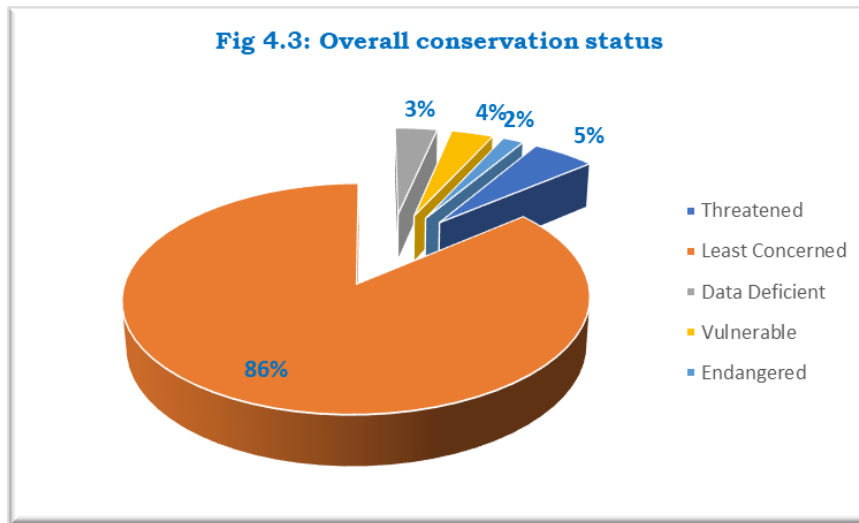
Species name	IUCN List Status	Red Status	Commercial Value
<i>Chitala chitala</i>	NT		Fo
<i>Salmostoma bacaila</i>	LC		Po
<i>Salmostoma phulo</i>	LC		Po
<i>Cabdio morar</i>	LC		Po
<i>Barilius barila</i>	LC		Po
<i>Opsarius barna</i>	LC		Fo
<i>Opsarius bendelisis</i>	LC		Fo
<i>Raiamas bola</i>	LC		Fo
<i>Esomus danrica</i>	LC		Po
<i>Danio rerio</i>	LC		Po
<i>Devario devario</i>	LC		Po
<i>Amblypharyngodon mola</i>	LC		Fo
<i>Osteobrama cotio</i>	LC		Fo
<i>Chagunius chagunio</i>	LC		Fo
<i>Puntius chola</i>	LC		Fo
<i>Puntius sophore</i>	LC		Fo
<i>Puntius derio</i>	LC		Po
<i>Cirrhinus mrigala</i>	LC		F
<i>Cirrhinus reba</i>	LC		F
<i>Labeo bata</i>	LC		F
<i>Labeo calbasu</i>	LC		F
<i>Labeo gonius</i>	LC		F
<i>Labeo rohita</i>	LC		F
<i>Gymnostomus ariza</i>	LC		Fo
<i>Tariqilabeo latius</i>	LC		Po

<i>Psilorhynchus nudithoracicus</i>	LC	Fo
<i>Psilorhynchus sucatio</i>	LC	Fo
<i>Acanthocobitis botia</i>	LC	Po
<i>Schistura zonata</i>	DD	Po
<i>Botia dario</i>	LC	Po
<i>Canthophrys gongota</i>	LC	Fo
<i>Sperata seenghala</i>	LC	Fo
<i>Mystus bleekeri</i>	LC	Fo
<i>Mystus cavasius</i>	LC	Fo
<i>Mystus tengra</i>	LC	Fo
<i>Bagarius bagarius</i>	VU	Po
<i>Ailia coila</i>	NT	Po
<i>Eutropiichthys murius</i>	LC	Po
<i>Eutropiichthys vacha</i>	LC	Po
<i>Wallago attu</i>	VU	F
<i>Gagata sexualis</i>	LC	Po
<i>Erethistoides sicula</i>	DD	Po
<i>Glyptothorax telchitta</i>	LC	Po
<i>Clarias magur</i>	EN	F
<i>Heteropneustes fossilis</i>	LC	F
<i>Xenentodon cancila</i>	LC	F
<i>Macragnathus aral</i>	LC	Fo
<i>Mastacembelus armatus</i>	LC	Fo
<i>Macragnathus pancalus</i>	LC	Fo
<i>Parambassis lala</i>	NT	Po
<i>Glossogobius giuris</i>	LC	Po
<i>Badis badis</i>	LC	Po
<i>Anabas testudineus</i>	LC	Fo
<i>Channa punctata</i>	LC	Fo
<i>Channa striata</i>	LC	Fo
<i>Trichogaster fasciata</i>	LC	Po
<i>Leiodon cutcutia</i>	LC	Po

LC- least concern, EN- endangere d,NT- Near threatened, VU- vulneable ,DD- data deficient, Fo-Food & Ornamental; Po- Potential ornamental; F-Food

Conservation Status of Fish: The data on conservation status for all the species collected from Mahananda river system was generated from “The IUCN Red List of Threatened Species” database. These data revealed that only three species (*Chitala chitala*, *Parambassis lala* and *Ailia coila*) were under ‘Near threatened’ (NT) category. One species *Clarias magur* was recorded as endangered. Whereas, two spices each were noticed as vulnerable (*Bagarius bagarius* & *Wallago attu*) and data deficient (*Erethistoides sicula* &

Fish Wealth of Mahananda River



Schistura zonata). Forty-nine species were accounted under 'Least Concern' category (Table 4.2 and Fig. 4.3). The least concern status of 49 species indicated a better environment and less exploitation for these species. Irrespective of all the results achieved, it can undoubtedly be surmised that the species under threat, endangered and vulnerable need adequate attention towards conservation of the individual species as well as their natural habitat with a holistic approach.



Fish Fauna of Mahananda River

From the early classical period of Linnaeus, Lamarck and Darwin, species was the taxonomic unit of fishery resources. This concept still remains as the concern stone of scientific research in various aspects of fish biology. According to Darwin's theory of the origin of species and modern theories of evolution, the species cannot remain as a constant entity. In the course of time, each species may undergo micro-evolutionary process leading to further speciation. The order of such speciation generally based on reproductive and geographic isolation and transformation of its populations into different sub-populations or stocks and later into new species. The "stocks" are said to be the natural units of a species. A stock is defined as a panmictic population of related individuals within a single species that is genetically distinct from other such populations.

The knowledge of fish diversity of the particular region is essential for rational management of ichthyo-fauna for the adoption of conservation strategies. Although many workers have studied ichthyo-fauna of lotic and lentic waters, however much is not known about the status of fish diversity of Mahananda river system. Therefore, considering a study was conducted to investigate the fish fauna of this river system. The outcome of this study will help in generation of the baseline data on the availability of fish fauna for better management of natural wealth. Considering this, the exploratory survey was conducted during 2020-2022. As such the fish samples collected from eight different sampling sites of Mahananda river were identified using standard keys. To validate the fish species identified following classical taxonomic techniques were further confirmed by using molecular taxonomic tools (DNA barcoding). The fish fauna identified using classical and molecular tools from Mahananda river system is presented in preceding pages.

***Chitala chitala* (Hamilton, 1822)**



Scientific name: *Chitala chitala* (Hamilton, 1822)

Common name: Clown knifefish

Local name: Mohi, Chital

Date of collection: 10-11-2020

Locality Name: Near Salmari

District: Katihar

State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1308

Taxonomic Classification

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Osteoglossiformes

Family: Notopteridae

Genus: *Chitala*

Species: *chitala*

IUCN Red List Status: Near Threatened (NT)

Distribution: India

Habitat: Rivers, lakes, beels, nullahs in the plains, reservoirs, canals and ponds.

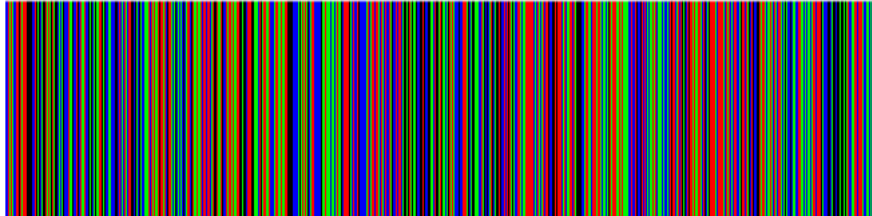
Salient/Diagnostic Features

Dorsal spines (total): 0; Dorsal soft rays (total): 9; Anal spines: 0; Anal soft rays: 117 - 127. The only species in which subadults and adults have a series of transverse gold or silver bars on the dorsum, but this color feature is not always present. Feed on aquatic insects, mollusks, shrimps, and small fishes. Females lay

Singh, Saini, Samanta & Verma

eggs usually on stake or stump of wood, males fan them with tail, keep them aerated and silt-free, guard them against small catfish and other predators. Spawn once a year during May to August.

DNA Barcode



GenBank Accession Number: OR232711

***Salmostoma bacaila* (Hamilton, 1822)**



Scientific name: *Salmostoma bacaila* (Hamilton, 1822)

Common name: Large razorbelly minnow

Local name: Chela

Date of collection: 28-05-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1047

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Danionidae

Fish Wealth of Mahananda River

Genus: *Salmostoma*

Species: *bacaila*

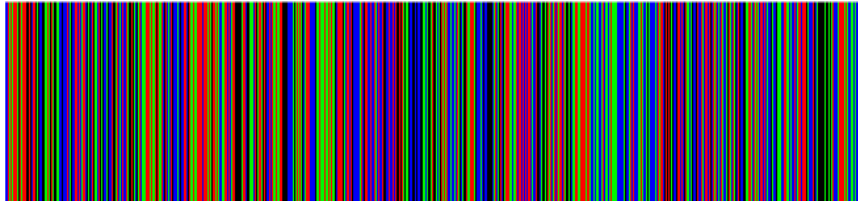
IUCN Red List Status: Least Concern (LC)

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

Habit and Habitat: Occurs in the lower reaches of rivers, ponds, beels, and inundated fields.

Salient /Diagnostic Features: The body is elongate and strongly compressed; mouth is oblique, lower jaw with a well-developed symphyseal knob; scales are very small, dorsal fin inserted well in advance anal fin; a considerable space present between anal and caudal. Lateral line is concave. Body colour is dorsally darkish but the rest of the body silvery. The fin formula is dorsal D. 10(2/8); pelvic P1. 12-13; pectoral P2. 9; anal A. 14-15(2/12-13).

DNA Barcode



GenBank Accession Number: **OR232712**

Salmostoma phulo (Hamilton, 1822)



Scientific name: *Salmostoma phulo* (Hamilton, 1822)

Common name: Finesacle razorbelly minnow

Local name: Chela

Date of collection: 28-05-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1045

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Danionidae
Genus: *Salmostoma*
Species: *phulo*

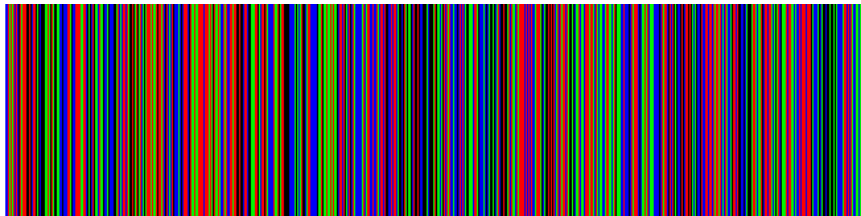
IUCN Red List Status: Least Concern (LC)

Distribution: India and Bangladesh

Habit and Habitat: Occurs in the lower reaches of rivers, ponds, beels, ditches and canals.

Salient /Diagnostic Features: Mouth oblique to body axis, cleft reaching anterior margin of orbit of slightly ahead. Lower jaw longer, with a knob at the junction (=symphysis) of the two bones. Lateral line complete with 99-112 scales, anal fin with 17-19 branched rays. Gill rakers, 13-16.

DNA Barcode



GenBank Accession Number: **OR232713**

***Cabdio morar* (Hamilton, 1822)**



Scientific name: ***Cabdio morar* (Hamilton, 1822)**

Fish Wealth of Mahananda River

Common name: Carplet

Local name: Morari

Date of collection: 29-07-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1144

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Danionidae

Genus: *Cabdio*

Species: *morar*

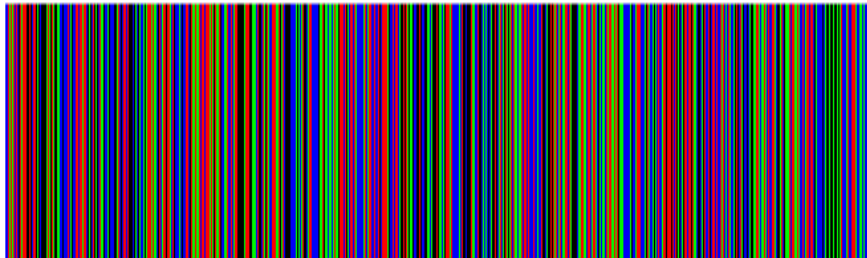
IUCN Red List Status: Least Concern (LC)

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

Habit and Habitat: Found in streams and ponds in plains and mountainous regions.

Salient/Diagnostic Features: Body subcylindrical; mouth inferior, jaws short, pharyngeal teeth in three rows, barbels absent; scales deciduous, lateral line slightly curved. Body yellowish silvery with a burnished lateral band. D. 2/7, P. 1/12-13, V. 1/7-8, A. 3/9, C. 19 (10/9). L 1. 36-38.

DNA Barcode



GenBank Accession Number: **OR232722**

***Barilius barila* (Hamilton, 1822)**



Scientific name: *Barilius barila* (Hamilton, 1822)

Common name: Barred baril

Local name: Dhawai/Barali

Date of collection: 28-05-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1052

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Danionidae

Genus: *Barilius*

Species: *barila*

IUCN Red List Status: Least Concern (LC)

Distribution: India, Nepal, Bangladesh and Myanmar.

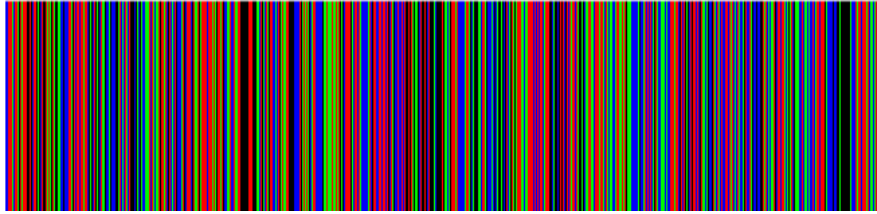
Habit and Habitat: Hill streams and shallow clear rivers along foothills

Salient /Diagnostic Features: Body shallow and slender, mouth moderate barbells two pairs (rostral and maxillary), dorsal fin almost entirely advance in anal fin, pectoral nearly as long as head, lower lobe of caudal longer. Scales moderate with many radii and lateral line complete with 43-46 scales. Characteristic muscular pad present in front bases of pectoral. Body colored by vertical blue band

Fish Wealth of Mahananda River

with pinkish fins and dark olivaceous back. D. 9 (2/7); P1. 13; P2. 9; A. 13-14(3/10-11)

DNA Barcode



GenBank Accession Number: **OR232727**

***Opsarius barna* (Hamilton, 1822)**



Scientific name: *Opsarius barna* (Hamilton, 1822)

Common name: Barna baril

Local name: Dudhnea/Boroli

Date of collection: 30-07-2020

Locality Name: Near Dhalkhola Bridge,

District: Purnea

State: Bihar (India)

GPS Coordinates: 25°51'33.8"N 87°48'17.7"E

Registration No.: COF/1216

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Danionidae

Genus: *Opsarius*

Species: *barna*

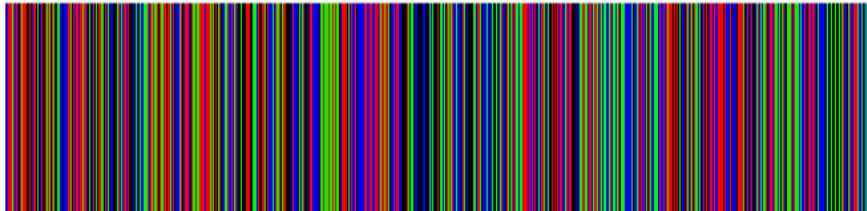
IUCN Red List Status: Least Concern (LC)

Distribution: India, Nepal, Bangladesh and Myanmar.

Habit and Habitat: Found in clear hill streams with gravelly bottom.

Salient /Diagnostic Features: 16 predorsal scales; lateral line complete with 40-42 scales; barbels absent; 10-13 anal-fin rays; body with 9-11 dark blue vertical bars; last dorsal-fin ray extending to caudal-fin base. Adult females are less-brightly-coloured, tend to grow a little larger and are thicker-bodied than males, especially when gravid.

DNA Barcode



GenBank Accession Number: **OR232732**

***Opsarius bendelisis* (Hamilton, 1807)**



Scientific name: *Opsarius bendelisis* (Hamilton, 1807)

Common name: Barna baril

Local name: Boroli/Bhareli

Date of collection: 30-07-2020

Locality Name: Near Dhalkhola Bridge,
District: Purnea, State: Bihar
Country: India

GPS Coordinates: 25°51'33.8"N 87°48'17.7"E

Registration No.: COF/1214

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Fish Wealth of Mahananda River

Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Danionidae
Genus: *Opsarius*
Species: *bendelisis*

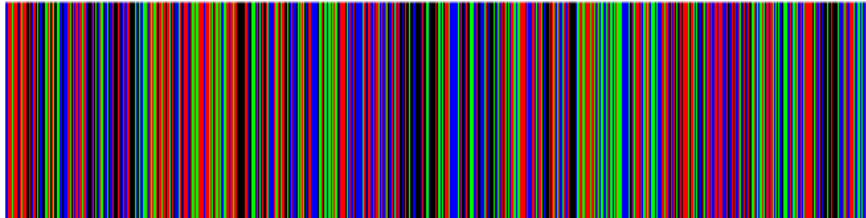
IUCN Red List Status: Least Concern (LC)

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

Habit and Habitat: In streams and rivers along the base of hills with pebbly and rocky bottom.

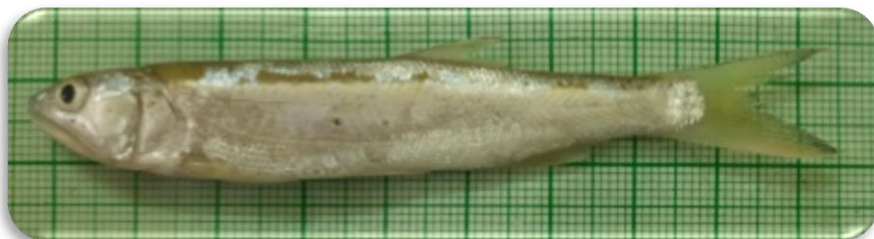
Salient/Diagnostic Features: Body type is elongated and compacted. The ventral shape is more convex than that of the dorsal. Black dots are present at the base of all scales with double spots on the lateral line. Fins are whitish tinged with colorful orange. The boundary of dorsal and caudal fins is grayish. The fins are yellow-tinted with black edges. Observed fin structure noted as Dorsal rays ii, 7; anal rays ii-iii, 8-9; pectoral rays i, 11-12; pelvic rays i, 8 and caudal rays 18. Lateral line scale counts noted with a total of 40-43 scales.

DNA Barcode:



GenBank Accession Number: **OR232735**

***Raiamas bola* (Hamilton, 1822)**



Scientific name: *Raiamas bola* (Hamilton, 1822)

Common name: Indian trout

Local name: Bhol

Date of collection: 17-10-2020

Locality Name: Near Jalalgaach

District: Kishanganj

State: Bihar (India)

GPS Coordinates: 26°24'59.8"N 88°11'38.9"E

Registration No.: COF/1270

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Danionidae

Genus: *Raiamas*

Species: *bola*

IUCN Red List Status: Least Concern (LC)

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

Habit and Habitat: Hill streams and rivers of foothills.

Salient/Diagnostic Features: Elongated, slender body which is laterally compressed with a sharp snout. The juvenile fish possess a pair of rudimentary maxillary barbels, but these are absent in the adults. It has very small scales and has 85-95 scales along its lateral line. The dorsal part of the body is greenish black, separated from the silvery flanks by a golden stripe running along the length of the body.

DNA Barcode



GenBank Accession Number: **OR232739**

***Esomus danrica* (Hamilton, 1822)**



Scientific name: *Esomus danrica* (Hamilton, 1822)

Common name: Flying barb

Local name: Denda

Date of collection: 29-07-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1157

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Danionidae
Genus: *Esomus*
Species: *danrica*

IUCN Red List Status: Least Concern (LC)

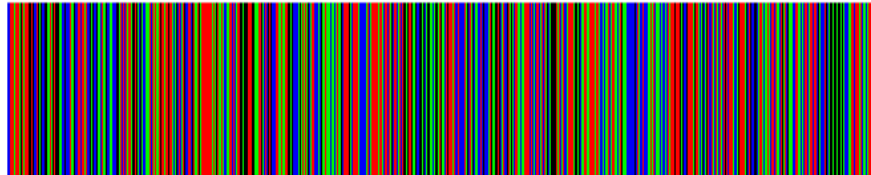
Distribution: India, Pakistan, Nepal, Bangladesh, Afghanistan, Sri Lanka and Myanmar.

Habitat: Rivers, ponds, weedy ditches, and irrigation canals.

Salient/Diagnostic Features: There are 16 to 17 predorsal scales. The lateral line pierces from 4 to 6 scales only anteriorly. There are 27 to 30 scales in a longitudinal series and these are arranged on the body in 6 transverse rows. The pectoral reaches the base of the ventral, which extends to the base of the anal. The outer rays of the paired fins usually extend for a considerable distance beyond the

fin membrane, but their length varies considerably. The minimum height of the caudal peduncle is contained from 1.2 to 2 times in its length. There are 14 scales round the caudal peduncle. There is a broad lateral band of a black colour extending from behind the eye to the base of the caudal fin.

DNA Barcode



GenBank Accession Number: OR232740

***Devario devario* (Hamilton, 1822)**



Scientific name: *Devario devario* (Hamilton, 1822)

Common name: Sind danio

Local name: Patukari/Debori

Date of collection: 29-07-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1167

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Danionidae

Fish Wealth of Mahananda River

Genus: *Devario*

Species: *devario*

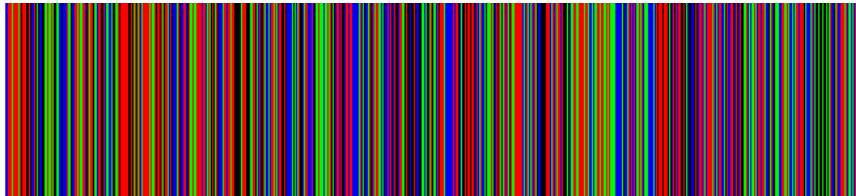
IUCN Red List Status: Least Concern (LC)

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

Habitat: Rivers, canals, ponds, beels and inundated fields

Salient /Diagnostic Features: Body rhomboidal and compressed. Ventral profile more convex than that of dorsal. Longer lower jaw with a symphyseal prominence and upper with a notch. Mouth small, obliquely directed upwards with no barbells. Dorsal fin inserted slightly to anal fin and caudal fin emarginated to lunate. Lateral line complete with 34-38 moderate sized scales.

DNA Barcode



GenBank Accession Number: **OR232742**

***Amblypharyngodon mola* (Hamilton, 1822)**



Scientific name: ***Amblypharyngodon mola* (Hamilton, 1822)**

Common name: Mola Carplet

Local name: Maurala/Dhawai

Date of collection: 30-07-2020

Locality Name: Near Dhalkhola Bridge,

District: Purnea

State: Bihar (India)

GPS Coordinates: 25°51'33.8"N 87°48'17.7"E

Registration No.: COF/1229

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Danionidae
Genus: *Devario*
Species: *devario*

IUCN Red List Status: Least Concern (LC)

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

Habitat: Ponds, canals, beels, slow-moving streams, nullahs and paddy fields.

Salient /Diagnostic Features: Body laterally compressed and dorsal profile is more convex than that of ventral. No barbels. Caudal fin deeply forked and lobes are pointed. Dark markings present in dorsal and anal fins. Body color light greenish on back and silvery at sides and beneath. Lateral line present and complete with about 60-75 scales. A conspicuous silvery lateral band running from gill cover to base of caudal fin. Fin formula: D. 9 (2/7); P1. 15; P2. 9; A. 7 (2/5).

DNA Barcode



GenBank Accession Number: **OR232743**

***Osteobrama cotio* (Hamilton, 1822)**



Fish Wealth of Mahananda River

Scientific name: *Osteobrama cotio* (Hamilton, 1822)

Common name: Cotio

Local name: Chela/Gurda

Date of collection: 29-05-2020

Locality Name: Near Dhalkhola Bridge,

District: Purnea

State: Bihar (India)

GPS Coordinates: 25°51'33.8"N 87°48'17.7"E

Registration No.: COF/1129

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Cyprinidae

Genus: *Osteobrama*

Species: *cotio*

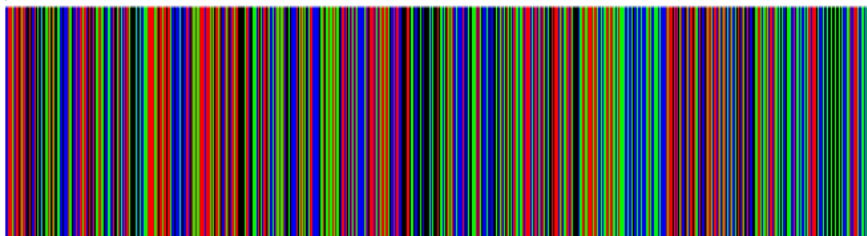
IUCN Red List Status: Least Concern (LC)

Distribution: India, Pakistan, Nepal and Bangladesh.

Habitat: Rivers, lakes, ponds, beels and ditches.

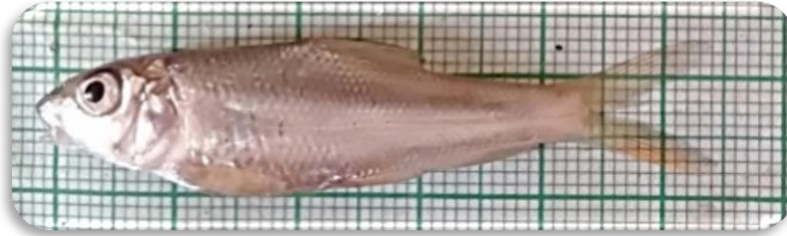
Salient /Diagnostic Features: Body deeply compressed. Dorsal and ventral profile almost equally convex. Mouth small and terminal with no barbels. Upper jaw slightly longer than lower jaw. Gill opening wide. Body silvery with dark on back. Fins are light greenish colored. Lateral line present and complete. Head 35.7% SL and 27.8% TL. Height 42.9% SL and 33.3% TL. Eye 24% HL. Fin formula: D. 10 (2/8); P1. 15; P2; 9-10; A. 33-36 (3/30-33).

DNA Barcode



GenBank Accession Number: **OR232744**

***Chagunius chagunio* (Hamilton, 1822)**



Scientific name: *Chagunius chagunio* (Hamilton, 1822)

Common name: Chaguni

Local name: Jarua

Date of collection: 29-05-2020

Locality Name: Near Dhalkhola Bridge,
District: Purnea, State: Bihar
Country: India

GPS Coordinates: 25°51'33.8"N 87°48'17.7"E

Registration No.: COF/1143

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Cyprinidae

Genus: *Chagunius*

Species: *chagunio*

IUCN Red List Status: Least Concern (LC)

Distribution: India, Nepal and Bangladesh.

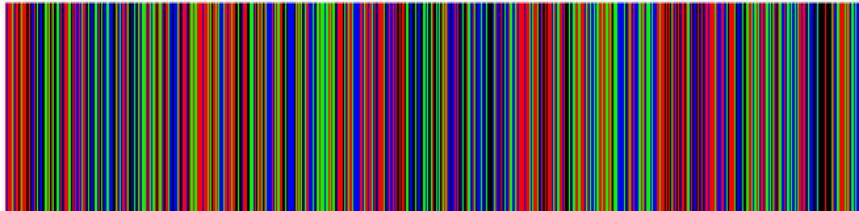
Habitat: Large rivers with rocky bottoms, clear and fast water and little or no vegetation.

Salient /Diagnostic Features: Body elongated, head compressed with flat sides. Mouth narrow and subterminal, snout overhanging, two pairs of barbels longer than orbit. Eyes situated high up on head. Scales small, lateral line complete with 44-47 scales. Body silvery with pinkish tinge, fins reddish with light outer edges, dorsal fin apex black. Pelvics and anal tinged with red. Head 3.4-3.6 in standard, 4.4-4.7 in total length. Height 3.2-3.7 in standard, 4.2-

Fish Wealth of Mahananda River

4.8 in total length. Eye 40-5.6 in head, snout 1.6-2.4, interorbital 1.3-2.0. Fin formula D. 11(3/8); P1. 15; P2. 9; A. 8 (3/5).

DNA Barcode



GenBank Accession Number: OR232746

***Puntius chola* (Hamilton, 1822)**



Scientific name: *Puntius chola* (Hamilton, 1822)

Common name: Swamp Barb

Local name: Siddhari/Chal punti

Date of collection: 18-10-2020

Locality Name: Near Salmari,
District: Katihar
State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1300

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei

Order: Cypriniformes

Family: Cyprinidae

Genus: *Puntius*

Species: *chola*

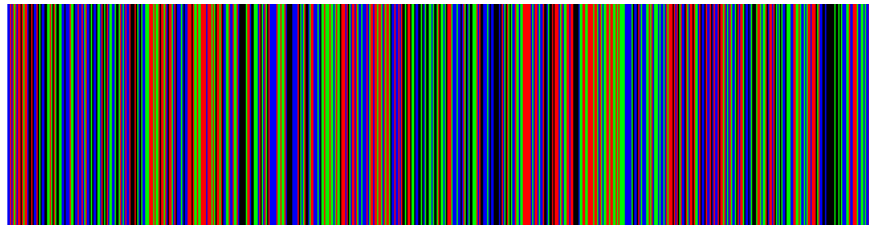
IUCN Red List Status: Least Concern (LC)

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

Habitat: Inhabits streams, rivers, canals, beels, haors, ponds and inundated fields.

Salient /Diagnostic Features: Deep and compressed body with less convex of its lower profile than upper. Terminal small mouth contain a pair of maxillary barbels. Dorsal fin inserted equidistant between snout and base of caudal. The last unbranched ray of dorsal fin is osseous, fairly strong and smooth. Pectoral as long as head excluding snout. 24-28 scales on lateral line. Body silvery with golden opercle. A dark blotch on the base of caudal fin (on 24-26 scales on lateral line). A black blotch present at 2nd to 5th ray of dorsal. Fin formula: D iii 8; A ii 5; P i 14; V i 8.

DNA Barcode



GenBank Accession Number: **OR232747**

***Puntius sophore* (Hamilton, 1822)**



Scientific name: *Puntius sophore* (Hamilton, 1822)

Common name: Pool Barb

Local name: Puti

Date of collection: 29-07-2020

Fish Wealth of Mahananda River

Locality Name: Near Tayabpur Bridge

District: Kishanganj

State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1176

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Cyprinidae

Genus: *Puntius*

Species: *sophore*

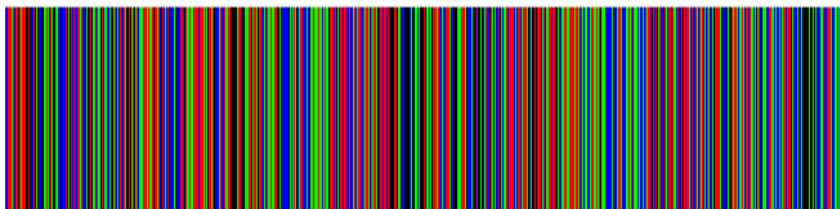
IUCN Red List Status: Least Concern (LC)

Distribution: India, Pakistan, Nepal, Bangladesh, Myanmar and Yunnan, China, Bhutan and Afghanistan

Habitat: Rivers, streams and ponds in plains and submontane regions, floodplains, large river with high turbid monsoon flow and with diverse substrate consisting of sand, mud, gravel, pebble, cobble, and boulders.

Salient /Diagnostic Features: A dark spot is present at tip of tail and another at base of dorsal fin rays. Body is moderately compressed. Dorsal profile is more convex than that of abdomen. Mouth is small, terminal and upper jaw is slightly longer. Barbells are absent. Pectoral fin is as long as head excluding snout. Pelvic originate a little behind the origin of dorsal. Lateral line is complete. In life body colour is silvery, back grey green to brownish, flanks with a bluish luster, underside white. Fin formula: D. 3-4/8-9, P1. 1/14-17, P2. 1/7-8, A. 2-3/7-8. Scales number above the lateral line is 8 to 10. 22-27 scales on the lateral line series.

DNA Barcode



GenBank Accession Number: **OR232751**

***Puntius terio* (Hamilton, 1822)**



Scientific name: *Puntius terio* (Hamilton, 1822)

Common name: One Spot Barb

Local name: Sehra Pothia

Date of collection: 28-05-2020

Locality Name: Near Pothia Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°21'02.3"N, 88°09'41.7"E

Registration No.: COF/1009

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Cyprinidae
Genus: *Puntius*
Species: *terio*

IUCN Red List Status: Least Concern (LC)

Distribution: Pakistan, India, Bangladesh and Myanmar.

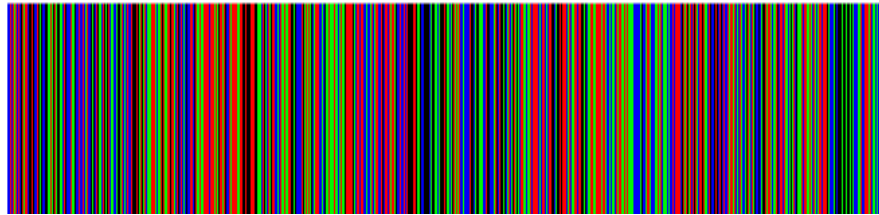
Habitat: Rivers, canals, ponds, ditches and inundated fields, standing waters over silt and mud.

Salient /Diagnostic Features: Body elongate, deep and laterally compressed. No barbels. Lateral line incomplete. 22-23 scales in longitudinal series. Body color metallic green above and whitish below with a fairly weak reddish or violet lustre. Green-silvery on flanks. A large round black blotch with golden margin over anal fin.

Fish Wealth of Mahananda River

Fins are hyaline or yellowish. Dorsal fin often with numerous dark spots and streaks and often united into a longitudinal band. Fin formula: D iii 8; A ii 5; P i 14; V i 8. A distinct large round golden edged black blotch present over anal fin. The male becomes a beautiful orange at mating time.

DNA Barcode



GenBank Accession Number: OR232759

***Cirrhinus mrigala* (Hamilton, 1822)**



Scientific name: *Cirrhinus mrigala* (Hamilton, 1822)

Common name: Mrigal Carp

Local name: Nainee/Mrigal

Date of collection: 17-07-2021

Locality Name: Near Bahadurganj Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°08'37.1"N 87°54'23.2"E

Registration No.: COF/1327

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Cyprinidae

Genus: *Cirrhinus*

Species: *mrigala*

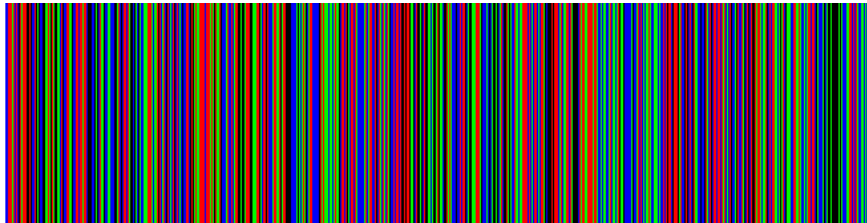
IUCN Red List Status: Least Concern (LC)

Distribution: Pakistan, India, Nepal and Bangladesh.

Habitat: Rivers, canals, ponds, ditches and inundated fields, standing waters over silt and mud.

Salient /Diagnostic Features: Body slender and in live, bright silvery white, dorsally brownish gray. Mouth sub-inferior, upper lip entire and lower lip indistinct. Dorsal fin inserted ahead of pelvic-fin origin, with 3 simples and 12–13 branched rays. Scales rounded. Transverse scale rows above lateral line with 7–8, lateral line scales 40–45.

DNA Barcode



GenBank Accession Number: **OR232761**

***Cirrhinus reba* (Hamilton, 1822)**



Scientific name: *Cirrhinus reba* (Hamilton, 1822)

Common name: Reba Carp

Local name: Kholiana

Date of collection: 18-10-2020

Locality Name: Near Salmari,
District: Katiharj
State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1284

Taxonomic Classification:

Fish Wealth of Mahananda River

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Cyprinidae
Genus: *Cirrhinus*
Species: *reba*

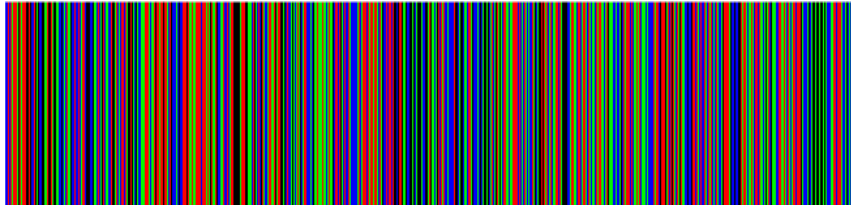
IUCN Red List Status: Least Concern (LC)

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

Habitat: Large streams and rivers. Also found in canals, ponds, beels and inundated fields.

Salient /Diagnostic Features: Body elongated, depth greater than head length. Mouth broad, upper lip entire, lower jaw with a thin cartilaginous cover. A pair of short rostral barbels present. In live, dark gray dorsally and silvery below, flank with 6–7 bluish horizontal bands. Scale size moderate and hexagonal in shape, lateral line scales 34–38, transverse scale rows 7/5–6. Fin rays counts dorsal ii–iii.8, anal iii.5, pectoral i.15, and pelvic i.8.

DNA Barcode



GenBank Accession Number: **OR232762**

***Labeo bata* (Hamilton, 1822)**



Scientific name: ***Labeo bata* (Hamilton, 1822)**

Common name: Bata labeo

Local name: Bata

Date of collection: 18-10-2020

Locality Name: Near Salmari,
District: Katiharj
State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1305

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Cyprinidae

Genus: *Labeo*

Species: *bata*

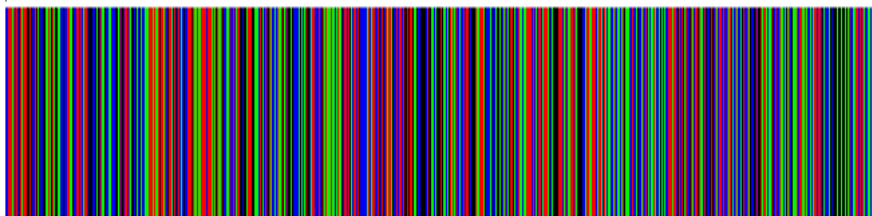
IUCN Red List Status: Least Concern (LC)

Distribution: India, Bangladesh and Pakistan

Habitat: Rivers and rivulets.

Salient /Diagnostic Features: Dorsal profile is more convex than that of abdomen. Snout bluntly pointed. Body elongated. Snout slightly projecting beyond mouth of ten studded with pores. A pair of small maxillary barbells is hidden inside the labial fold. No cartilaginous support to lips. Dorsal originates midway between snout tip and anterior base of anal. Pelvics originate slightly nearer to snout tip than to caudal base. Bluish or darkish on upper half, silvery below, opercle light orange. Fin formula: D. 2-4/9-10, P1.1/15-17, P2. 1/8. A. 2-3 and lateral line scales 37-40.

DNA Barcode



GenBank Accession Number: **OR232765**

***Labeo calbasu* (Hamilton, 1822)**



Scientific name: *Labeo calbasu* (Hamilton, 1822)

Common name: Orange fin labeo

Local name: Karaochhi/Kalbasu

Date of collection: 18-10-2020

Locality Name: Near Salmari,
District: Katiharj
State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1283

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Cyprinidae

Genus: *Labeo*

Species: *calbasu*

IUCN Red List Status: Least Concern (LC)

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

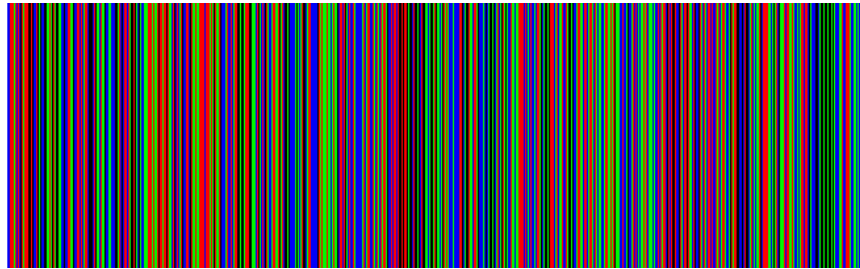
Habitat: River, sluggish streams and creeks

Salient /Diagnostic Features: Dorsal profile is more convex than of abdomen. Lips thick and fringed, 2 pairs of barbells, rostral pair longer than maxillary pair. No pores on snout. Eye situated a bit

Singh, Saini, Samanta & Verma

anterior from the half of the head. Caudal peduncle is short and scales moderate in size. There are 20 rows of scales before dorsal fin and 22 rows round the caudal peduncle. Mouth is moderately wide and inferior. Gill openings wide and gill rakers are villiform, short and feeble. Colour dark-black but the ventral part is light. Fin formula: D. 17-18 (3/14-15); P1. 16-18; P2. 9 (1/8); A. 7(2/5) and lateral line scales 40-44.

DNA Barcode



GenBank Accession Number: OR232766

***Labeo gonius* (Hamilton, 1822)**



Scientific name: *Labeo gonius* (Hamilton, 1822)

Common name: Kuria labeo

Local name: Kursa

Date of collection: 10-11-2020

Locality Name: Near Salmari,
District: Katihar
State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1309

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Fish Wealth of Mahananda River

Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Cyprinidae
Genus: *Labeo*
Species: *gonius*

IUCN Red List Status: Least Concern (LC)

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

Habitat: Rivers and freshwater streams.

Salient /Diagnostic Features: Mouth sub-inferior and narrow, lips thick and fringed; one pair each of maxillary and rostral barbel, maxillary shorter than rostral; post-labial groove uninterrupted; dorsal fin with 2 simple and 16–18 branched rays, scales small, 65–80 lateral line scales, 44–57 preanal scales, and transverse scale rows 9/1/13. Fin Formula: B. iii, D. 16, P. 16, V. 8, A. 7, C. 18.

DNA Barcode



GenBank Accession Number: **OR232768**

***Labeo rohita* (Hamilton, 1822)**



Scientific name: *Labeo rohita* (Hamilton, 1822)

Common name: Rohu labeo

Local name: Rohu

Date of collection: 17-07-2021

Locality Name: Near Bahadurganj Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°08'37.1"N 87°54'23.2"E

Registration No.: COF/1328

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Cyprinidae
Genus: *Labeo*
Species: *rohita*

IUCN Red List Status: Least Concern (LC)

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

Habitat: Rivers, freshwater streams, lakes, channels, ponds and reservoirs.

Salient /Diagnostic Features: Snout without lateral lobe; lips thick and fringed with a distinct inner fold, isthmus rounded, dorsal fin with 13–14 branched rays, 12–16 predorsal scales, and lateral line complete with 40–42 pored scales. In live, bluish to brownish along the back, silvery with tinged red along flank and belly whitish. In most of the specimens, the fins are blackish.

DNA Barcode



GenBank Accession Number: **OR232770**

***Gymnostomus ariza* (Hamilton, 1807)**



Scientific name: *Gymnostomus ariza* (Hamilton, 1807)

Common name: Ariza labeo

Local name: Reba/Bata

Date of collection: 18-10-2020

Locality Name: Near Salmari,
District: Katihar
State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1303

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Cyprinidae
Genus: *Gymnostomus*
Species: *ariza*

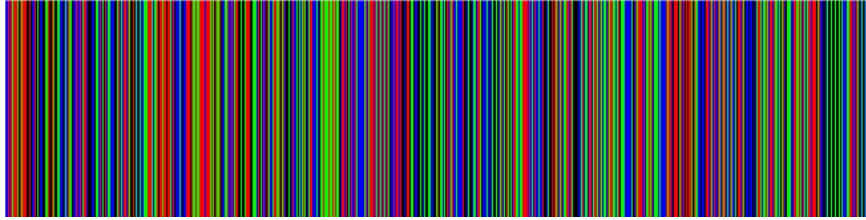
IUCN Red List Status: Least Concern (LC)

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

Habitat: Rivers, ponds, beels and inundated fields.

Salient /Diagnostic Features: Body with variably intense thin stripes distributed mostly above the lateral line; larger individuals sometimes with a broad mid-lateral stripe; 32-35 lateral scales; 7-8/1/5-6 transverse scale rows; 8-9 branched dorsal-fin rays 8-9; 22-24+ 11-12=34(4), 35 (3) vertebrae. Live colour pattern variable, overall dull dirty white to greyish, silvery or yellow.

DNA Barcode:



GenBank Accession Number: OR232771

***Tariqilabeo latius* (Hamilton, 1822)**



Scientific name: *Tariqilabeo latius* (Hamilton, 1822)

Common name: Gangatic latia/Stone roller

Local name: Kalabata

Date of collection: 29-07-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1156

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Cyprinidae

Genus: *Tariqilabeo*

Species: *latius*

Fish Wealth of Mahananda River

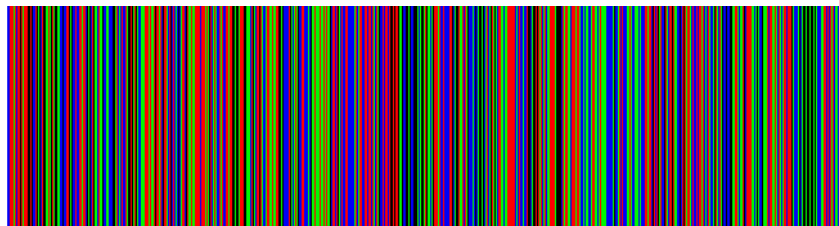
IUCN Red List Status: Least Concern (LC)

Distribution: India, Bangladesh, Myanmar and China.

Habitat: Rivers, freshwater streams, lakes, channels, ponds and reservoirs.

Salient /Diagnostic Features: Snout without lateral lobe; lips thick and fringed with a distinct inner fold, isthmus rounded, dorsal fin with 13–14 branched rays, 12–16 predorsal scales, and lateral line complete with 40–42 pored scales. In live, bluish to brownish along the back, silvery with tinged red along flank and belly whitish. In most of the specimens, the fins are blackish.

DNA Barcode



GenBank Accession Number: **OR232773**



Psilorhynchus nudithoracicus

Scientific name: *Psilorhynchus nudithoracicus*
(Tilak & Husain, 1980)

Common name: Rainbow minnow

Local name: Titari

Date of collection: 29-05-2020

Locality Name: Near Dhalkola Bridge,
District: Purnea
State: Bihar (India)

GPS Coordinates: 25°51'33.8"N 87°48'17.7"E

Registration No.: COF/1128

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Psilorhynchidae
Genus: *Psilorhynchus*
Species: *nudithoracicus*

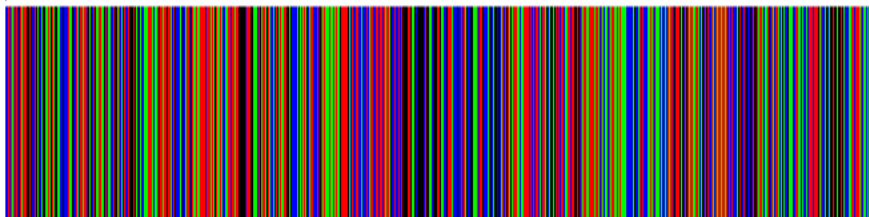
IUCN Red List Status: Least Concern (LC)

Distribution: India, Bangladesh and Nepal.

Habit and Habitat: Occurs over small pebbles in shallow running waters where the bottom is mainly sand. Also found in a slow-moving stream with a sandy bed.

Salient /Diagnostic Features: A well-developed lateral stripe, 6-7 poorly developed saddles that do not make contact with the lateral blotches, 7-11 lateral blotches, 34-35 lateral line scales, 9+8-9 principal caudal-fin rays, 36 total vertebrae, and the ventral surface between paired fins with a broad rectangular scaleless patch.

DNA Barcode



GenBank Accession Number: **OR232776**

***Psilorhynchus sucatio* (Tilak & Husain, 1980)**



Scientific name: *Psilorhynchus sucatio* (Tilak & Husain, 1980)

Common name: River stone carp

Local name: Titari

Date of collection: 17-10-2020

Fish Wealth of Mahananda River

Locality Name: Near Jalalgaach

District: Kishanganj

State: Bihar (India)

GPS Coordinates: 26°24'59.8"N 88°11'38.9"E

Registration No.: COF/1279

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Psilorhynchidae

Genus: *Psilorhynchus*

Species: *sucatio*

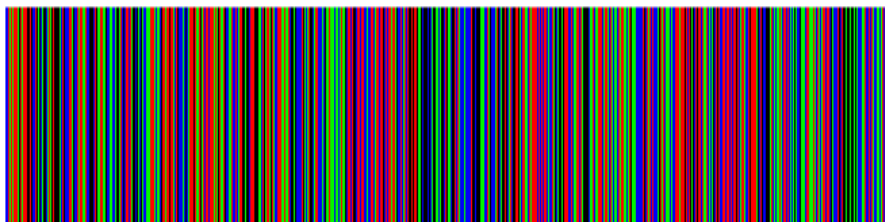
IUCN Red List Status: Least Concern (LC)

Distribution: India, Bangladesh and Nepal.

Habit and Habitat: Occurs mainly in the edges of sandy streams. Common near emergent or overhanging vegetation Prefers pools and run areas of mountain streams.

Salient /Diagnostic Features: Presence of anteriorly directed radii over the anterior field of body scales, by its small pectoral fins, pectoral-fin length equal to pelvic-fin length, presence of rostral cap separates from the upper lip around the corner of the mouth, absence of a post-epiphyseal fontanelle. Fin formula: Dorsal-fin rays ii. 8. Anal-fin rays ii-iii. 5-6(3); caudal-fin rays 8-10 + 8-9; dorsal procurrent rays 3-5, ventral procurrent rays 3-5; pectoral fin rays iv-v. 7-9; pelvic-fin rays ii. 6-7. Lateral line scale 33-36.

DNA Barcode



GenBank Accession Number: **OR232777**

***Acanthocobitis botia* (Hamilton, 1822)**



Scientific name: *Acanthocobitis botia* (Hamilton, 1822)

Common name: Mottled loach

Local name: Chitkabri Baghi

Date of collection: 28-05-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1051

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Nemacheilidae

Genus: *Acanthocobitis*

Species: *botia*

IUCN Red List Status: Least Concern (LC)

Distribution: Indus basin in Pakistan to the Mae Khlong basin in Thailand through Ganges, Chindwin, Irrawaddy, Sitang and Salween basins, also from Yunnan, China.

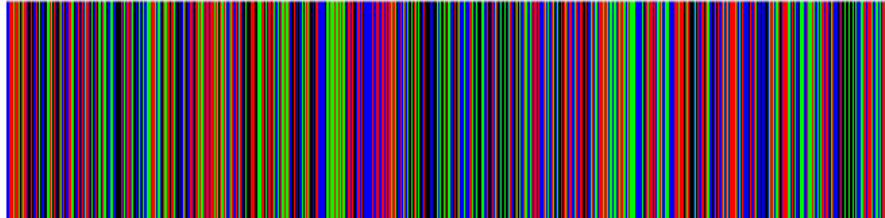
Habit and Habitat: Adults inhabit clear water, swift flowing streams with rocky, pebbly and sandy bottoms.

Salient /Diagnostic Features: Body depth about 20% of Standard length, dorsal soft rays: 14-17; pectoral soft rays: 13-14, pelvic soft rays 8-9 and anal soft rays: 8. Lateral line not interrupted with pore count of 65-112. Distinguished from its congeners by the absence of a suborbital flap in male, the flap being replaced by a suborbital

Fish Wealth of Mahananda River

groove; lateral line reaches at least to anus. Body at least partly covered with scales, though minutes. Belly straight and horizontal, A conspicuous black spot at upper extremity of caudal fin base.

DNA Barcode



GenBank Accession Number: OR232781

***Canthophrys gongota* (Hamilton, 1822)**



Scientific name: *Canthophrys gongota* (Hamilton, 1822)

Common name: Gongota loach

Local name: Gutum

Date of collection: 29-07-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1155

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Cobitidae

Genus: *Canthophrys*

Species: *gongota*

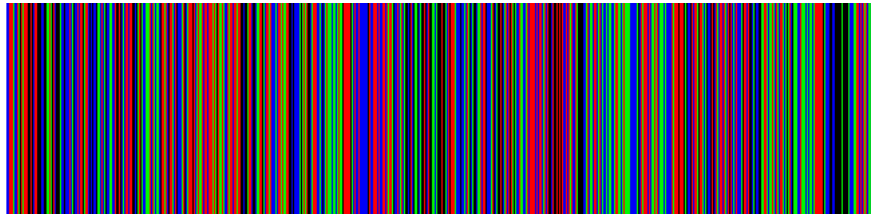
IUCN Red List Status: Least Concern (LC)

Distribution: India, Nepal and Bangladesh.

Habit and Habitat: Inhabits streams and rivers. Occurs in shallow slow-moving streams with sandy, muddy or gravelly bottom.

Salient /Diagnostic Features: Body is subcylindrical and posteriorly tapering. Upper profile of snout is nearly straight or a little concave. Eyes are close together situated high up at middle of head. Lips are thick, lower with papillae, 4 rostral and 2 maxillary barbells. Anterior nostrils are tubular, posterior nostrils are simple holes. Scales are small. Lateral line is present. Dorsal fin is started at center between anterior margin of eye and root of caudal fin. Pelvics originate slightly in advance of that of dorsal; caudal rounded. Body colour and decoration: Greenish above and yellowish-white below. Back usually with irregular bands descending upto lateral line. D iii 8; A ii 5; P i 10; V i 6.

DNA Barcode



GenBank Accession Number: **OR232784**

***Schistura zonata* (McClelland, 1839)**



Scientific name: *Schistura zonata* (McClelland, 1839)

Common name: Gongota loach

Local name: Gutum

Date of collection: 29-07-2020

Locality Name: Near Tayabpur Bridge,

District: Kishanganj

State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1024

Fish Wealth of Mahananda River

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Nemacheilidae
Genus: *Schistura*
Species: *zonata*

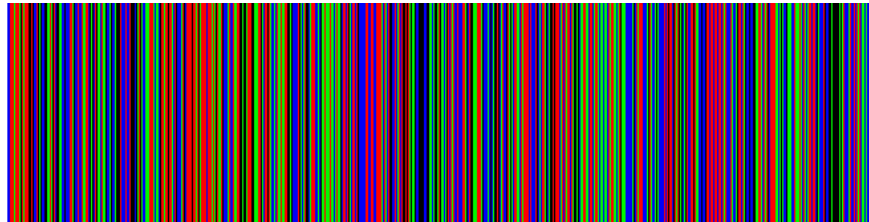
IUCN Red List Status: Data deficient

Distribution: India and Pakistan.

Habit and Habitat: Inhabits streams and rivers. Occurs in shallow slow-moving streams with sandy, muddy or gravelly bottom

Salient /Diagnostic Features: Body elongate of almost uniform depth, compressed posteriorly. Lateral line complete. Body with 11 bands across lateral line interspaced with short narrower bands above caudal and dorsal fins with fine spots. Dorsal fin insertion midway between snout tip and caudal fin base.

DNA Barcode



GenBank Accession Number: **OR232787**

***Sperata seenghala* (Sykes, 1839)**



Scientific name: *Eutropiichthys vacha* (Hamilton, 1822)

Common name: Batchwa vacha

Local name: Bachawa

Date of collection: 30-07-2020

Locality Name: Near Dhalkhola Bridge,
District: Purnea
State: Bihar (India)

GPS Coordinates: 26°17'18.3"N 88°02'35.4"E

Registration No.: COF/1202

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Siluriformes
Family: Schilbeidae
Genus: *Eutropiichthys*
Species: *vacha*

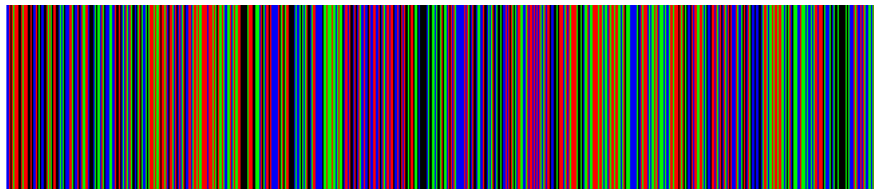
IUCN Red List Status: Least Concern (LC)

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

Habitat: Found in rivers, canals and tidal waters

Salient /Diagnostic Features: Body elongate, compressed. Greatest body depth located at dorsal-fin origin. Dorsal profile of body nearly straight from rear of head to dorsal-fin origin and gently convex between posterior terminus of dorsal-fin base and caudal-fin origin. Lateral line complete. Adipose fin small, located above posterior one third of anal-fin base. Pelvic fin small, its length only slightly less than one-half that of pectoral fin. Pectoral fin triangular, first branched ray longest. Number of rakers on the first gill arch 15-20, the number of branched pectoral fin rays 14-15, the number of branched anal-fin rays (44 to 48, the length of the accessory premaxillary tooth patch extending posteriorly nearly to the terminus of the gape.

DNA Barcode



GenBank Accession Number: **OR232790**

***Wallago attu* (Bloch & Schneider, 1801)**



Scientific name: *Wallago attu* (Bloch & Schneider, 1801)

Common name: Wallago

Local name: Boari

Date of collection: 18-10-2020

Locality Name: Near Salmari,
District: Katihar
State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1282

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Siluriformes

Family: Siluridae

Genus: *Wallago*

Species: *attu*

IUCN Red List Status: Vulnerable (VU)

Distribution: India, Pakistan to Vietnam and Indonesia, Afghanistan.

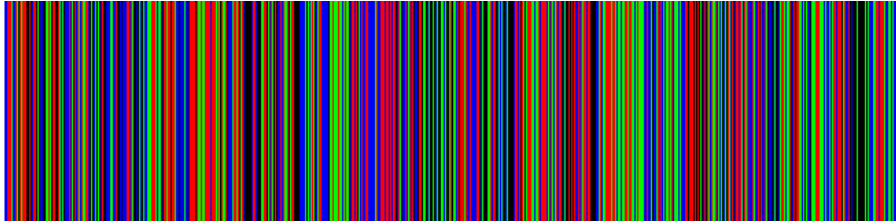
Habitat: Found in large rivers, lakes and tanks mostly hides under holes in river banks and canals.

Salient /Diagnostic Features: Dorsal soft rays (total): 5; Anal soft rays: 77-97. Head is broad and snout depressed. Body is elongated and strongly compressed. Mouth is very deeply cleft, its corner reaching far behind the eyes. Teeth in jaws set in wide bands; vomerine teeth in two small patches. Two pairs of barbels are present, maxillary barbels extending to anterior margin posterior of

Singh, Saini, Samanta & Verma

anal fin, and mandibular barbels to angle of mouth. Eyes are small, with a free orbital margin. Dorsal fin is small and anal fin very long. Mandibular barbel is longer than pelvic fin; 24-30 gill rakers on the first arch. Fin formula: D.6; P16 (11/5); V.12; A.91 (6/87); C.18.

DNA Barcode



GenBank Accession Number: OR232819

***Gagata sexualis* (Tilak, 1970)**



Scientific name: *Gagata sexualis* (Tilak, 1970)

Common name: Gagata

Local name: Buhani

Date of collection: 29-07-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1159

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Siluriformes
Family: Sisoridae
Genus: *Gagata*
Species: *sexualis*

IUCN Red List Status: Least Concern (LC)

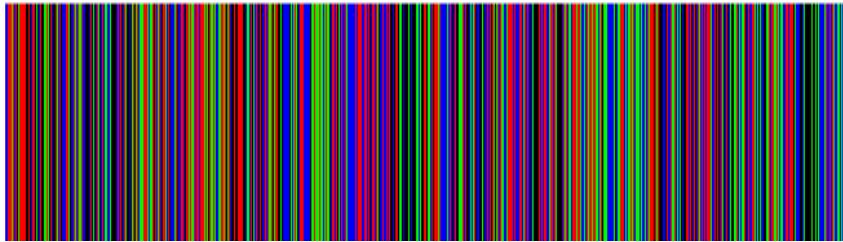
Fish Wealth of Mahananda River

Distribution: India.

Habitat: Upper reaches of river.

Salient /Diagnostic Features: The presence of 5 dark saddles on the body, an elongate and slender snout, and pronounced sexual dimorphism in the shape of the dorsal fin. Pectoral fin reaches the base of ventral fin, maxillary barbel longer than head and with long nasal barbel, dorsal fin spine smooth on both edges and pectoral fin spine with eight to ten serrations.

DNA Barcode



GenBank Accession Number: **OR232821**

Erethistoides sicula (Ng, 2005)



Scientific name: *Erethistoides sicula* (Ng, 2005)

Common name: Erethistid catfishes

Local name: Kata Kanti/Tinkati/Jeenkatia

Date of collection: 28-05-2020

Locality Name: Near Pothia Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°21'02.3"N 88°09'41.7"E

Registration No.: COF/1028

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Siluriformes
Family: Sisoridae
Genus: *Erethistoides*
Species: *sicula*

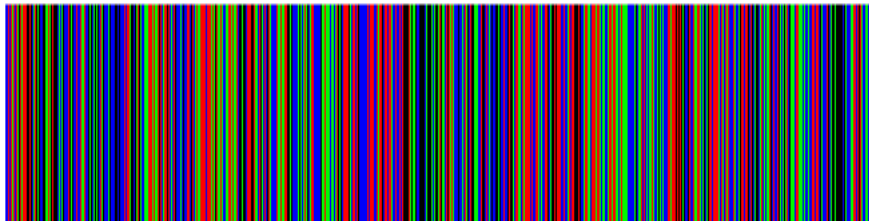
IUCN Red List Status: Data Deficient (DD)

Distribution: India

Habitat: Occurs mainly in hill streams, found in muddy parts of rivers overgrown with vegetation.

Salient /Diagnostic Features: Dorsal soft rays (total): 5; Anal soft rays: 10 - 11; Vertebrae: 29 - 31. It differs from both *E. montana* and *E. pipri* in having a longer caudal peduncle (19.6–22.3% SL vs. 14.4–18.4) and shorter pectoral spine (14.6–28.0% SL vs. 30.7–32.1). It further differs from *E. montana* in having a dorsally projecting bony splint on the opercle immediately posterior to its articular facet with the hyomandibula (vs. splint absent; Fig. 2) and from *E. pipri* in having a more slender head (13.4–15.1% SL vs. 16.4).

DNA Barcode



GenBank Accession Number: **OR232822**

***Glyptothorax telchitta* (Hamilton, 1822)**



Scientific name: *Glyptothorax telchitta* (Hamilton, 1822)

Common name: Telchitta

Local name: Telchitta

Date of collection: 17-10-2020

Locality Name: Near Jalalgaach

District: Kishanganj

State: Bihar(India)

GPS Coordinates: 26°24'59.8"N 88°11'38.9"E

Registration No.: COF/1268

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Siluriformes

Family: Sisoridae

Genus: *Glyptothorax*

Species: *telchitta*

IUCN Red List Status: Least Concern (LC)

Distribution: Pakistan, India, Bangladesh and Nepal

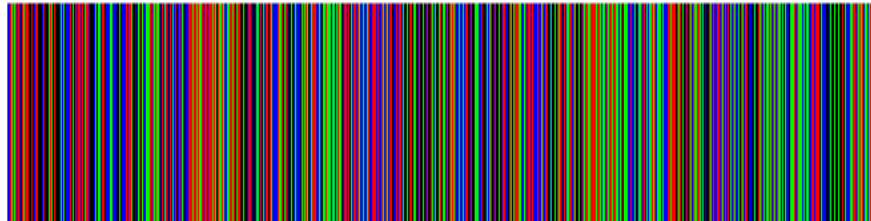
Habitat: They are benthopelagic and mainly lives on bottom. Inhabits mainly in hill streams.

Salient /Diagnostic Features: Distinguished from its congeners, except *G. botius*, in northeast India in having a combination of large, prominent tubercles on the head and body, a thoracic adhesive apparatus without a median depression, and a very slender body and caudal peduncle (sometimes described as spindle shaped). *G. botius* differs from *G. telchitta* in having a more triangular snout when viewed laterally, the absence of dark saddles on the body, a thoracic adhesive apparatus with narrower folds of skin, a shorter

Singh, Saini, Samanta & Verma

adipose-fin base (9.5-11.5% SL vs. 12.0-16.4) and a deeper caudal peduncle (4.7-5.9% SL vs. 3.1-4.2) (Ref. 54474). Description: Dorsal fin with I,5, i, or I,6 rays; Anal fin with iv,8, iv,9, iv,9, i, iv,10 or iv,11, i rays; pectoral fin with I,7, i, I,8 or I,8, i rays; pelvic fin with i,5 rays

DNA Barcode



GenBank Accession Number: OR232827

***Clarias magur* (Hamilton, 1822)**



Scientific name: *Clarias magur* (Hamilton, 1822)

Common name: Magur Catfish

Local name: Magur

Date of collection: 09-09-2022

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1325

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Fish Wealth of Mahananda River

Infraclass: Teleostei

Order: Siluriformes

Family: Clariidae

Genus: *Clarias*

Species: *magur*

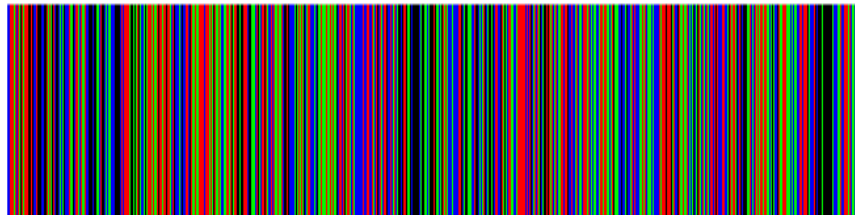
IUCN Red List Status: Endangered (EN)

Distribution: India and Bangladesh.

Habit and Habitat: Fresh and brackish waters of plains.

Salient /Diagnostic Features: Body elongated, head moderately depressed and covered by osseous plates. Eyes small, mouth terminal and barbels 4 pairs of which maxillary barbels extend to middle or end of pectoral fins and mandibular pairs are shorter. Dorsal fin inserted slightly anterior tip of pectoral fins. Pectoral spine strong and fairly serrated on both edges. Body color brownish to green-blue. The back dark with a greenish lustre. Pale brown or reddish on flanks and belly often numerous striking pale to white spots on flanks. Dorsal anal fins have red margins. Fin formula: D 70-76; A 45-58; P I 8-11; V i 5.

DNA Barcode:



GenBank Accession Number: **OR232831**

***Heteropneustes fossilis* (Bloach, 1794)**



Scientific name: ***Heteropneustes fossilis* (Bloach, 1794)**

Common name: Stinging Catfish

Local name: Singhi

Date of collection: 09-09-2022

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1319

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Siluriformes
Family: Heteropneustidae
Genus: *Heteropneustes*
Species: *fossilis*

IUCN Red List Status: Least Concern (LC)

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

Habit and Habitat: Very common in pond, ditches, swamps and marshes. Also found in muddy river.

Salient /Diagnostic Features: Body elongate and compressed, depressed head covered with osseous plate at top and sides of the head. Pectoral fin short and rounded $\frac{1}{2}$ to $\frac{1}{3}$ the distance between pectoral and pelvic fin origin. Caudal fin rounded. Barbels four pairs in which maxillary pairs extend to end of pectorals or to commencement to anal and mandibular pairs extend upto base of pelvics but nasal pair considerably shorter than mandibular pairs. Outstanding anatomical feature is a pair of accessory respiratory organ (air sacs) which extends backwards from the gill-chamber on either side of vertebral column. Caudal rounded. Body color reddish brown or purplish brown but in mature stage of specimens it shows black in color. Fin formula: D 6-7; A 60-70; P I 7; V i 5.

DNA Barcode



GenBank Accession Number: **OR232832**

***Macrognathus aral* (Bloch & Schneider, 1801)**



Scientific name: *Macrognathus aral* (Bloch & Schneider, 1801)

Common name: One-stripe spinyeel

Local name: Gainchi

Date of collection: 10-11-2020

Locality Name: Near Salmari,
District: Katihar
State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1310

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Synbranchiformes

Family: Mastacembelidae

Genus: *Macrognathus*

Species: *aral*

IUCN Red List Status: Least Concern (LC)

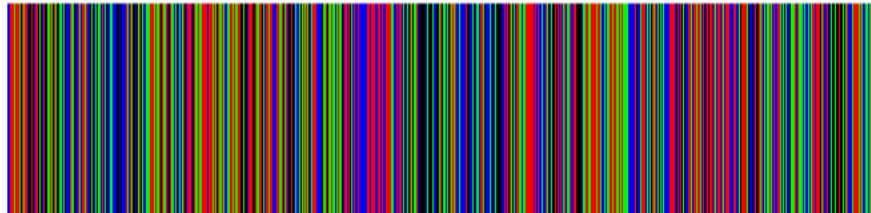
Distribution: India, Pakistan, Sri Lanka, Bangladesh, Nepal and Myanmar.

Habitat: Found in fresh and brackish waters and deltas of large rivers, common in ponds and slow flowing rivers with vegetation in plains.

Salient /Diagnostic Features: A moderately large double band spiny eel with slightly compressed cylindrical body contour, fairly longer rostrum with distinct tooth plates in the concavity. Two longitudinal broad bands along the lateral line from eye to caudal peduncle. Soft dorsal fin with 3-7 distinct ocelli at the base, caudal fin light brown with 4-5 white zigzag vertical bands. Dorsal and anal

fins are also not confluent with the caudal fin; vertebral count (27+33). Fin formula: D XVII–XXI 45–43; P i15–20; A III42–53; C 12–15.

DNA Barcode



GenBank Accession Number: OR232837

***Macrognathus punctalus* (Hamilton, 1822)**



Scientific name: *Macrognathus punctalus* (Hamilton, 1822)

Common name: Barred spiny eel

Local name: Gainchi

Date of collection: 30-07-2020

Locality Name: Near Dhalkola Bridge,

District: Purnea

State: Bihar (India)

GPS Coordinates: 26°17'18.3"N 88°02'35.4"E

Registration No.: COF/1238

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Synbranchiformes

Family: Mastacembelidae

Genus: *Macrognathus*

Species: *punctalus*

Fish Wealth of Mahananda River

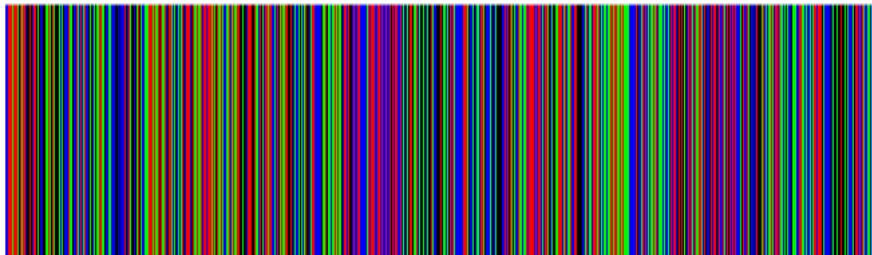
IUCN Red List Status: Least Concern (LC)

Distribution: India, Nepal, Pakistan and Bangladesh.

Habitat: Inhabits slow and shallow waters of rivers of plains and estuaries. Also found in canals, streams, beels, ponds and inundated fields

Salient /Diagnostic Features: Cylindrical body contour with shorter rostrum without tooth plates but tubular nostril guarded by fimbriae present, opercular and pre-orbital spines absent. Overall body colour brown spackled with spots arranged in three to four longitudinal rows or may be irregularly arranged on dorsum and lateral aspect of entire body from opercular region to caudal peduncle; dorsal and anal fin hyaline grey with spackled with black spots and caudal fin with vertical black dotted streaks. Dorsal and anal fins are not confluent with the caudal fin; vertebral count (29+36. Fin formula: D XXII–XXVII 30–42; P i15–17; A III30–46; C 11–13.

DNA Barcode



GenBank Accession Number: **OR232839**

***Mastacembelus armatus* (Lacepede, 1800)**



Scientific name: *Mastacembelus armatus* (Lacepede, 1800)

Common name: Zig-zag eel

Local name: Baam

Date of collection: 18-10-2020

Locality Name: Near Salmari,

District: Katihar

State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1296

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Synbranchiformes
Family: Mastacembelidae
Genus: *Mastacembelus*
Species: *armatus*

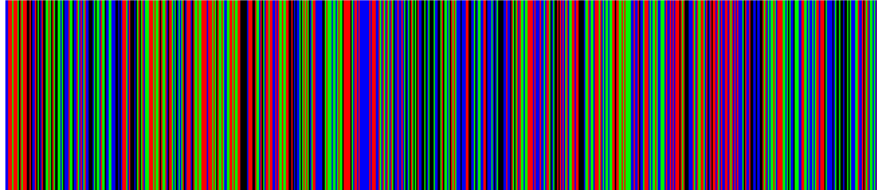
IUCN Red List Status: Least Concern (LC)

Distribution: India, Bhutan, Nepal, Pakistan, Vietnam, Sri Lanka.

Habitat: Highland streams to lowland wetlands, streams and rivers with sand, pebble, or boulder substrate. Also occur in still waters, both in coastal marshes and dry zone tanks.

Salient /Diagnostic Features: Body is relatively slender, elongated and slightly compressed. Long dorsal and anal fin is present which is confluent with caudal fin. Pelvic fin is absent, tip of snout is trilobed which are a central pointed one, two lateral, short, blunt ones. Body color is dull brown with 1-3 darker, longitudinal zigzag lines, more or less connected to form a reticulated pattern, more or less distinct and restricted to the dorsal two thirds of the body. Dorsal spines commence over middle of pectoral fin which is rounded. An undulating black band is situated from eye to caudal, a similar thinner one below it. A row of black spots is found along base of soft dorsal fin. Fin formula: D. XXXVII-XXXVIII/78-84, P1. 25-26, A. III/77-85.

DNA Barcode



GenBank Accession Number: OR232846

***Parambassis lala* (Hamilton, 1822)**



Scientific name: *Parambassis lala* (Hamilton, 1822)

Common name: Highfin glassy perchlet

Local name: Chani/Lal Chanda

Date of collection: 28-05-2020

Locality Name: Near Pothia Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°21'02.3"N, 88°09'41.7"E

Registration No.: COF/1018

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei

Order: Perciformes
Family: Ambassidae
Genus: *Parambassis*
Species: *lala*

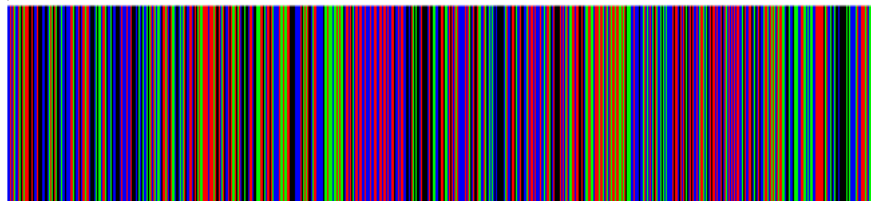
IUCN Red List Status: Near Threaten (NT)

Distribution: India, Bangladesh and Myanmar.

Habit and Habitat: Found in ponds, ditches and pools.

Salient /Diagnostic Features: Body small, almost rounded with oblique mouth, No canine teeth on lower jaw, lower jaw not prominent. 16 gill rakers on lower arm of first arch and about 90 lateral line scale. Dorsal, anal and caudal fins deep orange or reddish orange colored with blackish outer margins. Orange, body with three longitudinal dusky bands along sides, adult males with two broad vertical dark bands. Second spine of dorsal fin is very elongated. Fin formula: D VII+I 11; A III 13; P i 10; V I 5.

DNA Barcode



GenBank Accession Number: **OR232849**

***Badis badis* (Hamilton, 1822)**



Scientific name: *Badis badis* (Hamilton, 1822)

Common name: Badis

Local name: Pathra/Sunha

Date of collection: 29-07-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj

Fish Wealth of Mahananda River

State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1166

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Anabantiformes

Family: Badidae

Genus: *Badis*

Species: *badis*

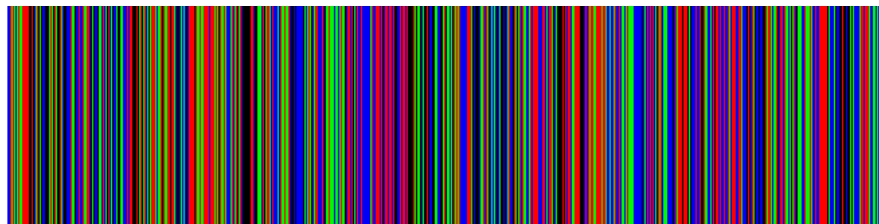
IUCN Red List Status: Least Concern (LC)

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

Habitat: Rivers, ponds, swamps and ditches.

Salient /Diagnostic Features: Dorsal spines (total): 15 - 17; Dorsal soft rays (total): 7-10; Anal soft rays: 6 - 8. The species has conspicuous dark blotch covering superficial part of cleithrum above pectoral fin base. Body depth is 30.7-38.9% standard length; interorbital width 6.5-8.3% standard length and scales in lateral row is 25-27; circum-peduncular scales 19-20; pectoral rays usually 12. A series of prominent dark blotches along dorsal fin base and/or a series of dark blotches along middle of dorsal fin; and has indistinct bars on side are present. Fin formula: D XVI-XVIII 7-10; A. III 6-8; P 12; V I 5.

DNA Barcode



GenBank Accession Number: **OR232854**

***Glossogobius giuris* (Hamilton, 1822)**



Scientific name: *Glossogobius giuris* (Hamilton, 1822)

Common name: Tank goby

Local name: Bulla

Date of collection: 29-05-2020

Locality Name: Near Dhalkola Bridge,
District: Purnea
State: Bihar (India)

GPS Coordinates: 25°51'33.8"N 87°48'17.7"E

Registration No.: COF/1124

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Gobiiformes
Family: Gobiidae
Genus: *Glossogobius*
Species: *giuris*

IUCN Red List Status: Least Concern (LC)

Distribution: Africa to Oceania: Red Sea and East Africa and most inland freshwater bodies over the Indian Ocean and western Pacific. Common in coastal and estuarine waters from austral Africa and Madagascar to India and south of China.

Habitat: Found mainly in freshwater and estuaries, but also enter the sea. Also occur in canals, ditches and ponds. Found in clear to turbid streams with rock, gravel or sand bottoms

Salient/Diagnostic Features: Head flattened, lower jaw projecting; body pale without longitudinal lines. Dorsal fins with small spots forming longitudinal stripes. Pelvic fins jointed but attached to the

Fish Wealth of Mahananda River

body only from their anterior part. The body is brownish yellow with 5 to 6 dark and rounded spots on its sides. Dorsal fins are light with brownish spots. Pelvic fins are grey. Pectorals and caudal fins are grey and often hyaline. Scales ctenoid on the body, cycloid on breast and pectoral fin base. Fin formula: Dorsal fin: D1. VI, D2. I/ 9; pectoral: P1. 17–18; pelvic: P2. I/5; anal: A. I/8-9; and caudal: C. 17-18; Scales in lateral series 29-35.

DNA Barcode



GenBank Accession Number: OR232852

***Channa punctata* (Bloch, 1793)**



Scientific name: *Channa punctata* (Bloch, 1793)

Common name: Spotted Snakehead

Local name: Girai, Lata

Date of collection: 29-05-2020

Locality Name: Near Dhalkola Bridge,
District: Purnea
State: Bihar (India)

GPS Coordinates: 25°51'33.8"N 87°48'17.7"E

Registration No.: COF/1061

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei

Order: Anabantiformes

Family: Channidae

Genus: *Channa*

Species: *punctata*

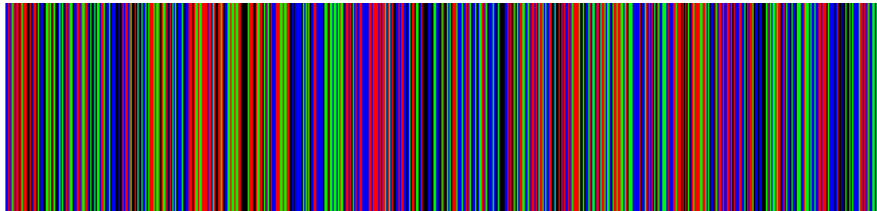
IUCN Red List Status: Least Concern (LC)

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

Habitat: Found in ponds, swamps, brackish water, ditches and beels. Adults prefer stagnant waters in muddy streams.

Salient /Diagnostic Features: Body elongate and cylindrical. Head 3.3-3.9 of TL and 2.7-3.3 of SL. Eyes comparatively small and located anterior part of head. Eye diameter 6.2-8.5 of HL. Lower jaw slightly protruding. No barbels. Scales large. Pectoral just above pelvic, caudal large and rounded. Pelvic is about 75% of pectoral fin length. 37-41 scales on lateral line. Body color varies with its habitats, generally yellowish to brown on back and lighter below. A series of about 8-9 vertical bands above lateral line, alternating with a similar series below it. Fin formula: D 28-33; A 20-23; P 15-18; V 6.

DNA Barcode



GenBank Accession Number: **OR232856**

***Leiodon cutcutia* (Hamilton, 1822)**



Scientific name: *Leiodon cutcutia* (Hamilton, 1822)

Common name: Ocellated pufferfish

Local name: Fokcha/Petfulni

Fish Wealth of Mahananda River

Date of collection: 29-07-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj
State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1145

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Tetraodontiformes
Family: Tetraodontidae
Genus: *Leiodon*
Species: *cutcutia*

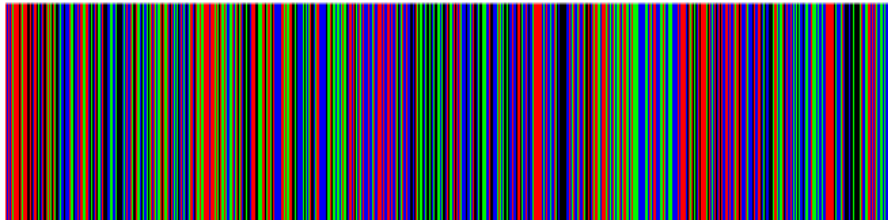
IUCN Red List Status: Least Concern (LC)

Distribution: India, Bangladesh, Sri Lanka, Myanmar, Mekong and Malay Archipelago.

Habit and Habitat: Found in ponds, beels, canals and rivers

Salient /Diagnostic Features: Body compressed laterally; dorsal profile rising nearly rectilinear to midst of back, from there sloping gradually to caudal fin; interorbital flat; body spines apparently absent; mouth terminal, directing forwards or downwards; no prominent chin; lower border of eye above level of mouth corner, upper border not interfering with dorsal profile; nasal organ a very short tube, height 2 or more in diameter, with one terminal opening, at the most only slightly lobed; no skin folds on back or belly.

DNA Barcode



GenBank Accession Number: **OR232857**

***Danio rerio* (Hamilton, 1822)**



Scientific name: *Danio rerio* (Hamilton, 1822)

Common name: Zebra danio

Local name: Anju

Date of collection: 02-06-2020

Locality Name: Near Pothia Bridge,
District: Kishanganj; State: Bihar (India)

GPS Coordinates: 26°21'02.3"N, 88°09'41.7"E

Registration No.: COF/1139

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Cypriniformes

Family: Danionidae

Genus: *Danio*

Species: *rerio*

IUCN Red List Status: Least Concern (LC)

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

Habit and Habitat: Freshwater streams, canals, ditches, ponds and beels, Occur in slow-moving to stagnant standing water bodies, particularly rice-fields and lower reaches of streams. Very commonly found in rivulets at foot hills.

Salient /Diagnostic Features: Four uniformly, pigmented, horizontal stripes on the side of the body, all extending onto the end of caudal fin rays. Anal fin distinctively striped. Lateral line absent. Rostral barbels extend to anterior margin of orbit; maxillary barbels

Fish Wealth of Mahananda River

end at about middle of opercle. Dorsal fin with 30-32 branched rays and anal fin with 10-12 branched rays.

***Botia dario* (Hamilton, 1822)**



Scientific name: *Botia dario* (Hamilton, 1822)

Common name: Bengal Loach

Local name: Rani mach/Baghi

Date of collection: 20-04-2022

Locality Name: Near Bahadurganj Bridge,
District: Kishanganj, State: Bihar (India)

GPS Coordinates: 26°08'37.1"N 87°54'23.2"E

Registration No.: COF/1329

Taxonomic Classification:

Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Grade: Pisces
Subgrade: Teleostomi
Class: Osteichthyes
Subclass: Actinopterygii
Infraclass: Teleostei
Order: Cypriniformes
Family: Botiidae
Genus: *Botia*
Species: *dario*

IUCN Red List Status: Least Concern (LC)

Distribution: India, Bangladesh and Bhutan.

Habitat: Occurs in clear mountain streams.

Salient/Diagnostic Features: Body elongated and laterally compressed. Dorsal profile more convex than that of ventral, head flattened at sides. Mouth small and ventral. 4 pairs of barbels

including 2 rostral, 1 maxillary and 1 mandibular pair present. Body color yellow or yellowish with several (generally 7) black colored transverse bands. Lateral line present and complete. Caudal fin forked. Fin formula: D. 11-13 (2-3/9-10); P1. 14; P2. 8; A. 7-8 (2/5-6).

***Xenentodon cancila* (Hamilton, 1822)**



Scientific name: *Xenentodon cancila* (Hamilton, 1822)

Common name: Freshwater gar

Local name: Kakiya/Kaua machli

Date of collection: 28-05-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj, State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1044

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Beloniformes

Family: Belonidae

Genus: *Xenentodon*

Species: *cancila*

IUCN Red List Status: Least Concern (LC)

Distribution: Sri Lanka and India, eastward to the Mekong.

Habitat: River, Freshwater and brackish water streams.

Salient /Diagnostic Features: Body very elongate and slightly compressed or sub-cylindrical. Jaws are prolonged into beak, lower jaw longer than upper. Each jaw contains a row of sharp teeth. Dorsal and anal fin opposite each other and very close to caudal fin.

Fish Wealth of Mahananda River

Back grayish and whitish below. Lateral line present and complete.
Fin formula: D. 15-16; P1. 10-11; P2. 6; A. 17-18.

***Anabas testudineus* (Bloch, 1792)**



Scientific name: *Anabas testudineus* (Bloch, 1792)

Common name: Climbing perch

Local name: Kawai

Date of collection: 10-11-2020

Locality Name: Near Salmari, istrict: Katihar, State: Bihar (India)

GPS Coordinates: 25°35'01.2"N 87°48'53.5"E

Registration No.: COF/1311

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Anabantiformes

Family: Anabantidae

Genus: *Anabas*

Species: *testudineus*

IUCN Red List Status: Least Concern (LC)

Distribution: India to Wallace line including China

Habitat: Found mostly in canals, lakes, ponds, swamps and estuaries. Adults occur in medium to large rivers, brooks, flooded fields and stagnant water bodies including sluggish flowing canals. Often found in areas with dense vegetation

Salient /Diagnostic Features: Dorsal spines (total): 16 - 20; Dorsal soft rays (total): 7-10; Anal spines: 9-11; Anal soft rays: 8 - 11. Color in life dark to pale greenish, very pale below, back

dusky to olive; head with longitudinal stripes ventrally; posterior margin of opercle with a dark spot; iris golden reddish. Body form variable, affected by age and amount of food consumed. Scaled head with 4-5 rows between eye and rear margin of pre-operculum. Scales large and regularly arranged, ciliate. Posses an accessory air-breathing organ. Able to survive for several days or weeks out of water if the air breathing organs can be kept moist. Quite famous for its ability to walk.

***Channa striata* (Bloch, 1793)**



Scientific name: *Channa striata* (Bloch, 1793)

Common name: Striped Snakehead

Local name: Shawl

Date of collection: 20-04-2022

Locality Name: Near Bahadurganj Bridge,
District: Kishanganj, State: Bihar (India)

GPS Coordinates: 26°08'37.1"N 87°54'23.2"E

Registration No.: COF/1330

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Anabantiformes

Family: Channidae

Genus: *Channa*

Species: *striata*

IUCN Red List Status: Least Concern (LC)

Distribution: Pakistan, India to Thailand, South China.

Fish Wealth of Mahananda River

Habitat: Adults inhabit ponds, streams and rivers, stagnant and muddy water of plains, swamps, lowland river, brooks, flooded fields, sluggish flowing canals and paddy fields.

Salient /Diagnostic Features: Body elongate, cylindrical with depressed head. Eyes moderate and its diameter 6-7 times. Large scales on head and caudal fin rounded. Body color gray-green to black-green above; pale or yellow on sides and white below. Dorsal and anal fins are darker in color and with dark patches. Caudal also dark and with two vertical bands on its base. Paired fins are pale. Fin formula: D 37-46; A 23-29; P 15-17; V 6.

Trichogaster fasciata



Scientific name: *Trichogaster fasciata* Bloch & Schneider, 1801)

Common name: Banded gourami

Local name: Kholisha/Khosti

Date of collection: 29-07-2020

Locality Name: Near Tayabpur Bridge,
District: Kishanganj, State: Bihar (India)

GPS Coordinates: 26°23'21.5"N 88°09'21.6"E

Registration No.: COF/1187

Taxonomic Classification:

Phylum: Chordata

Subphylum: Vertebrata

Superclass: Gnathostomata

Grade: Pisces

Subgrade: Teleostomi

Class: Osteichthyes

Subclass: Actinopterygii

Infraclass: Teleostei

Order: Anabantiformes

Family: Osphronemidae

Singh, Saini, Samanta & Verma

Genus: *Trichogaster*

Species: *fasciata*

IUCN Red List Status: Least Concern (LC)

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

Habitat: Occurs in large rivers, estuaries, ditches, ponds and lakes, generally preferring weedy environment.

Salient /Diagnostic Features: Dorsal spines (total): 15 - 17; Dorsal soft rays (total): 9-14; Anal spines: 15-18; Anal soft rays: 14 - 19; Vertebrae: 27. Body is elongated and strongly compressed. Mouth is small, slightly protrusible; upper lip papillose, especially in old males. Preorbital serrate is present in young specimen. Color greenish with oblique orange or bluish bars descending downwards and backwards from the back to the anal fin. Vertical fins are with alternating dark and pale spots or bars and anal fin often with a red margin.



Bibliography/References

- Camargo JA, Alonso A and Salamanca A 2005. Nitrate toxicity to aquatic animals: a review with new data for freshwater invertebrates. *Chemosphere*. 58, 1255–1267.
- Carl, J., Ferraris, J.R. and Vari, R.P., 2007. Revision of Catfishes of the Genus *Eutropiichthys*, with the Description of Two New Species (Siluriformes: Schilbidae). *Copeia*, 2007(4), pp. 866–885.
- Conway, K.W., D.E. Dittmer, L.E. Jezisek and H.H. Ng, 2013. On *Psilorhynchus sucatio* and *P. nudithoracicus*, with the description of a new species of *Psilorhynchus* from northeastern India (Ostariophysi: Psilorhynchidae). *Zootaxa* 3686(2):201-243.
- Crandall KA, Fetzner JW (Jr), Lawler SH, Kinnersley M & Austin CM 1999. Phylogenetic relationships among the Australian and New Zealand genera of freshwater crayfishes (Decapoda: Parastacidae). *Australian Journal of Zoology*. 47, 199 – 214.
- Darshan, A., Abujam, S. and Das, D.N., 2019. Biodiversity of Fishes in Arunachal Himalaya: Systematics, Classification, and Taxonomic. Publ: Elsevier 978-0-12-815556-1.
- Das, B.C., McCartin, K., Liu, T.C., Peterson, R.T., and Evans, T. 2010. A forward chemical screen in zebrafish identifies a retinoic acid derivative with receptor specificity. *PLoS One*. 5(4):e10004.
- Datta Munshi, J. S. and Srivastava, M. P. 1988. Natural history of fish and systematics of freshwater fishes of India. Published by Narendra Publishing House, Delhi pp 403.

- Day, Francis. 1886. The fauna of British India including Ceylon and Burma, Fishesries 1: 548: 2: 509.
- Day, Francis. 1889. The fauna of British India including Ceylon and Burma, Fishesries 1: 548: 2: 509.
- Dekkers, W.J., 1974. Review of the Asiatic freshwater puffers of the genus *Tetraodon* Linnaeus, 1758 (Pisces, Tetraodontiformes, Tetraodontidae). Institute of Taxonomie Zoology, University of Amsterdam, The Netherlands.
- Dhanze, R., Debbarma, P., Debbarma A. and Dhanze, J.R., 2018. Biosystematics and distributional status of spiny eel fish species of the genus *Macrognaathus* Lacepede, (Synbranchiformes: astacembelidae) from Northeastern region of India. *Journal of Entomology and Zoology Studies* 2018; 6(4): 369-378.
- Ferraris, C.J. Jr., 2007. Checklist of catfishes, recent and fossil (Osteichthyes: Siluriformes), and catalogue of siluriform primary types. *Zootaxa* 1418:1-628.
- Fricke, R., Eschmeyer, W.N. and R. van der Laan (eds) 2023. Eschmeyer's Catalog of Fishes: Genera, Species, Reference.
- Froese, R., and D. Pauly, editors. 2018. *Labeo gonius* Hamilton, 1822. FishBase.
- Goswami, M., Thangaraj, K., Chaudhary, B. K., Bhaskar, L. V. S. K., Gopalakrishnan, A., Joshi, M.B., Singh, L. and Lakra, W. S. 2008. Genetic heterogeneity in the Indian stocks of seahorse (*Hippocampus kuda* and 112 *Hippocampus trimaculatus*) inferred from mtDNA cytochrome b gene. *Hydrobiologia*, DOI 10.1007/s10750-008-9642-3
- Huber, J.H., 1996. Killi-Data 1996. Updated checklist of taxonomic names, collecting localities and bibliographic references of oviparous Cyprinodont fishes (Atherinomorpha, Pisces). Société Française d'Ichtyologie, Muséum National d'Histoire Naturelle, Paris, France, 399 p.
- Jayaram, K. C. 1981. The freshwater fishes of India, Pakistan, Bangladesh and Srilanka- A Handbook. Published by Zoological Survey of India, Calcutta pp. 475.
- Jayaram, K. C. 1999. The Freshwater Fishes of the Indian Region. Delhi, Narendra Publishing House, New Delhi, India.
- Jayaram. K.C., 2010. Freshwater Fishes of the Indian Region. 2nd ed. Narendra Publishing House. Delhi-India
- Khan, H.A. and V.G. Jhingran, 1975. Synopsis of biological data on rohu *Labeo rohita* (Hamilton, 1822). *FAO Fish. Synop.* (111):100 p.

Fish Wealth of Mahananda River

- Kullander, F.F., 2001. Phylogeny and species diversity of the South and Southeast Asian cyprinid genus *Danio* Hamilton (Teleostei, Cyprinidae). Ph.D. Thesis-Stockholm University, Department of Zoology. p. 1-26. Sweden, Stockholm University. Department of Zoology.
- Kullander, S.O. and R. Britz, 2002. Revision of the family Badidae (Teleostei: Perciformes), with description of a new genus and ten new species. *Ichthyol. Explor. Freshwat.* 13(4):295-372.
- Liao, T.Y., E. Unlu and S.O. Kullander, 2011. Western boundary of the subfamily Danioninae in Asia (Teleostei, Cyprinidae): derived from the systematic position of *Barilius mesopotamicus* based on molecular and morphological data. *Zootaxa* 2880:31-40.
- Malik DS 2011. Population dynamics and conservation management of Himalayan Mahseer (*Tor* species) in riverine aquatic ecosystem in Garhwal region of Uttarakhand (India). *Journal of Applied and Natural Science.* 3, 97 – 101.
- Mauge, L.A., 1986. Gobiidae. p. 358-388. In J. Daget, J.-P. Gosse and D.F.E. Thys van den Audenaerde (eds.) Check-list of the freshwater fishes of Africa (CLOFFA). ISNB, Brussels; MRAC, Tervuren; and ORSTOM, Paris. Vol. 2.
- Menon, A.G.K., 1999. Check list - fresh water fishes of India. *Rec. Zool. Surv. India, Misc. Publ., Occas. Pap. No. 175*, 366 p.
- Ng, H.H. and M. Kottelat, 2008. The identity of *Clarias batrachus* (Linnaeus, 1758), with the designation of a neotype (Teleostei: Clariidae). *Zool. J. Linn. Soc.* 153:725-732.
- Ng, H.H., 2005. *Erethistoides sicula*, a new catfish (Teleostei: Erethistidae) from India. *Zootaxa* 1021:1-12.
- Ng, H.H., 2005. *Glyptothorax botius* (Hamilton, 1822), a valid species of catfish (Teleostei: Sisoridae) from northeast India, with notes on the identity of *G. telchitta* (Hamilton, 1822). *Zootaxa* 930:1-19.
- Pethiyagoda, R., 1991. Freshwater fishes of Sri Lanka. The Wildlife Heritage Trust of Sri Lanka, Colombo. 362 p.
- Pethiyagoda, R., M. Meegaskumbura and K. Maduwage, 2012. A synopsis of the South Asian fishes referred to *Puntius* (Pisces: Cyprinidae). *Ichthyol. Explor. Freshwat.* 23(1):69-95.
- Rahman AKA. 2005. Freshwater Fishes of Bangladesh (Second edition). The Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka-1000, p.394.

Singh, Saini, Samanta & Verma

- Rahman, A.K.A., 1989. Freshwater Fishes of Bangladesh, 1st edition, Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka-1000.
- Rahman, A.K.A., 2005. Freshwater Fishes of Bangladesh, 2nd edition, Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka-1000, pp.
- Roberts, T. R., 1997. Systematic revision of the tropical Asian labeo in cyprinid fish genus *Cirrhinus*, with descriptions of new species and biological observations on *C. lobatus*. Natural History Bulletin of the Siam Society 45(2): 171-203.
- Roberts, T.R., 1994. Systematic revision of tropical Asian freshwater glassperches (Ambassidae), with descriptions of three new species. Nat. Hist. Bull. Siam Soc. 42:263-290.
- Talwar, P.K. and A.G. Jhingran, 1991. Inland fishes of India and adjacent countries. Vol. 1. A.A. Balkema, Rotterdam. 541 p.
- Talwar, P.K. and A.G. Jhingran, 1991. Inland fishes of India and adjacent countries. Vol. 2. A.A. Balkema, Rotterdam.
- Vishwanath, W. and Shantakumar, M., 2007. Fishes of the genus *Osteobrama* Heckel of northeastern India (Teleostei: Cyprinidae). Zoos' Print J. 22 (11):2881-2884.
- <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>
- <https://en.bdfish.org/>
- <https://www.fishbase.se/>

