

# Freshwater Fish biodiversity of Indrapuri Dam, Rohtas, Bihar.

Babita Sharma<sup>1\*</sup>, Ambiya Khatoon<sup>1</sup>, Manoj Kumar Jaiswal<sup>2</sup>

<sup>1</sup>Zoology Department, Patna Science College, Patna University, Patna 800005, Bihar, India

<sup>2</sup>Zoology Department, C.M.P. Degree College, University of Allahabad, Prayagraj, Uttar Pradesh, India

## Abstract

This study focuses on freshwater fish biodiversity of a dam, a topic of great interest and importance in ecology and conservation biology. Complex interactions between the physical and ecological factors of dam environments can dramatically impact the fish populations they support. Dams alter the flow regime, reduce access to habitats, change water temperatures, and may introduce pollutants, all of which can lead to changes in freshwater fish populations. Dams can also be a source of novelty environments that host unique species assemblages, including the introduction of exotic species and the creation of novel habitats, such as rivers being converted into reservoirs or dams creating warm water outlets. Effective management practices, including the restoration of habitat connectivity and focusing on conservation efforts, can positively impact fish populations in dam environments, enhance the fish biodiversity, and help to preserve and restore the natural environment. Our biodiversity study summarizes the work done in this direction till date on Indrapuri Dam of Rohtas district in Bihar, India along with its comparison to data collected by us. Our aim here is to know how diversity is changing in this dam over the years. We found 41 freshwater fish species in this dam belonging to 19 families and 10 orders in this study as compared to 25 fish species belonging to 12 families and 5 orders reported 7 years back. In comparison to previous studies we found an increase in biodiversity of fishes in the dam.

**Key words:** Freshwater fish biodiversity, Anthropogenic effects and Indrapuri dam.

## Introduction

Dam pose threats to freshwater fish biodiversity in various ways as other factors like global warming. Impact of dams is way more than any other factors and is predictable and pressing on fishes [1]. It is important to take care of our water bodies in order to sustain the needs of our growing population. We use water for different purposes like irrigation, human consumption, industrial consumption and more. Most of these activities reduce the quality of our water bodies. Our study area for this study is the Indrapuri Barrage (also known as the Sone Barrage) which spans the Sone River in Rohtas district of Bihar. It is world's 4th largest barrage measuring 1,407 meters (4,616 feet) in length. The Sone River flows east-northeast through Uttar Pradesh, Jharkhand, and Bihar and finally joins the river Ganges before Danapur, Patna. It's construction began in the 1960s and was completed in 1968. Anicut over the Sone at Dehri was built in 1873-74, making it one of the country's oldest irrigation systems. Fishes are the keystone species of ecosystems that help in determining the distribution and diversity of other creatures. They are excellent markers of the ecosystem's health and water quality. Our country has a diverse fish biodiversity with over 2,200 fish species, and

is ranked ninth in terms of freshwater mega biodiversity [2] and a large amount of freshwater fish output still relies on wild population catch [3]. 11% of total 21730 fish species are found in Indian waters [4]. Scientific description of 24,600 extant fish species are available and they are divided into 482 families and 57 orders [5]. The initial evaluation, classified 46 freshwater fish species as endangered in India [6], the second review covered 320 freshwater fish species, with 43 being classified as severely endangered, 90 as endangered, and 81 as vulnerable [7]. Meanwhile, a recent evaluation for central India (Madhya Pradesh, Chhattisgarh, and Rajasthan) found 168 fish species, 41 of which were classified as endangered (24.40 %) [8]. All this data indicates towards the deteriorating quality of water which ultimately leaves the freshwater fishes vulnerable. We aim to find out how biodiversity in Indrapuri Dam area is changing through the years.

## Methodology

Conserving fish species is possible only after identifying them correctly. For identifying correct scientific names web resources like Fish Base ([www.fishbase.org](http://www.fishbase.org)) and Eschmeyer Catalog of Fishes were used. Following types of characters were taken into consideration:

---

\*Correspondence to: Babita Sharma, Zoology Department, Patna Science College, Patna University, Patna 800005, Bihar, India, E-mail: babita2005@gmail.com

Received:-03-Dec-2023, Manuscript No. aajfr-23-125143; Editor assigned:04-Dec-2023, PreQC No. aajfr-23-125143(PQ); Reviewed:18-Dec-2023, QC No.aajfr-23-125143;

Revised: 22-Dec-2023, Manuscript No. aajfr-23-125143(R); Published: 31-Dec-2023, DOI: 10.35841/aajfr-7.6.177

---

**Morphological Characters:** Refer to the physical features of an organism that are related to its form, structure and appearance. These characteristics include aspects such as body shape, size, coloration, presence of appendages or organs and other observable physical attributes [9,10].

**Morphometric Characters:** Refer to the quantitative measurements which were measured by calipers or rulers.

**Meristic Characters:** Are quantitative traits that describe the countable features of an organism. 1. Number of fin rays: Different species have specific number of rays in their fins (dorsal fin, pectoral fins, and anal fin). These numbers can vary between individuals and populations, but they are typically consistent within a species. 2. Number of vertebrae: The number of vertebrae is another meristic characteristic used to differentiate between fish species. This count can vary between species and can be used as an identification feature. 3. Number of gill rakers: different species have a specific number of gill rakers on their gill arches. These structures help filter food particles from the water. 4. Number of scales: The number of scales along the lateral line or on the body is another meristic character that can vary between individuals and populations. These meristic characteristics, along with the morphological characteristics mentioned earlier, help researchers differentiate between and understand the unique traits of each species [11-13].

**Descriptive Characters:** Are used to describe the physical appearance, coloration, shape of the body, presence or absence of certain fins, color patterns, scales, and other distinctive features (Figure-1).

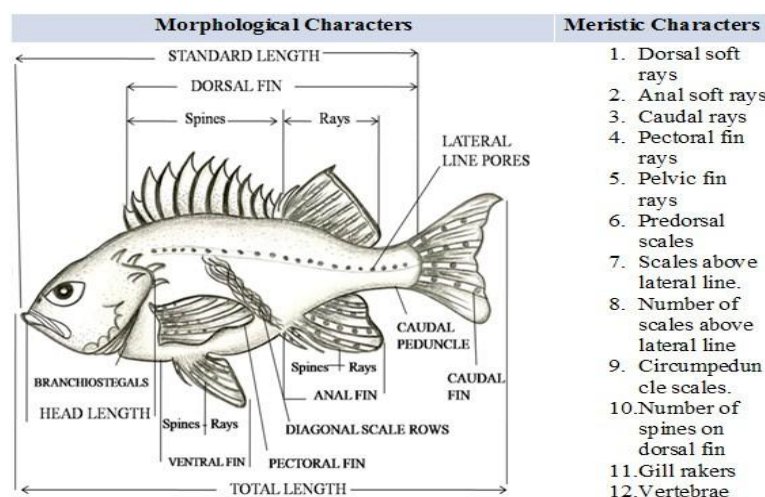
### Fish diversity of Indrapuri Dam

Though fishes include Agnatha (jawless fishes), Chondrichthyes (Sharks and Rays), Sarcopterygii (lobe finned fishes) and Actinopterygii (the bony or Ray finned fishes) we will focus on freshwater bony fishes only. Out of total

32500 marine and freshwater species, 11952 are freshwater (Helfman et. al. 2009). Any discrepancies in naming and classification were dealt by International Commission on Zoological Nomenclature (ICZN). The purpose of this study is to determine the current state of freshwater fish biodiversity of the Indrapuri Dam, Bihar, India. Earlier studies suggest that Indrapuri Dam had 25 fish species belonging to 12 families and 5 orders [14, 15]. We found more species that we are adding here. We did identification and morphological characterization of the 10 orders, 19 families and 41 freshwater fish species that are found in the dam. All these fishes are bony fishes belonging to class Osteichthyes. Further they are members of subclass Actinopterygii, commonly known as ray finned fishes. They comprise 50% of the living vertebrates. 99% fishes belong to this subclass and infraclass Teleostei, commonly known as bony fishes. The table below represents classification of the freshwater fishes we found in Indrapuri dam (Table -1).

### Order 1: Siluriformes

Fishes of this order are generally known as catfishes. Most species of this order have a flattened head and wide mouth with bony plates instead of teeth. They typically have smooth, scaleless skin, although some have bony plates or spines embedded in their skin. Nearly all species have some form of barbels or sensory organs around their mouth which they use to locate food. Catfishes are primarily freshwater fishes, although some species live in brackish or saltwater habitats [16, 17]. Many catfish species are important food fish and are cultivated in fisheries around the world. Some also have a reputation for being nocturnal scavengers and can be found in aquariums. Some catfish can grow to very large sizes, such as the Mekong giant catfish, which is one of the largest freshwater fish in the world, weighing up to 600 pounds. We found 14 fish species belonging to 7 families from this order in the selected sites of Indrapuri Dam (Table-2).



**Figure 1:** (A) Represents the morphological characters that are used for identification and characterization of fishes. Morphological characters tell us about the aspects of body form. Given above is a sample diagram that introduces us to all standard terms related to morphological identification. (B) represents meristic characters used for identification and characterization of fishes. Meristic characters tell us about the serially repeated and countable traits. Given above is a sample diagram that introduces us to all standard terms related to morphological and meristic characters for fish identification.

**Citation:** Sharma B, Khatoon A, Jaiswal M. Freshwater Fish biodiversity of Indrapuri Dam, Rohtas, Bihar. *J Fish Res.* 2023;7(6):177

**Table 1:** Types of fish species found in Indrapuri Dam. The table represents the freshwater bony fishes that were found in the dam. We found fishes belonging to 10 orders (Siluriformes, Symbranchiformes, Perciformes, Cypriniformis, osteoglossiformes, Anguilliformes, Clupeiformes, Anabantiformes, Gobiiformes and Beloniformes), 19 families and 41 species.

Summary of the 41 species of fishes found in Indrapuri Dam, Bihar, India.				
	Orders = 10	Families = 19	S.No.	Name of fishes = 41
ACTINOPTERYGII	1.Siluriformes	A. <i>Bagridae</i>	1 - 3	<i>Mystus bleekeri</i> , <i>Mystus tengara</i> , <i>Rita rita</i>
		B. <i>Clariidae</i>	4	<i>Clarias batrachus</i>
		C. <i>Erethistidae</i>	5	<i>Hara jerdoni</i>
		D. <i>Heteropneustidae</i>	6	<i>Heteropneustes fossilis</i>
		E. <i>Pangasiidae</i>	7	<i>Pangasius pangasius</i>
		F. <i>Siluridae</i>	8-9	<i>Ompak bimaculatus</i> , <i>Wallago attu</i>
		G. <i>Schilbeidae</i>	10 -14	<i>Ailia colia</i> , <i>Clupisoma garua</i> , <i>Clupisoma montana</i> , <i>Eutropiichthys vacha</i> , <i>Silonia silondia</i>
	2.Synbranchiformes	H. <i>Mastacembelidae</i>	15	<i>Mastacemelus pancalus</i>
	3.Perciformes	I. <i>Channidae</i>	16	<i>Channa punctatus</i>
		J. <i>Ambassidae</i>	17	<i>Elongate glassy perchlet</i>
		K. <i>Chichlidae</i>	19	<i>Oreochromis niloticus</i> , <i>O. mossambicus</i>
	4.Osteoglossiformes	L. <i>Notopteridae</i>	20	<i>Notopterus notopterus</i>
	5. Cypriniformes	M. <i>Cyprinidae</i>	21 - 35	<i>Amblypharyngodon microlepis</i> , <i>Chagunius chagunio</i> , <i>Esomus danricus</i> , <i>Labeo angara</i> , <i>Labeo bata</i> , <i>Labeo rohita</i> , <i>Megarasbora elonga</i> , <i>Barilius barna</i> , <i>Chela cachius</i> , <i>Puntius sophera</i> , <i>Osteobrama cotio</i> , <i>Raiamas guttatus</i> , <i>Puntius chola</i> , <i>Cirrhinus reba</i> , <i>Cyprinus carpio</i> .
		N. <i>Cobitidae</i>	36	<i>Lepidocephalichthys guntea</i>
6. Anguilliformes	O. <i>Anguillidae</i>	37	<i>Anguilla bengalensis</i>	
7. Clupeiformes	P. <i>Clupeidae</i>	38	<i>Gudusia chapra</i>	
8. Anabantiformes	Q. <i>Osphronemidae</i>	39	<i>Trichogaster labiosa</i>	
9. Gobiiformes	R. <i>Gobiidae</i>	40	<i>Glossogobius giuris</i>	
10. Beloniformes	S. <i>Belontiidae</i>	41	<i>Strongylura fluviatilis</i>	

#### A. Family: *Bagridae*

It is a family of catfishes found in both freshwater and brackish water habitats. Most members of are native to Asia, but some species are also found in Africa. They have smooth, scaleless skin that is often slimy or mucous-covered. Often, they have a long adipose fin that extends along the length of their body, from just behind the dorsal fin to the caudal fin [18-20]. Another distinctive feature of Bagrid catfish is the presence of a bony plate on their pectoral fin spine, which they use for defense against predators [21]. They are typically bottom-dwelling fishes, using their sensitive barbels to locate prey, and preying on a variety of small invertebrates and fish [22]. Many species of Bagrid catfish are popular food fish, and are also kept as aquarium fish due to their typically hardy nature. Bagrid catfishes are commonly known as naked catfishes as they are devoid of scales. Omnivorous, easy to rear and not fussy as eaters. Larger ones are used as food mainly and sometimes kept as aquarium fishes. *Mystus* name was derived from word *Mystax* meaning "whiskered" used by Belon in 1553 to describe all fishes with whiskers. These whiskers/barbels that are four in number are covered by a layer of taste bud enriched epithelium. We found following fishes belonging to this family in our dam [23, 24].

**Species 1:** *Mystus bleekeri*, commonly known as the Bleeker's catfish or Blue eye catfish, is a species of catfish belonging to the family Bagridae. These fishes are found in rivers, streams, and lakes throughout Southeast Asia, including India, Nepal, Myanmar, and Thailand. The body of *Mystus bleekeri* is elongated and slender, with a silvery white coloration. They have a prominent adipose fin that extends almost all the way to

the base of the tail. The eyes of this species are a striking blue color, which is where they get the common name "*Blue Eye Catfish*." *Mystus bleekeri* are hardy and adaptable fish. They typically grow to be around 6-8 inches in length when kept in captivity. They need plenty of hiding places and a varied diet to stay healthy. They are also known for being sociable and often do well in groups.

**Species 2:** *Mystus tengara*, locally known as Singora is a freshwater striped catfish having high nutritional value. This fish is cultured by small scale fishermen these are oviparous and eat aquatic invertebrates and small fishes. These fish are found in freshwater habitats throughout South Asia, including Bangladesh, Myanmar and northeastern India. *Mystus tengara* gets its name from the Bengali word "tanager," which means the pattern of bricks on a wall, as it has a mottled brick-red coloration on its body. They have a relatively slender body shape, with a slightly forked tail and stout barbels. They also have a long adipose fin, which is a distinguishing feature of catfish. These fish are primarily bottom-dwellers, where they feed on a variety of invertebrates, small fish, and plant matter. *Mystus tengara* is known to be a hardy species, which is why it is popular in the aquarium trade. In captivity, it reaches a maximum size of around 16 cm (6 inches). The lifespan of these catfish can vary but it is typically around 8-10 years [25-28].

**Species 3:** *Rita rita*, a fresh water, brackish and demersal fishes living close to the floor of the water body. They are sluggish and bottom dwelling fishes that feed on small fishes, crustaceans, insect as well as on decaying organic matter. *Rita rita*, also known as the Rita catfish or Rita pabo, is a species

of catfish belonging to the family *Bagridae*. These fish are found in freshwater systems throughout South Asia, including the Ganges-Brahmaputra river basin. The body of *Rita rita* is elongated and cylindrical, with a brownish-black coloration and lighter colored undersides. They have a large head with prominent, barbels, and a distinctly "cat-like" appearance. They are also known for their sharp, serrated spines, located on their pectoral fins, which can be used for defense [29]. These catfish are primarily bottom-dwellers and feed on a variety of aquatic invertebrates, small fish, and plant matter other small aquatic animals. They inhabit fast-flowing streams and can tolerate a wide range of water conditions. In captivity, *Rita rita* can grow up to 65 cm (26 inches) in length. *Rita rita* is prized for its meat and is an important food source for many communities living in the regions where they are found [30, 31]. They are also sometimes kept in aquariums, but due to their large size, they require a very large tank that can accommodate their active swimming lifestyle.

### B. Family: *Clariidae*




These fishes are capable of taking oxygen directly from the air by the help of their Labyrinth organ. Found in fresh water rivers, muddy water canals and ditches. *Clariidae* is a family of freshwater catfish commonly known as the air-breathing catfish or the walking catfish [32]. They are found in freshwater systems throughout Southeast Asia, Africa, and parts of the Middle East. One of the distinguishing features of the *Clariidae*

family is the presence of a lung which allows them to breathe air, using a modified swim bladder. This adaptation allows them to survive in poorly oxygenated or stagnant waters and even survive out of water for short periods. *Clariidae* catfish have a narrow, elongated body with a large, flattened head and a pair of long, barbels protruding from their mouths. They have an assortment of different color patterns ranging from light to dark brown, with spotty, blotchy, or striped scales. These catfish are primarily nocturnal, and they feed on insects, crustaceans, and small fishes [33, 34]. They can also survive on plant matter and detritus when their primary food source is scarce. In captivity, many species of *Clariidae* are quite popular as they are hardy and do well in aquariums. They are also used for food, particularly in Southeast Asia. We found only *Clarias batracus* from this family in our dam (Figure-2).

**Species 4:** *Clarias batracus*, commonly known as the walking catfish or the freshwater catfish, is a species of air-breathing catfish belonging to the family *Clariidae*. They are found in freshwater systems throughout Southeast Asia and parts of South Asia. *Clarias batracus* doesn't actually "walk" on its fins, but is capable of wriggling its way across land using its long body and strong muscles to navigate and climb over obstacles. They are primarily nocturnal bottom feeders, feeding on a wide range of foods including insects, crustaceans, small fish, and plant matter. The body of *Clarias batracus* is elongated, with a flattened head, long barbels, and

**Table 2:** Table represents a comparative account of 5 families of order Siluriformes that we found in Indrapuri Dam. *Mystus bleekeri*, *Mystus tengara* and *Rita rita* were the three members found belonging to family *Bagridae*, *Clarias batracus* from family *Clariidae*, *Hara jerdoni* from family *Erethistidae*, *Heteropneustes heteropneustes* from family *Heteropneustidae* and *Pangasius pangasius* from family *Pangasiidae* were found. Table shows comparative pH, Temperature, habit and length of fishes along with International Union for Conservation of Nature (IUCN) status of fishes mentioned as EN, Endangered; VU, Vulnerable; NT, Near threatened; LRnt, Low risk near threatened; NA, Not assessed and LC, Least concerned.

Order 1. Siluriformes (Part 1)						
Family 1-5: <i>Bagridae</i> (e.g. <i>Mystus</i> , <i>Rita</i> ), <i>Clariidae</i> (e.g. <i>Clarius</i> ), <i>Erethistidae</i> (e.g. <i>Hara</i> ), <i>Heteropneustidae</i> (e.g. <i>Heteropneustes</i> ), <i>Pangasiidae</i> (e.g. <i>Pangasius</i> ). IUCN status of all these fishes is least concerned (LC).						
Fish Name (IUCN status)	Local Name	pH	Temp	Feeding habits	Life years	Length in cm
<i>Mystus bleekeri</i> (LC)	Palwa, Kander, Keongar	5.8 - 8.0	18 - 26	Omnivorous, Oviparous	1.5 - 4.4	15.5
<i>Mystus tengara</i> (LC)	Tengra, Singarah	6.5 - 7.2	22 - 28	Omnivorous, Oviparous	4 - 5	15
<i>Rita rita</i> (LC)	Ritha	6.5 - 8.0	18 - 26	Demersal Fish, Omnivorous	4 - 5	150
<i>Clarius batracus</i> (LC)	Mangur Walking Catfish	5.5 - 8.0	20 - 26	Omnivorous	15 - 16	47 - 50
<i>Hara jerdoni</i> (LC)	Indian stone Fish, Sylhet hara	5.6 - 7.6	18 - 24	Omnivorous, Nocturnal	5	4
<i>Heteropneustes fossilis</i> (LC)	Stinging Catfish, Singhi	6.0 - 8.0	21 - 25	Omnivorous, Carnivorous	17.5	30
<i>Pangasius pangasius</i> (LC)	Pangus, Pariasi	6.0 - 7.5	23 - 28	Potamodromous, Herbivorous	10 - 15	300

Fish Family	Fish name	Fish Picture
A. <i>Bagridae</i>	1. <i>Mystus bleekeri</i>	
	2. <i>Mystus tengara</i>	
	3. <i>Rita rita</i>	

**Figure 2:** Figure represents the members of order Siluriformes and family *Bagridae*. We found three catfishes in the dam belonging to family *Bagridae*, namely *Mystus bleekeri*, *Mystus tengara* and *Rita rita*.

**Citation:** Sharma B, Khatoon A, Jaiswal M. Freshwater Fish biodiversity of Indrapuri Dam, Rohtas, Bihar. *J Fish Res.* 2023;7(6):177

a pair of sharp spines located behind the pectoral fins. They have uniform brownish-grey coloration and are covered in small scales. In captivity, they are hardy and generally easy to care for, and as a result, are popular in the aquarium trade [35]. However, they require a mature tank with plenty of hiding places and good water quality. They grow quickly and can reach up to two feet in length, needing plenty of space to swim as adults. In some parts of Southeast Asia, *Clarias batrachus* are considered a delicacy and are farmed for their meat, while in other places they are actually considered an invasive species [36]. Complete mitochondrial genome is available for this endangered fish [37].

#### C. Family: *Erethistidae*

The Family Erethistidae is a group of freshwater catfishes that are native to Asia. They are small to medium-sized fish with a flattened head and body. Some species have long spines on their fins for protection from predators, and many have a distinctive pattern of stripes or spots on their bodies [38]. These fish are popular among aquarium enthusiasts because of their unique appearance and interesting behavior. They are also valued by some cultures as a food source. We found one species from this family that is *Hara jerdoni*.

**Species 5 :** *Hara jerdoni* is a small fish with a lifespan of around 5 years. Shy and docile by nature and lives in the slow moving waters with soft pebble substratum. Their food includes bloodworms and daphnia. It is also known as the Asian Stone Catfish. Small freshwater catfish species that is native to parts of Asia, including India, Bangladesh, and Myanmar. They have a dark brown to black body with lighter spots that can help them blend into their natural environment. It is known to be a peaceful fish that can be kept in community aquariums with other small fish species. They prefer a well-planted tank with plenty of hiding places, and they can be fed a variety of foods including flakes, pellets, and frozen and live foods [39-41].

#### D. Family: *Heteropneustidae*

Heteropneustidae is a family of catfish species that are found in freshwater habitats in Asia and Africa. They are commonly referred to as air-breathing catfishes, due to their specialized ability to breathe air using a primitive lung in addition to their gills. The family includes about 52 species in 9 genera. They are generally small to medium-sized fish, with most species reaching less than 30 cm in length. Some of the more well-known species include the Indian catfish (*Heteropneustes fossilis*) and the walking catfish (*Clarias batrachus*). Air breathing catfishes typically inhabit slow-moving streams, ponds, and swamps, and they feed on insects, small crustaceans, and other small aquatic creatures [42]. They are also sometimes kept as aquarium fish due to their unique behavior and adaptation to breathing air.

**Species 6:** *Heteropneustes heteropneustes* feed mainly on small crustaceans and worms. Found in ponds, ditches, muddy waters, swamps and marshes are the airspace catfishes. These fishes show an elongated and compressed body type. Their heads are depressed specifically. They are called airspace catfishes for they have large air sacs that function like a lung.

These fishes are dangerous as their pectoral fins have an associated poison gland [43, 44].

#### E. Family: *Pangasiidae*





The Pangasiidae family of fish, commonly known as catfish, is a group of freshwater fishes found primarily in Southeast Asia. These fish are known for their whisker-like barbels that help them navigate the murky waters they inhabit. They come in various sizes and colors, with some growing up to 10 feet long. Some popular species include the *Pangasius hypophthalmus*, also known as the iridescent shark, and the *Pangasianodon gigas*, nicknamed the giant pangasius. Overall, these fish are an important food source for many people and play a significant role in their respective ecosystems [45, 46].

**Species 7:** *Pangasius pangasius*, also known as the Pangas catfish or Vietnamese sutchi catfish, is a freshwater fish that belongs to the family Pangasiidae. It is native to Southeast Asia, where it is a popular food fish. It is a relatively small fish, growing up to around 30 inches in length and weighing around 4 pounds. The Pangas catfish feeds mainly on small fish, crustaceans, insects, and other small aquatic animals (Figure-3). It is an important species for the aquaculture industry due to its fast growth rate, resistance to disease, and high tolerance to a wide range of environmental conditions. However, it is also considered an invasive species in some areas where it has been introduced. These are obligate air breathing fishes reared for consumption. Mainly herbivorous in nature. Their flesh is sweet and fine grained considered of good quality. Complete mitochondrial genome sequence is available for this endangered fish [47].

#### F. Family: *Schilbeidae/Aiilidae*

Fish belonging to the family Schilbeidae are commonly known as schilbeid catfishes, or simply schilbeids. These fish are a diverse group found in freshwater habitats throughout Africa and Asia. There are over 80 species in the family, and they vary widely in size and habits. Schilbeid catfish are mostly nocturnal, and they are often found in fast-moving water. Many species are predatory and feed on small fish, while others are omnivorous. Some of the larger species are important food fish, while smaller species are kept in aquaria. Schilbeids are characterized by their long dorsal and anal fins, which often have several finlets between them. They typically have slender bodies and wide, flattened heads with long, barbels around their mouths [48]. Some of the more interesting species in the family include the African buttercatfish, the dwarf African catfish, and the clown catfish.

**Species 8:** *Ailia colia*, also commonly known as Gangetic Ailia or Ailia fish, is a freshwater fish species belonging to the family Osteoglossidae. It is found primarily in the rivers and estuaries of India, Pakistan, Bangladesh, and Myanmar. The fish can reach up to 30 cm in length and is usually silver with a curved head and small, sharp teeth. *Ailia colia* is an important food fish in many areas of its distribution, where it is often caught using traditional fishing methods like gill nets, cast nets, and traps. In addition to its economic value, the species is also used for research purposes because of its phylogenetic importance. Like many other freshwater fish

Fish Family	Fish name	Fish Picture
B. Clariidae	4. <i>Clarias batracus</i>	
C. Erethistidae	5. <i>Hara jerdoni</i>	
D. Heteropneustidae	6. <i>Heteropneustes fossilis</i>	
E. Pangasidae	7. <i>Pangasius pangasius</i>	

**Figure 3:** Figure represents other members of order Siluriformes. Members from three more families. *Clarias batracus* belongs to family Clariidae, *Hara jerdoni* belongs to Erethistidae, and *Heteropneustes fossilis* belongs to Heteropneustidae.

species, *Ailia colia* currently faces the threat of overfishing, habitat destruction, and pollution [49]. As a result, many organizations and individuals are working to ensure the long-term conservation of this endangered species and its ecosystem. Lifespan of 1.4 - 4.4 years.

**Species 9:** *Clupisoma garua* are fresh and brackish water fishes that inhabit rivers and large freshwater bodies. Bottom dwelling fishes that feed on insect, shrimps and small fishes. *Clupisoma garua* is a freshwater fish species that belongs to the *Schilbeidae* or *Aillidae* family. It is commonly found in slow-moving rivers, streams, and flood plains in the Indus, Ganges, and Brahmaputra river basins of South Asia (Table-3). Some general characteristics of *Clupisoma garua* fish include a cylindrical-shaped body that is elongated and compressed, with a smooth skin covered with slime. It has a small head and small eyes, and its mouth is located ventrally with no barbels. The fish has 4 to 5 pairs of gill slits that are crescent-shaped and wide. The dorsal fin extends from behind the head to the tip of the tail and has a deeply forked caudal fin. The fish is usually dark brown in color and can grow up to 25 cm in length [50-53].

**Species 10:** *Clupisoma montana* is a freshwater fish found in slow-moving rivers, streams, and ponds in certain parts of South Asia, particularly in the streams of Myanmar and the middle parts of the Irrawaddy River basin. This fish is also known as the Mountain Goonch or Squid Catfish and has a similar body shape to *Clupisoma garua* as well with a smooth skin covered with slime. The Squid Catfish has a flattened head and narrower body profile than *Clupisoma garua* and can grow up to 50 cm in total length [54,55]. The distinguishing feature of *Clupisoma montana* is its round lamellae that pierce the skin along the margins of the pectoral fin base in males, which is not present in its close relative, *Clupisoma garua*. Overall, both *Clupisoma garua* and *Clupisoma montana* are interesting species of freshwater fish with unique characteristics.

**Species 11:** *Eutropiichthys vacha* is pelagic and Potamodromous fish that feeds on small fish and insects. This fish is climate sensitive and can be used to study effect of climate change. *Eutropiichthys vacha* is another freshwater fish species that belongs to the family *Schilbeidae* and is

found in South and Southeast Asia, particularly in the Ganges, Brahmaputra, and Mekong river basins. This fish has an elongated and cylindrical-shaped body, with a pointed head and a small mouth. It has a single dorsal fin that is located closer to the tail and a deeply forked caudal fin. Its skin is covered with smooth scales [56]. The color of *Eutropiichthys vacha* is usually gray or brown with golden or silver reflections on the sides and belly. It can grow up to 50 cm in length and has an important role in the freshwater ecosystem by feeding on insects, crustaceans, and smaller fishes. *Eutropiichthys vacha* is also an important fish for commercial and subsistence fishery, particularly in Bangladesh and India, where it is caught and processed for local and regional markets [57-59].

**Species 12:** *Silonia silondia* also known as Silond catfish, is a demersal fish that inhabit rivers, shoals. Bottom dwellers and carnivorous by nature that feed on animal based food including small fishes, crustaceans, insects, molluscs and plants materials (Figure-4). This fish is found in India, Bangladesh, Pakistan and Nepal. It can grow up to 72 inches or 183cm. During breeding season the adults migrate from estuaries into large rivers during monsoon season. As water level decreases they get stranded in small pools [60].





#### G. Family: *Siluridae*

The *Siluridae*, also known as the siluroid catfishes, are a family of freshwater catfishes. Size of these catfishes vary greatly and can range from small, 10 cm (4 in) in species like *Amblyceps mangois* to larger 2 m (6 ft 7 in) species like the giant Mekong catfish (*Pangasianodon gigas*). Appearance varies significantly between species, many have cylindrical, eel-like body shape and smooth and scaleless skin. They also have a protective covering of bony plates along the head and upper body. Most Silurids are nocturnal and typically feed on live or decaying fish, insects and other invertebrates. Found in freshwater habitats on every continent with the exception of Australia and Antarctica. Importance: Many species are important food fishes in some regions of the world such as the Mekong, while others are kept as pets or used as ornamentation in a home aquarium [61, 62].

**Species 13:** *Ompok bimaculatus*, also known as the butter catfish, is a species of freshwater catfish found in rivers and

**Table 3:** Table given below represents the members of order Siluriformes. Members from three more families. *Ailia colia*, *Clupisoma garua*, *Clupisoma montana*, *Eutropiichthys vacha* and *Silonia silonia* belongs to family Schilbeidae, and *Ompok bimaculatus* and *Wallago attu* belongs to family Siluridae. Table shows comparative pH, Temperature, habit, lifespan and length of fishes. International Union for Conservation of Nature (IUCN) status of fishes mentioned as EN, Endangered; VU, Vulnerable; NT, Near threatened; LRnt, Low risk near threatened; NA, Not assessed and LC, Least concerned.

Order 1.Siluriformes (Part 2)						
Family 6-7: Schilbeidae (e.g. <i>Ailia</i> , <i>Clupisoma</i> , <i>Eutropiichthys</i> , <i>Silonia</i> ) and Siluridae (e.g. <i>Ompok</i> , <i>Wallago</i> ). IUCN status of most least concerned (LC), <i>Ompok</i> is near threatened (NT) whereas <i>Wallago</i> is Vulnerable (VU)						
Fish Name (IUCN status)	Local Name	pH	Temp	Migration	Life in years	Length in cm
<i>Ailia colia</i> (NT)	Ailia , Kajoli , Batasi, Bahpati	6.5 - 7.2	22 - 24	Diadromous	1 - 4.5	15 - 30
<i>Clupisoma garua</i> (LC)	Guarchcha ,Garua bachcha	6.5 - 7.2	15 - 20	Potamodromous , Demersal	4.5 - 14	61
<i>Clupisoma montana</i> (LC)	Kocha garua	6.5 - 7.2	15 - 20	Potamodromous , Demersal	4.5 - 14	29
<i>Eutropiichthys vacha</i> (LC)	Batchwa bacha River catfish	6.5 - 7.2	24	Potamodromous , Pelagic	2.73	34 - 40
<i>Silonia silonia</i> (LC)	Silonia vacha	6.5 - 7.2	23 - 26	Benthic , Carnivorous	1.4 - 4.4	80 - 100
<i>Ompok bimaculatus</i> (NT)	Butter catfish , Chechera	6.0 - 8.0	20 - 26	Demersal	1.4 - 4.5	45
<i>Wallago attu</i> (VU)	Boyal , Boyari	6.0 - 7.6	19 - 29	Demersal , Potamodromos Carnivorous	10	75 - 240

Fish Family	Fish name	Fish Picture
F. Schilbeidae/ Ailiidae	8. <i>Ailia colia</i>	
	9. <i>Clupisoma garua</i> 10. <i>C. montana</i>	
	11. <i>Eutropiichthys vacha</i>	
	12. <i>Silonia silonia</i>	

**Figure 4:** Figure represents the members of order Siluriformes. *Ailia colia*, *Clupisoma garua*, *Clupisoma montana*, *Eutropiichthys vacha* and *Silonia silonia* belongs to family Schilbeidae, and *Ompok bimaculatus* and *Wallago attu* belongs to family Siluridae. Column one represents the name of the family. Second represents name of species whereas pictures of the fishes are shown in the right most column.



streams throughout Southeast Asia. Adults can reach up to 30 centimeters or 12 inches in length. Their appearance is brownish-grey in color with two distinct black spots on their backs (hence the name “*bimaculatus*”). Nocturnal and usually found hiding under rocks or submerged logs during the day. They feed on small fish insects, and crustaceans. They can live up to 10 years in captivity. Economically important food fish in Southeast Asia. Complete genome sequence is available [63, 64].

**Species 14:** *Wallago attu*, also known as the *Wallago* catfish, is a species of freshwater catfish found in South and Southeast Asia. Adults can reach up to 180 centimeters (6 feet) in length and 40 kilograms (90 pounds) in weight. Olive brown to dark brown in colour with a streamlined, eel-like body shape and uniform fins along the belly. They have sharp, serrated spines on their pectoral and dorsal fins. By nature they are predatory carnivores that feed on fish, crustaceans and other aquatic organisms. They are known to migrate long distances between rivers and reservoirs and prefer large, deep rivers and lakes with muddy or sandy bottoms. An important food fish in many parts of South and Southeast Asia, and also popular

among recreational anglers for their size and fighting ability (Figure -5).

## Order 2: Symbranchiformes

They are a group of primarily freshwater fish that are found in tropical and subtropical regions. Members of this group have elongated bodies that are eel-like in appearance. They possess a reduced or absent dorsal fin, and a caudal (tail) fin that is either well-developed or absent altogether. *Symbranchiformes* have a well-developed sense of smell and a secondary olfactory organ, called the vomeronasal organ, which is used to detect chemicals in the water. They are mostly nocturnal and feed on small animals that they find on or in the substrate and in the water column. *Symbranchiformes* have adapted to poorly-oxygenated waters by developing an accessory breathing organ called the supra-branchial organ that allows them to breathe air. They belong to a group of fish known as the bony-tongues, which also includes the *Arapaimidae* (arapaimas) and the *Osteoglossidae* (arowanas) [65-67].

Fish Family	Fish name	Fish Picture
G. Siluridae	13. <i>Ompok bimaculatus</i>	
	14. <i>Wallago attu</i>	

**Figure 5:** Figure represents the members of order Siluriformes. Members *Ompok bimaculatus* and *Wallago attu* belong to family Siluridae. Column one represents the name of the fish family. Second column represents name of fish species whereas pictures of the respective fishes are shown in the right.

#### H. Family: *Mastacembelidae*

They are a family of freshwater fish, also known as spiny eels, found primarily in freshwater habitats in Africa and Asia. Members of this family are elongated, serpent-like fishes that lack pelvic fins. Mastacembelids are generally nocturnal and feed on small invertebrates and fish as they move along the substrate [68, 69]. They possess a specialized sense organ known as the rostral organ, which is used to detect weak electric fields generated by prey. Some species possess large, spiny projections on their dorsal fin, which can be used for defense or as a display mechanism. Mastacembelids have lung-like structures for oxygen exchange, and some species have been observed to emerge from the water entirely to gulp air. They are popular aquarium fish due to their unique appearance and interesting behavior patterns [70-73].

**Species 15:** *Mastacembalus pancalus*, also known as the Royal Spiny Eel or Zig Zag Spiny Eel, is a freshwater fish species commonly found in rivers and streams in parts of South Asia including India, Bangladesh, Nepal, and Pakistan. This long, slender fish has a serpentine-like appearance. Its body is dark brown to black, with a white to yellowish underside. It has an elongated jaw with multiple sharp teeth, and a series of spines running down its dorsal fin and tail. The Royal Spiny Eel can reach up to 60 cm (24 inches) in length, although in the aquarium it usually grows to around 30 cm (12 inches). It typically inhabits shallow, fast-moving rivers with rocky or sandy bottoms, as well as other freshwater habitats such as ponds and swamps (Table-4). The Royal Spiny Eel is a carnivorous fish, feeding mostly on small fish, crustaceans, insects, and other small aquatic animals. This species is mostly nocturnal and spends most of the day hiding under rocks, logs, or other structures in the water. It is known for its ability to move both forwards and backwards, and is a strong swimmer. It is believed to spawn during the rainy season and eggs are deposited in sand or gravel substrates [74, 75].

#### Order 3: *Perciformes*

They are the largest order of fish, containing over 9,000 known species, and are found in both saltwater and freshwater habitats across the world. Members of this order have a wide range of body shapes and sizes, but most are characterized by a flat or laterally compressed body, spiny fins, and a ctenoid or cycloid scales. Perciformes are carnivorous, with many species preying on other fish and invertebrates. They have a

range of reproductive strategies, with some species guarding their eggs and young while others have no parental care. Perciformes are highly adaptable fish, with many species able to survive and thrive in a range of environmental conditions. The group includes many popular game fish species, like bass, perch, and snappers, as well as many popular aquarium species, like cichlids, angelfish, and gobies. They are important economically and are a major source of protein for human consumption [76-78].

#### I. Family: *Channidae*

Also known as snakeheads, *Channidae* is a family of freshwater fish found primarily in Asia and Africa. Snakeheads are elongated, predatory fish with a large mouth and sharp teeth. Most species have an oblong shape with a flattened head, and some possess distinctive stripes or blotches. Members of this family are hardy and adaptable fish, able to survive in low-oxygen environments and move overland between water bodies, a trait known as air-breathing. They are carnivorous and feed on a wide variety of prey, including fish, crustaceans, and insects. Snakeheads have a well-developed sense of sight and can often be highly territorial and aggressive. Some snakeheads are popular food fish, while others are kept as aquarium fish. However, several species have also become invasive in non-native ecosystems, causing harm to biodiversity and the local economy of invaded regions [79].

**Species 16:** *Channa punctatus*, also known as the spotted snakehead is native to the Indian subcontinent, where it is found primarily in rivers, streams, and ponds. The fish has an elongated, cylindrical body with a flattened head and a large mouth filled with sharp teeth. Its body is typically olive or brownish in color, with dark brown spots covering the upper surface of the body and sides. The fish is a carnivore, feeding mainly on small fish, crustaceans, and insects. *C. punctatus* is known to be a hardy fish and can tolerate a range of environmental conditions, including low oxygen levels and high temperature. It is also a good swimmer, able to move quickly and gracefully through the water. *C. punctatus* is a popular food fish in many parts of its native range and is also kept as an aquarium fish [80, 81].

#### J. Family: *Ambassidae*

*Ambassidae* is a family of freshwater fish commonly known as the glassfish family. The body of *Ambassidae* is nearly completely transparent which allows their bones, organs, and



**Table 4:** Table given below represents the members of three orders Symbranchiformes, Perciformes and Osteoglossiformes. Members include *Mastacembelus pancalus* from family Mastacembelidae and order Symbranchiformes. *Channa punctatus* belongs to family Channidae whereas *Oreochromis niloticus* and *Oreochromis mossambicus* are from family Cichlidae. Elongate glassy perchlet belongs to family Ambassidae. All these families, Channidae, Cichlidae and Ambassidae belong to order Perciformes. Last member shown in table is *Notopterus notopterus* that belongs to family Notopteridae and order Osteoglossiformes. Table represents comparative pH, Temp, habit and length of fishes. International Union for Conservation of Nature (IUCN) status of fishes mentioned as EN, Endangered; VU, Vulnerable; NT, Near threatened; LRnt, Low risk near threatened; NA, Not assessed and LC, Least concerned.

Order 2.Symbranchiformes						
Family 8. Mastacembelidae (e.g. Mastacembelus)						
Fish Name	Local Name	pH	Temp	Migration	Life years	Length in cm
<i>Mastacembelus pancalus</i> (LC)	Gunchi ,Pankal, Turi, chirka	6 - 8	22 - 28	Local	15	11 - 18
Order 3.Perciformes						
Family 9-11. Channidae (Channa), Cichlidae (Oreochromis) and Ambassidae (glassy perchlet),						
<i>Channa punctatus</i> (LC)	Great snake head . Garai	6.8 - 7.4	22 - 28	Potamodromous ,Benthopelagic	4.5 -14	61
<i>Oreochromis niloticus</i> (LC)	Nile or Gora Tilapia	6 - 9	25 - 27	Herbivorous	9	60
<i>Oreochromis mossambicus</i> (VU)	Mozambique or Kala Tilapia	5 - 9	11 - 38	Omnivorous	11	39
<i>Elongate glassy perchlet</i> (LC)	Chanda	NA	28 - 32	Potamodromous, Carnivorous	NA	11
Order 4. Osteoglossiformes						
Family 12. Notopteridae (e.g. Notopterus)						
<i>Notopterus notopterus</i> (LC)	Bronze feather back, Moh Patra	6 - 8	20 - 28	Bottom dweller, Carnivorous	4.4	25 - 60

even muscles to be visible. Most species are small fish, usually measuring less than 15 centimeters in length. Like most fish, they possess two dorsal fins, the first being larger than the second. Predominantly freshwater habitats. Mostly found in slow-moving freshwater, such as rivers, lakes or wetlands. They are primarily carnivorous and typically feed on smaller invertebrates, including zooplankton, insect larvae and small fish. The Glassfish are popular among aquarium enthusiasts due to their striking appearance and peaceful temperament. They are also sought after for their delicacy in some regions where they are native.

**Species 17:** *Elongate glassy perchlet*, also known as Chanda nama, is a small freshwater fish found in South and Southeast Asia. These fish are known for their elongated bodies, transparent appearance, and small size which is around 11 cm. They are popular among aquarium enthusiasts due to their unique appearance, peaceful temperament, and relatively low-maintenance needs. However, some species are occasionally consumed as food in certain regions where they are native. It inhabits freshwater ponds, canals, streams, and flooded rice fields. Abundant during the rainy season. Feeds on mosquito larvae and worms. Exhibit lepidophagy which means it also eats scales of other fishes. Considered useful for controlling malaria and parasites (Figure-6).




#### K. Family: Cichlidae

The family *Cichlidae* is a diverse group of freshwater fish that includes over 1,600 species. Cichlids have well-developed teeth in their jaws. They can have either a single row of teeth on each jaw or multiple rows of teeth. Cichlids have a diverse range of body shapes and sizes. Some species like the angelfish have thin, disc-shaped body, while others like the Oscar have a more robust body with a large head. Brightly colored scales: Many species of Cichlids have vibrant and brightly colored scales that can be used for communication, courtship, and camouflage. Some *Cichlid* species are known for their aggressive behavior, especially during breeding and territorial

disputes. Many *Cichlid* species display significant parental care, including nest-building, brood defense, and/or mouth-brooding. Most *Cichlid* species are omnivorous, feeding on a diet of plants, insects, small fish, and other organisms.

**Species 18:** *Oreochromis niloticus* has a lifespan of more than 10 years, found in freshwater rivers, streams, canal, lakes and ponds. *Oreochromis niloticus*, commonly known as Nile tilapia, is a freshwater fish species belonging to the family *Cichlidae*. The Nile tilapia is native to Africa and has also been introduced in many other parts of the world. It is an important species for aquaculture and food production, with a mild-tasting white flesh that is high in protein. Nile tilapia can grow up to 24 inches in length and can weigh up to 9.9 lbs. They have an elongated and slightly laterally compressed body, with a rounded head and a small, elongated mouth. The color of Nile tilapia is generally gray or greenish-brown, with black spots and vertical bars on their body and fins. Nile tilapia is an omnivorous species, feeding on a variety of plant and animal materials, including phytoplankton, zooplankton, aquatic plants, and insects. In aquaculture settings, they are typically fed commercial fish feeds that contain a mixture of plant and animal-based proteins. Nile tilapia is known for its rapid growth rate, ability to tolerate poor water quality conditions, and mild taste, which has made it a popular choice for aquaculture in many countries. Nile tilapia farming must be managed carefully to minimize environmental impacts.

**Species 19:** *Oreochromis mossambicus* has a life span of 11 years is a fresh water fish. Commonly known as Mozambique tilapia, is a freshwater fish species belonging to the family *Cichlidae*. It is native to southeastern Africa and is widely distributed in both freshwater and brackish environments. Mozambique tilapia is an important species of tropical aquaculture and is cultured in many parts of the world. Mozambique tilapia can grow up to 16 inches in length and can weigh up to 3.3 pounds. They have an elongated, slightly compressed body with a pointed snout and a small, terminal mouth. The colour of Mozambique tilapia varies depending

Fish Family	Fish name	Fish Picture
H. Mastacembelidae	15. <i>Mastacembelus pancalus</i>	
I. Channidae	16. <i>Channa punctatus</i>	
J. Ambassidae	17. <i>Elongate glassy perchlet</i>	

**Figure 6:** Figure represents the members of order Symbranchiformes and Perciformes. *Mastacembelus pancalus* belongs to family Mastacembelidae and order Symbranchiformes whereas *Channa punctatus* belongs to family Channidae and *Elongate glassy perchlet* belongs to family Ambassidae. Both these families Channidae and Ambassidae belong to order Perciformes. Column one represents the name of the fish family. Second column represents name of fish species whereas pictures of the respective fishes are shown in the right most column.

on the environment and can range from dark green to brown or grey. Mozambique tilapia is an omnivorous species, feeding on a variety of plant and animal materials, including algae, plankton, and small invertebrates. In aquaculture, they are often fed commercial feeds that contain a high proportion of plant-based proteins. Mozambique tilapia is known for its hardiness and ability to tolerate a range of environmental conditions, including high salinity and low oxygen levels. As such, it has become an important species for aquaculture in many countries. However, as with other farmed fish species, Mozambique tilapia farming must be managed carefully to minimize environmental impacts.

#### Order 4: Osteoglossiformes

The *Osteoglossiformes* order is a group of freshwater fish species that are known for their bony tongues and primitive characteristics. The order includes about 250 species and is divided into two families: *Arapaimidae* (Arapaimas) and *Osteoglossidae* (Bony tongues). Members of the *Osteoglossiformes* order are widely distributed in the tropics and subtropics, with most species found in Africa, South America, and Southeast Asia. Many species are important food fishes and are also popular in the aquarium trade. Characteristic features of the *Osteoglossiformes* order include a primitive lung-like swim bladder, a bony tongue that is covered with teeth, and large scales. Fish species in this order have a long, narrow body shape and have a generally silvery or gray coloration. Some of the most notable species in the *Osteoglossiformes* order include *Arapaima gigas* (Giant Arapaima), *Osteoglossum bicirrhosum* (Silver Arowana), and *Heterotis niloticus* (Nile Perch). Some species, like the *Arapaima*, can grow up to 15 feet in length and can weigh over 400 lbs. Although many species in the *Osteoglossiformes* order have been heavily exploited for food and the aquarium trade, conservation efforts are underway to help protect and preserve these unique and fascinating fish species.

#### L. Family: Notopteridae




The *Notopteridae* family, also known as the featherback fish or knife-fish family, is a group of freshwater ray-finned fish. They are characterized by their elongated bodies and long dorsal fins that resemble a feather or a knife blade. These

fish are found in Africa and Southeast Asia and are popular in the aquarium trade. They have elongated bodies, typically ranging from 30 to 100 centimeters in length, long dorsal fins that extend down the back and resemble either a feather or knife blade, smooth scales with a slimy texture and small, conical teeth in both upper and lower jaws. Some species have an electric organ near their anal fin which allows them to generate an electric field for sensory purposes. Members of this family are carnivorous and primarily feed on other fish and aquatic invertebrates. They are nocturnal and often found in areas with plenty of vegetation or structure to provide cover.

**Species 20:** *Notopterus notopterus*, also known as the Bronze featherback or Omпок, is a species of freshwater fish in the *Notopteridae* family. They are elongated and have a brown to bronze colored body with a slimy texture and large scales. Their dorsal fin is very distinctive in shape with long spines at the front of the fin followed by a fringe of smaller rays that resemble feathers or fins. Their anal fin is located at the very end of the body and has a similar shape to the dorsal fin. They feed on small fish, aquatic insects, worms, and crustaceans. They are native to South Asia and Southeast Asia, found in rivers and lakes that have slow-moving or standing water. Bronze feather back fish are nocturnal, often burrowing in the substrate or hiding in underwater vegetation during the day and coming out to feed at night (Figure-7).

#### Order 5: Cypriniformes

This order contains over 3,000 species and is one of the largest fish orders. Members of this order are mostly freshwater fish, just a few fishes are brackish. They all have a single dorsal fin, which is located farther back on the body and lacks spines. Their mouths are small, toothless (except for a few species) and located on the underside of the head. *Cypriniformes* are omnivorous, feeding on a variety of things such as algae, insects, and small organisms. Many species of this order are very important as food sources for humans and are often farmed commercially. They exhibit a wide range of reproductive strategies from egg-scattering to mouth brooding. Examples of fishes in the *Cypriniformes* order include: carp, minnows, loaches, rasboras, danios, and barb.

Fish Family	Fish name	Fish Picture
K. Chichlidae	18. <i>Oreochromis mossambicus</i>	
	19. <i>Oreochromis niloticus</i>	
L. Notopteridae	20. <i>Notopterus notopterus</i>	

**Figure 7:** Figure given above represents the members of orders Perciformes and Osteoglossiformes. Members *Oreochromis niloticus* and *Oreochromis mossambicus* are from family Chichlidae and order Perciformes. *Notopterus notopterus* belongs to family Notopteridae and order Osteoglossiformes. Pictures of the fishes are given in the right most column.

### M. Family: Cyprinidae

*Cyprinidae* is the largest family of fish, with over 3,000 species distributed worldwide. Most species within this family are freshwater fishes, although a small number of species are found in brackish waters. They have a slender, torpedo-shaped body with a single dorsal fin that is located far back on the body. Cyprinids have small, toothless mouths that are located on the underside of the head, with a cartilage-based structure called the "rostral cap" that helps to crush food. They are generally herbivorous, feeding on algae, aquatic plants, and detritus, but some species are also omnivorous and feed on insects and other small animals. Many species within the family are used for human consumption, and some are also economically important as game fish or for their ornamental value in aquariums. Cyprinids are able to thrive in a wide range of habitats, from fast-moving rivers to still ponds and lakes. Some examples of fish in the *Cyprinidae* family include carp, minnows, dace, roach, and barbs (Table- 5).

**Species 21:** *Amblypharyngodon microlepis*, commonly known as the Perilampid barb or small-scale carp, is a species of freshwater fish in the family *Cyprinidae*. It is native to southeast Asia, specifically in the Mekong and Chao Phraya River basins. It has a torpedo-shaped body, a small, pointed head, and a small, inferior mouth. They are typically about 7-10 centimetres in length and have a greyish-brown dorsal side and a silver ventral side. They have few, small scales that are embedded in their skin rather than overlapping like in most other fish species. *A. microlepis* are omnivorous, feeding on a variety of small aquatic animals and plant matter. They are also relatively hardy and can adapt to a range of water conditions.

**Species 22:** *Chagunius chagunio*, commonly known as Chaguni or Indian Carp, is a freshwater fish species belonging to the family *Cyprinidae*. It is native to South Asia, predominantly found in the rivers of India and Bangladesh. Some general characteristics of *C. chagunio* include a sleek, cylindrical body that is brownish in colour and has a pointed snout with a small inferior mouth. They typically grow up to 40 centimetres in length and can weigh up to 1.5-2 kilograms. It is a herbivorous species, feeding mainly on plant matter such as algae, aquatic plants, and detritus. They are a popular food

fish in South Asia and are also used as bait for sport fishing. In addition to their use as a food source and bait, they are also valued as an indicator species for water quality assessments in the region.

**Species 23:** *Esomus danricus*, commonly known as the Redline Torpedo or Danio Danrik, is a small freshwater fish species belonging to the family *Cyprinidae*. It is native to parts of South and Southeast Asia, including regions of India, Sri Lanka, and Myanmar. It is an elongated, fish with streamlined body that is silver to golden in colour with a distinct red stripe running from its snout to the base of its tail fin. They typically grow up to 7.5 centimetres in length and can live up to 3-4 years. *E. danricus* is an active schooling fish that prefers to live in fast-flowing streams and rivers with rocky or sandy substrates. They are omnivorous, feeding on a variety of small aquatic invertebrates, as well as algae and other plant matter. The Redline Torpedo is a popular aquarium fish due to its bright colours, hardiness, and ease of care. They are a peaceful species that can be housed with other small, non-aggressive fish in a community tank setting. The fish is utilized for larval control of mosquitoes to control diseases like malaria, dengue etc. [82].

**Species 24:** *Labeo Angara* is Herbivorous fresh water fish found in river, lakes and ponds. Commonly known as Angra labeo. This species is native to Asia continent and commonly found in countries like Pakistan, Nepal, Burma, Afghanistan and Bangladesh. This fish has been known to reach a maximum length of around 22 cm. Herbivorous by nature and found in river, lakes and ponds. Commercially important fishes for food and sport. Migratory fishes and therefore became rare in Bangladesh after construction of dam on Tinau River of Nepal otherwise it is common fish of least concern.

**Species 25:** *Labeo Bata*, also known as the Bata labeo, is a freshwater fish species found in South and Southeast Asia, including India, Nepal and Bangladesh. Some general characteristics of *Labeo bata* include a compact, elongated body that is silver in colour with a dark-colored dorsal side. They have a blunt snout and a relatively small mouth, and they can grow up to 50 cm in length and 1.5 kg in weight. It is an omnivorous fish that feeds on a variety of aquatic plants, insects, crustaceans, and small fish. They prefer to live in large

**Table 5:** Table given below represents the members of order Cypriniformes. Members include *Amblypharyngodon microlepis*, *Changunius changunio*, *Esomos danricus*, *Labeo angra*, *Labeo bata*, *Labeo rohita*, *Megarasbora elonga*, *Barilius barna*, *Chela cachius*, *Puntius sopher*, *Osteobrama cotio* and *Lepidocephalichthys guntea*. Table shows comparative pH, Temp, habit and length of fishes. International Union for Conservation of Nature (IUCN) status of fishes mentioned as EN, Endangered; VU, Vulnerable; NT, Near threatened; LRnt, Low risk near threatened; NA, Not assessed.

Comparative account of order Cypriniformes					
Order 5. Cypriniformes					
Family 13-14. Cyprinidae (e.g. <i>Amblypharyngodon</i> , <i>Chagunius</i> , <i>Esomus</i> , <i>Labeo</i> , <i>Megarasbora</i> , <i>Barilius</i> , <i>Chela</i> , <i>Puntius</i> and <i>Osteobrama</i> ) and Cobitidae (e.g. <i>Lepidocephalichthys</i> )					
Fish Name and IUCN Status	Local Name	pH	Temp	Feeding Habits	Length cm
<i>Amblypharyngodon microlepis</i> (LC)	Indian carplet, Potia	NA	26 - 27	Omnivorous	12 - 13
<i>Chagunius chagunio</i> (LC)	Chagrin, Puti	6 - 7.5	20 - 25	Omnivorous	50
<i>Esomos danricus</i> (LC)	Flying barb, Dendu	7.6	20 - 25	Omnivorous	15
<i>Labeo Angara</i> (LC)	Angra labeo, Kharsa	NA	NA	Herbivorous	22
<i>Labeo bata</i> (LC)	Bata labeo/Rohili	4.8	25 - 26	Herbivorous	35
<i>Labeo rohita</i> (LC)	Rohu /Ruhi	8.0 - 8.8	22 - 31	Herbivorous	94
<i>Megarasbora elonga</i> (LC)	Bengal barb/Bhagna	NA	26 - 27	Surface dweller	21
<i>Barilius barna</i> (LC)	Opsarius barna	6-8	16 - 24	Surface dweller	13
<i>Chela cachius</i> (LC)	Silver hatchet /chela	6.8 - 7.5	22 - 26	Omnivorous	12
<i>Puntius sopher</i> (LC)	Pool barb /Spot fin swamp barb	6.5 - 7.5	22 - 25	Surface dweller , Omnivorous	20
<i>Osteobrama cotio</i> (LC)	Cotio cotio	NA	22 - 25	Omnivorous	15
<i>Lepidocephalichthys guntea</i> (LC)	Guntea loach	6-8	20 - 25	Potamodromous, Insectivorous	15

rivers, ponds, and lakes with clean water and a sandy or rocky bottom. *Labeo bata* is considered an important commercial fish species in many parts of its native range, and it is also popular amongst anglers (Figure-8).

**Species 26:** *Labeo rohita* is a freshwater fish species commonly found in South and Southeast Asia. Typically grows to about 1 meter in length and weigh up to 50 kg (110 lb). Elongated fish with a slightly curved body, a blunt snout, and an upturned mouth. Steel green above the lateral line, silvery-white below the lateral line, occasionally with black patches on its body. Feeds on aquatic plants, small crustaceans, and aquatic insects. Found in rivers, lakes, and other freshwater bodies with gentle to moderate currents and clear water. Spawn in shallow water at the onset of monsoons and may breed up to four times in a year. Economically important and demanded heavily in the market for its taste and nutritional value, which is rich in proteins, minerals and omega-3 fatty acids [83, 84].

**Species 27:** *Megarasbora elanga*, Rasboras are a group of small, peaceful freshwater fish that belong to the family *Cyprinidae*. They are native to various regions of Southeast Asia, including Indonesia, Thailand, and Malaysia. These fish are commonly kept in aquariums due to their vibrant colours and ease of care. Some general characteristics of rasboras include a streamlined body shape, brightly colored scales, and a relatively small mouth. They typically grow between 2.5 to 5 cm in length and live for about 2 to 4 years. Rasboras are schooling fish that can be housed together with other small, peaceful species in an aquarium. They feed mainly on small insects and crustaceans in the wild, but in an aquarium setting, they can be fed a diet of flake or pellet food along with occasional live or frozen foods such as bloodworms or brine shrimp.






**Species 28:** *Barilius barna* is a freshwater fish that belongs to the family *Cyprinidae*. Some of its general characteristics include a slender and elongated body shape that is typically

olive green or brownish in colour with a silvery underside. They have a small head with a terminal, slightly oblique mouth and a narrow caudal peduncle. In terms of size, they generally reach a maximum length of around 15 centimetres (6 inches). They are known for being active swimmers and are commonly found in streams, rivers, and other freshwater habitats in India and Nepal.

**Species 29:** *Chela cachius* also known as the Silver hatchet chela is a species of freshwater fish that is native to South America. It has a silver and somewhat translucent body that is flattened laterally. They have a distinctive shape, with a pointed, arched dorsal fin that resembles a hatchet. The species typically grows to be 3-4 inches in length, although they can reach up to 5 inches at times. Primarily feed on insects and insect larvae floating on the water's surface. They are also known to eat small crustaceans and other small organisms. They are freshwater fish that can be found in the shallow waters of rivers, streams, and swamps in South America. They are very active and playful fish that enjoy swimming around and jumping out of the water. They are schooling fish and feel most comfortable in groups of six or more.

**Species 30:** *Puntius sopher*, also known as the spotted barb or sorubim is a freshwater fish that is commonly found in South Asian countries such as India, Pakistan, Nepal, and Bangladesh. It has a cigar-shaped body, with a deep belly and an arched back. Its dorsal surface is a mottled brownish-green colour, which is adorned with black spots, and its underbelly is silvery-white. Its fins are transparent or whitish in colour, and there may be a reddish-orange tint near the tail fin. It can grow up to 20 cm (8 in) in length. This fish feeds on a diet of insects, crustaceans, and other smaller aquatic organisms. *P. sopher* prefers freshwater habitats that are slightly alkaline. It is commonly found in slow-moving rivers, ponds, and lakes. It is a social fish that tends to form schools. It can also be quite active and likes to swim around in the open waters, especially during dawn and dusk. The breeding season for

**Citation:** Sharma B, Khatoon A, Jaiswal M. Freshwater Fish biodiversity of Indrapuri Dam, Rohtas, Bihar. *J Fish Res.* 2023;7(6):177

Fish Family	Fish name	Fish Picture
M. Cyprinidae	21. <i>Amblypharyngodon microlepis</i>	
	22. <i>Changunius changunio</i>	
	23. <i>Esomus danricus</i>	
	24. <i>Labeo angra</i>	
	25. <i>Labeo bata</i> 26. <i>Labeo rohita</i>	

**Figure 8:** Figure given above represents 5 members of order Cypriniformes and family Cyprinidae. Members include *Amblypharyngodon microlepis*, *Changunius changunio*, *Esomus danricus*, *Labeo angra* and *Labeo bata*, *Labeo rohita*.

*P.sophore* occurs during the monsoon season in India (typically from June to September). The female lays sticky eggs on submerged vegetation, and both parents help to care for the eggs and newly hatched fry [85].






**Species 31:** *Osteobrama cotio* is a species of freshwater fish found in parts of Asia, including India, Nepal, and Bangladesh. It typically grows up to 20-25 centimetres in length and prefers small to medium-sized rivers with rocky or sandy substrates. Feeds on insects, crustaceans, and small fishes. Slender and elongated body with a deep belly, concave head, and a terminal mouth (Figure -9). Dorsal surface is greyish-green in colour, while the ventral side is silvery-white. The fish usually forms shoals and is an active swimmer. Spawning occurs during the monsoon season in fast flowing rivers and streams [86, 87].

**Species 32:** *Raiamus guttatus*, also known as the White-spotted Frogfish, is a fascinating fish with unique features. They have incredible ability to blend into its surroundings. It has a fleshy, warty appearance with various colour variations, including shades of yellow, brown, and white, allowing it to mimic its environment and ambush prey. This fish has modified pectoral fins that resemble legs, which it uses to "walk". These fins are also used to anchor itself to a substrate, providing stability while waiting for prey. It has a large, expandable mouth that can engulf prey almost as big as itself [88-90]. It uses a unique appendage called an "illicium" or "fishing rod" to attract prey. The *illicium* has a fleshy lure at the end, resembling a small fish or worm, which the frogfish uses to entice its unsuspecting victims. The White-spotted Frogfish can grow up to 10 centimetres in length, with a stocky body and a large head. Its body shape allows it to remain stable on the floor, even in strong currents. Like other frogfish species, the *Raiamus guttatus* has a unique reproductive strategy. The male releases sperm into the water, and the female collects it in her body. She then lays a gelatinous mass of eggs, which the male fertilizes externally. The eggs hatch into tiny larvae that float in the water until they develop into juvenile frogfish.

**Species 33:** *Puntius chola*, commonly known as the Chola Barb or Clown Barb, is a small freshwater fish found in South Asia. The Chola Barb has a striking appearance with vibrant

colours. It typically has a golden or silver body with black vertical stripes running along its sides. The fins are usually red or orange, adding to its overall beauty. The Chola Barb is a relatively small fish, reaching an average length of around 5-7 centimetres. This makes it suitable for smaller aquariums or community tanks. These fish are known for their active and social nature. They thrive in groups, so it's recommended to keep them in schools of at least six individuals. They are peaceful and can coexist with other peaceful fish species. The Chola Barb is an omnivore, meaning it eats both plant matter and small invertebrates. In captivity, they can be fed a varied diet consisting of high-quality flakes, pellets, frozen or live foods like brine shrimp or bloodworms, and even some vegetable matter. Breeding Chola Barbs can be challenging, but not impossible. They are egg-scatterers, meaning they release eggs into the water, which are then fertilized by the male. To encourage breeding, it's important to provide them with suitable hiding spots and slightly acidic water conditions. In the wild, Chola Barbs are found in slow-moving rivers, streams, and ponds with vegetation. They prefer well-oxygenated water and appreciate the presence of plants in their aquarium. Overall, the Chola Barb is a beautiful and active fish that can bring life and colour to any freshwater aquarium [91, 92].

**Species 34:** *Cirrhinus reba*, commonly known as the Reba carp, is a freshwater fish species found in Southeast Asia. The Reba carp has an elongated body with a slightly flattened shape. It typically has a silvery-grey coloration with scales along its body. The average size of the *Cirrhinus Reba* fish is around 20-30 centimetres, although larger individuals can reach up to 40 centimetres in length. This species is primarily found in rivers, lakes, and reservoirs in countries like Thailand, Cambodia, Vietnam, and Laos. It prefers slow-moving or still waters with abundant vegetation. The Reba carp is omnivorous, feeding on a variety of food sources. Its diet includes small aquatic organisms, algae, plant matter, and even insects. *Cirrhinus reba* is known for being a peaceful and social fish. It usually forms shoals with other individuals and tends to be active during the day. During the breeding season, which typically occurs during the rainy season, the Reba carp migrates to flooded areas to spawn. They lay their eggs among

Fish Family	Fish name	Fish Picture
M. Cyprinidae	27. <i>Megarasbora elanga</i>	
	28. <i>Barilius barna</i>	
	29. <i>Chela chachius</i>	
	30. <i>Puntius sophore</i>	
	31. <i>Osteobrama cotio</i>	

**Figure 9:** Figure given above represents 5 members of order Cypriniformes and family Cyprinidae. Members include *Megarasbora elanga*, *Barilius barna*, *Chela chachinus*, *Puntius sophore*, and *Osteobrama cotio*.

aquatic plants, and both male and female fish participate in parental care [93, 94].

**Species 35:** *Cyprinus carpio*, commonly known as the carp fish, is a freshwater fish species that belongs to the family *Cyprinidae*. Carps can grow to varying sizes, but they typically range from 12 to 24 inches in length, with some larger species capable of reaching up to 47 inches. They have a relatively elongated body, with a stocky appearance. Their body is generally covered with large scales. The coloration of carps can vary depending on their habitat and specific species. Common carp, for example, are typically olive-green or brassy in color, with a golden hue on their sides. They may also have darker spots or blotches. One of the distinguishing features of carps is their four barbels located on the upper lip. These sensory organs help them locate food in muddy or murky waters. Carps have a single dorsal fin located towards the posterior end of their body. This fin helps in stability and maneuverability while swimming. Carps are omnivorous, feeding on a variety of plant matter, insects, crustaceans, and small fish. They use their pharyngeal teeth, located at the back of their throats, to crush and grind their food. Carps are adaptable fish and can thrive in various freshwater habitats like ponds, lakes, rivers, and even slow-moving water bodies. They prefer areas with vegetative cover and a soft bottom substrate (Figure-10). Carps reproduce by laying adhesive eggs on submerged vegetation or other objects. They undergo external fertilization, where the male releases sperm to fertilize the eggs after they are laid [95, 96].

#### N. Family: *Cobitidae*





*Cobitidae* is a family of freshwater fish commonly known as loaches or river loaches. Loaches have a slender, elongated body with a pointed head and a small mouth. They vary in coloration and pattern, but often have a mottled or spotted appearance, and may have whisker-like sensory barbels around their mouth. Loaches can range in size from just a few centimetres (such as the pygmy loach) to more than 30 centimetres (such as the giant river loach). Loaches can be found in freshwater habitats such as rivers, streams, ponds, and lakes, as well as in certain coastal marine habitats. They prefer the bottoms of water bodies, and may inhabit areas with

rocky or sandy bottoms, or be found hiding among aquatic vegetation. Omnivorous by nature, feeding on a variety of aquatic organisms such as small aquatic insects, crustaceans, algae, and even fish eggs or small fish. Generally bottom-dwelling fish that are well-adapted to life in freshwater environments. Some can be quite active and playful, while others tend to be more reclusive. Some species are known to have complex social behaviours, and may form schools or shoals. Reproduction varies widely among the different species in the family *Cobitidae*, but most lay eggs which are usually deposited or attached to vegetation. Some species exhibit parental care with males guarding eggs or newly hatched fry [97].

**Species 36:** *Lepidocephalichthys guntea*, also known as the Guntea loach, is a freshwater fish found in several countries of South and Southeast Asia, including India, Bangladesh, Myanmar (Burma), and Thailand. They have a slender body with a flattened shape. The colour of their body is usually dark brown to blackish and sometimes having whitish spots. The head is large and has a flattened cystic shape. The average size of this fish species is around 7-8 cm in length. They usually inhabit shallow, fast-moving, and rocky rivers and streams with clear water. It can also be found in springs, rivulets, and hill streams. They prefer to live under rocks and logs with slow-moving water. The Guntea loach feeds on small invertebrates, plant debris, and fish eggs. They are nocturnal active at night and hiding during the day. They are known to be peaceful fish and they school with their own species. They spawn during the monsoon season.

#### Order 6: *Anguilliformes*

*Anguilliformes* is an order of ray-finned fish that includes eels found in both marine and freshwater environments. They are long elongated, snake-like fishes that lack pelvic and pectoral fins, or have reduced fins. Dorsal fin is continuous with the anal fin, which runs along the entire length of the fish. There are no scales on the skin surface (Table-6). Their skin often secretes slimy mucus for protection. Fishes of this order are carnivorous, with a diet that may include fish, crustaceans and other small aquatic animals. Most species are bottom-dwellers, living in crevices and under rocks, while some

Fish Family	Fish name	Fish Picture
M. Cyprinidae	32. <i>Raiamas guttatus</i>	
	33. <i>Puntius chola</i>	
	34. <i>Cirrhinus reba</i>	
	35. <i>Cyprinus carpio</i>	

**Figure 10:** Figure given below represents 4 members of order Cypriniformes and family Cyprinidae. Members include *Raiamas guttatus*, *Puntius chola*, *Cirrhinus reba* and *Cyprinus carpio*.

species are pelagic and can swim in open water. Some species are capable of significant migrations, traveling thousands of kilometres for breeding purposes. Eels can be commercially valuable, with some species being used for their meat or for aquarium trade.

#### O. Family: *Anguillidae*

*Anguillidae* is a family of freshwater and saltwater fish commonly known as eels. Eels have an elongated, snake-like shape with a slender body that lacks pelvic fins. They tend to be grey or brown in colour, with a slimy, smooth skin that lacks scales. They have a small head with a terminal mouth that is distinguished by a prominent upper jaw. Eels can vary in size, from small species less than 20 cm in length (such as the Japanese eel), to larger species that can exceed 1 meter in length (such as the European eel). Eels can be found in a variety of aquatic habitats, from freshwater streams, rivers, and lakes to coastal and open ocean regions. They tend to prefer environments with low to moderate current flow, and may inhabit rocky or sandy bottoms or hide beneath vegetation or in crevices. Carnivorous by nature and feed on a variety of aquatic animals such as fish, crustaceans, and aquatic insects. Some species are known to hunt and scavenge at night, while others feed on small prey in the sediment. Eels are known for their impressive ability to swim long distances and navigate through complex ecosystems. Some eel species are catadromous, meaning they spend most of their life in freshwater but migrate to seawater for spawning. Others are anadromous and live in seawater but migrate to freshwater for spawning. Eels have a unique life cycle in which they begin life as leptocephalus larvae that drift in the oceans before transforming into juvenile eels, commonly known as glass eels, which migrate into freshwater rivers. Some species are considered to be catadromous, whereas other eel species are known for their spawning hydrothermal vents in the deep sea that are only accessible by submarine.

**Species 37:** *Anguilla bengalensis*, also known as the Indian mottled eel, is a species of freshwater eel that is native to South and Southeast Asia. The Indian mottled eel has an elongated, snake-like body that is covered in a mottled pattern of dark brown or black spots on a light brown or yellowish background. It has a small head with a terminal mouth and a single long dorsal fin that runs most of the length of

its body. This species can grow up to 80 cm (31 inches) in length, with a maximum weight of around 1 kg (2.2 lbs). The Indian mottled eel can be found in freshwater habitats such as rivers, streams, and ponds, as well as in certain coastal marine habitats such as mangrove forests. It prefers areas with slow-moving or stagnant water and a lot of vegetation, and can often be found hiding in muddy or weedy bottoms. The Indian mottled eel is a carnivorous fish, feeding on a variety of aquatic animals such as small fish, crustaceans, and insects. This species is mostly nocturnal and spends most of the day hiding in crevices or among aquatic vegetation. It is known for its ability to travel long distances overland, using its body to slither across damp terrain in search of new habitats. Little is known about the reproductive behavior of the Indian mottled eel, but like other members of the family *Anguillidae*, it is thought to be a catadromous species that migrates to the ocean to spawn.

#### Order 7: *Clupeiformes*

*Clupeiformes* is an order of ray-finned fishes that includes herring, shad, sardines, and anchovies. Body relatively elongated and laterally compressed. Single dorsal fin, located posteriorly on the body. Adipose fin absent. Pelvic fin abdominal and without spines. Gills with long and slender gill rakers. Usually a silver-colored body covered in small scales. Mouth is terminal and they feed on small planktonic organisms [98].

#### P. Family: *Clupeidae*

The *Clupeidae* family is a group of fish that includes many important species such as herring, shad, and sardines. Fishes of this family are small to medium in size, typically ranging from 20-40 cm in length. They have silvery scales and streamlined bodies to help with swimming in schools. Migration wise they are Anadromous, meaning they migrate from the sea to freshwater to spawn. Considered important as commercial and food fish species, due to their high abundance and nutritional value. Typically found in coastal waters and estuaries, but some species may inhabit freshwater habitats.

**Species 38:** *Gudusia chapra*, also known as Indian River shad or gangetic leporinus, is a small freshwater fish found in rivers and streams of India, Nepal, Bangladesh, and Myanmar. These fishes are small in size, typically about 15-20 cm in length. They have elongated and cylindrical body shape, with

**Table 6:** Table given below represents the members of order Anguilliformes. Family Anguillidae, member *Anguilla bengalensis*, Order Clupeiformes, Family Clupeidae, member *Gadusia chapra*, Order Anabantiformes, Family Osphronemidae, member *Trichogaster labiosa*, Order Gobiiformes, Family Gobiidae member *Glossogobius giuris* and Order Beloniformes, Family Belonidae, member *Strongylura fluviatilis*. Table shows comparative pH, Temp, habit and length of fishes. International Union for Conservation of Nature (IUCN) status of fishes mentioned as EN, Endangered; VU, Vulnerable; NT, Near threatened; LRnt, Low risk near threatened; NA, Not assessed and LC, Least Concerned.

Order 6. Anguilliformes					
Family 15. Anguillidae (e.g. <i>Anguilla</i> )					
Fish Name	Local Name	pH	Temp in degrees	Migration	Length cm
<i>Anguilla bengalensis</i> (NT)	Indian long fin eel	NA	26 - 29	Catadromous Carnivorous	200
Order 7. Clupeiformes					
Family 16. Clupeidae (e.g. <i>Gudusia</i> )					
<i>Gudusia chapra</i> (VU)	Indian river shad, Gobri	NA	NA	Potamodromous, Surface dweller	20
Order 8. Anabantiformes					
Family 17. Osphronemida (e.g. <i>Trichogaster</i> )					
<i>Trichogaster labiosa</i> (LC)	Thick lipped Gourami	6.0 - 7.5	22 - 27	Carnivorous - Omnivorous	10
Order 9. Gobiiformes					
Family 18. Gobiidae (e.g. <i>Glossogobius giuris</i> )					
<i>Glossogobius giuris</i> (VU)	Tank goby, Flat headed goby	NA	25	Omnivorous	50
Order 10. Beloniformes					
Family 19. Belonidae (e.g. <i>Gobius</i> )					
<i>Strongylura fluviatilis</i> (LC)	Needle fish	NA	NA	Carnivorous, Pelagic	51.7

a pointed snout and small eyes. Dark greyish-brown colour on the back, and a lighter shade on the belly. Smooth scales and no barbels. By nature they are carnivorous, preying on small fish and crustaceans. Important food fish for local communities, due to its high protein content and availability (Figure-11). Breeds throughout the year in the rivers and flooded fields, with breeding activities peaking in the monsoon season [99].

### Order 8: Anabantiformes

Anabantiformes is an order of ray-finned fishes that includes labyrinth fishes, such as the popular aquarium species *Betta splendens* (also known as Siamese fighting fish). These fishes usually have a compressed and elongated body. They possess a unique organ called a labyrinth organ, which allows them to breathe air directly from the surface. Most species are small, and some are less than 1 inch (2.5 cm) in length. Inhabits freshwater environments, mostly in tropical and subtropical regions. They are fairly short-lived fishes, with most species living up to around 4 years.

#### Q. Family: Osphronemidae

Osphronemidae is a family of freshwater fishes belonging to the order Anabantiformes. This family includes popular aquarium species such as gouramis, bettas, and snakeheads. Many species possess a labyrinth organ, which allows them to breathe air from the surface of the water. Species within this family are generally peaceful, but some territorial species such as the *Betta splendens* can be aggressive with their own kind if housed in small spaces. Many species within this family exhibit beautiful colours and patterns, which make them popular among aquarium enthusiasts. They are omnivores, and their diets in the wild include both animal and plant matter. Osphronemidae are found in freshwater habitats such as rivers, ponds, and swamps mostly in Asia [100].

**Species 39:** *Trichogaster labiosa* (commonly known as Thick-lipped Gourami) is a species of gourami fish. They are small, typically growing up to 10 cm (4 inches) in length. Thick-

lipped Gouramis have a compressed and elongated body with a flattened head and possess a distinctive blue-black mask on their face, with a yellow-golden body. They are peaceful, and non-aggressive, making them an ideal community fish in the aquarium hobby. Omnivores by nature, they feed on insects, small invertebrates, and plant matter. They can be found in freshwater streams, ponds, and rivers throughout Southeast Asia, Especially in Thailand, Laos, Cambodia and Vietnam habitats.

#### Order 9: Gobiiformes

Most species of Gobiiformes are tiny fish, usually measuring less than 10 cm in length. They all have flattened bodies that help them easily navigate through small crevices and cracks in the substrate. Mainly found on the bottoms of bodies of water such as streams, rivers, estuaries, and seafloors. Two dorsal fins and one anal fin: most Gobies have two dorsal fins, with the second one being long and spine-like. They also possess a single anal fin, which is usually large. Most species of Gobiiformes have either very small scales or are entirely scaleless. They all possess relatively large eyes, which they use to locate prey and avoid predators. They are unique diverse and fascinating group of fish.




#### R. Family: Gobiidae

The family Gobiidae is a diverse group of small, bottom-dwelling fish that are found in both marine and freshwater environments. They have elongate bodies with a depressed head and ventrally-placed mouth. They have two dorsally-located dorsal fins, with the first dorsal fin often being spiny. They typically have large, well-developed pectoral fins. They are often brightly colored and may have intricate patterns or markings. Some species are able to breathe air and may be able to survive in low-oxygen environments. They are usually very small, with most species being less than 10 cm in length.

**Species 40:** *Glossogobius giuris*, also known as the giuris goby or mud goby, is a member of the family Gobiidae.

**Citation:** Sharma B, Khatoon A, Jaiswal M. Freshwater Fish biodiversity of Indrapuri Dam, Rohtas, Bihar. *J Fish Res.* 2023;7(6):177



Order	Fish Family	Fish name	Fish Picture
05. Cypriniformes	N. Cobitidae	36. <i>Lepidocephalichthys guntea</i>	
06. Anguilliformes	O. Anguillidae	37. <i>Anguilla bengalensis</i>	
07. Clupeiformes	P. Clupeidae	38. <i>Gudusia chapra</i>	

**Figure 11:** Figure given above represents the members of orders Cypriniformes, Anguilliformes, and Clupeiformes. Members include *Lepidocephalichthys guntea* belonging to family Cobitidae and order Cypriniformes. *Anguilla bengalensis* belonging to order Anguilliformes and family Anguillidae and *Gadusia chapra* belonging to order Clupeiformes and family Clupeidae. Pictures of the fishes are given in the right most column.

They have a cylindrical, elongated body with a depressed head and a slightly pointy snout. They range in size from 10-20 cm in length. They are usually brown or olive green in colour, with a paler belly. They have two dorsal fins, the first of which is spiny and the second soft. They have large pectoral fins that help them move around on the bottom. They are capable of breathing air and can survive in low-oxygen environments. They are typically found in brackish or freshwater environments, such as rivers, swamps, and ponds. They are omnivorous, feeding on a variety of aquatic invertebrates, small fish, and algae [101].

#### Order 10: Beloniformes

*Beloniformes* is an order of ray-finned fishes that contains a number of families, including the famously long-nosed needlefish, as well as the halfbeaks, which have elongated lower jaws. They are usually streamlined and torpedo-shaped, with elongated jaws, which in some members can be quite long and narrow. They are generally small to medium-sized, rarely exceeding 1 meter in length, and some species are much smaller. *Beloniformes* are found in both marine and freshwater environments worldwide. They are carnivorous and feed mainly on small fish, crustaceans, and planktonic organisms. They have a single dorsal fin located near the tail, which may be quite large in some members. They have a relatively small anal fin located behind the anus. Their caudal fin can vary from being forked to being highly elongated, depending on the species. Some members of the order *Beloniformes* are prized game fish, while others are important as commercial and bait species.

#### S. Family: *Belonidae*




The family *Belonidae* is a group of ray-finned fish within the order *Beloniformes*. The members of the family have a long, slender, and torpedo-shaped body. They have a tapered snout, which is elongated into a beak-like structure in some species. Their jaws are lined with sharp teeth. They have a single long dorsal fin spanning almost the entire length of the body, with a few exceptions. Their anal fins and pelvic fins are situated close to the tail. They are found in both freshwater and marine environments of tropical and temperate regions worldwide. Some species of *Belonidae* are known for their ability to jump and leap out of the water in order to avoid capture. They are a predatory species, feeding mainly on small fish, crustaceans, and aquatic insects. Some members of the family, such as the

needlefish, serve as food and sport fish, while others are used as bait [102].

**Species 41:** *Strongylura fluviatilis*, commonly known as the freshwater needlefish. The freshwater needlefish has an elongated, slender body shape with a pointed, beak-like snout. They have a dorsal fin that runs almost the entire length of the body. The coloration of the freshwater needlefish is generally a dark bluish-gray on the back and upper sides, with a lighter, silvery underbelly. They can grow up to 70 cm (27 inches) in length, but typically only reach around 30 cm (12 inches). They are typically found in freshwater environments such as rivers, lakes, and ponds. Freshwater needlefish are carnivorous and eat mainly smaller fish and occasionally aquatic insects or crustaceans (Figure -12). They are excellent jumpers and use this ability as a predator defense mechanism. The species is known to exhibit cannibalistic behaviour, particularly adults preying on juveniles [103].

#### Conclusion

Freshwater fish biodiversity in dams can be complex and can vary greatly depending on multiple factors, including physical and ecological attributes of the dam and its surroundings, as well as the species that may have been introduced into the environment. Dams have been shown to impact fish populations in different ways, often leading to changes in both the number and diversity of fish species present. This may be due to altered flow regimes, changes to the water temperature, or the presence of pollutants. However, with proper management practices and a focus on conservation efforts, freshwater fish biodiversity in dam environments can be maintained and even enhanced. By understanding the specific characteristics of the environment and the fish species that inhabit it, measures may be taken to protect the ecosystem and many of the unique and valuable fish species that call it home. This review cum article outlines all the studies done till date on diversity and water quality of the Indrapuri Dam located in Rohtas district of Bihar. We observed that species from two families i.e. *Schilbeidae* and *Cyprinidae* were more abundant indicating that the quality of water is favourable for their growth. These fishes also have greater capacity to adapt to changing environmental conditions. Significant debility in the distribution of some fish species could be due to pollution, habitat loss, and changes in environmental conditions, illegal fishing, water abstraction, siltation and/or

Order	Fish Family	Fish name	Fish Picture
08. Anabantiformes	Q. Osphronemidae	39. <i>Trichogaster labiosa</i>	
09. Gobiiformes	R. Gobiidae	40. <i>Glossogobius giurus</i>	
10. Belontiiformes	S. Belontiidae	41. <i>Strongylura fluviatilis</i>	

**Figure 12:** Figure given above represents the members of orders Anabantiformes, Gobiiformes, and Belontiiformes. Members include *Trichogaster labiosa* belonging to family Osphronemidae and order Anabantiformes. *Glossogobius giurus* belonging to family Gobiidae and order Gobiiformes and *Strongylura fluviatilis* belonging to order Belontiiformes and family Belontiidae. Pictures of the fishes are given in the right most column.

invasion of exotic species, eutrophication, overexploitation and over-harvesting as food fish, ornamental trade, and sport. Due to hybridization with closely related and fast spreading newly introduced species, a rapid drop in the population of the species can be predicted. All of these variables have the potential to result in significant inland fish population decreases. As a result, several species' distributional ranges have reduced dramatically in recent decades, limiting them to only a few small regions. Within species, salmonids are the most vulnerable, whereas cyprinids are somewhat more resistant; within life stages, older fish are more resistant than younger fish. The overall condition of health of the fish, as well as the state of feeding off early fry, are also crucial, as is the impact of the aquatic medium's water quality attributes on toxicity. We found that the number of fish species in the dam has increased in comparison to the ones reported earlier. We found 41 freshwater fish species that belonged to 10 orders and 19 families in this study as compared to 25 fish species that belonged to 5 orders and 12 families. Thus we conclude that the biodiversity in the dam is increasing and environment is healthy enough to support healthy growth of fishes. Not only that it perhaps provided more of habitat types and leads to increase in biodiversity eventually.

### Acknowledgements

Authors thank Zoology Department of Patna Science College and Patna University for all support provided.

### Conflict of Interests

Authors declare no conflict of interest.

### References

- Kano Y, Dudgeon D, Nam S, et al. Impacts of dams and global warming on fish biodiversity in the Indo-Burma hotspot. *PLoS One*. 2016;11(8):e0160151.
- Qureshi TA. Status of finfish diversity of Madhya Pradesh. In: *Proceeding of the Workshop on Conservation Assessment of Freshwater Fish Diversity for Central India*. Eds.: WS Lakra and UK Sarkar 2007.
- Sugunan VV. Fisheries management of small water bodies in seven countries in Africa, Asia and Latin America. *FAO fisheries circular*. 1997(933).
- International Consultation on Biological Diversity (ICBD) (SAARC, Asian and Other Regional Countries), Country Paper: India, Ministry of Environment and Forests, Government of India and United Nations Environment Programme, Bangalore, India. 1994; 3:22- 23.
- Nelson J S. *Fishes of the World*. Fourth Edition, John Wiley & Sons, Inc. 2006, 1-601.
- Annual report. National Bureau of Fish Genetic Resources, Lucknow, Uttar Pradesh, India. 1992- 1993.
- Molur S, Walker S. Report of the Workshop on "Conservation assessment and management plan for freshwater fishes of India".
- Lakra WS, Sarkar UK. Freshwater fish diversity of central India. In: *Workshop on Conservation Assessment of Freshwater Fish Diversity for Central India (2006: CIAE, Bhopal) 2007*. NBFGR, IARI.
- Thakur K. A Review on Freshwater Fish Diversity of India and Concept of DNA Barcoding in Fish Identification. *Egypt J Aquat Biol Fish*. 2021;25(3):667-93.
- Makmur S, Arfiati D, Bintoro G, et al. Morphological, meristic characteristics and mtDNA analysis of Hampala Fish (*Hampala macrolepidota* Kuhl & Van Hasselt 1823) from ranau lake, Indonesia. *J biodivers environ. sci*. 2014;5(2):447-55.
- Makmur S, Arfiati D, Bintoro G, et al. Morphological, meristic characteristics and mtDNA analysis of Hampala Fish (*Hampala macrolepidota* Kuhl & Van Hasselt 1823) from ranau lake, Indonesia. *J biodivers environ. sci*. 2014;5(2):447-55.
- Biswas I, Nagesh TS, Sajina AM, et al. Morphometric variations and meristic counts of *Clupisoma garua*: an approach for assessing stock structure in the river Ganga. *J Exp Zool India*. 2018;21(2).
- Hussain A, Qazi JI, Shakir HA, et al. Length-weight relationship, meristic and morphometric study of *Clupisoma naziri* from the river Indus, Pakistan. *Punjab Univ J Zool*. 2009;24(1-2):14-25.
- Gunasekar A, Isaac SS. The biodiversity of fish fauna in Indrapuri dam Rohtas district, Bihar (India). *Int J Fish Aquat*. 2017;5(2):416-9.

**Citation:** Sharma B, Khatoon A, Jaiswal M. Freshwater Fish biodiversity of Indrapuri Dam, Rohtas, Bihar. *J Fish Res*. 2023;7(6):177

15. Sandhya KM, Lianthuamluaia L, Karnatak G, et al. Fish assemblage structure and spatial gradients of diversity in a large tropical reservoir, Panchet in the Ganges basin, India. *Environ. Sci Pollut Res.* 2019;26:18804-13.
16. Khatoon A, Pandey K, Kumar A, et al. Identification study of freshwater fish *Clupisoma garua* and *Clupisoma montana*. *J Fish Res.* 2023; 7(3):1-7.
17. Sharma B, Pandey K and Jaiswal MK. Understanding the systematics and ecology of freshwater fish *Clarias batrachus*: A first step towards its Conservation. *TIJER Int res j.* 2023;(9): a870-a878.
18. Sharma B, Kumari P and Jaiswal MK. Food and feeding habits of walking catfish, *Clarias batrachus* and other commercial fishes: A review. *TIJER Int res j.* 2023;10(9): a879-a889.
19. Sharma B, Khatoon A, and Jaiswal MK. Bioaccumulation of Zn in freshwater fishes worldwide and their possible impacts on human health: A review. *TIJER Int res j.* 2023;10(9): a890-a909.
20. Betancur-R R, Acero A, Bermingham E, et al. Systematics and biogeography of New World sea catfishes (Siluriformes: Ariidae) as inferred from mitochondrial, nuclear, and morphological evidence. *Mol Phylogenet Evol.* 2007;45(1):339-57.
21. Betancur-R R. Molecular phylogenetics and evolutionary history of ariid catfishes revisited: A comprehensive sampling. *BMC Evol Biol.* 2009;9:1-8.
22. Saini A, Dua A, Mohindra V, et al. Molecular discrimination of six species of Bagrid catfishes from Indus river system using randomly amplified polymorphic DNA markers. *Mol Biol Rep.* 2011;38:2961-5.
23. Ng HH, Lalramliana LA, Lalthanzara H. *Olyra saginata*, A new species of bagrid catfish (Actinopterygii: Siluriformes) from northeastern India. *Zootaxa.* 2014;3821(2):265-72.
24. Ng HH, Ferraris CJ. A new species of anguilliform catfish (Actinopterygii: Siluriformes: *Bagridae*) from Bangladesh and northeastern India. *Zootaxa.* 2016;4079(3):381-7.
25. Saini A, Dua A, Mohindra V, et al. Molecular discrimination of six species of Bagrid catfishes from Indus river system using randomly amplified polymorphic DNA markers. *Mol Biol Rep.* 2011;38:2961-5.
26. Darshan A, Abujam S, Kumar R, et al. *Mystus prabini*, A new species of catfish (Siluriformes: *Bagridae*) from Arunachal Pradesh, north-eastern, India. *Zootaxa.* 2019;4648(3):zootaxa-4648.
27. Esmaeili HR, Sayyadzadeh G, et al. *Mystus cyrusi*, A new species of bagrid catfish (Teleostei: *Bagridae*) from Middle East. *Zootaxa.* 2022;5099(3):325-43.
28. Nair SM, Kumari K, Kumar AP, et al. The identity and distribution of striped bagrid catfish, *Mystus tengara* (Hamilton 1822) revealed through integrative taxonomy. *Mol Biol Rep.* 2022:1-1.
29. Mohanty BP, Mitra T, Banerjee S, et al. Proteomic profiling of white muscle from freshwater catfish *Rita rita*. *Fish Physiol Biochem.* 2015;41:789-802.
30. Haque MA, Paul S, Jewel MA, et al. Seasonal analysis of food items and feeding habits of endangered riverine catfish *Rita rita* (Hamilton, 1822). *Braz J Biol.* 2021;82:e237040.
31. Amin MR, Mollah MF, Taslima K. Morphological observation and length-weight relationship of critically endangered riverine catfish *Rita rita* (Hamilton). *Pak J Biol Sci.* 2014;17(2):234-40.
32. Devassy A, Kumar R, Shajitha PP, et al. Genetic identification and phylogenetic relationships of Indian clariids based on mitochondrial COI sequences. *Mitochondrial DNA Part A.* 2016;27(5):3777-80.
33. Agnese JF, Teugels GG. Insight into the phylogeny of *African Clariidae* (Teleostei, Siluriformes): implications for their body shape evolution, biogeography, and taxonomy. *Mol Phylogenet Evol.* 2005; 36(3):546-53.
34. Jansen G, Devaere S, Weekers PH, et al. Phylogenetic relationships and divergence time estimate of African anguilliform catfish (Siluriformes: *Clariidae*) inferred from ribosomal gene and spacer sequences. *Mol Phylogenet Evol.* 2006;38(1):65-78.
35. Lee P, Sulaiman Z. Genetic identification and structure of *Clarias batrachus* (Linnaeus, 1758) from Southeast Asia using a mitochondrial DNA marker. *Zootaxa.* 2015;3962(1):182-90.
36. Ahmed AT, Rahman MM, Mandal S. Biodiversity of hillstream fishes in Bangladesh. *Zootaxa.* 2013 ;3700(2):283-92.
37. Mohindra V, Singh RK, Kumar R, et al. Complete mitochondrial genome sequences of two endangered Indian catfish species, *Clarias batrachus* and *Pangasius pangasius*. *Mitochondrial DNA.* 2015;26(5):678-9.
38. Wang J, Lu B, Zan R, et al. Phylogenetic relationships of five Asian schilbid genera including *Clupisoma* (Siluriformes: *Schilbeidae*). *PloS one.* 2016;11(1):e0145675.
39. Mandal S, Jena JK, Singh RK, et al. De novo development and characterization of polymorphic microsatellite markers in a *schilbid catfish*, *Silonia silondia* (Hamilton, 1822) and their validation for population genetic studies. *Mol Biol Rep.* 2016;43:91-8.
40. Li X, Zhou W. The species of *Clupisoma* from Yunnan, China (Teleostei: Siluriformes: *Ailiidae*), with a comment on the validity of the family *Ailiidae*. *Zootaxa.* 2018;4476(1):77-86.
41. Riaz P, Naeem M. Elemental composition of carnivorous fish *Wallago attu* (*Siluridae*, *Siluriformes*) from River Chenab, Pakistan. *Braz J Biol.* 2023;84:e270501.
42. Dhar R, Pethusamy K, Singh S, et al. Draft genome of *Ompok bimaculatus* (Pabda fish). *BMC Res Notes.* 2019;12:1-3.

**Citation:** Sharma B, Khatoon A, Jaiswal M. Freshwater Fish biodiversity of Indrapuri Dam, Rohtas, Bihar. *J Fish Res.* 2023;7(6):177

43. Malakar AK, Lakra WS, Goswami M, et al. Molecular identification of three Omphok species using mitochondrial COI gene. *Mitochondrial DNA*. 2012;23(1):20-4.
44. Kumari N, Yadav DK, Khan PK, et al. Occurrence of plastics and their characterization in wild caught fish species (*Labeo rohita*, *Wallago attu* and *Mystus tengara*) of River Ganga (India) compared to a commercially cultured species (*L. rohita*). *Environ Pollut*. 2023;334:122141.
45. Hussain B, Fatima M, Al-Ghanim KA, et al. Environmentally induced nephrotoxicity and histopathological alternations in *Wallago attu* and *Cirrhinus mrigla*. *Saudi J Biol Sci*. 2019;26(4):752-7.
46. Tavares-Dias M, Dias-Júnior MB, Florentino AC, et al. Padrão de distribuição de crustáceos ectoparasitos de peixes de água doce do Brasil. *Rev. Bras. Parasitol. Vet*. 2015;24:136-47.
47. Banerjee TK, Agarwal SK, Rai AK, et al. Histochemical localization of alkaline phosphatase, acid phosphatase, and succinic dehydrogenase activities in the epidermis of the freshwater teleost, *Amphipnous cuchia* (Hamilton) (Symbranchiformes, Pisces). *Mikroskopie*. 1976;32(9-10):294-300.
48. Xie L, Yang X, Ma Z, et al. Complete mitochondrial genome of *Macrogathus aculeatus* (Synbranchiformes: *Mastacembelidae*). *Mitochondrial DNA*. 2015;26(5):801-2.
49. Nakayama T, Yamaguchi T, Minh DTN. Carbapenem-Resistant *Citrobacter freundii* and *Escherichia coli* Harboring a Common IncC-Type Plasmid Encoding IS26 Upstream of blaNDM-1, sul1, aph (3')-VI, and qacE Isolated from Edible *Mastacembelidae* Fish. *Microbiol Resour Announc*. 2023;3.
50. Kanu UC, Zhang E, Jianzhong S. Molecular phylogenetic analysis of spiny eels (Mastacembelidae: *Mastacembelus*) from the Rokel River basin and adjacent areas of Sierra Leone, West Africa. *Zootaxa*. 2022;5169(1):61-70.
51. Kottelat M. *Mastacembelus simack*, The valid name of the Mesopotamian spiny eel (Teleostei: *Mastacembelidae*). *Zootaxa*. 2022;5162(4):446-50.
52. Ng HH, Tan HH. A new, Uniquely patterned spiny eel (Teleostei: *Mastacembelidae*) from southern Borneo, Kalimantan Tengah, Indonesia. *Zootaxa*. 2020;4819(1):zootaxa-4819.
53. Brown KJ, Rüber L, Bills R, et al. Mastacembelid eels support Lake Tanganyika as an evolutionary hotspot of diversification. *BMC Evol Biol*. 2010;10(1):1-1.
54. Vankara AP, Vijayalakshmi C. Histopathological changes of the esophagus of the freshwater eels, *Macrogathus aculeatus* (Bl.) and *Mastacembelus pancalus* (Lac.) due to infection of metacercariae of *Clinostomum mastacembeli* Jaiswal, 1957. *J Parasit Dis*. 2009;33:65-9.
55. Mittal AK, Ueda T, Fujimori O, et al. Histochemical analysis of glycoproteins in the unicellular glands in the epidermis of an Indian freshwater fish *Mastacembelus pancalus* (Hamilton). *Histochem J*. 1994 ;26:666-77.
56. Kaur R, Dua A. 96 h LC50, behavioural alterations and histopathological effects due to wastewater toxicity in a freshwater fish *Channa punctatus*. *Environ Sci Pollut Res*. 2015;22:5100-10.
57. Pandey AK, Nagpure NS, Trivedi SP, et al. Investigation on acute toxicity and behavioral changes in *Channa punctatus* (Bloch) due to organophosphate pesticide profenofos. *Drug Chem Toxicol* . 2011 ;34(4):424-8.
58. Ghazali SZ, Lavoué S, Sukmono T, et al. Cenozoic colonisation of the Indian Ocean region by the Australian freshwater-originating glassperch family *Ambassidae* (Teleostei). *Mol Phylogenetics Evol*. 2023;186:107832.
59. Wainwright PC, Smith WL, Price SA, et al. The evolution of pharyngognath: A phylogenetic and functional appraisal of the pharyngeal jaw key innovation in labroid fishes and beyond. *Syst Biol*. 2012 ;61(6):1001-27.
60. Azad KN, Sarower-E-Mahfuj M, Iqbal T, et al. Differentiation of intraspecific phenotypic plasticity of elongate glassy perchlet, Chanda nama: Insights into landmark-based truss morphometric and meristic variations. *J Adv Vet Anim Res*. 2020;7(4):585.
61. Keller-Costa T, Canário AV, Hubbard PC. Chemical communication in cichlids: A mini-review. *Gen Comp Endocrinol*. 2015;221:64-74.
62. Sparks JS, Smith WL. Phylogeny and biogeography of cichlid fishes (Teleostei: Perciformes: Cichlidae). *Cladistics*. 2004;20(6):501-17.
63. Clabaut C, Bunje PM, Salzburger W, et al. Geometric morphometric analyses provide evidence for the adaptive character of the Tanganyikan cichlid fish radiations. *Evolution*. 2007;61(3):560-78.
64. Wattanakul W, Thongprajukaew K, Hahor W, et al. Optimal Replacement of Soybean Meal with Fermented Palm Kernel Meal as Protein Source in a Fish Meal-Soybean Meal-Based Diet of Sex Reversed Red Tilapia (*Oreochromis niloticus* × *O. mossambicus*). *Animals*. 2021;11(8):2287.
65. Lamanna F, Kirschbaum F, Ernst AR, et al. Species delimitation and phylogenetic relationships in a genus of African weakly-electric fishes (*Osteoglossiformes*, *Mormyridae*, *Campylomormyrus*). *Mol Phylogenet Evol*. 2016 ;101:8-18.
66. Kumazawa Y, Nishida M. Molecular phylogeny of *osteoglossoids*: A new model for Gondwanian origin and plate tectonic transportation of the Asian arowana. *Mol Biol Evol*. 2000;17(12):1869-78.
67. Inoue JG, Kumazawa Y, Miya M, et al. The historical biogeography of the freshwater knifefishes using mitogenomic approaches: A mesozoic origin of the *Asian notopterids* (Actinopterygii: *Osteoglossomorpha*). *Mol Phylogenet Evol*. 2009;51(3):486-99.

**Citation:** Sharma B, Khatoon A, Jaiswal M. Freshwater Fish biodiversity of Indrapuri Dam, Rohtas, Bihar. *J Fish Res*. 2023;7(6):177

68. Ahmad W, Naeem M. Genetic diversity in natural population of *Notopterus notopterus* evaluated through mitochondrial DNA marker ATPase 6/8 regions and cytochrome b gene. *Mol Biol Rep.* 2022 ;49(5):3903-10.
69. Pasco-Viel E, Charles C, Chevret P, et al. Evolutionary trends of the pharyngeal dentition in *Cypriniformes* (Actinopterygii: *Ostariophysi*). *PLoS One.* 2010;5(6):e11293.
70. Gaubert P, Denys G, Oberdorff T. Genus- level supertree of *Cyprinidae* (Actinopterygii: *Cypriniformes*), partitioned qualitative clade support and test of macro- evolutionary scenarios. *Biol Rev.* 2009 Nov;84(4):653-89.
71. Yang K, Jiang W, Wang X, et al. Evolution of the intermuscular bones in the *Cyprinidae* (Pisces) from a phylogenetic perspective. *Ecol Evol.* 2019;9(15):8555-66.
72. Sudasinghe H, Pethiyagoda R, Maduwage K, et al. The identity of the Sri Lankan *Amblypharyngodon* (Teleostei, Cyprinidae). *ZooKeys.* 2019(820):25.
73. Das MK, Rao MR, Kulsreshtha AK. Native larvivorous fish diversity as a biological control agent against mosquito larvae in an endemic malarious region of Ranchi district in Jharkhand, India. *J. Vector Borne Dis.* 2018;55(1):34-41.
74. Das S, Choudhury SS. Analysis of heavy metals from water, sediment, and tissues of *Labeo angra* (Hamilton, 1822), from an Ox-box lake-an wetland site from Assam, India. *J Environ Sci Health A.* 2016 ;51(1):21-33.
75. Chakraborty M, Ghosh SK. An assessment of the DNA barcodes of Indian freshwater fishes. *Gene.* 2014 ;537(1):20-8.
76. Rasal KD, Iquebal MA, Jaiswal S, et al. Liver-specific microRNA identification in farmed carp, *Labeo bata* (Hamilton, 1822), fed with starch diet using high-throughput sequencing. *Mar Biotechnol.* 2019;21:589-95.
77. Sahoo L, Patel A, Sahu BP, et al. Preliminary genetic linkage map of Indian major carp, *Labeo rohita* (Hamilton 1822) based on microsatellite markers. *J Genet.* 2015;94:271-7.
78. Behera BK, Baisvar VS, Kunal SP, et al. Population structure and genetic diversity of Indian Major Carp, *Labeo rohita* (Hamilton, 1822) from three phylo-geographically isolated riverine ecosystems of India as revealed by mtDNA cytochrome b region sequences. *Mitochondrial DNA Part A.* 2018;29(2):199-205.
79. Tang KL, Agnew MK, Hirt MV, et al. Systematics of the subfamily danioninae (Teleostei: Cypriniformes: *Cyprinidae*). *Mol Phylogenet Evol.* 2010;57(1):189-214.
80. Rahman MM, Norén M, Mollah AR, et al. The identity of *Osteobrama cotio*, and the status of “*Osteobrama serrata*”(Teleostei: Cyprinidae: *Cyprininae*). *Zootaxa.* 2018;4504(1):105-18.
81. Singh M, Verma R, Yumnam R, et al. Molecular phylogenetic analysis of genus *Osteobrama* Heckel, 1843 and discovery of *Osteobrama serrata* sp. nov. from North East India. *Mitochondrial DNA Part A.* 2018;29(3):361-6.
82. Pallavi, Goswami M, Nautiyal P, et al. Genetic divergence and molecular phylogenetics of *Puntius* spp. based on the mitochondrial cytochrome b gene. *Mitochondrial DNA.* 2012;23(6):477-83.
83. Gupta D, Dwivedi AK, Tripathi M. Taxonomic validation of five fish species of subfamily *Barbinae* from the Ganga river system of northern India using traditional and truss analyses. *PloS one.* 2018 ;13(10):e0206031.
84. Islam MN, Sultana S, Alam MJ. Sequencing and annotation of the complete mitochondrial genome of a threatened *labeonine* fish, *Cirrhinus reba*. *Genomics Inform.* 2020;18(3).
85. Inayat M, Abbas F, Hafeez-ur-Rehman M, et al. Optimizing rice-fish co-culture: Investigating the impact of rice spacing density on biochemical profiles and production of genetically modified tilapia (*Oreochromis* spp.) and *Cyprinus carpio*. *Plos one.* 2023;18(12):e0295996.
86. Shabir U, Dar JS, Bhat AH, et al. The hidden world of fish fungal pathogens: Molecular identification and phylogenetic analysis in common carp, *Cyprinus carpio*. *Arch Microbiol.* 2023;205(9):311.
87. Bohlen J, Šlechtová V, Tan HH, et al. Phylogeny of the southeast Asian freshwater fish genus *Pangio* (Cypriniformes; *Cobitidae*). *Mol Phylogenet Evol.* 2011;61(3):854-65.
88. lechtov V, Bohlen JR, Perdices A. Molecular phylogeny of the freshwater fish family *Cobitidae* (Cypriniformes: *Teleostei*): Delimitation of genera, mitochondrial introgression and evolution of sexual dimorphism. *Mol Phylogenet Evol.* 2008;47(2):812-31.
89. Sinha RK, Singh SP, Singh SB. *The morphology and anatomy of the alimentary canal of a cobitid fish, Lepidocephalichthys guntea* (Ham). *Folia Morphol.* 1981;29(3):269-71.
90. Tang KL, Fielitz C. Phylogeny of moray eels (Anguilliformes: *Muraenidae*), with a revised classification of true eels (Teleostei: Elopomorpha: *Anguilliformes*). *Mitochondrial DNA.* 2013;24(1):55-66.
91. Lin YS, Poh YP, Tzeng CS. A phylogeny of freshwater eels inferred from mitochondrial genes. *Mol Phylogenet Evol.* 2001;20(2):252-61.
92. Mohindra V, Singh RK, Tripathi RK, et al. *Complete mitogenome of Indian mottled eel, Anguilla bengalensis bengalensis* (Gray, 1831) through PacBio RSII sequencing. *Mitochondrial DNA Part A.* 2017 ;28(2):238-9.
93. Arai T, Chai IJ, Iizuka Y, et al. Habitat segregation and migration in tropical anguillid eels, *Anguilla bengalensis bengalensis* and *A. bicolor bicolor*. *Sci Rep.* 2020;10(1):16890.

**Citation:** Sharma B, Khatoon A, Jaiswal M. Freshwater Fish biodiversity of Indrapuri Dam, Rohtas, Bihar. *J Fish Res.* 2023;7(6):177

94. Wang Q, Dizaj LP, Huang J, et al. Molecular phylogenetics of the *Clupeiformes* based on exon-capture data and a new classification of the order. *Mol Phylogenet Evol.* 2022;175:107590.
95. Lavoué S, Miya M, Saitoh K, et al. Phylogenetic relationships among anchovies, sardines, herrings and their relatives (*Clupeiformes*), inferred from whole mitogenome sequences. *Mol Phylogenet Evol.* 2007;43(3):1096-1.
96. Sarkar UK, Khan GE, Dabas A, et al. Length weight relationship and condition factor of selected freshwater fish species found in river Ganga, Gomti and Rapti, India. *J Environ Biol.* 2013;34(5):951-6.
97. Zworykin DD. Phylogenesis of reproductive strategies in labyrinth fishes (*Anabantoidei*) and their sisterly groups. *Zh Obshch Biol.* 2016;77(6):464-881.
98. Wang GP, Liu WJ, Si GC, et al. The complete mitochondrial genome sequence of *Trichopodus leerii* (Perciformes: *Osphronemidae*) and phylogenetic studies of *Osphronemidae*. *Mitochondrial DNA A DNA Mapp Seq Anal.* 2016;27(4):2570-1.
99. Lee CT, Ingersoll DW. Social chemosignals in five *Belontiidae* (Pisces) species. *J Comp Physiol Psychol.* 1979;93(6):1171.
100. Hoese DF, Hammer MP. A review of the *Glossogobius giurus* complex in Australia, with wider discussion on nomenclature and possible synonymies. *Zootaxa.* 2021;4974(1):79115.
101. Banford HM, Bermingham E, Collette BB. Molecular phylogenetics and biogeography of transisthmian and amphi-Atlantic needlefishes (Belonidae: *Strongylura* and *Tylosurus*): Perspectives on New World marine speciation. *Mol Phylogenet Evol.* 2004;31(3):833-51.
102. Cipriano RR, Noletto RB, Kantek DL, et al. Comparative cytogenetic analysis of marine needlefishes (*Beloniformes*) from southern Brazil. *Cytotechnology.* 2016;68:1585-9.
103. Liao JC. Swimming in needlefish (*Belonidae*): Anguilliform locomotion with fins. *J Exp Biol.* 2002;205(18):2875-84.