

# “Dwindling the Major Indigenous Freshwater Fish Species- An Ecological Meltdown Scenario to Local Environmental Sustainability”: A Bio-geographical Study on Khejuri over Coastal Medinipur

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**Abstract:** *Ecological Meltdown is a reminder, a warning bell to human species that we are not the only one on this planet. Whatever nature has provided is for all the living beings on this earth to share. But we in our greed, in the name of our development, are encroaching on the right of others by the sheer arrogance of being the superior most species. In case of the territory of Khejuri Blocks which came into existence as a consequence of coalescence of twin sister islands-Kedgeree and Hijili and emerged as small riverine islands along the western bank of Hooghly estuary, it is not exceptional. This area has undergone not only various morphological and environmental changes throughout its geological history but also witnessed social, political and economic transformations under Mughal, Portuguese and British rules with tremendous unchecked and explosive population. All such transformations have brought about alternations of in livelihoods of local people and economy of the area under consideration. In most recent, Khejuri is being experienced by newer techno-agricultural system from its past trend, more profitable brick manufacturing and fish farming and efforts towards coastal tourism. As a result, last one decade of Khejuri reflects a large scale of land use change where most of the typical and periodic wetlands which are the feeding and breeding grounds of all indigenous fish species and other aquatic lives have, loosened its existence quickly. Due to this rapid habitat loss; unregulated or illegal killing or collection of those indigenous species; unplanned application of chemical fertilizers, pesticides, fungicides and insecticides; soil, land and water pollution from foresaid activities; competition of those species with other species; evolving newer diseases and also predation a remarkable number of fresh water indigenous fish species have been threatened in different ways. This is one of the typical scenarios of loss of fish diversity responsible to exploitation of local fish resources and also destruction of aquatic ecosystem. This zoo-geographical as well as geo-environmental study and analysis reveal also that considerable of declining indigenous fish resources. The results of the study clearly indicate the socio-economic and environmental cost of eroding fish resources side by side and reflect an ecological melt down scenario in local environmental atmosphere which is not viable livelihood option for this coastal region in terms of its environmental sustainability.*

**Keywords:** Ecological Meltdown, twin sister islands, environmental changes, brick manufacturing, fish farming, coastal tourism, land use change, indigenous fish species, wetlands, aquatic ecosystem, environmental cost and environmental sustainability.

## 1. Introduction

*“The universe is the creation of the Supreme Power meant for the benefit of all His creations. Individual species must, therefore, learn to enjoy its benefits by forming a part of the system in close relation with other species. Let not any one species encroach upon the other’s right.”*

**-ISHOPANISHAD**

An ecological crisis as well as ecological meltdown occurs when the environment of a species or a population changes in a way that destabilizes its continued survival. There are many possible causes of such crisis: It may be that the environment quality degrades compared to the species' needs, after a change of abiotic ecological factor (for example, an increase of temperature, less significant rainfalls). It may be that the environment becomes unfavourable for the survival of a species (or a population) due to an increased pressure of predation or illegal anthropogenic intervention on natural life-way. Lastly, it may be that the situation becomes unfavourable to the quality of life of the species (or the population) due to raise in the number of individuals (overpopulation). When human life cannot be sustained because of ecological disasters, may be considered also as ecological meltdown.

Ecological Meltdown is now the global warning to economic and techno-centric man that we are not in safe and sure on this planet. We are digging the hole of hazards resulting from degrading environment melting down ecology created by one-third contribution from nature and two-third from civilized people. The picture of global ecological meltdown that emerges from the exhaustive analysis of global data drawn from the most reliable sources clearly indicates that we have reached the point of no return for ecological destruction. Human greed has pushed the planet's biodiversity to the gateway of extinction where the other biological species will disappear first, followed by humans. While efforts are on world over to recover from the economic catastrophe, we seem blind to a graver catastrophe, the ecological meltdown: footsteps of which are getting louder with every passing day.

Where the Ganga ends up her more than a 2500 km long journey embraces Sagar Dwip with two outspread arms and then plunges into the sea, Khejuri stands on the western bank of the western arm of the Ganga, alias Bhagirathi, allies Hooghly. In fact, from the floor of water mass through the emerging form as **twin sister islands**, Khejuri and Hijili, were born of Bhagirathi-silt during 16<sup>th</sup> century. Since then the area has undergone not only various morphological and environmental changes throughout its geological history but also witnessed social, political and economic

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transformations under the various rules of history with tremendous unchecked and explosive population growth (36,006 & 169.74/ sq. km of population and its density in 1871 have been turned into 3, 10,000 & 1156/sq. km in 2011). In most recent, Khejuri is being experienced by newer techno-agricultural system from its past trend, more profitable brick manufacturing and fish farming and efforts towards coastal tourism. As a result, last one decade of Khejuri reflects a large scale of land use change. In fact, more than 80% of emerging brick fields and 85% of fish farms has been developed in between 2001 and 2011 along the bank of rivers and canals encroaching most of the agricultural lands. Now 17.8% and 4.7% of land cover of the area are being used for fish culture and brick manufacturing while about 30% of 58% agricultural lands is characterized by multi-agricultural system. As a result, most of the typical and periodic wetlands which are the feeding and breeding ground of all indigenous fish species and other aquatic lives have, loosened its existence quickly. Due to this rapid habitat loss; unregulated or illegal killing or collection of those indigenous species; unplanned application of chemical fertilizers, pesticides, fungicides and insecticides; soil, land and water pollution from foresaid activities; competition of those species with other species; evolving newer diseases and also predation about 36 indigenous fish species have been threatened in different ways. According to global threatened categories of IUCN, in this area, 8-species have already extinct, 8-species are critically endangered, about 10 species are endangered and 10-species are vulnerable. This is one of the typical scenarios of loss of fish diversity responsible to exploitation of local fish resources and also destruction of aquatic ecosystem.

Not only intensive questionnaire survey have been conducted taking significant number of samples from different corners of Khejuri but also some individual, group and telephone interviews with older and eminent persons have been practiced for this study. Secondary data sets have also been collected from BDO, Animal Resource Development Office, Fisheries Development Office, District Brick Field Association and Panchayet Offices. Those data have been compiled and analyzed. The analyses reveal that considerable of declining indigenous fish resources. The results of the study clearly indicate the socio-economic and environmental cost of eroding fish resources side by side and reflect an ecological melt down scenario in local environmental atmosphere which is not viable livelihood option for the region in terms of environmental sustainability.

## 2. Aim and Objectives

**General Aim:** Focusing the ecological meltdown Situation due to dwindling the indigenous fish species in Khejuri;

### Specific Objectives:

- Finding out the threatened indigenous freshwater fish species & their natural habitat;
- Examining the Land use changes related to declining fish species;
- Analyzing the causes for threatening of fish species; and
- Assessing the Environmental Cost of those species.

## 3. Location of the Study Area, Khejuri

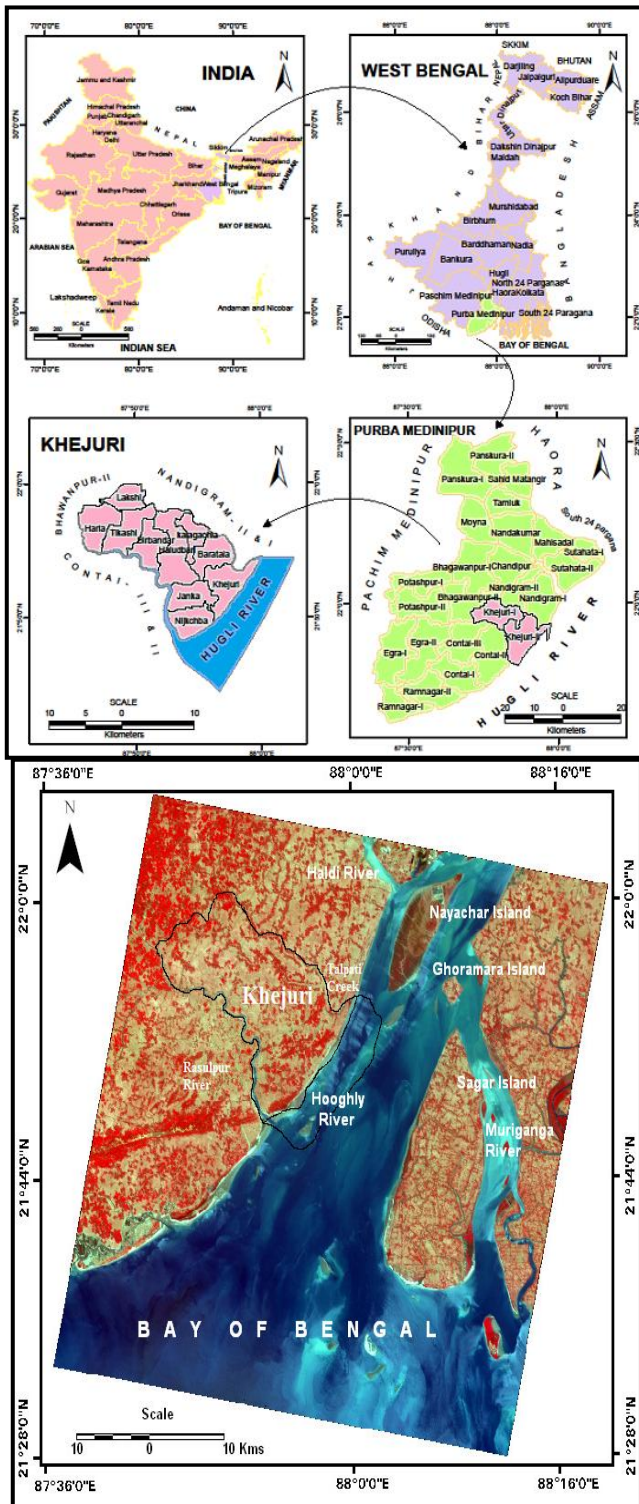
Where the Ganga ends up her more than a 2,500 km long journey embraces Sagar Dwip with two outspread arms and then plunges into the sea, Khejuri stands on the western bank of the western arm of Ganga, alias Bhagirathi, allies Hoogly.

Geographical location of any region reflects it's all of the physical and anthropogenic features more or less. Location helps to estimate the spatial, environmental and also socio-economic entities of the region. Not only that, it depicts the problems and prospects as possible as and helps to plan for prosperity from potentiality.

My study area, Khejuri is, geo-environmentally, one of the important coastal segments reflecting the typical coastal environment over Medinipur as well as West Bengal Coast. Geomorphologically, this region is situated over the 'geomorphic triple junction' of River Hoogly, River Rasulpur and Bay of Bengal, i. e., it shows the well convergence of closing journeys of River Rasulpur and Hooghly and happy beginning of Bay of Bengal. In fact, it has been featured by fluvio-coastal characteristics in the combination of fluvial and coastal actions. Khejuri is existed on Rasulpur-Pichhaboni basin hydrology over Lower Ganga Course.

Geometrically this area is located in between 21°45'N - 22°00'N latitudes and 87°45'E - 88°05'E longitudes. So, it indicates the typical sub-tropical Monsoonal climatic location with its latitudinal and longitudinal entity over Indian sub-continent. Geologically, it is of mostly recent formation which shows the sedimentary and lithological characteristics of recent Quarternary formation.

Administratively, Khejuri is designated as one of the coastal police stations (P. S.) surrounded by Nandigram at the north, Bhagwanpur and Bhupatinagar at the north-west and west, Uttar Kanthi at the south (detouched by river Rasulpur) and River Hooghly and Bay of Bengal at the east and south-east. Khejuri consists of two blocks as Khejuri-I and Khejuri-II and 11-Gram Panchayets (G.P.) named as Haria, Tikashi, Lakshi, Birbandar, Kamarda and Kalagachhia (6) in Khejuri-I CD Block and Baratala, Haludbari, Khejuri, Janka and Nij Kasaba (5) in Khejuri-II CD Block. From the democratic point of view, it is existed as Khejuri Assembly and included of Kanthi Constituency of Purba Medinipur district in West Bengal, India.



**Figure-1 & 2:** Location Map prepared from Administrative Maps and the Satellite Image (Sensor:-Landsat -5,TM, Date:-February 6,2010, No. Of Bands:-7, Spatial Resolution:-30m, Path/Row:-139/45).

#### 4. Methods & Methodology

From the sense of own birth place as well as motherland, a special attention to this place, Khejuri Police Station has been growing day to day in my thinking world. But, this historical coastal segment over Bengal coast is loosening its geo-environmental dignity and ecological purity due to some illegal, unscientific and haphazard anthropogenic activities and development planning which are growing at its rapid

and extensive rate with modernization and techno-centrism. Most of the wetlands of Khejuri are not also out of this uncivilized action of civilized society. In this perspective, selection of the study area has been considered and an ecological meltdown scenario due to specifically dwindling condition of indigenous fresh water fish species in the area has been emphasized in this study. Intensive questionnaire survey, habitat survey and sampling process, local official and institutional survey and interviews with local people, older and experienced individuals, different expertise, resource personalities, academicians, environmentalists and environmental workers have been considered specially as relevant as. Secondary data have been collected from regarding offices, institutions and departments like West Bengal Biodiversity Board, Land and Land Reform Department of West Bengal, Environment Department, Govt. of West Bengal, West Bengal Pollution Control Board, Department of Fishing and Fisheries, Govt. of West Bengal, two Block Development Office and different Panchayet Offices of the study area, etc. Literature review including different relevant journals, articles, research papers, project works and books has been the main tool for conducting and completing the study. Different primary and secondary data have been compiled and analyzed with the help of proper statistical techniques (SPSS), GIS mapping techniques and Image Analysis.

#### 5. Existed types of Niches in the Study Area:

Since, the study area is one of the segments of coastal-fluvial basins of Bengal and included of Rasulpur-Pichhabani watershed, there are observed the variety in niches as well as habitats. There are mainly found five types of niches for freshwater indigenous fish species. These are:

- 1) Small Domestic Ponds: existed throughout the study area;
- 2) Big Ponds: either owned by individuals or few families, may be as social resource also-existed throughout the study area;
- 3) Rain fed Canals/ Drains/ Irrigation Canals: frequently observed at the roadside position and somewhere connected with main or base rivers or channels. It should be notified that Orissa Coast Canal has passed through Khejuri-I CD Block;
- 4) Land shaping Ponds: mainly excavated for agricultural irrigation purpose. The magnitude of such type of niches has been improved through different kinds of Governmental Schemes and Projects during different planning periods; and
- 5) Low lying inundated Paddy Fields: observed throughout the study area.

Without the above, there are observed much of coastal wetlands, tidal canals, river channels, creeks and basin lowlands on and along the coastal belt. But, those are affected and influenced by saline water and saline water fishes.

6. Preference of Fresh Water Fishes found in Khejuri

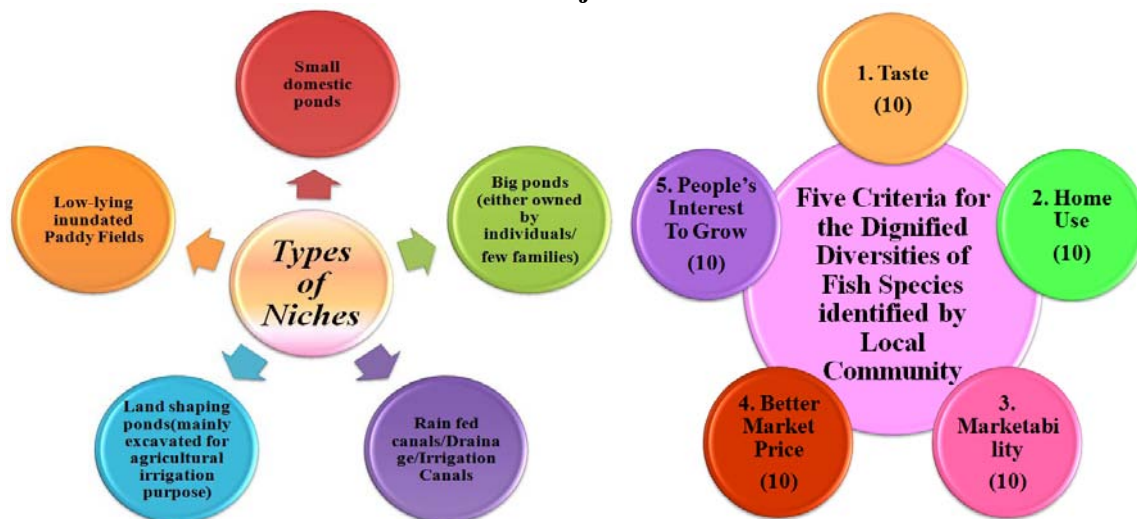


Figure 3: Types of Niches existed in the study area & Figure-4: Criteria for the dignified diversities of fish species identified by local community

Preference of freshwater fish species has been justified and experimented on the basis of field survey and interviewing or interacting with local people. From the survey, it has been seen that there are specifically five criteria to dignify the diversities of freshwater fish species. These are (1) taste as the food element, (2) home use, (3) marketability, (4) better market price and (5) people’s interest to grow or rare up these. First two criteria are for the fulfillment of basic and

domestic demands, second two are for economic comfortness or self-sufficiency and last one is for only aesthetic or self-recreational satisfaction from habit or hobby. However, the above mentioned criteria show the dignity and importance of the major freshwater fish species to indigenous people in the study area.

Table 1: Small Pond as the Niche with the diversities of fish species

Niche	Types of Fishes	Scientific Names	Taste	Home Use	Marketability	Price Obtained	Interest To Grow
Small Ponds	Rohu*	Labeo rohita	H	M-H	M-H	M	M-H
	Mrigal*	Cirrhinus mrigala	M-H	M-H	M	M	M
	Catla*	Catla catla	M	M	M	M	M
	Java Punti	Puntius javonicus	H	H	M	M	H
	Tialpia	Oreochromis niloticus	M	M-H	L-M	L-M	M-H
	Singhi*	Heteronustes fossilis	H	L	H	H	L
	Magur*	Clarius batrachus	H	L	H	H	L
	Mourala*	Amblypharyngodon mola	H	H	H	H	L
	Silvercarp	Hypophthalmichthys molitrix	L	H	L	L	H
	Koi*	Anabus testudineus	H	M	H	H	L
Tangra*	Mystus vittatus	H	L	H	M-H	L	

H = High, M-H = Moderate to High, L-M = Moderate to Low & L = Low

Niche	Types of Fishes	Scientific Names	Taste	Home Use	Marketability	Price Obtained	Interest to Grow
Big Ponds	Rohu*	Labeo rohita	H	M-H	M-H	M	M-H
	Mrigal*	Cirrhinus mrigala	M-H	M-H	M	M	M
	Catla*	Catla catla	M	M	M	M	M
	Java Punti	Puntius javonicus	H	H	M	M	H
	Tialpia	Oreochromis niloticus	M	M-H	L-M	L-M	M-H
	Singhi*	Heteronustes fossilis	H	L	H	H	L
	Magur*	Clarius batrachus	H	L	H	H	L
	Mourala*	Amblypharyngodon mola	H	H	H	H	L
	Silvercarp	Hypophthalmichthys molitrix	L	H	L	L	H
	Koi*	Anabus testudineus	H	M	H	H	L
	Tangra*	Mystus vittatus	H	L	H	M-H	L
	Golda Chingri*	M. rosenbergii	H	L	H	H	H
	Sol*	Channa striatus	M-H	H	M	M	L
	Lata*	Channa punctatus	M	H	L	L	L
	Pabda*	Ompak pabda	H	M	H	H	H
Bata*	Labeo bata	H	M-H	M-H	H	H	

Niche	Types of Fishes	Scientific Names	Taste	Home Use	Marketability	Price Obtained	Interest To Grow
Drainage/ Irrigation Canals	Rohu*	Labeo rohita	H	M-H	M-H	M	M-H
	Mrigal*	Cirrhinus mrigala	M-H	M-H	M	M	M
	Catla*	Catla catla	M	M	M	M	M
	Java Punti	Puntius javonicus	H	H	M	M	H
	Tialpia	Oreochromis niloticus	M	M-H	L-M	L-M	M-H
	Singhi*	Heteronustes fossilis	H	L	H	H	L
	Magur*	Clarius batrachus	H	L	H	H	L
	Mourala*	Amblypharyngodon mola	H	H	H	H	L
	Silvercarp	Hypophthalmichthys molitrix	L	H	L	L	H
	Koi*	Anabus testudineus	H	M	H	H	L
	Tangra*	Mystus vittatus	H	L	H	M-H	L
	Golda Chingri*	M. rosenbergii	H	L	H	H	H
	Sol*	Channa striatus	M-H	H	M	M	L
	Lata*	Channa punctatus	M	H	L	L	L
	Pabda*	Ompak pabda	H	M	H	H	H
	Bata*	Labeo bata	H	M-H	M-H	H	H
Bhetki*	Lates calcarifer	H	L	H	H	H	
Pankal*	Mastacembelus pancalus	H	H	M	M	L	
Pangus	<b>Pangasius pangasius</b>	M	M	L-M	L-M	M	

Niche	Types of Fishes	Scientific Names	Taste	Home Use	Marketability	Price Obtained	Interest to Grow
Land Shaping Ponds (On Farms)	Rohu*	Labeo rohita	H	M-H	M-H	M	M-H
	Mrigal*	Cirrhinus mrigala	M-H	M-H	M	M	M
	Catla*	Catla catla	M	M	M	M	M
	Java Punti	Puntius javonicus	H	H	M	M	H
	Tialpia	Oreochromis niloticus	M	M-H	L-M	L-M	M-H
	Silver carp	Hypophthalmichthys molitrix	L	H	L	L	H
	Golda Chingri*	M. rosenbergii	H	L	H	H	H

Niche	Types of Fishes	Scientific Names	Taste	Home Use	Marketability	Price Obtained	Interest to Grow
Paddy Fields	Koi*	Anabus testudineus	H	M	H	H	L
	Tangra*	Mystus vittatus	H	L	H	M-H	L
	Singhi*	Heteronustes fossilis	H	L	H	H	L
	Magur*	Clarius batrachus	H	L	H	H	L
	Mourala*	Amblypharyngodon mola	H	H	H	H	L
	Sol*	Channa striatus	M-H	H	M	M	L
Lata*	Channa punctatus	M	H	L	L	L	

**Table-2, 3, 4 & 5:** Big Ponds, Drainage, Farms & Paddy Fields as the Niches with the diversities of fish species

### 7. Nutritional Value of Indigenous Freshwater Fish Species of Khejuri Area:

indigenous fishes are better than that of large fish species. Based on the survey and analysis, it is clear to assess that most nutritious fishes have been affected at more magnitude.

From the consideration of nutritional values of the indigenous freshwater fishes, there is observed small

**Table 6:** Nutritional Value of Indigenous Freshwater Fish Species in the Study Area

Fish Species (per 100gm raw, edible parts)	Scientific Names	Vitamin (mg)	Calcium (mg)	Iron (mg)
<b>Small Indigenous Species</b>				
Mourala*	Amblypharyngodon mola	1960	1071	7
Dhela	Rohtee catio	937	1260	-
Darkina	Esomus danricus	1457	-	-
Chanda	Parambassis spp.	341	1162	-
Punti	Puntius spp.	37	1059	-
<b>Large Fish Species</b>				
HILSA	Hilsa hilsa	69	126	3
Silver Carp Adult	Hypophthalmichthys molitrix	17	268	-
Rohu	Labeo roheta	27	317	-
Silver Carp Juvenile	H. Molitrix	13	-	-
Tilapia	Oreochromis niloticus	19	-	5

## 8. What is the IUCN Red List?

The IUCN Red List of Threatened Species (also known as the IUCN Red List or Red Data List), founded in 1964, is the world's most comprehensive inventory of the global conservation status of biological species.

Species are classified by the IUCN Red List into nine groups,<sup>[15]</sup> set through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation.

- **Extinct (EX)** – No known individuals remaining.
- **Extinct in the wild (EW)** – Known only to survive in captivity, or as a naturalized population outside its historic range.
- **Critically endangered (CR)** – Extremely high risk of extinction in the wild.
- **Endangered (EN)** – High risk of extinction in the wild.
- **Vulnerable (VU)** – High risk of endangerment in the wild.
- **Near threatened (NT)** – Likely to become endangered in the near future.
- **Least concern (LC)** – Lowest risk. Does not qualify for a more at-risk category. Widespread and abundant taxon are included in this category.
- **Data deficient (DD)** – Not enough data to make an assessment of its risk of extinction.
- **Not evaluated (NE)** – Has not yet been evaluated against the criteria.

When discussing the IUCN Red List, the official term "**threatened**" is a grouping of three categories: Critically Endangered, Endangered, and Vulnerable.

### 1) What is Indigenous Freshwater Fish Species?

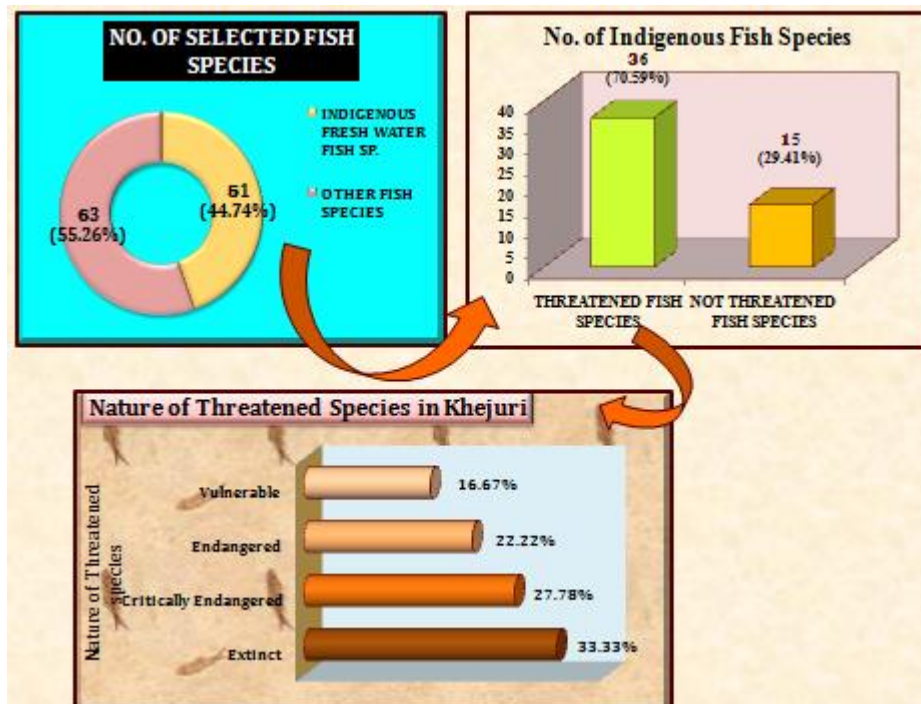
In biogeography, a species is defined as **indigenous** to a given region or ecosystem if its presence in that region is the

result of only natural process, with no human intervention. The term is equivalent to "**native**" in less scientific usage. Every natural organism (as opposed to a domesticated organism) has its own natural range of distribution in which it is regarded as indigenous. Outside this native range, a species may be introduced by human activity; it is then referred to as an **introduced species** within the regions where it was anthropogenically introduced.








Indigenous fish species are found generally in freshwater systems. The indigenous freshwater fish species (IFFS) form a major component of food consumed by families, especially those living closer to freshwater resources. IFFS found in the vast inland water resources, provide not only nutrition but also livelihood opportunities and income to a large number of fishers.

### 2) Recent Status of Indigenous Fresh Water Fish Species in the Study Area:








From the survey and study on the selected area, 114 fish species have been identified and considered to justify the status of indigenous fresh water fish species. Among those 51(44.7%) were included of indigenous fresh water fish species and 63 (55.3%) as others. Survey as well as this study shows a tremendous result that out of 51-identified and selected species, about 70.6% is threatened more or less where only 29.4% is out of danger in recent. According to IUCN Red Data Book List, all of the threatening species have been divided into different intimidating categories where it is observed that among the threatening species in the study area, Khejuri, about 33% is under extinct level unluckily, about 28% is going to critically endangered position, about 22% is included of endangered category and approximately 17% is at vulnerable level. The following figures and tables reflect recent status of major freshwater fish species existed in the study area.





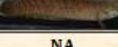




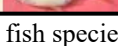


**Figure 5:** Threatened Scenario of the Indigenous Freshwater Fish Species in the Study Area

Sl. No.	Name Of Species	Local Name	Scientific Name	Nature Of Existence	Picture
1.	Olive barb	Shorpunti / শরপুন্টি	<a href="#">Puntius sarana</a>	Critically Endangered	
2.	Ticto barb	2-spot barb; Titpunti	Puntius ticto	Endangered	
3.	Rosy barb	কাচোন পুন্টি	Puntius conchoniuis	Extinct	
3.	Indian glassy fish	Chanda, Lal chanda	Chanda ranga	Critically Endangered	
4.	Elongate glass-perchlet	Chanda, Nama chanda	Chanda nama	Critically Endangered	
5.	Asiatic snakehead	Cheng	Channa orientalis	Extinct	
6.	Mud perch	Meni, Bheda	Nandus nandus	Extinct	

7.	Cuchia	Kuchia	Monopterusuchia	Extinct	
8.	Pabo catfish	Kani Pabda	Ompok pabo	Extinct	
9.	Keo Fish	Balgura	Platycephalus indicus	Critically Endangered	
10.	Spiny Eel	Raj pankal	Macroganathus siamensis	Critically Endangered	
11.	Snakeskin Gourami	Bhutkori	Trichogaster pectoralis	Extinct	
12.	Orange-fin labeo	কালবাউস	Labeo calbasu	Vulnerable	
13.	Zebra fish	আনজু	Danio rerio	Extinct	

14.	Gangetic Mystus	Mitha Tengra	Mystus cavasius	Vulnerable	
15.	Dwarf Gourami	Kholisa/ Patkholisa	Colisa lalia	Extinct	
16.	Dwarf Gourami	Kholisa/ Patkholisa	Colisa lalia	Critically Endangered	
17.	Walking catfish	Koi	Anabas testudineus	Vulnerable	
18.	Boga labeo	Bhangan, Bata	Labeo boga	Endangered	
19.	2-track spinyeel	Baim, Salbaim, Bam	Mastacembelus armatus	Critically Endangered	
20.	NA	Singhi	Heteronustes fossilis	Vulnerable	

21.	Cypriniformes Balitoridae	Dari	<a href="#">Schistura scaturigina</a>	Critically Endangered	
22.	Perciformes Gobiidae	Chewa	<a href="#">Pseudapocryptes elongatus</a>	Vulnerable	
23.	Barred spiny eel	Pankal baim	<a href="#">Macrognathus pancalus</a>	Vulnerable	
24.	Wallago	Boal	<a href="#">Wallago attu</a>	Critically Endangered	
25.	<a href="#">Barca snakehead</a>	Pipla shol, Tila shol	<a href="#">Channa barca</a>	Endangered	
26.	<a href="#">Tor mahseer</a>	Mahashol	<a href="#">Tor tor</a>	Extinct	NA
27.	<a href="#">Grey featherback</a>	Foli, Pholi	<a href="#">Notopterus notopterus</a>	Endangered	
28.	<a href="#">Humped featherback</a>	Chital	<a href="#">Notopterus chitala</a>	Critically Endangered	
29.	Tank goby	Bele	<a href="#">Glossogobius giuris</a>	Extinct	
30.		Gachhua	<a href="#">Channa gachhua</a>	Extinct	
31.	<a href="#">Mola carplet</a>	<a href="#">Mola</a>	<a href="#">Amblypharyngo don mola</a>	Vulnerable	

Tables-7, 8, 9 & 10: Existence & status of major indigenous fresh water fish species in the study area

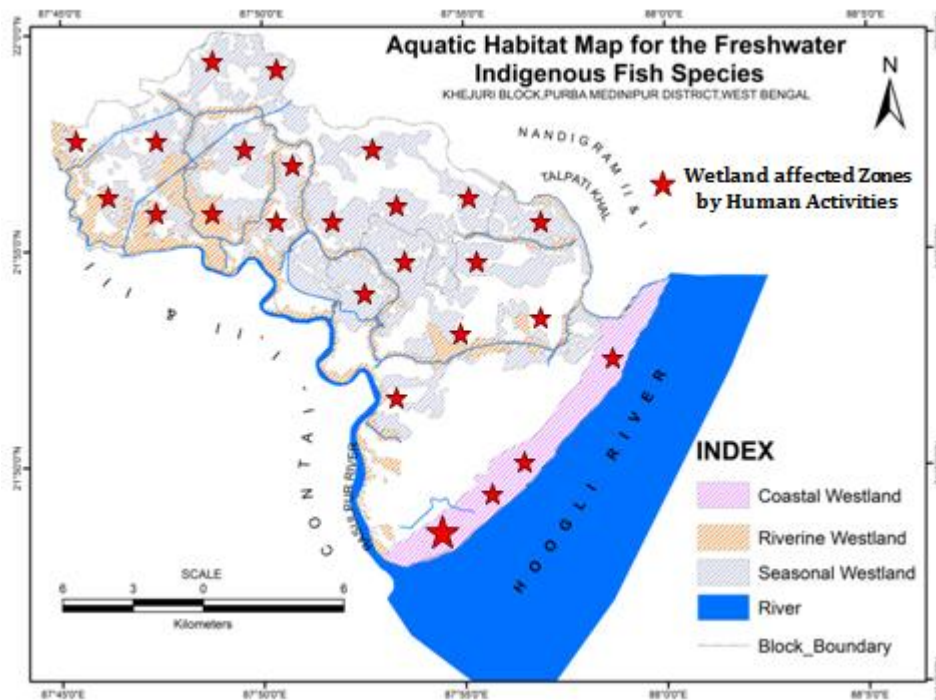


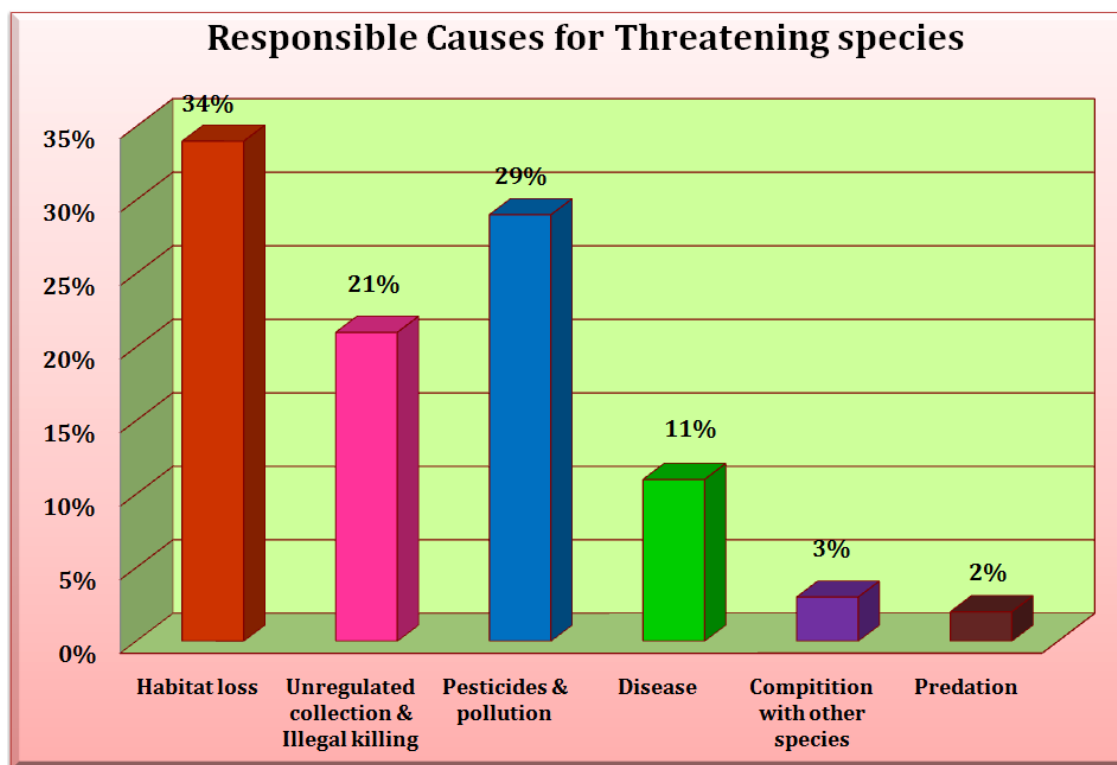
Figure 6: Aquatic Habitat and affected zones of the study area

### 3) Responsible Causes due to threatening the Indigenous Fresh Water Fish Species:



**Table 11:** Responsible Causes for threatening the Indigenous Fresh Water Fish Species in the Study Area

Sl. No.	Responsible Factors/ Causes for Threatening the Species	Sub-causes
1.	Habitat Loss, Modification & Fragmentation	• Settlement Expansion & encroachment of aquatic habitats
		• Extension and development of commercial construction & activities and capturing the freshwater habitats
		• Fish Farming & Shrimp Cultivation replacing the natural habitats
		• Brick Manufacturing covering the natural habitats as well as riverine or roadside wetlands
		• Double Cropped Agricultural Land Expansion loosening the opportunity of seasonal wetlands
		• Shrinkage of Natural Wetlands by changing natural process and also uncivilized works of civilized inhabitants
		• Shrinkage of Seasonal Wetlands (specifically crop lands) due to different anthropogenic activities
2.	Habitat Pollution and Degradation	• Damaging the River or Drainage System by different natural and anthropogenic activities or changes
		• Pesticides & Pollution from Modern Agriculture
		• Pollution from Fish Farming & Shrimp Cultivation
		• Pollution from Brick Manufacturing
3.	Unregulated Collection & Killing	• Pollution from Settling or Constructing Pockets
		• Over-collection & exploitation for fulfillment the huge food demands for explosive population
4.	Disease	• Over-collection & exploitation of immature species at their initial & early young stage
		• Disease from pollution/ toxic elements from different sources
5.	Competition with other species	• Microbial disease
		• Competition with other natural indigenous fish species
		• Competition with other natural aquatic species
		• Competition from exotic species
6.	Predation	• Competition with other artificial/ cultivated/ imported fish species
		• Intensive subsistence/ livelihood predation
7.	Declining the Growing and Breeding Space & Environment	• Extensive/ commercial/ economic predation
		• Habitat loss due to above causes
		• Polluting & degrading the environment due to above causes
		• Changing land use and environment due to both physical and anthropogenic changes
		• Drastically land use change through the development of the region



**Figure 7:** Ways That Species Become Threatened

4) Landuse Patterns of Khejuri & Threats to the Indigenous Fresh Water Fish Species:

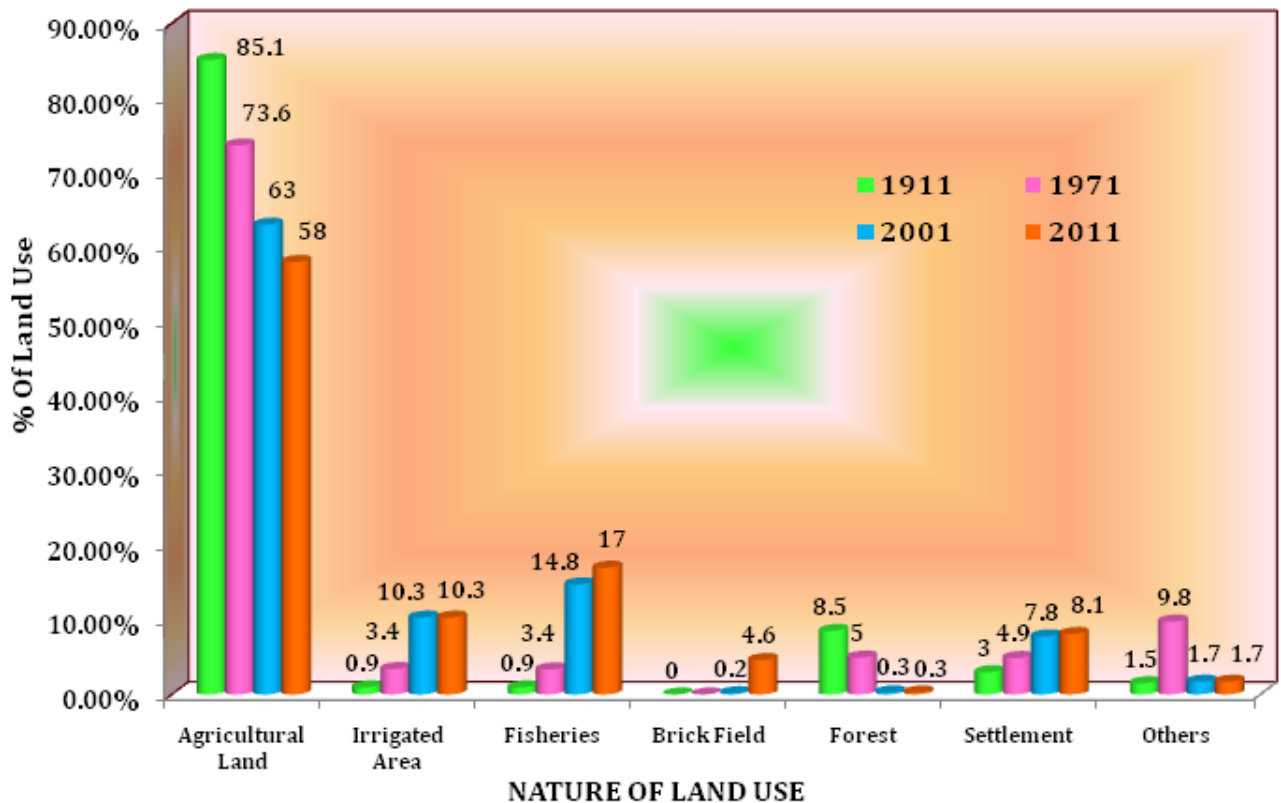


Figure 8: Changing Land use Scenario responsible to the Gradual Declining of the Habitat of threatening Fish Species

Changing Land use Trend of this area is not very exceptional to the global scenario. Changing livelihood status throughout the time influences the land uses and land covers with the upgrading expectations of needy and greedy human beings. Self-orienting human activities are reflected as the signature of changing landscape. In case of my study area, there is also observed this scenario of changing land use/ land cover. Data have been collected and compiled for this purpose which reveals that explosive population growth, haphazard settlement expansion, illegal and capricious human activities and recent development and planning process have compelled to change and modify this coastal landscape.

Squeezing behavior of agricultural lands due to changing anthropogenic mind setting towards more beneficial economic activities influences the decline in natural lowland or wetland for different aquatic fresh water living forms. Not only that, establishment and development of brick manufacturing and recent trend towards fish and shrimp farming have encroached the large habitat existence of freshwater fish species along with other aquatic lives. Thus, the changing land use image depicts the turn down look up of natural feeding and breeding field of indigenous fresh water fish species in the study area, Khejuri.

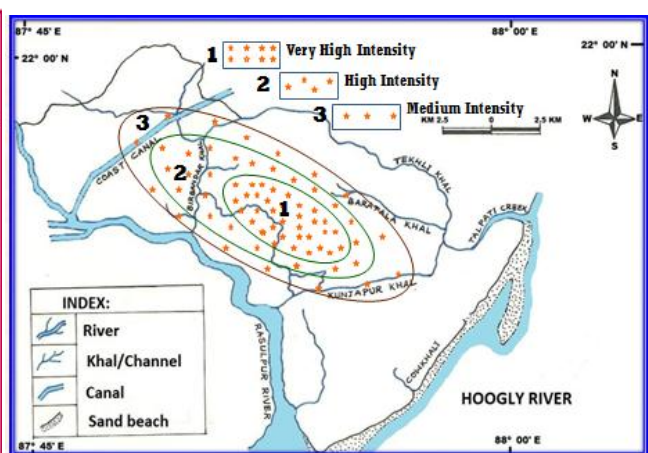
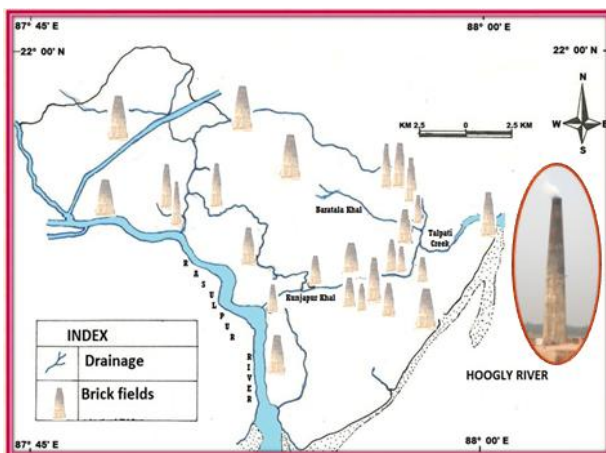


Figure-9: Brick Fields covering the habitat of aquatic lives & Figure-0: Variation of Indigenous Fresh water fishes based on the intensity

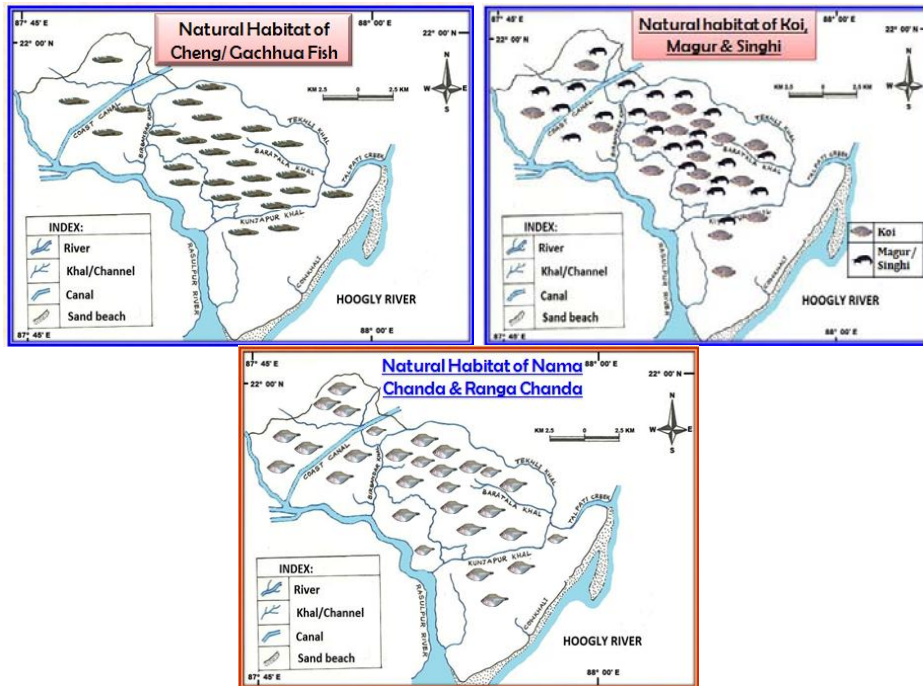


Figure-11, 12 & 13: *Channa orientalis*, *Clarius batrachus* and *Heteronustes fossilis* & *Chanda ranga* and *Chanda nama*

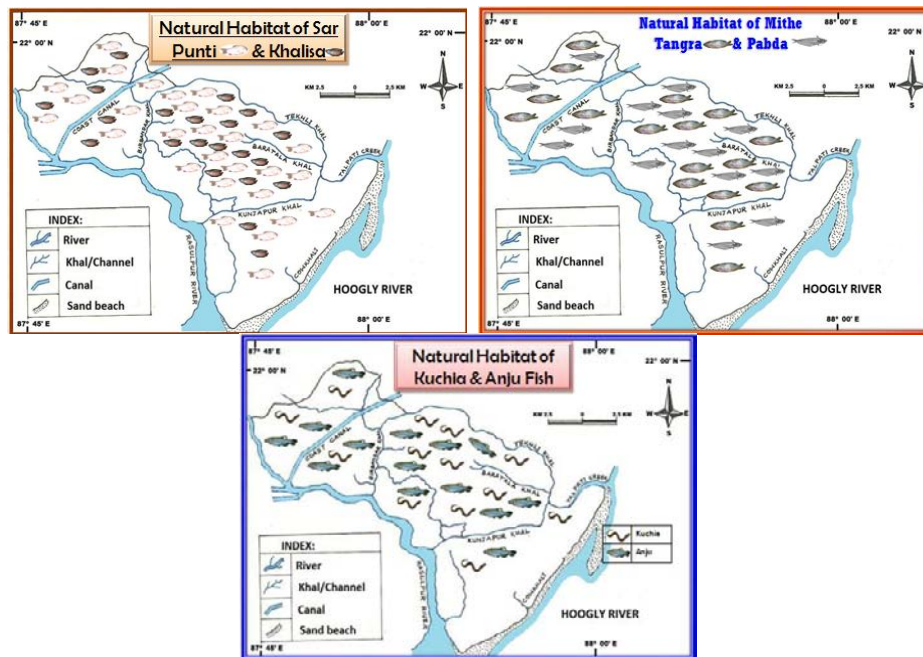
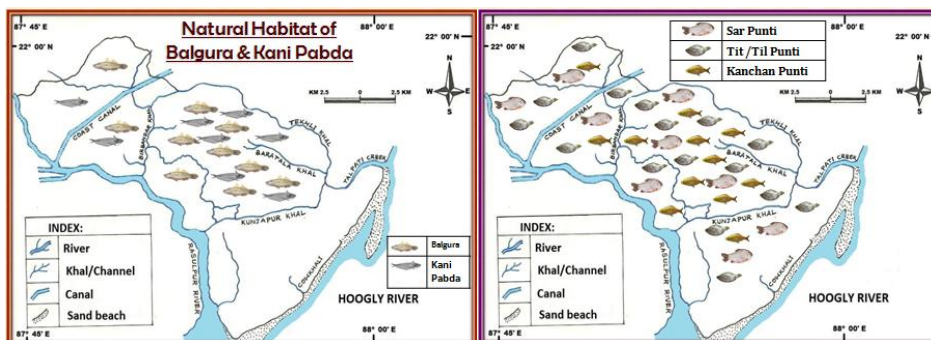


Figure-14, 15 & 16: *Puntius conchoniuis* & *Colisa lalia*; *Mystus cavasius* and *pabo catfish* & *Monopterus cuchia* and *Danio rerio*



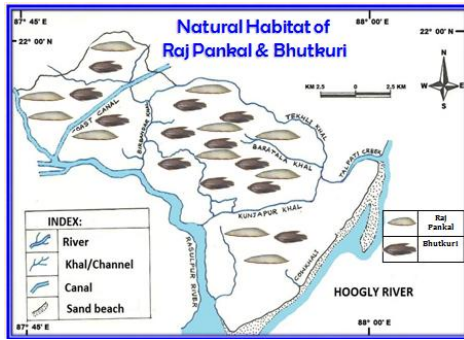


Figure-17, 18 & 19: *Platycephalus indicus* and *Ompok pabo*; *Puntius conchonius*, *Puntius ticto* and *Puntius sarana* & *Macrognathus pancalus* and *Trichogaster pectoralis*

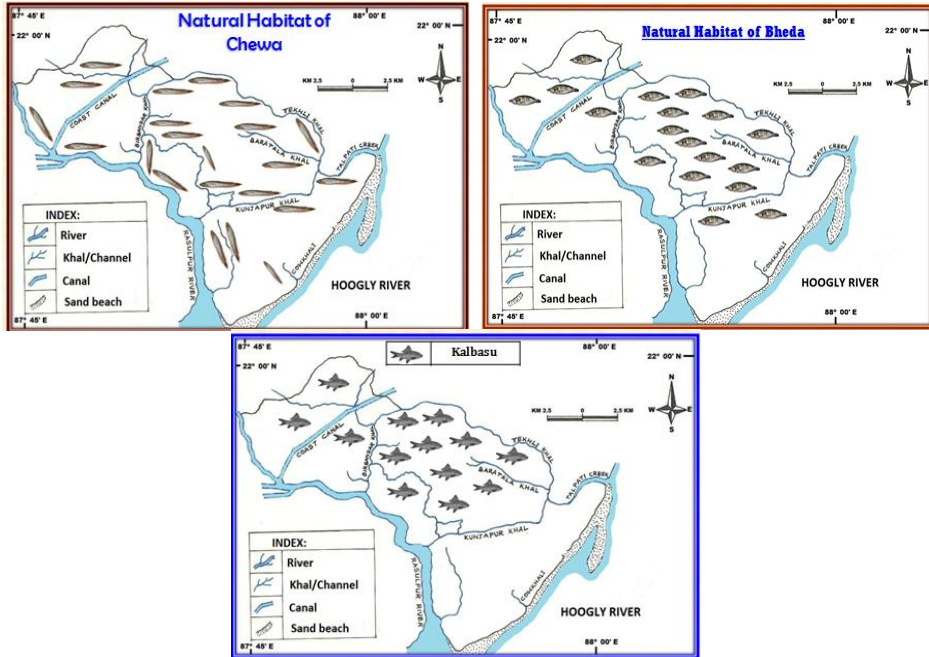


Figure-20, 21 & 22: *Pseudapocryptes elongatus*; *Nandus nandus* & *Labeo calbasu*

Figure-10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 & 22: Habitat Distribution of some major indigenous fresh water fish species throughout the study area

### 9. Impacts due to threatening the Indigenous Fish Species in the Study Area:

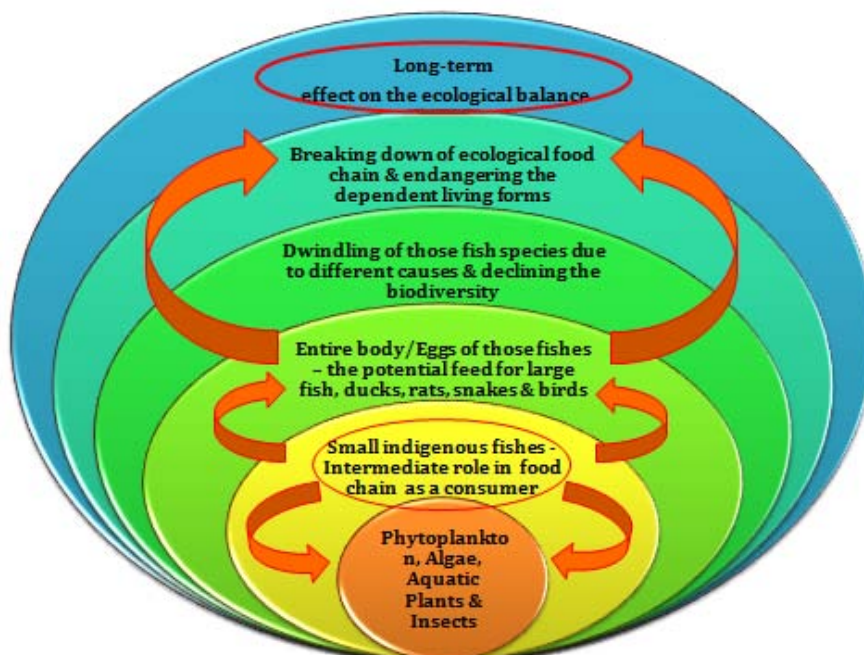


Figure 23: Ecological Meltdown Scenario due to declining the Fresh water Fish Species

**Table 12:** Impacts due to threatening the Indigenous Freshwater Fish Species in the Study Area

Physical Impacts	Physical-Anthropogenic Impacts	Anthropogenic Impacts
Dwindling the Indigenous Freshwater Fish Species	Change in Food Chain & Food Habits in Society & Environment	Crisis of Fish Food as well as Fish Protein
Declining the Aquatic Species Diversity	Affection of co-species, population & communities including human beings	Changing Food Lifestyle & Livelihood
Decreasing the Aquatic Biodiversity	Change and modification in agricultural ecosystem and practices	Economic Loss to dependent root level people & improving the local poverty and unemployment
Degrading the Natural Aquatic Ecosystem & Habitat	Declining the Fish Resources and related aquatic and terrestrial characters including human self	Loosening the Socio-cultural, ethical & aesthetic value centering the mentioned fish species

## 10. Recommendations

### 1) The proposals/ recommendation related to Nutrition:

- undertake studies on intra-household consumption of fish by season;
- prioritize species to be cultured, in consultation with stakeholders; and
- Popularize the consumption of nutrient-dense fish species through awareness programmes, and, at the same time, ensure that the access rights to these species remain with the local communities, by empowering local governments to take decisions on these issues.
- document and explore the nutritive value and therapeutic properties of small native fish species, also in relation to cooking and eating habits;
- Evaluate the role of the indigenous freshwater fish species in nutritional security of vulnerable groups, such as pregnant and lactating women and children;
- Profile these species under the ICAR network project on nutrition.

### 2) The key recommendations related to Poverty Alleviation:

- recognizing the role of SIFFS in poverty alleviation, through assessment of their contribution to the economy and nutrition of disadvantaged populations, particularly women and children;
- ensuring protection/management of aquatic habitats, while ensuring that the rights of access of disadvantaged groups to aquatic resources are secured;
- ensuring that research and policy promote the integration of these species into culture-based fisheries and aquaculture systems; and
- Strengthening appropriate community institutions to protect access rights, ensure responsible ecosystem management and equitable economic benefits.

### 3) The key recommendations related to Biodiversity:

- assess freshwater habitat, species richness, endemism and causes of degradation, with a view to developing priorities for SIFFS conservation;

- review the adequacy of existing policies, identifying gaps, conflicts, etc., with a view to strengthening policies for conservation of these species; and
- Develop local community awareness, evolve specific recovery programmes with local participation and develop management strategies/models for replication and upscaling.

### 4) The key recommendations related to Legal Policy, Planning and Strategy Making:

- Ensure that policy and legislation at different levels on captures fisheries; aquaculture and biodiversity conservation addresses the development needs and conservation requirements of the indigenous freshwater fish species;
- Developing policy and support system (for example translocation of native species, IPR protection etc.)
- prepare Blockwise endemic and endangered status reports of small native species;
- ensure that the benefits flow to the local community in case of any commercial utilization of resources;
- compile, document, protect and reward farmers' innovations and traditional knowledge on seed production and culture of native fish species;
- request the Honey Bee network to document innovations and traditional knowledge regarding native fish species;
- develop institutional mechanisms to promote culture, consumption and conservation of small native fish species; and
- Encourage a network project along the lines of the AIMS project, for developing and promoting the culture of native fish species.
- Protect access rights of local communities, especially women, to the indigenous freshwater fish species, particularly through appropriate policies and legislation that take into consideration the local socioeconomic, cultural and institutional context; and
- Document and protect traditional knowledge and farmers' innovation with regard to use of the indigenous freshwater fish species resources.
- Data and analyses on fish consumption are needed to determine their contribution to micronutrient intakes.
- Advocacy, awareness raising and nutrition education at all levels on the importance of small, nutrient-dense fish to increase diet diversity and combat micronutrient malnutrition, and the importance of cleaning and cooking practices, should be promoted.
- Sustainable, low-cost, large scale strategies to increase the management, conservation, production and accessibility of micronutrient-dense small fish species should be developed and implemented.
- Regarding strategy for promotion of small native fish species, there is need for planning and research to focus prioritization, further refinement of culture technology and market development.

## 11. Strategy to Safe Guard the Threatening Indigenous Freshwater Fish Species in Khejuri:

### 1) Habitat change should be carefully considered:

Since habitat destruction or change for settlement expansion, informal industrial development, agricultural development or for damming on the course of the drainage or river systems alter the growth and production of the fish particularly freshwater fishes, therefore, due consideration should be given to protect and conserve our resident fish populations. Where deforestation is required for the developmental purposes, replantation should be done to maintain the stability of the soil, clear water and optimum temperature for survival and breeding of the fishes.

### 2) Environment Impact assessment of the exotic fish species

Since the impact of the introduction of the alien species are uncertain due to their ecological interactions in new environments, careful environment impact assessment prior to introduction is essential to conserve the biodiversity of the fishes of this state. In this respect it is a good principle to try to use endemic species for aquaculture to protect and conserve the endemic species of our country instead of importing exotic species, which sometimes creates very harmful effect to our native species. National policies are to be formed considering the diversity of our native fish fauna. Appropriate laws for checking deliberate or accidental introduction of exotic fishes are to be formed. Since introduction of the exotic fish species is a significant threat affecting 30% of all threatened fish species, import of alien species should be very carefully assessed.

### 3) Use of endemic and native fish species for aquaculture:

Our country is now one of the leading fish producing countries having 225 endemic fish species. We have almost one hundred potential fish species' for aquaculture. Out of them 40 species only are being cultured. It is suggested for use of endemic and native species for aquaculture to protect and conserve our own fish resources. In case of the study area, this suggestion should be considered.

### 4) Monitoring on pollution of the natural water bodies

The settlement, agricultural, commercial and industrial waste materials should be treated to remove their toxic effects before discharging their materials in the drainage systems. Pollution due to pesticides and fertilizers in and around the water courses also affect the fish population in general, therefore, the fishermen and the local people should be aware of the detrimental effect of these materials on the fishes and they should be also instructed to use the biodegradable pesticides only. Some are of the opinion that pollution of the River Hooghly has to some extent prevented the migration of the Hilsa fishes in West Bengal including Khejuri. Appropriate steps are to be taken to reduce' the pollution of the water bodies where fishes naturally occur or are cultured.

### 5) Strict implementation of the laws governing the fishing activities:

The existing laws for controlling the fishing operations are to be implemented properly. Monitoring of the water bodies should be done periodically to protect and conserve the fish resources and other aquatic animals. Contradictory laws and policies of the Government and in effective implementation of laws have also affected our resident *fish* species.

### 6) Fish sanctuary

The River Hooghly and its distributaries like Rasulpur, which pass through this study area, Khejuri contains most of the freshwater fishes of study area. Certain portions of their courses may be declared as freshwater fish sanctuaries like that of the Wildlife Sanctuaries of our country. It has been found that several scattered isolated pools are formed during the summer months along the courses of its distributaries. Many important commercial fishes take shelter in these pools until the next onset of the monsoon. During this period fishermen catch these fishes indiscriminately including the brooders, which ultimately destroy the growth and multiplication of the fish population. In view of this fact these pools may also be declared as fish sanctuaries. Fish sanctuaries may also be set up in different isolated perennial ponds and lakes throughout this state.

### 7) Protection and conservation of the endemic species:

Seven endemic species of India are found in this state. These endemic species are considered as our National wealth. Their protection and conservation measures should be like that of the threatened species since out of the 7 endemic species, 3 species are also endangered species of our country.

### 8) Implementing Proper Land use Policy as per Government Land use Principles and Laws:

To prevent the illegal, haphazard, unscientific and unplanned land use changes which are degrading the habitat quality and quantity of fresh water fish species and promoting the ecological meltdown, there should be needed to implement strictly the proper land use policy from the administrative as well as government site. To make success of it, no partiality for any political, economic, social and administrative individual or group should be considered. Only one sense and self for local as well as regional ecology and environment must be considered liberally.

### 9) Public awareness programmes:

Since the fishermen particularly those living near the different river systems or water bodies are the real custodians of the fish community, they should be informed the followings facts to protect the fishes through different mass awareness programmes.

- 1) The traditional fishermen should be aware of the utility and use of proper mesh size of the nets and the effect of indiscriminate fishing since their livelihood is almost completely dependent on the fish catch. During fishing the fishermen should be instructed not to use very small mesh sized net to avoid capturing juveniles or immature fishes.
- 2) The traditional fishermen should be taught the easy identification of the threatened and endemic species of

our country occurring in this region, Khejuri to protect them from extinction.

- 3) The -impact of over harvesting of fishes in a particular zone should also be intimated to the local fishermen. They should be instructed not to capture matured fishes particularly during the breeding seasons. During breeding seasons netting should be very restricted if not totally stopped. Fishermen may be opted for alternative means of livelihood especially during the breeding season to protect the brooders.

## 12. Conclusion

The work has identified 114 fish species from Khejuri recording 51 as the indigenous freshwater species and 63 as others. Out of the 51 freshwater fish species, 30-36 are listed in the threatened freshwater fishes of Khejuri. Among these 33 threatened species, 12 species have been designated as from critically endangered to extinct species, 10 species have been identified as critically endanger species, 8 as endangered and 6 as vulnerable of this area. This study also includes 15 species which are out of threatening and some of common domestic freshwater species are not considered in the study because of they are secured from the threatening. In all of the above causes for threatening the species, humans have been identified as the major character of extinction and the chief threat to different species at risk of their extinction. Drastically land use change has been the prime fact to create this issue in this region. Finally it may be stated that fish feeds on another fish when it is hungry. But we, the mankind depend on fish for our food, medicine, mental development, longevity and for aphrodisiac. We keep them as pets and we thrive by selling them. In a nut shell we are the benefactors, so let them survive for our survival. So, we should need to conserve the indigenous freshwater fish species by protecting their natural habitat and Promote sustainable use of the indigenous freshwater fish species in both capture and culture fishery systems for enhancing nutritional security of the rural poor, providing greater employment opportunities. Side by side we must have to examine actively the feasibility of incorporating the indigenous freshwater fish species into existing poly-culture practices through research, development and extension programmes and the Target studies on contribution of the indigenous freshwater fish species from different aquatic resources and farming systems should be considered from the heart of unity of all sections of society. Which people are acting in the role of villain in this ecological meltdown real drama, should be aware of the importance of those species in the local economy and also ecology. At the end, it should be noted that more and more research, study and programme relating the issue can draw out a blue print for preventing the dwindling run up of indigenous freshwater fish species in this region.

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