DIVERSITY OF SMALL INDIGENOUS FISH SPECIES AND THEIR PRESENT "IUCN' STATUS IN DHEMAJI DISTRICT , ASSAM

A dissertation submitted in partial fulfillment of the requirement for the degree of Master of Science in Zoology

SUBMITTED BY :-

Rajamoni Saikia
Roll no :- 202820024014
Reg no :- 451528220

GUIDED BY :-

Dr. Jashodeb Arjun
Associate professor
dept . of Zoology

SILAPATHAR SCIENCE COLLEGE AFFILIATED BY
ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
(2022)

CERTIFICATE

This is to certify that the dissertation entitled " DIVERSITY OF SMALL INDIGENOUS FISH SPECIES AND THEIR PRESENT "IUCN" STATUS IN DHEMAJI DISTRIC , ASSAM " submitted in partial fulfillment of the requirement for the degree of Master of Science in Zoology is a compilation of the result of bonafide work carried out by Rajamoni Saikia (Reg. no : 451128220 , Roll no : 202820024014) , department of ZOOLOGY , Silapathar science college affiliated by ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY , (Assam) under my guidance and supervision .

The dissertation or any its part has not been submitted elsewhere for any other degree of distinction in any other university / institution . All the help and assistance received during the course of work have been duly acknowledged .

I am pleased to forward this dissertation for consideration for the award of the degree of Master in Science in Zoology (Under Silapather science college) affiliated by ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY , Assam .

Date : 23 - 07 - 2022

(Dr . Jashodeb Arjun)

Place : Silapathar science college

Dissertation Supervisor

Extra
T. Konkhala
Assistant Professor
CHF, CAU.

CANDIDATE' S DECLARATION

I , Rajamoni saikia , hereby declare that the research work entitled " **DIVERSITY OF SMALL INDIGENOUS FISH SPECIES AND THEIR PRESENT "IUCN" STATUS IN DHEMAJI DISTRIC , ASSAM .** ' in partial fulfillment of the requirement for the degree of Master of Science in Zoology is being presented in the form of thesis and submitted in the department of Zoology , Silapathar Science College affiliated by ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY , Assam , under the supervision of Dr. Jashodeb Arjun , Associate professor .

The matter presented in the project has not been submitted by me for any other degree of this or any other institute .

Rajamoni Saikia

Signature of the Candidates

This is to certify the above statement made by the candidate is correct to the best of my knowledge .

Date : 23 - 07 - 2022

Signature of supervisor

ACKNOWLEDGEMENT

It is always a pleasure to remind the fine people for their sincere guidance I have received to uphold my practical , filed and laboratory skills in the accomplishment of my dissertation , as a study like this can never be the outcome of the effort of a single person , rather it bears the imprint of a number of people who directly or indirectly helped me in the partial fulfillment of the project .

Firstly , my gratitude goes to my guide Dr . Jashodeb Arjun , professor , Department of Zoology , Silapathar Science college affiliated by Assam Science And Technology University Assam for his enthusiasm and encouraging assistance the work .

Secondly , I am thankful to the Head of our institution , Dr . Ranjit Saikia for providing us with all the material and facilities required . Also , I would like to express my deepest thanks to Dr. Utsab Singha and Dr. Parimal Chandra Ray , (Assistant professor) Department of Zoology and also Dr Jitu Gogoi, for showing the right direction towards completing the work .

Lastly , I thank my parents , friend for their cooperation , support.

Date : 23 - 07 - 2022

Rajamoni saikia

CONTENT

INTRODUCTION

Fishes are cold blooded vertebrates having an aquatic mode of habitat [1]. Fish constitutes almost half of the total number of vertebrates in the world. Small indigenous fish species (SIFS) compromise a significant group of total fin fish and small fish populating and contribute significantly to the nutritional as well as lively hood security to the rural mass .

The Brahmaputra drainage system in North-east India is one of the largest hydrographic basins in South-east Asia. This mighty river has a very rich and diverse aquatic gene pool, particularly of fishes and featured among the global hot spots of freshwater fish diversity (Kottelat and Whitten, 1996). Out of the 765 native freshwater fish species available in India, 450 have been classified as SIS (small indigenious fish) freshwater fish (NBFGR, 2011). Maximum diversity of SIS's has been recorded from the north-east region followed by Western Ghat and Central India (NBFGR, 2011). By standard definition, SIS fish should not exceed in length of about 25 cm/9 inch at maturity (Felts *et al.*, 1996; Hossain *et al.*, 1999; Khanam *et al.* (2003). But, as per the study conducted by Kostori *et al.* (2011), the above definition contradicts since for few species like *Puntius sarana*, *Clarias batrachus*, *Channa barca*, *Xenentodon cancila* and *Heteropneustes fossilis*, size exceeds 25 cm, yet they are considered as SIS fish.

. Fish have a very special consideration and place in human civilization from the time immemorial. Fish is one of the most important sources of food . The live weight of majority of fish

usually consists of about water (70-80%), protein (20-30%) and of lipid (2- 12%) . Therefore, fish is considered as one of useful source of several minerals, especially if bones are consumed. Furthermore, some nutritional components of fish have functional effects on human health. For example, fish oil is one of the most important natural sources of polyunsaturated fatty acids including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which have been proven to have useful effects on human health. SIS fish is a vital source of vitamin A, along with calcium for rural poor households [4]. It has been reported that some species such as *Amblyphayngodon mola*, *Osteobrama cotio* and *Esomus danricus* contain high amount of vitamin A and other micronutrients and minerals . Certain fishes and their by-products contribute to useful Ayurvedic and Unani medicines for the treatment of duodenal ulcer, skin disease, night blindness, general weakness, loss of appetite, cold, cough, bronchitis, asthma, tuberculosis etc . The people of the rural areas of Assam used many locally available fishes for medicinal purpose from time immemorial. Different ethnic communities are used indigenous fish species against various diseases from anaemia to gynaecological problems. The present communication is a review on the diversity of small indigenous freshwater fish species in Assam and their nutritional contents and medicinal importance.

Fish are invariably one of the most important biotic components of an aquatic ecosystem which apart from forming protein rich food source for human beings, also act as a good bio indicators of a water body. The Northeastern region of India is one

of the hot spots of freshwater fish biodiversity in the world . However, the rich biodiversity of the freshwater fish of the India has been rapidly declining over the years due to excessive human activities and as well as other environmental factors. In future, the loss of biodiversity and its effects are predicted to be greater for aquatic ecosystems than for terrestrial ecosystems (Sala *et al.*, 2000) . Physico - chemical parameters of the water body are one of the essential factors required for the sustenance of life in any kind of the aquatic ecosystem.. Among the several kinds of inland freshwater bodies, the riverine system holds a unique position in terms of ecosystem, which generally covers different types of climatic zones, landscapes and bio-geographic regions. However, the cleanliness of rivers is one of the primary factors required for sustenance of aquatic life. So far, there are no specific records and systematic study on the hydrobiology and fish inventory. However, some works on ornamental fish diversity on different rivers of Assam has been done by the several workers [3, 4]; (Sarma, *et al.*, 2012)[5]. Moreover, Assam rivers are one of the vital resources for earning livelihood of fisher folk and other villager inhabiting in and around the river since long time and also providing recreation and other agricultural activities for human beings as well as habitat for many diverged species of aquatic plants and animals.

Fish contribute a significant amount of animal protein to the diets of people worldwide. In addition, fish is an important source of essential vitamins and minerals while also having a low content of saturated fat, carbohydrates and cholesterol. Fish is highly nutritious and serves as a valuable supplement in diets lacking essential vitamins and minerals. Nutritional quality of some Indigenous fish species was recorded by various researchers.

Twenty-three small indigenous fish species (SIS) in the size range of 3-18 cm were analysed for proximate composition and minerals (Ca and P) content to evaluate their nutritive value. The moisture content of different species ranged between 71.00 and 81.94%. The muscle protein content among the species varied widely (16.16-22.28%). The carcass lipid content varied between 1.87 and 9.55% and showed an inverse relationship with the moisture content, the calcium and phosphorus contents ranged between 0.85-3.20% and 1.01-3.29%, respectively [20]. Protein content was estimated as 18.46%, 15.23%, 14.08%, 18.26%, 16.99%, and 15.84% in *A. mola*, *G. chapra*, *P. chola*, *C. nama*, *A. coila*, and in *P. atherinoides* respectively. The highest value of lipid content was recorded in *G. chapra* (5.41%) and the lowest was in *C. nama* (1.53%). The fat content recorded in *P. chola* (3.05%), *A. coila* (3.53%) and in *A. mola* (4.10%) Ash content found in *P. atherinoides* (3.29%) and in *C. nama* (3.92%). The value of ash in *P. chola*, *A. mola*, *A. coila*, and in *G. chapra* recorded as 1.19%, 1.64%, 1.98% and 1.55% respectively, the moisture content was recorded as 74.43%, 76.38%, 75.06%, 73.32% in *P. chola*, *A. mola*, *G. chapra* and in *P. atherinoides* respectively [21].

Assam is enriched with varieties of water bodies including rivers and beels or wetlands. The various types of wetlands found in Assam are Lakes / Ponds, Ox-bow Lakes Marshy areas etc. Fish diversity of these water bodies are under serious threat due to environmental degradation and related problems. Today it is well known fact that the environment degradation has caused

damage to biodiversity including plants & animals [9]. In spite of that, all these water bodies are the house a wide variety of fish species. Several workers were reported variety of fish species, including SIS from different rivers and wetlands of Assam. There are about 69 species of fishes in Lake of Assam belonging to 49 genera, 24 families and 11 orders. Of these fishes, 84.2% belonged to the primary freshwater group (cyprinids 35.39%), while the rest to the peripheral class [10]. In another study recorded18 species of fish in Brahmaputra river and its tributaries in Assam, comprising 15 genera and 10 families. Most of the species they recorded and collected were have economic value as food, medicinal, recreation and aesthetic purposes [11]. About 27 SIS belonging to 5 orders, 17 genera of 13 families were recorded from Jorhat, Assam [12]. A total of 52 SIS fish belonging to 15 families and 33 genera were recorded from the entire upper stretches of river Brahmaputra. Cyprinidae was found to be most abundant family with 22 species , followed by Bagridae with 9 species and Cobitidae family with 4 species . They also recorded *Botialohachata* which was not recorded earlier from this part . Another study from Dipalibeel of Kokrajarh Assam recorded 67 number of fish species including 4 exotic fish belonging to 49 genera under 25 families from 8 orders .Other workers also recorded and documented fish diversity from different rivers of Assam. Some of the important Small Indigenous Freshwater Fish Species recorded by various workers from Assam are listed below and arranged in an order having Zoological name, family name, order, local name in Assamese language, and IUCN threat status as per CAMP Report, 1998 .

small indigenous is consider and easily digestible food item and rich source of animal protein . SIS species contain a huge amount of vitamin A and D which are essential for human bones , teeth , skin and eyes . it also supply good amount of calcium , phosphorus , iron , iodine . those minerals are essential for developing body resistance against disease . some SIS like punthi (punthius species contain double the amount of iron compared to many other aquaculture carps fish species).

AIMS AND OBJECTIVE

1. Study of the locally available Small Indigenous Fish species

2. Study the nutritional value of different fish species .

3. Study the availability and population comparison .

4. This study provides the current status of small indigenous fish species especially the threatened species.

5. To study the conservation strategy and their present status .

REVIEW OF LITERATURE

a. According to Mohanty B.P. et al (2013) Small indigenous fishes (sif) comprise a significant group of total finfish and shellfish population And contribute significantly to the nutritional as well as livelihood security of the rural mass. They are nutrient dense and a rich source of micronutrients. The sif provide most of the essential Minerals important in human nutrition as they are eaten whole, with bone, head and eye. The trace Elements present in sif include copper, zinc, selenium, iodine, magnesium, iron, cobalt, and Chromium. Besides these microminerals, they are abundant in macro minerals like calcium and phosphorous.

b. The latest study on indigenous fish published by Duarah Pallwabee et al (2019) on their research paper has explained about the diversity of small Indigenous fish species of Assam and its nutritive qualities , essential fatty acid , amino acid , vitamins and minerals and the role of fish in nutrition and food security .

c. Another study on diversity of small indigenous species in the upper reaches of Brahmaputra in Assam North eastern India by Baishya R.A. et (2016). Here they described about the diversity of SI fish found in Brahmaputra river .

d. Biodiversity study of SIS (small indigenous species)of fish in northwest part of Bangladesh and detection of threatened

species by department of biology and genetics (2018) . This study provide the current status of small indigenous fish species specially the threatened species. Here they have explained about the threatened species and conservative strategies . In their study they observed that the SIS were most abundant during pre-monsoon period and least abundant during winter season in the area of the river under study. The study also revealed that the upper reaches of river Brahmaputra is fairly rich in SIS fish diversity. However, better management strategies such as controlled harvest and scientific fishing policies will ensure sustainable exploitation and conservation of SIS fish in the region.

e. Bordoloi R. et. al. (2015) , has done a detailed study on SIF present in majuli and given a detailed decription and number of fishes and Biodiversity conservation status of small indigenous fish present in this region . During their study period they were encountered 55 species belonging to 7 orders and 19 families. Maximum diversity is observed in the family *Cyprinidae which* represents 18 species (32.72%) followed by *Channidae* 6 species, *Belontidae and Chacidae each 4 pecies (7.27 %), Chandidae and Siluridae each 3 species (5.45 %), Cobitidae, Nandidae, Notopteridae and Mastercembelidae each 2 species (3.63 %), Anguillidae, Anabantidae Heteropneustidae, Gobiidae, Synbranchidae, Siluridae, Claridae, Schilbeidae, Chacidae and Tetradontidae* each 1 species (1.81%). According to IUCN red list category, out of 55 species, 41.8 % species are not ealuated (NE),

36.36 % species are least concern (LC), 10.9 % species are near threatened (NT), 5.45 % species are vulnerable (VU) , 3.63 % lower risknear threatened (LRnt) and 1.81% species data deficient (DD)

f. An article on an investigation on larvicidal efficacy of some ingenious fish species of Assam, India Published by Dibrugarh University by Phukon H.K el al (2013) . in their study they gave detail about the consumption of mosquito larva by different size fishes at different time intervals was given in the article.

g. The study conducted by Deori j D.et al (2015) on Fish diversity and habitat ecology of Dhing river - A tributary of Brahmaputra river give details about the water physio chemical parameters , fish diversity , their IUCN status and their distribution . they also mention Scientific & systematic exploration of these potential will definitely ensure employment generation & will help to earn foreign exchange. Hence forth, this paper investigates the varieties of ornamental fishes found in four water bodies of Dhing area of Nagaon district in Brahmaputra valley of Assam.

h. Small indigenous freshwater fish species in nutrition of ethnic population of northeast india By Bibha chetia Borah (2017) this research paper beautifully describe the nutritive value of

small ingenious fish species and traditional preservation technology of small fish species.

i. The nutrient quality of the small indigenous fish species Amblypharyngodonmola , most favorite fish food of the local people of kokrahjar BTAD Assam India , publish by intentional journal of all researcher education and scientific method on January 2022 , describe the detail profile of the small ingenious fish species . During their survey, a total of 50 fish species belonging to 18 families and 34 genera have been recorded from this river and it was found to be dominated with Cyprinidae family followed by Bagridae and Siluridae. Habitat ecology reveals that the minimum (18.5 °C) water temperature was recorded in winter and the maximum (25.76 °C) in monsoon; lowest (20.73 °C) air temperature in winter and highest (26.66 °C) in monsoon; highest (141.33 µS cm-1) conductivity in winter and its lowest (89 µS cm-1) in monsoon; minimum (13.56 cm) transparency in monsoon and its maximum (72.16 cm) in winter; minimum (0.40 m/s) current flow in winter and the maximum (0.98 m/s) in monsoon; the lowest (7.16) pH in monsoon and highest (7.76) in winter; the lowest (6.33 mg/l) DO in post monsoon .

MATERIAL AND METHODS

Study area : -

Dhemaji district is an administrative district in the state of Assam , India . the district headquarters are located at Dhemaji and commercial headquarter being located Silapathar . the Disrtrict occupies an area of 3237 sq km , being in a confluence of river with the mighty Brahmaputra river .

It is located at 27'48° North 94'58 ° east . It has an average elevation of 91m . Dhemaji is located to the north of river Brahmaputra. To its north lies the Arunachal Himalayas . To its east lies the State Arunachal Pradesh and to the west is Lakhimpur a district of Assam . It has large and small rivers flowing through it . Some of them are Jiadhal , Gainodi , Dihang , Dimow and Simen . Subansiri river flows by its western border.

River Brahmaputra passes through the south and East of Dhemaji , the state of Arunachal Pradesh is to its North . Dhemaji is highly flood prone area . The major water bodies of dhemaji are Jiadhal / kumatiya , Gainade Nanadi , Moridhal , Dimow , Simen etc .

The study sites are : -

1. **Gainadi river**
2. **Jiadhal river**
3. **Telijan river**

DIVISION OF STUDY AREA

1. STUDY AREA (1) :

Name of the place : - **JIADHAL**

The river jiadha is one of the sub tributary of the river Brahmaputra originated from Himalayan mountains of Arunachal Pradesh at an altitude of 1247m above the sea level .

The physio-chemical parameters of Jiadhal river are summarize as below : –

1.Temperature : - Average temperature recorded 20 °C

2.Transparency : – The average minimum transparency recorded 13.56cm during our survey time . transparency of water was effected by number of factors,both the dissolve and suspended Material Can influence water transparency.

3. pH - The average Recorded ph was 7.3. the pH value of natural water bodies was changes due to biological activity, any alternation of PH can effect the aquatic organism.

4.Dissolved oxygen : - Dissolved oxygen is a very important parameter of water quality and a index of physical and biological process on in water. In the study time the average dissolved oxygen was recorded 6.55 mg/l the variation of the dissolved oxygen label depend on primary production and respiration of aquatic organism present in the water.

5.Total alkalinity -alkalinity is a total measure of substance in water that has acid neutralizing capacity.

The average alkalinity was recorded around 37.33 mg/litre . Surface alkalinity may result from waste discharge from nearby surface area. The main source of natural alkalinity are rocks which

contain carbonate , silicate ,and phosphate may also contribute to alkalinity .

Fig : - Map showing Jiadhal river river of Dhemaji

2. STUDY AREA (2) –: Gainadi

Gainadi river is in sissiborgaon ,dhemaji . It is in 10km distance from silapathar .(27.33'42"N .94.29'34"E)

1. Temperature =average temperature recorded 25°
2. Transparency = 10.77cm
3. Ph -=7.3
4. Dissloved oxygen=-6.20mg /l
5. Total alkalinity=3.5mg/l

Fig : - Map showing Gainadi river of Dhemaji

Study area 3 : Telijan

(27.27'14"N ,94 .33'19"E)located near Dhemaji town . We visited Telijan pathar vallage , and interacted with local fishermen .

1. Temperature = 26 ° C
2. Transparency = 6cm
3. Ph = 7.5
4. Dissolved oxygen = 6.50mg/l
5. Total alkalinity = 34.5mg/l

Fig : - Map showing Telijan river of Dhemaji

METHODOLOGY

The locations of the sampling sites were documented using global positioning system (GPS) receiver and were chosen on the basis of accessibility and similarity in physical habitat. To study of the SIS fish species of the Dhemaji district area in the rivers name Gainadi , Jiadhal and Telijan river were studied during April , 2022 to June , 2022 . Distance from one sampling site to another was approximately 30 km . Fishes were sampled from landing centre as well as by directly visiting the area where maximum fishing practices were being carried out. The fishing were also carried out with the help of local fishermen employing cast net , gillnet , hook and some local traditional fishing instrument .

The water sample was collected between 6:30 and 9:30 am in a glass stopper bottle and immediately fixed at the site and analyzed the certain physio - chemical parameters as per standard procedures .

Survey was conducted by active searching and trial guided by local people especially fisherman in this region. Survey was done during morning hour and evening also. The fish species were also collected from the local market of Dhemaji district survey areas during our visit . Photograph of those fishes and identify the fish species. The identification of fishes are done by internet (Google lens) and with the help of my guide. On the other hand the secondary informations was gathered through the local

fisherman and experienced person in this field .The latest scientific names of the fish species were followed with the website www.fishbase and also photographs are taken by digital camera . The list of collected fish species with their IUCN status discuss below in result section.

RESULT

The collected fish here kept in glass jar for identification as well as took photographs to study their morphology by following a standard procedure. The fishes mainly collected from jiadhal , Gainadi , Telijan .

Altogether a total of 27 fish species has been recorded from the sampled stretch of the all three river and belonging to 18 families (Table 1) and 6 Order (Table 2) . It has been observed that among the families ***Cyprinidae*** and ***osphoronemidae*** family was the most dominant, which includes both 4 species . Next followed by the Bagridae family with 3 species . The present finding was contradictory with the findings of Sarma *et al.* 2012 [5, 17-21] Shahnawaz *et al.* 2009[22].

List 1 : List of fish species recorded from all three side and their conservation status :-

Zoological name	Family name	Order	Local name in Assamese language	IUCN threat status
1. *Paracanthocobitis botia,*	*Nemacheilidae*	*Cypriniformes*	Botia	LR-nt
2. *Anabas testudineus,*	*Anabantida*	*Perciformes*	Kawoi,	VU
3. *Amblypharyngodon mola*	*cyprinidae*	*Cypriniformes*	Moa	LR-lc
4. *Aspidopania morar*	*cyprinidae*	*Cypriniformes*	Barlala	LR-nt
5. *Botia dario*	*Botiidae*	*Cypriniformes*	gethu	NE
6. *Chandanama,*	*Ambassidae*	*Perciformes*	chanda	NE
7. *Channa punctatus,*	*channidae*	*Perciformes*	goroi	LR-nt
8. *Channa stewartii*	*channidae*	*Perciformes*	chengalee	NE

9. *Clarias batrachus,*	*Clariidae*	*Siluriformes*	Magur	VU
10. *Glossogobius giuris*	*Gobiidae*	*Perciformes*	Patitmutura	LR-nt
11. *Heteropneustes fossilis*	*Heteropneustidae*	*siluriformes*	singi	VU
12. *Macrognathus*	*Mastacembelidae,*	*Symbranchiformes*	tura	LR-nt
13. *Mystus bleekeri,*	*Bagridae*	*Siluriformes,*	Singorah,	VU
14. . *Mystus cavasius,*	*Bagridae*	*Siluriformes,*	Borsingarah	LR-nt
15. *Mystus tengara,*	*Bagridae*	*Siluriformes*	Rongasingora	NE
16. *Nandus nandus*	*Nandidae*	*Perciformes,*	Gedgedi,	LR-nt
17. *Puntius chola,*	*Cyprinidae,*	*Cypriniformes,*	puthi	VU
18. . *Pethia conchonius*	*Cyprinidae*	*Cypriniformes*	puthi	vu

19. *Systomussarana*	*Cyprinidae*	*Cypriniformes,*	seneeputhi,	VU
20. *Pethiaticto*	*Cyprinidae*	*Cypriniformes,*	Chakariputhi	VU
21. *Rosbora daniconius*	*Danionidae*	*cypriniformes,*	danikona	NE
22. *Salmostoma bacaila*	*Danionidae*	*Cypriniformes,*	selkona	LR-lc
23. *Trichogaster chuna,*	*Osphronemidae*	*Perciformes,*	vecheli	NE
24. *Trichogaster fasciata,*	*Osphronemidae*	*Perciformes,*	Khalihona	LR-nt
25. *Trichogaster lalius,*	*Osphronemidae*	*Beloniformes,*	ronga Khalihona	LR-nt
26. *Xenentodon cancila,*	*Belonidae*	*Beloniformes,*	kakila	LR-nt
27. *Devario devario*	*cyprinidae*	*cyprinae*	borra	VU

(En-Endangered; VU-Vulnerable, LR-nt :- Lower risk near threatened, LR-lc- Lower risk least concern, NE- Not evaluated.)

Table 2 :-

Number of family of fishes :

Name of Family	Number of family
Nemacheilidae	1
Anabantida	1
cyprinidae	6
Botiidae	1
Ambassidae	1
channidae	2
Clariidae	1
Gobiidae	1
Heteropneustidae	1
Mastacembelidae,	1
Bagridae	3
Nandidae	1
Danionidae	2
Osphronemidae	3
Belonidae	1
cyprinidae	1

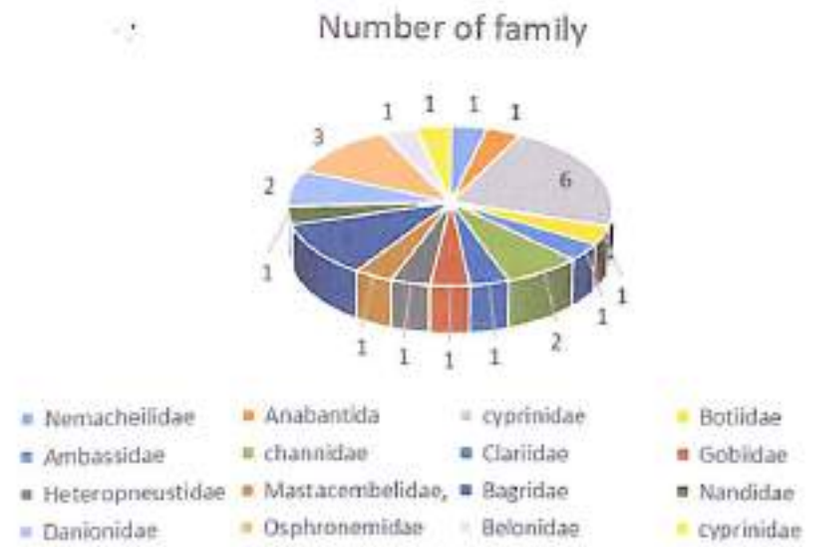

Fig 1: Pie chart distribution of number of family of fish species.

Table 2 :-

The number of Order of fishes -

Name of Order	Number of order
Cypriniformes	10
Perciformes	8
Siluriformes	5
Symbranchiformes	1
Beloniformes	2
Cyprinaen	1

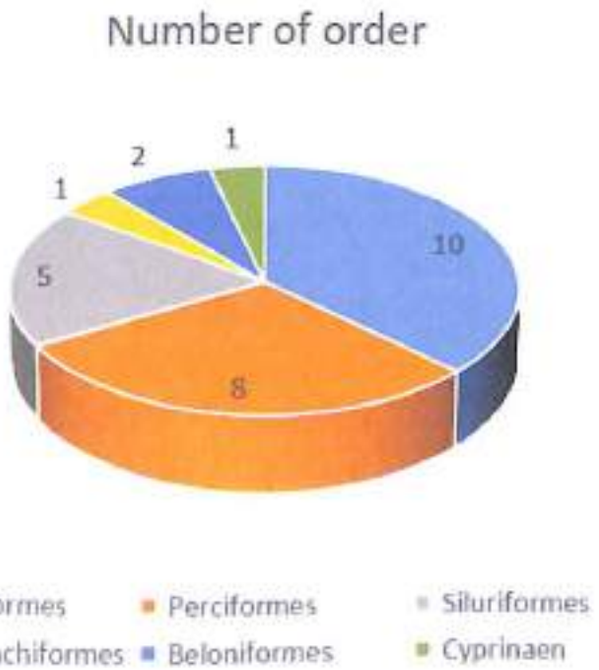

Fig 2 : showing the number of order in pie chart

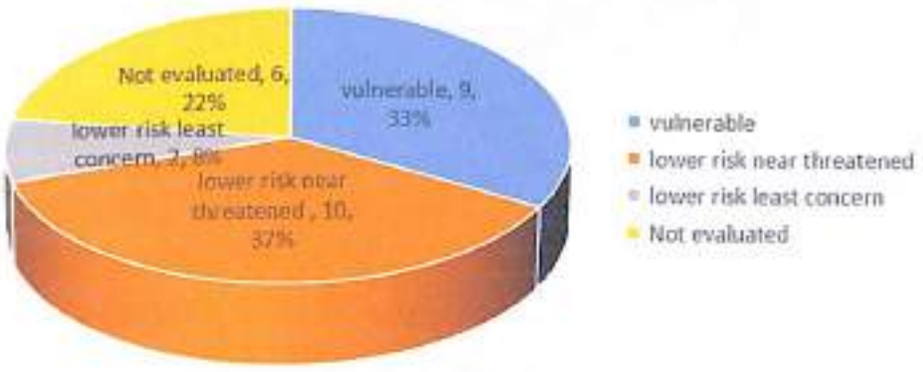

Fig 3 : Percentage distribution of conservation status of recorded fish species.

Photographs of collected ornamental fish species :-

Fig :- Channa Punctatus

Fig :- Mystus Cavasius

Fig : Mystus Tengara

Fig :- Anabas Testudineus

Fig : Amblypharyngdon Mola

Fig : Nandus Nandus

Fig : Mustus Bleekeri

Fig : Prichogaster Chuna

Fig : Devario Devario

Fig :- Aspidoparia Morar

Fig :- Amblypharymgdon Mola

Fig :- Paracanthocobitis Botia

Fig :- ***Channa Stewartir***

Fig : ***Mystus Cavasius***

Fig :- ***Clarias Batrachus***

Fig : - Glossogobius Giuris

Fig : Macrognathus

Fig : Puntius Chola

Fig :- baspata

Fig :- Rosbora Daniconius

DISCUSSION

Anthropogenic pressure, siltation on the bed of wetlands and soil erosion are the most important factor for fish decreasing fish population. Fast growing water hyacinth weed contributing to eutrophication by slowing down water currents and depositing debris at the bottom of the wellands.

Fish provides the main source of animal protein to about one billion people globally. Fisheries are an important part of food security, particularly for many poor people in developing countries. In developing and under developed countries, they make up about 22% of overall animal protein consumption. Fish is a source of protein, micro-nutrients and essential fatty acids, providing an important complement to the predominantly carbohydrate based diet of many poor people in developing countries. Fish and fisheries contribute to food security in a variety of ways and the importance of small-scale fisheries, in particular, for food security is emphasised by Food and Agriculture Organization (FAO), 2003. Small, indigenous fish are particularly important for nutrition because they are eaten whole, with bone, head and eye, thereby providing a source of calcium and other micronutrients (Kongsbak *et al.*, 2008). Small indigenous fishes (SIF) usually include those species which attain a maximum length of 25-30 cm in mature or adult stage of their lifecycle. They comprise a significant group of total finfish and shellfish population which contribute greatly to the nutritional security of the rural poor. The SIF are prolific breeders, need little or no management and grow in the rice fields, irrigation

and drainage channels, backyard ponds, derelict water bodies, beels, wetlands and hence in almost all lentic and lotic water systems. However, in recent aquaculture practice integration of small indigenous species into polyculture systems have proven to be prudent as it results in overall pond fish production. India, one of the 17 global mega biodiversity hotspots, is native to many freshwater fish species. About 2,246 indigenous finfish species have been recorded from India (Lakra *et al.*, 2010) of which, 765 from freshwater resources out of which 450 species are categorized as small indigenous fish species (SIF). Some freshwater SIF include highly nutritious fish like mola, punti, chanda, chela, tengra, shingi, magur, koi, gute, lata and many types of crabs, mollucks, small prawns etc. The majority of fish eaten by the rural poor are the small indigenous fishes. They consume these fish species as these are commonly available and do not have good market demand, compared to large sized fishes. Many times, as affordability for pulses and vegetables is difficult, rural poor live on these small fishes which they get as by-catch .

Potential cultivable indigenous small fishes :

Among SIF's, many species are cultivable with high demand, cultivable and can be introduced as a candidate species in freshwater aquaculture system. These are *Amblypharyngodon mola*, *A. microlepis*, *Notopterus notopterus*, *Puntius sarana*, *Labeo bata*, *Puntius ticto*, *Cirrhinus reba*, *Salmostoma bacaila*, *Nandus nandus*, *Anabas testudineus*, *Esomus danricus*, *Puntius chola*, *P. sarana*, *Glossogobius giuris*, *Danio devario*, and *Chanda nama* etc. Other potential species for aquaculture diversifi cation

includes *Labeo gonius*, *L. bata*, *Labeo boggut*, *L. dussumeri*, *L. fimbriatus*, *Barbodes carnaticus*, *Puntius pulchellus*, *P. kolus*, *P. sarana* and *Cirrhinus cirrhosa*. Some of these species are being cultured at minimum scale, mostly based on wild seed collection. The air-breathing and non air- breading species, *Channa marulius*, *C. striatus*, *C. punctatus*, *C. gachua*, *Channa bleheri* , *C. aurantimaculatata* ,*C. stewartii* have not been taken up for the aquaculture at large scale. With the technology available for seed production and culture of air breading (Clarius batrachus, Heteropnustes fossilis), non air breading cat fi sh *(Mystus seenghala*, *Mystus aor*, *Horabagrus brachysoma*, *Notopterus notopterus*, *Ompok pabda*, *O. pabo*, *Ailia coila)*, farming needed to be popularized and expanded. Research and policy support for domestication of potential cultivable food and ornamental indigenous fishes as well as value added products from aquatic organisms is also required.

CONCLUSION

Indigenous fish species are the common food item among the local population with traditional identified pharmacological benefits in treating different ailments . Many fish species are considered as diet supplement for elderly people. Fish plays a major role in the diet constituting the only animal protein source among rural poor households.thus, fish can play an important role in food security and able to supply cheap and save food especially for the rural pore of the world. Small indigenous fish species plays a very significant rule in Assam especially in rural Assam. They provide food nutrition and supplementary income to the fisherman of the rural areas. They act as a source of vitamins, proteins, calcium and iron to the people diet.because the price of small faces is affordable also. High demand of small indigenous species makes those species vulnerable to over exploitation in their natural habitat which along with other anthropogenic and natural factors has been leading to degradation of rich small indigenous fish species biodiversity of the region.as such urgent necessary steps need to be taken to conserve send propagate as well as to restore the natural population for sustainable nutritional security of the population. Also we can educate the local people about the proper time of fishing (not to over capturing of fish during breeding times) .

Freshwater aquatic environments are experiencing serious threats to both biodiversity and ecosystem stability and many strategies and priorities have been proposed to solve this

crisis. The major threats to the SIF's are as: loss of naturalhabitats, use of small mesh sized gears, dewatering, use of insecticides and pesticides, industrial and domestic pollution, siltation of water bodies, invasion of exotics and disease .

REFERENCES

[1]. Baliarsingh, B.K., Laishram Kosygin, L., Swain, S.K., Nayak, A.K., (2015). Species Diversity and Habitat Characteristics of Freshwater Fishes in the Similipal Biosphere Reserve, Odisha with Some New Records. *Biological Forum – An International Journal,* Vol. 7(1): 171-179.

[2]. Nath, M., Ngasepam, R.S., Das, B.K., Dutta, B., Das, U., Das, P., Kar, S. and Kar, D., (2015). A Preliminary Study on Fish Diversity of Kakri and Deo River around Dharmanagar in Tripur. *InternationalJournal of Theoretical & Applied Sciences,* Vol. 7(2): 6- 13.

[3]. Felts, R.A., Fazts, F. and Akteruzzaman, M., (1996). "Small Indigenous Fish species culture in Bangladesh" (Technical brief) IFADEP Sub project 2, Development of Inland Fisheries, pp 41.

[4]. Larsen, T., Thilsted, H.S., Kongsbak, K.and Hansen, M., (2000). Whole small fish as a rich calcium source. *British J. Nut.*, Vol. **83**: 191-196.

[5]. Begum, M. and Minar, M.H., (2012). Comparative Study About Body Composition of Different SIS, Shell Fish and Ilish; Commonly Available In Bangladesh. *Trends in Fisheries research,* Vol. **1**(1): 38-42.

[6]. Roos, N. and Islam, M.M., (2003). Small indigenous fish species in Bangladesh: contribution to vitamin A,calcium and iron intakes. *J Nutr.* Vol. **133** (11 Suppl 2) :4021S-4026S.

[7]. Thilsted, S.H., Roos, N., Hassan, N., (1997). The role of small indigenous fish species in food and nutrition security in Bangladesh. *The ICLARM Quarterly*, Vol. **20** (3&4): 82-84.

[8]. Kotpal, R.L., (2006). Modern Textbook of Zoology – Vertebrates, Rastogi Publication, Merrut.

[9]. Tamot, P. and Awasthi, A., (2012). An Approach to Evaluate Fish Diversity and Limnological Status of Sewage Fed Urban Lake (Shahpura), Bhopal, India. *International Journal of Theoretical and Applied Science*, Vol. **4**(1): 20-22.

[10]. Kar, D., Nagarathna, A.V., T.V. Ramachandra, T.V.and Dey, S.C., (2006). Fish diversity and conservation aspects in an aquatic ecosystem in northeast India. *Zoos' Print Journal*, Vol. **21**(7): 2308-2315

[11]. Das, M. and Antoney, P.U., (2010). Preliminary Study of Fish Fauna Found in Brahmaputra River and Its Tributaries in Assam. Retrieved on 21st march 2019 from the site:http://www.ces.iisc.ernet.in/energy/lake2010/Theme%20 7/mrinmoy_das.pdfIndian.

[12]. Duarah, P., (2014). Study on the ITK of Tea tribe community of Assam Regarding the application of Indigenous Fish Species as medicine. IABSR&SD, Ed. K.Das., Unika Prakashon, pp-244-255.

[13]. Baishya, R.A., Basumatary, S.H.K., Kalita, H.K., Talukdar, B., Dutta, A. and Sarma, D., (2016). Present status and diversity of small indigenous fish species (SIS) in the upper reaches of river Brahmaputra in Assam, north-eastern India. *J. Fish.*, Vol. **63**(1) :1-7,

Singha, N., Nag, R. and Deka, P., (2017). A preliminary study on ichthyofaunal diversity of Diplai Beel of Kokrajhar district of Assam, India. *International Journal of Fisheries and Aquatic Studies*, Vol.**5(3)**: pp. 269-275.

[15]. Nath, B. and Deka, C., (2014). A Study on Fish Diversity, Conservation Status and Anthropogenic Stress of Chandubi Tectonic Lake, Assam, India. *J. Bio. Innov*, Vol. **1(6);** pp:148-155.
Duarah et al., ***International Journal on Emerging Technologies***
10(2):357-361(2019) 361

[16].Bora, D. and Sarma, S., (2014). Ichthyofaunal diversity from Sonkosh river, Assam, India. *The Clarion*, Vol. **3**(1):18-24.

[17]. Kaushik, G. and Bordoloi, S., (2016). Ichthyofaunaof Ranganadi River in Lakhimpur, Assam, India.*Check List,* Vol. **12**(2): 1-6.

[18]. Nag, R., Singha, N. and Deka, P., (2017). A study on the fish diversity of DhirBeel of Dhubri District ofAssam, India. *International Journal of Applied Research*, Vol. 3(5) :19-26.

[19]. CAMP Report (1998). Conservation Assessment and Management Plan (C.A.M.P) for freshwater fishesof India. National Bureau of Fish Genetics Resources, Zoo Outreach Organization, 1998, India.
https://www.fws.gov/.../fisheries/CAMP...Reports/.../1998_CAMP_annual

[20]. Hussain, M.A. and Afsana, K. and Azad Shah, A.K.M. (1999). Nutritional value of some small indigenous fish species (SIS) of Bangladesh. *Bangladesh Journal of Fisheries Research*, Vol. 3(1): 77-85.

[21]. Mazumder, A., Rahman, M.M., Ahmed, A.T.A., Begum, M.and Hossain, M.A., (2008). Proximate Composition of Some Small Indigenous Fish Species (Sis) In Bangladesh. *Int. J. Sustain. Crop Prod.* Vol. 3(4): 18-23.

[22]. Ahmed, S., Rahman, A.F.M., Mustafa, G., Hossain,M.B. and Nahar, N., (2012). Nutrient Composition of Indigenous and Exotic Fishes of Rainfed Waterlogged Paddy Fields in Lakshmipur,Bangladesh. *World Journal of Zoology*, Vol. 7(2): 135-140.

[23]. Sarma, D., Joshi, V., Akhtar, M.S. et al. (2019), *Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci.* Vol. **89**: pp. 475 – 482, https://doi.org/10.1007/s40011-017- 0956-7.

[24]. Teronpi, V., Singh H.T., Tamuli, A.K., Teron, R., (2012). Ethnozoology of the Karbis of Assam, India: Use of ichthyofauna in traditional health-care practices. *Ancient Sci Life*, Vol. **32**: 99-103.

[25]. Duarah, P. and Das, K., (2014). Diversity of Small Indigenous Freshwater Fish Species in Jorhat Assam: with special reference to ITK about health benefit from such species. *JOAR*, Vol. **1**(1): 151-156.

[26]. Borah, M.P. and Prasad, S.B., (2016).Ethnozoological Remedial Uses by the Indigenous Inhabitants in Adjoining Areas of the Pobitora Wildlife Sanctuary, Assam, India. *International Journal of*
Pharmacy and Pharmaceutical Sciences, Vol. **8**(4): 90- 96.

Gupta, T. and Dey, M., (2017). Ichthyotherapy: Use of Fishes as Medicine by Ethnic Karbi People of Assam, India, *EJPMR*, Vol. **4**(10): 341-343.

[28]. Paul, S., (2018). Ethnozoological Knowledge Among Mising Tribes of Dhemaji. *Journal of Engineering, Science and Mathematics*, Vol. 7(3): 53-65.

28. [29]. Debnath, S., (2011). *Clarias batrachus*, the medicinal fish: An excellent c&idate for aquaculture & employment generation,

International Conference onAsia Agriculture and Animal IPCBEE Vol.**13**, IACSIT Press, Singapoore, pp. 32-37.

29. [30]. Jakhar, J.K., Pal, A.K., Reddy, A.D., Sahu, N.P.G., Venkateshwarlu, G. and Vardia, H.K., (2012). Fatty Acids Composition of Some selected Indian Fishes. *African Journal of Basic & Applied Sciences*, Vol. **4 (5)**: 155-160.

30. [31]. Latham, M.C., (1997). Human Nutrition in the Developing World. FAO (Food and Agricultural Organization). pp. 508.

31. [32]. Ahmad, Z., Somchit, M.N., Mohamad Hasan S., Goh, Y.M., Abdul Kadir, A., Zakaria, M.S., Mat Jais,A.M., Rajion, M.A., Zakaria, Z.A. and Somchit, N., (2005). Fatty acid and amino acid composition of three local Malaysian Channa spp. Fish. *Food Chem*, Vol. **97**(4): 674- 678.

32. [33]. Kapoor, M., Kojima, F., Appleton, I., Kawai, S. and Crofford, L.J., (2006). Major enzymatic pathways in dermal wound healing: current understanding and future therapeutic target. *Curr. OpinInvestig Drug*, Vol. **7(5)**: 418-22.

33. Ray, S.M., Ahmed, I. M., Khatun, M.M., Ashkar Sayeed, A.B., Shah, M.S., Golam, M., (2014). Antioxidant Potential and Nutrient Content Of Selected Small Indigenous Species of Fish. *Pharmacologyonline*, Vol. **2**: 48-53 .

34. http://mutagens.co.in **4953** River in Ganga basin, India. *Environmentalist*, DOI 10.1007/s10669-010-9277- 6.

35. Mahapatra B. K., Vinod, K., Mandal, B. K. and Bujarbaruah, K. M. (2006). Ornamental Fisheries in North Eastern India, Research Bulletin No. 49, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya. MPEDA (2007). Export Performance of Marine Products during 2005-06,

36. http://www.mpeda.com. Nautiyal P. (2005). Taxonomic richness in the fish fauna of the Himalaya, Central Highlands and Western Ghats (Indian Subcontinent). *International Journal of Ecology and Environmental Science*, 31(2): 73 - 92.

37. Negi R. K. and T. Negi. (2010). Assemblage structure of stream fishes in the KumaonHimalaya of Uttarakhand State, India. *Life Science Journal*, 7(1) : 9-13.

38. Nelson J. S. (2006). *Fishes of the World* .John Wiley and Sons, Inc. 4th Edition: 624pp. Pathani S. S. and K. K. Upadhyay (2006). An inventory on zooplankton, zoobenthos and fish fauna in the river Ramganga (W) of Uttarakhand, India. *Himalayan Ecology* 14(2): 33-42.

39. Ramamoorthy K., Bhuvaneswari S., Sankar G. and Sakkaravarthi, K., Proximate composition and carotenoid content of natural carotenoid sources and its colour enhancement on marine ornamental fish *Amphipriono cellaris* (Cuveir, 1880) (2010). *World J. Fish and Marine Sci.*, 2(6), 545 – 550.

40. Satheesh J. M. (2002). Biology of the clown fish, *Amphiprionsebae*(Bleeker) from Gulf of Mannar (Southeast coast of India). Ph.D. Thesis, Annamalai University, India, , pp: 1 – 159.

41. Shahnawaz A., M. Venkateshwarlu D. S. Somashekar and K. Santosh (2010). Fish diversity with relation to water quality of Bhadra river of Western Ghats (India). *Environmental Monitoring and Assessment*, 161: 83-91.

42. Sumith J. A., K. R. Munkittrick and N. Athukorale (2011). Fish assemblage structure of two contrasting stream catchments of the Mahaweli river basin in Sri lanka: Hallmarks of human exploitation and implications for conservation. *The Open Conservation Biology Journal*, 5 : 25 – 44.

43. Talwar P. K. and A. G. Jhingran (1991). *The Inland Fishes of India and adjacent countries*. 2 Vols. Oxford & IBH publishing Co., New Delhi, Bombay, Calcutta. Inland Fishes, India.1-2. I-xvii+36 unnumbered +1-1158, 1 map.

44. Uniyal D. P. (2002). *Eco- Taxonomical studies of ichthyofaunal of the Amalawa and Asan river at Western Doon valley*. D. Phil. Thesis submitted to H.N.B. Garhwal University, Srinagar, Uttaranchal: 1-250.

45. Uniyal D. P. and A. Kumar (2006). Fish diversity in the selected streams of Chakrata and Shiwalik hills (District Dehradun , Uttarakhand), India *Record Zoological Survey of India*, Occ. Paper No. 253 : 1-120 .

46. Uniyal D. P. and H. S. Mehta (2007). Faunal diversity of Western Doon Shiwaliks Fishes: (Pisces). *Zoological Survey of India* (Special Publication): 41 - 59.

47. Vishawanath W., W. S. Lakra and U. K. Sarkar (2007).*Fishes of North East India*. Ed. The Director, National Bureau of Fish Genetic Resources, Lucknow 264 pp .

****