Ichthyofaunal Diversity And Their Conservation Status In Selected Sites Of Gomti River, Lucknow, Uttar Pradesh.

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Abstract:

The Present Study was done to study the Ichthyofaunal Diversity in selected sites of Gomti River, Lucknow, the capital of Uttar Pradesh which has huge possible varieties of fishes. The selected sites were Ghaila Ghat, Mehndi Ghat and Kudiya Ghat. The results of present investigation revealed the occurrence of total 52 fish species belonging of 7 orders viz.Cypriniformes, Perciformes, Clupeiformes, Ophiocephaliformes, Mastacembeliformes, Mugiliformes and Beloniformes and 19 families viz. Notopteridae, Clupeidae, Engraulidae, Cyprinidae, Cobitidae, Siluridae, Sissoridae, Schelibeidae,Heteropneustidae, Pangasidae, Claridae, Belonidae, Ophiocephalidae, Mugilidae, Mastacembelidae, Sciaenidae, Nandidae, Anabantidae and Gobioidae.Most of the species recorded in the present study were under Least Concern (LC). In order to know the varieties of fishes and their status of conservation data have been collected from local fish farmers and survey of market. Generally, speaking India has overall 60-70% of world's biological resources from which fishes represent 80% of globalfishes. Overall last few decades, fresh water fishes are under threat according to the reports of IUCN. The fishes under these area are under threat due to several human activities like overfishing, pollution, climate change and hence, it is highly recommended to prevent the diversity loss.

Keywords: Ichthyofaunal, Diversity, IUCN, Threats, Overfishing.

Introduction:

One of the most fascinating group of animals in the animal kingdom is of fishes. Fishes are important part of aquatic ecosystem and are studied by researchers due to their fascinating biological characteristics for instance, different types of scales, fins, and some peculiar characters like swim bladder, lateral line system and gills for respiration.

Ichthyology, the branch of zoology which is concerned with the study of fishes and more especially, the Pisces class of Kingdom Animalia which is derived from the Greek word Ichthyus means fish and logos means to study. David Starr Jordan was the well-known and famous Ichthyologist who wrote 650 articles and books on the subject. Fishes are one of the most diverse groups of vertebrates, comprising over 33,000 species worldwide (Nelson J.S., 1994; Nelson J.S., 1994). Their diverse morphology, behavior, and ecological

roles make them fascinating subjects for study. Understanding the diversity of fishes is not only crucial for ecological research but also for conservation and management efforts.

The River Gomti is a tributary of the Ganga River which flows through the state of Uttar Pradesh and Uttarakhand. It rises from a natural lake named "GomatTaal", which is a small glacier water body in the district of Nainital of Uttarakhand. The river Gomti covers an area of about 950 kilometres long that is rich in alluvial plains of Uttar Pradesh ahead meeting the river Ganges near Saidpur in the similar state. The river Gomti arrives in Lucknow after housing 240 kilometre of its journey from its source. Rivers like Kathna, Reth, Sarayan, Luni, Kalyani, and Sai are also the tributaries of the river Gomti which ministers domestic water supply in several geographical areas of the country. According to the reports, the mass mortality of the fishes is blamed due to sewage pollutants and habitat alteration (Nagpure et al., 2001; Sarkar et al., 2010). Over a distance of approximately 370 kilometres, the river Gomti is heavily polluted from both point as well as non-point sources (Srivastava et al., 2017). A number of researchers working on this line reports the biodiversity degradation, as a result of exotic species invasion, pollution in an environment and habitat loss due to intervention of human (Farah et al., 2016) The Gomti River supports agriculture, provides drinking water and serves as a source of occupation for many peoples. Over the decades, the river had faced several environmental pollutions due to various industrial wastes, sewage release, etc (Mishra et al., 2014). Endeavours are being made to clean up the river. Several initiatives like sewage treatment plants, awareness campaigns, riverfront developmental projects had been undertaken to protect and rejuvenate this important river.

The study of fish diversity provides insights into evolutionary processes, ecological interactions, and ecosystem health. Conservation of biodiversity is important in the areas of developing countries where people are directly or indirectly dependent on natural resources for their livelihood (Mishra, et al.,2021b). Fishes play vital roles in ecosystems, assisting as predators, prey, and ecosystem engineers, thus impacting the structure and function of aquatic ecosystems. The water is a high and introductory natural resource for all living organisms and a precious natural asset (Mishra and Dikshit, 2021a). The freshwater is devoted for industrial water supply, hydropower generation, catch edible fishes or irrigation (Verma, 2016). These water bodies have varied and well-off fish fauna but water pollution due to spills of toxic wastes or thermal discharge or low dissolved oxygen levels and coal mine acids have deeply exposed water quality and diversity of fishes (Wolter, et. al.,2000). The river ichthyofauna is rapidly changing due to human activities for instance, pollution, overexploitations, destruction of habitat. The relationship between human's well-being and biodiversity is correlated and is being advanced increasingly through the concept of ecosystem resources issued by the species. Biodiversity is important for the stability of habitat, conservation of comprehensive environmental quality for superior knowledge of intrinsic species on the globe (Vijaykumar, 2008).

Gomti also collects rubbish garbage from the industry of Sitapur before Lucknow and hence, river's extreme pollution is now well-known. As the population of Lucknow is increasing day-by-day, river Gomti is getting polluted by numerous ways for instance, effluents from sugar and distillery plants, agricultural and industrial trash, etc. Due to exotic fish's native fishes are being harmed and because of pollution the presence of foreign fishes is thought to serve as harming product for river's biodiversity. In addition, it is compulsory to keep a record of previously recognized fish species by which the freshwater fishes of the River Gomti will get help (S K Singh, 2015).

Human activities are most likely to harm the river. As a result, many aquatichabitats are extinct or vulnerable. According to the report of Uttar Pradesh Pollution Control Board (UPPCB), the river Gomti's flow has much decreased because of the upcoming biomass on the waterway has increased (Ducanal JR, Lockwood JL, 2001-2002). The deficiency of awareness on the ichthyofauna is a big pause for popularizing little known fish variety in a specific ecosystem. Several efforts had been made to estimate fish fauna habitat; this will benefit in outlining methods for their production and successful exploitation (Renjithkumar et al., 2011). Numerous researchers had studied ichthyofauna of several water bodies but there is more

need and scope for upgrading of information. The main objective of the study is to provide data with an understanding knowledge of the fish diversity of the selected sites of Gomti River and implement conservation and planning of the aquatic environments. Most of the higher vertebrates living in an aquatic environment are interdependent on fishes for their livelihood (Groombridge,1992).

Materials And Methodology:

Materials Required:

Pen and Notebook

Fishing nets

Microscope

Formalin (for preservation of samples)

GPS device for tagging location

Reference book

Camera

Dissecting kit (for preservation)

Plan of field work

From February to April 2024, fieldwork was done in and around the three major sites of Gomti River, viz., Site-1 (MehndiGhat), Site-2 (KudiaGhat) and Site-3 (GhailaGhat). The observations were made between 7:00am to 9:00am in the morning and 4:00pm to 6:00pm in the evening. Sampling was done on 150-200m distance from the river at each site. Several fishes were discharged to water after counting their numbers and identification at the sampling sites. The samples were carefully examined, and they were compared to the book plates. Additionally, identification was accomplished with the aid of websites, mobile applications. The survey was conducted using the electrofishing and seine netting method.

Basis of Selection of Study Area

Because of its diverse fish population, the area also has a large variety of fishes.

The research area has the ideal number of different species.

Collection and Identification

Fishing was carried under the assistance of local fishermen using gill net, cast net, drag net, scoop net including hooks and lines (Bose et al.,2013). The samples were collected from the selected sites of Gomti river and fish markets. Gomti is the main river which flows from west to east and covers entire length of the district (Verma et al., 2015). The sample collected were preserved in 10% formalin solution. As soon as the small fishes were caught, they were immediately placed in a wide mouth jar having 2 litre capacities with formalin solution (Bagra, 2010). Species that were to be preserved was tied with a mirror plate and thread before placing it in a jar. Separate jar was used depending on the different sizes and structures of fishes, for preserving individual species and brought to the laboratory of Department of Zoology, Isabella Thoburn College, Lucknow, Uttar Pradesh for the identification under microscope. Fresh or preserved samples were identified from the reference book. In addition, various morphological characters, shape, colors, sizes, lengths, etc. were recorded by Identification Sheets of FAO, Srivastava (2002). The collected sample of

fishes were sorted and identified up to species level. The present conservation status of the species was evaluated from the International Union for Conservation of Nature (IUCN),2020 red list of threatened species (Mishra and Mishra, 2021). The fresh fish sample was identified by their natural colour, Patterns of scales and mouths whereas preserved specimens were used for studying various morphometric characteristics. The local names of collected fishes were familiarized from fishermen, farmers and retailers (Verma et al.,2017).

Result:

The fish diversity of collected and identified fish species from river Gomti, Luckow, Uttar Pradesh, India along with availability and conservation status as shown in (Table-1).

Table 1: Taxonomic Position, Local name, and IUCN Status of local ichthyofaunal diversity of selected sites of Gomti River at Lucknow, India.

S.No.	Scientific Name	Order	Local/Common name	Family	IUCN Status
1.	Notopterusnotopterus	Clupeiformes	Moya	Notopteridae	NT
2.	Notopteruschitala	"	Patra	Notopteridae	LC
3.	Gadusiachapra	"	Suhia	Clupeidae	VU
4.	Goniolosamanmina	"	MajhaliSuhia	Clupeidae	VU
5.	Setipinnaphasa	"	Phansi	Engraulidae	NE
6.	Labeorohita	Cypriniformes	Rohu	Cyprinidae	LC
7.	Labeocalbasu	"	Karaunchar	"	LC
8.	Catlacatla	"	Bhakur	"	LC
9.	Cirrhinusmrigala	"	Nain	"	LC
10.	Mystuscavasius	"	Sutahava Tengar	"	LC
11.	Mystusmenoda	"	Belaunda	"	LC
12.	Mystustengara	"	Tengana	"	LC
13.	Mystusvittatus	"	Tengara	"	EN
14.	Mystusaor	"	DariaiTengar	"	LC
15.	Mystusseenghala	"	DariaiTengar	"	LC
16.	Cyprinuscarpio	"	Common Carp	"	VU
17.	Hypopthalmicthysmolitrix	"	Silver carp	"	NT
18.	Ctenopharyngodonidella	"	Grass carp	"	NE

19.	Oxygasterbacaila	"	Chalhawa	"	LC
20.	Oxygasterclupeioides	"	Silhani	"	LC
21.	Puntiussarana	"	Darahee	"	LC
22.	Puntiussophpore	"	Sidhari	"	LC
23.	Puntiustictio	"	Punti	"	LC
24.	Puntiusjavanicus	"	Japanipunti	"	LC
25.	Amblypharyngodonmola	"	Dhawai	"	LC
26.	Osteobramacotio	"	Gurda	"	VU
27.	Nemacheilusbotia	"	Carri	Cobitidae	EN
28.	Ompakbimaculatus	"	Jalkapoor	Siluridae	NT
29.	Bagariusbagarius	"	Gonch	Sissoridae	EN
30.	Ailiacolia	"	Patasi	Schilbeidae	LC
31.	Clupisomagarua	"	Baikari	"	LC
32.	Eutropichthysvacha	"	Banjhoo	"	EN
33.	Pangasiuspangasius	"	Pangus	Pangasidae	EN
34.	Clariasbatrachus	"	Mangur	Claridae	LC
35.	Rita rita	"	Belgagara	Siluridae	EN
36.	Heteropneustesfossilis	"	Singhi	Heteropneustidae	EN
37.	Wallagoattu	"	Parhin	Siluridae	VU
38.	Xenentodoncancila	Beloniformes	Kauwa	Belonidae	NT
39.	Channastriatus	Ophiocephaliformes	Sauri	Ophiocephalidae	LC
40.	Channapunctatus	"	Girai	"	LC
41.	Channamarulias	"	Saur	"	LC
42.	Channagachua	"	Chanaga	"	LC
43.	Rhinomugilcorsula	Mugiliformes	Hunra	Mugilidae	EN
44.	Mastacembelusarmatus	Mastacembeliformes	Baam	Mastacembelidae	LC
45.	Mastacembeluspancalus	"	Malga	"	LC
46.	Mastacembelusaculeatus	"	Pataya	"	LC
47.	Sciaenacoitor	Perciformes	Patharchatti	Sciaenidae	NE
48.	Nandusnandus	"	Dhebari	Nandidae	LC
49.	Anabas testudinius	"	Kawai	Anabantidae	LC
50.	Colisafasciatus	"	Khosti	"	LC
51.	Colisachuna	"	Kholisa	"	LC
52.	Glossogobiusgiuris	"	Bulla	Gobioidae	NT

IUCN Red List: LC: Least Concern; VU: Vulnerable; NE: Not Evaluated; EN: Endangered; NT: Near Evaluated; DD: Data Deficient.

Table 2: Name of the Order,Number of families,Genus and Species.

S.No.	Order	Family	Genus	Species
1.	Clupeiformes	3	5	5
2.	Cypriniformes	8	32	32
3.	Beloniformes	1	1	1
4.	Ophiocephaliformes	1	4	4
5.	Mugiliformes	1	1	1
6.	Mastacembeliformes	1	3	3
7.	Perciformes	4	6	6

Table 3: Name of the Order and Percentage of Abundance of species.

S.No.	Name of the Order	Percentage of Abundance
1.	Clupeiformes	09.62%
2.	Cypriniformes	61.55%
3.	Beloniformes	01.93%
4.	Ophiocephaliformes	07.71%
5.	Mugiliformes	01.93%
6.	Mastacembeliformes	05.71%
7.	Perciformes	11.55%

Altogether, 52 species belonging to 7 orders and 19 families were recorded in the present study. Out of them the maximum number of species was found to belong to Order Cypriniformes (32 species) followed by Perciformes (06 species), Ophiocephaliformes (04 species), Mastacembeliformes (03 species), Mugiliformes (01 species) and Beloniformes (01 species). Based on the number of the species richness Order Cypriniformes was found to be the most dominant. On the basis of abundance, family Cyprinidae is the most dominating family of 15 species, followed by family Siluridae 09 species, family Ophiocephalidae 04 species, family Schilbeidae, Mastacembelidae and Anabantidae consists of 03 species, family Notopteridae and Clupeidae consists of 02 species and family Engraulidae, Cobitidae, Belonidae, Mugilidae, Sciaenidae, Nandidae, Heteropneustidae, Sissordiae, Pangasidae, Claridae and Gobioidae constitute only one species during the investigation. Out of 52 fish species, 05 species found to be near threatened, 03 species endangered, 05 species vulnerable, 31 species least concern while 08 species are not evaluated. The dominant order Cypriniformes comprises 62.5% of all the number of species recorded. Next to Cypriniformes, other dominant orders were Perciformes, Clupeiformes, Ophiocephaliformes, constituting 11.5%, 9.62% and 7.71% of species were recorded, respectively. Other orders like Mastacembeliformes shared 5.71% and Mugiliformes as well as Beloniformes constituting 1.93% respectively. Genus Mystus represented by 06 species was dominant followed by Genus Channa with 04 species. The results presented provides an insight to the diversity and conservation status of fresh water fish species in the selected sites of River Gomti that have established a baseline for future investigations. The result presented is close to the findings of previous research (Sarkar et al., 2010).

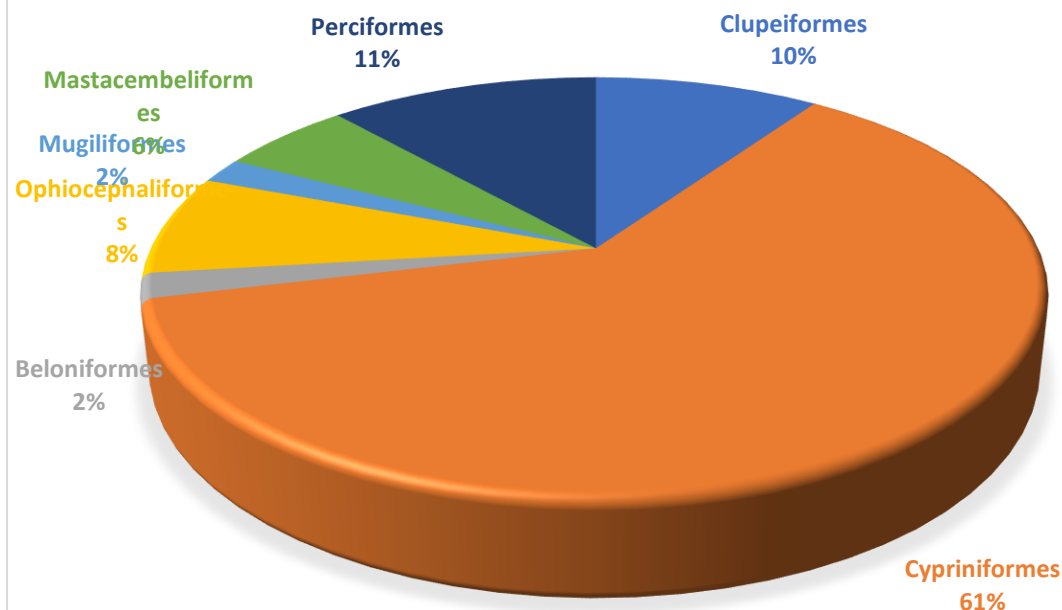FIG.1; DIAGRAMMATIC REPRESENTATION OF PER CENT CONTRIBUTION IN EACH ORDER.

Table 4: Name of the Family, Number of Species and total Percentage of Abundance.

S.No.	Name of the Family	Number of Species	Percentage of abundance
1.	Notopteridae	02	3.85%
2.	Clupeidae	02	3.85%
3.	Gobioidae	01	1.93%
4.	Cyprinidae	15	28.85%
5.	Cobitidae	01	1.93%
6.	Siluridae	09	17.31%
7.	Sissoridae	01	1.93%
8.	Schillbeidae	03	5.77%
9.	Heteropneustidae	01	1.93%
10.	Pangasidae	01	1.93%
11.	Sciaenidae	01	1.93%
12.	Belonidae	01	1.93%
13.	Ophiocephalidae	04	7.69%
14.	Mugilidae	01	1.93%
15.	Mastacembelidae	03	5.77%
16.	Claridae	01	1.93%
17.	Nandidae	01	1.93%
18.	Anabantidae	03	5.77%
19.	Engraulidae	01	1.93%

Table 5: Number of Species and Percentage of fish fauna as per IUCN Red list category.

S.No.	IUCN Status	Number of species	Percentage of Abundance
1.	Least Concern (LC)	31	59.62%

2.	Not Evaluated (NE)	08	15.38%
3.	Vulnerable (VU)	05	09.62%
4.	Near Threatened (NT)	05	09.62%
5.	Endangered (EN)	03	05.76%

Fig.3; Diagrammatic Representation of per cent contribution of fish fauna as per IUCN Red list category.
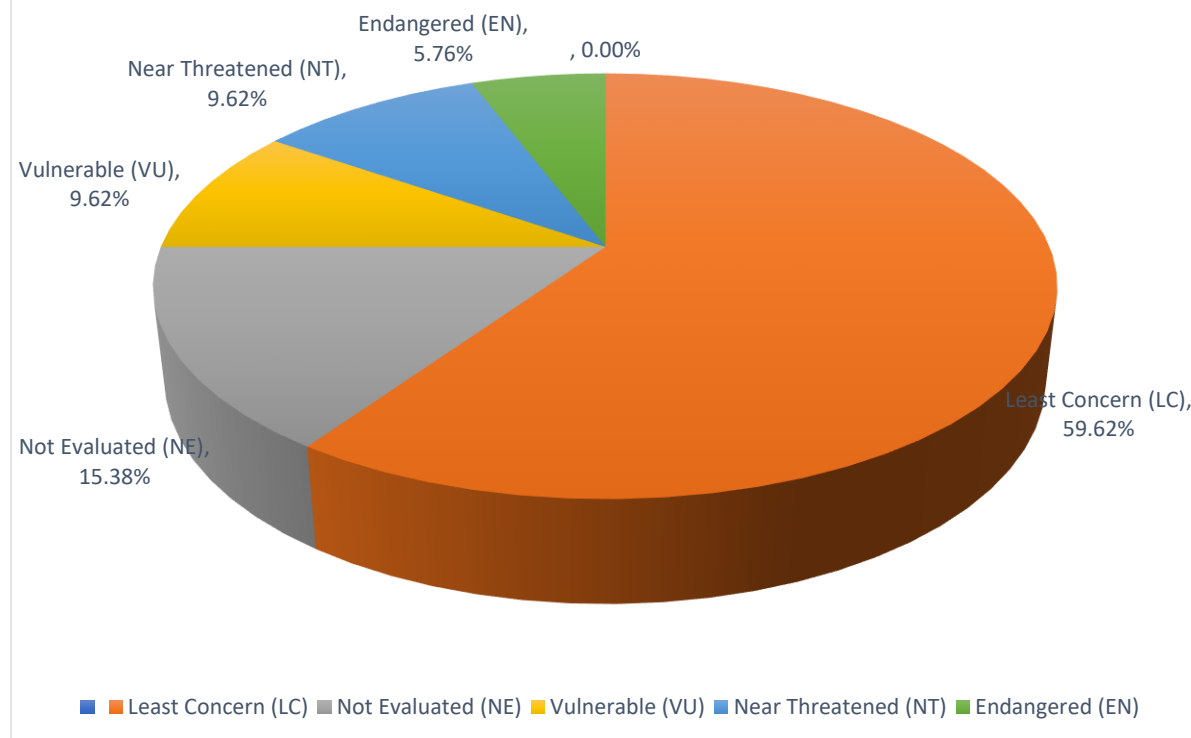
Discussion

The number of fish species (52) recorded in this study is almost similar to the number of fish species discovered in the same river, although the collection sites were different which indicates a rich species diversity (Sarkar et al.,2010). It shows that the river supports varied diversified nature of fish species. Several investigators reported a highest dominance of Ichthyofaunal diversity in different rivers, notable among them are Rao (2001) who reported 83 fish species in the upper Ganga (Rishikesh-Kanpur); Payne et al., (2004) discovered 30 and 56 species in Allahabad (U.P.) and Patna (Bihar) stretches of River Ganga simultaneously. In reference to these, Sarkar et al., (2007) reported the Piscean fauna of Samaspur Bird Sanctuary of Uttar Pradesh and recorded 46 species of fishes in the year 2007.

In the current study as mentioned above, the order Cypriniformes was found to be the most abundant group as compared to other orders. Out of 19 families, Cyprinidae was the most dominant group with 09 species, as in Sarkar et al., (2010) who reported 20 species out of 56, under this family from the same River Gomti but different collection site. Sharma et al., (2014) also investigated a total of 56 fish species from Upper Lake of Bhopal (Madhya Pradesh) where Cyprinidae was also observed to be dominant with 13 species. From Damodar River at Burdwan district, West Bengal where Cyprinidae was dominant with 14 species (Patra and Saha, 2013) in the river island, Masuli, Assam where 20 species of Cyprinidae was reported (Das and Sabitry, 2012). Most of the fish species presented in this investigation were found to be under least concern(LC). Simultaneously, several researchers like Sharma et al.,2014 and Patra and Saha, 2013 cited under the LC category 30 out of 56 species from upper lake of Bhopal (M.P) and 31 out of 46 species from Damodar River at Burdwan district, West Bengal. Notopteruschitala,

Hypopthalmicthysmolitrix, Ompakbinaculatus, Xenentodoncancila, and Glossogobiusgiuris were found to be near threatened, hence, in extreme danger of extinction in the upcoming era.

A survey from fishermen revealed that fishes are mostly exploited due to their high value as food were L. rohita, L. calbasu, Mystusaor, M. seenghala, M. cavasius, M. tengara, M. vittatus , Heteropneustesfossilis, Channapunctatus, C. striatus, C. marulius and C. gachua. Three exotic species, namely Cyprinuscarpio, Hypopthalmicthysmolitrix and Ctenopharyngodonidella were found to pose serious threats to migratory and threatened species, particularly to those having small size groups. Many researchers such as Lakra et al., (2008); Singh and Lakra(2011); Garcia-Berthou et al.,(2005); Garcia-Berthou et al.,(2007); and De Silva et al.,(2009); investigated that the exotic species are the primary causes of erosion and extinction of fish biodiversity in aquatic ecosystems. It was also reported that the invasive alien species are causing environmental and ecological issues in many countries including India.

Sarkar et al., (2010) reported that overfishing, excess use of poison, use of long nylon mosquito nets, indiscriminate killing of fishes, use of fine mesh size are the primary causes for deterioration of fish biodiversity, specially in River Gomti. Other researchers like Sebastian et al., (1999) and Kurup et al., (2004) noted that the excessive use of pesticides to preserve the agricultural crops in cultivated areas resulted in severe health problems in fishes, that leads to large-scale fish mortality.

The diversity of fishes are threatened because of the illegal and devastating fishing techniques, contamination of water bodies, alteration of habitat and eutrophication (Habit et al.,2006). These are some of the factors that are highly reducing the overall fish diversity to a high extent (Jayaram,1981). The main cause of indiscriminate killing of fishes during its early life stage especially in breeding season is the use of fine mesh size long nylon nets (Habit et al.,2006). Such techniques used are adapted only for short profit that ultimately leads to regular reduction of fishes diversity (Allan et al.,2005). Food demand is rapidly increasing day-by-day, due to increase in population by which wetlands are heavily pressured and transformed into croplands to grow the production of crop, farmers use different fertilizers (Savei,2012), that causes decreased level of oxygen into water bodies and eutrophication, simultaneously, fish diversity is harmed (Fu et al.,2003). Unless and until, a proper conservation measures are implemented, the loss of diversity is likely to increase as human population is directly or indirectly dependent on aquatic fishery (Darwall and Vie,2005).

Conclusion

Fish biodiversity of the River Gomti is well-known because of its abundance. According to the IUCN extent data, signifies that fishes are in great risk of extinction shortly. The best access to the conservation of the species is to propagate conservation knowlegde, education, and practices to fishermen about the danger of extinction of the species (Corbacho and Sanchez, 2001). Many of the authors also suggested the public awareness for cleaning of the river on regular basis, maintaining proper depth in the river, sewage treatment of the river, avoiding illegal and harmful fishing methods instead using small mesh sized net, poisoning, overfishing and catching of different life stages of fish may cause major loss of fish diversity. Fish with highly enormous food value and limited distribution of area are more vulnerable to threats. Hence, there is an obvious requirement for greater and effective programs for conservation of fish species to preserve the natural beauty and freshwater legacy of Uttar Pradesh region.

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