Diversity of Fresh Water Fishes and their Conservation Status in Eastern Uttar Pradesh, India

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Abstract: The diversity of fresh water fishes was studied by monthly samples collected from different fish markets of various districts of eastern Uttar Pradesh during April, 2020 to March, 2021. Over the last few decades, fresh-water ecosystems have suffered from intense human intervention resulting in habitat loss and degradation and as a consequence many fish species have become highly endangered especially where heavy demand is placed on fresh-waters. In the present study total of **69 fish species** belonging to **07 orders, 20 families** and **39 genera** were found in different districts (fishes were collected from fish markets) of eastern Uttar Pradesh especially Sultanpur, Ambedkar Nagar, Ayodhya, Gonda, Basti, Sant Kabir Nagar, Siddharth Nagar, Gorakhpur, Maharajganj, Azamgarh and Jaunpur. Among the species, Cypriniformes were the most leading order of the total fish diversity followed by Perciformes, Clupeiformes, Ophiocephaliformes, Mastacembeliformes, Mugiliformes and Beloniformes. In this study family Cyprinidae were the most dominating family of the total fish diversity followed by family Siluridae, Schilbeidae, Ophiocephalidae, Anabantidae, Clupeidae, Mastacembelidae, Notopteridae, Cobitidae, Claridae, Centropomidae, Nandidae, Engraulidae, Sissoridae, Heteropneustidae, Pangasidae, Belonidae, Mugilidae, Sciaenidae and Goboidae. The fishes in these areas are under threat due to anthropogenic activities such as overfishing and pollution hence author strongly recommend practical conservation action plan to prevent the loss of fish diversity.

KEYWORDS: *Fish diversity, Conservation status, Fresh water, Eastern Uttar Pradesh.*

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INTRODUCTION

Fishes are very diverse animals and can be categorized in many ways, i.e., by feeding behaviour, by vision, by shape, by locomotion, by toxicity etc. Although most fish species have probably been discovered and described, about 250 new ones are still discovered every year. According to Fish Base- 34,300 species of fish had been described as of September, 2020. That is more than the combined total of all other vertebrate species; amphibians, reptiles, birds and mammals. Most of the higher vertebrates residing in an aquatic environment are dependent on fishes for their food. Biodiversity conservation is especially important in developing countries where people are directly dependent on natural resources such as forests and fisheries for their livelihoods (**Corbacho and Sanchez, 2001**)[10]. Fishing using illegal methods like electro-fishing, pesticides, dynamite is also major threats to fish diversity all over the globe (**Bhakta and Bandyopadhyay, 2008**)[5], (**Groombridge, 1992**)[19]. Water pollution especially spills of toxic wastes (oil and petroleum products, industrial acids, pesticides and fertilizers) contributes greatly to the loss of fish diversity and their habitat degradation (**Bunn and Arthington, 2002**)[8].

Among the organisms, fishes are the best known species of aquatic organisms and they are the only food source harvested from natural populations (**Barman, 2007**)[2]. Furthermore, fishes exist at or near the top of food chain and can serve as an indicator of a balanced aquatic ecosystem (**Talwar and Jhingran, 1991**)[35]. Fish diversity comprises of species richness (number of species in a defined area), species abundance (relative number of species) (**Flores, et. al., 2009**)[16]. Today, the fish diversity and associated habitats management is a great challenge and the ability to evaluate the effects of habitat change and other impacts on the fish population before and after the change occur (**Bhattacharya, et. al., 2018**)[6]. In the recent years, several broad scale studies have identified modification and loss of aquatic habitat as primary factor threatening conservation of fresh water fishes and communities (**Basu, et. al., 2012**)[3]. The fish diversity, community structure and species assemblages in the streams and rivers are interdependent on many abiotic and biotic factors (**Chaube, 1988**)[9]. These factors determine the success or failure of fish species assemblages in the river or streams within the range of spatial distribution limits (**Dawson, et. al., 2003**)[14].

All over India, freshwater fish diversity is on a decline. Many of them have been lost forever few studies have been carried out so far regarding this aspect. They mainly identified major sources driving extinction which are- over harvesting, completion by newly introduced exotic fishes, pollution and illegal and destructive fishing methods (**Sarkar and Bain, 2007**)[28]. According to a workshop estimate hosted out by National Bureau Fish Genetic Resources a total of 227 Indian fresh water fishes are threatened based on the IUCN (International Union for Conservation of Nature and Natural Resources) Red list Categories of 1994. Some other factors are also contributing towards the loss of fish diversity (**Lakra and Sarkar, 2007**)[26]. In the irrigation canal when water is stopped in the canals, they are trapped near the gate and fished out. The shallow streams and pools, such as those at the base of waterfalls, fall victim to the easy availability of dynamite ever since quarrying and road construction began on a grand scale in the country (**Boruah and Biswas, 2002**)[7]. The shock waves of the blast destroy all fish in the vicinity. Sewage, industrial effluents, chemical fertilizers and pesticides are polluting India`s fresh waters (**Shahnawaz, et. al., 2010**)[33]. The drastic modification of fresh water habitats by damming streams and rivers siltation leading to reduction in their depth has also profoundly affected fish diversity (**Basudev, et. al., 2015**)[4]. The overall deterioration of habitat has rendered many fishes susceptible to diseases. One of the most serious is epizootic ulcerative syndrome disease that brought mass mortalities and extinction of some species in Indian fresh water fishes.

MATERIAL AND METHODS

STUDY AREA:

The study was conducted for a period of one year from April, 2020 to March, 2021. The fish sampling was carried out on monthly basis from different fish markets of various districts (i.e., Sultanpur, Ambedkar Nagar, Ayodhya, Gonda, Basti, Sant Kabir Nagar, Siddharth Nagar, Gorakhpur, Maharajganj, Azamgarh and Jaunpur.) of eastern Uttar Pradesh, India.

COLLECTION AND IDENTIFICATION OF FISHES:

The fish data were collected from different fish markets of various districts of eastern Uttar Pradesh, India. The

fish market survey and sample collection were carried out in the early morning (between 08:00 to 11:00 AM) due to the good availability of fish. The market survey and questionnaire survey with retailers and fishermen was carried out to know the abundance of fish species. The collected fish samples were washed thoroughly and preserved in 10% formaldehyde solution at the sampling site, and brought to the nearest laboratory (i.e., Department of Zoology, Ganpat Sahai P.G. College, Sultanpur, Tilak Dhari P.G. College, Jaunpur and L.B.S.S. P.G. College Anand Nagar, Maharajganj, Uttar Pradesh, India). The identification of fish sample was done with the help of standard reference books (**Talwar and Jhingran, 1991**[32]**; Jhingran, 1991**[24]**; Dutta Munshi and Srivastava, 1998**[15]**; Srivastava, 2010**[34] **and Jayaram, 2010**[22]). The International Union for Conservation of Nature (**IUCN, 2018**)[20] red list of threatened species was followed to evaluate the present conservation status of the species. The fresh fishes were mainly used for identification of natural colour, pattern of scales, mouth pattern and identifying marks while preserved specimen used for studying morphometric characteristics. The local names of the fishes were acquainted from retailers, farmers and fishermen.

RESULTS

The fish diversity of collected and identified fish species from different sites of various districts of eastern Uttar Pradesh, India along with conservation status as shown in **Table-1** and availability of fish species in various districts are shown in **Table-2**.

Table 1: Taxonomic position and conservation status of different fresh water fishes of various Districts of eastern Uttar Pradesh, India.

S.N.	Scientific Name of Fish	Common/ Local Name	Order	Family	IUCN Status
1.	*Notopterus chitala*	Moya	Clupeiformes	Notopteridae	NT
2.	*Notopterus notopterus*	Patra	"	"	LC
3.	*Gadusia chapra*	Suhia	"	Clupeidae	VU
4.	*Gadusia godanahia*	Godnahia Suhia	"	"	VU
5.	*Goniolosa manmina*	Majhali Suhia	"	"	VU
6.	*Setipinna phasa*	Phansi	"	Engraulidae	NE
7.	*Catla catla*	Bhakur	Cypriniformes	Cyprinidae	LC
8.	*Cirrhinus mrigala*	Nain	"	"	LC
9.	*Cirrhinus reba*	Raia	"	"	LC
10.	*Labeo rohita*	Rohu	"	"	LC
11.	*Labeo bata*	Bata	"	"	LC
12.	*Labeo calbasu*	Karaunchar	"	"	LC
13.	*Labeo gonius*	Kurshi	"	"	LC
14.	*Cyprinus carpio*	Common carp	"	"	VU
15.	*Hypopthalmicthys molitrix*	Silver carp	"	"	NT
16.	*Ctenopharyngodon idella*	Grass carp	"	"	NE
17.	*Oxygaster bacaila*	Chalhawa	"	"	LC
18.	*Oxygaster clupeioides*	Silhani	"	"	LC
19.	*Puntius chola*	Chela Punti	"	"	EN
20.	*Puntius sarana*	Darahee	"	"	LC
21.	*Puntius sophpore*	Sidhari	"	"	LC
22.	*Puntius ticto*	Punti	"	"	LC
23.	*Puntius titius*	Tit Punti	"	"	LC
24.	*Puntius javanicus*	Japani Punti	"	"	LC
25.	*Puntius conchonius*	Kanchan Punti	"	"	LC
26.	*Amblypharyngodon mola*	Dhawai	"	"	LC
27.	*Barilius bola*	Bhola	"	"	DD
28.	*Esomus danricus*	Dendua	"	"	DD
29.	*Osteobrama cotio*	Gurda	"	"	VU
30.	*Nemacheilus botia*	Carri	"	Cobitidae	EN
31.	*Botia dario*	Baghaua	"	"	LC
32.	*Wallago attu*	Parhin	"	Siluridae	VU

33.	*Mystus cavasius*	Sutahava Tenger	"	"	LC
34.	*Mystus menoda*	Belaunda	"	"	LC
35.	*Mystus tengara*	Tengana	"	"	LC
36.	*Mystus vittatus*	Tengara	"	"	EN
37.	*Mystus aor*	Dariai Tengar	"	"	LC
38.	*Mystus seenghala*	Dariai Tengar	"	"	LC
39.	*Rita rita*	Belgagara	"	"	EN
40.	*Ompak bimaculatus*	Jalkapoor	"	Siluridae	NT
41.	*Bagarius bagarius*	Gonch	"	Sissoridae	EN
42.	*Ailia coila*	Patasi	"	Schilbeidae	LC
43.	*Clupisoma garua*	Baikari	"	"	LC
44.	*Eutropichthys vacha*	Banjhoo	"	"	EN
45.	*Eutropichthys murius*	Golmuhi	Cypriniformes	"	EN
46.	*Silonia silondia*	Silund	"	"	EN
47.	*Heteropneustes fossilis*	Singhi	"	Heteropneustidae	EN
48.	*Pangasius pangasius*	Pangus	"	Pangasidae	EN
49.	*Clarias batrachus*	Mangur	"	Claridae	LC
50.	*Clarias gariepinus*	Hybrid Mangur	"	"	LC
51.	*Xenentodon cancila*	Kauwa	Beloniformes	Belonidae	NT
52.	*Channa striatus*	Sauri	Ophiocephaliformes	Ophiocephalidae	LC
53.	*Channa punctatus*	Girai	"	"	LC
54.	*Channa marulius*	Saur	"	"	LC
55.	*Channa gachua*	Chanaga	"	"	LC
56.	*Rhinomugil corsula*	Hunra	Mugiliformes	Mugilidae	EN
57.	*Mastacembelus armatus*	Baam	Mastacembeliformes	Mastacembelidae	LC
58.	*Mastacembelus pancalus*	Malga	"	"	LC
59.	*Macrognathus aculeatus*	Pataya	"	"	LC
60.	*Chanda nama*	Chanari	Perciformes	Centropomidae	LC
61.	*Chanda ranga*	Chanari	"	"	LC
62.	*Sciaena coitor*	Patharchatti	"	Sciaenidae	NE
63.	*Badis badis*	Sumha	"	Nandidae	LC
64.	*Nandus nandus*	Dhebari	"	"	LC
65.	*Anabas testudinius*	Kawai	"	Anabantidae	LC
66.	*Colisa fasciatus*	Khosti	"	"	LC
67.	*Colisa lilius*	Khosti	"	"	LC
68.	*Colisa chuna*	Kholisa	"	"	LC
69.	*Glossogobius giuris*	Bulla	"	Gobioidae	NT

IUCN Red list: **LC**: Least Concern, **VU:** Vulnerable, **NE:** Not Evaluated, **EN:** Endangered, **NT:** Near Threatened, **DD:** Data Deficient.

Table 2: Availability of the Fishes at various Districts of Eastern Uttar Pradesh, India

S.N.	Scientific Name of Fish	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
1.	*Notopterus chitala*	+	-	+	-	++	+	+	+	-	+	++
2.	*Notopterus notopterus*	++	+	+	-	+	+	++	+	-	+	+
3.	*Gadusia chapra*	+	+	++	+	+	-	+	++	+	-	+
4.	*Gadusia godanahia*	+	-	+	+	+	-	+	+	+	-	+
5.	*Goniolosa manmina*	-	+	+	-	+	+	+	+	-	+	+
6.	*Setipinna phasa*	-	-	+	++	++	+	++	++	+	-	++
7.	*Catla catla*	++	++	++	++	++	++	++	++	++	++	++
8.	*Cirrhinus mrigala*	++	+	++	++	++	+	+	++	++	+	++
9.	*Cirrhinus reba*	+	-	+	+	+	-	+	+	-	+	+
10.	*Labeo rohita*	++	++	++	++	++	+	++	++	++	++	++
11.	*Labeo bata*	+	-	+	-	+	+	-	+	-	+	+

12.	*Labeo calbasu*	++	+	+	+	+	-	+	+	+	+	+
13.	*Labeo gonius*	+	-	+	-	+	-	-	+	-	+	+
14.	*Cyprinus carpio*	++	++	++	++	++	++	++	++	++	++	++
15.	*Hypopthalmicthys molitrix*	++	+	++	+	++	++	++	++	+	++	++
16.	*Ctenopharyngodon idella*	++	+	++	+	++	++	+	+	+	++	++
17.	*Oxygaster bacaila*	++	++	++	+	++	+	++	+	+	++	++
18.	*Oxygaster clupeioides*	++	++	++	++	++	+	++	+	+	++	++
19.	*Puntius chola*	+	+	+	+	++	+	++	+	-	+	-
20.	*Puntius sarana*	++	++	++	+	++	+	++	+	+	+	+
21.	*Puntius sophpore*	++	++	++	++	++	+	++	++	+	++	+
22.	*Puntius ticto*	+	+	+	+	+	-	+	+	-	+	+
23.	*Puntius titius*	-	+	+	+	+	-	+	-	-	+	-
24.	*Puntius javanicus*	+	+	++	+	++	++	++	++	+	-	+
25.	*Puntius conchonius*	+	-	+	+	+	-	++	+	+	-	-
26.	*Amblypharyngodon mola*	-	+	+	+	+	+	+	++	-	+	+
27.	*Barilius bola*	+	-	+	-	+	+	+	+	+	-	-
28.	*Esomus danricus*	+	-	+	-	+	+	+	+	-	-	+
29.	*Osteobrama cotio*	+	+	+	+	++	-	+	+	-	+	+
30.	*Nemacheilus botia*	+	+	+	++	+	-	-	+	+	+	-
31.	*Botia dario*	-	-	+	+	-	-	+	-	-	+	-
32.	*Wallago attu*	++	++	++	++	+	++	+	++	++	++	+
33.	*Mystus cavasius*	+	+	++	+	+	+	+	+	+	+	+
34.	*Mystus menoda*	+	-	+	+	++	++	+	++	+	+	-
35.	*Mystus tengara*	++	+	++	+	+	++	+	++	-	+	+
36.	*Mystus vittatus*	+	+	++	+	+	+	-	+	+	+	+
37.	*Mystus aor*	+	+	+	+	+	+	-	+	+	-	-
38.	*Mystus seenghala*	++	+	++	++	++	+	+	++	+	+	++
39.	*Rita rita*	+	-	+	+	-	+	-	+	+	-	+
40.	*Ompak bimaculatus*	-	-	+	+	-	+	+	-	-	+	-
41.	*Bagarius bagarius*	+	+	++	-	+	+	++	+	-	+	+
42.	*Ailia coila*	+	-	+	+	+	-	++	+	-	+	+
43.	*Clupisoma garua*	++	-	++	+	++	+	+	-	+	+	++
44.	*Eutropichthys vacha*	+	+	+	-	+	+	+	+	-	+	+
45.	*Eutropichthys murius*	-	-	+	-	-	+	+	+	-	+	-
46.	*Silonia silondia*	-	-	+	+	+	+	++	++	-	+	-
47.	*Heteropneustes fossilis*	+	+	+	+	+	++	-	+	+	+	+
48.	*Pangasius pangasius*	+	+	+	+	+	++	+	+	+	+	++
49.	*Clarias batrachus*	+	+	+	+	+	++	+	+	-	+	+
50.	*Clarias gariepinus*	+	+	++	+	++	+	+	+	+	+	+
51.	*Xenentodon cancila*	+	+	+	++	+	-	-	+	-	-	-
52.	*Channa striatus*	++	+	+	++	+	+	+	+	+	+	+
53.	*Channa punctatus*	++	+	++	+	+	+	+	+	+	+	+
54.	*Channa marulius*	+	-	+	-	-	+	-	+	+	-	+
55.	*Channa gachua*	+	+	+	-	+	+	-	+	+	+	+
56.	*Rhinomugil corsula*	+	-	+	-	+	+	+	++	+	+	+
57.	*Mastacembelus armatus*	++	++	+	-	+	++	-	+	+	+	++
58.	*Macrognathus aculeatus*	+	++	+	-	+	+	+	+	+	+	++
59.	*Macrognathus aculeatus*	++	++	++	+	+	+	+	+	++	++	+
60.	*Chanda nama*	-	+	+	+	-	+	-	+	-	+	+
61.	*Chanda ranga*	+	+	+	+	-	+	-	+	-	+	+
62.	*Sciaena coitor*	-	+	+	+	+	+	+	++	+	-	-
63.	*Badis badis*	-	-	+	+	+	-	+	+	-	-	-
64.	*Nandus nandus*	+	+	+	+	+	-	+	++	+	+	+
65.	*Anabas testudinius*	++	+	++	++	+	+	++	++	+	++	++
66.	*Colisa fasciatus*	+	+	+	+	++	+	++	++	+	++	++
67.	*Colisa lilius*	-	-	+	+	+	+	+	+	+	+	-
68.	*Colisa chuna*	-	+	-	+	+	-	-	+	-	-	-

69.	*Glossogobius giuris*	+	-	+	+	-	+	-	+	+	+	-

Here, I= Sultanpur, II= Ambedkar Nagar, III= Ayodhya, IV= Gonda, V= Basti, VI= Sant Kabir Nagar, VII= Siddharth Nagar, VIII= Gorakhpur, IX= Maharajganj, X= Azamgarh and XI= Jaunpur, + + = Abundant, + = Moderate, - = Least.

Table 3: Name of the Order, Number of species and % of Abundance

S.No.	Name of the Order	Number of Species	% of Abundance
1.	Cypriniformes	44	63.77
2.	Perciformes	10	14.49
3.	Clupeiformes	06	08.70
4.	Ophiocephaliformes	04	05.80
5.	Mastacembeliformes	03	04.34
6.	Mugiliformes	01	01.45
7.	Beloniformes	01	01.45

Table 4: Name of the family, Number of species and Percentage (%) of Abundance

S.No.	Name of the Family	Number of Species	% of Abundance
1.	Notopteridae	02	2.90
2.	Clupeidae	03	4.34
3.	Engraulidae	01	1.45
4.	Cyprinidae	23	33.33
5.	Cobitidae	02	2.90
6.	Siluridae	09	13.04
7.	Sissoridae	01	1.45
8.	Schilbeidae	05	7.25
9.	Heteropneustidae	01	1.45
10.	Pangasidae	01	1.45
11.	Claridae	02	2.90
12.	Belonidae	01	1.45
13.	Ophiocephalidae	04	5.80
14.	Mugilidae	01	1.45
15.	Mastacembelidae	03	4.34
16.	Centropomidae	02	2.90
17.	Sciaenidae	01	1.45
18.	Nandidae	02	2.90
19.	Anabantidae	04	5.80
20.	Gobioidae	01	1.45

Table 5: Number of species and percentage of fish fauna as per IUCN red list category

S.No.	IUCN Status	Number of Species	Percentage
1.	Least Concern (LC)	42	60.87
2.	Vulnerable (VU)	06	8.70
3.	Not Evaluated (NE)	03	4.34
4.	Endangered (EN)	12	17.39
5.	Near Threatened (NT)	05	7.25
6.	Data Deficient (DD)	01	1.45

In the present study total **69 fish species** were collected from different fish markets of sampling districts of eastern Uttar Pradesh, India, belonging to **7 orders** and **20 families**. Of these 07 orders, on the basis of species richness and percentage composition the order Cypriniformes was most dominant (44 species) followed by Perciformes (10 species), Clupeiformes (06 species), Ophiocephaliformes (04 species), Mastacembeliformes (03 species), Mugiliformes (01 species) and Beloniformes (01 species) (**Table-3; Figure-1**). Of these 20 families based on the species richness and percentage composition, the family Cyprinidae was most dominant (23 species), followed by family Siluridae (09 species), Schilbeidae (05 species), Ophiocephalidae (04 species), Anabantidae (04 species), Clupeidae (03 species), Notopteridae (02 species), Cobitidae (02 species), Claridae (02 species), Centropomidae (02 species), Nandidae (02 species), Engraulidae (01 species), Sissoridae (01 species), Heteropneustidae (01 species), Pangasidae (01 species), Belonidae (01 species), Mugilidae (01 species), Sciaenidae (01 species) and Gobioidae (01 species) (**Table-4; Figure- 2**). In the present study as per IUCN (2018) out of 69 species found in various districts of eastern Uttar Pradesh, India, 42 species are in Least Concern (LC) with a contribution of 60.87%, 06 species is Vulnerable (VU) with a contribution of 8.70%, 03 species is Not Evaluated (NE) with a contribution of 4.34%, 12 species is Endangered (EN) with a contribution of 17.39%, 05 species are Near Threatened (NT) with a contribution of 7.25% and 01 species is Data Deficient (DD) with 1.45% contribution (**Table-5; Figure-3**):

Fig. 1: Relationship between Order and Species Abundance of Fish

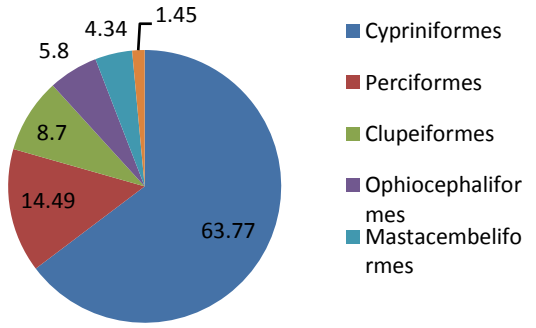


Fig. 2: Relationship between Family and Species Abundance

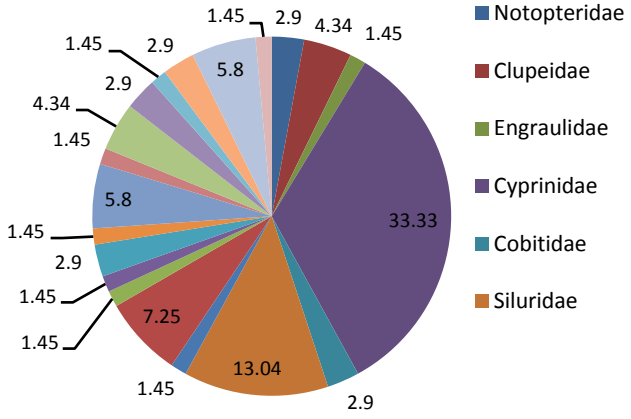
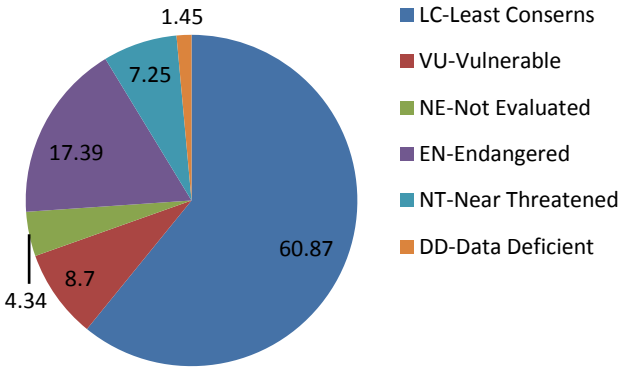


Fig. 3: Percentage status of species categories as per IUCN (2018)



DISCUSSION

The present investigation revealed that the total of about **69 fish species** were recorded belonging to **07 orders** and **20 families**. The information collected from the local fish seller of the area reveals a high decline in the fish population in the last few years. Some species of *Channa, Heteropneustes, Clarias, Rita, Puntius, Mystus, Mastacembelus, Nandus, Anabas etc.,* were seen and collected by fishermen before a few years but rarely/ do not appear in fishing operations these days. There is a need for reevaluation of threatened category of fishes because these species were not available in very large quantity though its market demand is very high. This may due to uncontrolled fishing to meet the high market demand of the local fishes. Besides, the fishing activities were intensified with the introduction of modern fishing gear and techniques (**Johal, et. al., 2002**)[25].

The fish diversity is threatened due to illegal and destructive fishing methods, pollution, habitat alteration, eutrophication, siltation and water abstraction. These factors are highly affecting the overall fish diversity to a large extent (**Jayaram, 1981**)[22, 23]. Illegal and destructive fishing methods i.e., use of small mesh sized net, poisoning, destructive gears, overfishing and catch of all life stages of fish is the major concerns for the loss of fish diversity (**Gibbs, 2000**)[18]. The use of fine mesh size long nylon nets causing indiscriminate killing of fishes irrespective of early life stage and brooders particularly in breeding season (**Habit, et. al., 2006**)[20]. Such practices, which are adopted for short term profit, ultimately lead to regular overfishing and consequent reductions in fish diversity (**Allan, et. al., 2005**)[1]. With the rapid increase in the human population increases the demand of food, for this the people occupy the area of beel for the agricultural purpose by which the wetlands are heavily pressured and converted to croplands and to increase the crop production, farmers use various chemical fertilizers (**Savei, 2012**)[31], which cause eutrophication and decreases the dissolved oxygen level in water bodies which simultaneously harms the fish diversity (**Fu, et. al. 2003**)[17]. The increasing dependence of human population on aquatic fishery resources including water and the continuing introduction of exotic species in natural water bodies of eastern Uttar Pradesh, the loss of fresh water fish diversity is likely to increase further unless proper conservation measures are implemented.

The best approach to the conservation of the species is to disseminate conservation information, education and practices to fishermen and other stakeholders about the danger of extinction of the species and the need for its

conservation (**Darwall and Vie, 2005**)[11]. This will go a long way towards protecting and preserving the species. Prevention now is not only better, but also cheaper than looking for ways of recalling the lost species (**Rahel, et. al., 2008**)[27]. Once extinction occurs, it could not be easily reserved or recalled. To this, fish biologists, limnologists, aquatic ecologist and conservationists have a major role to play in creating public awareness and support for the conservation mechanisms (**Sarkar, et. al., 2008; 2010**)[29,30] for the species pointed out the need for scientists to generate awareness for the conservation of fish species (**Das and Chakrabarty, 2007**)[13]. This study highlighted the need for stake holders to watchful of autogenic and anthropogenic threats, activities and harmful practices (**Wolter, et. al., 2000**)[36] which may cause the extinction of fish species in eastern Uttar Pradesh and the effects of this extinction, and the ways by which it could be prevented (**Shaffer, et. al., 2009**)[29]. A holistic approach to the conservation of fish species in the fresh water reservoir would be to integrate its conservation management strategies in to its water quality and production management programs (**Das, et. al., 2011**)[12]. This would enable the evaluation of the present and future conditions of the species in the fresh water reservoirs of eastern Uttar Pradesh and its ability to sustain present and future exploitation.

Legislation related to agriculture and allied activities including fisheries is the jurisdiction of State Governments. The Department of Fisheries Government of Uttar Pradesh is trying to conserve these threatened fish species by regulating several measures like the fishing ban, closed season, regulate fishing, gears selectivity etc. The government and NGO organization have a major role to play in creating awareness and support for the conservation mechanism of fish species. The consumer awareness regarding buying of threatened fish species from the market is prerequisite to conserve the threatened resources is a better way. However, more awareness and motivations are required on the value of freshwater fish diversity and its conservation.

CONCLUSION

The market based survey showed that there was a drop in fish diversity in the last few years. Deforestation, flood, sand mining, recreational activities, organic and inorganic pollution, overfishing, unregulated uses of pesticides in the agricultural fields, irrational fish harvesting along different activities are the central causes for the loss of fish diversity. Authors are strongly recommended the practical conservation action plan to prevent the loss of fish diversity. Appropriate management and conservation policy should be inserted in to the fishing policies of the Government. The authors are also recommended for regular cleaning of water bodies and protection of fish seeds such as eggs, spawns, fry and fingerlings as well as small sized fishes.

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