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THREAT STATUS AND CONSERVATION PRIORITY FOR THE ICHTHYOFAUNA OF THE RIVER GOMTI IN THE LUCKNOW REGION

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ABSTRACT
It was decided to carry out this study to find out more about the present situation of the rapidly diminishing icthyo-faunal biodiversity in the Gomti River, which is a Ganges tributary in the Lucknow region that extends for around 940 kilometers. In this study, 56 species belonged to 41 genera and nine orders, and 21 families were discovered, according to the results. The Cyprinidae order contained the greatest number of species (33.91 percent), followed by the Siluridae (30.32 percent), the Ophiocephaliformes (5.37 percent), the Mastacembeliformes (3.59 percent), the Clupeiformes (3.59 percent), the Mugiliformes (1.79 percent), the Beloniformes (1.79 percent), and the Tetraodontiformes (1.79 percent (1.79 percent). According to the International Union for Conservation of Nature, more than half of the species (46), which include the Ompok bimaculatus, Ompok pabda, and Wallago attu, Bagarius bagarius, and Ailia coila, are classed as Least Concern (Least Concern) (IUCN). Several foreign species, including Cyprinus carpio, Ctenopharyngodon idellus, Oreochromis mossambicus, and Hypophthalmichthys molitrix, were eliminated from the research due to a lack of accessible data. Fishes from three different sample sites along the Gomti River in the Lucknow Region were found to have statistically significant (p 0.05) Simpson diversity indexes, fish species richness, and fish abundance.

Keywords: Biodiversity; Itchyo-fauna; IUCN; Threats

1.INTRODUCTION
Local fisherman's socioeconomic status is strongly tied to the amount of economic development in a country's economy. This food source not only offers the cheapest supply of protein but also contains essential nutrients for human health. India and Bangladesh are connected by Asia's longest river, the Ganga, also known as the Ganges, which flows through both countries. According to estimates, the Ganges drainage is home to 350 fish species, many of which are unique to the area. A large proportion of the total catch of fish is made up of fish from the Cypriniformes family (50 percent), Siluriformes (23 percent), and Perciformes (14 percent). It is necessary to know the relationship between length and weight of a fish to calculate growth rate, feeding phases, survival and maturity age structures, and other essential components of fish population dynamics, as shown in the present research. In fisheries management, length-weight relationship (LWR) studies may be used to provide information on stock condition at a regional and temporal scale by constructing yield equations for estimating and comparing the population.
New information derived from LWRs may prove to be very beneficial for fisheries managers to boost commercial yields of such economically and commercially important fish species. These variations occur more often in fish in some regions, potentially as a result of seasonal changes, spawning times, and recurrent spawning, and maybe as a result of food availability. However, there is a significant fish population that is easily accessible and that is commercially beneficial. Conditions like "condition," "fatness," or overall well-being are used to compare fish in the fishing industry, and the condition factor is one such phrase. It may be used to determine the intensity of feeding, the age of the fish, and the rate of development in fish. The six species under inquiry are critically vital to the fisheries of this area, and each of them is also commercially significant.

2.LITERATURE REVIEW
Rubina Mondal (2020) Globally, environmental and human factors have an impact on the organization of fish communities in a variety of aquatic environments. In this study, the fish assemblages in lower-order streams in two very different locations of India are compared to see how they vary. In the two sites where we

conducted our research, we documented the species richness of these monsoon-driven lower-order streams. We also looked at the effect of the season on the richness and diversity of these tropical streams, as well as the influence of other important environmental factors. In the years 2015 to 2017, samples were taken from streams in the Indian states of Madhya Pradesh and West Bengal to get seasonal data on fish abundance and environmental parameters. The Shannon index H' was used to compare species richness (SR) and diversity (Shannon index H') across different locations and seasons. The most essential parameters determining overall richness and diversity were identified via the use of multiple linear regression techniques. According to the findings of the data analysis, these streams are quite diversified in both places. Families including Cyprinidae, Bagridae and Channidae dominated both habitats, with Cyprinidae being the most numerous. Although the richness and diversity of fish populations in both places differed in terms of geography and local ecology, it was discovered that they were both impacted by environmental features that were comparable. This shows that environmental factors play a major role in determining the organization of fish communities. The passage of water has an impact on the richness and variety of both locations. Seasonal influences on the makeup of fish groups were found to be minimal in tropical streams, according to our findings. Stream and river ecosystems are becoming more vulnerable as a result of habitat loss and water quality degradation in nations such as India. As a result, it is critical to have a thorough understanding of the regional and local drivers of community organization in aquatic fauna. The utilization of common environmental features across ecoregions as a starting point for future research and management plans for key river basins and fish conservation may be a useful tool for the conservation of fish in the future.

Archisman Mahapatra (2018) A total of six commercially important freshwater fish species, including Ompak pabda, Labeo bata, Channa punctatus, Rita rita, Ailia coila, Clarias batrachus, and Ompak pabda, were studied in Varanasi ponds near the River Ganges for their length-weight relationships and condition factors to determine the significance of allometric growth factor as well as their well-being. Researchers discovered that b values ranged from 1.53 (the lowest; Rrita) to 3.65 (the highest; L. bata) and that all 362 specimens except for one (A. coila) had negative b values, even though this species had positive allometric growth. When it comes to weight gain and reaching an economically feasible size, C. punctatus has a condition factor value of 1.28, which makes it the most profitable species in terms of profit to the fisherman. It was decided to change the length of Ompak pabda to a new maximum length (32 cm TL).

Gupta D and Tripathi M (2017) Many aquatic species have been wiped off by human activities, and the species makeup of certain places has changed as a result. Fish diversity studies are vital for the sustainable management of fisheries. This report presents the results of an exploratory investigation on the ichthyofauna of the Gomti River in Lucknow. More than 60 different species of ichthyosaurs were found in all, belonging to 18 families and 8 orders. The Gomti River was home to several unusual fish species, including Hypophthalmichthys molitrix, Cyprinus carpio, Clarias gariepinus, and Ctenopharyngodon idella. The ichthyofaunal diversity indices varied noticeably across the five distinct sample locations, according to the findings of the research. This order was shown to be the most prevalent across all of our study locations. Despite the river's high pollution level, fish populations were determined to be adequate at most of the locations studied.

Sharad C. Srivastava (2014) Throughout an individual's whole life cycle, their feeding habits play a crucial role. The amount and kind of food that fish consume determines their ability to grow, reproduce, and survive, as well as their ability to contribute to the health of aquatic ecosystems. Because of their affinity for certain foods, fishes compete for the same foods as humans. This may have a detrimental influence on the population dynamics of salmon. In this study, gut content analysis was done to determine the dietary habits of carp and catfish, and the results were published. Because of the diverse variety of food items that the fish species eat, there is evidence of interspecific and intraspecific competition in their diets. The findings demonstrated that, even though carp and catfishes mostly consume phytoplankton and zooplankton, they may be able to thrive on an omnivorous diet.

U.K. Sarkar (2013) There are 2148 fishes, belonging to 8 families, 12 genera, and 15 freshwater fish species (Wallago attu, Rita rita, Sperata seenghala, Sperata Aor, Mastacembalus armatus), captured from the Ganga River, the Gomti River and the Rapti River between May 2011 and March 2012. This study is based on the length-weight relationships (LWRs) of these fishes, which were collected from the Ganga, the Gomti River, and the Rapti River from May 2011 to March 2012. Between 1.30 to 3.07, there was a wide range of growth coefficient (b) values, with a mean growth coefficient (b) of 2.03. Conditions in the river basin contributed to the wide range of the condition factor (K), which ranged from 0.76 to 2.95 and had a mean value of 1.43. As a baseline for other tropical Indian rivers and tributaries, the Ganga and its tributaries were evaluated for the patterns of LWRs and condition parameters of freshwater fish species.

3. OBJECTIVES OF THE STUDY

- To study The Gomti River's icthyo-faunal biodiversity was studied to determine its present state of decline.
- To analyze Mystus aor, M. seenghala, M. cavasius, Labeo bata, L. calbasu, L. rohita, Channa marulius, C. punctatus, and C. striatus were among the fish studied because of their high food value.

4.MATERIAL AND METHODS

4.1 Sampling sites and collection of fish

Sampling was conducted at three key locations along the Gomti River: Shahid Smarak, Hanuman Setu, and Site 3. (Kudiaghat). Between January and December of 2015, gill, drag, and scoop nets were used to harvest fish. In the lab, fish were preserved in 5 percent formalin for subsequent research. The quantity and diversity of fish species throughout the various locations were calculated. The equations were used to assess biodiversity using Simpson's 1-D index:

$$D = \sum ni\ (ni-1)/\ N\ (N-1),$$

where D = Simpson's Index of Dominance; ni = total number of individuals of a particular species; N = the total number of individuals of all species. According to the procedures established and endorsed by the International Union for Conservation of Nature and Natural Resources (IUCN), this research evaluated the threat level of each fish species.

4.2 Identification and calculation

The use of Talwar & JhJhingran's1991) manuals and keys and Jayaram's (1991) keys helped identify the fish (1999). According to Srivastava, each species of indigenous and alien fish was examined for its color, banding patterns, morphometric characteristics, and meristic traits, and fin formulae were created (1980 & 1988). A one-way ANOVA was used to examine the data from three separate sampling locations. Graph Pad Prism5 was used for all of the computations.

5.RESULTS

In all, 56 species from 41 different genera, 9 different orders, and 21 different families were found in this investigation. Cypriniformes has the most species (33.91%), followed by Siluriformes (30.32%), Perciformes (17.85%%), Ophiocephaliformes (5.37%%), Mastacembeliformes (3.59%%), Clupeiformes (3.59%%), Mugiliformes (1.79%), Beloniformes (1.79%), and Tetraodontiformes (1.79%). (1.79 percent).

Fin formula, IUCN status, and the present population status of the ichthyo-fauna of the Gomti River are all described in detail. Table 1 shows the quantity and proportion of each order's families, genus, and species. Each family's percentage make-up was figured up. More than half (46), including Ompok bimaculatus, Ompok pabda, Wallago attu, Bagarius bagarius, and Ailia coil, are classified as Least Concern (LC) or Near Threatened, respectively. It is not known if the rare Cyprinus carpio, Ctenopharyngodaon idellus, Hypophthalimichthys molitrix, and Oreochromis mossambicus, were taken at sampling sites with low to moderate abundances, were evaluated or not.

ichthyofauna Simpson's index of dominance (D) values were highest at site 1 (0.0509), followed by site 2 (0.0433), and lowest at site 3 (0.0419). (Table 2). A score of 0 indicates no diversity, whereas a score of 1 indicates boundless variety (the bigger the value of D, the lower the diversity). Site 3 (0.9581) had the highest Simpson's Index of Diversity (1-D), followed by Site 2 (0.9567), and Site 1 had the lowest (1.D) (0.9491). Site 3 was found to be the richest, followed by site 2 (53), and site 1, which had the fewest specimens (49).

Site 3 (1495) had the highest number of species, followed by site 2 (1188), while site 1 had the lowest richness of species (796). Puntius sophore ranked as the most common species in this survey, with Salmostomo bacaila in second place with 318, Trichogaster fasciata in third, Trichogaster lalia in fourth, Channa punctatus in fifth, Rasbora daniconius in the sixth, and Ompok pabda in seventh (see Table 3). River Gomti's three sample locations were found to have a statistically significant difference (p 0.05) between them, according to an analysis of variance (ANOVA).

6.DISCUSSION

The number of fish species (56) discovered in this study is equivalent to the number of fish species discovered by Sarkar et al. (2010) in the same river, showing that the river supports a diverse variety of species. In the upper Ganga (Rishikesh-Kanpur) segment of the river, according to Rao (2001), 83 species of fish were discovered, however, Payne et al. (2004) discovered 30 and 56 species of fish in the Allahabad (Uttar Pradesh) and Patna (Bihar) portions of the river, respectively. Sarkar and colleagues (Sarkar et al., 2007) discovered 46 different fish species in the Samaspur Bird Sanctuary in Uttar Pradesh (2007).

Cypriniformes were found to be the most dominant order in the current study, according to the findings. In this research, more than a dozen families were represented, including The Cyprinidae were the most numerous, accounting for 19 species out of a total of 21. (Sarkar et al., 2010). Sharma et al. discovered that the Cyprinidae family has the greatest number of members, with 13 individuals, in the Upper Lake of Bhopal (M.P.) (2014). In Burdwan, West Bengal, according to Patra and Saha (2013), there are 46 ornamental fish species, 14 of which are Cyprinidae; Das and Sabitry (2012) recorded 62 ornamental fish species from the river island of Masuli, Assam; this research indicated that the majority of the fish species studied had a low count of individuals, and Das & Sabitry (2012) discovered that the majority of the fish species studied had a low count of individuals (LC). A total of 56 species were discovered in the upper Bhopal Lake (M.P.) and the Damodar River (Burdwan district, West Bengal), and more than 30 of those species were categorized as LC by Sharma et al. (2014) and Patra & Saha (2015). (2013). Others, such as the Wallago attu and the Bagarius bagarius have been declared to be in danger of extinction, while others, such as the Ompok bimaculatus and the Ompok pabda, have been determined to be extinct in their entirety.

By the findings of the current study, the fish species most frequently targeted by fishermen because of their high market value as the food was Mystus for, Mystus seenghala, Mystus cavasius, L. calbasu, L. rohita, C. punctatus, and C. striatus. Mystus aor was the most frequently targeted fish species. The species of threatened fish discovered in this study included the Ompok pabda, O. bimaculatus, Clupisoma garua, Wallago attu, Ailia coila, and Eutropiichthys vacha, among others. Four invasive species, Ctenopharyngodon idellus, Cyprinus carpio, Hypophthalmichthys molitrix, and Oreochromis mossambicus, pose a threat to migratory and endangered species, particularly those with small size groups. Ctenopharyngodon idellus is a migratory and endangered species that live in small groups. More than a dozen authors, including GarciaBerthou and colleagues (2005, 2007), Lakra and colleagues (2008, 2009), De Silva and colleagues (2009), Singh and Lakra (2011), and others, claim that invasive species are the primary culprits in the degradation or annihilation of native fish biodiversity in freshwater ecosystems. GarciaBerthou and colleagues (2005, 2007), Lakra and colleagues (2008, 2009), Singh and Lakra (2011), and others, claim that invasive species are the primary culprit It has been reported that the introduction of foreign fish populations has caused environmental and ecological problems in several countries, including India.

The indiscriminate killing of fish at all stages of life, including larvae and brooders, overfishing, overuse of poison, use of fine mesh size nets, and long nylon mosquito nets, according to Sarkar et al. (2010), have all contributed to the decline in fish biodiversity, particularly in the Gomti River in India. Other experts, such as Sebastian et al. (1999) and Kurup et al. (2004), have shown that pesticide use in farmed areas may cause major health problems for fish, resulting in widespread fish mortality.

Table 1 Icthyo-fauna fauna of the Gomti river in Lucknow, India: the number and percentage composition of families, genus, and species within each order

S. No	Order	Family	Genus	Species	% of Fami- lies in Order	% of Genera i n Order	% of Species in Order
1	Clupeiformes	2	2	2	9.52	4.89	3.59
2	Cypriniformes	2	13	19	9.52	31.70	33.91
3	Siluriformes	6	12	17	28.58	29.26	30.32
4	Mugiliformes	1	1	1	4.76	2.44	1.79
5	Beloniformes	1	1	1	4.76	2.44	1.79
6	Ophiocephaliformes	1	1	3	4.76	2.44	5.37
7	Perciformes	6	8	10	28.58	19.50	17.85
8	Mastacembeliforme s	1	2	2	4.76	4.89	3.59
9	Tetraodontiformes	1	1	1	4.76	2.44	1.79
Total		21	41	56	100	100	100

Table 2 Indicators of fish variety, quantity, and richness in the Gomti River, India

Biodiversity Parameters	Site-1	Site-2	Site-3
Species Richness	49	53	56
Abundance (N)	796	1188	1495
Simpson,s index of dominance (D)	0.0509	0.0433	0.0419
Simpson,s index of diversity (1-D)	0.9491	0.9567	0.9581

Table 3 The diversity and quantity of fish species in the river Gomti at three different locations in Lucknow, India

S.No	Name of Species	Site-1	Site-2	Site-3	Richness	Abundance
1	Gudusia chapra	15	29	25	3	69
2	Notopterus notopterus	15	18	29	3	62
3	Catla catla	5	15	25	3	45
4	Cirrhinus mrigala	16	20	25	3	61
5	Cirrhinus reba	3	1	2	3	6
6	Ctenopharyngodon idella	1	-	3	2	4
7	Cyprinus carpio	25	27	35	3	87
8	Hypophthalmichthys molitrix	1	-	2	2	3
9	Esomus danricus	-	7	4	2	11
10	Labeo bata	7	17	11	3	35
11	Labeo calabasu	10	21	21	3	52
12	Labeo gonius	14	15	13	3	42
13	Labeo rohita	5	7	16	3	28
14	Osteobrama cotia	15	19	20	3	54
15	Salmostoma bacaila	95	130	155	3	380
16	Puntius sarana	42	51	86	3	179
17	Puntius sophore	85	103	130	3	318
18	Puntius ticto	27	35	55	3	117
19	Rasbora daniconius	21	55	47	3	123
20	Botia lohachata	-	1	2	2	3
21	Lepidocephalus guntea	3	9	10	3	22
22	Ompok bimaculatus	5	9	11	3	25
23	Ompok pabda	-	-	1	1	1
24	Wallago attu	3	9	10	3	22
25	Sperata seenghala	10	22	34	3	66
26	Mystus tengara	23	32	39	3	94
27	Mystus vittatus	18	22	19	3	59
28	Mystus cavasius	10	12	15	3	37
29	Sperata aor	19	39	27	3	85
30	Rita rita	24	42	50	3	116
31	Bagarius bagarius	3	6	8	3	17
32	Nangra nangra	1	2	1	3	4
33	Gagata cenia	3	11	12	3	26
34	Ailia coila	1	6	11	3	18
35	Clupisoma garua	7	15	20	3	42
36	Eutropiichthys vacha	2	9	12	3	23
37	Heteropneustes fossilis	7	15	22	3	44
38	Clarias batrachus	5	7	12	3	24
39	Rhinomugil corsula	2	1	1	3	4
40	Xenenthodon cancilla	10	25	27	3	62
41	Channa marulius	-	1	1	2	2
42	Channa punctata	35	51	65	3	151
43	Channa striata	18	12	31	3	61
44	Chanda nama	7	8	12	3	27
45	Sciaena coitor	2	2	1	3	5
46	Badis badis	-	5	7	2	12
47	Nandus nandus	3	13	19	3	35
48	Anabas testudineus	2	5	7	3	14
49	Trichogaster chuna	10	14	15	3	39
50	Trichogaster fasciata	70	95	110	3	275
51	Trichogaster lalia	50	60	80	3	190
52	Glossogobius giuris	6	4	13	3	23
53	Oreochromis mossambica	15	7	31	3	53
54	Mastacembelus pancalus	5	23	29	3	57
55	Mastacembelus armatus	15	23	25	3	63
56	Tetraodon cutcutia	-	1	1	2	2

7. CONCLUSIONS

The river's fish biodiversity is well-known for its abundance. Fish in the Gomti River are in danger from a variety of human-caused factors including overcrowding, commercial exploitation, indiscriminate use of pesticides and fertilizers, habitat modification, water diversion, and the introduction of foreign species. Not all of the fish species that have been studied have been equally vulnerable to extinction. Fish with enormous bodies, high food value, and a limited area of distribution are more vulnerable to threats, and the IUCN extant data indicates that several fish species are at grave risk of extinction shortly.

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