Original Research Article

Ichthyofaunal diversity and abundance in the Longnit River, Karbi Anglong, Assam: A preliminary assessment

ABSTRACT:

The present study aims to provide a comprehensive assessment of the ichthyofaunal diversity, abundance, and conservation status of fish species in the Longnit River, Karbi Anglong, a relatively less documented region with limited studies on its biodiversity. An extensive survey was conducted from November 2020 to June 2021, in two distinct catchment areas of the river using standard methodologies. A total of 23 species belonging to 14 families and 6 orders were identified, with Cyprinidae being the most dominant family. Notable genera, such as *Botia*, *Crossocheilus*, *Garra*, *Glyptothorax*, *Labeo*, and *Psilorhynchus*, were recorded, which are characteristic of such fast-flowing hillstream ecosystems. Although continuous monitoring is essential to assess potential threats, the IUCN conservation status assessment revealed that the majority of species fall under the Least Concern category. Diversity indices reveal a high level of species richness and evenness with the Shannon Diversity Index (H') = 3.0, The Simpson's Index of Dominance (D) = 0.05, and Simpson's Index of Diversity (1-D) = 0.95 indicating a rich diversity and low dominance by any one species. As a preliminary study, these results on the fish diversity and abundance of Longnit River provide fundamental data for the development of targeted conservation strategies to preserve the aquatic hill stream fish fauna of this underexplored ecological zone.

KEYWORDS: Assam; Diversity; Diversity Indices; Fish; Hill stream; Karbi Anglong; Longnit River,

1. INTRODUCTION

Fish and fisheries have always contributed to human well-being, with millions of people globally depending on them for food, employment, and income purposes. Human involvement is particularly higher in the case of developing countries as compared to developed countries, highlighting the importance of fisheries as a source of income there (Gebremedhin et al., 2021). In spite of the rich biodiversity, freshwater ecosystems are one of the most threatened habitats in the world (Reid et al., 2019). Factors such as habitat degradation, overexploitation, and invasive species continue to be constant threats to the ichthyofaunal biodiversity with potentially negative effects on human welfare and well-being (Dudgeon et al., 2006) It is estimated that more than 30,000 species of fish are present on Earth (FishBase, 2005), which is eventually projected to be around 32,500 (Coad and Murray, 2006). Of these, approximately 13,000 species live in freshwater accounting for 40-45% of the total fish population (Lévêque et al., 2008). India, being one of the megadiversity countries, contributes to about 7.7% of global fish diversity (Thakur et al., 2021). However, many freshwater ecosystems, particularly in remote and hilly areas of this country, remain understudied and unexplored.

Comprising of eight states, the region of North East India is a biodiversity hotspot. The diversity in its freshwater ecosystem can be attributed to the Himalayas and the Indo-Burma ranges, providing a varied geomorphology consisting of hills, plateaus, and valleys, which further give rise to numerous lakes, hill streams, and rivers (Goswami et al., 2012). These hill streams form large rivers, which eventually become a part of the Ganga-Brahmaputra-Barak-Chindwin-Kolodyne-Gomati-Meghna system (Kar and Khynriam, 2022). Although the ichthyofauna of Northeast India is still in the discovery survey state, with smaller regions left relatively unexplored (Vishwanath, 2017), a total of 422 species of fish were reported from the NE region belonging to 133 genera and 38 families showcasing its species richness and diversity (Goswami et al., 2012). Among the northeastern states, Assam has the largest number of fish species, followed by the states of Arunachal Pradesh, Meghalaya, Tripura, Manipur, Nagaland, Sikkim and Mizoram (Mahanta et al., 2003).

The Karbi Anglong district of Assam is a hilly terrain with its highest peak measuring 1,360 meters. It has numerous torrential streams which eventually flow into small rivers forming a part of large rivers. The district extends between 25º33′ North to 26º35′ North Latitude and 92º10′ East to 93º50′ East Longitude (https://karbianglong.gov.in). The Longnit River (*Longnit Aroi* in the Karbi language) originates from the Khonbamon Hills and flows through the Langrik-Langroithom, Siloni (Langsokangthu) and Longnit Bazar before merging with the Jamuna River, a tributary of Brahmaputra. The Longnit River is a perennial water body, carrying mineral-rich sand during monsoon season. It originates from a peak in the hills and flows through various villages as the main source of water for the people residing in those areas, forming the drainage network of the district along with Dhansiri and Kopili rivers. Despite the ecological importance of these hill streams, the region's streams have yet to be scientifically explored and researched, which has led to an incomplete assessment of the species diversity in the area. The position of the hill streams in high elevated areas with thick forest covering has been a major hindrance in studying the fish species richness. (Teronpi et al., 2015).

The Longnit River is understudied and lacks baseline data regarding species composition, abundance, and richness. Therefore, this study is an effort to bridge the research gap regarding the fish diversity of Longnit River in Karbi Anglong District, Assam, India. The aims and objectives of this study are: i) documentation of fish diversity, ii) analysis of abundance, richness, and evenness of fish species in the river, iii) evaluation of IUCN conservation status, and iv) critical data for future assessments and conservation strategies.

2. MATERIALS AND METHODS

2.1 Study Area:

The study was conducted in the Longnit River, Karbi Anglong, Assam. Fish samples were collected from two different catchment areas 3-4 km apart, selected based on habitat variations and accessibility. The selected catchment areas are Siloni (26º02′54.37″N, 93º39′00.42″E) and Longnit (26º04′66.40″N, 93º41′05.48″E) as shown in Figure 1. The exact location of the sampling sites was recorded using the Mobile UTM Geo map application for GPS (Global Positioning System) coordinates, as shown in Figure 3 (Kumar et al., 2020).

Figure 1: Catchment sites in the Longnit River a) Siloni b) Longnit

2.2 Fish Sample Collection:

The present work is based on the studies conducted for 8 months, from November 2020 to June 2021. The study on fish species in the river was conducted systematically by collecting data from captured fish. Fishing was done by experienced fishermen using a combination of both indigenous and modern techniques, including electro-fishing, fishing gears such as gill nets, hooks, lines, etc., as shown in Figure 2 (Teronpi et al., 2015). Photographs were taken immediately after collection by placing the fish on a clean sheet with a scale along the length of the specimen (Chhetry and Deka, 2016). The fish specimens were further preserved individually in 10% formalin for detailed examination and taxonomic identification (Gandotra and Sharma, 2015). Identification and classification of fishes were made as per standard taxonomic keys (Talwar and Jhingran, 1991), (Jayaram, 1999) and an online database (https://fishbase.se/home.htm).

Figure 2: a) Electrofishing b) Community fishing

2.3 Statistical Analysis:

The collected fish samples were counted, and percentage abundance was calculated. Data analysis was done using Microsoft Excel, and the diversity indices were calculated using standard formulae.

a) The Shannon-Weiner Species Diversity Index (H'):

The Shannon-Weiner (S-W) diversity index was used to measure the diversity in the fish population using the following formula:

$$H' = -\sum_{i=1}^{s}(pi)(\ln pi)$$

$$Pi = ni/N$$

Where, H' = index of diversity

ni = number of individuals of species i

N = total number of individuals of all species

b) Simpson's Diversity Index (D):

Simpson's Diversity Index was used to measure the diversity of the community using the following formula:

$$D = \sum \frac{n-1}{N(N-1)}$$

Where, n = number of individuals of a particular species

N = total number of individuals of all species

c) Simpson's Index of Diversity (1-D):

Simpson's Index of Diversity was used to measure the diversity of the community using the following formula:

1-D,

Where, D = Simpsons's Diversity Index

d) Margalef's Species Richness (R)

Margalef's Index is a species richness index. The formula is-

$$R = (S-1) / \ln N$$

Where, S = number of species

N = total number of individuals

e) Pielou's Measure of Species Evenness (J)

Pielou's evenness is an index to measure evenness in a diverse community. The formula is-

$$J = H' / \ln (S)$$

Where, H' = Shannon Weiner diversity

S = total number of species in a sample

2.4 Secondary Data: Secondary data was collected through observation and interaction with the local people and fishermen of the area. Occurrences of fish species other than the ones collected directly from the sampling sites were also recorded (Nag et al., 2017). Information on local names, food value, and indigenous fishing methods was obtained from the fishermen and local people. The conservation status has been listed according to the standard IUCN list (Rao and Rao, 2021).

2.5 Map of Study Area:

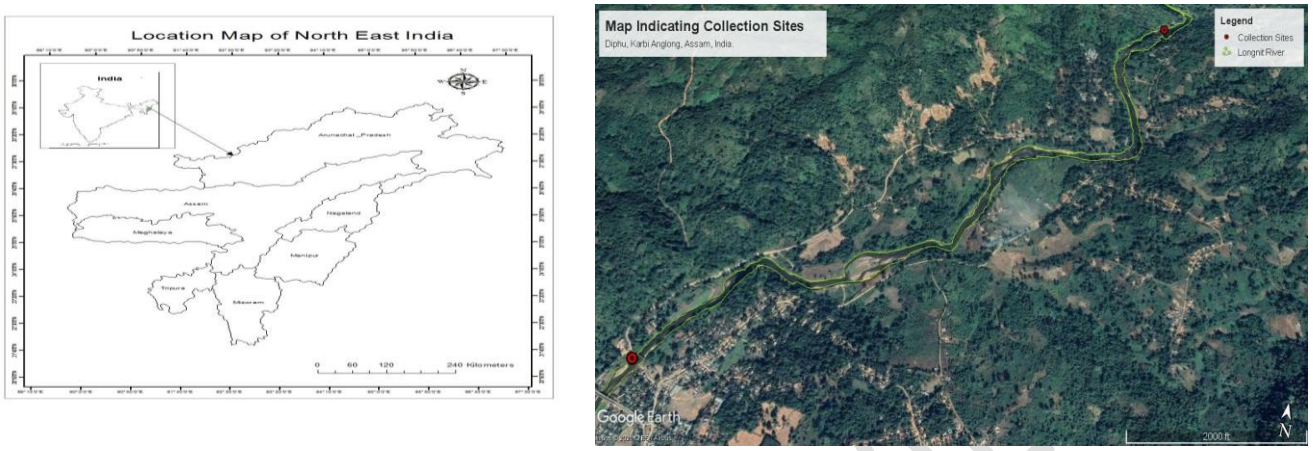


Figure 3: Map of Karbi Anglong district showing sampling sites in Longnit

3. RESULTS

3.1 Fish Diversity and conservation status:

A total of 23 species belonging to 20 genera, 14 families, and 6 orders have been recorded in the Longnit River during the study period of 8 months, *viz.*, Nov 2020 to June 2021. Table 1 lists the fish species that have been recorded at the present study site. The updated fish nomenclature is based on Fish Base ver. (06/2021). (https://fishbase.se/home.htm). The dominant order among the total of six orders observed throughout the study period is Cypriniformes, as shown in Figure 4, and out of the total of fourteen families, the dominant family was found to be Cyprinidae, as illustrated in Figure 5. The species found in the river were identified and categorized into various groups viz., Least Concern (LC), Near Threatened (NT), Vulnerable (VU), and Endangered (EN), as shown in Table 1, according to the standard IUCN list (IUCN, 2021). Seventeen (17) fish species were found to be under the Least Concern category. Figure 6 shows the percentage of species under various threat categories. 75% of fish species were in the Least Concern category, 13% were Near Threatened, and 9% were vulnerable, whereas only 4% of the total fishes were in the endangered category.

TABLE 1: Fish species found in Longnit River and their IUCN status.

SL NO.	LOCAL NAME	SCIENTIFIC NAME	FAMILY	IUCN STATUS
1.	Ok Nujung	*Anguilla bengalensis* (Gray,1831)	Anguillidae	Near Threatened (NT)
2.	Arnam Chekengke	*Badis badis* (Hamilton, 1822)	Badidae	Least Concern (LC)

3.	Ok Charplup	*Barilius bendelisis* (Hamilton, 1807)	Danionidae	Least Concern (LC)
4.	Ok Phakleng	*Botia rostrata* (Gunther, 1868)	Botiidae	Vulnerable (VU)
5.	Ok Langso	*Channa gachua* (Hamilton, 1822)	Channidae	Least Concern (LC)
6.	Ok Borok	*Channa punctata (*Bloch, 1793)	Channidae	Least Concern (LC)
7.	Magur	*Clarias magur* (Hamilton, 1822)	Clariidae	Endangered (EN)
8.	Nuter	*Crossocheilus latius* (Hamilton, 1822)	Cyprinidae	Least Concern (LC)
9.	Nune k er	*Devario aequipinnatus* (McClelland, 1839)	Danionidae	Least Concern (LC)
10.	Ok Nune	*Devario assamensis* (Barman, 1984)	Danionidae	Vulnerable (VU)
11.	Nuhong Chainong	*Garra nasuta* (McClelland, 1838)	Cyprinidae	Least Concern (LC)
12.	Patimutura	*Glossogobius giuris* (Hamilton, 1822)	Gobiidae	Least Concern (LC)
13.	Bengsirkep	*Glyptothorax trilineatus* (Blyth, 1860)	Sisoridae	Least Concern (LC)
14.	Singhi	*Heteropneustes fossilis* (Bloch, 1794)	Heteropneustidae	Least Concern (LC)
15.	Ok Nutun	*Labeo dyocheilus* (McClelland, 1839)	Cyprinidae	Least Concern (LC)
16.	Nutheng Morok	*Labeo pangusia* (Hamilton, 1822)	Cyprinidae	Near Threatened (NT)
17.	Ok Sangti	*Lepidocephalichthys guntea* (Hamilton, 1822)	Cobitidae	Least Concern (LC)
18.	Turi	*Macrognathus aral* (Bloch & Schneider, 1801)	Mastacembelidae	Least Concern (LC)
19.	Bamuni	*Mastacembelus armatus* (Lacepede, 1800)	Mastacembelidae	Least Concern (LC)

20.	Kumchirui	*Monopterous cuchia (*Hamilton, 1822)	Synbranchidae	Least Concern (LC)
21.	Nutheng	*Neolissochilus hexagonolepis* (McClelland, 1839)	Cyprinidae	Near Threatened (NT)
22.	Nuhong So	*Psilorhynchus balitora* (Hamilton, 1822)	Psilorhynchidae	Least Concern (LC)
23.	Ok Puthi	*Puntius sophore* (Hamilton, 1822)	Cyprinidae	Least Concern (LC)

FIGURE 4: Pie-chart showing percentage of order-wise distribution of fish species in Longnit River.

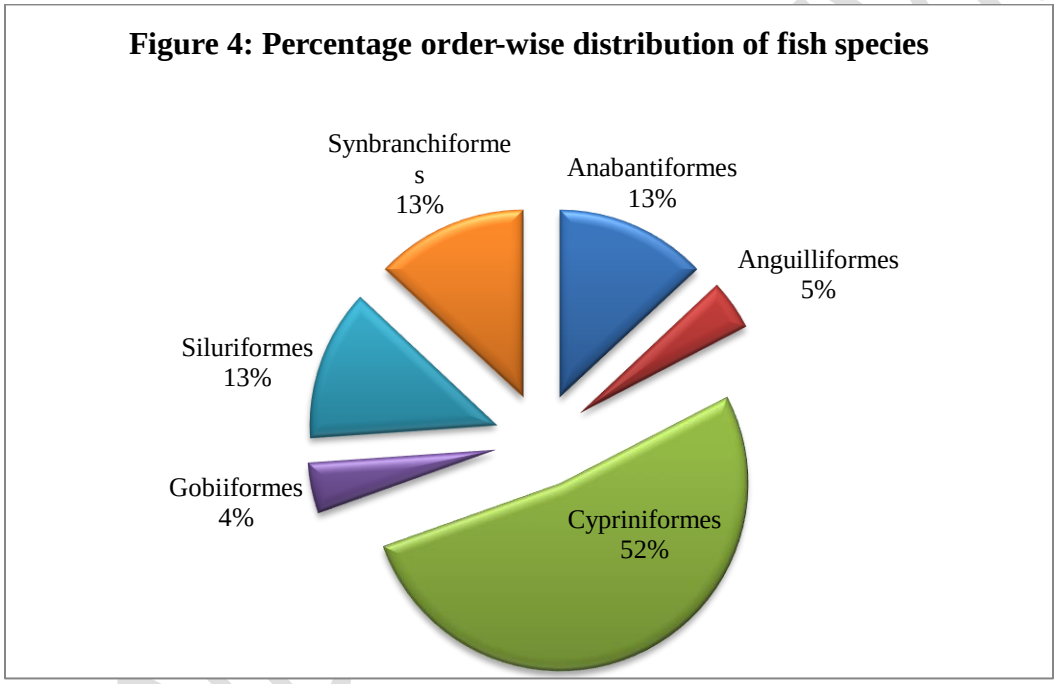


FIGURE 5: Pie-chart showing percentage of family-wise distribution of fish species in Longnit River.

Figure 5: Percentage of family-wise distribution of fish species

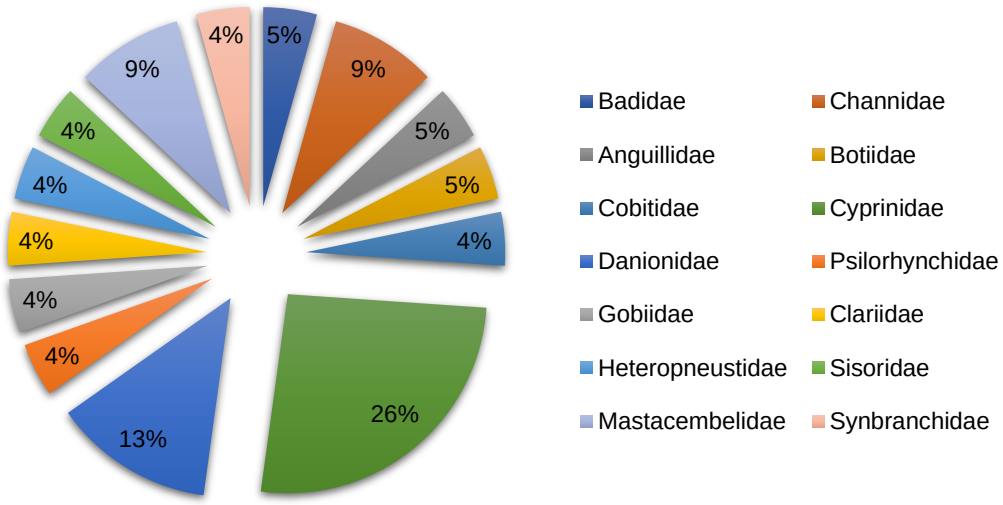
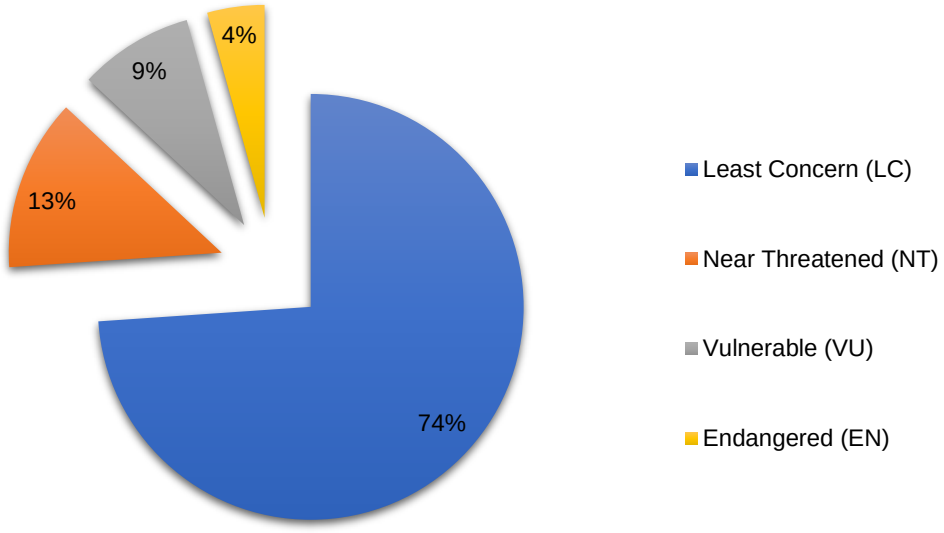


FIGURE 6: Pie-chart showing percentage of fish species under various threat categories as per the IUCN status.

Figure 6: Percentage of species under various threat categories as per IUCN status



3.2 Abundance

Among the 23 fish species found in the Longnit River, *Neolissochilus hexagonolepis* was found to be the most abundant, as shown in Table 2 and Figure 7. It had a dominance percentage of 8.27%,

whereas *Anguilla bengalensis* and *Monopterous cuchia* were found to be the least dominant, with 0.51% and 0.82% percent dominance, respectively. Other prevalent species after *N. hexagonolepis were Garra nasuta and Barilius bendelisis, with a dominance percentage of* 8% and 7.65%, respectively (Figure 8).

TABLE 2: Fish abundance in the river.

SL NO	SPECIES	WINTER	RETREAT ING WINTER	PRE MON SOON	TOTAL ABUNDANCE	% ABUNDANCE
1.	*Anguilla bengalensis*	3	0	2	5	0.510204
2.	*Badis badis*	10	11	10	31	3.163265
3.	*Barilius bendelisis*	23	21	31	75	7.653061
4.	*Botia rostrata*	8	0	15	23	2.346939
5.	*Channa gachua*	14	10	12	36	3.673469
6.	*Channa punctata*	15	11	16	42	4.285714
7.	*Clarias magur*	11	11	18	40	4.081633
8.	*Crossocheilus latius*	19	16	22	57	5.816327
9.	*Devario aequipinnatus*	10	9	14	33	3.367347
10.	*Devario assamensis*	4	9	8	21	2.142857
11.	*Garra nasuta*	34	15	29	78	7.959184
12.	*Glossogobius giuris*	2	7	14	23	2.346939
13.	*Glyptothorax trilineatus*	31	10	10	51	5.204082
14.	*Heteropneustes fossilis*	10	12	20	42	4.285714
15.	*Labeo dyocheilus*	18	16	27	61	6.22449

16.	*Labeo pangusia*	18	17	26	61	6.22449
17.	*Lepidocephalichthys guntea*	11	14	18	43	4.387755
18.	*Macrognathus aral*	4	7	15	26	2.653061
19.	*Mastacembelus armatus*	15	15	9	39	3.979592
20.	*Monopterous cuchia*	0	0	8	8	0.816327
21.	*Neolissochilus hexagonolepis*	27	22	32	81	8.265306
22.	*Psilorhynchus balitora*	9	9	14	32	3.265306
23.	*Puntius sophore*	26	17	29	72	7.346939
	TOTAL	322	259	399	980	100

FIGURE 7: Pie-chart showing percentage of various fish species in the river.

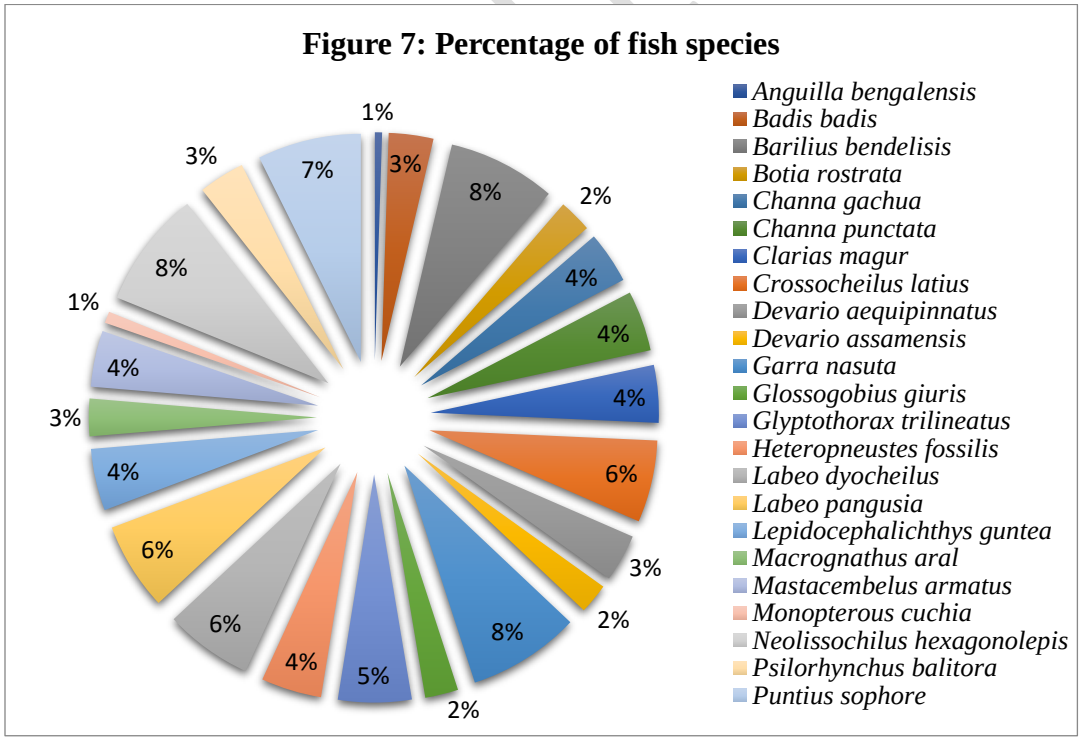
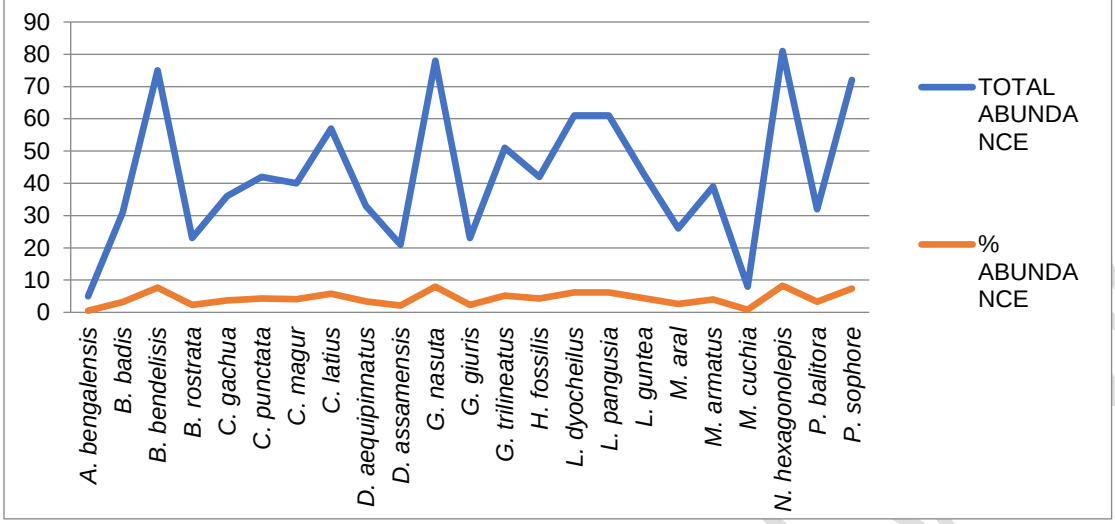


FIGURE 8: Graph showing Abundance and percentage abundance of the fish population.

Figure 8: Abundance and percentage abundance of the species



3.4 Statistical Analysis

The following are the statistical results for the overall fish population.

TABLE 3: Species Richness and Diversity Indices of the fish population.

Indices						
No. of Individuals	(S)	(H')	(D)	(1-D)	(R)	(J)
980	23	3.0	0.05	0.95	3.19	0.94

S = Number of Species, H' = Species Diversity

D = Simpson Index of Dominance, 1-D = Simpson Index of Diversity

R = Margalef's Species Richness, J = Pielou's Species Evenness

4. DISCUSSION

The purpose of this study was to determine the ichthyofaunal diversity and abundance from the two sites along the Longnit River during the study period. Since the river originates in the hills, a variety of hill-stream fish species with significant adaptations to this mode of life were observed. 23 ichthyospecies have been recorded during the study, belonging to 14 families and 6 orders. According to the taxonomic analysis of the fish species, Order Cypriniformes was the highest in percentage composition with 35% families, followed by Siluriformes, Synbranchiformes, and Anabantiformes, with the lowest being Gobiiformes and Anguilliformes. The dominance of the

Cypriniformes is consistent with the results of similar studies conducted in Karbi Anglong, Assam (Das and Sharma, 2012; Teronpi et al, 2015; Kar and Das, 2024) and India (Pawara et al., 2014; Bose et al., 2019; Joshi et al., 2022). The Cyprinidae family was found to be the most prevalent family among the fourteen families seen throughout the study period, accounting for 26% of the total families. Other studies on fish diversity in rivers and beels of India also show Cyprinidae to be the most dominant family (Das et al., 2013; Naik et al., 2013; Chhetry and Deka, 2016; Sharma et al., 2017; Jana et al., 2021; Chetry et al., 2023; Sharma et al., 2025).

17 fish species were classified as Least Concern, including common species such as *Garra nasuta*, *Puntius sophore*, and *Barilius bendelisis*. Only one rare species, *Clarias magur, belonging to the Endangered category*, was found. These results correlate with the studies conducted by Chhetry and Deka in 2016. The majority of the fish species found in the river are in the IUCN's least concern category, although there are a few that are endangered, vulnerable, or near threatened, similar to an earlier study (Teronpi et al., 2015). This is a major reason to develop conservation plans before these populations become extinct.

The fish population of the Longnit River revealed that hill stream fishes make up the majority of the species, with some plain water species too. *Neolissochilus hexagonolepis* was found to be the most abundant, with a dominance percentage of 8.27, while *Anguilla bengalensis* and *Monopterous cuchia* were the least dominant, with dominance percentages of 0.51 and 0.82, respectively. The percentage distribution is clearly illustrated in the pie chart given in Figure 7.

A total of 980 numbers of fishes were found combining all eight months. The Shannon Weiner Diversity Index (H') was calculated to be 3.0, indicating a high level of diversity and a balance between total species and total individuals within each species. Teronpi et al., in 2015, also found high diversity in a similar study. The ENS (Effective Number of Species) was discovered to be 20 (Table 3), which means that around 20 species need to be equally abundant in the dataset, which would result in the diversity index found. The Simpson's Index of Dominance (D) and Simpson's Index of Diversity (1-D), respectively, were found to be 0.05 and 0.95, indicating considerable diversity. Margalef's Species Richness (R) was 3.19, and Pielou's Species Evenness (J) was 0.94, indicating that most of the species in the population were distributed evenly.

5. CONCLUSION

The present study's findings reveal that the Longnit River has rich ichthyofaunal diversity and serves as an important habitat for diverse fish species, showcasing a rich ecological system characterized by hillstream and plainwater fishes. This hillstream is an ideal habitat for critical Indigenous fish genera such as Botia, Crossocheilus, Garra, Glyptothorax, Labeo, Psilorhynchus, etc., which are characteristic of such hilly aquatic habitat. The dominance of the Cyprinidae family is in line with earlier research conducted in the region, suggesting a consistent ecological trend across similar aquatic habitats. The value of the diversity indices from the study also indicates a relatively healthy ecosystem, revealing a rich fish diversity in the area, along with a balance between the total number of species and individuals within each species.

The present IUCN status of the fish demonstrates the presence of vulnerable and endangered species, highlighting the ecological pressure these ichthyofauna face. Also, interviews with the local fishermen revealed the decline in fish catches over the years, generally because of overexploitation and habitat degradation due to sand mining, indicating the urgent need for

conservation strategies in the near future. The results from this preliminary study underscore the necessity for further research in these hill stream rivers for proper monitoring of the fish population, which is crucial for the preparation and implementation of effective management and conservation measures to safeguard the biodiversity hotspot.

6. ETHICAL APPROVAL

The ethical statement is not applicable to our study. However, all the procedures for handling the fish samples were carried out according to the guidelines of the Institutional Animal Ethical Committee (IAEC).

Disclaimer (Artificial intelligence)
Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

7. REFERENCES:

1. Gebremedhin, S., Bruneel, S., Getahun, A., Anteneh, W., & Goethals, P. (2021). Scientific methods to understand fish population dynamics and support sustainable fisheries management. *Water*, 13(4), 574. https://doi.org/10.3390/w13040574
2. Reid, A. J., Carlson, A. K., Creed, I. F., Eliason, E. J., Gell, P. A., Johnson, P. T., ... & Cooke, S. J. (2019). Emerging threats and persistent conservation challenges for freshwater biodiversity. *Biological reviews*, 94(3), 849-873. https://doi.org/10.1111/brv.12480
3. Dudgeon, D., Arthington, A. H., Gessner, M. O., Kawabata, Z. I., Knowler, D. J., Lévêque, C., ... & Sullivan, C. A. (2006). Freshwater biodiversity: importance, threats, status and conservation challenges. *Biological reviews*, *81*(2), 163-182.Dudgeon, D., Arthington, A. H., Gessner, M. O., Kawabata, Z. I., Knowler, D. J., Lévêque, C., ... & Sullivan, C. A. (2006). Freshwater biodiversity: importance, threats, status and conservation challenges. *Biological reviews*, 81(2), 163-182. https://doi.org/10.1017/S1464793105006950
4. FishBase (2024). Available at https://fishbase.se/home.htm
5. Coad, B. W., & Murray, A. M. (2006). " Fishes of the World" by Joseph S. Nelson [book review]. *The Canadian Field-Naturalist*, *120*(1), 116-117.
6. Lévêque, C., Oberdorff, T., Paugy, D., Stiassny, M. L. J., Tedesco, P. A. (2008). Global diversity of fish (Pisces) in freshwater. *Freshwater Animal Diversity Assessment*, 545–567. https://doi.org/10.1007/978-1-4020-8259-7_53
7. Thakur, K., Kumar, R., & Bhavna. (2021). A review on freshwater fish diversity of India and concept of DNA barcoding in fish identification. *Egyptian Journal of Aquatic Biology and Fisheries*, 25(3), 667–693. https://dx.doi.org/10.21608/ejabf.2021.179996
8. Goswami, U. C., Basistha, S. K., Bora, D., Shyamkumar, K., Saikia, B., & Changsan, K. (2012). Fish diversity of North East India, inclusive of the Himalayan and Indo Burma biodiversity hotspots zones: A checklist on their taxonomic status, economic importance,

geographical distribution, present status and prevailing threats. *International Journal of Biodiversity and Conservation*, 4(15), 592–613. DOI: 10.5897/IJBC11.228
9. Kar, D., Khynriam, D. (2022). Fishes in the Upstream Rheophilic Stretch of River Barak at Karong. *Sustainability in Environment*, 7(3), 77. http://dx.doi.org/10.22158/se.v7n3p77
10. Vishwanath, W. (2017). Diversity and conservation status of freshwater fishes of the major rivers of northeast India. *Aquatic Ecosystem Health & Management*, 20(1-2), 86-101. https://doi.org/10.1080/14634988.2017.1294947
11. Mahanta, P. C., Tyagi, L. K., Kapoor, D., & Ponniah, A. G. (2003). Integration of Fish Biodiversity Conservation and Development of Fisheries in North Eastern Region: Issues and Approach. *Participatory Approach for Fish Biodiversity Conservation in North East India*. Edt. PC Mahanta and LK Tyagi. Pub. Director, NBFGR, Lucknow, India.
12. District Profile of Karbi Anglong (2024). Government of Assam. Available at https://karbianglong.gov.in/information-services/detail/district-profile-of-karbi-anglong
13. Teronpi, V., Singh, H. T., Tamuli, A. K., & Teron, R. (2015). Assessment of Physico-Chemical Characteristics and Fish Diversity of Hill Streams in Karbi Anglong district, Assam, India. *International Research Journal of Environment Sciences*, 4(5), 6-11. http://www.isca.in/
14. Kumar, D., Maurya, A. K., Prasad, L., Singh, C. P., Radhakrishnan, K. V., & Somasekara, S. R. (2020). Fish biodiversity and its diversity indices in the Himalayan River Ghaghara at Northern India. *Journal of Entomology and Zoological Studies*, 8(6),1559-1564.
15. Chhetry, B., & Deka, P. (2016). Ichthyofaunal diversity of era kopili beel of Karbi Anglong district of Assam, India. International *Journal of Advanced Science and Research*, 1(6), 33–41.
16. Gandotra, R., & Sharma, P. (2015). Study of Ichthyofaunal Diversity in a stream in Sunderbani, District Rajouri, Jammu (J&K). *International Journal of Multidisciplinary Research and Development*, 2(9), 401-404.
17. Talwar, P. K., & Jhingran, A. G. (1991). *Inland Fishes of India and Adjacent Countries*. Oxford & IBH, New Delhi.
18. Jayaram, K. C. (1999). The freshwater fishes of the Indian region. Narendra Pub. House, Delhi.
19. Nag, R., Singha, N., & Deka, P. (2017). A study on the fish diversity of Dhir Beel of Dhubri district of Assam, India. *International Journal of Applied Research*, 3(5), 19-26.
20. Rao, K. R., & Rao, R. R. (2021). Ichthyofaunal diversity of narayanapuram anicut at Nagavali river, Srikakulam district of Andhra Pradesh, India. *Uttar Pradesh Journal of Zoology*, 42(19), 24-35. Retrieved from https://mbimph.com/index.php/UPJOZ/article/view/2458
21. IUCN. (2021). IUCN Red List of Threatened Species. Available at https://www.iucnredlist.org/en
22. Das, B., & Sharma, S. (2012). A comparison of fish diversity of Kopili and Jamuna rivers of Karbi Anglong District, Assam. *The Science Probe*, *1*(1), 21-29. Corpus ID: 131337903
23. Kar, D., & Das, B. (2024). Taxonomic Study of the Riverine Fishes of Karbi Anglong in North East India of the Eastern Himalayan Biodiversity Hotspot. Oceanography & Fisheries, 17(3), 555962. http://dx.doi.org/10.19080/OFOAJ.2024.17.555962
24. Pawara Ravindra, H., Patel Nisar, G., & Patel Yusuf, E. (2014). Review on fresh water fish diversity of Maharashtra (India). *Journal of Entomology and Zoology Studies*, 2(5), 358-364.

25. Bose, R., Bose, A. K., Das, A. K., Parashar, A., & Roy, K. (2019). Fish diversity and limnological parameters influencing fish assemblage pattern in Chambal River Basin of Madhya Pradesh, India. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*, 89, 461-473. https://doi.org/10.1007/s40011-017-0958-5
26. Joshi, K. D., Pathak, A. K., Kumar, S., Dayal, R., Singh, A. K., Kumar, R., ... & Lal, K. K. (2022). Fish community diversity assessment of protected Saraiyaman wetland in the Ganga River basin, India. *Community Ecology*, *23*(1), 63-73. https://doi.org/10.1007/s42974-021-00073-4
27. Das, M. K., Sharma, A. P., Vass, K. K., Tyagi, R. K., Suresh, V. R., Naskar, M., & Akolkar, A. B. (2013). Fish diversity, community structure and ecological integrity of the tropical River Ganges, India. *Aquatic Ecosystem Health & Management*, *16*(4), 395-407. https://doi.org/10.1080/14634988.2013.851592
28. Naik, A. K., Kumar, J., Mahesh, V., & Benakappa, S. (2013). Assessment of fish diversity of Tunga river, Karnataka, India. *Nature and Science*, *11*(2), 82-87. http://www.sciencepub.net/nature
29. Sharma, A. P., Das, M. K., Vass, K. K., & Tyagi, R. K. (2017). Patterns of fish diversity, community structure and ecological integrity of River Yamuna, India. *Aquatic Ecosystem Health & Management*, *20*(1-2), 30-42. https://doi.org/10.1080/14634988.2017.1265879
30. Jana, A., Sit, G., & Chanda, A. (2021). Ichthyofaunal diversity of River Kapaleswari at Paschim Medinipur district of West Bengal, India. *Flora and Fauna*, 27(1), 113-124. https://doi.org/10.33451/florafauna.v27i1pp113-124
31. Chetry, V., Das, H., Saikia, P. K., Saikia, M. K., Saikia, B. P., & Sarma, K. (2023). Ichthyofaunal diversity in Jia Bharali River of north bank landscape of Assam in eastern Himalaya, Northeast India. *Ecology, Environment and Conservation*, 29, S145-S157. https://doi.org/10.53550/eec.2023.v29i01s.023
32. Sharma, J. P., & Paul, D. K. (2025). Diversity of Ichthyofauna and their Abundance in Ghaghara River, Siwan District, Bihar, India. *Asian Journal of Biology*, 21(1), 17-25. https://doi.org/10.9734/ajob/2025/v21i1472