

ICHTHYOFAUNAL DIVERSITY AND CONSERVATION STATUS ASSESSMENT OF DOYANG RESERVOIR, NAGALAND, INDIA

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ABSTRACT

The present study was incorporated with ichthyofaunal diversity and conservation assessment of freshwater fishes which are found in Doyang reservoir, Nagaland in between 2015 to 2018. Total 64 numbers of freshwater fishes in which 6 order and 16 families are found where most dominated order is Cypriniformes and family is Cyprinidae. The IUCN red list of threatened species find out that, 70% Least Concern (LC), 12% Near Threatened (NT), 8% Vulnerable (VU), 2% Endanger (EN), 3% Not Evaluated (NE) and 5% Data Deficient (DD) status have been availed by those species. As per IUCN, the population trends of the fish species also shows 75% are unknown, 11% stable and 14% have decreasing population trends in status. The distribution and abundance in different regions are also verified. The specified fishes are need immediate proper scientific management and conservation strategies for future availability of these freshwater fish species.

KEYWORDS: Conservation, Distribution, Doyang Reservoir, Ichthyofaunal diversity, Nagaland.

INTRODUCTION

In India, the freshwater resources are found in different systems like ponds, canals, freshwater lakes, reservoirs, rivers, tanks, etc. About 10.86 million Indian people are directly or indirectly depended on fresh water fishery sectors (Sarkar, Sharma et al. 2015). The data revealed that about 19,370 numbers of reservoirs (comprised with surface area of 3.15 million ha) are extended throughout the India (Ayyappan, Jena et al. 2006). Due to this fact, reservoirs played crucial role in inland fish production, providing as vital sources of nutrients and also an important field for employment generation and livelihood formation (Bhattacharya, Chini et al. 2018). Reservoir fish production was not significantly well developed and interestingly it is well known as a partial product (Amarasinghe and Weerakoon 2009). In north-east region, Nagaland is one of the most well know state which has wide variety of topographical conditions, comprising of huge numbers of perennial and seasonal rivers, diverse weather conditions and inland water bodies which leads to extreme variety of native fresh water fish diversity (Odyuo and Nagesh 2012; Ao et al. 2008). According to the recent data, reservoirs and lakes in this state comprised with about 3,528 ha area but it is unfortunate that only 5% resources have been properly used in this state. In north-east region of India, the Doyang Reservoir (Latitude 26°13'10" N and Longitude 94°17'90" E) is one of the largest freshwater reservoir which is situated in Wokha District, Nagaland. The catchment area of reservoir is 2,258 ha which is enriched with Chumeya, Chubi, Djupvu, Tzuza and Doyang rivers. Due to the water resources, vast area and its small extensions, the ichthyofaunal diversity of this reservoir has become massive (Haldar, Vass et al. 2006). So this work emphasizes on the ichthyofaunal diversity and conservation assessment of that mentioned reservoir.

MATERIALS AND METHODS

The Doyang reservoir was principally focused to find out the freshwater fish diversity, conservation status and distribution in different random sampling sites from 2015 to 2018 (about 3 years of study). The fish samples are collected by gillnets, cast nets and also from the local fish market and local fishermen by the help of mechanized and non-mechanized boat. After the collection of fish sample, fishes are identified upto species level with the help of standard protocol and online servers (Talwar 1991, Jayaram 1999, Froese and Pauly 2000, Nelson, Grande et al. 2016). Some of the fish samples were brought to the laboratory for further identification and confirmation. The IUCN red list of threatened categories (Version 2019-1) is also validated for the fish conservation status assessment (IUCN, 2019).

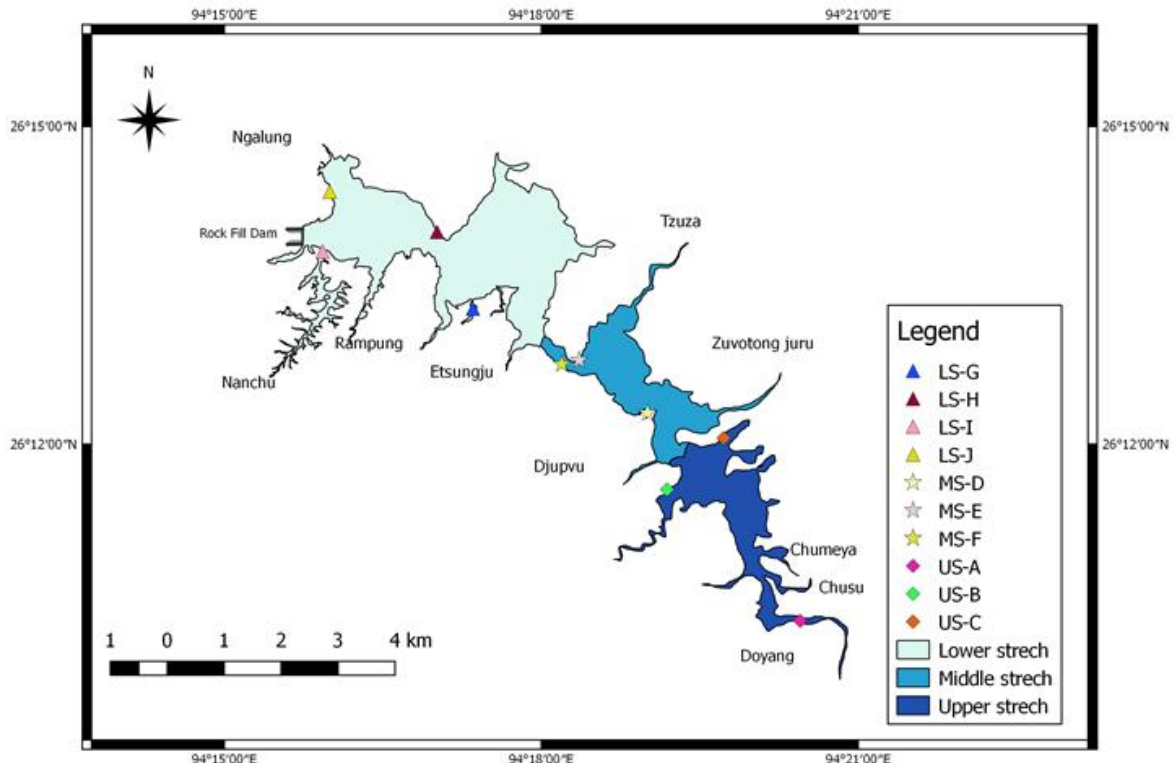


Figure 1: Map showing different sampling site at Doyang Reservoir, Nagaland, India.

RESULTS AND DISCUSSIONS

During these 3 years of research period in regular mode, the entire Doyang reservoir was survey out and organic checklist was prepared (Table 1). The reservoir was categorized into three distinct areas for the proper assessment. Towards the Doyang river site denoted as ‘upper stretch’, the main Doyang reservoir denoted as ‘lower stretch’ and the rest of the middle part of the reservoir mentioned as ‘middle stretch’. This work points out that a total 64 numbers of freshwater fish species are found in this reservoir and its extensions where it comprises with 6 order and 16 families (Figure 2a and 2b). The most distinct fish order is Cypriniformes and fish family is Cyprinidae. Depending on availability of the freshwater species in three different stretches, the species are distinguished.

This research work also point out the total 14 species which are now IUCN red list NT, VU, EN categories and most of them having population decreasing trends (Table 2). So these species need vital consideration for conservation purposes. Depending on seasonal availability, we surveyed out the availability of those species in the reservoir. Depending on the three seasonal variability like- pre monsoon (Pr-Mn), monsoon (Mn) and post-monsoon (Po-Mn), mentioned fish sample are collected and represented through matrix plot depending on their abundance and distribution. In matrix plot, the red color denoted with numerical value of 2 which indicate the high abundance of that species, value 1.5 denoted as yellow color which stands for moderate abundance, value 1 shows as green which denoted as low abundance and deep blue color denoted as 0 (zero) which stands for absent of that species on that particular season (Figure 4).

Table 1: The check list (from order to species level) of 64 freshwater fish species found in Doyang reservoir during the survey period of 2015 to 2018

Sl. No.	Order	Family	Scientific name	Upper Stretch	Middle Stretch	Lower Stretch
1	Anguilliformes	Anguillidae	<i>Anguilla bengalensis</i> (Gray, 1831)	++	+	-
2	Beloniformes	Belonidae	<i>Xenentodon cancila</i> (Hamilton, 1822)	+	+	-
3	Cypriniformes	Botiidae	<i>Botia dario</i> (Hamilton, 1822)	++	++	+
4		Cobitidae	<i>Lepidocephalichthys berdmorei</i> (Blyth, 1860)	++	-	-
5		Cyprinidae	<i>Bangana dero</i> (Hamilton, 1822)	++	++	+
6			<i>Barilius barila</i> (Hamilton, 1822)	++	+	+
7			<i>Barilius bendelisis</i> (Hamilton, 1807)	-	-	+
8			<i>Barilius vagra</i> (Hamilton, 1822)	++	+	+
9			<i>Chagunius chagunio</i> (Hamilton, 1822)	+	+	++
10			<i>Chagunius nicholsi</i> (Myers, 1924)	+	+	+
11			<i>Cirrhinus mrigala</i> (Hamilton, 1822)	-	+	++
12			<i>Crossocheilus burmanicus</i> (Hora, 1936)	-	+	+
13			<i>Crossocheilus latius</i> (Hamilton, 1822)	-	-	+
14			<i>Ctenopharyngodon idella</i> (Valenciennes, 1844)	+	+	++
15			<i>Cyprinion semplotum</i> (McClelland, 1839)	+	-	+
16			<i>Cyprinus carpio</i> (Linnaeus, 1758)	+	++	++
17			<i>Danio dangila</i> (Hamilton, 1822)	++	+	+
18			<i>Devario aequipinnatus</i> (McClelland, 1839)	++	-	-
19			<i>Devario devario</i> (Hamilton, 1822)	+	+	-
20			<i>Devario naganensis</i> (Chaudhuri, 1912)	+	+	-
21			<i>Esomus danrica</i> (Hamilton, 1822)	+	+	-
22			<i>Garra annandalei</i> (Hora, 1921)	+	-	-
23			<i>Garra gotyla</i> (Gray, 1830)	++	-	-
24			<i>Garra lissorhynchus</i> (McClelland, 1842)	++	-	-
25			<i>Garra mclellandi</i> (Jerdon, 1849)	+	-	-
26			<i>Garra naganensis</i> (Hora, 1921)	+	-	-
27			<i>Gibelion catla</i> (Hamilton, 1822)	+	+++	+++
28			<i>Hypophthalmichthys molitrix</i> (Valenciennes, 1844)	+	++	+++
29			<i>Labeo bata</i> (Hamilton, 1822)	-	+	++
30			<i>Labeo calbasu</i> (Hamilton, 1822)	-	++	+++
31			<i>Labeo dyocheilus</i> (McClelland, 1839)	-	+	+++
32			<i>Labeo gonius</i> (Hamilton, 1822)	-	+	++
33			<i>Labeo pangusia</i> (Hamilton, 1822)	-	-	+
34			<i>Labeo rohita</i> (Hamilton, 1822)	-	-	+
35			<i>Neolissochilus hexagonolepis</i> (McClelland, 1839)	++	+	++
36			<i>Opsarius barna</i> (Hamilton, 1822)	++	+	+
37			<i>Pethia ticto</i> (Hamilton, 1822)	+	+	++
38			<i>Puntius chola</i> (Hamilton, 1822)	+	+	++
39			<i>Puntius sophore</i> (Hamilton, 1822)	-	+	+
40			<i>Schizothorax richardsonii</i> (Gray, 1832)	-	+	-
41			<i>Systemus sarana</i> (Hamilton, 1822)	+	-	-
42			<i>Tor putitora</i> (Hamilton, 1822)	+	+	+
43			<i>Tor tor</i> (Hamilton, 1822)	+	+	++
44		Nemacheilidae	<i>Schistura manipurensis</i> (Chaudhuri, 1912)	+	+	-
45			<i>Schistura multifasciata</i> (Day, 1878)	+	-	-
46			<i>Schistura reticulofasciata</i> (Singh & Banarescu, 1982)	+	-	-
47		Psilorhynchidae	<i>Psilorhynchus homaloptera</i> (Hora & Mukerji, 1935)	+	-	-
48	Perciformes	Anabantidae	<i>Anabas testudineus</i> (Bloch, 1792)	-	-	+
49		Badidae	<i>Badis badis</i> (Hamilton, 1822)	-	+	+
50		Channidae	<i>Channa punctata</i> (Bloch, 1793)	+	+	+
51			<i>Channa orientalis</i> (Bloch & Schneider, 1801)	+	+	++
52			<i>Channa stewartii</i> (Playfair, 1867)	+	+	+
53			<i>Channa striata</i> (Bloch, 1793)	+++	+	+
54		Cichlidae	<i>Oreochromis mossambicus</i> (Peters, 1852)	-	-	+
55	Siluriformes	Clariidae	<i>Clarias batrachus</i> (Linnaeus, 1758)	-	+	++
56		Heteropneustidae	<i>Heteropneustes fossilis</i> (Bloch, 1794)	-	+	+
57		Siluridae	<i>Ompok bimaculatus</i> (Bloch, 1794)	+	-	-
58			<i>Ompok pabo</i> (Hamilton, 1822)	+	+	++
59			<i>Pterocryptis berdmorei</i> (Blyth, 1860)	+	+	-
60			<i>Pterocryptis gangetica</i> (Peters, 1861)	+	-	-
61		Sisoridae	<i>Glyptothorax telchitta</i> (Hamilton, 1822)	+	+	-
62			<i>Glyptothorax trilineatus</i> (Blyth, 1860)	+	-	-
63	Synbranchiformes	Mastacembelidae	<i>Macrognathus pancalus</i> (Hamilton, 1822)	+	+	+
64			<i>Mastacembelus armatus</i> (Lacépède, 1800)	+	++	++

Note: Reservoir is divided out in 3 stretches where '+' and '-' denotes the species abundance in those areas. Here '+++' means high abundance, '++' stands for moderate species abundance, '+' low species abundance and '-' stands for species not found on that region.

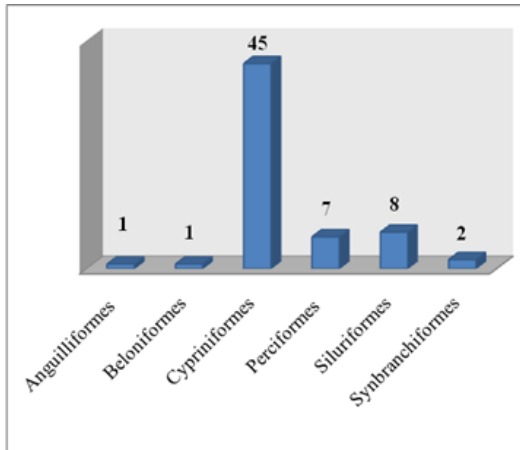


Figure 2(a)

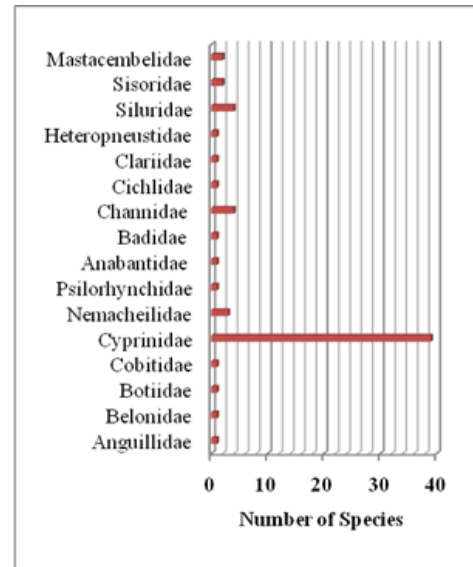


Figure 2(b)

Figure 2(a) and 2(b): The bar and column diagram represent the order and family wise distribution of freshwater fishes.

The IUCN red list of threatened species (Version 2019-1) confirmed that out of 64 species which are found in Doyang reservoir categorized as follow, 70% Least Concern (LC), 12% Near Threatened (NT), 8% Vulnerable (VU), 2% Endanger (EN), 3% Not Evaluated (NE) and 5% Data Deficient (DD) status. As per IUCN, the population trends of the fish species also shows 75% are unknown, 11% stable and 14% have decreasing population trends in status (Figure 3a and Figure 3b). The species which acquired NT, VU and EN status need immediate conservation priority for future abundance of those species on those particular regions

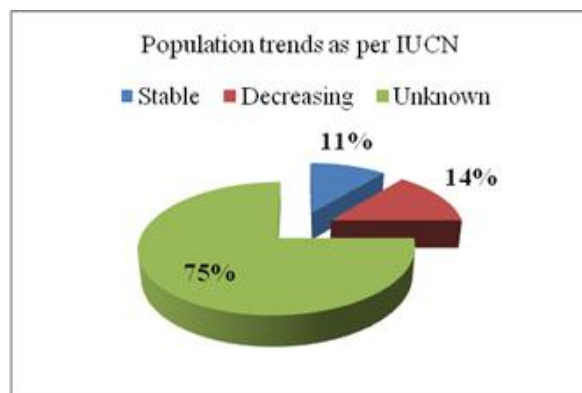
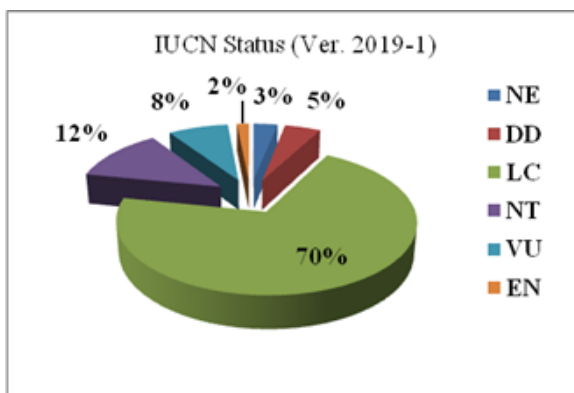


Figure 3 (a): IUCN status validation of available fish species in Doyang reservoir; (b) IUCN population trends assessment.

Table 2: List of the species which are found on that area which are under IUCN red list NT, VU and EN categories. The symbols are used for preparation of matrix plot.

SL. No.	Scientific name	Symbol	IUCN status	Population trends
1	<i>Anguilla bengalensis</i> (Gray, 1831)	A	NT	Unknown
2	<i>Cyprinion semiplotum</i> (McClelland, 1839)	B	VU	Decreasing
3	<i>Cyprinus carpio</i> (Linnaeus, 1758)	C	VU	Unknown
4	<i>Devario naganensis</i> (Chaudhuri, 1912)	D	VU	Decreasing
5	<i>Hypophthalmichthys molitrix</i> (Valenciennes, 1844)	E	NT	Decreasing
6	<i>Labeo pangusia</i> (Hamilton, 1822)	F	NT	Decreasing
7	<i>Neolissochilus hexagonolepis</i> (McClelland, 1839)	G	NT	Decreasing
8	<i>Schizothorax richardsonii</i> (Gray, 1832)	H	VU	Decreasing
9	<i>Tor putitora</i> (Hamilton, 1822)	I	EN	Decreasing
10	<i>Schistura manipurensis</i> (Chaudhuri, 1912)	J	NT	Unknown
11	<i>Schistura reticulofasciata</i> (Singh & Banarescu, 1982)	K	VU	Unknown
12	<i>Oreochromis mossambicus</i> (Peters, 1852)	L	NT	Unknown
13	<i>Ompok bimaculatus</i> (Bloch, 1794)	M	NT	Unknown
14	<i>Ompok pabo</i> (Hamilton, 1822)	N	NT	Decreasing

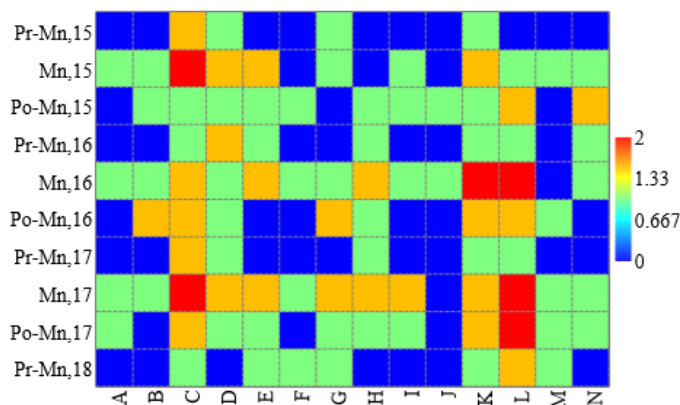


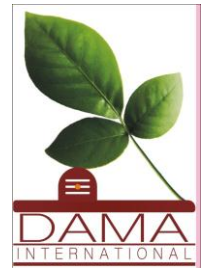
Figure 4: Matrix plot on 14 species depend on seasonal variations.

CONCLUSION

The Doyang Reservoir comprises of incomparable species diversity of freshwater species and is not only helpful for fish production but also important for diverse aquatic organism to stabilize the local reservoir ecosystem. These works also found out that due to the introduction and culture practices of IMC and other introduced carp species, the main reservoir fish diversity has been reduced. Introduced fish species are destroying endemic fish species habitat. Due to the less stress towards the upper stretch of reservoir (towards the Doyang River) endemic species are much more available rather than other sites. Besides, a total of 14 species are found in this site which is under IUCN vulnerable, endangered and near threatened categories which need immediate proper scientific management and conservation strategies for future availability of these freshwater fish species.

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