



STUDY OF DIVERSITY INDICES OF FISH HETEROGENESITY OF KALU DAM, AHMEDNAGAR, MAHARASHTRA

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ABSTRACT

The present study was carried out to study the ichthyofauna of Kalu dam. The evaluation was based on the study of fish diversity from Nov. 2014 to Oct. 2015. During the study period altogether 27 fish species belonging 10 families and 5 orders were found in the dam. Cypriniformes was the dominated order with 14 species followed by Perciformes 5 species, Siluriformes 4 species, Synbranchiformes 3 species and Osteoglossiformes with 1 species. Fish diversity was assessed by calculating the various diversity indices such as Shannon - Wiener diversity index (H), Simpson's Dominance index (D), Simpson's index of diversity (1 - D), Evenness index (J).

KEY WORDS: Ichthyofauna, Kalu dam.

INTRODUCTION

In the last few decades much attention is being paid to aquaculture as a source of food to the growing population of the country. Fishes constitute the most conspicuous component of inland aquatic fauna and rank very high as a source of proteins. Fishes are one of the important elements in the economy of many nations as they have been a stable item in the diet of many people. For sustained exploitation and simultaneous conservation of fisheries resources, basic scientific information on biodiversity is vital (Sone and Malu, 2000; Shendge, 2008; Pawar *et al.*, 2011). Fish diversity is also a good bioindicator of water quality like zooplankton species considered as biological tool for further bio-monitoring and assessing trophic status of water bodies (Kawade and Pandarkar, 2015). Aquatic ecosystems consists of physico-chemical and biotic components which directly affect the diversity of flora and fauna of water bodies (Borane, 2015). Fishes are the only major group of vertebrate which affect the human civilization from ancient time. They are one of the good and cheapest source of protein food for all classes of people. So it is essential to study the distribution and the availability of fish from freshwater reservoirs and tanks (Khodake *et al.*, 2014). The study of fish diversity in reservoir is used for fish cultivation and it becomes an essential tool for better fish production. In the field of fish diversity of different freshwater bodies earlier contributions were made by many workers (Khedkar, 2005; Rao *et al.*, 1998; Sharma and Nayak, 2001; Soni *et al.*, 2008; Srivastava *et al.*, 2008; Pawar and Pandarkar, 2010; Pawar *et al.*, 2011). There are over 19,000 reservoirs in India covering 3,15,366 ha and many more are under construction (Sugunan, 2000). Reservoir fishery in India is also important from social economic point of view as it has the

potential of providing employment to about 2 million people (Khan *et al.*, 1991). In fish diversity and its culture, study of interrelationship between the physicochemical parameters and plankton production of reservoir and its relation with fluctuation of zooplankton is of great importance (Kawade & Pandarkar, 2014). India occupies 9th position in the world in provisions of freshwater larger biodiversity. There are about 450 families of freshwater fishes globally. Roughly 40 are represented in India. About 25 of these families contain commercially important species (Khodake *et al.*, 2014). In India there are 2,500 species of fishes of which 930 lives in freshwater and 1,570 are marine (Ubarhande *et al.*, 2011 and Das B. K. *et al.*, 2014).

Kalu dam is selected as freshwater body for the present study, where several edible fish species occur and fishing is done regularly. There is tremendous scope for enhancing inland fish production in this water body through scientific management. No attempt so far is been made to study fish diversity from this reservoir. Hence, it was felt essential to undertake this study.

MATERIALS & METHOD

Kalu dam selected as freshwater body for the present study is a man-made perennial dam. It is built during 2000 to 2010 and has a catchment area 188.81 Sq. Kms. It is earthen and masonry and with length 1580 Mtrs. Kalu dam is major water source to the residency and adjoining areas for over 15 years. It is one of the oldest impoundments situated at Dhawalpuri across Kaluriver, post- Dhawalpuri, tahsil-Parner, District-Ahmednagar, State-Maharashtra. longitude: 74-28'-45" (E) and latitude: 19-12'-15" (N) of equator and at an elevation of 663.50 Mtrs. above FSL. It is a shallow dam, maximum height of dam is 37.09 Mtrs. Gross storage of dam

is 289.00 Mcft. Available yield is 685.00 Mcft. Many food fishes are abundant in this dam and constitute a major fishery resource. There is a tremendous scope for enhancing inland fish production in this water body through scientific management. This dam is also used for fish culture. Fishes were collected with the help of local fishermen using different types of nets, during November 2014 to October 2015 from Kalu dam. Immediately photographs were taken with the help of digital camera. After noting their original colour and general pigmentation, the specimens were brought to the laboratory and preserved in 10% formalin solution. The large fishes were given an incision in their abdomen and preserved. The meristic and morphometric characters were measured and fishes were identified up to the species level, with the help of standard texts (Dutta Munshi and Srivastava, 1988; Day, 1994; Jayaram, 1999). The scientific recognition and classification of fish species were made by using standard books and keys. Specimens with doubtful identifying characters were identified from Zoological Survey of India (ZSI) Pune. Usually, for quantitative way of water assessment, species diversity indices of diverse water bodies were computed in recent years. The diversity indices are calculated from the

abundance data of the organisms and serve as a very good indicator of pollution. One widely used measure of diversity that combines species richness with equitability is the Shannon-Weiner index. Simpson diversity index is also an important index, used widely for water quality monitoring. For determination of diversity indices, total number of species, total number of individuals in a sample and total number of individuals of a species were determined. From these data Shannon -Weiner Index (H), Simpson's Dominance Index (D), Simpson's Index of Diversity (1-D), Pielou's evenness Index (J) were determined using the following equations.

1. Shannon - Weiner Index (H)

It depends on both the number of species present and the abundance of each species.

$H = - \sum P_i (\ln P_i)$, where P_i is the proportion of each species

$P_i = A/T$, where A is number of each species in the sample, and T is the total number of individuals of all species in the sample.

2. Simpson's Dominance Index (D) is determined using the following equations.

$$D = \frac{n_1(n_1 - 1) + n_2(n_2 - 1) + \dots + n_{20}(n_{20} - 1)}{N(N - 1)}$$

Where n is the total number of individual of a particular species and N is the total number of Individuals of all species.

3. Simpson's Index of Diversity = $1 - D$

H

4. Pielou's evenness Index (J) : $\frac{H}{\ln(S)}$

Ln (S)

Where H is the Shannon - Weiner Index and S is the number of species.

TABLE 1: Systematic fish diversity, feeding habits and relative abundance of fish species of Kalu dam

Sr. No.	Order	Family	Species Scientific name	Species Common name	Abundance
1.	Cypriniformes	Cyprinidae	<i>Cirrhinus mrigala</i> (Hamilton)	Mrigala	15
			<i>Labeo rohita</i> (Hamilton)	Rohu	74
			<i>Cirrhinus reba</i> (Hamilton)	Reba	07
			<i>Catla catla</i> (Hamilton)	Katla	16
			<i>Labeo angra</i> (Ham-Buchanan)	Labeo	10
			<i>Labeo bata</i> (Hamilton)	Bata	02
			<i>Oxygaster bacaila</i> (Hamilton)	Chilwa	06
			<i>Puntius conchoniis</i> (Ham-Buchanan)	Carp Minnows	07
			<i>Punctius sophure</i> (Hamilton)	Pool barb	39
			<i>Garra mullya</i> (Sykes)	Sucker fish	56
			<i>Gonoproktopterus kolus</i> (Sykes)	Kolus	19
			<i>Labeo boggut</i> (Sykes)	Boggut	134
			<i>Salmophasia bacaila</i> (Hamilton)	Razorbelly minnow	32
			<i>Lepidocephalichthys thermalis</i> (Val.)	Spiny loach	08
2.	Perciformes	Cobitidae	<i>Oreochromis mossambicus</i> (Peters)	Tilapia	140
		Cichlidae	<i>Channa punctatus</i> (Bloch)	Kabra	09
		Channidae	<i>Glossogobius siur</i> (Ham-Buchanan)	Goby	34
		Gobioidae	<i>Glossogobius giuris</i> (Hamilton)	Goby	38
		Ambassidae	<i>Chanda nama</i> (Hamilton)	Kach	120
3.	Siluriformes	Bagridae	<i>Mystus bleekeri</i> (Day)	Cat fish	79
			<i>Mystus cavasius</i> (Hamilton)	Cat fish	19

		Siluridae	<i>Mystus malabaricus</i> (Jerdon)	Cat fish	10
			<i>Ompok bimaculatus</i> (Bloch)	Cat fish	24
4.	Synbranchiformes	Mastacembelidae	<i>Mastacembalus armatus</i> (Lacepede)	Vam	12
			<i>Macrogathus aculeatus</i> (Bloch)	Vam	02
			<i>Macrogathus pancalus</i> (Hamilton)	Vam	11
5.	Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i> (Pallas)	Asian knife fish	78

TABLE 2: The Fish species richness and diversity indices

S/N	Index	Value
01	Species Richness	27
02	Species abundance (N)	1001
03	Shannon - Weiner Index (H)	2.7968
04	Simpson's Dominance Index (D)	0.0794
05	Simpson's Index of Diversity (1-D)	0.9205
06	Pielou's evenness (J)	0.8485

RESULTS & DISCUSSION

In the present ichthyofaunal study, different fish species were observed in the Kalu dam, Dist. Ahmednagar, Maharashtra. Fishes belonging to 17 genera, 10 families and 5 orders were collected during the study period. Many fishes have economic importance and sold after collection in the local fish market. In the study period 27 fish species of 17 different genera, 10 families and 5 orders were recorded from the Kalu dam, during November 2014 - October 2015. Study showed that, the members of order Cypriniformes dominated by 14 species followed by order Perciformes 5 species, Siluriformes with 4 species order Synbranchiformes with 3 species and Osteoglossiformes order with one species. The above study reveals that there is dominance of fish species belonging to family Cyprinidae. Dominance of fish species belonging to family Cyprinidae which was also reported from other fresh water bodies (Ahirrao and mane, 2000; Kadam and Gaikwad 2006; Khedkar, 2005; Mishra and Gupta, 2007; Shrikant *et al.*, 2009; Pandarkar *et al.*, 2014; Khodake *et al.*, 2014; Rankhamb S.V., 2011, Mishra *et al.*, 2012; Kharat *et al.*, 2012; Jaybhaye *et al.*, 2013; Jaiswal and Ahirrao 2012, Ubharhande and Sonwane 2012). In the present study, the occurrence of 27 fish species indicates good fish diversity and their production in Kalu dam might be due to the suitable water quality of the dam that provides proper breeding ground for fish. The collected fish species (Table 1) were also classified on the basis of their relative abundance into abundant, moderate and rare. Table 2 shows fish species richness and various diversity indices. It is observed that, in present study species abundance was 1001, Shannon - Weiner Index (H) recorded 2.7968. The Simpson's Dominance Index (D) was recorded 0.0794 and the Simpson's Index of Diversity (1-D) was recorded 0.9205. The Pielou's sevenness (J) value was recorded 0.8485.

ACKNOWLEDGEMENTS

Authors are thankful to Principal, New Arts, Commerce and Science College, Ahmednagar and Zoological Survey of India, Pune for providing the necessary facilities for completion of this work.

REFERENCES

- Ahirrao, S.D. & Mane, A.S. (2000) The diversity of Ichthyofauna, taxonomy and fisheries from fresh waters of Parbhani, district, Maharashtra state. *J. Aqua. Bio.* 15(1and2): 40-43.
- Borane V.R. (2015) Study of ichthyofaunal diversity in relation to physico-chemical characteristics of Londhare dam water, Shahada taluka, Maharashtra, India, *J. Environ. Res. Develop.* 10(01), 59-64.
- Day F. (1994) The fishes of India, Burma and Ceylon, fourth Indian reprint, vol. I and II Jagmandar book Agency, New Delhi.
- Das B.K., Singh Ng. R., Dutta B, Kar D. (2014) Length Weight Relationship of *Labeo rohita* (Hamilton-Buchanan) and *Labeo gonius* (Hamilton-Buchanan) in Sone Beel, the biggest Wetland of Assam, India. *Journal of Environmental Research and Development*; 8(3A):587-593.
- Duttamunshi, J.S. & Srivastava, M.P. (1988) Natural history of fishes and Systematics of freshwater fishes of India, Narendra Publishing house, New Delhi.
- Jaiswal, D.P. & Ahirrao K.D. (2012) Ichthyodiversity of the rangavali dam, Navapur distirct Nandurbar, Maharashtra state, *J. Res. Biol.* 3(1), 241-245.
- Jayabhaye, U.M. & Lahane, L.D. (2013) Study of ichthyofaunal diversity of pimpaldari tank, Hingoli, Maharashtra, India, *Int. Index. Ref. Res. J.*, 6, (43-44).
- Jayaram, K.C. (1999) The freshwater fishes of the Indian region. Narendra Publishing house, New Delhi.
- Kadam, S.U. & Gaikwad, J.M. (2006) Ichthyofauna of Masoli reservoir, District Parbhani, Maharashtra- A study of inland reservoir fishery in India. *J. Aqua. Biol.* 21(2): 59-61.
- Kawade S.A. & Pandarkar A.K. (2015) Study of Zooplankton diversity of Dnyaneshwar Sagar in relation to trophic status. *J. Exp. Zool. India*, 18(2): 807-810.

- Kawade S.A. & Pandarkar A.K. (2014) Study of interrelationship between water parameters and Zooplankton diversity of Dnyaneshwar Sagar, Ahmednagar, Maharashtra. *J. Exp. Zool. India*, 17(2): 737-742.
- Khan, A.A., Kartha, K.N., Percy Dawson & George (1991) Fish harvesting system in Indian reservoir. Proc. of Nat. Workshop on 1000 energy fishing 8-9 August 1991
- Kharat Sanjay, S., Mandar Paingankar & Nilesh Dahanukar (2012) Freshwater fish fauna of Krishna river at Wai, Northern Western Ghats, India, *J. Threat. Taxa.*, 4(6), 2644-2652.
- Khedkar, G. D. (2005) Studies on fish diversity in relation to bird habitat from Nathasagar bird sanctuary area, Nathasagar reservoir, Paithan, Dist. Aurangabad, Maharashtra. *J. Aqua. Biol.* 20(2): 231-238.
- Khodake S.P., P. Borale R & Petare, R.K. (2014) Ichthyofaunal diversity in Jamkhedi reservoir in Dhule district of Maharashtra, India, *J. Environ. Res. Develop.* 9(1): 177-183.
- Mishra, A.K. & Gupta, R.C. (2007) Studies on Physico-chemical conditions and fish diversity of Guzartal, Jaunpur, Uttar Pradesh, India. *J. Exp. Zool. India*. 10(1): 199-202.
- Mishra S., Zha, B.C. & Das, A.K. (2012) Ichthyofaunal diversity of Chilika lake : The southern sector, *J. Chem. Bio. Phy. Sci. Section B.*, 3(1), 345-353.
- Pandarkar A.K, Pawar B.A. & Shendge, A.N. (2014) Ichthyofaunal studies of Visapur reservoir in relation to fish culture, Ahmednagar district, Maharashtra. *Flora and fauna*. 20(2): 247-250.
- Pawar, B.A. & Pandarkar, A.K. (2010) Fish and insect diversity of Kelewadi Lake in relation to fish culture, Ahmednagar district, Maharashtra. *Flora and Fauna*. 16(1): 105-110.
- Pawar, B.A., Pandarkar, A.K. & Shendge, A.N. (2011) Ichthyofauna of Pravara River in relation to Pisciculture, Ahmednagar district, Maharashtra. *J. Exp. Zool. India*. 14(1): 129-132.
- Rankhamb, S.V. (2011) Ichthyofaunal diversity of Godavari river at Mudgal tq. Pathri, dist. Parbhani, Rec. Res. Sci. Tech., 3(12), 11-13.
- Rao, L. M., Rao, G.V. and Sivani, G. (1998) Hydrobiology and Ichthyofauna of Mehadrigeedda stream of Visakhapatnam, Andhra Pradesh. *J. Aqua. Biol.* 13(1 and 2): 25.
- Sharma, S.V. & Nayak, D.Y. (2001) Checklist of fishes inhabiting the water bodies in Nallamali Hill range in Andhra Pradesh. *J. Aqua. Biol.* 16(1): 35-36.
- Shendge, A.N. (2008) Ichthyofaunal diversity of Ujani dam. *J. Exp. Zool. India*. 11(1); 147-150.
- Sone, A.A. and Malu, R.A., (2000) Fish diversity in relation to aquaculture in Ekbhurgii reservoir, Washim, Maharashtra. *J. Aqua. Biol.* 15(1&2): 44-46.
- Soni, S., Agrawal, N.C., Singh, K. & Ahirwal, R.P. (2008) Ecological study on predatory fishes of Sagar district. *Flora and Fauna*. 14(2): 287-289.
- Srikanth, K., Ramu, G. & Benarjee, G. (2009) The study on fish diversity of Rammappa lake, Warangal district (A.P.), India. *J. Aqua. Biol.* 24 (2): 57-60.
- Srivastava, V., Sadhu, D.N. & Singh, R.K. (2008): Hazaribag district, an adobe of ornamental fishes in Jharkhand. *Flora and Fauna*. 14(2): 319-323.
- Sugunan (2000) Reservoir fishery of India FAO fisheries Tech. Paper No. 345 FAO Rome 1-424.
- Ubharhande, S.B. & Sonawane, S.R. (2012) Study of freshwater fish fauna and water quality at Paintakali dam from Bulhana district, M.S., India, *J. Exp. Sci.*, 3(7), 4-8.
- Ubarhande, S.B., Jagtap, J.T. & Sonawane, S.R. (2011) Ichthyofaunal diversity from Ambadi dam, Taluka Kannad, district Aurangabad (M.S.) *Rec. Res. In. Sci. Tech.*, 3(6), 34-37.