



Fish fauna of Lakkavalli lake, Karnataka with respect to environmental variables

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Abstract

The fish diversity of aquatic system plays a major role in our national economy. The present study was undertaken with the purpose of assessing water quality and fish diversity of Lakkavalli Lake, Shimoga, Karnataka. The fish diversity is correlated with physico-chemical variables which are the regulatory factor for the distribution and abundance of different aquatic fauna including fishes. In the present study 16 species have been recorded and majority of fishes are exploited by human consumption. For the proper sustainable management and utilization of this water resource, it is mandatory to take up the steps to monitor the lake regularly for sustainable fisheries.

Keywords:- Chikmangalore District, Fish fauna, Lakkavalli Lake, Water quality variables

Introduction

Fishes have been playing a crucial role in the human diet from time immemorial as it has got an excellent protein source. This protein has high digestibility and growth promoting value for human consumption. Nutritional studies have shown that fish proteins rank in the same class as chicken proteins and are superior to milk, beef protein and egg albumen. Inland fisheries in India have great potential of contributing to the food security of country. Wetlands are the main resources exploited for inland fisheries and understanding of fish faunal diversity is a major aspect for its development and the sustainable management. Wetlands in India support rich variety of fish species, which in turn support the commercial potential of the fisheries (Krishna and Piska, 2006). Thus, there is a wide scope for study in the fisheries sector of the country. The Chikmangalore District is one of the important districts of Karnataka state for the fish production and natural water resource. Considerable works have been done on the availability and distribution of reservoir fishes (Venkateshwarlu *et al.*, 2002; Sakhare and Joshi, 2002; Dutta *et al.*, 2003; Paik *et al.*, 2003; Pawar *et al.*, 2003; Lohar and Borse, 2003). In the present study various physico-

chemical parameters were studied to see the effect on the fish diversity in the Lakkavalli wetland. The findings will benefit the planning and management of sustainable fisheries and conservation of natural resources at national level.

Materials and Method

Study area

Lakkavalli lake of Chikmangalore District is one of the major perennial lakes and it receives rainwater during monsoon and river water from the Bhadra river through Bhadra channel. The water from the water body is extensively used for agriculture and aquaculture purposes. It is situated at an elevation of 601 m above mean sea level and located at latitude of 13° 40' N and longitude of 75° 36' E. The lake acquires land area of 0.8 square km and a depth of 2-3 m.

The study was conducted regularly for a period of one year (Oct. 2006 to Sep. 2007) and fishes were collected with the help of fisherman by repeated netting. Fish sampling was done by using a variety of fishing nets of varying mesh sizes *viz.* gill nets, cast nets and dragnets. After collection, fishes were examined and 5-10 specimens were preserved in 4% formalin for further laboratory analysis. The fishes were identified by using Jayaram (1999), Talwar and

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Jhingran, (1991) and Dutta Munshi and Shrivastava, (1988). The physico-chemical variables were estimated at periodical intervals and analysis was done by following the standard procedures APHA, 1995 and Trivedi *et al.*, 1998.

Results and Discussion

Besides providing the excellent protein source to human population, the fishes are also serving as indicators of water quality (Peter, 1987). The fish can be used to monitor the water quality for toxic substances and as bioindicators of water quality and environmental health of a water body (Seth *et al.*, 1967). The physico-chemical variations of the lake are summarized in Table 1. The monthly collected water samples showed variations in all parameters. The water temperature ranged between 18.00 to 33.00 °C which is the tolerance limit of most of the cultivable fishes. The total dissolved solids ranged between 100.00 to 235.00 mg/l. The high amount of total dissolved solids increase the density of water and resulting in elevation of osmoregulatory mechanism of aquatic biota. Dissolved Oxygen (DO) indicates physical, chemical and biological activities in a water body. DO affect the solubility and availability of many nutrients and therefore productivity of aquatic ecosystems (Wetzel, 1983). Significant fluctuations were recorded in monthly values of DO ranged between 1.90 to 7.20 mg/l, thus

supporting the concept that lentic water bodies under natural conditions contains a high volume of DO ending with saturation point (Welch, 1952). The pH ranged between 7.10 to 8.20 and hence the water body showed alkaline nature throughout the year. The increase in pH values during summer or pre-monsoon period was due to increased concentration of bicarbonate alkalinity. Similar kind of findings were observed by Ramakrishnan (1991) and Ramakrishnan *et al.* (2000). The results are also in accordance with those of WHO (1984a, b). The high values of BOD (1.50 to 9.10 mg/l) show the high quantity of biodegradable materials and presence of non-biodegradable substances. The total alkalinity was observed in the range of 80.00 to 210.00 mg/l and the similar observations were made by Mahadevan and Krishnaswamy (1983) and Wagh (1998). It shows that Lakkavalli lake is high in salt concentration like carbonates, bicarbonates, phosphates, nitrates etc. The total hardness is mostly contributed by the amount of calcium and magnesium with the support of other ions. The present investigation shows the total hardness varied between 51.00 to 148.00 mg/l. The calcium and magnesium values ranged between 12.00 to 39.00 mg/l and 9.50 to 27.00 mg/l respectively. The optimum values of hardness ranges between 75 to 150 mg/l which supports the total fish productivity (Das, 1996). Hence, the water of the Lakkavalli lake is suitable for fishery purpose.

Table-1: Monthly variation of physico-chemical parameters of Lakkavalli lake (Oct 2006- Sep. 2007)

Parameters	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.
Air temp. (°C)	26.00	24.00	23.00	21.00	23.00	26.00	29.00	31.00	30.00	29.00	28.00	26.00
Water temp. (°C)	24.00	23.00	21.00	18.00	20.00	24.00	28.00	30.00	33.00	27.00	27.00	24.00
pH	7.11	7.56	7.21	8.10	7.70	7.37	7.32	7.10	7.10	7.40	8.20	7.80
TDS (mg/l)	134.00	170.00	183.00	224.00	235.00	202.00	193.00	100.00	110.00	131.00	145.00	178.00
TH (mg/l)	68.00	82.00	90.00	101.00	110.00	119.00	134.00	148.00	93.00	75.00	51.00	60.00
TA (mg/l)	155.00	119.00	128.00	160.00	123.00	98.00	100.00	80.00	86.00	112.00	210.00	110.00
DO (mg/l)	4.50	5.10	3.50	6.40	5.10	1.90	2.30	2.60	3.50	5.50	7.20	7.10
BOD (mg/l)	6.10	4.50	8.30	7.70	8.20	7.10	9.10	8.10	4.60	2.50	1.50	1.50
Ca (mg/l)	15.10	17.80	20.40	22.10	25.20	26.80	27.00	39.00	20.00	16.00	12.00	14.00
Mg (mg/l)	12.90	15.60	16.90	19.20	20.60	22.50	25.90	27.00	18.00	14.00	9.50	11.00

Note:- TH- Total hardness, TA- Total alkalinity



Fish fauna

The fish fauna is an important aspect of fishery potential of a water body. The study of fish diversity serves as a guide to know the availability of fish fauna and further finding out the possibility of introducing new species that are not endemic to that area. Detailed study of fishes of an area forms the prerequisite for understanding any culture programme and to take up management policies. It has been observed that distribution and abundance of fish species is quite variable because of geographical and geological conditions. In the present study, 16 fish species (Table-2) have been recorded. On the basis of occurrence, the collected fish species are categorized as Rare (A-1), Common (A-2) common and Very common A-(3-4). Das (1996) was the first to record 23 fish species belonging to 7 families and 14 genera in river Tawi, in which family Cyprinidae was dominant. The results are also in confirmatory with those of Wakid and Biswas (2005) and Devi (1997). The same observations were also made by Venkateshwarlu *et al.* (2007). It is well known that the environmental conditions have its impact on fish

species density. So in this regard, the environmental conditions would be favorable to Cyprinidae family to grow and flourish at higher levels than other families. The other factor would be genetic that the species belonging to this family possess the genetic make-up which is better than other families to cope up with the environmental stress and new adaptations. Almost all fishes recorded are useful as food fishes. As far as the feeding ecology of fishes is concerned, the fishes in Lakkavalli lake could be categorized in to herbivores, carnivores and omnivores. Herbivores fishes include *Labeo rohita*, *Labeo calbasu*, carnivores or predatory fishes include all cat fishes like *Notopterus notopterus*, *Mystus cavasius*, *Oreochromis mossambica*, etc. and omnivores includes *Clarias batracus*, *Cirrhinus mrigala* etc. It has been shown that physico-chemical variables influence the distribution and abundance of aquatic life including fishes. Freshwater lakes show significant variation in different physico-chemical variables. Hydrobiological studies on freshwater lakes have shown that they have generally warmer water

Table-2: List of fish species with biodiversity status, abundance and size in Lakkavalli lake

Species	Vernacular/ Local name	Biodiversity status IUCN-1990	Abundance	Size (cm)
<i>Labeo calbasu</i>	Karae-Kolasa	LR nt	A-1	90.00 cm
<i>Labeo rohita</i> *	Rohu	LR nt	A-2	91.00cm
<i>Puntius chola</i>	Dodda-karsae	VU	A- (3-4)	12.00 cm
<i>Glossogobius guiris</i>	Bhangi-sidda	LR-nt	A- 1	30.00 cm
<i>Cirrhinus fulungee</i>	Arja	LR -nt	A- (3-4)	30.00 cm
<i>Cirrhinus reba</i>	Arja	VU	A- (3-4)	30.00 cm
<i>Cirrhinus mrigala</i>	Mrigal	LR- nt	A-2	99.00 cm
<i>Catla catla</i> *	Catla	VU	A-2	182.00 cm
<i>Cyprinus carpio</i>	Gowri	LR -IC	A-2	28.00 cm
<i>Mystus cavasius</i>	Girlu	LR- nt	A- (3-4)	46.00 cm
<i>Ompok bimaculatus</i>	Godalae	EN	A-1	45.00 cm
<i>Oreochromis mossambica</i> *	Jilebi	NA	A- (3-4)	29.00 cm
<i>Notopterus notopterus</i>	Chappali	LR-nt	A- (3-4)	61.00 cm
<i>Mastacembelus armatus</i>	Haavu-meenu	LR nt	A- (3-4)	61.00 cm
<i>Clarias batracus</i>	Murugodu	VU	A-2	46.00 cm
<i>Rasbora daniconius</i>	Golai	LR-nt	A- (3-4)	7.00 cm

Note: Abundance: A-1-rare, A-2-common, A-(3-4) - very common; EN= Endangered; LR- IC=Lower risk least concern; LR- nt = Lower risk-near threatened; VU= Vulnerable; NA = not assessed; *Introduced species



temperature, lower suspended solids, alkaline pH and significantly high DO and less CO₂. Jaya Raju *et al.* (1994) have also studied fish diversity with respect to physico-chemical variables. Our studies have shown that temperature and DO are the main controlling factors in the distribution of fishes. Our results are in confirmatory with those of Rajaram *et al.* (2004).

References

- APHA, 1995. *Standard Methods for the Examination of Water and Wastewater*. 20th ed., American Public Health Association, USA.
- Das, R.K., 1996. Monitoring of water quality, its importance in disease control. Paper presented in Nat. Workshop on fish and prawn disease, epizootics and quarantine adoption in India. October 9, 1996. CICFRI. pp: 51-55.
- Dutta Munshi, J.S. and Shrivastava, M.P., 1988. *Natural history of fishes and systematics of freshwater fishes in India*. Narendra Publishing Co. Delhi, India. pp: 421.
- Devi, B.S., 1997. Present status, potentialities, management and economics of fisheries of two minor reservoirs of Hyderabad, Ph.D thesis, Osmania University.
- Dutta, S.P.S., Kour, H. and Zutshi, 2003. Ichthyofauna of river Tawi and its tributaries and important tributary of the river Chenab J&K State. *J. Aquatic Biol.*, 18(2): 61-68.
- Jaya Raju, P.B., Prasad Rao, G.D.V. and Sharma, S.V., 1994. Seasonal variations in physicochemical parameters and diversity in the flora and fauna of the river Munneru, a tributary to river Krishna, Andhra Pradesh, India. *J. Aquatic Biol.*, 9(1 & 2): 19-22.
- Jayaram, K.C., 1999. *The freshwater fishes of the Indian region*. Narendra Publishing House, Delhi-06.
- Krishna, M and Piska, R.S., 2006. Ichthyofaunal diversity in secret lake Durgamcheruvu, Ranga Reddy District, Andhra Pradesh, India. *J. Aqua. Biol.*, 21(1): 77-79.
- Lohar, P.S. and Borse, S.K., 2003. Diversity of fish fauna in river Tapi, Maharashtra. *J. Aquatic Biol.*, 18(2): 47-49.
- Mahadevan, A. and Krishnaswamy, S., 1983. Chironomid population size as an index of pollution in the river Vaigai. *Pollution res.*, 3(1): 35-38.
- Paik, Tapas Kumar and Ckabraborty, S.K., 2003. Ichthyofauna of East Singhbhum District, Jharkhand, India. *J. Aquatic Biol.*, 18(2): 50-60.
- Pawar, S.K., Madlapure, V.R. and Pulle, J.S., 2003. The study on fish diversity in the Sirurdam near Mukhed, Nanded District (M.S.) India. *J. Aquatic Biol.*, 18(2): 69-70.
- Peter, T., 1987. Fish, fisheries, aquatic macrophytes and water quality in Inland Waters. *Water quality Bull.*, 12(30): 103-129.
- Rajaram, R., Srinivasan, M., Ajmal Khan, S. and Kannam, L., 2004. Ichthyofaunal diversity of Great Nicobar Islands, Bay of Bengal. *J. Ind. Fish. Ass.*, 31: 13-26.
- Ramakrishnan, N. 1991. Primary production of two man-made freshwater reservoirs at Annamalai Nagar, Tamil Nadu, International on Land-Water interaction (8-13 December), NIE, New Delhi. pp: 61.
- Ramakrishnan, N., Ganesan, N.C. and Thevanathan, R., 2000. Distribution of planktonic algae in three different freshwater bodies of Tiruvannamalai District, Tamil Nadu, Nat. Symp. On Phycology in the New Millennium Org. in CAS, Uni. Of Madras, Chennai (March 1-3). pp: 45.
- Sakhare, V.B. and Joshi, P.K., 2002. Ecology of Palas NI Legaon in Osmanabad District, Maharashtra. *J. Aquatic Biol.*, 18(1): 17-22.
- Seth, A.K., Srivastava, S.K., George, N.G. and Bewtra, J.K., 1967. Monitoring of certain toxic constituents in water supply by fish. *Ind. J. Environ. Hlth.*, 9(1): 34-37.
- Talwar, P.K. and Jhingran, A., 1991. *Inland fishes of India and adjacent countries*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2(19): 1158.
- Trivedi, R.K., Goal, P.K. and Trishal, C.L., 1998. *Practical methods in Ecology and Environmental Science*. Enviro Media Publications, Karad, India.
- Venkateshwarlu, M., Shanmugham, M. and Mallikarjun, H.R., 2002. The fish fauna of Bhadra reservoir Western Ghats. *J. Aquatic Biol.*, 17(1): 9-11.
- Venkateshwarlu, M. Jothi Srigowri and Asha Shree, H.M., 2007. Proceedings on "Diversity and Life processes from Ocean and Land". Goa University. Goa. pp: 156-159.
- Wagh, N.S., 1998. Hydrobiological parameters of Hargal dam in relation to pollution. Ph. D. thesis, Dr. B.A.M.U. Aurangabad.
- Wakid, A. and Biswas, S.P., 2005. Status and diversity of fish fauna in Dibru-saikhowa National park, Assam. *J. Bom. Nat. Hist. Soc.*, 102(1): 50-55.
- Welch, P.S., 1952. *Limnological methods*. Mc Graw Hill, New York, USA.
- Wetzel, R.G., 1983. *Limnology*. 2nd edition. Saunders Coll. Publ. pp: 767.
- WHO, 1984a. *Guidelines for drinking water quality*. Vol. I. Recommendations. WHO, Geneva.
- WHO, 1984b. *Guidelines for drinking water quality*. Vol. II. Health criteria and other supporting information, WHO, Geneva.

