Estimation of physical parameters of Khadakwasala reservoir as a potential site for conservation of threatened fish Mahseer

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Abstract

Mahseer (*Tor* sp.) as a game fish has earned world wide reputation. Various species of Mahseer have been reported from rivers flowing across India. Mahseer is now represented by five species by Menon (1992), as per classification. Mahseer are declining in their numbers and sizes due to indiscriminate fishing, high level of pollution in aquatic ecosystems due to industrial waste disposal in rivers, construction of dams etc. The species is assessed as threatened due to continuing decline in the overall population.

Khadakwasala is a village, situated about 20m km from Pune. It is famous for its dam built on Mutha river. The dam was first built in 1879. However it was rebuilt after infamous flooding of Pune city during 1961. This dam is one of the main sources of water for the city of Pune and is selected for the conservation of Mahseer for this study.

For this study four sampling stations were selected at this reservoir. Samples were collected from surface, middle and bottom layers of the water. Monthly samples of water were collected from Khadakwasala reservoir for a period of eighteen months and the physical parameters were analysed.

Analysis of the data reveals that atmospheric and water temperature variation during the study follows general climatic conditions of the region. Secchi-disc-transparency was lower in rainy season and higher in summer months. pH value ranged between 7.3-8.5 with moderate fluctuations during the study period, indicating that values observed are on the alkaline side and did not show any wide range of fluctuation.

Physical parameters observed during the study period clearly indicate that Khadakwasala reservoir offers favourable physical conditions for conservation of threatened fish Mahseer. Also the reservoir is monitored and managed by Maharashtra government making it an ideal site for conservation of this fish.

Key Words:- Mahseer**,** indiscriminate fishing ,reservoir, physical parameters.

1. Introduction

Mahseer as a world-famous game fish and it needs no introduction. Several species of mahseer inhabit different rivers throughout the length and breadth of India in general and Maharashtra in particular. Five species of Mahseer are found in various parts of India, apart from three sub-species. *Tor khudree* (Sykes) is primarily found in areas in and around Maharashtra.

Mahseer have been of considerable economic importance because of their abundance at one time. However Mahseer are declining in their numbers and sizes in different parts of India, due to indiscriminate fishing of brood stock and juveniles, fast environmental degradation of aquatic ecosystems, construction of dams, barrages etc. under various river valley projects. Mahseer population has declined heavily due to construction of dams and barrages as it breeds by migrating upstream and laying eggs in shallow water in rocky areas. Mahseer needs clean water with high levels of dissolved oxygen to survive. Due to heavy levels of pollution, its habitat is shrinking fast, causing alarming drop in the population. The species is assessed as threatened due to continuing decline in the overall population.

2. Study Area

Khadakwasala is a village, situated about 20km from Pune and is mainly known for a dam on river Mutha. This dam is one of the main sources of water for the city of Pune. In the vicinity, there is well-known National Defence Academy and Central Water & Power Research Station(CWPRS).

This dam was first built by the British in 1879 on small canal running parallel to the Mutha river. In 1961, the Khadakwasla Dam had to be blown, as the upstream Panshet Dam overflowed, causing devastating floods in the city of Pune. The dam was later rebuilt. The original dam, built in the 1879 as a masonry gravity dam was the first of its kind in the world.

Details of Khadakwasla Dam are as follows –

Impounds	Mutha River
Locale	Khadakwasla Village, Pune, Maharashtra India
Length	1939 m
Height	31.79 m
Opening Year	1869
Dam Owner(s)	Government of Maharashtra

Details of Khadakwasla Reservoir are as follows –

Creates	Khadakwasla Lake
Capacity	374 Million Cubic Meter

Geographical Coordinates –

18°26′30″N 73°46′5″E / 18.44167°N 73.76806°E / 18.44167; 73.76806

3. Materials and Methods

The present study comprises analyses of physical parameters of Khadakwasala reservoir as a possible conservation site for Mahseer. Physical parameters of the reservoir play a very important role with regard to its suitability for propagation and conservation of threatened fish mahseer. The methodology adopted to conduct above mentioned study is as follows.

Sampling Stations

There has been an apparent similarity and uniformity in the physical appearance of water along the stretch of the reservoir. The aquatic macro vegetation was remarkably scarce. Four sampling stations were selected at various location in this reservoir. Samples were collected from surface, middle and bottom layers of the water.

Sampling method

Sampling is the most important part of any limnological investigation. It is such a critical activity that the success, achievements and failure largely depend on the strategy and plan of collection of samples.

Monthly samples of water were collected from Khadakwasala reservoir for a period of twenty one months. The physical parameters viz. atmospheric and water temperatures, secchi disc transparency and pH were analyzed and captured at the site itself, as their values are liable to change soon. The parameters were analyzed according to the Standard Methods of Golterman et al. (1978), Boyd (1979), NEERI (1986) and APHA (1995).

Temperature

The atmospheric and water temperatures were recorded with the help of a simple mercury thermometer graduated from 0-50^0 C and each degree divided into 10 divisions.

Secchi disc transparency

The Secchi disc is a metallic plate of 20 cm. diameter with four (alternate black and white) quadrants of the upper surface and a hook in the center to tie a graduated rope. It is lowered into the water of a lake until it can no longer be seen by the observer. This depth of disappearance, called the Secchi depth, is a measure of the transparency of the water. Average depth of the visibility and disappearance of disk was taken as Secchi transparency.

Transparency is inversely proportional to the turbidity of water, which in turn is directly proportional to the amount of suspended organic and inorganic matters. When the Secchi disc is gradually lowered in water it remains visible in the euphotic zone, only to that lower level where light is about 15% of the radiation at the surface.

Hydrogen ion concentration (pH)

The pH of water was measured by portable pen type pH meter. The pH meter was standardized against buffer solutions of 4 and 7 pH.

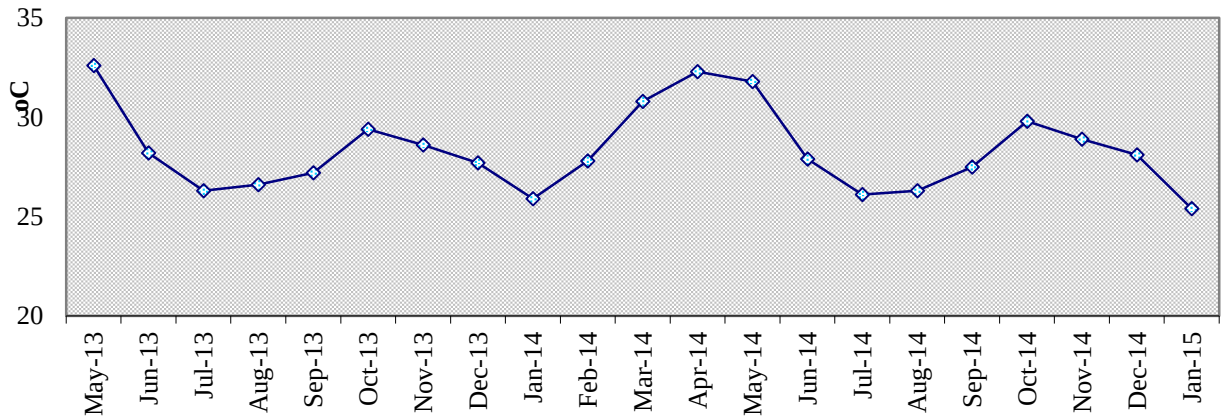
4. Results and Discussion

This section comprises of the result achieved after performing a regular monthly sampling of the reservoir for eighteen month at four different selected sites. Each parameter was captured and the minimum and maximum values are being discussed to understand the trend of that particular parameter.

Atmospheric Temperature

During the study period minimum atmospheric temperature was recorded to be 25.4^0 C whereas the maximum temperature was recorded to 32.6^0 C . The trend of atmospheric temperature as shown in chart below indicates that the temperature variation during the study follows general climatic conditions of the region (Chart 1)

Chart 1. Monthly Variation In Atmospheric Temperature at Khadakwasla Reservoir



Water Temperature

Water temperature follows the similar trends as recorded in atmospheric temperature. At S-2 and S-3 minimum temperature was recorded to be 21.1^0 C the month of January in bottom water, whereas the maximum temperature was found to be 29.2^0 C in the surface water collected during May-14 at S-1 sampling station.. An overview of this data indicates that the surface layer was always warmer as compared to the bottom water (Chart 2a and Chart 2b)

Chart 2.a Monthly Variation In Water Temperature of Khadakwasala Reservoir from May-13 to Apr-14

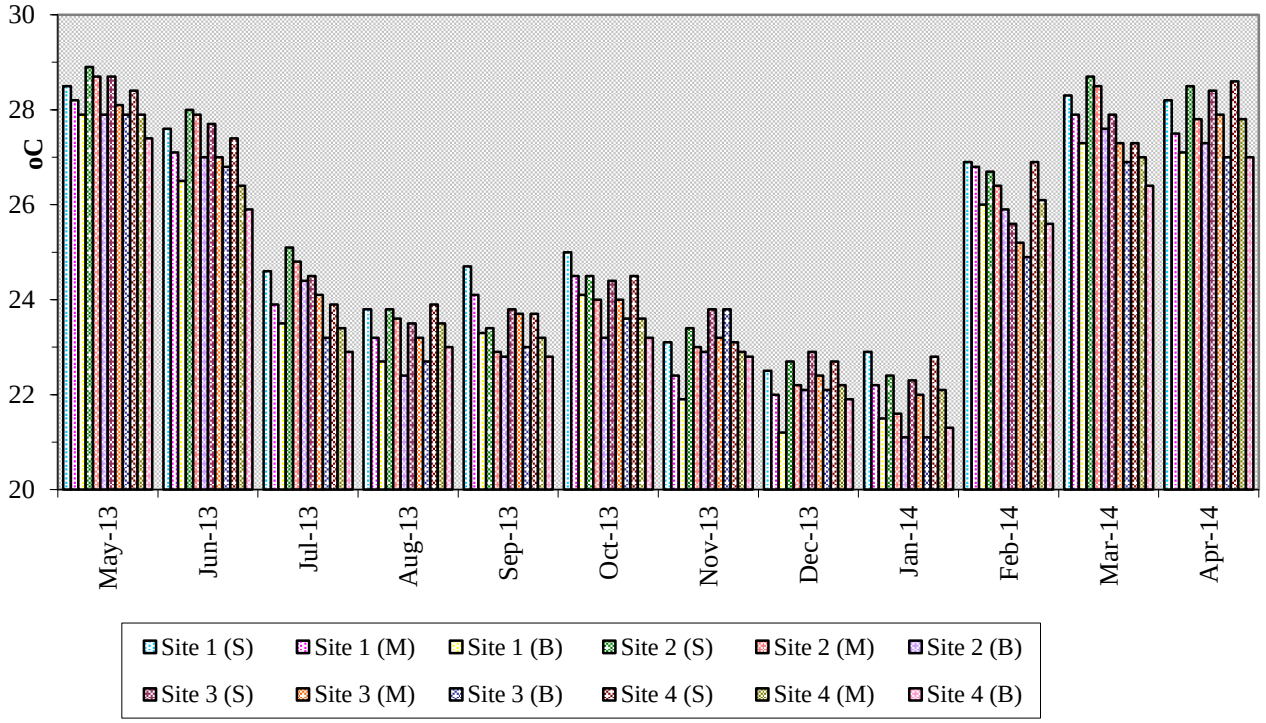
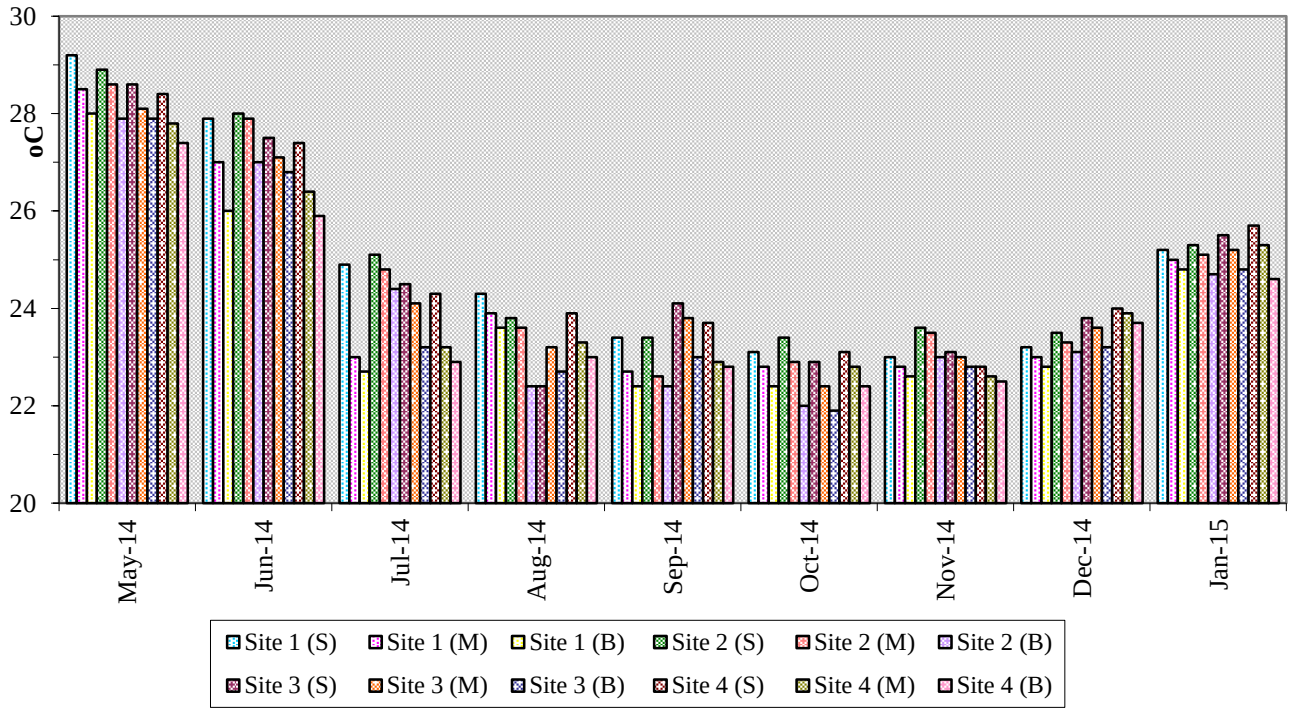


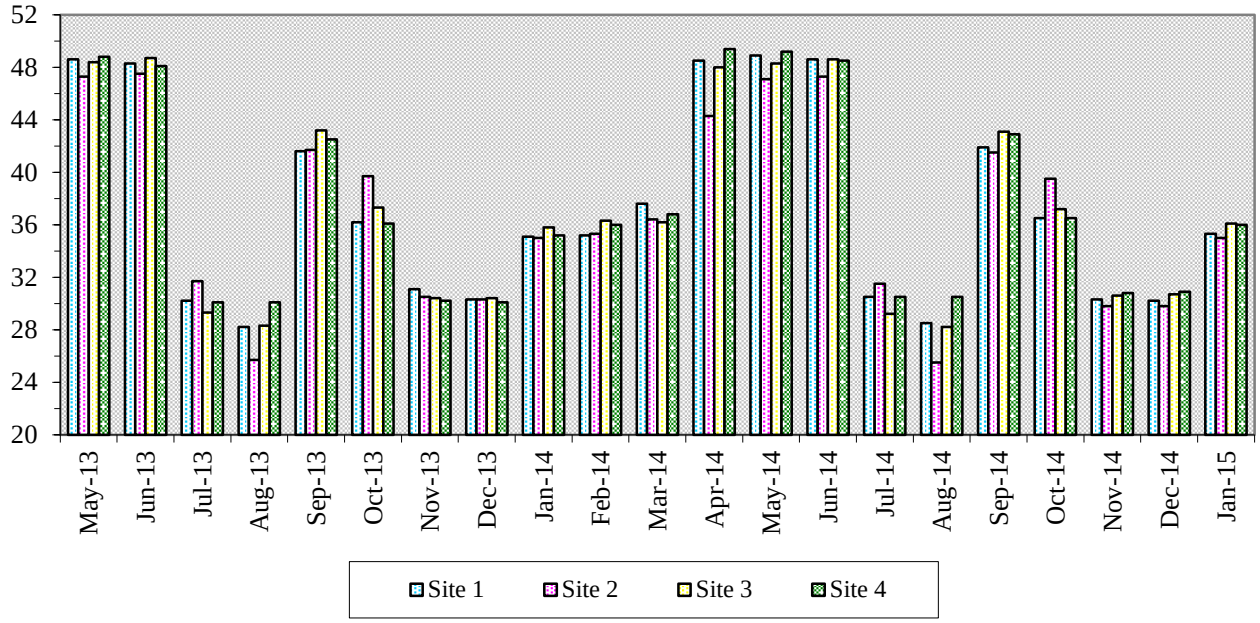
Chart 2.b Monthly Variation In Water Temperature of Khadakwasala Reservoir From May 2014 to Jan 2015



Secchi disc transparency

Secchi disc transparency indicates intensity of light penetration through the water columns. During the present study the Secchi transparency varied between 25.5 and 49.4 cm. at different sites in different months. The collected data clearly indicates that the secchi-disc-transparency was always lower in rainy season and higher in summer months.

Chart 3. Monthly Variation In Secchi Disc Transparency of Khadakwasala Reservoir From May-2013 to Jan-2015



pH

During the present study pH value ranged between 7.3-8.5 with moderate fluctuation with the minimum value recorded to be 7.3 in bottom water whereas the maximum value was recorded to be 8.5 during the month of May and July in surface water.

The trend shows that the maximum values were recorded in the months of April to July and the minimum values in the months of October and December. Thus, the values recorded were fairly on the alkaline side and did not show any wide range of fluctuation.

Chart 4.a. Monthly Variation In Water pH of Khadakwasala Reservoir From May-2013 to Apr-2014

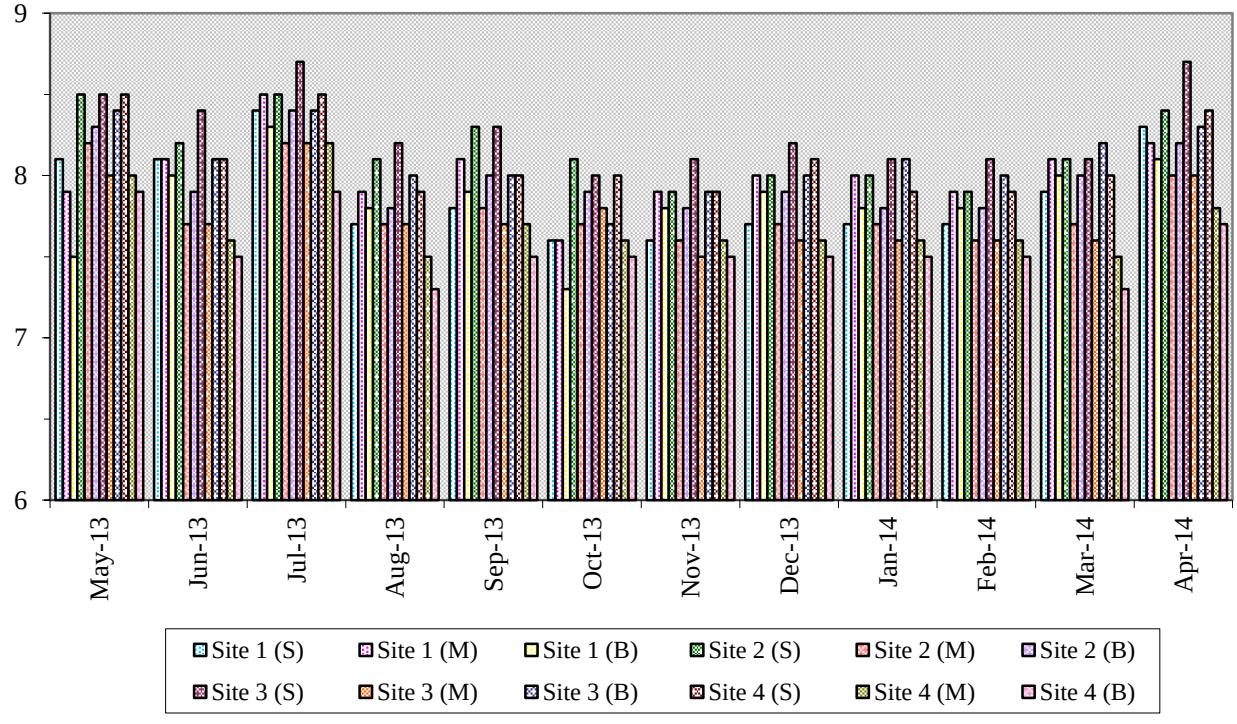
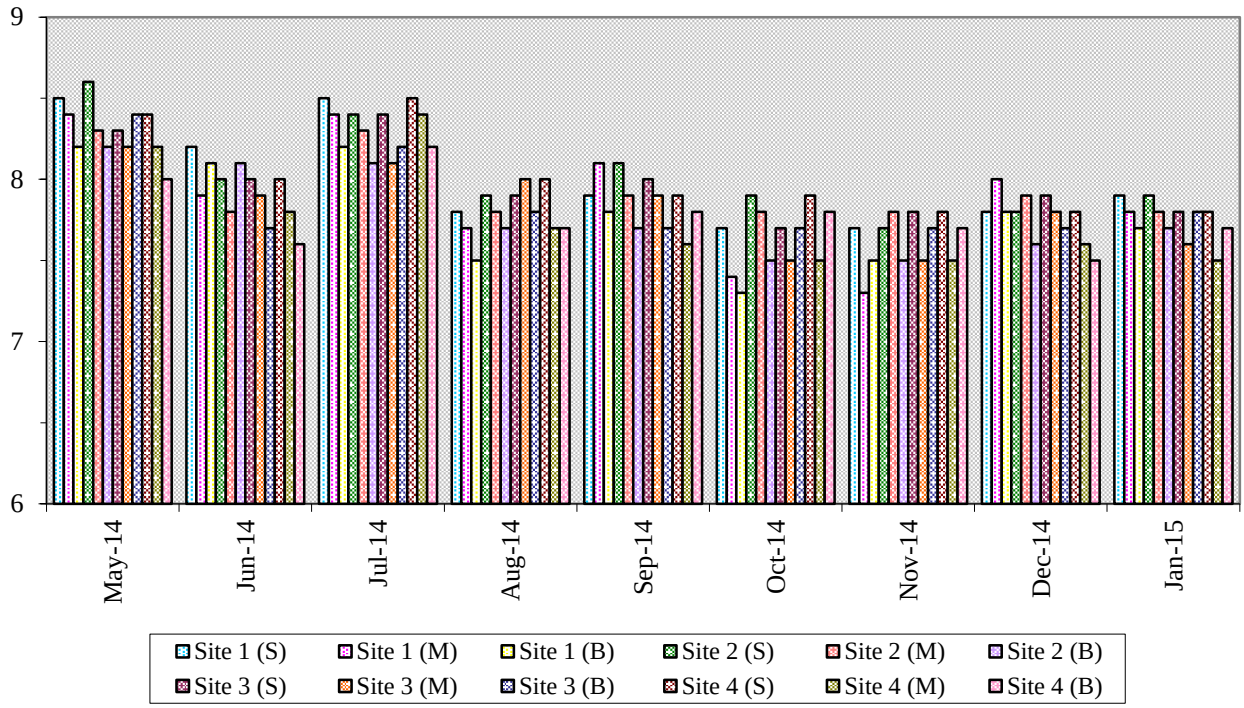


Chart 4.b. Monthly Variation In Water pH of Khadakwasala Reservoir From May-2014 to Jan-2015



5. Conclusion

Khadakwasala offers a moderate climate both in terms of atmospheric and water temperatures throughout the year. Secchi disc transparency found to be in healthy range during the entire study period. Lower transparency during monsoon season is primarily due to increase in the turbidity due to rains. Transparency values improved during summer season indicating that reservoir offers a healthy ecosystem. Hydrogen ion concentration (pH) value also varied in moderate range throughout the year and values recorded were fairly on the alkaline side and did not show wide range of fluctuation.

All the physical parameters analyzed as part of this study clearly make Khadakwasala reservoir a favorable site for conservation of endangered fish Mahseer. This reservoir is a primary source of water for Pune City and is managed and constantly monitored by Government of Maharashtra with limited human activity and possibility of polluting the water body. These positive factors make Khadakwasala reservoir make it a suitable site for conservation of Mahseer.

6. References

APHA 1995. Standard methods for the examination of water and waste water. Published jointly by American Public Health Association. American Water Works Association and Water Pollution Control Federation, New York (19th Ed.).

Boyd, C.E. (1979). Water quality in warm water fish ponds.

Day, F. (1878).The fishes of India. W.W. Dawson and Sons Ltd., London, 778 pp.

Day, F. (1889). The Fish fauna of British India including Ceylon and Burma. Taylor and Francis, London,1.

Desai, V.R. (1970) Studies on fishery and biology of Tor tor(Ham.) from river Narmada.1. Food and feeding habits. J. Inland Fish. Soc.India, 2: 101-112.

Edmondson, W.T. (1959). Fresh water Biology. 2nd ed. New York, London, Johr Wiley and Sons, 1-1248.

George, J.P. (1976). Hydrobiological studies on the lower lake of Bhopal with reference to the productivity of economic fishes. Ph.D. Thesis, Bhopal University, Bhopal.

Golterman, H.L., Clymo, R.S. and Ohnstad, M.A.M. (1978). Methods for physical and chemical analysis of fresh water. IBP No. 8, Blackwell Science Publications, 1-22.

Gopal, R. and Bhargava, T.N. (1981). Appraisal of the quality of ground waters in the arid zone of Rajasthan and Kutch. Dept. Sci. J., 31(1) : 73-86.

Huet, M. And Timmermans, J.A. (1971). Breeding and Cultivation of fish. Fishing News (Book) Ltd., London.

Jhingran, V.G. (1983). Fish and Fisheries of India, Hindustran Publishing Corporation I pp. 1-603.

Kulkarni,C.V. and S.N. Ogale (1995). Conservation of the Mighty Mahseer of India. Tata Electric Company. Bombay House, Bombay: 39 pp.

Needham,J.L. and Needham, P.R. (1962). A Guide to the Study of Fresh Water biology. Holden Day Inc. San Francisco, pp. 108.

Ogale, S.N. (2001). Multiple breeding of the golden mahseer (Tor putitora). Applied Fish. Aqua. 1(1): 31 – 33.

Pennak,R.W. (1953). Freshwater invertebrates of the United States. The Ronald Press Co., New York.

Spence, D.H.N., (1964). The macrophytic vegetation of freshwater locus, swamps and associated fens. In the vegetation of Scotland (ed. J.H. Bundtt). Oliver and Boyd. Edinburgh.

Talwar, P.K. and Arun, G. Jhingran (1991). Vol. 2 Oxford IBH Publishing Co. Pvt., New Delhi, pp. 554 to 1063.

Tiwari, R. (1996). Studies on the eco-biology and culturability of a commercially important fresh water prawn Macrobrachium dayanum under different environmental condition. Ph.D. Thesis, Barkatullah University, Bhopal.

Ward, H.B. and Whipple, G.C. (1959). Fresh biology. John Wiley and Sons.

Welch, P.S. (1952). Limnology. 2nd Ed. McGraw Hill Book Co., New York, 1- 538.