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QUALITATIVE AND QUANTITATIVE ASSESSMENT OF ZOOPLANKTONS IN KHADAKWASLA RESERVOIR FOR ESTABLISHING IT AS A CONSERVATION SITE FOR MAHSEER SPECIES

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Abstract

The importance of Mahseer as a world-famous game fish needs no emphasis. 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 due to anthropogenic activities.

Reservoirs are human modified aquatic ecosystems (INAG, 2009a) which retain a large volume of water as most of them are built for generation of power and flood control. Reservoirs also form an essential component of most irrigation systems .

These reservoirs not only play an important role in serving humans, but also provide suitable fish culture ground and thus enhancing fish production which serves the purpose of conservation of fishes which are vanishing from their habitat. In this study, we aimed to assess the biological parameters of Khadakwasla reservoir as an indicator of water quality, in regard to its suitability for propagation and multiplication of fish Mahseer. The methodology adopted included monthly collection of water samples from four sampling stations of Khadakwasla reservoir for a period of twenty one months. Analysis of the parameters was done according to the Standard Methods of Golterman et al. (1978), Boyd (1979), NEERI (1986) and APHA (1995).

During the period of study maximum 9 and minimum 8 species of rotifera, maximum 8 species and minimum 4 species of cladocera were recorded. Minimum number of copepoda recorded was 2 with the maximum number as 3 species. Minimum number of species of ostracoda was 1 and the maximum number was 2.

As it has been stated by several investigators the Mahseer species has shown adoptability from riverine to lacustrine condition and from observations from the above analysis it could be inferred that Khadakwasla reservoir if managed scientifically can be developed as a conservation site for Mahseer.

Keywords- Reservoir, Mahseer , Parameters , Water quality,Conservation.

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Introduction

Mahseer, the undisputed king of Indian rivers is considered as one of the largest and toughest fighters amongst freshwater sports fish. Its maximum length and weight is reported as 2.75m(9 ft) and weight 54kg(118 lb) respectively in natural ecosystems (Rahman, 1989).

The *Tor* species is also associated with religious faiths and has a cultural significance in South-eastern parts of Asian subcontinent. Despite being reported in abundance once, now the dwindling number and size of Mahseer population natural ecosystem has alarmed the conservationist as the status of Mahseer is now an endangered fish as per IUCN (2014).

Though represented by 16 recognised species, taxonomic ambiguity had turned out to be a constraint to efforts leading to conservation. But recent taxonomic revisions had partially led to overcoming it (Pinder et al 2019). This resulted in revision of the IUCN Red List status of Tor fishes and though eight species remain 'Data deficient', still three species are assessed as 'Near Threatened' and 'Endangered' each, one 'Vulnerable' and one 'Critically Endangered'.

Mahseer in the Indian sub-continent has a wide distribution from Himalayan rivers which extend up to the lower reaches of mostly all major river systems. (Sarma et al., 2009). Its behaviour exhibits upstream migration and can go through rapids of 20-25 knots (Sarma et al., 2009) in clean fast flowing water for breeding. May to August is considered as the conducive period for the maturation of this fish in natural riverine waters (Bhatt and Pandit, 2015) Mahseer's spawners of the size range from 190 to 250 mm total length have a total fecundity which falls between a range of 3987 to 7320 eggs (Sarma et al., 2016). In absence of sand or gravel it is seen that the eggs of Mahseer can sink and perish in the loose mud (Qasim, 1956a).

Though this fish has very high table value which is also associated with its cultural importance, the status of Mahseer has been in jeopardy in their native riverine habitat due to being impacted by anthropogenic activities like point and nonpoint sources of pollution. construction of dams etc. which lead to habitat fragmentation.

As it is seen that River-reservoir interfaces can act best place for recreational fishery and conservation as it not only provides high-quality feed for fishes but also potentially spawning areas for both benthic omnivores and piscivores (Pennock et al , 2020) (Nathan et al, 2022), . Such reservoirs are advised to be considered for species whose population is declining day by day habitats. Khadakwasla reservoir, which is subject to investigation in this study, is also one of such reservoirs.

Khadakwasla reservoir is selected to conduct study of its suitability for conservation of Mahseer. This reservoir is selected because it has got topography, which suits Mahseer development. This dam is built on a river known as the Mutha River. This Dam is situated only 21 km away from the city of Pune in Maharashtra, India. The Khadakwasla dam resulted in formation of a reservoir

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which is known as Khadakwasla Lake. This reservoir acts as the major source of drinking water for Pune city and its suburban areas .

Presence of defence and government establishments like National Defence Academy (NDA), the Defence Institute of Advanced Technology (DIAT), the College of Military Engineering, Pune (CME, Dapodi) and Central Water and Power Research Station (CWPRS) in near vicinity keeps a control on anthropogenic activities around this reservoir. A few kilometres to the south lies Sinhagad Fort; the twin dams of Panshet and Varasgaon, which mainly supply water for irrigation but also feed into Khadakwasla Lake, lie just 8 km (5.0 mi) due west of the backwaters of Khadakwasla Lake.

An adult Mahseer is considered as an omnivore fish as being mainly herbivorous, it is also carnivorous to a lesser extent. Its feeding habits indicates that it not only feeds on green filamentous algae, larvae of various insects, small molluscs, but also on algal growth which has coated rocks (Sarma et al., 2013). It exhibits a diet preference of vegetable matter during adult stages and carnivorous feed is preferred in hatchery conditions at early larval rearing stage (Sharma et al., 2013). Being an intermittent feeder, it is also known to be a column and bottom feeder.

In the present study we would take efforts to qualitatively and quantitatively analyse the biological parameters of Khadakwasla reservoir in reflection to its suitability for conservation of Mahseer.

Materials & Methods

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 S-1, S-2, S-3, S-4 were selected at this reservoir. Samples were collected from surface, middle and bottom layers of the water.

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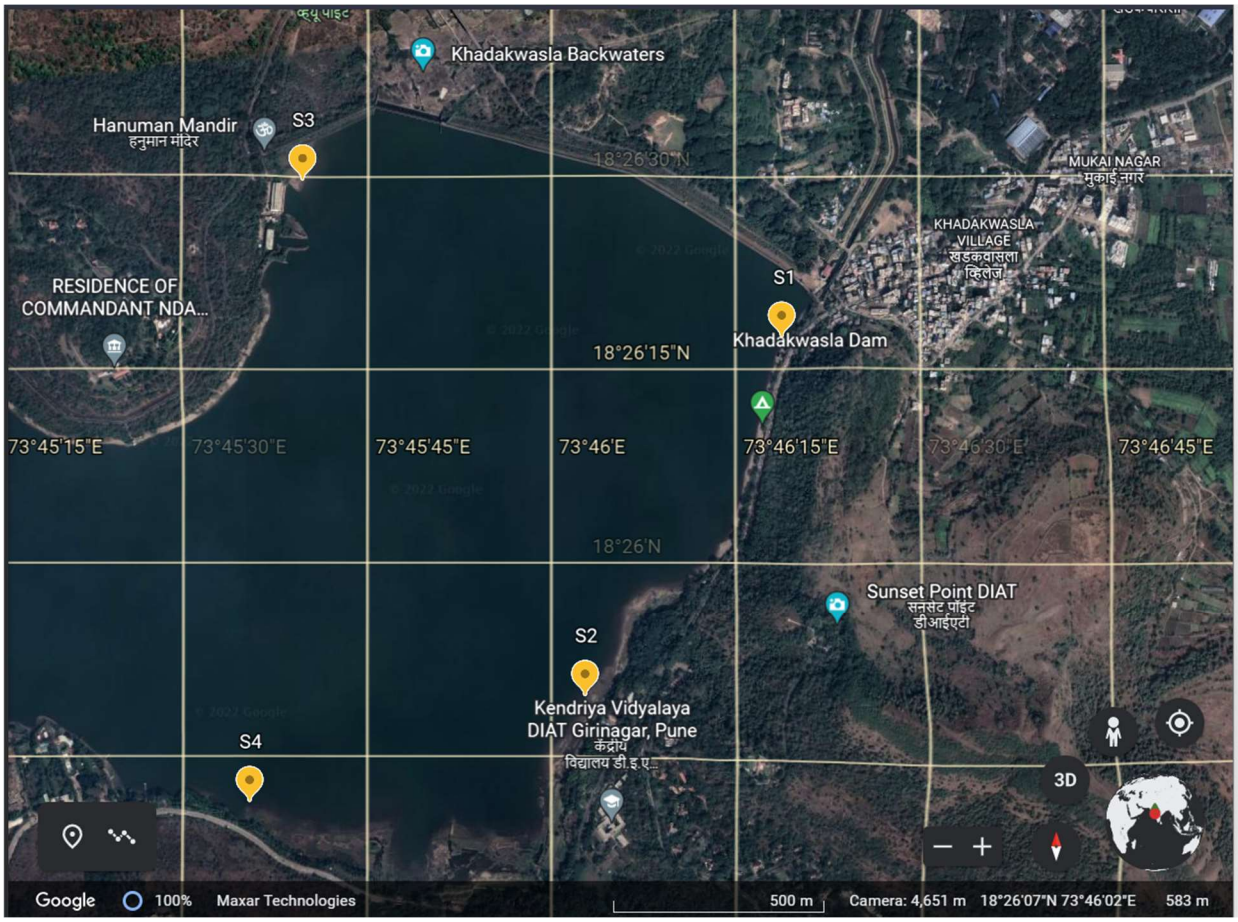

Fig 1 - Google Earth Image of Study area and Sites for sample collection

Zooplankton collections were made by filtering 50ltr water through a bolting silk net (No. 25). They were preserved in 5% formalin and subsequently each sample was concentrated to 10 ml. as described by Wetzel and Likens (1979).

Quantitative Analysis of zooplankton

Counting of zooplankton was done by Sedgwick Rafter Cell (50 x 20 x 1 mm.). All samples were analysed in three replicates, which were subsequently used for determining zooplankton concentrations. One ml. of each replicate was counted in the Sedgwick Rafter cell under a research microscope and the mean was calculated.

Qualitative analysis of zooplankton

Identification of zooplankton was done according to the keys given by Pennak (1953), Edmundson (1959), Ward and Whipple (1959), Needham and Needham (1962) and APHA (1995).

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Results and Discussion

Zooplankton consists mostly of invertebrates, larvae and immature stages of both invertebrates and vertebrates. The majority of zooplankton depends indirectly on nutrient control of the quality and quantity of their algal, bacterial or detrital food. To a lesser extent, they may be influenced by the physico-chemical conditions of their aquatic environment altered as a result of algal metabolism, such as pH and oxygen concentrations (Iftekhar Mohiuddin & Pandey, 1997). These are the prime protein food source for fish in any natural aquatic environment. Hence, considerable attention has been paid to this vital component in a water body.

Zooplankton are vital components of energy flow at secondary level and are effectively used to estimate the fishery potentials of water bodies. They also respond quickly to environmental changes. During the present study the total number of zooplankton ranged from 67 to 615 organisms/ltr. at S-1 sampling station, 58 to 595 organisms/ltr. at S-2 sampling station in Khadakwasla reservoir; 53 to 528 organisms/ltr. at S-3 sampling station and 42 to 488 organisms/ltr. at S-4 sampling station in Khadakwasla reservoir indicating high energy pool at the secondary level. The summer maxima of zooplankton observed at the sampling stations of Khadakwasla reservoir is in accordance with the findings of Nair and Tranter (1971) Haridas et al. (1973) and John (1996). Green (1972) observed increased values of zooplankton due to the increase in nutrients and phytoplankton. This observation is true in case of present investigation also.

During the period of study maximum 9 species of rotifera were recorded at S-2 and S-4 and the minimum was 8 at S-1 and S-3. Maximum number of species of cladocera were recorded as 8 at S-3 and minimum was 4 at S-4. Minimum number of copepoda recorded was 2 at S-1 and maximum number was 3 at S-2, S-3 and S-4. Minimum number of species of ostracoda was 1 at S-1, S 3 and S-4 and the maximum number was 2 at S-2

Rotifers dominated the zooplankton population in Khadakwasla reservoir. They have been used as indicators of eutrophic status of lakes by many workers (Pejler, 1957, 1965; Radwan, 1976 and Chaurasia and Adoni, 1987). Present observations are also in confirmation with the above opinion. Summer peaks of Rotifers were observed in Khadakwasla reservoir which is in accordance with the findings of Tiwari (1996). According to Kannan and Job (1980) abundance of cladocerans is due to the addition of allochthonous nutrients, which is also opined by the present work. Verma et al. (1984) reported copepods as sensitive to pollution, whereas Bhatti and Rana (1987) found them as pollution tolerant forms. The present findings are in accordance with the opinion of Bhatti and Rana (1987). Kurasawa (1975) also observed the dominance of Copepods in Eutrophic lakes. Ostracoda was the group represented by low numbers and hence it could be an indication of a pollution sensitive group.

Rotifera, Cladocera, Copepoda and Ostracoda were represented by 8, 5, 2 and 1 species respectively at S-1 sampling station, 9, 7, 3 and 2 species respectively at S-2 sampling station in

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Khadakwasla reservoir 8, 8, 3 and 1 species respectively at S-3 sampling station and 9, 4, 3 and 1 species at S-4 sampling station. Among these *Asplahchna brightwelli*, *Brachionus calyciflorus* and *Keratella tropica* belonging to Rotifera and *Daphnia* species belonging to Cladocera are identified as biological indicators of eutrophic conditions of the water body. Bhatnagar (1984) has observed that *Brachionus calyciflorus*, *B. caudatus, Filinia longiesta* and *Asplanchna brightwelli* are indicators of eutrophy. *Brachionus calyciflorus, B. caudatus* have also been invariably considered as indicators of eutrophy by Arora (1966), Chaurasia (1985) and Arya et al. (1988). *Daphnia* and *Bosmina* species have been reported by Jeffries and Mills (1990) as eutrophic indicators. Thunmark (1945) had also cited *Daphnia* as an indicator of eutrophy. Maemets (1983) indicated *Keratella quadrata, K. cochlearis, Trichocerca sp*. and *Polyarthra sp.* as organisms of eutrophic waters.

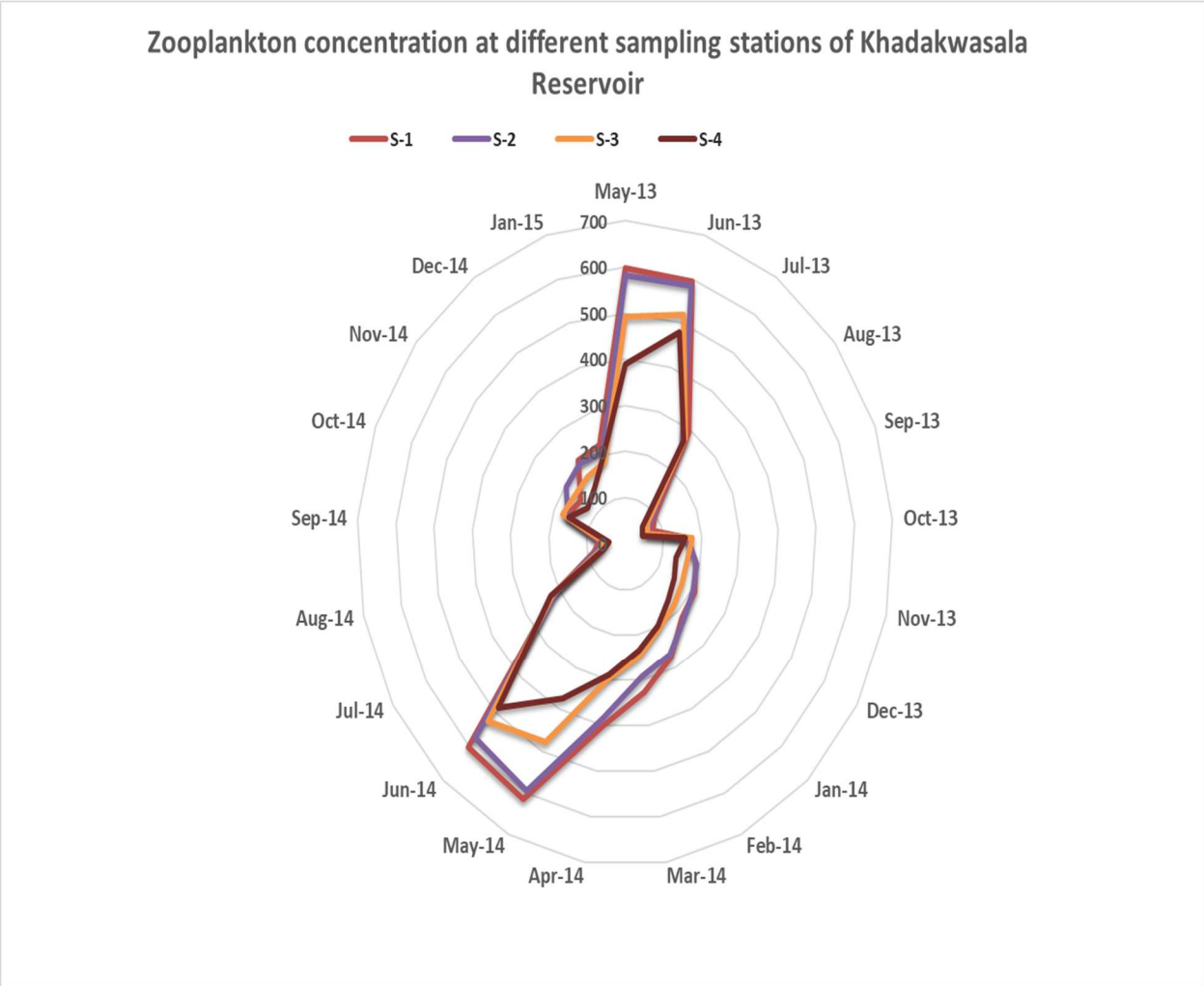

Fig 2 - Quantitative Analysis of Zooplankton at Khadakwasla

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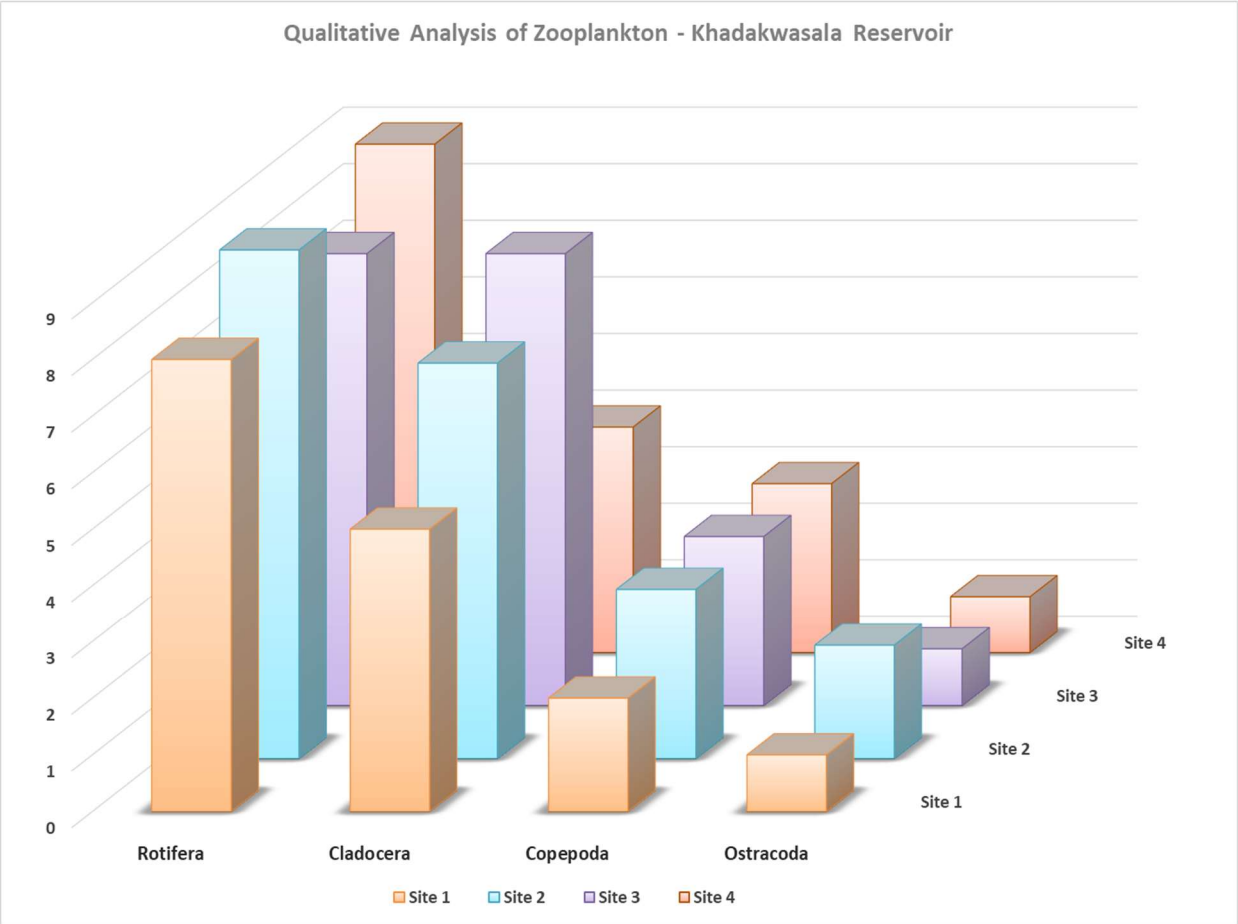

Fig 3 - Qualitative Analysis of Zooplankton at Khadakwasla

Conclusion

The composition of the zooplankton population is represented by almost all the groups of micro invertebrates and hence the system as such can be considered as a healthy ecosystem. Zooplankton also form a major part of carp feed, which is evident in the present study.

As it has been stated by several investigators the *Mahseer* species has shown adoptability from riverine to lacustrine condition it can be concluded that this fish can be well protected in Khadakwasla reservoir if managed scientifically. When compared with the feeding habits of Mahseer caught from other systems, the present water body also provides ample food and breeding scope for the fish. Thus, making it the most suitable habitat for conservation of this endangered species in the lacustrine environment.

DISCLAIMER

The products used for this research are commonly and predominantly used in our area of research and country.

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