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Physico-chemical parameters and ichthyofauna abundance of Dharmasagar reservoir of Warangal district (T.S.) India

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Abstract

The present investigation deals with the study of physico-chemical parameters and bio-diversity of fish fauna in Dharmasagar reservoir. The physico-chemical parameters such as Temperature, Electrical Conductivity (EC), Total Dissolved Solids (TDS), pH, Dissolved Oxygen (DO), Total Alkalinity, Free Carbon dioxide (Free CO₂), Chlorides, Total Hardness and Biochemical Oxygen Demand (BOD) were estimated. The study was also made to record the fish fauna from this reservoir, which revealed that there are 14 species of fishes recorded. The fishes were identified in to species level and their abundance was estimated and discussed. The water temperature was less than 34 °C, pH was 8.5. Total alkalinity range up to 250mg/l. DO and CO₂ of water ranged from 5 to 12 mg/l. Hence, it is estimated that all these values are within the permissible limits.

Keywords: Dharmasagar reservoir, Physico-chemical parameters, Fish fauna and Abundance.

1. Introduction

India is having very rich sources of Inland water bodies in the form of rivers, canals, reservoirs, lakes, water impoundments, tanks and pounds. The perennial fresh water bodies hold a great promise as a source of drinking water and aquaculture potential in terms of fishes. These water bodies are located in different parts of country especially in rural areas and mainly used as a source of drinking water, irrigation and fish production by the local fishermen communities. The country is endowed with vast and varied resources opposing river ecological heritage and rich bio-diversity. Fresh water fishery sites are varied like 45,000 Km. of rivers, 1, 26, 334 Km., of canals, ponds and tanks 2.36 million hectares and 2.05 million hectares of reservoirs [3]. About 21,730 species of fishes have been recorded in the world of which about 11.7% are found in Indian waters. Out of the 2,546 species so far listed (ICBD, 1994) 73 (3.32%) to the warm fresh waters domain, 143 (6.50%) to the brackish waters and 1440 (65.45%) to the marine ecosystem. [6]. The fresh water fishes of Indian, sub-continent are represented by 930 species [12].

Fishes are most important bio-product of fresh, marine and brackish water ecosystems contributive as an essential and beneficial food items to mankind since ancient time. Water quality can have a great influence on the ability of aquatic plants and animals to exist and grow in stream pond or lake [1]. Several physico-chemical factors such as temperature, electrical conductivity pH, dissolved oxygen, chlorides and biological oxygen demand could act as stresses and adversely affect fish growth and reproduction [10]. Hence, the regular monitoring of physico-chemical parameters is essential to determine the status of water with reference to drinking and fish culture. Fish fauna of a reservoir basically represents the fish diversity and their abundance. Indian reservoirs preserve a rich variety of fish species, which supports to the commercial fisheries. The notable studies on physico-chemical parameters in relation to fish abundance are [5, 9, 13, 16, 18]. The objectives of the present study were to document the fish species abundance in relation to physico-chemical characteristics of water and suggest appropriate conservation and management strategies.

2. Materials and methods

2.1 Study site: Dharmasagar reservoir is one of the important historical, moderate, perennial, man-made, rural freshwater bodies of Warangal district, Telangana State.

It was constructed during the grand period of Kakatiya dynasty. The reservoir is located at Dharmasagar village about 16 Kms distance from Warangal city, and situated in the 18°-00'-13" N latitudes and 79°-43'-26" E longitudes. The water spread area of reservoir is 1200 acres. The main scope of this reservoir is irrigation, drinking and fishing purposes. The climate of these areas is moderately cool.

2.2 Methodology

For limnological study, the water samples were collected between 8:00 A.M to 11:00 A.M on monthly intervals, brought to the laboratory and analysed immediately. Water temperature was measured at the time of sampling sites using mercury thermometer, pH was measured with standard pH meter, while other parameters were analysed in the laboratory according to the methods suggested by APHA [2] and Trivedy and Goel [21].

The study was carried out from October, 2007 to September, 2008. The samples of fishes were collected every month throughout the study period, with the help of the local fishermen. The collected fish species were preserved in 10% formalin and identified with the standard literature [8, 11, 10].

3. Results and discussion

The physico-chemical parameters of Dharmasagar reservoir of Warangal district has been investigated to evaluate its suitability for drinking, Irrigation and fish culture. Water quality is an important criterion for fish habitat. The diversity and abundance of fishes mainly depends upon the basic and abiotic factors and type of the ecosystem, age of the water body, mean depth, water level, fluctuations, morpho-metric features and bottom have great implications.

Table 1: Showing Physico-Chemical Parameters of Dharmasagar Reservoir during October, 2007 to September, 2008.

Sl. No.	Parameter	Oct. 07	Nov. 07	Dec. 07	Jan. 08	Feb. 08	Mar. 08	Apr. 08	May. 08	June. 08	July. 08	Aug. 08	Sep. 08	Grand mean
1.	Water Temperature (°C)	27.8	26.7	25.5	26.8	29.7	31.4	32.4	33.3	29.2	26.7	25.5	24.5	28.49
2.	pH	7.4	7.7	7.6	7.7	8.0	8.2	8.4	8.5	7.8	7.7	7.7	7.3	7.84
3.	Electrical Conductivity (µmhos/cm)	0.289	0.293	0.285	0.296	0.299	0.310	0.311	0.342	0.316	0.307	0.326	0.309	0.306
4.	Total Dissolved Solids (mg/l)	253.75	268.50	267.25	302.00	355.75	374.75	399.25	412.00	188.75	146.50	128.25	118.25	267.91
5.	Dissolved Oxygen (mg/l)	8.49	8.25	8.10	7.75	7.40	7.15	7.02	6.99	8.75	9.66	10.52	11.76	8.48
6.	Free Carbon dioxide (mg/l)	5.67	5.50	5.52	5.80	6.77	7.87	8.32	8.25	9.60	10.45	10.30	7.75	7.64
7.	Total Alkalinity (mg/l)	240.5	2393.5	227.2	220.0	213.2	213.2	210.7	206.0	200.2	181.0	159.0	149.2	204.9
8.	Chlorides (mg/l)	37.5	41.4	40.5	50.4	59.5	60.5	76.0	90.1	73.5	59.1	40.3	36.4	5.43
9.	Total Hardness (mg/l)	102.0	91.2	97.5	98.5	115.7	125.2	131.0	136.2	110.2	106.2	103.0	100.7	109.80
10.	Biological Oxygen Demand (mg/l)	6.4	7.3	8.4	10.8	6.2	5.3	3.7	3.2	4.0	5.0	5.5	6.0	6.00

The water quality parameters data reveals that the water temperature range between 24.5 to 33.3 °C is within the tolerance limit of most of the cultivable fishes. The pH ranged from 7.3 to 8.5. The pH of reservoir water was well within the permissible limit given by ISI (1983) and WHO [22] throughout the sampling period. The electrical conductivity of the reservoir water ranged from 0.285 to 0.326 µmhos/cm. The total dissolved solids were recorded in the range of 118.5 to 412.0 mg/l. The Oxygen is the one of most important factor in any aquatic ecosystem. The main sources of dissolved oxygen are from the atmosphere and the photosynthesis. In the present investigation the DO was found to be in the range between 7.02 to 11.76 mg/l. Dissolved oxygen levels in warm water, fish habitats should not be less than 5 mg/l, during at least 16 hours of any 24 hours cycle. Srinivasan [19] and Bahura [4] have reported on inverse relationship of DO with temperature. The carbon dioxide content of water depends upon the temperature depth, range of respiration, decomposition of organic matter, chemical nature of the bottom and geographical feature of the terrain surround in the water body. During the present study free CO₂ was observed in the range of 5.50 to 10.45 mg/l.

The total alkalinity is generally imported by the salts of the carbonates, bicarbonates, phosphates, nitrates etc, together

with the hydroxyl ions in Free State. The total alkalinity were recorded in the range of 142.2 to 239.5 mg/l. The values of chlorides ranged between 36.4 to 90.1 mg/l. The concentration of chlorides increases with the degree of eutrophication. Hardness is governed by the contents of calcium and magnesium salts largely combined with bicarbonates and carbonates giving temporary hardness and with sulphates, chlorides causing permanent hardness. In the present investigation total hardness of water varied between 91.2 to 136.2 mg/l. The optimum values of hardness range between 75 to 150 mg/l, supports fish productivity [6]. During the present study, the BOD varied between 3.2 to 10.8 mg/l, similar trends were also reported by PatkiSaroj [14]. The values of all parameters recorded during present investigation are around the ranges mentioned above, thus making Dharmasagar reservoir water suitable for fishery.

The Fish fauna is an important aspect of fishery potential of a water body. It is observed that the abundance of fish species is variable because of geographical and geological conditions of the reservoir. In the present investigation 14 fish species have been identified during from October, 2007 to September, 2008. It was also recorded that occurrence of fish species most abundant 5, abundant 6, less abundant 3 on the basis of their number in each catch (Table -2, Table -3 and Fig-1).

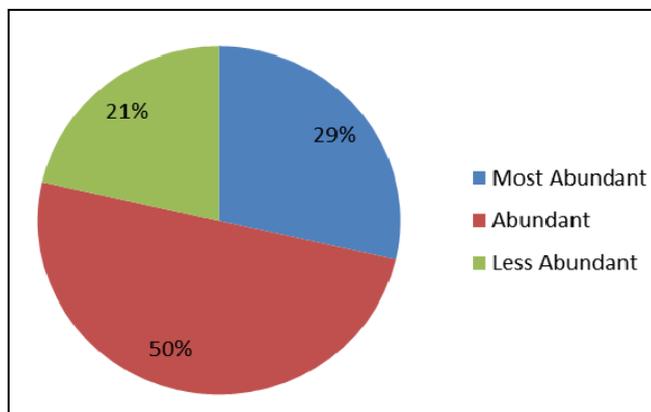
Table 2: Showing Abundance of Ichthyofauna in Dharmasagar Reservoir during October – 2007 to September, 2008

Sl. No.	Local Name	Zoological Name	Abundance
1.	Botcha	Catla catla (Ham)	+++
2.	Kodipe	Ampli Pharyngo donmola (Han)	++
3.	Bangaru Thega	Cyprinus carpio carpio (Linn)	+++
4.	Jella	Mystus bleekeri (Day)	++
5.	BuddaParaka	Punctatus titus (Ham-Buch)	++
6.	Motta Pilla	Channa punctatus (Blooch)	++
7.	Merige	Cirrhinus mrigala (Ham)	++
8.	Marphoo	Clarias batrachus (Linn)	+
9.	KorraMatta	Channa straitus (Bloch)	+++
10.	PandiParaka	Nandus nandus (Ham)	++
11.	Mala Pankidi	Channa orientalis (Ham)	+
12.	Botcha	Labeo potail (Sykos)	++
13.	Rahu	Labeo rohita (Ham-Bush)	+++
14.	Papera	Mastacembelus armatus (Lac)	+

Abundance Ratings: +++ Most abundant
 ++ Abundant
 + Less abundant

Table 3: Showing percentage wise abundance of fish species

Sl. No.	Abundance of Fish Species	No. of Fish Species	Percentage
1.	Most Abundant	4	28.57
2.	Abundant	7	50.00
3.	Less Abundant	3	21.43

**Fig1:** Showing Percentage wise Fish Abundance

Among the 14 species of fishes, *Catla catla*, *Cyprinus carpio carpio*, *Channa striatus*, *Labeo rohita* are most abundant due to their stocking. Though *Amplipharyngodon mola*, *Mystus bleekeri*, *Punctatus Titus*, *Channa punctatus*, *Cirrhinus mrigala*, *Nandus nandus* and *Labeo potail* are abundantly found in the reservoir and other types are less abundant.

The changes in the completion of a fish assemblage often indicate a variation in the water quality parameters such as water temperature, pH, and dissolved oxygen etc. The present results are in agreement with other researchers Piska *et al.*,^[16] have observed that the major carps are most abundant in Ibrahimbagh and Dergam Chervu. Salaskar and Yergi^[17] have recorded 10 main fish species from Plowailake, Mumbai in Maharashtra. Pawar *et al.*,^[15] have observed 16 fish species from Petwadams in Nanded district of Maharashtra, India. Bhalerao^[5] have studied about the fish diversity and water quality at KasarSai Dam, Hinjewadi, Pune, and Maharashtra, India and reported 15 fish species from KasarSai Dam Reservoir. Similar observations were in agreement with the present investigation.

4. Conclusion

Based on the results of the present study, the physico chemical parameters values of Dharmasagar reservoir water are within the permissible limits as per prescribed standards. It was observed that generally the fish production increases in the month of May and reduces in January month. It can also be stated that the productivity of the Dharmasagar reservoir can be improved if the alkalinity of the water can be made over 100 ml/lit. This may help in growth of the planktons, which in turn may help to increase the fish production. Hence, the reservoir water is suitable for fish culture. Finally it is observed that major carps are most abundant in Dharmasagar reservoir.

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