

Study on hydro-chemical parameters and their influence on ichthyofauna diversity in a lentic water body : a model in Warangal district of Andhra Pradesh

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SUMMARY : Freshwater bodies are one of the most common and stable habitats of biosphere. The freshwater habitats have their own physico-chemical and biological characters which are subjected to modify by local conditions and physiographic features. Now a days, the ecology of reservoirs is under stress conditions due to fast pace of industrial development, deforestation, cultural and agricultural practices. These activities trigger the rate of sedimentation of the reservoir bed characterised by silt and organic suspended matter, which initiates the process of eutrophication at a very early stage and show a deterioration of the quality of the habitat. The water quality parameters have a great influence on the growth and other factors of aquatic organisms. Therefore, the lentic water body gives a good source for fisheries. The present investigation deals with limnological and physico-chemical parameters and their influence on ichthyofauna abundance in a lentic water body. The study was carried out for a period of one year *i.e.*, from October, 2008 to September, 2009. The investigation was focused on the determination of hydro-chemical parameters such as water temperature (24.5-33.9°C), pH (7.4-8.7), EC (0.28-0.33 millimhos), TDS (140.2-425.5mg/1), DO (7.1-10.9 mg/1), free CO₂ (5.0-11.7mg/1), total alkalinity (94.0-240.5mg/1), chlorides (27.0-70.7mg/1), total hardness (96.7-142.0mg/1) and BOD (3.4-11.1mg/1). The values of these parameters were higher during summer months. The study was made to record fish fauna availability. In this reservoir, it was recorded that 18 species of fishes were identified, the major fishes in this, were common carps and cat fishes. In the light of recent literature, the data have been discussed and it is concluded that limnological and physico-chemical parameters in this reservoir are most comply with suitability of human consumption and favourable for fishery.

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The life depends on water and the quality of water can be determined through their physical, chemical and biological characteristic features. Water bodies are found at different geographical and geological areas. Fresh water ecosystems are highly dynamic and more complex than any other type of the ecosystems. Fresh water bodies include large number of rivers, reservoirs, impoundments, tanks, ponds and lakes. Among them lentic water bodies are major resource of water for human consumption and livestock. They are being used as main source of drinking, and also used for domestic purposes and aquaculture practices.

Water quality has a great influence on aquatic plants and animals that grow in streams, ponds and lakes (Achenon, 1983). Several physico-chemical parameters such as temperature, electrical conductivity (EC), pH, dissolved oxygen (DO), chlorides, biological oxygen demand (BOD), could influence fish growth and reproduction. Therefore, the regular monitoring of physico-chemical parameters of water body is essential to determine its status whether it is fit or not for fish culture practices.

The present study is aimed at investigating the impact of physio-chemical parameters on the fish diversity in the Dharmasagar reservoir of

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Warangal district. Notable studies on the physico-chemical parameters in relation to the fish diversity and fish growth are earlier being done elsewhere by Piska and Chary (2000), Shastri and Pendse (2001), Kadam *et al.* (2007), Gupta *et al.* (2008), Srikanth (2009) and Rohankar (2009).

EXPERIMENTAL METHODOLOGY

Dharmasagar reservoir is a historical and lentic fresh water body of Warangal district of Andhra Pradesh state. This reservoir is moderate, perennial, manmade, rural water body. It is constructed during the period of Kakatiya dynasty (1160-1323AD). The reservoir is located at Dharmasagar village about 16 km distance from Warangal city and situated in the 18°-00'-13"N latitudes and 79°-43'-26"E longitudes. Water spread area of this water body is 81.2 sq km and total catchment area is 159.0 sq. km. Total area of reservoir is 1200 acres. The main scope of this reservoir is irrigation, drinking and fish culture.

The present study was carried out for a period from October, 2008 to September, 2009. The water samples were collected on a monthly basis at specific dates in every month. Surface samples were collected in a clean plastic container to study various hydro-chemical parameters. The water samples were brought to the laboratory for analysis and the parameters like temperature, pH, EC, TDS, DO, Free CO₂, total alkalinity, total hardness, BOD were estimated by the standard methods (APHA, 1985 and Trivedy and Goel, 1984). The fish samples were also collected every month throughout the study period for which the help of the local fishermen was sought. The fish were preserved in 10% formalin and subsequently identified as described by Day (1978), Jayaram (1981), Sarkar and Benerjee (2000) and Mishra *et al.* (2003).

EXPERIMENTAL FINDINGS AND DISCUSSION

The water samples were analyzed and the data are presented in Table 1. The fish fauna identified are presented in Table 2 in which 18 fish species have been identified.

The present hydro-chemical parameters data revealed that, the water temperature ranged between 25.4° to 33.9°C. The water temperature was maximum recorded in the month of May and minimum in September and it is within the tolerance limit of most of the cultivable fishes. The pH ranged from 7.4 to 8.7. While pH ranged more than 9.0 is unsuitable for fish growth (Swingle, 1967). The electrical conductance of reservoir water ranged from 0.285 to 0.336 µmhos. The total dissolved solids were recorded in the range of 140.2 to 425.2 mg/l. The oxygen is the one of the most important factors in any ecosystem. The main source of dissolved oxygen is from the atmosphere and photosynthesis. Dissolved oxygen is an important parameter affecting metabolic of all aquatic organisms that possess aerobic respirative biochemistry

Table 1 : Hydro-chemical parameters of dharmasagar reservoir during October, 2008 to September, 2009

Sl. No.	Parameters	Units	Oct. 08	Nov. 08	Dec. 08	Jan. 09	Feb. 09	Mar. 09	Apr. 09	May. 09	June. 09	July. 09	Aug. 09	Sep. 09	Min.	Max.	Avg.
1.	Water temperature	°C	26.5	25.8	24.5	28.1	30.0	31.9	32.4	33.9	29.6	26.2	25.5	25.4	25.4	33.9	29.2
2.	pH		7.60	7.75	7.77	7.82	8.25	8.45	8.67	8.70	7.77	7.67	7.67	7.45	7.45	8.70	8.075
3.	Electrical conductivity	µmho	0.289	0.295	0.292	0.300	0.307	0.313	0.327	0.336	0.309	0.301	0.296	0.285	0.285	0.336	0.3105
4.	T.D.S	mg/l	221.0	238.7	251.2	267.5	305.7	321.0	371.7	425.5	170.7	152.5	150.2	140.2	140.2	425.2	282.7
5.	Dissolved oxygen	mg/l	8.78	8.84	8.36	8.03	7.84	7.69	7.48	7.15	9.10	10.13	10.97	9.64	7.15	10.97	9.06
6.	Free CO ₂	mg/l	5.05	5.07	5.65	6.92	7.85	8.40	8.97	9.27	10.82	11.55	11.70	7.57	5.05	11.70	8.375
7.	Total alkalinity	mg/l	239.9	240.5	199.2	217.0	211.0	196.7	187.0	160.7	124.2	118.2	102.7	94.0	94.0	240.5	167.25
8.	Chlorides	mg/l	29.93	29.50	31.37	32.51	40.94	48.13	68.42	70.73	50.29	38.87	32.89	27.07	27.07	70.73	48.9
9.	Total hardness	mg/l	118.7	107.0	98.5	96.7	119.5	131.7	137.7	142.0	123.5	110.7	103.2	103.2	96.7	142.0	119.35
10.	BOD	mg/l	7.45	8.57	9.35	11.17	5.97	4.10	3.65	3.40	4.10	5.60	5.67	5.40	3.40	11.17	7.285

(Wetzel, 1975). In the present investigation, the dissolved oxygen was found to be in the range between 7.1 to 10.9 mg/l. A minimum value of 4.0 mg/l dissolved oxygen in water is essential for the survival of fish life and water is suitable for fish growth. During the present study, free CO₂ was observed in the range of 5.0 to 11.7 mg/l. Kadam *et al.* (2007) during the study of Masoli reservoir, recorded CO₂ in the range of 3.82 mg/l to 6.80 mg/l, 3.81 mg/l to 6.79 mg/l, 3.83 mg/l to 6.79 mg/l and 3.85 mg/l to 6.81 mg/l from site A, B, C and D, respectively. Manjare *et al.* (2010) reported that the maximum value (28.6 mg/l) was recorded in the month of December (winter) and minimum value (0.0mg/l) in the summer months. This may depend upon alkalinity and hardness of water body.

The total alkalinity were recorded in the range of 94.0 to 240.5 mg/l. Mahadevan and Krishnaswamy (1983) observed the total alkalinity values varied from 100 to 214.7 mg/l. Manjare *et al.* (2010) recorded the total alkalinity ranged from 121.25 mg/l to 200 mg/l in Tamdalg tank in Kolhapur, Maharashtra. Kadam *et al.* (2007) recorded the total alkalinity values were high during winter and low during monsoon. The steep fall during monsoon may be due to dilution of winter. Hujare (2008) reported in alkalinity results was maximum in summer and minimum in winter due to high photosynthetic rate. Chloride is considered to be an important factor as it is one of the essential ions in assessing the status of natural water bodies (Hutchinson, 1957). In the present study, the values of chlorides ranged between 27.0 to 70.7 mg/l. Krishnamoorthi

and Selvakumar (2010) recorded the chloride values ranging from 46 to 363 mg/l in summer, 65 to 18 mg/l in winter and 9 to 22 mg/l in rainy season. The maximum value of chloride reaches in summer. The present findings agree with Pawar and Pandarkar (2011). The concentration of chlorides increases with the degree of eutrophication. The total hardness of water varied between 96.7 to 142.0 mg/l. The optimum values of hardness range between 75 to 150 mg/l supports fish productivity (Das, 1996). Rama Devi (2007) reported the maximum value as 122 mg/l during early monsoon in the months of June and the minimum as 94 mg/l during late monsoon in the November in Alisagar Dam reservoir, Thanakalan village, Nizamabad. Pawar and Pandarkar (2011) worked on water quality values ranged between 90 (July) and 166 (September) and concluded that minimum in post monsoon, maximum in summer season. During the present study biological oxygen demand valued of water varied from 3.4 to 11.1 mg/l. Similar observation has also been made by Shiddamallayya and Prathima (2008) and Krishnamoorthi and Selvakumar (2010). Various physico-chemical factors in the reservoir play an important role for augmenting the fish distribution and their yield capacity. Therefore, it is necessary to determine the dynamic effects of environmental factors on fish growth (Sugunan *et al.*, 2000). The environmental variability also strongly influences the fish population. Many physico-chemical parameters of water have been implicated in the initiation of maturational and reproductive events in some fishes.

Table 2 : Fish diversity of Dharmasagar reservoir during October, 2008 to September, 2009

Sr. No.	Local name	Zoological name	Family	Order
1.	Chandamama	<i>Salmostoma bacila</i> (Hamilton)		
2.	Kodipe	<i>Ambly phaiyngodon mala</i> (Hamilton)		
3.	Bangaru theega	<i>Cyprinus carpio carpio</i> (Linnaeus)		
4.	Budda parka	<i>Punctius titu</i> (Hamilton - Buchanan)		
5.	Budda parka	<i>P.cosualis</i>		
6.	Rohu	<i>Labeo rohita</i> (Hamilton - Buchanan)	Cyprinidae	Cypriniformes
7.	Bocche	<i>L. potil</i> (Sykos)		
8.	Merige	<i>Cirrhinus mrigala</i> (Hamilton - Buchanan)		
9.	Botcha	<i>Catla catla</i> (Hamilton - Buchanan)		
10.	Jella	<i>Mystus bleeker</i> (Day)		
11.	Valuga	<i>Wallago attu</i> (Schneider)	Siluridae	
12.	Marphoo	<i>Clarias batrachus</i> (Linnaeus)	Clariidae	
13.	Pandiparka	<i>Nandus nandus</i> (Hamilton)	Nandidae	Perciformes
14.	Paapera	<i>Mastacembelus armatus</i> (Lacepede)	Mastacemblidae	
15.	Malapankidi	<i>Channa orientalis</i> (Hamilton)		
16.	Mottapilla	<i>C. punctatus</i> (Bloch)	Channidae	Channiformes
17.	Korramatta	<i>C. striatus</i> (Bloch)		
18.	Vollenka	<i>Notopterus notopterus</i> (Pallas)	Notopteridae	Osteoglossiformes

Conclusion:

It is concluded that the values of hydro-chemical parameters of Dharmasagar reservoir are within the permissible limits. Therefore, the reservoir is suitable for fish culture and it is observed that major carps are most diversified in Dharmasagar reservoir.

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