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Studies on Water Chemistry and Fish Production of Manchar Lake, Dadu, Sindh (Pakistan)

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Abstract: An ecological survey of Manchar lake was carried out during 1998-99, Water samples were analyzed, viz: water temperature, light penetration, pH, alkalinity, conductivity, salinity, total dissolved solids, total hardness, phosphates, chlorides and dissolved oxygen.
Water quality analysis indicated salinity (1.8-3.9 g/l), pH (7.4-8.7) and hardness (614-1000 mg/L).
Thirty Two fish species have been recorded, among these 13 commercial species are harvested on regular basis. Fish production is estimated to be 500 metric ton/year.
The physico-chemical parameters of lake water are towards higher side for a typical fresh water body. Thus the decrease in the fish population in Manchar lake may be attributed to higher values of environmental factors.

Key words: Water quality, Fisheries, Manchar Lake

Introduction

Manchar lake is located at a distance of about 18 km. away from Sehwan. It is a vast natural depression flanked by the Khirthar mountain range in the west, the Lakhi hills in south and the river Indus in the east. The lake provides habitates for a diversity of life including significant population of fish, migratory birds, aquatic macrophytes, Benthose, Invertebrates and Plankton that are of use to man and animals. The lake covers an area between 60-200 sq. km.

Water enters into the lake from three main sources (a). Aral and Danister canals, (b). The Main Nara Valley Drain which was constructed in 1932 with Sukkur Barrage command area. It is an old abundant distributary of Indus river. The water quality of this drain has been badly effected after the construction of drainage projects of Right Bank Outfall Drain (RBOD). These drainage projects started pouring effluent into Main Nara Valley Drain (MNVD), (c). Water also enters into Manchar Lake from numerous hill torrents of Khirthar mountain during rainy season.

Ecological studies on the lakes of Sindh are very few. Report on Keenjhar Lake (Baqai and Rehana, 1973; Siddiqu *et al*., 1973; Nazneen, 1980). Haleji Lake (Baqai *et al*., 1974; Saqib, 1990) Hub Lake (Iqbal, 1988). Baker Lakes complex (Jafri, 1997; Leghari *et al*.,1997) can be mentioned in this connection.

Some studies have been carried out on the biological conditions of Manchar lake by Prashad and Mukerji (1930), Baig and Khan (1976), Hussain (1961) and Khuhawar and Mastoi (1995) have published some data on chemical conditions of this lake.

Ecological changes in aquatic life depend upon the physico-chemical environmental characteristic of water bodies. The present study provides information about the influence of physico-chemical factors on fish production of Manchar Lake.

Materials and Methods

Five sampling stations were selected from entire lake for the sampling of water and fish (Fig. 1). Sampling was carried out between 7.00 am and 4.00 pm at monthly intervals.

Physical factors such as, temperature of water, depth and transparency (secchi disk measurement) were carried out in the field. In the laboratory, chemical factors, pH of water was measured with Orion Model 420 A pH meter, electrical conductivity, total dissolved solids and salinity of water was measured by WTW 320 conductivity meter, total alkalinity, dissolved oxygen, total hardness, chlorides and orthophosphate were determined by using the standard methods for the examination of water and waste water (APHA, 1976).

Fish specimen were collected from fish landing centres, fresh fish samples were caught with various net. Data of fish production was collected from fish traders at Sehwan and Bubak landing centres.

Results

Temperature of water varied between 17-34°C. The lake is shallow with observed water depth within range of 5-11 feet. The maximum depth was observed in November-December.

The transparency values varied from 23-65 inches, Dissolved oxygen varied between 4.3-8.4 mg/l, pH of lake water was observed within the limits of 7.4-8.7, total alkalinity remained 141-240 mg/l ($CaCO_3$). Total hardness recorded between 614-934 mg/l ($CaCO_3$) Estimation of salinity showed variation 1.7-3.9 g/l, Conductivity was within the range of 3.6-7.8 ms/cm, The minimum TDS contents were 2239 mg/l while maximum were 4865 mg/l, Orthophosphate range from 0.11-0.36 mg/l. Chlorides were in the range of 700-1673 mg/l (Table 1).

Fishery: Fish community of Manchar Lake is diverse, consisting mainly of Carps, Catfishes, Snakeheads (Murrals), Spinyeels and Tilapia. 32 species have been recorded which includes 13 species of commercial value. The Major Carps, (*Labea rohita, Cirrhinus mrigala* and *Catla calla*), *Cat fishes* (*Wallago attu*, *Mystus singhara* and *Hateropneustes fossils*), *Murrels* (*Channa marulius*, *Channa punctatus*) and (*Oreochromus massambicus*) (Table 2). It appears from the available data that average fish production is about 45 mt/month (Table 3).

Discussion

Manchar is a shallow lake, having a saucer shaped basin. The depth and area of the lake is variable depending upon

Table 1: Physico-chemical variables of Manchar Lake

Parameters	1998							1999				
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Temp. of water°C	32.00	29.00	34.00	30.00	24.00	19.00	18.00	17.00	19.00	25.00	29.00	32.00
Visibility: (inches)	23.00	23.00	26.00	27.00	28.00	28.00	46.00	55.00	38.00	65.00	42.00	45.00
Depth (teet)	7.50	6.40	7.90	8.50	10.50	11.00	11.00	10.50	10.00	6.50	7.0	5.0
Dissolved Oxygen: (mg/l)	4.90	4.76	5.14	4.30	4.80	7.30	6.50	7.20	8.42	4.82	5.90	6.52
pH	8.02	7.97	8.07	7.40	7.40	7.60	8.10	8.70	7.90	7.40	8.5	7.68
Total Alkalinity (mg/l ($CaCO_3$)	166.00	184.00	219.00	173.00	158.00	160.00	221.00	240.00	213.00	141.00	146.00	155.00
Hardness: (mg/l (Ca mg)	934.00	918.00	750.00	715.00	614.00	648.00	768.00	714.00	827.00	832.00	844.00	902.00
(Orthophosphate (mg/l)	0.35	0.36	0.26	0.27	0.12	0.11	0.12	0.19	0.27	0.26	0.27	0.31
TDS: (mg/l)	4865.00	3216.00	2996.00	3072.00	2239.00	2270.00	2516.00	2963.00	3588.00	3677.00	3825.00	4486.00
Chloride: (mg/l)	1536.00	1673.00	1063.00	850.00	716.00	765.00	700.00	700.00	818.00	1293.00	1205.00	1329.00
Salinity: (g/l)	3.90	2.70	2.70	2.40	1.80	1.80	1.80	2.4	2.8	2.7	2.8	3.1
Conductivity: (ms/cm)	7.89	5.38	4.83	4.95	3.61	3.67	3.90	4.56	5.60	5.98	5.90	6.41

Table 2: List of fishes

Carla catla *
Labeo rohita *
Labeo calbasu *
Labeo gonuis *
Puntius sophoro
Puntius ticto
Cirrhinus mrigala *
Cirrhinus reba
Salmostoma bacaila
Barbus sarana
Ostioterama cotio
Mystus vittatus
Mystus cavasius
Clupisoma garua
Wallago attu *
Ompok bimaculates
Heterapneustus fossilis *
Rita rita *
Mystus bleekri
Gudusia chapra
Notopterus notopterus
Notopterus chitala *
Channa morulius *
Channa punctatus
Channa striatus *
Xenentodon Cancila
Chanda ranga
Mastacembelus armatus *
Mastacembelus pancalus
Macrognathus lacepda
Oreochromis mossambicus *
Glossosobuis guteum

* Commercial Fishes

Table 3: Fish production at 2 landing centres

Fish species	June	July	August	September
Bubak				
Channa morulius	8.516	1.288	2.171	1.602
Channa punctatus	0.988	0.381	3.003	5.764
Mastacemblus armatus	5.434	4.162	0.978	-
Wallago artu	0.434	0.018	-	-
Barbus sarana	-	0.081	-	0.088
Oreochromis mossambicus	-	-	1.024	0.350
Cirrhinus reba	-	-	1.456	3.016
Sehwan				
Channa morullius	6.006	4.200	3.500	45.000
Wallago attu	2.400	1.200	2.500	2.050
Oteochromus mossambicus	2.305	1.980	1.850	1.690
Mastacembalus armats	13.22	5.360	7.510	4.613
Labeo rohita	-	-	8.400	14.400
Carla catta	-	-	6.000	7.200
Cirrhinus mirgala	-	-	10.800	3.600
Total (m/t)	38.88	19.67	48.882	48.873

Table 4: Comparision of fish production of manchar lake. About 50 years ago

Year	Fish Production earliar data reported from Hussain (1961) in m.t
1944	2,304
1954	876
1957	943
1959	852
1960	919
1998 (Present study)	500

influx of water. Manchar lake area varied between 14-200 Sq.rniles. The area of the lake has been reduced to 30-100 Sq.miles (Table 4), after the construction of regulators on Aral and Danister canals and the Manchar containing bund (Hussain, 1961).

The water level (depth) varies with the seasonal change in the quantity of water which enters the lake. Present depth has been recorded from 5'-11'. The level decreases to 3.5'- 4' in dry season. In 1958, the lake has dried completely due to extremely dry summer conditions (Hussain, 1961). Seasonal fluctuation of physico-chemical parameters, a similar rise in dissolved oxygen contents in winter season has been reported by different workers (Singh *et al.*, 1980; Rao, 1986) due to reduction in microbial decomposition of dead organic matter, low organismal respiration demand, increased growth of submerged macrophytes and solubility of atmospheric oxygen by reduction in temperature. The results of pH and alkalinity values indicated that the lake water remained slightly alkaline throughout the period of study due to the inflow of sufficient amount of water through Indus river, hill torrents and MNV Drain. The permissible value of hardness by WHO is 200 mg/l. The hardness of lake water is above the WHO (1984) guide line. This increase in the water hardness could be due to the inflow of rain water from hill torrents of Khirthar mountain. Salinity, Conductivity and TDS were substantially high, this probably indicates that there could be some contamination of domestic sewage and agricultural waste water supply from MNV Drain. The chloride is a pollution indicating parameter i.e. related to the sewage contamination with degradation products. The WHO gives 250 mg/l of chloride as an acceptable value for drinking water. The salinity of water is the main factor which can effect the life of plants and animals, Khuhawar and Mastoi (1995) have also reported higher salinity of

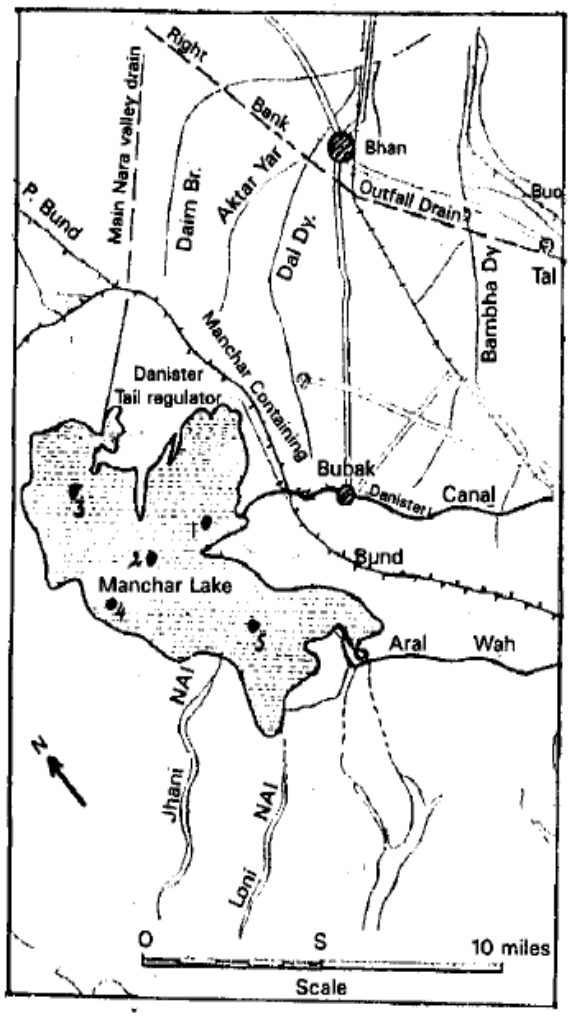

Fig. 1: Map of Manchar lake showing sampling stations

water in this lake. The seedlings of commercial fish species like *Labeo rohita, Cirrhinus mrigala* and *Carla catla* are very sensitive and can not tolerate the higher range of salinity. The physico-chemical variable of Manchar lake when compared with other lakes of Sindh, such as Keenjhar lake (chloride 38.9 mg/l, salinity 0.05, alkalinity 200 mg/l), (Khuhawar *et al*., 1998) Haleji lake (alkalinity 525 mg/l, chloride 75, TDS 338 mg/l) (Khuhawar *et al*., 1998), Hamal lake (hardness 670 mg/l, chloride 1750 mg/l, alkalinity 275 mg/l), (Khuhawar *et al*., 1998), Baker lake (TDS 580 mg/l, alkalinity 550 mg/l, hardness 210 mg/l) (Jafri, 1997) and Hub Dam (transparency, 2.1-3.3 m, pH 6.8-7.5, dissolved oxygen 3.1-5.3 mg/l, salinity 0.15-25 ppt., dissolved solids 502 ppm) indicated that all these lakes still retain the typical fresh water characteristics despite progressive eutrophication. In Manchar lake the process of eutrophication is at its extreme due to shallowness of the basin, but the whole range of chemical parameters have gone up, beyond the permissible limits, recommended by the WHO (1984).

Very skatchy data is available regarding the early record of number of fish species and fish production of Manchar lake. Prashad and Mukerji (1930) recorded 36 species including Hilsa ilisha, recorded 43 species, Baig and Khan (1976) reported 40 species while in the present study only 32 species have been recorded.

Table 4 indicates the variation of fish production in Manchar lake. The present low production of 500 mt/y may be attributed to higher alkalinity, hardness, salinity and chloride contents of lake water.

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