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HYDROLOGICAL STUDIES OF LYARI RIVER

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INTRODUCTION

Several small rivers flow in the province of Sind. Besides the well known Indus, the Lyari is one of such rivers. It is a small ephemeral stream that bisects Karachi, the largest city and port of Pakistan and flows into the Arabian Sea at the Monora channel. It is essentially a seasonal river carrying the collected water after the rains in the catchment area. The total length of the Lyari river is 50 km. Large quantities of unregulated waste water, sewage and industrial effluents are discharged in this river in Karachi and these effluents naturally affect the ecology of the river and have produced in turn, effects on biota [1]. To see the effect of discharge of these effluents, six collection centres were chosen on the course of this river in Karachi.

MATERIAL AND METHODS

Lyari river was divided into six parts in Karachi for limnological studies and samples were collected once in a month from the following stations on the course of the river: (i) Ahsanabad, (ii) Sohrab Goth, (iii) Gulshan-e-Iqbal, (iv) New Karachi, (v) P.I.B. Colony and (vi) West Wharf (Fig. 1).

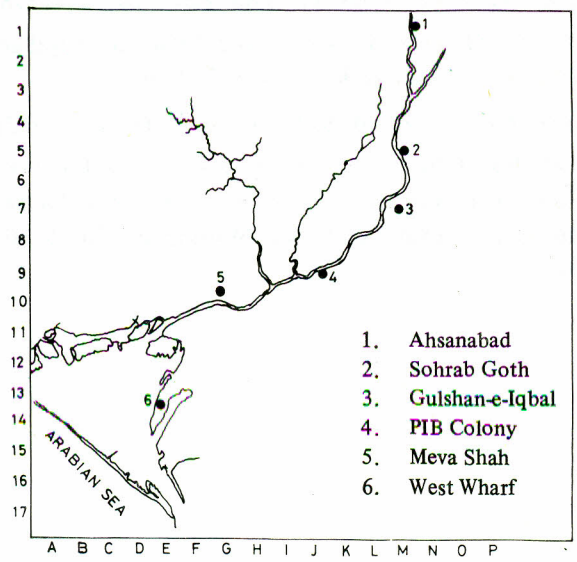

Fig. 1. Map showing Lyari river within Karachi.

The width of the shore line was determined by the transverese survey method [2]. The level or depth of the water was recorded by hook guage method [2]. The colour of the water was noted by the naked eye. Light penetration level was recorded by the Secchi disc method [2]. The temperature of the water was measured directly with the thermometer of 100° range. The pH of the water was determined by the Merck pH paper. The salinity was measured by Mohr's method given by Mackereth [3]. Dissolved oxygen was estimated by the Winkler procedure [2] and free CO_2 was titrated against N/44 sodium hydroxide as described by Welch [2].

RESULTS

Physico-chemical studies of Lyari river lasted for one year i.e. from Nov. 1983 to Oct. 1984 from stations 1 – 6 (Fig. 1). The ecological factors observed are shown in Table 1. Some salient features are given below.

Margin of the river	Generally sandy but rocky and swampy at stations 1 and 6.
River bed	Usually muddy but sandy at stations 5 and 6.
Width of the shore line	Usually between 20.6 to 34.0 m. but wider at station 6 due to over-flow during rainy season.
Water level	Usually between 20.0 to 100 mm but deeper at station 6.
Colour of water	Light green to silty due to mixing of sewage and industrial wastes; greenish in colour at stations 1-3 due to algal growth but silty at station 4 and blackish at station 6.
Light penetration	Maximum light penetration at stations 1-3 but negligible at stations 5

and 6 due to high mixing of city wastes.

Temperature — 21° (station 3; January 1984) to 35° (station 6; June 1984).

Salinity — 1-16 ‰ minimum (0.7 to 1.7 ‰) at station 3 and maximum at station 6 during September and October due to backflow of the Arabian sea.

pH — 7 – 8

Dissolved oxygen — 0.93 to 1.13 ppl. High values at stations 1-3.

Free carbon dioxide — 0.1 (stations 1-3) to 22.0 ppm. (station 5).

DISCUSSION

The water of the river appears greenish with high light penetration, neutral pH, low carbon dioxide, high oxygen content, minimum salt content at stations 1-3 (Table 1) indicating it to be freshwater (4). The greenish colour

Table 1. Variations in physico-chemical parameters at station 1 – 6.

Parameters	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July	Aug.	Sept.	Oct.
Width of the shoreline	7.17	10.20	11.0	9.03	14.25	13.10	14.20	5.62	13.22	14.0	15.17	15.0
(in meters) St. 1–5	to	to	to	to	to	to	to	to	to	to	to	to
	30.23	22.25	23.0	22.02	31.7	27.0	25.0	29.11	34.0	26.19	26.19	26.25
St: 6	56.0	=	17	=	29	"	"	=	"	=	"	=
Water levels (in mm)	44.0	37.5	37.5	35.0	37.5	32.5	37.5	35.0	50.0	46.25	35.0	30.0
St. 1–5	to	to	to	to	to	to	to	to	to	to	to	to
	50.0	40.5	40.9	65.5	62.0	50.0	100	50.5	75.0	72.10	40.12	38.5
St. 6	60	"	=	50	"	50	"	"	"	"	"	"
Light penetration	35.0	27.5	27.5	31.25	32.5	30.0	27.5	40.0	45.0	35.0	25.0	23.5
(in mm)	to	to	to	to	to	to	to	to	to	to	to	to
St 1–4	43.75	37.5	42.5	55.0	95.0	75.0	92.5	66.5	62.5	66.17	60.1	35.0
St. 5	17.5	15.0	15.0	42.5	42.5	32.5	20.0	42.5	42.5	37.5	37.5	32.5
St. 6	45	32.5	32.5	45.0	47.5	45.0	Neg	Neg	Neg	Neg	45.0	44.0
Temperature (°C)	22–25	22.3	22	22.8	24	27	32	28	27	27	25	25
St. 1–6		to	to	to	to	to	to	to	to	to	to	to
		25	25	26	29	29	35	32	30	28	30	29
Salinity (°/₀₀)	1.3	0.7	0.5	1.4	1.4	0.5	0.5	o.5	1.0	1.3	0.2	0.2
St. 1–5	to	to	to	to	to	to	to	to	to	to	to	to
	20.0	1.9	0.2	1.5	1.5	1.0	1.3	1.2	1.6	2.4	1.7	35.5
St. 6	5.0	4.0	3.0	14.0	14.0	3.0	8.0	15.0	32.0	8.0	35.5	42.0
Dissolved oxygen (ppl)	Neg	Neg	Net	1.44	Neg	Neg	1.30	1.30	1.13	0.02	0.56	0.56
St. 1–6	to	to	to	to	to	to	to	to	to	to	to	to
	1.33	1.55	1.15	1.55	1.44	1.44	Neg	Neg	1.25	1.22	1.25	1.27
Free carbon	0.1	1.0	1.0	2.0	1.0	2.0	4.0	0.4	6.0	6.0	10.1	0.1
dioxide. (in ppm)	ro	to	to	to	to	to	to	to	to	to	to	to
St. 1–5	2.5	3.0	2.2	4.0	3.0	3.0	5.0	4.0	10.0	12.0	14.0	14.0
St. 6	1.0	1.0	1.0	1.0	4.0	4.0	4.0	0.5	8.0	14.0	11.0	1.0
pH												
St. 1–6	7	7	7	7	7–8	7	7–8	8	7–8	7	7	7

Table 2. Fauna and flora of the Lyari river.

Freshwater region	Estuarine region
Molluscs	Molluscs
Gastropods	Gastropods
1. *Gabbia orcula*	1. *Agaronia nebulosa*
2. *Gyraulus euphraticus*	2. *Babylonia spirata*
3. *Indoplanorbis exustus*	3. *Bursa echinata*
4. *Larina burmana*	4. *Cerithium splendens*
5. *Lymanaea* spp.	5. *Littorina* (*Littorinopsis*) *Scabra scabra.*
6. *Melania tuberculata*	6. *Nerita* spp.
7. *Physa* spp.	7. *Nassarius* spp.
Bivalves	8. *Pyrula ficus*
1. *Corbicula* spp.	9. *Telescopium telescopium*
2. *Lamellidens* spp.	10. *Tibia curta*
3. *Parreysia* spp.	11. *Tonna dolium*
Fishes	12. *Turbinella* spp.
1. *Aphanius disper*	Bivalves
2. *Aplocheilus panchax*	1. *Anadara granosa*
3. *Channa* spp.	2. *Barbatia fusca*
4. *Molliensia latipinna*	3. *Codakia fisheriana*
5. *Puntius* spp.	4. *Perna viridis*
6. *Tilapia mossambica*	5. *Pelecyora trigona*
Insects	6. *Scapharca* (*Cunearca*) *clathrata*
1. Back swimmer	7. *Tellina* spp.
2. Nepa	8. *Timoclea imbricata*
3. Dragon fly nymphs	9. *Trisidos tortuosa*
4. Hydrophilus	Fishes
5. Stonefly nymphs	1. *Mugil* spp.
Acquatic weeds	2. *Tilapia mossambica*
1. Hydrilla	
2. Valisnaria	
3. Lemna	
Algae	
1. *Anabeena*	
2. *Aphanizomena*	
3. *Flosaquae*	
4. *Fragilaria*	
5. *Gamphosphaeria*	
6. *Gyrosegma*	
7. *Navicula*	
8. *Spirogyra*	
9. *Zygnema*	

indicates rich algal growth with algal mats floating on the surface. The colour however becomes silty during rainy season in this region also. The high oxygen content in freshwater areas of water occurs due to the continuous movement of water [5]. High oxygen content and rich algal growth indicate eutrophy [6,7,8]. The fauna and flora of this part mostly comprise freshwater species (Table 2). It could be utilized easily for productive purposes to cultivate fishes of nutritive value by creating fish ponds adjacent to river bed.

As the river advances the water rapidly becomes polluted due to the mixing of various effluents [9] the water at stations 4 and 5 appears silty or blackish, showing high turbidity with an alkaline pH, low light penetration, negligible oxygen content and high contents of free carbon dioxide (Table 1). The poor algal growth in this area shows pollution of the river by sewage and industrial wastes indicating distrophic condition of the water [10 and 11]. Although this part of the river is totally lacking in fauna, it could be used for the cultivation of some tolerant species like *Tilapia* spp. after frequent cleaning of these areas from polluted materials.

The water in this area possesses bad odour, resulting in unhygenic atmosphere for the inhabitants in the vicinal regions.

The last part of the river is deltaic or estuarine region [12]. This area shows mostly marine species of molluscs (Table 2) with other marine habitat (Table 1).

It can be seen that the course of the river can be divided easily into three parts (i) freshwater, stations 1-3; (ii) polluted (stations 4 to 5); and estuarine (station 6).

Our studies indicates an alarming level of pollution of this river. If this pollution is allowed to continue at the present rate then the whole flora and fauna of the river would vanish, creating an ecological disbalance. Immediate steps should be taken by the Government to decrease the level of pollution in the river and make water cleaner through out its course.

Key words: Hydrological studies, Lyari river, Limnological studies.

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