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SOME HYDROGRAPHIC FEATURES OF KORANGI-PHITTI CREEK

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ABSTRACT

Present study describes for the first time some hydrographic features (temperature, salinity, dissolved oxygen and pH) and their seasonal variations in Korangi-Phitti Creeks based on data collected during 1999-2001. Results showed that surface water temperature generally varied from 25-34°C during summer months (March–October), 19-27°C during winter months (November–February). Low temperature 19°C was recorded in the month of February 1999 at Port Qasim. Higher surface water temperature 34°C was recorded in May 2000 at Korangi Creek and in September 2001 at Port Qasim. In general high atmospheric temperature correspond with the high surface water temperature however at some stations during low tides the surface water temperature was slightly higher than the atmospheric temperature. Salinity in the Korangi creek ranged from 34‰-45‰ with maximum 45‰ at Port Qasim area during the SW monsoon in the month of September 2000. Lowest salinity 34‰ was observed at Port Qasim in the transitional period (April). Dissolved oxygen ranged from 2.2 mg/l to 10.75 mg/l with minimum of 2.2 mg/l in the month of February 2001 at Port Qasim during the NE monsoon and maximum 10.75 mg/l in the month of February 2000 during the NE monsoon.

Key-words: Hydrography, Korangi-Phitti Creek

INTRODUCTION

Information on hydrography of the northern Arabian Sea along the coast of Pakistan is very meager. Ali-Khan (1976, 1977 and 1989); Ali-Khan and Ali-Khan (1978); Ahmed *et al.,* (1995); Banse (1990) described the hydrographic features of offshore waters on data collected from different research vessels. Few studies that dealt with general hydrography of creeks and backwaters areas situated on the west coast of Karachi are Ahmed and Rizvi (1981), Hussain and Samad (1995) and Sultana and Mustaqeem (2003). Towards the coast of Karachi is the Indus delta flowed through Kalri branch (presently known as Gharo Channel) which spread in 64,000 ha into a network of creeks that includes the Korangi-Phitti Creeks (24°44'N to 67°15'E - 24°47'N to 67°20'E) (Meynell, 1995). This area has been neglected such that no study on the hydrography has appeared. Korangi-Phitti and Khuddi Creeks represent the remains of the Kalri course. The Korangi, Phitti and Gharo Creeks are tidal creeks with same salinity as that of coastal water (Haq, 1976); Korangi Creek is 20 km in length, 1,350 m wide and has average depth of 15 meters. The complex network of Korangi and adjacent creeks has vast mangrove dominated areas which create a highly productive ecosystem however no information on the hydrography of the creeks is available in the literature. Present study describes some detail of hydrographic data (temperature, salinity, dissolved oxygen and pH) of the Korangi-Phitti Creeks and there observed changes during the NE, SW and transitional periods from February 1999 to December 2001.

MATERIALS AND METHODS

During the present study Korangi-Phitti Creek system was treated as three major regions: 1. Port Qasim 2. Ganglaro Creek and 3. Korangi Creek. Total 123 samples were obtained from all three regions. At Port Qasim region samples were taken at localities Muzhar point (Latitude 24°47'39N, Longitude 067°17'38E), Port Qasim (Lat. 24°46'40N, Long. 067°19'58E), Thermal power (Lat. 24°46'30N, Long. 067°22'59E), Chara Creek (Lat. 24°44'07N, Long. 067°15'11E), Isaro Creek (Lat. 24°46'45N, Long. 67°22'38E), Kadairo Creek (Lat. 24°47'11N, Long. 067°17'35E), Shah Hasan (Lat. 24°46'24N, Long. 067°23'09E) and Bhambore (Lat. 24°46'27N, Long. 067°26'50E). At Ganglaro Creek region (Lat. 24°47'03N, Long. 067°17'43E) sampling was made at one station and at Korangi Creek region samples were taken from stations located at Korangi Creek (Lat. 24° 46'55N, Long. 67°17'33E), Phitti Creek (Lat. 24°45'40N, Long. 67°12'50E), Shun Creek (Lat. 24°43'23N, Long. 067°12'01E), Jharri Creek (Lat. 24°45'23N, Long. 67°12'11E), Rattu Kot (Lat. 24°44'07N, Long. 67°15'11E), Sangi Wali (Lat. 24°45'39N, Long. 67°21'23E), Kurgi Channel (Lat. 24°47'28N, Long. 67°11'59E), Babri Creek (Lat. 24°42'31N, Long. 67°22'53E), Dhonde Wali (Lat. 24°44'24N, Long. 67°18'57E), Sipli Creek (Lat. 24°43'20N, Long. 67°19'55E), Babri Wali (Lat. 24°44'31N, Long. 67°20'46E) and Lut Busti (Lat. 24°48'48N, Long. 67°14'39E). All stations are marked in map Fig. 1.

Temperature was measured by thermometer; dissolved oxygen (mg/l) was measured by DO meter, model no. 9071 (Jenway), provided with two probes, one with membrane for DO detection and the other temperature probe; sometimes Wrinkler's method of titration was also used to estimate DO; pH was determined by using pH paper strips; refractometer (precision 0.1%) model S-Mill-E, Atago Co. Ltd was used to read salinity; Global Positioning System (GPS) Tracker (Magellan Corporation) was used to navigate the position at each sampling station; data on tidal level in meters was obtained from the tide table published by Hydrographic Department, Pakistan Navy; rain-fall data was obtained from the Computerized Data Processing Centre, Meteorological Department, Karachi, Government of Pakistan. Monsoon period, Southwest (SW) May-September, Northeast (NE) November-March and two transitional period April (1st) and October (2nd) was followed as described by Ali-Khan (1976/1977).

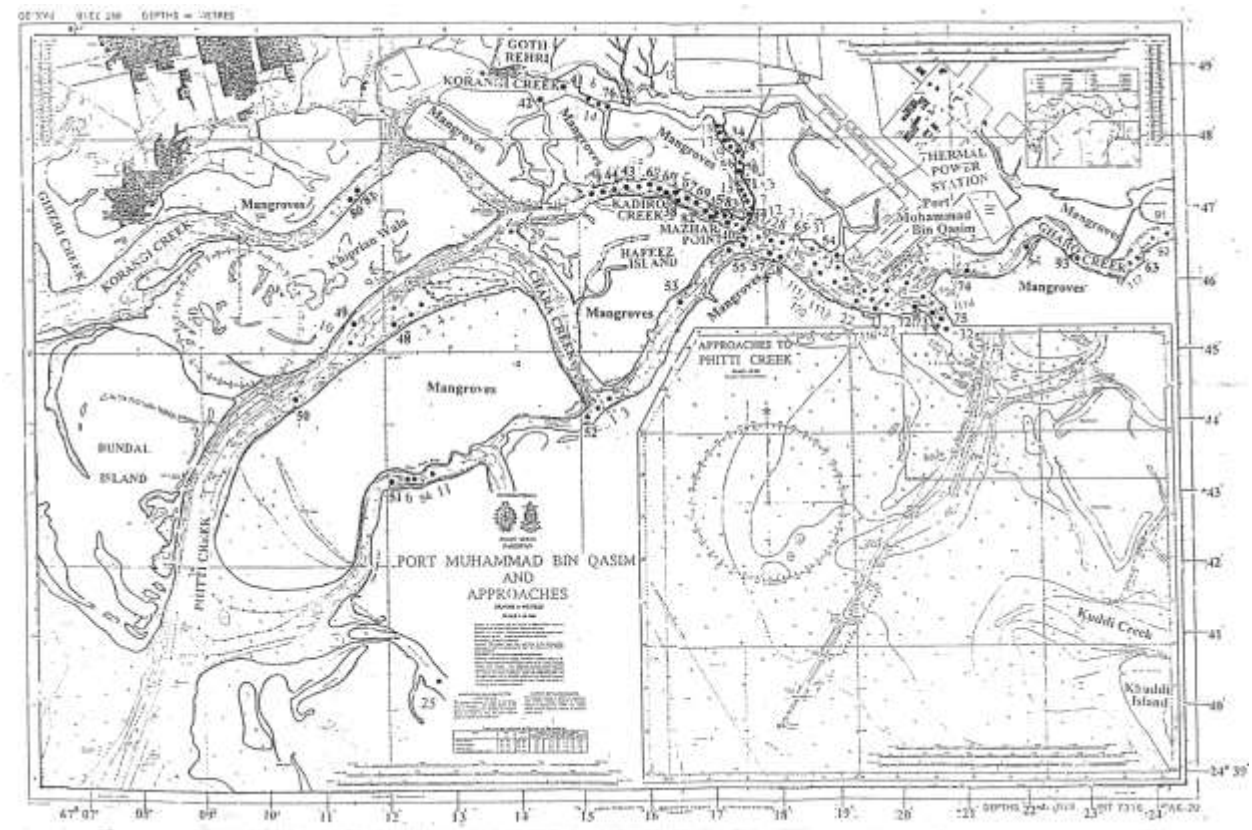

Fig.1. Study area Korangi-Phitti Creek showing sampling regions: 1. Port Qasim 2. Ganglaro Creek and 3. Korangi Creek

RESULTS

Temperature

Mean atmospheric temperature in Korangi-Phitti Creeks ranged from 28-33°C in summer (March-October) and 24-31°C in winter (November-February) during 1999 whereas mean surface water temperature varied from 26-31°C in summer and 20-27°C during winter. In 2000 mean atmospheric water temperature varied from 28-33°C during summer and 24-28.5°C during winter. Surface water temperature of Korangi-Phitti Creeks ranged from 28-31.5°C in summer and 21-25°C during winter. In 2001 during the summer, mean atmospheric water temperature was from 30-34°C and in winter 26-30.5°C during. Mean surface water temperature was from 27°C to 31°C during summer and 21-26.6°C during winter (Table 1 and Fig. 2a).

Analysis of atmospheric and surface water temperature during the two-monsoon (NE & SW) and transitional periods during 1999-2001 is shown in Table 2. During NE monsoon period of 1999, the mean atmospheric temperature was 27°C while mean surface water temperature was 24°C (n=6). In November 1999-March 2000, during NE monsoon season, mean atmospheric temperature was 27°C while mean surface water temperature was 23°C (n=5), and in NE monsoon season of November 2000-March 2001, the mean atmospheric temperature was

27°C while surface water temperature was 24°C (n=21) and in November-December 2001, the mean atmospheric temperature was 28°C while mean surface water temperature was 24°C (n=8) Table 2. The first transitional period of April 1999 was not available; in April 2000, first transitional period the atmospheric temperature was 32°C (n=1) while surface water temperature was 29°C. In first transitional period of April 2001, mean surface water temperature was the same 29°C (n=4). In SW monsoon (May-September) of 1999, the mean atmospheric temperature was 31°C while surface water temperature was 29.5°C (n=13). In 2000, mean atmospheric temperature was 31°C while surface water temperature recorded was 30°C (n=29); and in 2001, mean atmospheric temperature was 32°C while mean surface water temperature was 30°C (n=22). During the second transition period of 1999 (October) mean atmospheric temperature was 31°C while mean surface water temperature was 30°C (n=3), in 2000, mean atmospheric temperature was 33°C while the mean surface temperature was 30°C (n=11) and in 2001, mean atmospheric temperature was 33°C while mean surface water temperature was 30° C (n=4) (Table 2). Area wise analyses of mean surface water temperature at Port Qasim ranged from 21°C in February 2000 and January 2001 to 34°C in September 2001; at Ganglaro Creek surface water temperature ranged from 21°C in February 2000 and January 2001 to 32°C in June 2000, and at Korangi Creeks region surface water temperature ranged from 19°C in February 1999 to 34°C in May 2000.

Salinity

The mean salinity in Korangi-Phitti Creeks in the year 1999 was 35-38‰, in 2000 was 34–40‰ and in 2001 was 35-41‰. The detail data is shown in Table 1 and Fig 2b.

During monsoon regimes, the mean salinity in NE monsoon (February-March) was 37‰ in 1999; 38‰ in November 1999-March 2000; 39‰ in November 2000-March 2001, and same 39‰ in November-December 2001. The mean salinity in the first transitional period (April) of 2000 was 34‰ and in 2001 was 41‰. During the SW monsoon (May-September) of 1999 mean salinity was 36‰; in 2000 was 37‰ and in 2001 was 39‰. In second transition period (October) mean salinity was 37‰ in 1999; 39‰ in 2000 and 37‰ in 2001 (Table 2).

Table 1. Mean atmospheric, surface water temperature, salinity, dissolved oxygen, pH and rainfall data recorded during sampling period 1999- 2001.
(rainfall data obtained from Meterological Dept., Govt. of Pakistan
* = No data).

Year / Months	Atmospheric Temp. (°C) mean	Surface water Temp. (°C) mean ± SD	Salinity (ppt) mean ± SD	Dissolved Oxygen (mg/l) mean ± SD	pH Mean	Rainfall (mm) Mean
1999						
February	24.5	20±1.41	36±2.12	5.89±0.72	7	1.2
March	28.25	26±1.5	38±0.0	4.21±0.25	7	1.8
April	*	*	*	*	*	0.0
May	33	31±0.0	38±1.0	3.46±1.08	7.5	0.2
June	32.25	30 ±0.0	37±0.70	7.1±1.18	7	TRACE
July	29	28±0.0	35±0.0	6.11±0.0	7	0.2
August	29.5	28.5±0.0	36±0.70	4.64±0.70	6.8	TRACE
September	32	29±0.0	36±0.0	7.45±0.0	7	0.0
October	31.66	30±0.28	37±1.73	4.3±0.32	6.8	4.0
November	31	26±0.0	38±0.0	5.8±0.0	6.9	0.0
December	27	27±0.0	37±0.0	6.0±0.0	7	0.0
2000						
January	24	22±0.0	36±0.0	7.33±0.0	7	19.0
February	28.5	21±0.0	40±0.7	10.05±0.98	7	3.0

March	*	*	*	*	*	0.0
Table 1 Cont'd….						
April	32	29±0.0	34±0.0	3.9±0.0	7	0.0
May	32.84	31.2±1.5	38±0.5	4.77±1.17	7	TRACE
June	32.25	31.5±0.57	36±1.5	4.72±1.07	7	0.0
Table 1 cont'd…..						
July	28.33	28.6±0.51	35±0.0	5.4±1.27	7	TRACE
August	29.14	28.4±0.31	37±0.53	4.94±0.93	7	14.4
September	32	30.1±0.75	39±3.31	4.76±1.66	7	TRACE
October	33.54	30.4±1.12	39±2.3	4.66±2.03	7	0.0
November	27.66	25±0.4	40±0.0	7.66±0.81	7	0.0
December	27.5	23.5±0.25	39±1.15	8.2±0.29	7	0.0
2001						
January	26.7	21±0.31	40±1.5	4.3±0.40	7	0.0
February	28.5	24±1.23	39±0.81	3.21±0.85	7	0.0
March	30.17	27.5±1.57	38±1.5	3.47±0.35	7	0.0
April	32.5	29.7±0.72	41±1.0	3.7±0.24	7	0.0
May	33	31±0.27	40±1.89	6.35±0.71	7	0.0
June	31	29.8±0.44	39±0.44	4.5±0.95	7	8.0
July	30.5	29±0.0	35±0.70	2.65±0.21	7	52.5
August	31.4	30.2±1.64	38±1.34	6.5±1.70	7	14.5
September	34.16	31.3±1.50	40±0.40	7.45±0.41	7	TRACE
October	33.25	30±1.01	37±0.57	6.15±1.2	7	0.0
November	30.5	26.6±0.49	39±1.0	9.07±0.78	7	0.0
December	26	22.7±0.38	39±1.0	5.75±1.01	7	0.0

Mean salinity in the Port Qasim region ranged from 37-42‰ and highest salinity 45‰ was obtained during SW monsoon. Salinity in Ganglaro creek ranged from 34-41‰, the high salinity 43‰ was recorded during 2nd transitional period. In Korangi Creeks region mean salinity was 35-42‰ while high salinity 43‰ was observed during SW monsoon.

Dissolved Oxygen

The mean dissolved oxygen in 1999 was 3.46 to 7.45 mg/l; in 2000 was 3.9 to 10.05 mg/l; and in the year 2001 was 2.65 mg/l to 9.07 mg/l (Table 1 and Fig 2c).

The mean DO in the NE monsoon (February-March 1999) was 4.77 mg/l; in the NE monsoon of November 1999-March 2000, was 7.84 mg/l; in NE monsoon of November 2000-March 2001 was 5.05 mg/l and in the NE monsoon season of November-December 2001 was 7.41 mg/l. During SW monsoon (May-September 1999) the mean DO was 5.27 mg/l; 4.87 mg/l in 2000 and 5.92 mg/l in 2001. In the 2nd transition period (October) mean DO was 4.3 mg/l in 1999; 4.66 mg/l in 2000 and 6.15 mg/l in 2001. During 1st transition period (April) mean DO was of 3.9 mg/l in 2000 and 3.7 mg/l in 2001(Table 2).

The mean DO ranged from 3.4-9.35 mg/l at Port Qasim. During the NE monsoon the DO in this region showed fluctuations from 2.2 mg/l to 9.7 mg/l. During SW monsoon the DO ranged from 5.19-6.43 mg/l, in 1st transitional period DO was 3.4 mg/l and in 2nd transitional period ranged from 4.1-5.15 mg/l. Mean DO ranged from 3.7-7.5 mg/l at Ganglaro Creek. During the NE monsoon the DO showed fluctuations from 3.4 mg/l to 10.75 mg/l. In SW monsoon DO was 2.8 mg/l to 7.5 mg/l. In the 1st transitional period slight variations of DO was found (3.6-3.9 mg/l) while great variation was found in 2nd transitional period when DO ranged from 3.7-10.4 mg/l. In Korangi Creek area the mean DO values ranged from 3.4-7.3 mg/l. In SW monsoon low values of 2.5-3.6 mg/l was recorded. In this

region minimum surface oxygen values were comparatively higher from other regions. In the NE monsoon dissolved oxygen ranged from 3.0-9.8 mg/l; in the 1st transitional period DO was 3.9 mg/l, in 2nd transitional period DO was 4.67-6.8 mg/l (Table 3).

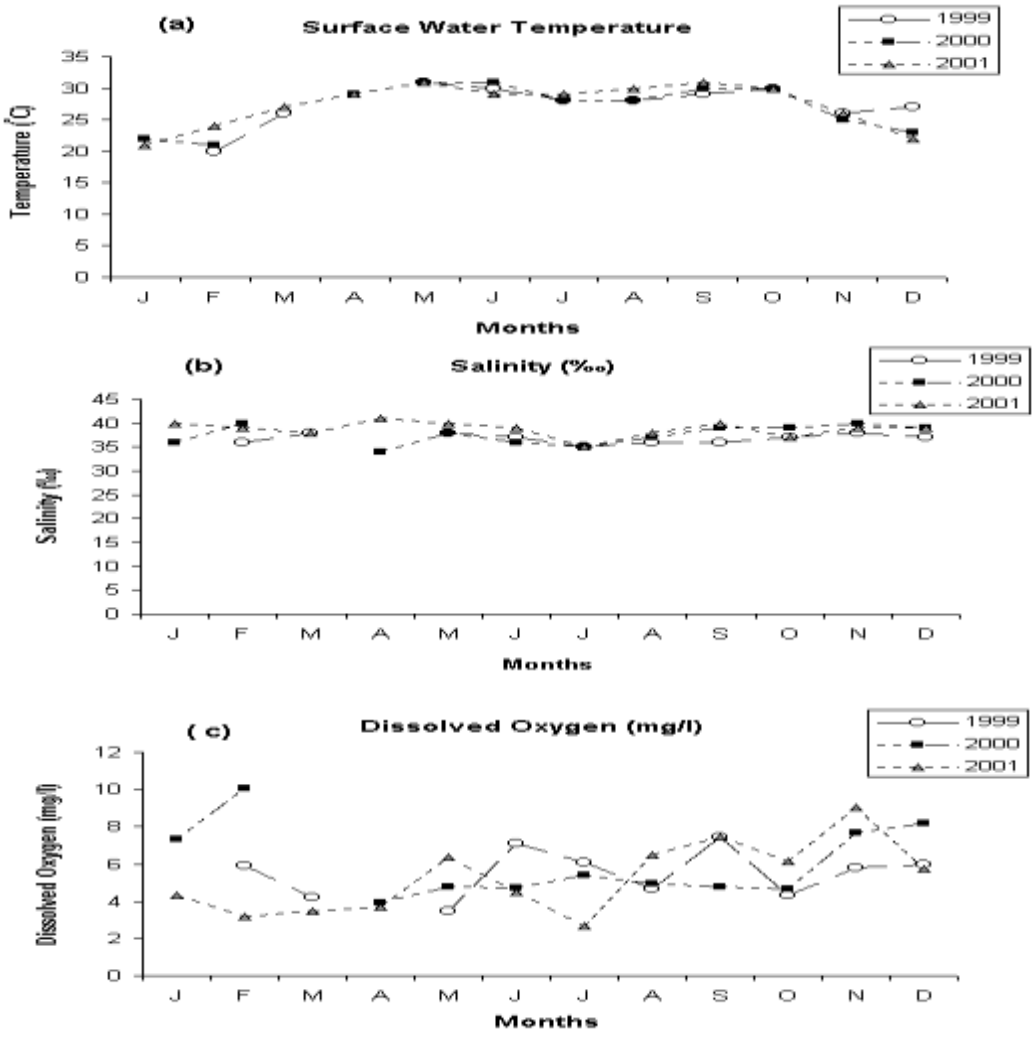

Fig.2. Mean hydrographic data taken at Korangi-Phitti Creeks system during Feb.1999 to Dec.2001. a) Mean surface water temperature °C; b) Mean salinity % ; c) Mean dissolved oxygen (mg/l).

pH

The pH values remained same (7) throughout the study period, slight change as 6.5-6.9 was noted just after rains (Table 1).

Rainfall

Usually rains are very scanty in the area, the data (Table 1) shows that during 1999 two periods of rainfall occurred; first during NE monsoon with 1.2-4.5 mm rainfall and second during SW monsoon season with very low 0.2 mm rainfall and during 2nd transitional period of October 4.0 mm rainfall was recorded. In the year 2000 mean rainfall in NE monsoon were 19.0 and 3.0 mm and in SW monsoon period (14.4 mm in August, while traces were recorded in May, July and September). During 2001 heavy outburst of rainfall was recorded in SW monsoon period, the heaviest rainfall (52.5 mm) was recorded in July; while in June and August rainfall was 8.0 mm and 14.5 mm; no rainfall was recorded in NE monsoon. There was no rainfall during 1st transitional period during 1999-2001 and in 2nd transitional period during 2000-2001.

DISCUSSION

Korangi and Phitti Creeks are the tidal creeks having same topographical features. The depth of creeks varies from shallow water and at places the creeks are as deep as 15 m. The rains are scanty and it may occur once or rarely twice in a year which may have brings significant hydrographical changes. Because of insufficient freshwater discharge from Indus River the whole creek system can be treated as closed estuary (Harrison, 2004). Data obtained during 1999-2001 shows that surface water temperature generally coincides with the atmospheric temperature. Low temperature was observed in 1999 (19°C), 2000 and 2001 (23°C) in winter months during NE monsoon. Similar studies from backwaters of Sandspit, west coast of Karachi showed low temperature 19°C; 20°C and 21°C (Javed and Mustaquim, 1993; Saeed *et al*., 1995; Hussain and Samad, 1995; Sultana and Mustaquim, 2003). The study from open sea toward Karachi Nooruddin and Khursheedudin (1968) reported similar values of mean surface water temperature of 19°C in January and highest average of 30°C in the month of June. The uniform high and low temperature in the Korangi and Phitti Creeks system makes these creeks identical to the coastal areas of Karachi. Ramamurthy (1963) and Prasad (1957) reported high temperature of seawater in the north Kanara coastal water (India) and in Mandapam Sea (India). Detail investigation in summer months when SW monsoon prevail in the region revealed similar high surface water temperature with difference of 1–3°C from atmospheric temperature during May, June, July, August and September 2000 and August 2001 at Khudi Creek, Port Qasim, Ganglaro Creek and Golaro Creek. This double seasonal oscillation in the sea temperature has been attributed to the two monsoons on these coasts (Ramamurthy, 1963). Korangi Creek at places close to the open sea remains under the strong influence of the tropical monsoon regimes such that the temperature appears to have similar patterns of double seasonal oscillation similar to that mentioned by Ramamurthy (1963). Appearance of higher water temperature from that of atmospheric temperature was also observed with low tide during early morning hours. In July and September 2000 the air and water temperature was observed to be same at Rattu Kot area. In June, September and December 2001, the atmospheric and water temperature noted was same at Port Qasim, Ganglaro creek and Dhonde Wali areas at high tide.

Salinity in all regions of the Korangi Creek remained high, minimum 34‰ and maximum 45‰ with mean 35-38‰ in the year 1999; 34-40‰ in the year 2000 and 35-41‰ in year 2001. High saline areas were Jharri Creek and Port Qasim with salinity 39‰, 45‰ and 43‰ in the years 1999, 2000 and 2001 respectively. Salinity concentrations in monsoon periods also did not show any pronounce fluctuations except during second transition period (October) when salinity remained 37-38‰. Since the rain generally and during the study period was scanty low salinity was not observed in the Korangi Creek. Earlier studies from backwaters also reported high salinity as 40-44‰ in backwaters, tidal creeks and mangrove swamps of Korangi creek (Nooruddin and Khursheedudin, 1968; Ahmed and Rizvi, 1981; Saifullah and Taj, 1995).

Dissolved oxygen in the surface water was observed as low as 2.2 mg/l and as high as 10.75 mg/l during the present investigations. Low oxygen (3 ml/l to 6.55 ml/l) has been reported by Hussain and Samad (1995) and Sultana and Mustaquim (2003) from backwaters of Sandspit area, both of these studies suggest that pollution and decomposition of mangrove plants are possible cause. The occurrence of low oxygen zones has been reported during the study. The water with such low oxygen far towards the deeper part of creek creates anoxic condition forcing fishes to migrate results no catch.

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Table 2. Minimum, maximum and mean values of surface water temperature, salinity and dissolved oxygen during the NE, SW monsoon and transitional periods, 1999-2001.

Monsoon Season	**No. of samples**	**Mean Temperature**		**Minimum /Maximum Sea WaterTemperature**	**Mean salinity**	**Minimum / Maximum salinity**	**Mean**	**Minimum / Maximum Dissolved Oxygen**
		Atmosph.	**Sea Water**					
		^{0}C	^{0}C	^{0}C	ppt	ppt	mg/l	mg/l
NE monsoon (Feb.-Mar.99)	6	27	24	19 (Feb.) / 28 (Mar.)	37	35 (Feb.) / 38 (Mar.)	4.77	4.04 (Mar.) / 6.4 (Feb.)
Ist Transit. (Apr.99)	Data not taken		_	_	_	_	_	_
SW monsoon (May-Sept.99)	13	31	29	28 (Jul.,Aug.) / 31 (May)	36	35 (Jul.,Aug.,Sept.) /39 (May)	5.27	2.65 (May) / 7.94 (June)
IInd Transit. (Oct. 99)	3	31	30	30 (Oct.)	37	35 / 38 (Oct.)	4.3	4.04 / 4.67 (Oct.)
NE monsoon (Nov.99-Mar.00)	5	27	23	21 (Feb.) / 26 (Nov., Dec)	38	37 (Dec.) / 40 (Feb.)	7.84	5.80 (Dec.) / 10.75 (Feb.)
Ist Transit. (Apr.00)	1	32	29	29 (Apr.)	34	34 (Apr.)	3.9	3.9 (Apr.)
SW monsoon (May-Sept.00)	29	31	30	28 (Jul.,Aug.) / 34 (May)	37	35 (Jun., Jul.) / 45 (Sept.)	4.87	2.4 (Sept.) / 7.3 (Sept.)
IInd Transit. (Oct. 00)	11	33	30	30.4 (Oct.)	39	35 / 43 (Oct.)	4.66	2.3 (Oct.) / 10.4 (Oct.)
NE monsoon (Nov.00-Mar.01)	21	28	24	21 (Jan.) / 28 (Mar.)	39	38 (Dec., Feb., Mar.) / 43 (Jan.)	5.05	2.2 (Feb.) / 8.5 (Dec.)
Ist Transit. (Apr.01)	4	32	29	29.7 (Apr.)	41	40 / 42 (Apr.)	3.7	3.4 / 3.9 (Apr.)
SW monsoon (May-Sept.01)	22	32	30	29 (Jul., Aug.) /34 (Sept.)	39	35 (Jul.) / 41 (Sept.)	5.92	2.5 (Jul.) / 8.3 (Aug.)
IInd Transit. (Oct. 01)	4	33	30	30 (Oct.)	37	37 / 38 (Oct.)	6.15	4.9 (Oct.) / 7.5 (Oct.)
NE monsoon (Nov.-Dec.01)	8	28	24	22 (Dec.) / 27 (Nov.)	39	38 (Nov., Dec.) / 40 (Nov., Dec.)	7.41	4.6 (Dec.) / 9.8 (Nov.)