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MANGROVES OF KALMAT KHOR, BALOCHISTAN

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Abstract

The mangrove stand of Kalmat Khor, situated in the middle of the Balochistan coastline, is poor most probably due to intensive cutting and lopping for fuel and fodder and absence of any significant source of freshwater. The trees are small with decumbent branches touching the muddy substrate and belong to only one species *Avicennia marina* (Forssk.) Vierh. The zonation pattern is disturbed most probably because of indiscriminate harvesting of trees.

Introduction

Mangroves are restricted to only three localities along the coast of Balochistan i.e., Miani Hor, Kalmat Khor and Gawatar Bay with an area of 18,350 acres as against 600,000 acres of the Indus Delta (Mirza *et al.*, 1988). While the mangroves of Indus Delta have been well studied. (Snedaker, 1984; Saifullah *et al.*, 1994), those of Balochistan have not received the attention of ecologist (Saifullah, 1993) except for a few taxonomic accounts of mangrove species (Burkill, 1956; Chapman *et al.*, 1965). Kogo *et al.*, (1980) and Saifullah (1982) made ecological observations on mangroves in Miani Hor. The present paper describes the mangroves of Kalmat Khor along with the associated prevailing marine ecological factors.

Material and Methods

Kalmat Khor (25°27'N, 64°05'E) (Fig. 1) is a lagoon located some 320 km west of Karachi in the central part of Balochistan near Pasni. It is surrounded by a number of small hills, which are a source of sedimentation and siltation in it during erratic rains (Ali & Mirza, 1989). The site is not easily accessible even by four wheel vehicles.

Kalmat Khor resembles the shape of a tree from an aerial view (Fig. 1) with its trunk representing the entrance which is a narrow 7 km long 2 km wide and about 12 m deep canal. It widens abruptly into a 19 km long and 27 km wide enclosed body of water with irregular contour. The total area is 102.25 km^2. Mud flats are widely developed in almost the entire lagoon, which are covered with shallow water at high tides. Basol river falls into the sea some 15 km east of the Khor. The shelf facing the Khor is narrow and only 40 km wide. Astola island is located 30 km offshore from it.

Climatically the area may be referred to as a subtropical maritime desert (Chaudhri, 1961) while Koppen (1936) described the area as a hot desert. Rainfall is very scanty with mean annual values ranging between 100-230 mm/yr and received during October to April only. Air temperatures are high with a mean value ranging between 20-28°C.

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Table 1. Environmental variables in the study area at Kalmat Khor.

Locality	Site	Q.No.	Q.P.	Date	Salinity (o/oo		Temp. (°C)		pH		Dissolved oxygen (mg/l)	Mud % silt+clay	Sand % >0.0625mm	Organic matter (%)	Organic carbon (g)
					Sea-water	Pore water	Sea-water	Pore water	Sea-water	Pore-water					
		S.W	1		41	40	22	20	8.1	8.0		77.25	22.75	7.90	0.2166
	Chundi			11-1-94											
		L.W	2		41	42	22	19	8.1	7.9	4.1	81.30	18.70	7.50	0.2055
Kalmat Khor															
		S.W	1		40	41	20	19	7.9	8.1		83.10	16.90	5.30	0.1444
	Kalmat			12-1-94							3.9				
		L.W.	2		40	41	20	18	8.0	8.0		82.35	17.65	4.69	0.1277

Q.No. = Quadrat Number, Q.P. = Quadrat Position, S.W. = Seaward, L.W. = Landward.

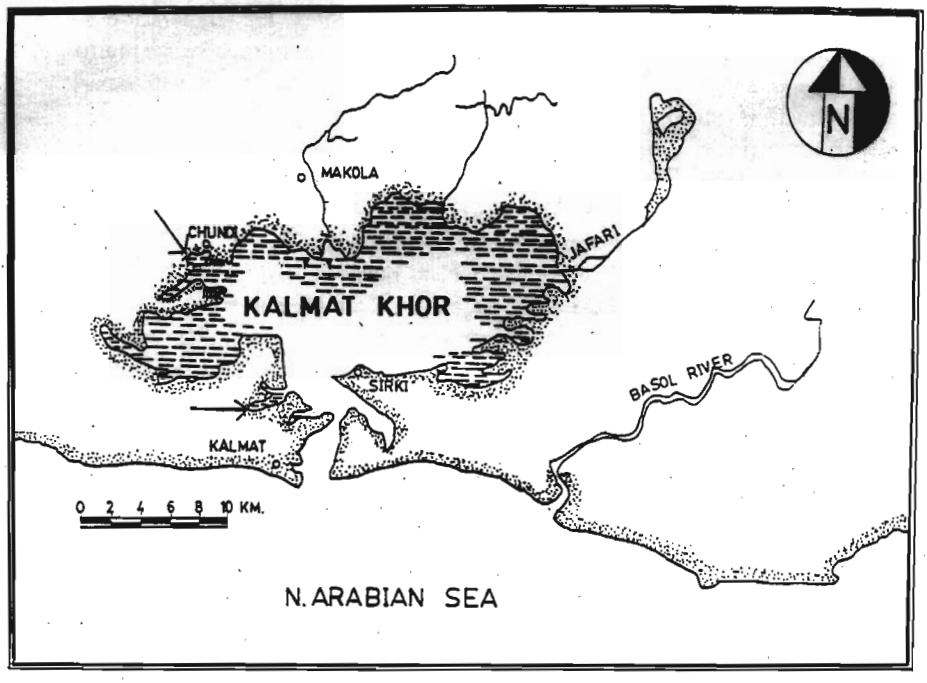

Fig.1. Map of Kalmat Khor with sampling sites Chundi and Kalmat village indicated by arrows.

Two sites Chundi and Kalmat (Fig. 1) were selected for sampling and vegetational analysis was carried during January 1994 following the method of Cintron & Novelli (1984). Usually two plots (10x10 m) were taken along a transect from the shore towards the interior of the mangrove stand. All the trees with diameter greater than 3 cm (dbh), were measured for their height, plant cover (canopy) and basal area. Plant cover was determined by the formula $C = \pi[(axb)/4]^2$ where a and b are two perpendicular diameters. Temperature and salinity of the seawater and pore water (soil water) were measured by a thermometer and a refractometer, respectively. pH and dissolved oxygen were measured with the help of Hanna Marine Science Kit. Pore water was obtained by making a 20 cm deep hole in the wet mud. Soil samples were collected with a corer to a depth of 20 cm. For grain size analysis the soil samples were first treated with H_2O_2 and then with HCl and after washing with water, to get rid of chlorides, were passed through 60 μm sieve to separate silt and clay. This fraction is termed collectively as mud (Tait, 1981). Organic content of the soil was also determined by dry oxidation method (Snedaker & Snedaker, 1984).

Results and Discussion

Salinity values were high due to minimum rainfall, intense radiation, high air temperature and lack of runoff from the land (Table 1). The entire Balochistan coast is a maritime desert (Koppen, 1936; Chaudhri, 1961). Water temperature values are

indicative of winter season, otherwise during most of the year the temperature is high and in summer it may be more than 30°C. pH values were in the alkaline range and oxygen values close to 4.0 mg/l. Like many other mangrove stands the soil was rich in clay and silt fraction (mud) and high organic matter content (Table 1).

Only one species *Avicennia marina* (Forssk.) Vierh. was found. It is known to be very hardy and resistant mangrove species and, therefore, is circumtropical in distribution (MacNae, 1968; Walsh, 1974; Tomlinson, 1986). Due to lack of runoff from the mainland and consequent hypersalinity in the area, the mangroves were dwarf in size (average height, 2 m) with dominant dbh size class between 10-15 cm (Tables 2) mostly as decumbent shrubs with their branches touching the muddy substrate. They were half the size and even less than the mangroves growing in Miani Hor and Gawatar Bay that are fed with Porali and Dasht rivers respectively (Saifullah & Rasool, 1995). The observed dwarfness in mangroves of Kalmat Khor may not be accounted for hypersalinity alone but also to severe harvesting pressure from the local inhabitants, who use mangrove parts as fuel and fodder for cattles and camels. There was clear signs of cutting and lopping of mangrove stand in the area. Another factor affecting the lagoon was the high rate of sedimentation and siltation which originates from the surrounding hills. During erratic rains the sediments are drained down the slopes and enter into the nearby lagoon (Ali & Mirza, 1989).

The Kalmat site was more favourable for growth (average height 2.42 m) than Chundi (average height 1.68 m) as depicted by the values of tree density, plant cover and basal area of the trees (Table 2). This is presumably due to greater harvesting pressure in the latter locality than the former because Chundi is close to the village and, therefore, readily accessible.

Vertical zonation of different size groups of *A. marina* was not distinct at Chundi and no decrease in size of plants was noticed with the increase in distance from the seashore at Kalmat village in response to concomitant increase in soil salinities (Pool *et al.*, 1977). Instead, they showed a reverse pattern with decreasing sizes towards (Fig. 2) which may be the result of indiscriminate cutting of the trees. However, on elevated shore banks, as is the case in Kalmat village, some members of Chenopodiaceae occupied the sea front.

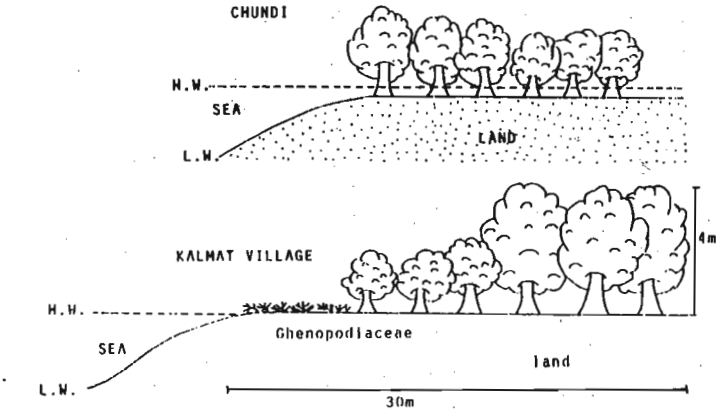

Fig.2. Zonation of size groups of *A. marina* at Kalmat Khor.

Table 2. Structural components of mangrove stand at Kalmat Khor.

dbh size group (cm)	Q. No.	D Trees/ 0.1 ha	C m^2/0.1 ha	B m^2/0.1 ha	RD	RC	RB	F	RF	I.V
Chundi										
0-5	1,2	100.00	71.73	0.1146	58.82	48.28	18.72	100.00	33.33	36.78
5-10	1,2	45.00	32.40	0.1147	26.47	21.80	18.74	100.00	33.33	26.18
10-15	1,2	25.00	44.43	0.3827	14.70	29.90	62.53	100.00	33.33	36.85
Total	2	170.00	148.56	0.6120						
Kalmat village										
0-5	1	20.00	9.90	0.0226	8.888	1.834	0.9626	50.00	12.50	7.161
5-10	1,2	70.00	109.10	0.3072	31.110	20.210	13.0500	100.00	25.00	23.05
10-15	1,2	100.00	247.50	0.9960	44.440	45.870	42.3300	100.00	25.00	37.25
15-20	2	20.00	67.38	0.4984	8.888	12.470	21.1800	50.00	25.00	18.35
20-25	2	15.00	10.58	0.5283	6.666	19.600	22.4500	50.00	12.50	13.87
Total	2	225.00	444.46	2.3525						

Quadrat Number, D = Density, C = Plant Cover, B = Basal Area, F = Frequency, RD = Relative Density
RC = Relative Cover, RB = Relative Basal Area, RF = Relative Frequency, I.V. = Importance Value

The mangrove stand in Kalmat Khor is unique along the entire Pakistani shore in the sense that it is completely isolated, without any significant runoff from land and exposed to severe climatic conditions. This makes it comparable with the mangroves of Red Sea (Mandura *et al.*, 1987). Perhaps the most important factor responsible for the occurrence of mangrove in arid climatic areas is the presence of protected shores, otherwise one would expect them to occur only in deltaic regions (Walsh, 1974).

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