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FISHERY AND ANTHROPOGENIC PRESSURE IN THE GULF OF KACHCHH, INDIA

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ABSTRACT

A comparative analysis of fish and prawn landings on the north and south coasts of the Gulf of Kachchh and anthropogenic pressure in the region were studied. The southern coast was found to be more productive than the northern coast during 1978-87. Higher mechanization of fishing crafts was recorded on the south side. Mangrove vegetation in the region was under great stress due to extensive cutting for fuel and fodder. The presence of large number of industries and ports along the coasts will have adverse effects on the fishery.

INTRODUCTION

THE GULF OF KACHCHH on the west coast of India abounds in a variety of marine fish and prawns. The high density and diversity of marine fauna in the area is due to the availability of different kinds of habitats. An increase in the human population along the coastline during the past few decades and their wholesome dependence on the fishery resources available has subjected the system to increased anthropogenic pressure.

Though some studies were carried out on the fishery in this area (Srivatsa, 1953; Ramamurthy, 1963 a; 1963 b; 1967; Kagwade, 1967; Bhaskaran *et al.*, 1970; Deshmukh, 1975; Sarvaiya, 1978; Bapat *et al.*, 1982; Mohammed, 1985), there is no comparative account available on the total landings of fish and prawn on the northern and southern regions of the Gulf.

Therefore, this paper gives a comparison of the total fish and prawn production along the northern and southern coasts of the Gulf of Kachchh during 1978-87, and also deals with the various human pressure in the region.

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MATERIALS AND METHODS

Catch data for the north (Kachchh District) coast and the south (Jamnagar District) coast was obtained from the Department of Fisheries, Government of Gujarat. Information on the anthropogenic pressure in the region was gathered during our frequent visits to few selected sites on the north (Jakhau, Modhwa and Surajbari) coast and south (Salaya, Sikka and Jodiya) coast, of the Gulf of Kachchh (Fig. 1).

RESULTS

Physical features of the Gulf

The Gulf of Kachchh (69° 04′ E and 22° 15′ N) has an area of about 7350 km^2 and a maximum depth of 60 m (Hashimi *et al.*, 1978). The northern shores of the Gulf are fronted by numerous sandy shoals, few river mouths and vast tidal flats, while the southern shores are marked by low level coastal plains with indentations, deep inlets, offshore islands, several river mouths, numerous coral reefs and extensive mud flats which dry at low tide.

Hashimi *et al.* (1978) studied the topography of the sea bed in the Gulf and found that the northern region from Jakhau to Mandvi (Fig. 1) is even. The sediments along the sea floor from Jakhau to Mandvi are composed of silt and clay. From Mandvi to Kandla it changes to silty sand, and beyond Kandla, the substratum is a mixture of sand and silty-clay. The sea bed in the southern region, extending from Okha to Jodiya (Fig. 1), has an even profile. The sediment covering the sea floor from Okha to Sikka is silty-clay and from Sikka to Jodiya, it is clayey-silt. The floor surface of both Poshitra and Pindara bays are covered with silty-clay deposits. Due to tidal currents of high velocity which prevent deposition of sediments, the central portion of the Gulf has an uneven substratum dominated by rocks.

Hydrographic features of the Gulf

The average tidal range in the Gulf is 4 m and it has tidal velocities of 2-5 knots (Hashimi *et al.*, 1978), with mean spring tide, from mouth to the closed end, ranging between 2.1 and 6.2 m (Srivastava and John, 1977). The major steady currents in the area are of tidal origin, though during the monsoon period

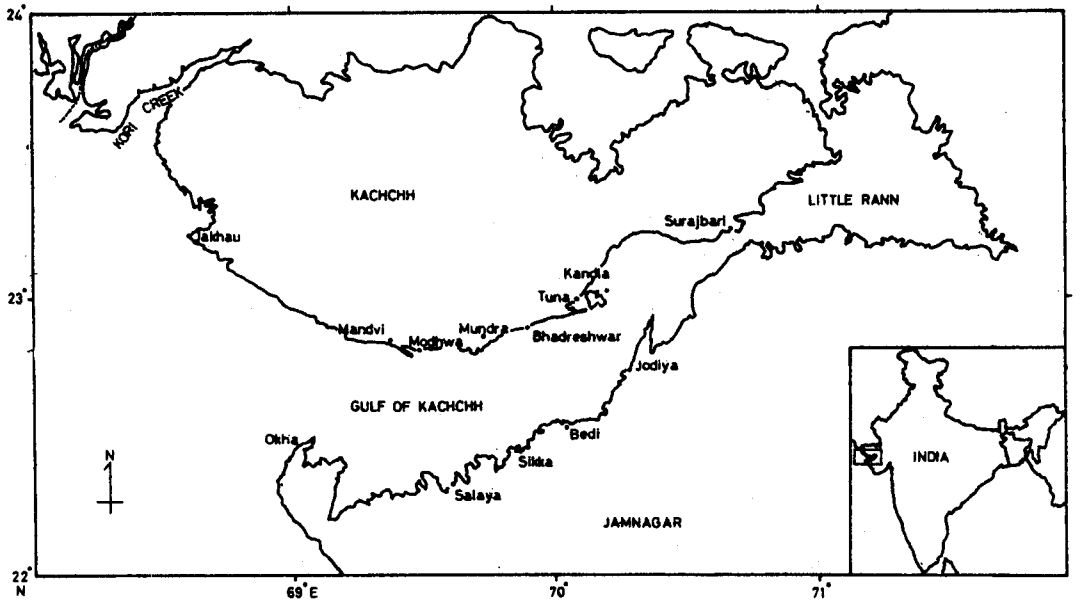

Fig. 1. The Gulf of Kachchh with important fishing centres on the north and south coast. The rectangle in the inset shows the study area.

the westerly winds generate wind driven currents. There is no significant freshwater influx in the area and the average annual rainfall is less than 52.2 cm (Srivastava and John, 1977).

small islands and fishing is done adjacent to these islands and also in the Poshitra and Pindara bays (Fig. 2). Most of the islands have a fairly good growth of mangrove vegetation and are fringed by coral reefs. Smaller

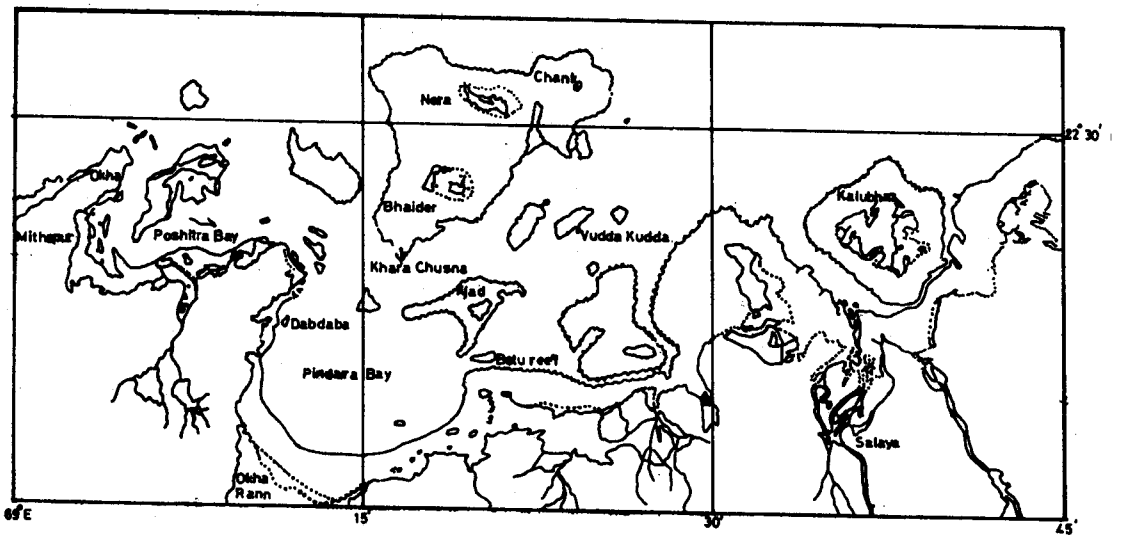

Fig. 2. The fishing grounds in and around the islands in the Gulf of Kachchh.

Fishing ground

Fishing by means of various mechanized and indigenous crafts is carried out extensively along the entire Gulf. Along the northern coast, fishing by trawlers is carried out in the waters off Jakhau, Mandvi, Modhwa, Mundra, Bhadreshwar, Tuna and Kandla (Fig. 1). Fishing was done in the past near Kori Creek, but it is now restricted due to its proximity to the Pakistan border. Indigenous boats are used for fishing in the shallow waters of the Little Rann, which is an extension of the Guld of Kachchh. An important prawn fishing ground is located in this region.

Fishing by trawlers along the southern coast is carried out in the waters off Okha, Salaya, Sikka, Bedi and Jodiya (Fig. 1). The southern region of the Gulf is dotted with many mechanized and non-mechanized crafts fish in the same grounds, but in shallower waters.

Fishery

Fishing is one of then main occupations of the inhabitants along the Gulf of Kachchh. Increased effort and mechanization of fishing operations has resulted in greater overall fish and prawn production. The average percentage contribution of fish and prawns of northern coast is about 83 and 17% respectively, and for southern coast, they are 86 and 14% respectively (Table 1).

A comparison of the total average production of the northern region of the Gulf of Kachchh with the southern region over the period 1978-87 showed the latter one to be more productive (Table 1). However, an examination of the 1984-87 years catch revealed

a reverse trend, with the northern region emerging as more productive zone with an average production of 33693 tonnes in comparison to 29007.2 t of the southern zone (Table 1).

The average individual fish and prawn production of the northern region for the period 1978-87 was less, as compared to that of the southern region (Table 2). During 1984-87, however, the average fish production of the northern region which was 29994.4 t surpassed that of the southern region's catch of 24985.9 t. The average prawn production on the north

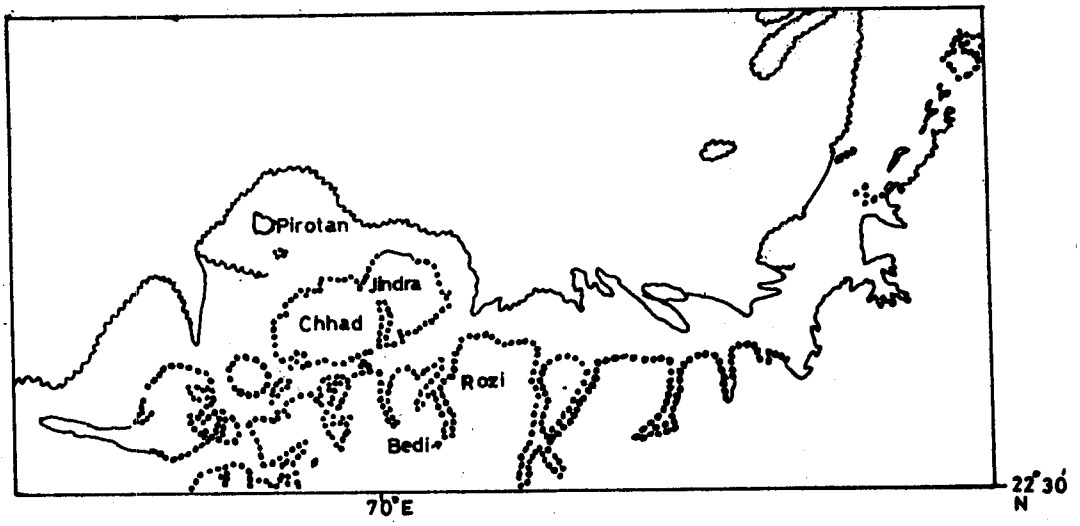

Fig. 3. The fishing grounds off Jamnagar Coast.

TABLE 1. *Total catch of north coast of the gulf (Kachchh District) in comparison to total catch of south coast (Jamnagar District) in metric tonnes*

Period	North coast			South coast		
	Total catch in tonnes	fish %	prawn %	Total catch in tonnes	fish %	prawn %
1977-78	5186.8	81.0	19.0	14887.7	84.6	15.4
1978-79	6226.8	83.2	16.8	21796.5	88.1	11.9
1979-80	5658.1	83.9	16.1	24954.5	87.9	12.1
1980-81	4108.6	69.0	31.0	28506.8	80.6	19.4
1981-82	6334.3	76.0	24.0	34166.8	84.6	15.4
1982-83	13784.6	84.2	15.8	29686.7	85.8	14.2
1983-84	23314.5	86.2	13.8	27444.0	91.3	8.7
1984-85	34288.0	86.3	13.7	32658.4	87.6	12.4
1985-86	35477.0	88.5	11.5	25763.4	86.7	13.3
1986-87	31314.0	92.6	7.4	28599.8	83.9	16.1
Mean	16569.27 ±13155.98	83.09 ±6.62	16.91 ±6.62	26846.46 ±5526.58	86.11 ±2.92	13.89 ±2.92

TABLE 2. *Total fish and prawn catch of north coast of the gulf in comparison to total finfish and prawn catch of south during 1978-87*

Period	Fish catch in tonnes		Prawn catch in tonnes	
	north coast	south coast	north coast	south coast
1977-78	4200.3	12595.0	986.5	2292.7
1978-79	5177.2	19202.7	1049.6	2593.8
1979-80	4742.0	21935.0	916.1	3019.5
1980-81	2831.1	22976.5	1277.5	5530.3
1981-82	4811.4	28905.1	1522.9	5261.7
1982-83	11599.8	25471.2	2184.8	4215.5
1983-84	20082.0	25056.4	3232.5	2387.6
1984-85	29598.0	28617.7	4690.0	4040.7
1985-86	31392.0	22332.4	4085.0	3431.0
1986-87	28993.1	24007.6	2320.9	4592.2
Mean	14342.69 ± 11929.94	23109.96 ±4736.65	2226.58 ±1357.33	3736.50 ±1174.52

coast during 1984-87 was less having 3698.6 t as compared to that of the south coast of 4021.3 t (Table 2).

Anthropogenic pressure on the Gulf

There are numerous uninhabited islands in the Gulf of Kachchh (Table 3). Most of them are remote and this has inadvertently protected them from human interference. Only the fishermen, who remain on the sea for prolonged periods, used to frequent them as these islands provided a ready supply of fuel (mangrove) required for cooking.

The fishermen make use of the islands in the Gulf for various purposes, depending on the location, topography and vegetation of the island. The islands located within and near the fishing grounds *viz.* Dabdaba, Devdi, Ajad, Bhaidar and Kalubhar (Fig. 2) are used as resting spots, between trawling operations. Some islands like Jindra, Chhad (Fig. 3), Nora, Chank, Bhaidar and Kalubhar (Fig. 2), which have good mangrove vegetation are frequented by the fishermen, with the sole aim of cutting the wood and bringing it back for household consumption and sale.

The best representative of remnant mangrove vegetation in the Gulf of Kachchh now exists on a tiny island, Khara Chusna (Fig. 2), where it receives total protection by virtue of a pir (Muslim mausoleum). There are about 40-50 trees with a maximum height of 10-12 m. In the rest of the Gulf the mangrove is normally 1-2 m tall along the coast with a maximum of 4 m at Pirotan Island (Fig. 3) which receives some protection as it is the principle exhibition site of the Marine National Park.

Ajad is the only island in the Gulf which is human inhabited. The island is surrounded by reefs, and in the northern region the mangrove vegetation is represented by *Rhizophora mucronata* and *Avicennia marina.* The resident community consists of 175 people constituting 21 families. They are mainly engaged in fishing, and agricultural activities are restricted to the monsoon *viz.* July to September. There are 19 non-mechanized and 2 mechanized boats in the island. The catch is sold at Salaya which takes 2 hours (by motor boat) from Ajad. As fishing is carried out in the vicinity of the island, the catch consists of reef fishes, sharks, rays and prawns.

The yield from any fishery bears a relationship with human effort and resources. In the Gulf, with an increasing number of fisherman concentrating on prawn fishery, prolonged exploitation could result in deplection of these stocks. There are many industries and ports along the Gulf which are responsible for a great deal of pollution in these waters. The major industries include, the Digvijay Cement Company, Gujarat State Fertilizer Company, Sikka Thermal Power Station located at Sikka, Vadinar Oil Terminal at Vadinar and Associated Cement Company at Dwarka. The main ports along the northern Gulf are Kandla, Mundra and Mandvi, While those along the southern gulf are Bedi, Sikka, Salaya and Okha.

DISCUSSION

The good production of fish and prawn on the northern coast could be attributed to the physical features of the region which are favourable for various fishing operations. Fishing along this coast is primarily carried out by means of traditional crafts and gears by resident fishermen in waters of 15-20 m depth. The gradual influx of migratory trawlers (chiefly from the southern coast) operating along the northern coast has reflected on the catch,

which began increasing rapidly. As it is impractical for the migratory fishermen to transfer the catch to their respective villages, it is disposed at the nearest landing centre. Thus, there has been an increase in the overall catch landed in the northern coast (Table 1). The decrease in prawn landings of the northern coast in 1986-87 (Table 3) could be due to overfishing at Jakhau (Pravez, 1990) which is an important prawn landing centre in Kachchh and also due to the drought which resulted in a failure of the monsoon and winter prawn fishery at Surajbari.

TABLE 3. *A list of islands in the Gulf of Kachchh*

Rozi	Bhaidar
Pirotan	Mitha Chusna
Jindra	Khara Chusna
Chhad	Ajad
Bhains bet	Khimra Khat
Dide ka bet	Shiyardi
Munde ka bet	Sanbeliya
Narara	Devdi
Kalubhar	Dabdaba
Dhani	Lefa
Gandhiya Kado	Man Merodi
Panero	Langa Merodi
Roji	Asab
Garu	Bet Shankhodhar
Chank	Sani Miyar
Nora	Dholiya Vado

The physical features of the southern region of the gulf are also favourable for fishing operations. The presence of many small offshore mangrove vegetation islands, surrounded by coral reefs, provide large quantities of nutritive detritus which attract shoals of fish and also act as nursery grounds for prawns. The sea floor profile is even and covered with silty clay sediments which make it suitable to do trawling for demersal species. The southern shore of the Gulf has many low level coastal plains with deep inlets and extensive mud flats, enabling fishing by traditional crafts and gears.

The crafts and gears used by the fishermen, do not differ much in the Gulf of Kachchh. A lower mechanization of crafts along the northern coast (35%) in comparison to 65% on the southern coast was observed. This could be attributed to the relatively backward economic and industrial conditions of Kachchh District as compared to Jamnagar. Lack of mechanization on the northern coast has restricted the fishing area for the fishermen, while on the southern coast mechanization has enabled them to exploit larger areas in the gulf.

Massive population growth along the gulf, an inevitable offshoot of the newly established industries that employ large labour force, has however resulted in an increasing demand for seafood, precipitating improved fishing methods and mechanization of boats. Consequently, there has been an increase in the number of people dependent on the coastal resources.

There are numerous uninhabited islands fringed with reefs and having good mangrove vegetation in the Gulf of Kachchh. Mangroves are essential for prawn fishery since they are the nursery grounds for various species of penaeid prawns. The juveniles of prawns feed on the algae, minute organisms and organic detritus (Panikkar, 1952) which are readily available in the mangrove ecosystem. This vegetation is also one of the coastal resources which is under great stress. The fishermen utilize the mangrove in a variety of ways. The large trunks are used as timber for ship building and for fuelwood. The green leaves serve as fodder for cattle and the straight branches of mangroves are cut to make poles used for staking fish nets.

Numerous channels from the sea run to the interior of the islands in the gulf which

enable the fishermen to take the boats to the centre of the island and hack off the mangroves. As the banks of the channels are cleared off, the tidal currents regularly wash away the silt and mud deposits from the denuded banks. As a result of the erosion, the channels become wider and mud is deposited on the live corals of the reefs fringing the island and choke them. Apart from this, because of the high turbidity of these waters, existence of algal vegetation and marine animals, in general, will be at stake.

Pollution of rivers, estuaries and seas by industrial effluents, pesticides and oil can adversely affect the prawn fishery (Kurian and Sebastian, 1982). The presence of large number of industries and ports along the Gulf of Kachchh could also have a dire long-term effect on the fishery.

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