

# DISTRIBUTION OF BENTHIC FAUNA IN THE GULF OF KUTCH

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## ABSTRACT

The distribution of benthic fauna in the Gulf of Kutch, off Dwaraka and Okha was studied. Benthic collections were made from 28 stations along a distance of about 100 Kms. Eleven macrofaunal and four meiofaunal groups were represented in the benthic fauna. The results showed the dominance of sipunculids in the meiofaunal group. The substratum was not uniform and six different kinds of substrata were observed. Inter-relating of the faunal groups, their distribution and abundance in the different substrata are discussed.

## INTRODUCTION

The distribution and abundance of benthic organisms in the estuaries, lakes and nearshore regions of India has been thoroughly studied by several authors (Annadale and Kemp, 1951; Panikkar and Aiyar, 1973; Srivastava, 1956 & 1959; Krishnamurthy, 1966; Desai and Krishna Kutty, 1967a, b and Parulekar, 1973). Benthos forms an important source of food for demersal fish and thus can be a good indicator of the abundance of fish stocks. It is important also to have information on the benthic organisms from off shore regions of the Indian Ocean. A survey of offshore benthos was therefore carried out in the Gulf of Kutch area, which is a rich fishing ground, during the INS Darshak Cruise in January, 1975.

## MATERIAL AND METHODS

Benthos samples were collected during January, 1975 from 28 stations along a distance of about 100 Km in the Gulf of Kutch (Fig. 1). Most of the samples

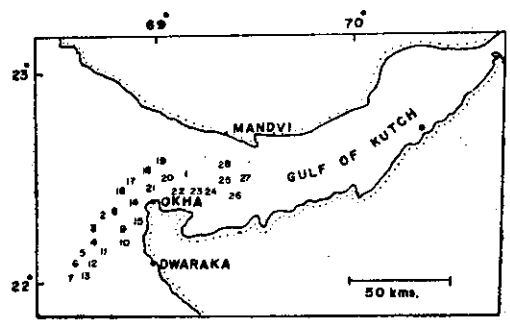


Fig. 1. Map of Gulf of Kutch

were collected by using a Van Veen Grab (0.048 m<sup>2</sup>) excepting a rocky bottom where a snapper was operated. For obtaining macrobenthic organisms, the sediment samples were washed through a sieve with stainless steel mesh of 0.5 mm sieve and the animals retained in the sieve were preserved in 5% formalin. At each stations, duplicate samples were collected. Biomass values were calculated on dry weight measurements. The biomass values of molluscs were estimated after removing shells. The crustaceans were treated with 5% hydrochloric acid for dissolving exoskeleton. The dry weights were determined by drying them in an oven at 110°C until constant weights were obtained (6–10 hrs). The meiobenthic samples were collected from the grab by inserting a plastic core tube of 1.85 cm diameter through a window on the top of the jaw of a grab from the top surface of the mud to a depth of 5 cm. The sediments types were determined by visual examination. Temperature were measured by using a reversing thermometer and salinity determined by Mohar's Method.

## RESULTS AND DISCUSSION

*Environmental features* :- Depth at 28 stations in Gulf of Kutch varied from 25-65 m. The substratum was not uniform and six different types of bottom sediments were encountered. They (Table No. 2)

1. very soft loose clay (Stn. 4, 12 & 13)
2. soft clay (Stn. 1, 2 5 to 10, 15, 17 & 18)
3. soft ciay sand (Stn. 3)
4. hard clay (Stn. 11 & 19)
5. shelled bottom (Stn. 20 & 21) and
6. rocky botiom (Stn. 14, 16 & 22 to 28)

Temperature and salinity were quite stable during the course of collections. The values varied from 19.70–21.88°C and 36.15–38.06‰ respectively (Table No. 1).

*Macro Benthic Fauna* :- The distribution of macrofaunal groups, their population density and the biomass of total and individual faunal groups are presented in Table 2 (Fig. 2 3). The total number of macrofaunal groups were eleven and represented by sipunculids, polychaetes, nematodes, echinoderms, crustaceans, prosobranchs, opisthobranchs, bivalves, scaphopods, corals and fishes. Sipunculids,, prosobranchs, bivalves and polychaetes occured in large numbers.

Both in biomass and population density, sipunculids were dominant amongst the macrobenthic fauna. They were chiefly recorded from very soft loose clay and soft clay substrata. The biomass value varied from 9.95–18.25 gm/m<sup>2</sup> and numerical density from 341–748 no/m<sup>2</sup> on a very soft loose clay substra-

TABLE 1. Environment factors, total biomass & faunal densities for sample stations.

Station No.	Depth (Meter)	Temp°C (Bottom)	Salinity %	Total Biomass g/m <sup>2</sup>	Population Count (nos/m <sup>3</sup> )
1	50	20.09	37.74	2.13	150
2	50	21.30	36.94	3.56	163
3	28	21.45	36.60	1.54	77
4	28	21.69	36.76	11.89	517
5	35	21.71	36.42	11.79	88
6	43	21.88	36.65	8.68	341
7	55	21.53	36.24	4.06	132
8	28	21.03	37.56	2.88	110
9	39	21.24	37.67	28.7	88
10	34	21.30	37.87	2.57	143
11	38	22.21	36.94	0.94	55
12	45	21.32	36.84	19.05	814
13	65	21.37	36.15	9.15	440
14	25	20.80	37.07	..	..
15	43	21.06	37.27	2.37	33
16	33	20.58	37.43	..	..
17	33	20.49	26.64	27.74	198
18	55	20.40	36.54	2.17	75
19	38	20.23	37.72	0.75	30
20	53	20.58	..	0.84	23
21	36	20.60	..	1.24	34
22	28	20.16	37.63	1.63	55
23	33	19.95	..	..	..
24	33	19.79	..	..	..
25	40	19.82	37.63	..	..
26	62	19.82	37.52	2.65	78
27	30	19.90	..	..	..
28	42	19.70	38.06	..	..

TABLE 2. Relationship between the type of substratum and individual groups biomass.

Station No.	Type of Substratum	Benthic macro fauna	Individual Biomass (g/m <sup>2</sup> )	Total Biomass (g/m <sup>2</sup> )	Overall macro fauna population	Meiofauna (nos/m <sup>2</sup> )	Overall meiofaunal population (nos/m <sup>2</sup> )	
1	Soft clay	Sipunculids	66	1.61		Polychaetes	100	
		Polychaetes	55	0.16	2.13	Crustaceans	200	
		Prosobranchs	22	0.24		Nematodes	300	
		Bivalves	11	0.12		Foraminifera	5600	
		Polychaetes	44	1.12		Nematodes	400	
		Nematodes	77	1.13	3.56	Foraminifera	3600	
2	Soft clay	Prosobranchs	32	1.17				
		Bivalves	10	0.14				
		Prosobranchs	44	1.32				
		Bivalver	11	0.16	1.54	77	Polychaets	200
		Scaphopods	22	0.06			Foraminifera	6800
								7000
4	Very soft loose clay	Sipunculids	462	11.27				
		Bivalve	10	0.17	11.89	507	Polychaetes	200
		Fishes	12	0.03			Nematodes	340
		Prosobranchs	23	0.42			Foraminiferas	7200
		Polychaetes	44	0.27				
		Crustaceans	11	0.36	11.79	88	Polychaetes	300
5	Soft clay	Prosobranchs	11	0.11			Nematodes	300
		Opisthobranchs	11	0.11			Foraminifera	8800
		Bivalves	11	11.94				
								9400

TABLE 2 Contd.

6	Soft clay	Sipunculids	65	2.13		Crustaceans	400	
		Polychaetes	67	2.15	8.68	Foraminifera	8500	
7	Soft clay	Crustaceans	11	1.04		Nematodes	200	
		Prosobranchs	187	3.15				
		Bivalves	11	0.24				
		Sipunculids	55	1.34				
		Polychaetes	33	0.39	4.06	132	Polychaetes	200
		Crustaceans	11	0.04			Foraminifera	9500
		Bivalves	22	2.25				
		Echinoderms	11	0.04				
		Sipunculids	11	0.54				
		Polychaetes	55	0.52	2.00	110	Foraminifera	10200
8	Soft clay	Prosobranchs	33	1.76				
		Scaphopods	11	0.06				
		Sipunculids	11	0.46				
		Scaphodes	77	2.41	2.87	88	Nematodes	200
							Crustaceans	300
9	Soft clay					Foraminifera	100	
						Foraminifera	3300	
10	Soft clay	Sipunculids	99	2.41		Nematodes	200	
		Polychaetes	44	0.16	2.57	143	Crustaceans	300
11	Hard clay	Polychaetes	11	0.59		Foraminifera	100	
		Prosobranchs	44	0.34	0.93	55	Foraminifera	3300
12	Very Soft loose clay	Sipunculids	748	18.25		Foraminifera	8800	
		Nematodes	55	0.10	19.05	814	Polychaetes	500
		Fish (eel)	11	0.70			Nematodes	500

TABLE 2 *Contid.*

13	Very soft loose clay	Sipunculids Polychaetes Nematodes	341 77 22	9.25 0.21 0.05	9.51	440	Polychaetes Foraminifera Nematodes	300 9200 400	9900
14	Rocky	—	—	—	—	—	—	—	—
15	Soft clay	Sipunculids Polychaetes	22 11	0.87 0.49	1.36	33	Foraminifera	10300	10300
16	Rocky	—	—	—	—	—	—	—	—
17	Very soft	Sipunculids Prosobranchs Bivalves Scaphopods	55 66 11 66	0.71 22.18 0.38 4.44	27.71	198	Nematodes Crustaceans Foraminifera	600 500 6500	9600
18	Soft clay	Sipunculids Prosobranchs Bivalves Polychaetes	22 23 18 12	0.82 0.71 0.40 0.21	2.17	75	Nematodes Polychaetes Foraminifera	200 200 6500	6900
19	Hard clay	Bivalves Polychaetes	12 12	0.34 0.41	0.75	30	Foraminifera	6700	6700
20	Complete shelled bottom	Prosobranchs	23	0.84	0.84	23	Foraminifera	3000	3000
21	Shelled bottom	Prosobranchs	34	0.24	1.24	34	Foraminifera	2500	2500
22	Rocky	Barnacle (Lepas)	55	1.63	1.63	55	—	—	—
23	Rocky	—	—	—	—	—	—	—	—
24	Rocky	—	—	—	—	—	—	—	—
25	Rocky	Red corals	—	—	—	—	—	—	—
26	Rocky	Barnacles (Lepas)	78	2.65	2.65	78	—	—	—
27	Rocky	—	—	—	—	—	—	—	—
28	Rocky	—	—	—	—	—	—	—	—

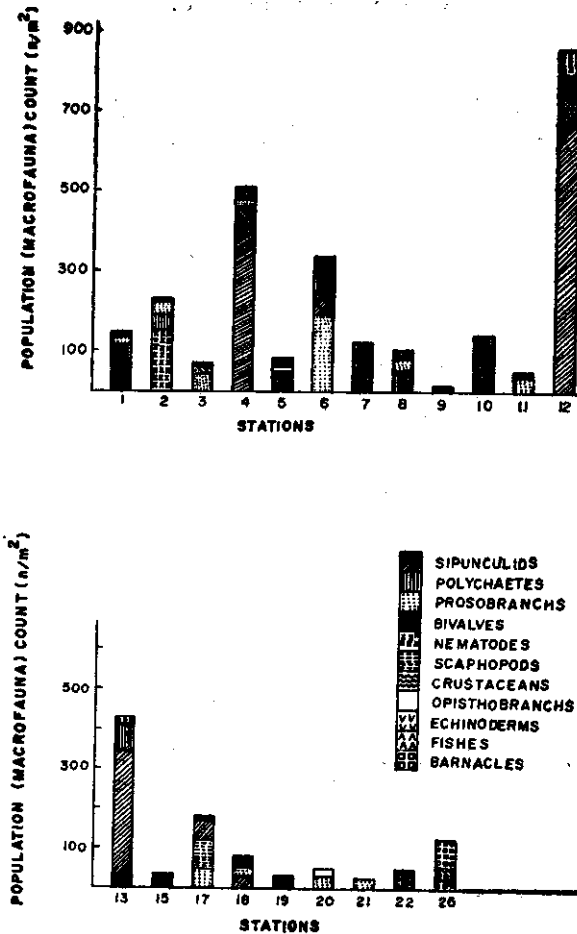


Fig. 2. Population density of macrobenthic faunal groups at different stations.

tum. On the soft clay substratum the density of biomass was 0.46–24 gm/m<sup>2</sup>; population density 11–99 ny/m<sup>2</sup>. Juvenile to adult size sipunculids were collected from the very soft loose clay substratum. They accounted for about 48% of total biomass and 54% of the macrobenthic fauna.

The next important faunal group was the prosobranch molluscs. They constituted about 26% of biomass and 15% by numerical count of the total macrobenthic fauna. They were most numerous in soft clay both in biomass (0.11–22.18 gm/m<sup>2</sup>) and population density (11–187 no/m<sup>2</sup>) as compared to the remaining substrata (Table 2). The prosobranchs were chiefly represented by *Nassa dorata*, *Conus punctatus*, *Natica* sp.

The third and fourth most important faunal groups were bivalve molluscs and polychaetes respectively. Bivalves were recorded from all substrata except the rocky and shelled bottom. Both bivalves (biomass : 0.12 to 11.94 gm/m<sup>2</sup>, population : 10 to 22 no/m<sup>2</sup>) and polychaetes (biomass : 0.16 to 2.15 gm/m<sup>2</sup> population : 11 to 77 no/m<sup>2</sup>) were most abundant in soft clay substratum. Bivalves and polychaetes accounted for 67% and 3% of biomass; and 3% and 13% by numerical count of the total macrobenthic fauna respectively. The other faunal group viz, scaphopods, nematodes, fishes, crustaceans, and opisthobranchs collectively accounted for 15% of numbers and 3% by biomass of the total macrobenthic fauna..

*Meiofauna* :- The foraminifera formed a major and dominant component (94%) of the total meiofauna (Fig. 3). They were chiefly represented by *Globigerina*

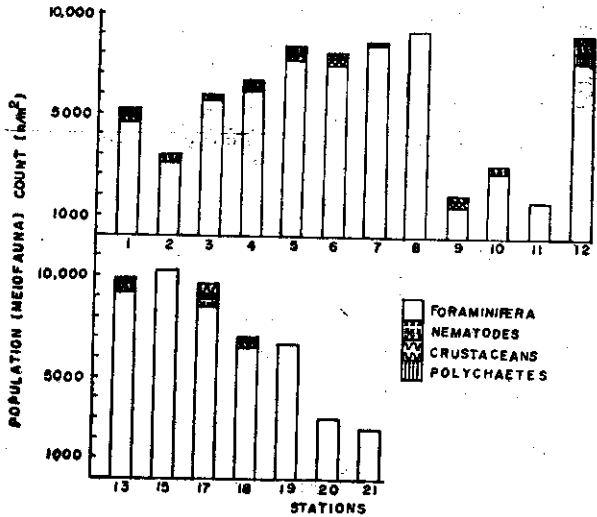


Fig. 3. Total biomass distribution of macrobenthos at various stations.

*bulloides*, *Rotalia beccarii* Nonion sp. *Quinqueloculina* sp. They were recorded from all substrates except rock. Foraminiferans were found to be most abundant in very soft loose clay substrata (1600–10,300/m<sup>2</sup>) when compared to the remaining substrata (1800–6800/m<sup>2</sup>). The remaining meiofaunal groups viz, polychaetes, nematodes and crustaceans, represented only only 6% of the total meiofauna. They were distributed in very soft loose clay and soft clay substrata with a population density of 100–500/m<sup>2</sup>, 200–600/m<sup>2</sup> and 200–500/m<sup>2</sup> respectively.

The influence of temperature, salinity, depth and substratum on the distribution and abundance of benthic organisms has been emphasized by many earlier workers (Seshappa, 1953; Holme, 1954; Southward, 1957; Desai and Krishnan Kutty 1967 a & b). There was also little difference in temperature and salinity at the different sampling stations and it would appear that the nature of subs-



tratum is the main factor accounting for the recorded differences in the benthic population density with increase in depths as evidenced by the average biomass values viz, 25–34 m (7g/m<sup>2</sup>), 35–44 m (4g/m<sup>2</sup>), 45–54 m (6g/m<sup>2</sup>) and 55–64 m (5 g/m<sup>2</sup>). This is mainly due to uneven distribution of macrobenthic fauna at different depths. A similar observation on the distribution of macrobenthic fauna was made by Parulekar (1973) in the Central West coast of India.

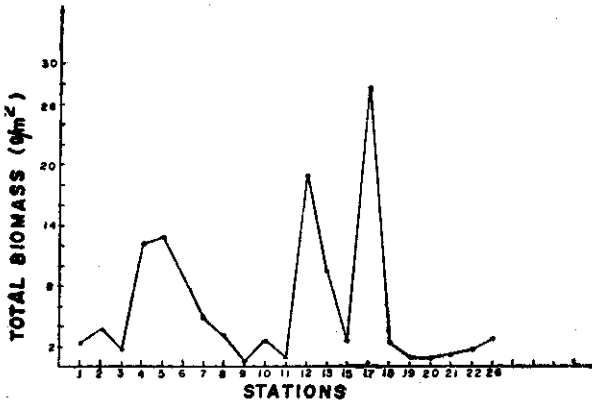


Fig. 4. Population density of meiobenthic faunal groups at different stations.

The distribution and abundance of macro and meiobenthic faunal groups in relation to different sediment types given in Table 3, show that numbers and biomass of benthic fauna were greatest in soft loose clay (17.0 + 2.7 gm/m<sup>2</sup>) and soft clay (4.2 + 0.2 gm/m<sup>2</sup>) substratum than the remaining substrata 1.3 + 0.2 gm/m<sup>2</sup>). Absence of animals on hard clay substratum was observed on the east coast (Panikkar and Aiyar 1937). Reports from West Coast of India (Desai and Krishnan Kutty, 1967 a & b, Desai 1971 and Parulekar, 1973) showed that the higher biomass values were associated with sandy substratum followed by silty bottom and minimum on hard substrata.

The present study indicates the dominance of sipunculids (soft loose clay) in the benthic macrofauna of the off shore regions of the Gulf of Kutch. The earlier reports from West Coast of India showed the dominance of bivalves and gastropods (Sandy) in the near shore region off Cochin (Desai, 1971) and the dominance of annelids (sandy mud) in the Central West Coast of India (Parulekar, 1973). The present studies have also shown a rich benthic fauna (Stn. 4, 5, 12 total biomass values 11.89, 11.79 and 19.05 g/m<sup>2</sup> respectively) from the sea off Dwarka. A comparison of the fish catch figures for this region with those of other parts of the world (Anon, 1936) indicated that the Dwarka off shore fishing grounds are one of the richest grounds of the world. This view has been further stressed by Jayaraman *et. al.*, (1959). The benthos serves as a rich source of food for demersal fishes, thus, a rich benthic productivity in the Gulf of Kutch, off Dwarka and Okha appears directly related to the rich fish stocks in these region.

TABLE 3. Macro and meiofaunal groups in relation to different types of sediments.

Faunal groups	Very soft loose clay	Soft clay	Sandy clay	Hard clay	Shelled bottom	Rocky bottom
<b>Macrofauna :-</b>						
Polychaetes	16%	79%	—	5%	—	—
Sipunculids	80%	20%	—	—	—	—
Probobranchs	4%	69%	8%	8%	11%	—
Bivalves	8%	75%	9%	9%	—	—
Crustaceans	—	20%	—	—	—	80%
Nematodes	50%	50%	—	—	—	—
Scaphopods	—	88%	12%	—	—	—
Echinoderms	—	100%	—	—	—	—
Opisthobranchs	—	100%	—	—	—	—
Corals	—	—	—	—	—	100%
Fishes	100%	—	—	—	—	—
<b>Meiofauna :-</b>						
Foraminiferans	20%	63%	5%	7%	5%	—
Polychaetes	50%	40%	10%	—	—	—
Nematodes	34%	66%	—	—	—	—
Crustaceans	—	100%	—	—	—	—

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