

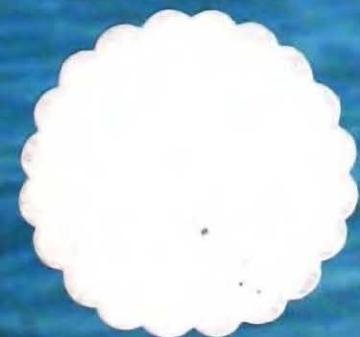
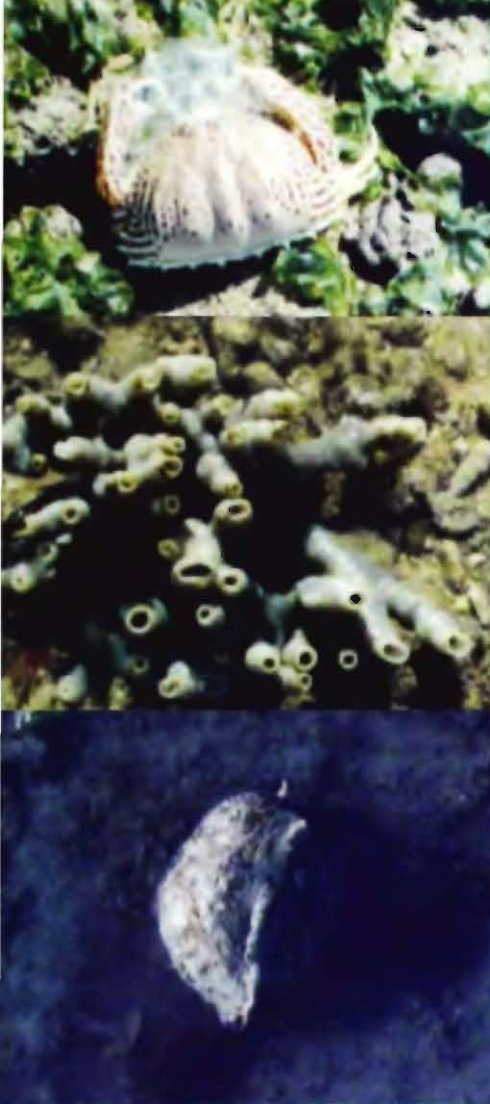
Conservation Area Series 23

Fauna of Marine National Park

Gulf of Kachchh (Gujrat)

N.V. SUBBA RAO
D.R.K. SASTRY

Zoological Survey of India



CONSERVATION AREA SERIES 23

**FAUNA OF MARINE NATIONAL PARK,
GULF OF KACHCHH, GUJRAT**

AN OVERVIEW

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सत्यमेव जयते

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**FAUNA OF MARINE NATIONAL PARK,
GULF OF KACHCHH, GUJARAT
*AN OVERVIEW***

Conservation Area Series

No. 23

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INTRODUCTION

The Gujarat state extending between 20°-24° 40' North Latitudes and 68°-74° 30' East Longitudes, has an area of 196,000 km² and a population of nearly 34 millions. The coastline of the state measures 1,663 km. It is the longest for any peninsular state of India and is next only to that of the Union Territory of Andaman and Nicobar Islands. The shelf area up to 200 m is 164,183 km² of which the 0-50 m zone comprises 64,810 km². From the viewpoint of conservation of environment and the biodiversity associated with it, the state has as many as 15 Sanctuaries comprising 15,710 km² and four National Parks comprising 481 km². These include a Marine Sanctuary with a core area as a Marine National Park located in the Gulf of Kachchh (formerly Kutch or Cutch) on its southern coast under the Jamnagar District.

Accounts of reconnaissance, State-of-Art and periodical assessment with respect to the environment and the associated biodiversity are indispensable for a proper monitoring of the Protected Areas. In spite of several accounts of the State's biodiversity dating back to the beginning of the 20th century, there appears to be no consolidated report of the biodiversity and effects on it of the deteriorating environment, particularly with reference to the Marine Sanctuary and Marine National Park. The present attempt is to provide basic information on the biodiversity of the area and the threats.

PHYSIOGRAPHY

Gulf of Kachchh is a pocket of the Arabian Sea. The districts of Kachchh and Jamnagar form respectively the northern and southern borders. The Gulf is aligned in the East-West direction. The mouth of the Gulf, which is about 60 to 75 km wide, is to the west opening into the Arabian Sea and the narrow head to the east. It is approximately 170 km in length. The Kachchh district has only a narrow intertidal region for a greater part and vast slushy areas of interspersed mangrove forests only on the east. In contrast, the intertidal area of Jamnagar district forming the southern border of the Gulf is extensive covering varied habitats.

The Gulf of Kachchh extending between 22° 15' and 23° 40' N Latitudes and 68° 20' and 70° 40' E Longitudes covers an area of 7,350 km² with a maximum depth of 60 m. The Marine Sanctuary comprises an area of 458 km² of the Gulf along the coast of Jamnagar District. Of this, an area of 163 km² has been designated as the Marine National Park, consisting of the intertidal region along the coast and 42 islands and islets scattered between Okha and Navlakhi. Of these 37 are in the Marine National Park and the rest of five in the Marine Sanctuary. Following is the list of named islands and reefs as per the Admiralty Chart 43, Gulf of Kachchh (Hydrographic Office, Tauton, Somerset TA 2DN, UK, 25 March 1997).

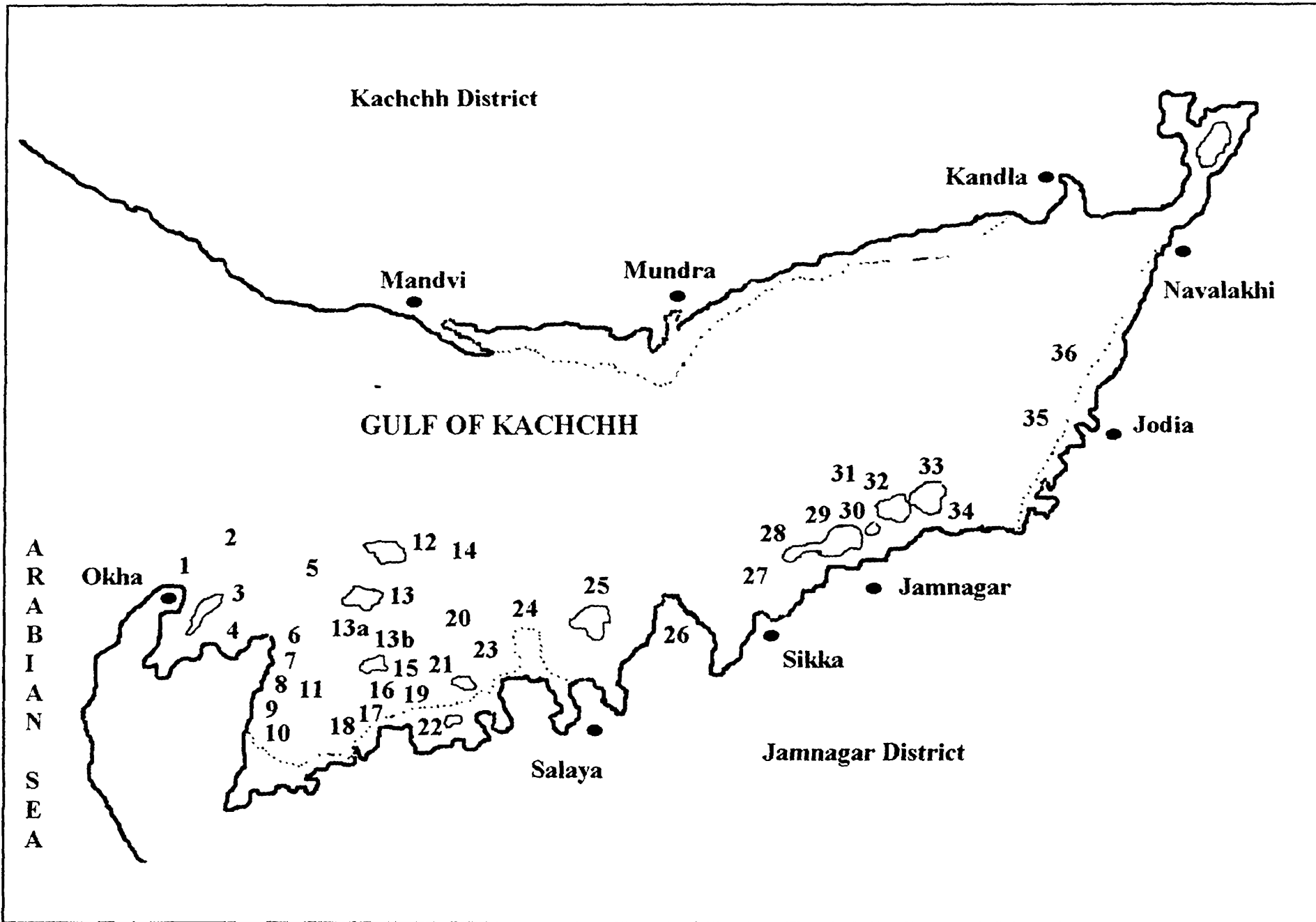


Fig. 1. Gulf of Kachchh. Numbers indicate Islands and reefs as per the Admiralty Chart 43, Hydrographic Office, UK.

- | | |
|---|------------------------|
| 1. Samiani Island | 17. Shiyardi Bet |
| 2. Chandri Reef | 18. Sanbeliya Bet |
| 3. Bet Shankhodhar
(Bet Island or Bet Dwaraka) | 19. Garu Bet |
| 4. Kyu Island | 20. Vudda Kudda Reefs |
| 5. Paga Reef | 21. Panero Tapu |
| 6. Boria Reef | 22. Roji Bet |
| 7. Asab Island | 23. Gandhiya Kado Tapu |
| 8. Lefa Bet | 24. Dhani Bet |
| 9. Dabdaba Island | 25. Kalubhar Tapu |
| 10. Devdi island | 26. Narara Bet |
| 11. Merodi Bet | 27. Goos Reef |
| 12. Nora Tapu (Bural or Chank Reef) | 28. Munde ka Bet |
| 13. Bhaidar Tapu (Bural or Chank Reef) | 29. Dide ka Bet |
| 13a. Kara Chusna Island
(Bural or Chank Reef) | 30. Bhains Bid |
| 13b. Mitha Chusna Island
(Bural or Chank Reef) | 31. Pirotan Island |
| 14. Chank Tapu (Bural or Chank Reef) | 32. Chhad |
| 15. Ajad Tapu | 33. Jindra Bet |
| 16. Khimra Khat Tapu | 34. Rozi Island |
| | 35. Balachadi Rocks |
| | 36. Mungra Reef |

Relative locations of these are shown in the same order in fig. 1. Other islands are Badia, Mangunda, Dona, Pashu, Guda Kudda, etc. Corals were observed to grow around 34 islands. It is a complex of fringing reefs backed by mud and sand flats, coastal marsh and mangrove forest subjected to exploitation. Live and dead coral reefs, islands and extensive mudflats that are exposed during low tide fringe the southern coast whereas tidal flats characterize the northern coast. Unlike the northern border, the Marine National Park area has an extensive intertidal region ranging from 3 to 5 km or more in width at some places. The islands and islets of the Park are nearer to the southern coast. Each of these is connected with the coast by extensive shallow area locally called as 'bet' and appears separate only during the high tide periods.

The extreme cold and hot weather influences the Gulf waters resulting high summer and low winter temperatures in spite of constant mixing with open ocean waters through tidal currents. The salinity ranges from 29 to 37 ppt because of a very low annual rainfall – annual rainfall varies from 522 mm to 975 mm – restricted to a short spell (June to September) of southwest monsoon. The salinity is almost constant from Sep.-Oct. to June-July with a sharp fall during August. The tides are semidiurnal which range from below CD to over 6m CD at various places. The normal tidal amplitude varies from about 4 to 4.5 m at a given place. The mean spring tide is 2.1 m at the wide mouth in the west whereas it is 6.2 m at the eastern closed end. As per the Admiralty Chart (*op. cit.*) following are the tidal conditions at Okha located at the mouth of the Gulf and Navalakhi, near the head of the Gulf.

Port	Height in Meters above Chart Datum		Difference
	MHWS	MLWS	
Okha	3.5	0.5	3.0
Navalakhi	7.2	0.8	6.4

The time lag between the mouth and head of the Gulf is about 2½ hrs. Tidal velocity ranges from two knots to five knots. Because of fast tidal currents, the bottom is under constant disturbance. This results in turbid waters and settlement of fine silt over the intertidal zone during the interphase.

The coastline and islands offer a variety of habitats such as rocky, sandy and muddy zones. However, the major habitats are corals and mangrove forests. The mangrove vegetation covers an area of over 580 km² of the Gulf with major portion under the Jamnagar district. The southern coast of the Gulf from Okha to Navlakhi has mangrove forests spread over 300 km². The coral beds are mainly of rubbles and conglomerates, the live ones occurring only as patches. The live coral patches harbour a number of associates while the dead conglomerates and rubbles provide protective habitats for diverse faunal elements and serve as substratum for algae and sessile fauna including edible oysters. Mangroves are well known for their role in the protection of the shoreline from erosion and the inland areas from heavy gales. In addition, there are nesting habitats for a number of resident and migratory birds. The litter from the vegetation and the excreta of the nesting birds enrich the environment with nutrients. The mangroves form a nursery for the young of various intertidal and offshore organisms. They also contribute to the economy of the natives by supplying fodder and fuel.

BIODIVERSITY

Because of the diverse habitats, stable conditions of ambient waters and enriching mangroves, the Gulf in general and the Marine Sanctuary including the Marine National Park in particular support a rich biodiversity. The first ever-comprehensive report on the fauna of the erstwhile Okhamandal coast covering part of the present Marine Sanctuary and Marine National Park area was by Hornell (1909, 1916). The main objective of his investigations, sponsored by the then Maharaja of Baroda, was to identify the areas of chank and pearl oyster beds and to explore the possibility of developing their culture fishery. In spite of the encouraging resources of chanks and pearl oysters, he found the prospects of their culture to be uneconomical because of lack of resident expertise. The studies and observations made side by side on the general fauna of the area are of pioneering nature and most valuable to science. It is particularly so in the background of increasing awareness of the importance of marine life and its environment and the declaration of the Marine Sanctuary and Marine National Park. Subsequently there have been only scattered reports of the fauna, though the area has been under an almost continuous study by several scientists. Only recently some reports on different aspects, though not exclusively on the biodiversity, started appearing.

HISTORICAL REVIEW

During his pioneering explorations in 1905-06, Hornell (1909, 1916) found the area a haven for a variety of faunal elements with rich growths of algae, sponges, corals, sea anemones, polychaetes, oysters, various other molluscs, echinoderms and fishes. Since the main thrust was on chanks and pearl oysters, only a general account of the fauna and flora was given. Though taxonomic account of some groups was presented, full information on the biological wealth could not be collected and presented. Pending establishment of their current status, the taxonomic account by various workers in the above report included Porifera (48 spp), Cnidaria (14 spp), and Bryozoa (23 spp) in addition to anomuran crustaceans and nudibranch molluscs. A new species of pinnotherid crab from windowpane oyster (*Placuna placenta*) was reported and the detailed anatomy of the latter was presented. In addition, a general report on the richness of other faunal elements encountered such as polychaetes, echinoderms and fishes, was also given.

Subsequently, with the establishment of Marine Biological Research Station by Gujarat State Fisheries (recently renamed as Gujarat Fisheries Aquatic Research Institute and affiliated to Gujarat Agricultural University) the scientists of the Station had thoroughly surveyed almost all the habitats of the entire area to have a fairly good knowledge of its wealth though deficient in taxonomical accounts. There are a few more scattered reports of which some are comprehensive, notably of plankton, phoronids, gastropods, bivalves, opisthobranchs etc.

The areas seem to have retained the past luxuriant biota till early seventies as appears from the published reports as well as unpublished observations and collections made by the scientists of Zoological Survey of India and other research organizations. Their periodical observations showed a gradual deterioration of the environment and consequent depletion in the faunal wealth.

PRESENT STATUS

The current status of diversity of the total biota is not available completely, since some taxonomic groups are either still under study or lack specialists. Some others need a reassessment. The following is only a bird's eye view presented from published accounts and some unpublished data collected by the authors. The present volume on the fauna of Gujarat gives up-to-date information on the status of individual groups of fauna.

FLORA

The flora of the area comprises two main components namely the mangroves and marine algae. Mangroves constitute an important subsidiary ecosystem of coral reefs. As per the State of Forest Report 1995, the mangrove area of the State is 689 sq km with 95% in the Gulf of Kachchh (536 sq km of Kachchh District and 118 sq km of Jamnagar Districts). The satellite data between 1993 and 1997 revealed an increase of 15.01 % in mangrove cover. As per the recent survey, Gujarat stands second in mangrove cover after Sunderbans,

accounting for 1031 sq km (State of Forest Report 1999, Forest Survey of India). The increase is mostly due to regeneration in the Gulf of Kachchh. The mangrove vegetation of the Gulf of Kachchh is very rich. Eight species of mangroves were reported from the Gulf of Kachchh. *Avicennia marina* is the most dominant species while *Aegiceros corniculatum* is an endangered species. The mangrove area of Gulf of Kachchh from Okha to Navlakhi and Mandvi-Mundra to Jakhau is extensive. Much of the mangrove ecosystem has been damaged and some good mangrove areas exist at Ajad, Bhaidar, Kalubhar, Dida ka Bet, Pirotan, Jindra, Chhad Kharachusna, Bedi Bandar, Jodiya, Narara etc. Regenerated mangroves occur around 22 islands of the Marine national Park. The mangroves are exploited mainly for fuel and fodder. About 10,000 people of the Wagher community were till recently entirely dependent on the mangrove resources. It was estimated that on an average 300 tons of fuel and 130 tons of fodder are collected annually. In addition, camel grazing also contributed to the loss of mangroves leading to inland penetration of saltwater. An estimated 95% of mature mangrove trees were cut during 1970s and 1980s.

The varied habitats of the coast and the rich supply of nutrients from the mangrove forests and their bird populations support abundant growth of diverse algal species. Recently Naik *et al.* (1991) made a comprehensive study of the algal wealth at ten selected sites in the Gulf of Kachchh. As per their report, the Gulf of Kachchh harbours a total of 108 species of algae comprising 29 species of Chlorophyceae, 30 species of Phaeophyceae and 49 species of Rhodophyceae. Of these, 38 species including as many as 20 species of red algae are rare. The other 70 species are common with the green algae *Ulva lactusa* as the dominant species at six sites, *U. fasciata* at two sites, *Enteromorpha intestinalis* and the red alga *Champia indica* at one each of the 10 sites studied. Other important species that are common are *Caulerpa racemosa*, *Iyengaria stellata*, *Sargassum tenerrium*, *Ceramium rubrum*, *Corallina officinalis*, *Gracilaria corticata* and *Hypnea musciformis*. In addition to their own productivity importance, these algae provide food and shelter to a variety of fauna and nurse the young of several species.

FAUNA

In addition to the abundant and ubiquitous members of Protist phyla, members of groups ranging from Porifera to Mammalia fairly richly represent the Animal Kingdom. The estimates of faunal wealth in terms of number of species vary greatly in different sources. However, authentic information is only partial because of incomplete exploration of certain groups and lack of expertise in some groups. As per the rough estimates of the scientists of Marine Biological Research Station the flora and fauna of the Gulf of Kachchh total to nearly 1,500 species as detailed below :

Algae	225 spp
Sponges	70 spp
Molluscs	300 – 400 spp
Fishes	400 spp
Other groups	400 spp

Singh (1997) gave the following figures with some uncertain figures for a few groups, totaling to nearly 900 species :

Algae	120	Echinodermata	Several
Sponges	70	Turtles	3
Hard and soft corals	37 or 56	Fish	180
Annelida	Several	Sea snakes	3
Mollusca	200+	Sea Mammals	3
Prawns	27	Birds	190
Crabs	30		

The alphabetical and unclassified compilation of Nambiar *et al.* (1995) shows the following diversity :

Trees, Shrubs & Herbs	107	Fish	11
Mangroves	9	Reptiles	3
Algae	68	Birds	174
Invertebrates	108	Mammals	3

After consulting the available published information mostly till 1994 and also the material in the National Zoological Collection, an inventory of the fauna has been prepared which consisted of only 736 species/subspecies/varieties (including four species of Porifera not listed but can be found in *Fauna of Gujarat State*). The total diversity might be marginally different when compared with that reported in the *State Fauna Series: Fauna of Gujarat State* (Zoological Survey of India, Kolkata). The available information on the faunal and floral wealth appended at the end is summarized below :

FLORA (Nambiar *et al.* 1995)

Trees / Shrubs / Herbs	103
Mangroves	9
Algae	68
Total	180

FAUNA

PORIFERA				49	
CNIDARIA	Scyphozoa		1		
	Hydrozoa		13		
	Anthozoa				
		Ceriantharia	1	46	
		Hexacorallia	37		
		Alcyonaria	8		
				60	
ANNELIDA	Polychaeta			27	
MOLLUSCA	Polyplacophora		1	178	
	Gastropoda		124		
	Bivalvia		50		
	Cephalopoda		3		
ARTHROPODA	Crustacea	Decapoda		58	
		Reptantia	30		
		Natantia - Peneidea	22		
		Natantia - Caridea	6		
SIPUNCULA				18	
ECHIURA				15	
PHORONIDA				1	
BRYOZOA				21	
BRACHIOPODA				1	
ECHINODERMATA	Crinoidea		2	29	
	Asteroidea		6		
	Ophiuroidea		11		
	Echinoidea		3		
	Holothuroidea		7		
CHORDATA	Chondrichthyes			14	
	Osteichthyes			84	
	Reptilia			4	
	Aves	Water birds		101	174
		Terrestrial birds		73	
	Mammalia	Sirenia		1	3
Cetacea		2			
Total No. of species/subspecies of Fauna				736	

N. B. Porifera, Cnidaria excluding Scleractinia and Bryozoa are from Hornell (1909 and 1916), Aves mainly from Naik *et al.* (1991). Porifera includes 5 more species not listed in the inventory.

As can be seen from the above table, sponges consist of nearly 50 species. They occupy various habitats and are of varied colours. These occupy particularly the shingle and coral rubble habitats. There are both encrusting and erect attached forms, the latter of soft as well as hard substrata.

Though the list of Cnidaria other than hard corals (37 species) includes only 23 species, intensive studies may add many more species. They include colonial hydrozoans, solitary sea anemones and tube dwelling *Cerianthus*.

Corals are more extensive in the western part especially near Poshitra Point and Boria Reef. Pirotan Island has small areas of live corals on the northern side while the eastern side has only dead corals. The coral reefs of Gulf of Kachchh are classified into fringing reefs (Bet Shankhodhar, Okha, Sikka, Chhad etc.), platform reefs (Paga, Bural Chank, Kalubhar etc.), patchy reefs (Goos, Ajad), and coral pinnacles (NE, NW and Southern Bural Chank reef) (Bahuguna and Nayak, 1998). Most areas have only patchy coral growth on sandstone and banks rather than true coral reefs (Pillai *et al.* 1980). Reef flats extend over 148.4 sq km. Live corals were observed on the seaward side on Paga Reef and Vasura. Mud over the corals was observed over 117.1 sq km followed by reef vegetation of 112.1 sq km. Studies by Space Application Centre revealed degradation of reefs between 1975 and 1985, and improvement after 1985.

Though there is no taxonomic information, free-living turbellarians and nemerteans also occur commonly in the area. A number of tube-dwelling and free-living polychaetes totaling to 27 species occur in such varied habitats as algal tufts, under surfaces, crevices, coral rubble and burrows in hard and soft substrata.

The molluscs are by far the largest group of marine invertebrates commonly encountered and thoroughly studied. They include chitons (1 sp), gastropods (124 spp), bivalves (50 spp) and cephalopods (3 spp). The crustacean component of Arthropoda also contributes considerably to the faunal diversity of the area. They chiefly include crabs (30 spp), hermit crabs and shrimps. The penaeid prawns account for 22 species and the carideans belong to six species as per the list of Naik *et al.* (1991). Of the lesser protostomes, 18 species of Sipuncula and 15 species of Echiura are known from the Marine National Park. The lophophorates are represented by one species each of Phoronida associated with the tube dwelling *Cerianthus* (Cnidaria) in muddy habitats and Brachiopoda and 21 species of Bryozoa. Earlier reports of echinoderms other than holothurians did not include correct and full identify of the species encountered. The present study brought to light 36 species of echinoderms from the coast of Gujarat including as many as 29 species from the Marine National Park area. These comprise two species of Crinoidea, six species of Asteroidea, 11 species of Ophiuroidea, three species of Echinoidea and seven species of Holothuroidea. Some of these are at present rare or absent at least in some localities from where they were earlier known (*vide infra*).

Among the chordates, fish and birds are the two major groups contributing to the biodiversity of the area. Some ascidians, reptiles and mammals were also reported. The fish

include 14 spp of cartilaginous fishes and 84 spp of bony fishes. Among these are the commercially important members of the families such as Clupeidae, Engraulidae, Harpadontidae, Serranidae, Carangidae, and Scombridae.

Reptiles are represented by four species of turtles. It is noteworthy that the only significant nesting of the green turtle *Chelonia mydas* on the mainland of India is in Gujarat, on the north and south shores of the Gulf of Kachchh and around the south and west coasts of Saurashtra (Bhaskar, 1984). Nesting by the turtle in other localities is not recorded or sporadic. Though it also occurs in other localities, feeding concentrations are known only in the Gulf of Kachchh. Gulf of Kachchh is the feeding area, though to a small extent, of the Hawksbill Turtle, *Eremochelys imbricata*. Small numbers of the Olive Ridley Turtle, *Lepidochelys olivacea* are known to nest in the Gulf.

Avian fauna of the Gulf displays a rich diversity of resident as well as migratory elements in the Marine Sanctuary and Marine National Park area. The water birds include pelicans, cormorants, herons, egrets, storks, flamingoes, plovers, sand pipers, gulls, terns, etc. The common terrestrial birds occurring in the area are kites, falcons, partridges, peafowls, pigeons, doves, parakeets, koels, larks wagtails, sparrows etc. Naik *et al.* (1991) listed as many as 94 water birds and 76 terrestrial birds from the islands of the Marine National Park. While 40 water birds are residents breeding in the area, the other 54 were considered as migratory or local migratory since they were not observed to breed in the area. With regard to terrestrial birds, they further noted that only 28 birds build nests and breed in the area. Thus a total of at least 174 birds make use of the Marine National Park for breeding and/or feeding purposes. Another four birds have been included in the list based on the records of Ali and Ripley (1983).

The mammalian component of the area consists of a single species of Sirenia and two species of Cetacea in addition to the camels grazing on the mangroves and visitors like domestic cattle, dogs etc.

It is well known that endemism in marine fauna is not high. Gulf of Kachchh and the adjoining coast of Gujarat have some significant fauna that do not occur elsewhere in India. The neretid mollusc *Nerita textilis* is one such species that has restricted distribution in Arabian Sea and occurs only along the Gujarat coast in India.

FISHERY

Fishery is an important aspect from the viewpoints of conservation of environment and economy of the population surrounding the protected areas. It provides livelihood for many. The southern region with coral growth is more productive than the northern region. Gujarat state has 46 registered exporters of fish, 41 freezing plants, 43 cold storage facilities and 16 other cold storage facilities (Usha Rai, 2001). The fishing industry in the Gulf consists mainly of fin-fishery and prawn fishery. In addition, the Gulf area, particularly the Marine Sanctuary, supports a rich shellfishery constituted by edible oysters, windowpane oysters and sacred chanks as well as several decorative shells. Fishing by trawlers is carried out along the

Jamnagar coast in the waters off Okha, Salaya, Sikka, Bedi and Jodiya, the adjoining islands and the Poshitra and Pindara Bays. Some available information on this aspect is summarized below.

Craft and Gear

The Gujarat state has over two lakh fishing vessels of which 4,283 are motorized traditional crafts (Usha Rai, 2001). The fishing crafts in the Gulf include a large fleet of trawlers, mechanized boats and canoes of local design. Out of the total fleet, 126 trawlers, 105 mechanised boats, 328 sailboats and many canoes originate in the Marine Sanctuary area in addition to several from Okha. Depending on the depth of operation and the fish to be caught, different types of gear are used including trawls, gill nets, drift nets and bagnets. In addition, several lone fishermen operate stake nets, dragnets, fixed bagnets and hooks in shallow waters of the Marine Sanctuary and Marine National park.

Fin-fishery

Several groups of fish contribute to the fishing industry of the state. About 27 species contribute to the fishery. Pomfrets, clupeids, sciaenids and prawns are the abundant components. A moderate fishery of *Hilsa* also exists. One of the single species fisheries is whale shark fishery all along the coast. About 600 whale sharks in 1999-2000 and 700 in 2000 were killed. It is the largest living fish measuring 8 to 12 m in length. A small whale shark of 2 m weighs about 0.5 tons while the largest of 14.5 m length weighs 12 tons. In comparison to the coast of Kachchh bordering the Gulf in the north, the coast of Jamnagar on the southern border is richer in fish and prawn fishery potential. The average catch on the southern coast over a 10-year period (1977-87) was 24,110 tonnes of finfish and 3,736 tonnes of prawns. The corresponding figures for the northern coast are 14,343 tonnes and 2,227 tonnes respectively. Fish catches have increased over the last 15 years (Desai, 1997).

Prawns are an important component of the fish catches in the Gulf of Kachchh. Peneid prawns of 10 species constitute about 50% of the prawn and shrimp catches. Important peneid prawns are *Metapenaeus kutchensis*, *Parapenaeopsis hardwicki*, *Parapenaeopsis stylifera*, *Penaeus merguensis* and *Penaeus pencillatus*. Seasonal species include *Solenocera crassicornis*, *Metapenaeus affinis*, *Metapenaeus monoceros*, *Metapenaeus brevicornis*, and *Penaeus semisulcatus*. The species *Penaeus canaliculatus*, *Penaeus japonicus*, *Penaeus monodon* and *Parapenaeopsis sculptilis* are poorly represented. The non-peneids consist of *Acetes indicus*, *Palaemon tenuipes*, *Palaemon styliferus* and *Hippolytina ensirostris* (see Pernetta 1993).

Shell Fishery

Gulf of Kachchh is known for its valuable molluscan resources. From recent excavations at Beyt Dwaraka, it has been observed that there was a flourishing shell trade of bangles at the place during the Post Harappan period. Although a few species of gastropods were used in the making of shell artifacts, it was *Turbinella pyrum* the much-valued sacred chank, around which the shell industry was built. Shells of sacred chank and other molluscs were

collected mainly from the Gulf of Kachchh. Commercially important molluscs of the Gulf are the pearl oyster, *Pinctada fucata*, the sacred chank, *Turbinella pyrum*, the windowpane oyster, *Placuna placenta* and the edible oysters, *Crassostrea gryphoides* and *Saccostrea cuculata*.

Till the early 20th century Jamnagar was one of the biggest centre of pearl fishery in the world. Pearl oysters in the Gulf of Kachchh do not occur in beds as they do in the Gulf of Mannar. Pearl oyster reefs are locally known as 'Kaddas' There were 42 oyster reefs covering an area of about 20,525 hectares in the Gulf. There are three species of pearl oysters, namely, *Pinctada chemnitzii* and *Pinctada sugillata*, which occur in the intertidal region exposed during ebb tides. Of these *Pinctada fucata* is by far the most important one as far as the pearl yield is concerned.

The pearl fishery of the Gulf of Kachchh is smaller in magnitude compared to that of the Gulf of Mannar. Although it was strictly not annual in nature, a regular fishery was conducted from 1913-1914 to 1966-67 with a few gaps during certain years. It was later conducted once in three years and the yield was only about 30,000 oysters with only 15% of them bearing pearls. The fishery lasted for three months starting after the onset of monsoon.

A survey made in 1964 by the Department of Fisheries, Government of Gujarat revealed that there were 552 oysters in a square mile area. A survey of important oyster reefs in 1971-72 and 1972-73 revealed a population density of 1-6 oysters per hectare. The latest available data indicate the population density of pearl oysters ranging from 4 to 144 numbers per km² at Sikka, 18 to 23 at Pirotan Island, and 1 to 16 at Narara. In the rest of the areas the population density varied from 1 to 3 per km² (Anon, 1989-90). It is evident that the natural population of oysters has been on the decline. There were attempts to augment the natural population of pearl oyster by transplanting *Pinctada fucata* from the Gulf of Mannar. A pearl culture programme was started in 1979 by the Department of Fisheries. It is yet to take off as a commercially successful and viable venture. Pearl oyster fishery is almost non-existent now.

There is a great demand for the shell of sacred chank. Until 1965 a major part of landing of sacred chank in the Gulf was exported to the then East Pakistan. Bengal merchants came a long way to Gujarat to purchase chanks, as these were considered of superior quality. There is a great demand for chank shells in West Bengal, Bangladesh and Bhutan.

In the Gulf, chanks are collected at various centres, such as Okha, Armada, Poshitra, Ajad, Nora Is., Salaya, Bhaana, Wadinar, Sikka, Pirotan Is. and Bedi, majority of which fall in the Marine National Park Area. Chanks are mostly handpicked during spring low tides. In a few places like Khumla and Ichhari, fishermen dive in about a fathom deep water to pick up shells. There are about 25 important fishing grounds situated on the north and northeast of Okha in the Gulf of Kachchh. At Sikka, Salaya, Wadinar and Bharana centres chanks are collected during March-June period, whereas in Okha the collection period starts from December-January. Chank collection is confined to shallow waters and deeper waters are not

explored. As a result the production has almost remained below 25,000 mark. Data on Chank collections from 1952-53 to 1966-67 are given below :

Year	Quantity (No.)	Year	Quantity (No.)
1952-53	14,058	1960-61	16,079
1953-54	16,752	1961-62	19,373
1954-55	14,419	1962-63	18,123
1955-56	11,628	1963-64	25,655
1956-57	10,002	1964-65	24,752
1957-58	10,601	1965-66	13,688
1958-59	15,580	1966-67	1,216
1959-60	23,037		

The value of the chanks depends on the size and condition of the shells. Smaller shells and worm-infected shells fetch lesser price. The quantity of chanks and their sale value during certain years are given in the following table :

Year	Quantity (No.)	Value (Rupees)
1981	15,437	1,32,800
1983	21,358	1,76,981
1986	34,563	2,70,860
1989	9,735	1,08,209

The breeding season of chank extends throughout January, February and March months. The egg capsules are laid on sandy and rocky bottom. Many egg capsules were noticed in the intertidal region near Pirotan, Paga and Ajad. Each egg capsule contains about 200 to 300 young ones.

Windowpane oyster fishery of the Gulf of Kachchh is second to that of the Kakinada Bay along east coast. Poshitra and Pindara are the two important fishing centres of windowpane oyster. Mother of pearl and pearl dust, valued at several lakhs of rupees per season, were extracted from this species. Shells are used in manufacturing tiles on a small scale. Pindara Bay located between Poshitra and Ajad, has a depth ranging from 1m to 3m. There are a number of islands in the mouth of the Bay, namely Paga, Mangunda, Boria, Dona, Dabdaba, Pashu, Pural (Chank), Vudda Kudda, Ajad, Gunda Kudda *etc.* Windowpane oyster occurs in small quantities in Balapur Bay of Beyt Island.

Pandya *et al.* (1976) estimated a population of about 50 million oysters from the Gulf. Rights to collect oysters are leased out by the Government of Gujarat to fishermen belonging to five villages *viz.* Salaya, Poshitra, Beyt (Okha), Rajpara and Murval (Sarvaiya, 1982). About 200-300 fishermen were engaged in the windowpane oyster shell collection. Fishing is done from the end of March to the end of October.

Oysters were collected from various centres namely Asaba, Sidibava, Nasgura, Jude, Divdi, Kurchal, Mongra, Jaganiya, Dheribbut, Sarhad, Pindara, Ghungra and Gadu in the Pindara Bay. The Department of Fisheries had a stipulation that the size of an oyster should be 4.5 cm or more, but never less than that. But there is a problem to enforce a strict inspection and as a result even small sized oysters were collected. However, with the establishment of the Marine National Park the collection of windowpane oyster and seaweed was stopped (Anon, 1992). It has resulted in the loss of employment to about 2,500 fishermen and loss of revenue of about Rs. 15 lakhs to the Government.

Oysters also constitute one of the most important resources of the Gulf. Besides their edible value, shells are used in the preparation of cleaning powder and chalk pieces. However, there seems to be no regular fishing of these oysters. Edible oysters are mainly concentrated in the Gulf of Kachchh. *Crassostrea gryphoides* was the most dominant species followed by *Saccostrea cuculata* and *Crassostrea rivularis*. *Crassostrea gryphoides* occurs at Armada, Jakhau, Jodia and Zorpara while the other species, *Saccostrea cuculata* is common at Okha port, Beyt Dwaraka and Sikka (Patel and Jetani, 1991). Edible oysters were also reported from Poshitra, its adjoining reef and Kin Point at Poshitra Bay, reef around Pindara of Pindara Bay and Sarmat, Rozi creek, Balachadi reef, and Sachana Reef along the Jamnagar coast (Narayanan, 1972). Although not very successful, attempts were made to transplant and culture *Crassostrea madrasensis* in the Gulf of Kachchh.

SOCIO-ECONOMICS OF FISHERMEN

An estimated 140,208 subsistence and commercial fishermen operate along the Gujarat coast. Of these 52,388 are full-time (Usha Rai, 2001). There are several fishing villages bordering the Gulf of Kachchh and Marine Sanctuary. The fish folk population of the villages consists of various communities. The population varies from hardly a hundred to nearly 5,000 households per villages. Most of the families are of large size. The size of each family ranges between 6 and 11, most with 8 members. They mainly depend on fishing industry, and to a lesser extent on livestock such as cattle, goats and fowl. Most of them are only wage earners on fishing boats belonging to a few rich ones. There are also several lone fishermen fishing on foot.

As can be expected, trawler and mechanized boat owners make large profits. Their savings range from Rs. 3,000 to Rs. 6,000 a month and those operating in the rich grounds off Jakhau save Rs. 3,000 on each trip. In contrast, owners of sailboats and canoes and the lone fisher folk fishing on foot save hardly anything. Much of their earnings go for maintenance of the craft and net and feeding several mouths of the family. During the peak seasons they may save a maximum of about Rs. 300 per month. However this varies from year to year.

GENERAL OBSERVATIONS

At the time of the first recorded explorations in 1905-06 by Hornell (1909, 1916) the then Okhamandal coast comprising a portion of the present Marine Sanctuary had a luxuriant biota

of algae, mangroves, sponges, sea anemones, polychaetes, molluscs, crustaceans, and echinoderms. The areas seem to have retained their, rich diversity till sixties or early seventies. However, subsequent information from published reports, unpublished observations and faunal collections of scientists of Zoological Survey of India and other scientific organizations, reveals a gradual deterioration of the environment and consequent changes in the composition and abundance of the biota. As can be expected, the change in the biodiversity is mainly due to destruction of habitats and deterioration of the environment brought about by man rather than nature.

ENVIRONMENT

The large conglomerates of dead corals form a major habitat in the Gulf of Kachchh. These and the abundant molluscan shells were considered in early days a rich and suitable source of calcium for developing cement industry in the state. Leasing out of the Gulf area to the local cement factory for extracting calcareous objects as raw material for cement production, led to large scale lifting of coral conglomerates including live and dead corals and various heavy shelled molluscs. This further aggravated the problem of silting in the shallow environment already being experienced due to constant churning by fast tidal currents. With the result, not only the few patches of live corals disappeared, the other biota too lost proper environment as well as habitats. Studies through Remote Sensing revealed a decrease of 12% coral area during a 10-year period from 1975 to 1985 (Sinha, 1989). A large number of industries and activities at different ports handling grains, oil *etc.* contributed to the deterioration of the environment through toxic wastes and organic enrichment resulting in fouling of waters.

Effect of the fishing harbour at Okha situated at the mouth of the Gulf, is limited to the harbour premises because of constant flushing into the open sea by tidal currents. However, a few kilometers interior at Adatra, providing berthing facilities for fishing craft had drastically affected the habitats, fauna and ambient conditions of their environment in the vicinity. The oil and grease from the fishing boats left a covering on the rocks while the fish wastes and trash fish made the habitats of the intertidal region almost anaerobic. During low tide periods the waters emit a foul smell and foul gases, understandably Hydrogen Sulfide, Methane *etc.* bubble out of the sediment.

The frequent visits of large student parties without a proper leader further affected the habitats very badly. This had its telling effect on the associated fauna. With no knowledge of the importance of preserving the habitat and its biota, and the impact of their unintelligent handling on the survival and replenishment of the biota, the student parties carelessly leave the shingles in a reversed state exposing the life on the undersurface directly to hazards leading to death and rendering the hiding elements shelterless.

FLORA

No particular observations were made regarding the algal diversity. However, the mangrove covering was badly affected. As per the reports available, grazing by camels and extraction

of fuel and wood by locals are the principal causes. Satellite data and space photographs showed a decrease of 11% in the mangrove forest area from 1975 to 1985 (Sinha, 1989). At present mangrove afforestation is being actively and successfully implemented. There are reports that in Mundra Taluka, over 1,500 acres of mangroves are being destroyed by salt industry to build saltpans besides laying a 16 km long road to jetty. Of this, approximately 2 km runs into the sea. It is unfortunate that part of the mangrove cover is under revenue authorities and does not constitute reserved forest. For example over 300 km² of mangroves are under the ports of Kandla, Mundra *etc.* discharges from many industries polluting the soil and water are threats to the mangroves. These though not strictly in the Marine Sanctuary and Marine National Park, are definite to affect their environment and biodiversity.

FAUNA

The industrial and human activities damaged the habitats and environment and also effected a drastic change in the composition and abundance of different faunal groups. Up to 1977 the Balapur Bay of Beyt Island was a rich bed of the unique echiuran, *Rubricelatus pirotansis*. It was commonly seen that the entire intertidal region was full of probosces of the echiuran spread out all over the region. It was almost impossible to walk without stepping on them. With passage of time, their population became so poor that now one has to search for their presence. So is the case with other faunal representatives of the area such as the cnidarian *Cerianthus* which houses the phoronid *Phoronis*, the brachiopod *Lingula*, and the asteroid *Astropeccten* to mention a few.

Till 1977 the Adatra area near Okha was a very clean and healthy habitat for a rich faunal assemblage. The echinoderms included large specimens of the asteroid *Anthenea*, the crinoid *Comanthus* and several holothurians. During the subsequent visits to the same area they were found absent. During 1992, only *Asterina*, which subsists on algal film and scum on rocks was present. As one walks along the area or turns a stone, black sediment and bubbles of foul gases are a common experience. While the general depletion of fauna might be due to damage and indiscriminate collection by frequenting student parties, deterioration of the ambient environment and change in the faunal composition can be attributed to the berthing of fishing boats and dumping of their wastes in the vicinity.

The picture of Pirotan Island is further disheartening. During early 1970s there used to be vast beds of live corals extending right from the mid-tide level to a great distance. Some scattered patches of live corals, echiurans, ophiuroids and holothurians were common even during late seventies. Subsequently these became dead by late seventies and later covered by silt in late eighties. During the recent visits the fauna was found to be very poor except for sponges, sabellids and mud dwelling molluscs. Though human presence and interference was absent, the damage was apparently due to large scale silting caused by extensive dredging for calcareous raw material for the nearby cement factory. The practice was continued till recent times.

In general majority of Echinoderms are adapted to life in a clean environment and only a few of them can adjust to polluted habitats. The following echinoderms were once common

but have become rare, if not absent, at the localities mentioned :

CRINOIDEA	<i>Comanthus</i>	(Okha)
ATEROIDEA	<i>Luidia</i>	(Poshitra)
	<i>Astropecten</i>	(Okha, Beyt Id)
	<i>Anthenea</i>	(Okha)
	<i>Echinaster</i>	(Okha, Beyt Id)
OPHIUROIDEA	<i>Marophiothrix</i>	(Okha)
	<i>Ophiothrix</i>	(Pirotan Id)
	<i>Ophionereis</i>	(Pirotan Id)
	<i>Ophiopeza</i>	(Pirotan Id)
	<i>Ophioplocus</i>	(Pirotan Id)

The echinoids, *Temnopleurus* and *Salmacis* are known only by the specimens in the Fishery Museum at Okha. The inaccessible or less frequented virgin areas such as Ajad Reef, Narara Beyt and others still seem to harbour a rich diversity.

ACTIVITIES AND THREATENING EFFECTS

The importance of the biodiversity of the Marine National Park and need to effective protection are well known particularly in the wake of developing activities and changing environment. Mangroves and coral reefs are the two important ecosystems of the Marine National Park. In spite of some positive changes such as regeneration of mangroves, Singh (1997) observed that some species such as *Rhizophora mucronata*, *Cerriops condolleana* and *Aegiceras corniculatum*, which were once common, are absent at present in certain areas while *Bruguiera gymnorhiza* and *Sonnerata apetala* became rare. The coral reef environment is vulnerable to natural as well as anthropogenic threats. The corals are surviving at the extremes of environmental parameters such as temperature, high salinity, fast tidal currents, etc. which are natural threats for healthy survival of coral reefs. Under the circumstances reducing the threats from human activity is the only way for sustainable protection of the Marine National Park.

Rohan and Jhala (1997) identified two important pollutants of the Gulf waters. These are crude oil spilling during transportation and bittern – a highly saline by-product in salt manufacture – occasionally released into the Gulf by the several salt-manufacturing units along the coast. They conducted some experiments to study the impact of these on the corals at Narara and Pirotan Islands. It was observed that the crude oil formed a sticky layer over the coral effecting increased and stable accumulation of silt over the coral, thus smothering the coral and causing its death. In the bittern treated corals the polyps retracted deep into the skeleton resulting in bleaching and excessive settlement of silt over the colony. However, after the subsidence of bittern effect the polyps expanded, cleaned the silt and recovered from the bleaching.

The results of these studies acquire significance in the light of several salt-manufacturing units around the Gulf and the proposed oil refinery' of the Reliance Petroleum Limited in the Gulf and proposal to de-notify huge chunks of the Marine Sanctuary and Marine National Park to facilitate easy transport of crude oil in the Gulf. An estimated 12 tons of crude oil results in spills per every million tons transported. It is feared that apart from the heated wastewater along with its pollutants, the oil spills during transportation of the crude alone is sufficient to destroy permanently the marine life of Jamnagar coast. The freshwater requirement necessitates tapping groundwater resources to a dangerous limit of incursion of saline waters into the subsurface (Aziz and Barnes, 1993).

Singh (1997) and Wafar (1997) have made detailed observations and suggestions for management of the Marine Protected Areas of the Gulf of Kachchh. As per the published information and the authors' own observations, some of the activities and threat to the environment and/or biodiversity are summarized below :

Activity	Effect
Commercial Fishing in the vicinity and Subsistence Fishing in the coral reef area	Depletion in the catch and damage to habitats
Coral collection for industrial and domestic use	Though collection for industrial use is at present banned, it has already resulted in habitat destruction and heavy siltation. Illegal collections of limestone and construction material are damaging the habitats.
Commercial shell collection	Though banned, illegal exploitation continues.
Exploitation of mangroves	Camel grazing and felling for fuel and timber are not only damaging the bird habitats but are also adding to siltation in the coastal habitats and possible erosion of the coastline.
Developmental activities	Proposed tidal power plant might affect circulation; discharge of domestic and industrial effluents pollute the Gulf waters and degrade the environment; Harbour and Port constructions cause destruction to the mangroves and coastal habitats and their biodiversity; solid wastes kill corals and their associated biota.
Educational and Recreational activities	Unguided activities result in destruction of habitats.

These are only some of the major threats that require immediate and serious attention of the Management Authorities. The following measures are to be taken for arresting the present

rate of degradation of environment as well as loss of its biodiversity and promoting possible replenishment of the biota :

1. Developmental activities should take into account the possible damage to the environment and its biota at local level as well as the area in general.
2. The Gulf area should be free from pollution causing developmental activities, such as industries and expansion of berthing facilities etc. should be minimum so as not to cause destruction of the environment.
3. The existing industries should be granted no further expansion.
4. Only un-mechanised fishing boats should have berthing facility in the Gulf. The activity and berthing of mechanized fishing craft should be limited to open coast.
5. Local population surrounding the Marine Sanctuary should be provided with alternative fuel and fodder to decrease the stress on the mangroves and disturbance to the avian fauna.
6. Population surrounding the Marine National Park and depending on it for livelihood should be provided with alternate livelihood to reduce pressure on the resources of the Marine National Park.
7. Student parties on educational visit and tourists on recreational visit should be preferably restricted to the open coast or should be properly guided during the visit to the Marine National Park area.
8. Illegal extraction and trade of windowpane oysters, chanks, and other molluscs should be controlled.

SUMMARY

The Gujarat State on the northern west coast of India has a long coastline of 1,663 km and a shelf area of 164,183 km², which play major role in the marine bioresources and economy of the State. The protected areas of the State include 15 sanctuaries and four National Parks. The Marine Sanctuary in the Gulf of Kachchh has a core zone of 163 km² designated as Marine National Park along the southern coast of the Gulf under Jamnagar District. It consists of the intertidal zone and the nearby islands separated from the coast only during high tide by shallow regions. In spite of the importance in conservation and management, there has been no comprehensive account on the biodiversity, threats *etc.* concerning the Marine National Park. Hence an attempt has been made to present recent observations and available published and unpublished information on these aspects. The general physiography, historical review of the studies and current status of the biodiversity of the Park have been presented. An inventory of 732 (+4) species and subspecies of the fauna and 180 species of flora known to occur in the area has been appended. Some threats to the environment and associated biodiversity have been identified and suggestions for conservation have been made.

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BIBLIOGRAPHY

- Abdulali, H. 1962. An ornithological trip to the Gulf of Kachchh. *J. Bombay nat. Hist. Soc.* **59** : 655-658
- Abdulali, H. 1963. Ornithological notes of a second trip to Gulf of Kachchh. *J. Bombay nat. Hist. Soc.* **60** : 703-708
- Alagaraja, K., Kurup, K. Narayana, Srinath, M. and Balakrishnan, G. 1982. *Analysis of marine fish landings in India- A new approach*. Central Marine Fisheries Research Institute, Cochin, Special Publication, 10
- Alagarwamy, K. and Narasimham, K.A, 1973. Clam, cockle and oyster resources of the Indian coast. *Proc. Symp. Living Resources of the Seas around India*, p. 648-658. Central Marine Fisheries Research Institute, Cochin.
- Ali, S. 1945. *The Birds of Kutch*. Oxford University Press, Bombay.
- Ali, S. 1974. Breeding of the Lesser Flamingo *Phoeniconaias minor* (Geoffroy), *J. Bombay nat. Hist. Soc.* **7** : 141-144
- Ali, S. and Ripley, S. Dillon. 1983. *Handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka*. Compact Edition. Oxford University Press, Delhi. 737 pp.
- Anon. 1981. All India census of marine fishermen, craft and gear, 1980. *Mar. Fish. Infor. Serv. T & E Ser.* **30** : 1-32. Central Marine Fisheries Research Institute, Cochin.
- Anon. 1985. *Marine National Park in the Gulf of Kachchh*. Paper presented at 25th Working Session of IUCN/CNPPA, Corbett National Park, India. 6 pp.
- Anon, 1987. Onslaught continues on underwater 'Cows' *The Hindu*, 3rd May 1987. p. 6.

- Anon, 1987. Endangered marine animal dead. *News* (Centre for Environment Education-News and Features Service, Ahmedabad) 1987, No. 2 : 1-2
- Anon. 1998. *Coral reefs of India: State-of-the-art report*. ENVIS publication series 2/98. ENVIS Centre, CAS in Marine Biology, Parangipettai. 52 pp.
- Anon. 1992. *Status of coral reefs of the Gulf of Kachchh and Andaman and Nicobar Islands*. National Institute of Oceanography, Goa. Prepared for Department of Environment, Ministry of Environment and Forests, Government of India. May 1992. 45 pp.
- Arthur, Rohan and Jhala, Y. V. 1997. Disturbance and coral community structure in the intertidal coral reefs of the Southern Gulf of Kachchh, Gujarat, India. *Proc. 8th International Coral Reef Symposium*, Panama, 24-29 June 1997. 16 pp.
- Awati, P. H. and Kshirasagar, G. R. 1935. Notes on the distribution of *Lingula* from the western coast of India. *J. Univ. Bombay*, 5 : 142-143
- Awati, P. H. and Kshirasagar, G. R. 1957. *Lingula* from the western coast of India. *Zool. Mem Univ. Bombay*, 4 : 1-87
- Azizz, T. and Barnes, H. 1993. Reliance Refinery: Endgame for Marine Park. *W. W. F. India Quarterly*, 4(4) : 6-11
- Bahuguna, A. 1997. Coral reefs and mangrove ecosystem of Marine National Park, Gulf of Kachchh. A review of ecological study using Satellite Data. In: M. P. Singh (ed.) *Recent Advances in Ecological Research*, Vol. I : 197-207. APH Publishing Corporation, New Delhi.
- Bahuguna, A. and Nayak, S. 1998. *Coral reefs of the Indian coast*. Space Application Centre, Ahmedabad. SAC/RSA/RSAG/DOC-COS/SN/16/97. 54 pp.
- Bahuguna, A. Nayak, S., Prasad, K. N., Kadri, S. A. and Trivedi, C. R. 1990. *Mapping of long-term changes in the tidal wetland areas of Gulf of Kachchh*. Scientific Note. Space Application Centre, Ahmedabad, IRS-UP/SAC/MCE/SN/29/90. 15 pp.
- Balan, K., Sivaraman, P., George, K. P. and Ramachandran, M. 1987. An appraisal of the marine fisheries of Gujarat. *Central Marine Fisheries Research Institute, Cochin*, Spl. Publ. 38 : 1-51
- Banerji, S. K. 1958. Fishery Survey and Statistics. *Fisheries of the West Coast of India*, p. 68 – 73. Central Marine Fisheries Research Institute of India, Cochin.
- Bapat, S. V., Deshmukh, V. M., Krishnamoorthi, B., Mathiah, C., Kagwade, V. V., Ramamirtham, C. P., Mathew, K. J., Pillai, S. K. and Mukundan, C. 1982. Fishery resources of the Exclusively Economic Zone of the northwest coast of India. *Bull. cent. mar. Fish. Res. Inst.* 33A : 13-21

- Bailey, R. 1996. The sea-birds of the south-west coast of Arabia. *Bull. cent. mar. Fish. Res. Inst.* **108** : 224-264
- Bebbington, A. 1974. Aplysiid species from east Africa with notes on the Indian Ocean of Aplysiomorpha (Gastropoda : Opisthobranchia). *Zool. J. Linn. Soc.* **54** : 63-99
- Bhandari, P. P. and Trivedi, Y. A. 1975. Sea weed resources of Hanumandandi and Vumani Reef near Okha Port, Gujarat. *Indian J. mar. Sci.* **4** : 97-99
- Bhaskar, S. 1978. Notes on the Gulf of Kutch. *Hamadryad*, **3**(3) : 9-10
- Bhaskar, S. 1984. The distribution and status of sea turtles in India. In: E. G. Silas (Ed) *Proceedings of the Workshop on Sea Turtle Conservation*, February 1984, Madras. p. 22-35. Central Marine Fisheries Research Institute, Cochin.
- Bhaskar, S. 1986. Dugongs. In: R. E. Hawkins (Gen.Ed.), *Encyclopaedia of Indian Natural History*. Oxford University Press, Bombay. p. 189
- Bhaskaran, M. and Gopalakrishnan, P. 1971. Observations on the marine plankton in the Gulf of Kachchh, off Port Okha. *Indian J. Fish.* **18** : 99-108
- Bhatt, T. 1983. India's coral islands: A fight for survival. *Sunday*, **11**
- Bhatti, Y. M., Kutty, M. N., Venkata Subba Rao, K. and Punswani, D. M. 1967. 'Ghor-Dara' Fishery of Bedi Port in the Gulf of Kutch. *Indian J. Fish.* **11**(1) A : 135-156 (1964)
- Bhosale, L. J. 1987. The Mangrove Ecosystem in India. In: Field and Dartnell. *Mangrove Ecosystem of Asia and Pacific*.
- Blair, D. 1980. *Indosolenorchis hirundinaceus* Cruz, 1951 (Platyhelminthes : Digenea) from the dugong, *Dugong dugon* (Mueller) (Mammalia : Sirenia). *Ann. Parasit. (Paris)*, **55**(5) : 511 - 525
- Blair, D. 1981. The monosome flukes (Digenea: Families Opisthotrematidae Poche and Rhabdiopoeidae Poche) parasitic in sirenians (Mammalia : Sirenia). *Aust. J. Zool. Suppl.* **81** : 1-54
- Browne, E. T. 1916. Notes on some jellyfishes from Okhamandal in Kathiawar collected by Mr. James Hornell in 1904-5. In : Hornell (1916) : 151-155
- Burn, R. and Narayanan, K. R. 1970. Taxonomic notes of *Eolis militaris* Alder and Hancock, 1864 (Opisthobranchia : Eolidacea). *J. Malac. Soc. Aust.* **2**(1) : 83-86
- Chavan, S. A. 1985. Status of mangrove ecosystem in Gulf of Kachchh. *Proc. Symp. Endangered Marine Animals and Marine Parks.* **3** : (paper no. 42) 15 pp. Marine Biological Association of India, Cochin.

- Chavan, S. A. (no year). Marine National Park in the Gulf of Kutch. *In* : H. A. Vaishnav and S. A. Chavan, *Coastal and Marine Ecosystems of Gujarat*, p. 13-22
- Chhapgar, B. F. 1957a. On the marine crabs (Decapoda: Brachyura of Bombay State, part I. *J. Bombay nat. Hist. Soc.* **54** : 399-439
- Chhapgar, B. F. 1957b. On the marine crabs (Decapoda : Brachyura) of Bombay State, part II. *J. Bombay nat. Hist. Soc.* **54** : 503-549
- Chhaya, N. D., Desai, A. Y. and Raval, Y. B. 1993. Research and development work carried out on edible oysters in Gujarat. *Mar. Fish. Inf, Service, Tech & Extn Series*, **125** (December 1993) : 7 – 9. CMFRI, Cochin.
- Chinoy, J.J. and Vaidya, B.S. 1970. Agar-agar and Alginate resources of India. *Vidya*, **13** : 188-211
- Dattagupta, A.K. and Menon, P.K.B. 1962. On a new species of *Ikedosoma* (Echiuridae). *Ann. Mag. nat. Hist.* (13) **5** : 305-309
- Dattagupta, A.K. and Menon, P. K. B. 1965. Additions to Indian Echiurid fauna. *Ann. Mug. nat. Hist.* (13) **8** : 193-200
- Dattagupta, A. K, Menon, P. K. B. and Johnson, P. 1963. Echiurids from Indian waters with the description of two new species. *Ann. Mag. nat. Hist.* (13) **6** : 57-63
- Dave, H. B., Bhaskaran, M., Chaya, N. D. and Mulia, K. D., 1982. Results of a pilot survey for prawn and mullet seeds at Jodia, Gujarat, India. *Proc. Symp. Coastal Aquaculture*, **1** : 183-186
- Davie, J. D. S. 1991. The status of mangrove systems in the Asia Pacific Region. Prepared for M. Collins *et al.* (Eds). *The Conservation Atlas of Tropical Forests. Asia and pacific*. WCMC, Cambridge.
- Dendy, A. 1916a. Report on calcareous sponges collected by Mr. James Hornell at Okhamandal in Kathiawar in 1905-6. *In* : Hornell (1916), p. 79-91
- Dendy, A. 1916b. Report on non-calcareous sponges collected by Mr. James Hornell (1916), p. 93-146
- Desai, K., Nimavat, D. and Pandya, J. A. 1977. Studies on the pearl oyster *Pinctada fucata* (Gouff) of the Gulf of Kutch. iii. Preliminary investigations on pearl culture. *Curr. Sci.* **46**(21) : 748-749
- Desai, P. 1997. Coastal environment of Gujarat with special reference to the Gulf of Kachchh. *Proc. Workshop on the Integrated Coastal Zone Management*. p. 129-144. Space application Centre (ISRO), Ahmedabad and Department of Forests and Environment, Government of Gujarat. April 2-4, 1997.

- Deshmukh, V. M., 1975. A note on the prawn fishery in the Gulf of Kutch during 1962-63. *Indian J. Fish.* **22** : 265-269
- Dwivedi, S. N. 1989. The conservation and sustainable management of India's genetic estate: - aquatic resources and genetic variability, ecosystems and conservation. National Symposium, WWF-India, 3-4 Nov.
- Eswaran, C.R. 1967. On an abnormal ray from the Gulf of Kutch. *J. mar. boil. Ass. India*, **9**(1) : 198-200.
- Easwaran, C. R., Narayanan, K. R. and Michael, M. S., 1969. Pearl fisheries of the Gulf of Kutch. *J. Bombay nat. Hist. Soc.* **66** (2) : 338-344
- F.A.O. 1979. General description of marine small scale fisheries, Gujarat, India. *Small-scale fisheries promotion in Southern Asia*, Colombo.
- Frazier, J. G. 1989. Sea Cow the last mermaid. *The India Magazine*, **9**(3) : 20-21, 23-25, 27
- Frazier, J. G. and Mundkur, T. 1991. Dugong, *Dugong dugon* (Mueller) in the Gulf of Kutch, Gujarat. *J. Bombay nat. Hist. Soc.* **87** : 368-379
- Gangopadhyay, T. 1996. A rich Kutch watches its systematic degradation: Mangrove covers, marine wealth and precious water losing ground to industries. *Indian Express*, January 20, 1996
- George, M. J. and Rao, P. V. 1966. On some decapod crustaceans from south-west coast of India. *Proc. Symp. Crustacea*, Part I : 327-336. Marine Biological Association of India, Cochin.
- George, M.J. 1969. Systematics, Taxonomic consideration and general distribution of Prawn Fishery of India. *Bull. cent. mar. Fish. Res. Inst.* **14** : 5-48
- George, M. J. and Suseelan, C. 1982. Distribution of species of prawns in the backwaters and estuaries of India with reference to coastal aquaculture. *Proc. Symp. Coastal Aquaculture*, **1** : 273-284
- George, P. C., George, M. J. and Rao, P. V., 1963. *Metapenaeus kutchensis* sp. nov. a penaeid prawn from the Gulf of Kutch. *J. mar. boil. Ass. India*, **5**(2) : 284-288
- Gideon, P. W., Menon, P. K. B., Rao, S. R. V. and Jose, K. V. 1957. On the marine fauna of Gulf of Kutch : A preliminary survey. *J. Bombay nat. Hist. Soc.* **54**(3) : 690-706
- Gokhale, S. V., 1957. The operation of dolnet of the Saurashtra coast. *J. Bombay. nat. Hist. Soc.* **54** : 714-725
- Gokhale, S. V. 1960. *Shell fisheries of Saurashtra region, Gujarat State*. Department of Fisheries, Gujarat.

- Gokhale, S. V., Eswaran, C. R. and Narasimham, R. 1954. Growth rate of pearl oyster, *Pinctada pinctada* in the Gulf of Kutch, with a note on pearl oyster fishery of 1953. *J. Bombay. nat. Hist. Soc.* **52**(1) : 124-136
- Gopalakrishnan, P. 1969a. Some marine algae from the Gulf of Kutch. *Phytos*, **8** : 61
- Gopalakrishnan, P. 1969b. On the Holothuroidea (Echinodermata) of the Gulf of Kutch. *J. Bombay nat. Hist. Soc.* **66** : 399- 400
- Gopalakrishnan, P. 1971. Some observations on the shore ecology of the Okha Coast. *J. mar. boil. Ass. India*, **12** (1970) : 15-34
- Gopalakrishnan, P. 1972. Studies on the marine planktonic diatoms off Port Okha in the Gulf of Kutch. *Phytos*, **11** : 37-49
- Haldar, B. P. 1981. On the climatology of the Beyt Island, western India, with special reference to the systematics of *Phoronis australis* Haswell (Phoronida). *Indian J. Zool.* **33** : 59-63
- Haldar, B. P. 1985. On the ecological status of *Rubricelatus pirotansis* (Echiura : Ikedaidae) from the Gujarat Coast, India. *Proc. Symp. Endangered Marine Animals and Marine Parks*, **4** : (Paper no. 52) 5 pp.
- Haldar, B. P. 1991. Sipunculans of the Indian Coast. *Mem. zool. Surv. India*, **17**(4) : 1-69
- Haldar, B. P. Sipuncula, Echiura and Medusae (Cnidaria). *State Fauna Series: Fauna of Gujarat*. Zoological Survey of India, Kolkata.
- Hashimi, N. H., Nair, R. R. and Kidwai, R. M. 1978. Sediments of the Gulf of Kutch. A high energy tide dominated environment. *Indian J. Mar. Sci.*, **7** : 1-7
- Hashimi, N.H., Narayana, N.V. and Wale, B.G. 1977. Submerged intertidal calcareous sandstones in the Gulf of Kutch. *Mahasagar, Bull. Natl. Inst. Oceanography*, **10** : 9-16
- Hornell, J. 1909. *Report to the Government of Baroda on the Marine Zoology of Okhamandal*. Part I. 148 pp. Williams and Norgate, London.
- Hornell, J. 1919. *Report to the Government of Baroda on the Marine Zoology of Okhamandal in Kathiawar*, Part II. Williams and Norgate, London.
- Hornell, J. 1951. *Indian Molluscs*. Bombay Natural History Society, Bombay.
- Howard, R. and Moore, A. 1980. *A comprehensive checklist of the birds of the world*. Oxford Univ. Pres. 701 pp.
- James, D. B. 1969. Catalogue of echinoderms in the reference collections of the Central Marine Fisheries research Institute. *Bull. cent. mar. Fish. Res. Inst.* **7** : 51-62

- James, D. B. (1984). Studies on Indian echinoderms – 15. On *Psolus mannarensis* sp. nov. and other dendrochirotids from the Indian Seas. *J. mar. boil. Ass. India*, **26**(1&2) : 109-122 (1984)
- Jones, S. 1976. The present status of the dugong, *Dugong dugon* (Mueller) in the Indo-Pacific and problems of its conservation. *Report of Advisory Committee on Marine Resources Research. Scientific Consultation in Marine Mammals*. Bergon. ACMRR/MM/SC/26. 26 pp. FAO, Rome.
- Jones, S. 1981. Distribution and status of the dugong, *Dugong dugon* (Mueller) in the Indian region. In : H. Marsh (ed). *The Dugong. Proc. Seminar/Workshop at James Coom University*, (8-13 May, 1979) : 43-54
- Joshi, H.V. and Krishnamurthy, V. 1972. The species of Enteromorpha from India. *Bot. J. Linn. Soc.* **65** : 119-128
- Kagwade, P.V. 1967. Prawn catches by the mechanized vessels in the trawling grounds of Bombay and Saurashtra, *Proc. Symp. Crustacea*. Part IV : 1348-1382. Marine Biological Association of India, Cochin.
- Kale, S.R. 1967. *Enteromorpha gujaratensis*, a new species from Gujarat, India, *Phytos*, **6** : 29-31
- Kathiresan, K. 1998. Distribution and status of mangroves in India. *Seshaiyana*, **6**(2) : 8-9. ENVIS Centre, CAS in Marine Biology, Parangipettai.
- Khachar, S., Naik, R. M. and Lav Kumar, K. S. 1960. A visit to the Flamingoes in the Great Rann of Kachchh. *J. Bombay nat. Hist. Soc.* **57** : 465-478
- Krishnamurthy, V. and Joshi, H. V. 1970. *A check-list of Indian Marine Algae*. CSMCRI, Bhavnagar. 27 pp.
- Krishnan, Sunita, Pravez, R. and Mansuri, A. P. 1996. Fishery and anthropogenic pressure in the Gulf of Kachchh, India. *J. mar. boil. Ass. India*, **37** (1995) : 49-55.
- Kundu, H. L. 1965. On the Marine Fauna of Gulf of Kutch, Part III. Pelecypoda. *J. Bombay Nat. Hist. Soc.* **62** : 84 - 103 and 211-236.
- Laumb, N.C. 1960. Prawn Fishery of Kachchh, Gujarat State. *The Fishing Industry of Gujarat Souvenir*. 49 - 54. Directorate of Fisheries, Government of Gujarat.
- Macann, C. 1939. The Flamingo (*Phoenicopterus ruber antiquorum* Temm.). *J. Bombay nat. Hist. Soc.* **57** : 216-217
- Menon, P.K.B., Dattagupta, A. K. and Das Gupta, D. 1961. On the marine fauna of the Gulf of Kutch. part II. Gastropoda. *J. Bombay nat. Hist. Soc.* **58** (2) : 475-494

- Menon, P.K.B., Dattagupta, A.K. and Johnson, P. 1964. Report on bonelliids (Echiura) collected from the Gulf of Kutch and Port Blair (Andaman Island). *Ann. Mag. Nat. Hist.* (13) 7 : 49-57
- Misra, A. and Chakraborty, R.K. 1983. Further records of polychaetes from Gujarat coast. *Rec. zool. Surv. India*, 81 : 69-75
- Mohan, R.S. Lal. 1963. On the occurrence of the *Dugong dugon* (Mueller) off the Gulf of Kutch. *J. mar. biol. Ass. India*, 5 : 152
- Moses, S.T., 1938. The recent placuna fishery in Baroda and some notes on the window pane oyster. *J. Bombay nat. Hist. Soc.* 41.
- Moses, S.T. 1942. The fisheries of the Gujarat coast. *J. Gujarat Res. Soc.* 4(2) : 61-82
- Mukundan, C. and Narayana Rao, K.V. (Eds) 1983. Fishery resources of the Exclusive Economic Zone of the northwest coast of India. *Bull. cent. mar. Fish. Res. Inst.*, 33 : 1-86
- Mundkur, T. 1987. Recent sightings of the Sandwich Tern *Sterna sandvicensis* with comments on its status in Gujarat. *J. Bombay nat. Hist. Soc.* 84 : 640-682
- Mundkur, T., Rao, L. and Varu, S., 1988. Distribution of the Slenderbilled Gull (*Larus genei* Brune) in the Gulf of Kutch, Gujarat. *J. Bombay. nat. Hist. Soc.* 85 : 420-422
- Mundkur, T., Pravez, R., Khachar, S. and Naik, R.M. 1989. Hitherto unreported nest site of the Lesser Flamingo *Conarias minor* in the Little Rann of Kutch. *J. Bombay nat. Hist. Soc.* 86 : 281-285
- Murthy, M. S., Bhattacharya, M. and Radia, P. 1978. Ecological studies on the intertidal algae of Okha (India). *Bot. Mar.* 21 : 381-386
- Murthy, M.S., Naresh, J.; Faldu, P.J. and Rao, Y.N. 1987. Photosynthesis of *Ulva lactusa* at different tidal levels during submergence and emergence. *Funct. Ecol.* 1 : 387-390
- Nagappan Nayar, K. 1984. *Report on the Technical Review of the Projects on culture of edible molluscs of the Dept. of Fisheries, Government of Gujarat at Sikka and Okha for the period 1977-1983.*
- Nagappan Nayar, K. and Mahadevan, S. 1973. Chank resources of India. *Proc. Symp. Living resources of India.* p. 672 - 686. Central Marine Fisheries Research Institute, Cochin.
- Naik, R.M., Mundkur, T. and Palmes, P. 1988. The Directory of Indian Wetlands. WWF India and AWB, Kuala Lumpur. p. 94-98
- Naik, R.M., Murthy, M.S, Mansuri, A.P., Rao, Y.N., Pravez. R. Mundkur, T. Krishnan, Sunita, Faidu, P.J. and Krishna, T.S.V.R. 1991. *Coastal marine ecosystems and*

anthropogenic pressure in the Gulf of Kachchh. WWF, India and Dept. of Biosciences, Saurashtra University, Rajkot, Final Report. 287pp.

- Naik, R.M. and Parasharya, B.M., 1987. Impact of the food availability, nesting habitat destruction and cultural variations of human settlements on the nesting distribution of a coastal bird, *Egretta gularis*, in western India. *J. Bombay nat. Hist. Soc.* **84** : 350-360.
- Nair, R.V., Mohan, R.V., Lal, and Rao, K.S. 1975. The dugong, *Dugong dugon*. *Bull. cent. Mar. Fish. Res. Inst.* **26** : 1-44
- Nambiar, P., Oza, G.M. and Lavkumar, K. 1995. Gulf of Kachchh Marine National Park. pp. 67-95. *Protecting Endangered National Parks*. RGICS Project No. 7, 206 pp. Rajiv Gandhi Institute for Contemporary Studies, New Delhi.
- Narayanan, K.R. 1969. On the opisthobranchiate fauna of the Gulf of Kutch. *Proc. Symp. Mollusca, India*, **1** : 188-213
- Narayanan, K.R. 1971a. On a new species of the genus *Berthellina* (Opisthobranchia: Notaspida) of the Gulf of Kutch. *J. mar. biol. Ass. India*, **12** : 210-212 (1970)
- Narayanan, K.R. 1971b. On two doridacean nudibranchs (Mollusca: Gastropoda) from the Gulf of Kutch, new to Indian Coast. *J. Bombay nat. Hist. Soc.* **68**(1) : 280-281
- Narayanan, K.R. 1974. Preliminary observations on the breeding of pearl oyster, *Pinctada fucata* (Gould) of the Gulf of Kutch. *J. Bombay nat. Hist. Soc.* **71**(1) : 32-40
- Narayanan, K.R. and Chandy, M. 1989. *A status paper on the fisheries of Gujarat*. Commissioner of Fisheries, Govt. of Gujarat.
- Narayanan, K.R. and Michael, M.S. 1968. On the relation between age and linear measurements of pearl oyster, *Pinctada vulgaris*. (Schumacher) of the Gulf of Kutch. *J. Indian Fisheries Assn.* **2**
- Nayak, S. Pandeya Anjali, Gupta, M.C., Trivedi, C.R., Prasad, K.N. and Kadri, S.A. 1989. Application of satellite Data for monitoring degradation of tidal wetlands of Gulf of Kachchh, Western India. *Acta Astronautica*, **20** : 171-178
- Nishiwaki, M. and Marsh, H. 1985. *Dugong dugon* (Mueller, 1776). In: S. H. Ridgeway and R. J. Harrison (eds), *Handbook of marine Mammals*, Vol. **3** : 1 - 31. Acad. Press, London.
- Palmes, P. and Briggs, C. 1986. Crab-plovers, *Dromas ardeola* in the Gulf of Kutch. *Forktail*, **1** : 21-28
- Pandya, J.A., 1972. Age and growth of the pearl oyster, *Pinctada vulgaris* (Schumacher) of the Gulf of Kutch. *J. Ind. Fisheries Assn.* **2**

- Pandya, J.A., 1972a. A note on the oyster bearing 52 pearls. *Biologica*, 6
- Pandya, J.A., 1974b. Pearl oyster resources and culture experiments in Gujarat. *Proc. Group Discussion on pearl culture, Tuticorin*. p. 25-27. Central Marine Fisheries Research Institute, Cochin.
- Pandya, J.A., 1976. The influence of temperature over growth ring formation in the pearl oyster, *Pinctada fucata* (Gould) of the Gulf of Kutch. *Indian J. Mar. Sci* 5(2) : 249-250
- Pandya, J.A., Sarvaiya, R.T., Gajera, G.L. and Chaudhury, K.R. 1976. A quick economic and hygienic method of extracting pearls from the window pane oyster. *Souvenir CIFE Association*, 1(6) : 22-26
- Parasharya, B. M. 1984. *Studies on the coastal birds and their marine habitat, with special emphasis on the biology of the Indian Reef Heron, Egretta gularis*. Unpublished Ph.D. Thesis, Saurashtra University, Rajkot.
- Parulekar, A.H., (no year). Bio-ecology of the Gulf of Kutch. (Key-note Address). *Marine Archaeology of Indian Countries*, 129-132
- Parulekar, A.H. and Untwale. A.C. 1976. *Report of flora, fauna and natural history of Pirotan Island in the Gulf of Kutch*. National Institute of Oceanography, Technical Report.
- Parulekar, A.H. and Untwale, A.C., 1978. *Status report on Pirotan Island (Gulf of Kutch) for starting a conservation plan*. National Institute of Oceanography, Technical Report. 16 pp.
- Patel, M.I. 1975. Pelagic copepods from the inshore waters off Saurashtra coast. *J. mar. boil. Ass. India*. 17(2) : 658-663
- Patel, M.I. 1976a. Corals around Poshetra Point, Gulf of Kutch. *Souvenir CIFE Assn. Bombay*, 1 : 11-16
- Patel, M.I. 1976b. Crabs around Poshetra Point, Gulf of Kutch. *Souvenir CIFE Assn. Bombay*, 1
- Patel, M.I. 1978. Generic diversity of scleractinians around Poshetra Point, Gulf of Kutch. *Indian J. Mar. Sci*. 7 : 30-32
- Patel, M.I. 1985a. Calcareous sand mining from beaches and littoral areas in the Gulf of Kutch, Gujarat and their possible deleterious effects on marine life. *Proc. Symp. Endangered Marine Animals and Marine Parks*, 3 (Paper No. 41) 8 pp.
- Patel, M.I. 1985b. Conservation of pearl oysters in the Gulf of Kachchh. *Proc. Symp. Endangered Marine Animals and Marine Parks*, 4 (Paper No. 56) 8 pp.

- Patel, M.I. 1985c. Conservation of patchy corals of the Gulf of Kutch, *Proc. Symp. Endangered Animals and Marine Parks*, 4 (Paper No. 56) 8pp.
- Patel, M.I. and Bhaskaran, M 1978. Possibilities of establishing coral based industries in Gujarat. *Seafood Export Journal*, 10 (4) : 23-27
- Patel, M.I. Buch, A. V., Chhaya, N. D., Bhaskaran, M. and Vashi, V. K. 1980. A proposed project on backwater fish farm of Jodia, Gujarat. *Proc National Symp. Shrimp Farming*. Bombay. 1978. The Marine Products Export Development Authority, Cochin 187 pp.
- Patel, M.I. and Jetani, K.L. 1991. Study of oysters from Gulf of Kutch. *Fishing Chimes*, 17 : 56-57
- Pernetta, J.C. (Ed). 1993. *Marine protected Area Needs in the South Asian Seas Region. Volume 2: India*. A Marine Conservation and Development Report. IUCN, Gland, Switzerland. vii + 77 pp.
- Pillai, C.S.G. and Patel, M.I. 1988. Scleractinian corals of the Gulf of Kachchh. *J. mar. Biol. Ass. India*. 30 : 50-74
- Pillai, C.S.G., Rajagopal, M.S. and Varghese, M.A. 1980. Preliminary report on a reconnaissance survey of the major coastal and marine ecosystem Gulf of Kutch. *Mar. Fish. Inform. Serv. T. & E. ser.* 14 : 16-20. Central Marine Fisheries Research Institute, Cochin.
- Pillay, T.V.R. 1948. The Marine fisheries of Kodinar in Kathiawar. *J. Bombay nat. Hist. Soc.* 48 : 47-61
- Qasim, S.Z. 1977. Biological productivity of the Indian Ocean. *Indian J. Mar. Sci.* 6 : 122-137
- Qasim, S.Z. and Kureishy, T.W. 1986. Biological diversity in the seas around India: Present status and major threats. *Proc. Indian Acad. Sci. (Anim. Sci./Plant Sci.) Suppl.*, November 1986, pp. 1-17
- Raj, Hardit Singh. 1933. The shellfisheries of the Bombay presidency Part II. *J. Bombay nat. Hist. Soc.* 36(2) : 884-897
- Ramamurthy, S. 1963. A note on prawn fishery of Kutch. *J. mar. biol. Ass. India*, 5(1) : 146-148
- Ramamurthy, S. 1967. Studies on the prawn fishery of Kutch. *Proc. Symp. Crustacea, Part IV* : 1424-1436. Marine Biological Association, Cochin.
- Ramamurthy, S. and Dhawan, R. M. 1963. On the plankton at Kandla in the Gulf of Kutch during August, 1958 to July, 1960. *Indian J. Fish.* 10(1) : 94-101
- Rao, C.A.N. and Soota, T.D. 1981. On some polychaetes from Gujarat coast. *Rec. zool. Surv. India*. 79 : 73-82

- Rashid, M. A. 1985. Gujarat's Gulf of Kutch - A Marine Paradise. *Symp. Endangered Marine Animals and Marine Animals Parks*, 3 : (Paper No. 40) 14 pp. Marine Biological Association of India, Cochin.
- Rashid, M.A. 1988. Gujarat's Gulf of Kutch – A Marine Paradise. p. 467-474. In : E. G. Silas (Ed). *Proc. Symp. Endangered Marine Animals and Marine Animals Parks*, 12-16 Jan 1985. Marine Biological Association of India, Cochin.
- Rudman, W.B. 1973. Chromodorid opisthobranch Mollusca from the Indo-west Pacific. *Zool. J. Linn. Soc.* 52(3) : 175-199
- Sarvaiya, R.T. 1977a. Studies on Mollusca of Saurashtra coast - I. Amphineura and Gastropoda. *Fishery Technol.* 14(1) : 27-32.
- Sarvaiya, R.T. 1977b. Studies on Mollusca of Saurashtra coast - II. Pelecypoda. *Fishery Technol.* 14(1) : 33-38
- Sarvaiya, R.T. 1977c. Studies on Mollusca of Saurashtra coast - III. Composition. *Fishery Technol.* 14(2) : 170-175
- Sarvaiya, R.T. 1978. Prawn fisheries of Kutch with special reference to Sukhper and Lakhpat. *Indian. J. Fish.* 25 : 35-40
- Sarvaiya, R.T. 1981. Commercially Important Molluscs of Saurashtra Coast : Conservation and Development. *Fishing Chimes*.7(9) : 49-53
- Sarvaiya, R.T. 1982. Window pane oyster fishery of Pindara Bay in the Gulf of Kachchh. *Sea Food Export. J.* 14(8) : 1-4
- Sarvaiya, R.T. and Chhaya, N.D. 1983. *Saurashtra Molluscs*. Ahmedabad. 46 pp.
- Scott, D.A. 1989. *A Directory of Asian Wetlands*. IUCN/Gland, Switzerland.
- Shirwaiker, P. and Parulekar, A.H. (no year). Gastropod Fauna of Beyt Dwaraka, Gulf of Kutch. *Marine Archaeology of Indian Ocean Countries*. p. 133-134
- Silas. E.G., 1961. Occurrence of the sea cow *Halicore dugong* (Erxl) off the Saurashtra Coast. *J. Bombay nat. Hist. Soc.* 58 : 263-266
- Silas, E.G. and Bastin Fernando, A. 1985. The Dugong in India- Is it going the way of the Dodo-?. *Proc. Symp. Endangered Marine Animals and Marine Parks*. Cochin, India.
- Singh, H.S. 1984. *Status Report on Mangroves in Gujarat State Marine National Park*. Gujarat State Forest Department, Jamnagar. 79 pp.
- Singh, H.S. 1997. issues and problems involved in managing Marine Protected Area : A case study on Marine National park, Jamnagar. *Proc. Workshop on Integrated Coastal Zone*

- Management*. p. 105-112. Space Application Centre (ISRO), Ahmedabad and Department of Forests and Environment, Government of Gujarat. April 2-4, 1997.
- Singh, N.T. 1986. Ecology and Productivity of Indian Coastal Region. *J. Andaman Sc. Assoc.* **2** (2) : 1-10
- Sinha, S. 1989. Gujarat's Marine National Park. *Colourful wildlife of Gujarat. The Gujarat Experience*. p. 24-34. Forest Department, Gujarat.
- Soota, T.D., Misra, A. and Chakraborty, R.K. 1981. Polychaete Fauna of Gujarat Coast. *Rec. zool. Surv. India*, **79** : 93-104
- Soota, T.D. and Reddy, K.N. 1976. On the distribution and habitat of the brachiopod *Lingula* in India. *Newsl. zool. Surv. India*, **2**(6) : 235-237
- Soota, T.D. and Sastry, D.R.K. 1977. A note on two species of *Echinaster* Mueller and Troscchel (Echinodermata : Asteroidea) from Indian Ocean. *Newsl. zool. Surv. India*, **3** : 168-169
- Soota, T.D. and Sastry, D.R.K. 1979. Notes on two species of *Echinaster* Mueller and Troscchel (Echinodermata : Asteroidea) from Indian Ocean. *Rec. zool. Surv. India*, **75** : 343-352
- Srinivasa Rao, P. 1962. *Polysiphonia acuminata* L. L. Gardiner – a new record for the Indian Ocean. *Curr. Sci.* **31** : 246-247
- Srinivasa Rao, P. 1967. The genus *Polysiphonia* from the Kathiawar coast of India. *Proc. Seminar on Sea, Salt and Plants, Bhavnagar*. p. 169-177
- Srinivasa Rao, P., Iyengar, E.R. and Thivy, F. 1964. Survey of Algin bearing seaweeds of Adatra reef, Okha. *Curr. Sci.* **15** : 464-465
- Srivastava, P.G. and John, V.C. 1977. Current regime in the Gulf of Kutch. *Indian J. Mar. Sci.* **6** : 39-48
- Srivatsa, K. R. 1953a. *A survey and comparative analysis of the prawn (shrimp) fishery of the Gulf of Kachchh in Saurashtra in western India*. Department of Industries and Supplies, Government of Saurashtra.
- Srivatsa, K. R. 1953b. *A preliminary note on the trawl fish catches and the fishing areas of Saurashtra coast* (Information obtained from the Japanese trawler *Taio Maru* No. 17). Department of Industries and Supplies. Government of Saurashtra.
- Srivatsa, K. R. 1954. *Boats and gears of Saurashtra fishermen*. Department of Fisheries, Government of Saurashtra.

- Thakkar, P. S. 1962. Why did the flamingos shift their breeding ground ? *ISRO (Ahmedabad) Tech. Rep.* p. 108-116
- Thivakaran, G. A. 1998. Mangrove ecosystem of Gujarat : Problems and conservation needs. *Seshiyana*, ENVIS Newsletter, **6** (1) : 6-8. ENVIS Centre, CAS in Marine Biology, Parangipettai.
- Thivy, F. and Sharma, H. C. 1966. *Ulva beytensis* spec. nov. from Gujarat, India. *Curr. Sci.* **35**(6) : 2-3
- Thornley, L. R. 1916a. Report on Hydroidea collected by Mr. James Hornell at Okhamandal in Kathiawar in 1905-06. *In: J. Hornell (1916) II* : 49-55
- Thornley, L. R. 1916b. Report on Polyzoa collected by Mr. James Hornell at Okhamandal in Kathiawar in 1905-06. *In: J. Hornell (1916) II* : 157-165
- Usha Rai. 2001. Green Talk : Off the Hook ? *The Hindu*, 24th June, 2001. Magazine p. VIII.
- Vaishnav, H. A. and Chavan, S. A. (no year). *Coastal and marine ecosystems of Gujarat*. Department of Forests, Government of Gujarat. 22 pp.
- Varghese, M. A. 1976. Windowpane oyster of the Gulf of Kutch. *Seafood Export J.* **VIII** (5) : 1-4
- Wafar, M. V. M. 1986. Corals and Coral Reefs of India. *Proc. Indian Acad. Sci. (Anim. Sci./ Plant Sci.)* Suppl., November 1986, p. 19-43
- Wafar, M. V. M. 1997. Management of coral reefs of Gulf of Kachchh. *Proc. Workshop on Integrated Coastal Zone Management*. p. 97-103. Space Application Centre (ISRO), Ahmedabad and Department of Forests and Environment, Government of Gujarat. April 2-4, 1997.

INVENTORY OF FAUNA OF GULF OF KACHCHH

Phylum **PORIFERA**

Class **DEMOSPONGIAE**

Subclass **TETRACTINOMORPHA**

Order **SPROPHORIDA**

Family **TETILLIDAE**

1. *Tetilla dactyloides* (Carter)
2. *Tetilla pitula* Hornell

Order **HADROMERIDA**

Family **TETHYIIDAE**

3. *Donatia seychellensis* (Wright)

Subclass **CARACTINOMORPHA**

Order **HALICHONDRIIDA**

Family **HALICHONDRIIDAE**

4. *Halichondria panicea* Johnston
5. *Halichondria reticulata* Baer

Order **AXINELLIDAE**

Family **AXINELLIDAE**

6. *Burbaris radiata* Dendy
7. *Ciacalypta dichotoma* Dendy
8. *Gelliodes fibrosa* Dendy

Order **HADROMERIDA**

Family **CLIONIDAE**

9. *Cliona coronaria* (Carter)

Family **PLACOSPONGIIDAE**

10. *Placospongia carinata* (Bowerbank)

Family **SPIRASTRELLIDAE**

11. *Spirastrella vagabunda* var. *tubulodigitata* Dendy

Family **SUBERITIIDAE**

12. *Suberitis flabellatus* Carter

Order HAPLOSCLERIDA

Family DESMACIDONIDAE

13. *Desmacidon minor* Dendy

Order POECILOSCLERIDA

Family OPHLITASPONGIIDAE

14. *Clathria spiculosa* (Dendy)

Order EPIPOLASIDA

Family JASPIIDAE

15. *Jaspis reptans* Dendy

Family MYXILLIDAE

16. *Myxilla arenosa* Dendy

Family TENDANIIDAE

17. *Acarnus tortilis* Topsent

Family CHONDRILLIDAE

18. *Chondrilla aglutinans* Dendy

19. *Chondrilla australiensis* Carter

Others (not classified)

20. *Asteropus simplex* Carter

21. *Chondropsis kirkii* (Carter)

22. *Darwinella australiensis* Carter

23. *Desmacella tubulata* Dendy

24. *Eesperella plumosa* (Carter)

25. *Gellius ridleyi* Hentschel

26. *Guitara indica* Dendy

27. *Higginsia* sp.

28. *Hippospongia clathrata* (Carter)

29. *Iotrochata baculifera* Ridley

30. *Leuconia barbata*

31. *Megalopastas retiaria* Dendy

32. *Myriastria haeckeli* Sollas

33. *Phakellia donani* (Bowerbank)

34. *Polymastia gemmifera*
35. *Raspalia fruticosa* var. *tenuiramosa* Dendy
36. *Reniera hornelli* Dendy
37. *Reniera permollis* (Bowerbank)
38. *Reniera semifibrosa* Dendy
39. *Reniera topsenti* Thiele
40. *Siphonochalina crassifibra* Dendy
41. *Siphonochalina minor* Dendy
42. *Spongelia cinerea* (Kellogg)
43. *Spongelia fragilis* var. *ramose* (Schulz)
44. *Sycettusa glomerata*

[The Porifera of Gujarat- Fauna of States- Gujarat, includes five more species: 45-49]

Phylum **CNIDARIA**

Class **SCYPHOZOA**

Order RHIZOSTOMEAE

Family CASSIOPEIDAE

50. *Cassiopea andromeda* var. *maldivensis* Browne

Class **HYDROZOA**

Order HYDROIDA

Suborder LEPTOMEDUSAE

Family PLUMULARIIDAE

51. *Plumularia badia* Kirchenpauer
52. *Plumularia buskii* Bale
53. *Plumularia caliculata* Bale
54. *Plumularia concave* Billard

Family LAODICEIDAE

55. *Staurodiscus tetrastaurus* Haeckel

Family EIRENIDAE

56. *Eirene ceylonensis* Browne

Family PROBOSCIDACTYLIDAE

57. *Proboscidactyla ornae* (McCrary)

Family SERTULARIIDAE

58. *Sertularia tenuis* Bale
59. *Idiella pristis* (Lamourouse)
60. *Thuiaria fenestrata* Bale

Family SYNTHECIIDAE

61. *Synthecium maldivensis* Borradaile

Order SEMAEOSTOMEAE

Family ULMARIDAE

62. *Aurelia solida* Browne

Family CEPHEIDAE

63. *Netrostoma coerulescens* Maas

Class ANTHOZOA

Subclass ZOANTHARIA

Order CERIANTHARIA

64. *Cerianthus* sp

Order HEXACORALLIA

Suborder ASTROCOENIINA

Family ACROPORIDAE

65. *Acropora humilis* (Dana)
66. *Acropora squamosa* (Ehrenberg)
67. *Montipora explanata*
68. *Montipora foliosa* (Pallas)
69. *Montipora hispida* Dana
70. *Montipora monasteriata* (Forskal)
71. *Montipora turgescens* (Dana)
72. *Montipora venosa* (Ehrenberg)

Suborder FUNGIINA

Family THAMNASTERIDAE

73. *Psammocora digitata* Edward and Haime

Family SIDERASTREIDAE

74. *Siderastrea savignyana* Milne Edwards and Haime

75. *Coscinaria monile* (Forsk.)
 76. *Pseudosiderastrea tayami* Yabe and Sugiyama

Family PORITIDAE

77. *Goniopora minor* Crossland
 78. *Goniopora nigra* Pillai
 79. *Goniopora planulata* (Ehrenberg)
 80. *Porites compressa* Dana
 81. *Porites lichen* Dana
 82. *Porites lutea* Milne Edwards and Haime

Suborder FAVIINA

Family FAVIIDAE

83. *Cyphastrea serialia* (Forsk.)
 84. *Favia favus* (Forsk.)
 85. *Favia speciosa* (Dana)
 86. *Favites complanata* (Ehrenberg)
 87. *Favites melicerum* Ehrenberg
 88. *Goniastrea pectinata* (Ehrenberg)
 89. *Hydnophora execa* (Pallas)
 90. *Leptastrea purpurea* (Dana)
 91. *Platygyra sinensis* (Milne Edwards and Haime)
 92. *Plesiastrea versipora* (Lamarck)

Family MUSSIDAE

93. *Acanthastrea simplex* Crossland
 94. *Symphillia radians* Milne Edwards and Haime

Family PECTINIIDAE

95. *Mycedium elephantotus* (Pallas)

Suborder CAROPHYLLIINA

Family CAROPHYLLIIDAE

96. *Paracyathus stokesi* Milne Edwards and Haime
 97. *Polycyathus verrilli* Duncan

Suborder DENDROPHYLLIINA

Family DENDROPHYLLIIDAE

98. *Dendrophyllia minuscula* Bourne

99. *Tubastrea aurea*
100. *Turbinaria crater* (Pallas)
101. *Turbinaria peltata* (Esper)

Subclass **ALCYONARIA**

Order **ALCYONACEA**

Family **ALCYONIIDAE**

102. *Lobophytum pauciflorum* (Ehrenberg)
103. *Sclerophytum polydactylum* (Ehrenberg)

Family **NEPHTHEIDAE**

104. *Dendronephthya brevirama* (Burckhardt)
105. *Dendronephthya dendrophyta* (Wright and Studer)

Family **PARAMURICEIDAE**

106. *Astromuricea stellifer* Hornell
107. *Echinomuricea uliginosa* Thomson and Simpson var. *tenerior* Hornell

Order **GORGONACEA**

Family **GORGONIIDAE**

108. *Lophogorgia luetkeni* Wright and Studer

Order **TELESTACEA**

109. *Telesto rubra* Gardiner

Phylum **ANNELIDA**

Class **POLYCHAETA**

Family **APHRODITIDAE**

Subfamily **POLYNOINAE**

110. *Eunoe pallida* (Ehlers)
111. *Lepidonotus cristatus* (Grube)
112. *Lepidonotus jukesi* (Baird)

Family **AMPHINOMIDAE**

113. *Amphinome rostrata* (Pallas)
114. *Eurythoe complanata* (Pallas)

Family **HESIONIDAE**

115. *Leocrates claparedei* (Costa)

Family PHYLLODOCIDAE

116. *Eulalia viridis* (Mueller)

Family NEREIDAE

117. *Nereis persica* Fauvel118. *Perinereis nuntia* (Savigny)119. *Perinereis nigropunctata* Horst120. *Pseudonereis anomala* Gravier121. *Pseudonereis rotnnestiana* Augner122. *Tylonereis bogoyawlensky* Fauvel

Family GLYCERIDAE

123. *Goniada emerita* Audouin and Milne Edwards

Family EUNICIDAE

Subfamily EUNICINAE

124. *Eunice australis* Quatrephages125. *Eunice siciliensis* Grube126. *Eunice tentaculata* Quatrephages127. *Morphysa sanguinea* (Montagu)

Subfamily LUMBRINEREINAE

128. *Lumbrinereis pseudopitularis* Fauvel

Subfamily ONUPHINAE

129. *Diapatra neapolitana* Delle Chiaje

Family CIRRATULIDAE

130. *Cirriiformia tentaculata* (Montagu)

Family TERESELLIDAE

Subfamily TRICHOBRANCHINAE

131. *Terebellides stroemi* Sars

Subfamily TERESELLINAE

132. *Loimia medusae* (Sowerby)

Subfamily THELEPINAE

133. *Streblosoma persica* (Fauvel)

Family SABELLIDAE

134. *Sabella fusca* Grube
135. *Sabellastrae sanctijosephi* (Gravier)

Family CAPITELLIDAE

136. *Notomastus latericeus* Sars

Phylum MOLLUSCA

Class POLYPLACOPHORA

Order NEOLORICATA

Suborder ISCHNOCHITONINA

Family CHITONIDAE

137. *Chiton iatricus* Winckworth

Class GASTROPODA

Subclass PROSOBRANCHIA

Order ARCHAEOGASTROPODA

Family FISSURELLIDAE

Subfamily DIODORINAE

138. *Diodora funiculata* (Reeve)
139. *Diodora induscica* (Reeve)
140. *Diodora singaporensis*
141. *Diodora subrostrata* Gray
142. *Diodora ticaonica* (Reeve)
143. *Scutus unguis* (Linnaeus)

Subfamily EMARGINULINAE

144. *Emarginula elongata* (Philippi)

Family PATELLIDAE

Subfamily NACELLINAE

145. *Cellana radiata radiata* (Born)

Family TROCHIDAE

Subfamily TROCHINAE

146. *Clanculus microdon* A. Adams
147. *Trochus (Infundibulum) radiatus* Gmelin
148. *Trochus (Infundibulum) ochroleucus* Gmelin

Subfamily MARGARITINAE

149. *Euchelus asperus* (Gmelin)
 150. *Euchelus quadricarinatus* (Horten)

Subfamily MONODONTINAE

151. *Monodonta australis* (Kiener)

Subfamily CALLIOSTOMATINAE

152. *Calliostoma* sp.

Subfamily GIBBULINAE

153. *Osilinus kotschy* (Philippi)

Subfamily UMBONIINAE

154. *Umbonium vestiarium* Linnaeus

Family STOMATELLIDAE

155. *Stomatella elegans* Gray

Family TURBINIDAE

Subfamily TURBININAE

156. *Turbo coronatus* Gmelin

Subfamily ANGARIINAE

157. *Angaria distorta* (Linnaeus)

Subfamily ASTRAEINAE

158. *Astraea (Astralium) semicostata* (P. Fisher)

Family NERITIDAE

159. *Nerita (Theliostyla) albicilla* Linnaeus
 160. *Nerita (Theliostyla) textilis* Gmelin
 161. *Nerita (Ritena) undata* Linnaeus
 162. *Neritina (Dostia) violacea* (Gmelin)

Order MESOGASTROPODA

Family ASSIMINEIDAE

163. *Assiminea rubella* Blanford
 164. *Assiminea rotunda* Blanford

Family LITTORINIDAE

- 165. *Nodilittorina (Granulilittorina) vidua* (Gould)
- 166. *Littoraria (Littoraria) undulata* (Gray)
- 167. *Littoraria (Littorinopsis) scabra scabra* (Linnaeus)

Family PLANAXIIDAE

- 168. *Planaxis sulcatus* (Born)

Family LACUNIDAE

- 169. *Mainwaringia paludomoidea* Nevill

Family CERITHIIDAE

- 170. *Cerithium caeruleum* Sowerby
- 171. *Rhinoclavis sinensis* (Gmelin)

Family POTAMIDIDAE

- 172. *Cerithidea cingulata* (Gmelin)
- 173. *Telescopium telescopium* (Linnaeus)

Family TURRITELLIDAE

- 174. *Turritella maculata* (Linnaeus)
- 175. *Turritella columnaris* Kiener

Family STROMBIDAE

- 176. *Strombus urceus* Linnaeus
- 177. *Tibia curta* Sowerby

Family CYPRAEIDAE

- 178. *Cypraea (Erosaria) ocellata* (Linnaeus)
- 179. *Cypraea (Monetaria) annulus* (Linnaeus)
- 180. *Cypraea (Mauritia) arabica* Linnaeus

Family NATICIDAE

- 181. *Natica tigrina* (Roeding)
- 182. *Natica didyma* (Roeding)
- 183. *Sinum neritoideum* (Linnaeus)

Family BURSIDAE

- 184. *Bursa (Bufonaria) echinata* (Link)

Family EPITONIIDAE

185. *Epitonium immaculatum* (Sowerby)
 186. *Epitonium lineolatum* (Reeve)

Family JANTHINIDAE

187. *Janthina janthina* (Linnaeus)

Order PARASITA

Family EULIMIDAE

188. *Niso pyramidelloides* G. and H. Nevill

Order NEOGASTROPODA

Family MURICIDAE

Subfamily MURICINAE

189. *Murèx carbonnieri* (Jousseau)
 190. *Muricanthus kuesterianus* (Tapparone Canefri)
 191. *Murex trapa* Roeding
 192. *Chicoreus brunneus* (Link)

Subfamily DRUPINAE

193. *Drupa heptagonalis* (Reeve)
 194. *Drupa tuberculata* (Blainville)
 195. *Erglatax contracta* (Reeve)

Subfamily THAIDINAE

196. *Purpura panama* (Roeding)
 197. *Thais lacera* (Born)
 198. *Thais rugosa* (Born)

Family COLUMBELLIDAE

Subfamily PYRENINAE

199. *Pyrene flava* (Bruguiere)
 200. *Pyrene scripta* (Lamarck)

Family BUCCINIDAE

Subfamily PISANIINAE

201. *Cantharus (Porlia) spiralis* (Gray)
 202. *Cantharus (Porlia) undosus* (Linnaeus)

Subfamily BUCCININAE

203. *Babylonia spirata* (Linnaeus)

Family NASSARIIDAE

204. *Bullia (Bullia) melanoides* (Deshayes)

205. *Nassarius mucronata* (A. Adams)

206. *Nassarius (Niotha) nodifera* (Powis)

207. *Nassarius planicostata* (A. Adams)

208. *Nassarius pullus* Linnaeus

209. *Nassarius stolatus* (Gmelin)

210. *Nassa hepatica* (Montagu)

Family OLIVIDAE

211. *Oliva nebulosa* Lamarck

212. *Oliva lepida* Duclos

213. *Oliva subulata* (Linnaeus)

214. *Olivincillaria gibbosa* (Born)

215. *Ancillaria albifasciata* Sowerby

Family VASIDAE

216. *Turbinella pyrum* (Linnaeus)

Family MITRIDAE

217. *Mitra (Strigatella) scutulata* (Gmelin)

Family VEXILLIDAE

218. *Vexillum sculptilis* (Reeve)

Family CONIDAE

219. *Conus achatinus* Gmelin

220. *Conus biliosus* (Roeding)

221. *Conus coronatus* Gmelin

222. *Conus lentiginosus* Reeve

223. *Conus textile* Linnaeus

Family TURRIDAE

224. *Funa flavidula* (Lamarck)

225. *Turricula javana* Linnaeus

226. *Turricula tornata fulminata* (Kiener)

227. *Turris undosa* (Lamarck)

Family TEREBRIDAE

228. *Duplicaria duplicata* (Linnaeus)

Family ARCHITECTONICIDAE

229. *Architectonica laevigata* (Lamarck)

Subclass **OPISTHOBRANCHIA**

Order CEPHALASPIDEA

Family BULLIDAE

230. *Bulla ampulla* Linnaeus

Family HAMINEIDAE (Atyidae)

231. *Haminea elegans* A. Adams

232. *Haminea tenera* (Adams)

Family HYDATINIDAE

233. *Hydatina zonata* (Lightfort)

Order SACOGLOSSA

Family ELYSIIDAE

234. *Elysia grandifolia* Kelaart

Order APLYSIOMORPHA

Family APLYSIIDAE

235. *Aplysia benedicti* Eliot

236. *Aplysia rudmani* Bebbington

Order NOTASPIDEA

Family PLEUROBRANCHIDAE

237. *Berthellina citrina* (Ruppell and Leuckart)

Family PLEUROBRANCHAEIDAE

238. *Pleurobranchaea morula* Bergh

Order NUDIBRANCHIA

Suborder DORIDOIDEA

Family ARCHIDORIDIDAE

239. *Archidoris minor* Eliot

Family CHROMODORIDIDAE

240. *Hyselodoris infucata* (Ruppell and Leukart)

Family DENDRODORIDIDAE

241. *Dendrodoris nigra* Stimpson

242. *Doriopsilla miniata* Alder and Hancock

Family DISCODORIDIDAE

243. *Discodoris botoliensis* Bergh

Family KENTRODORIDIDAE

244. *Kentrodoris funebris* Kelaart

Family POLYCERATIDAE

245. *Placompherus ceylonicus* Alder and Hancock

246. *Placompherus ocellatus* Ruppell and Leukart

Family PHYLLIDIIDAE

247. *Phyllidia zeylanica* Kelaart

Suborder DENDRONOTOIDEA

Family BORNELLIDAE

248. *Bornella digitata* Adams and Reeve

Family TETHYIDAE

250. *Melibe rangiana* Bergh

Suborder ARMINOIDEA

Family ARMINIDAE

251. *Armina cinerea* Farran

252. *Dermatobranchus semistriatus* Baba

253. *Hervia ceylonica* Farran

254. *Hervia militaris* Alder and Hancock

Subclass PULMONATA

Order ARCHAEOPULMONATA

Family ELLOBIIDAE

255. *Auricularia aurisjudae* (Linnaeus)

256. *Cassidula nucleus* (Gmelin)

257. *Melampus fasciatus* Deshayes
 258. *Melampus singaporensis* Pfeiffer

Order BASOMMATOPHORA
 Family AMPHIBOLIDAE

259. *Salinator burmana* Blanford

Order SYSTELLOMMATOPHORA
 Family ONCHIDIIDAE

260. *Onchidium tenerum* Stiolizcka
 261. *Onchidium verruculatum* Cuvier

Class BIVALVIA
 Subclass PTERIOMORPHA
 Order ARCOIDA
 Family ARCIDAE

262. *Anadara granosa* (Linnaeus)
 263. *Anadara gubernaculum* (Reeve)
 264. *Anadara rhombea* (Born)
 265. *Arca fusca* Bruguiere
 266. *Arca navicularis* Bruguiere
 267. *Barbatia obliquata* Gray
 268. *Scapharca inequivalvis* (Bruguiere)

Family GLYCIMERIDIDAE

269. *Glycemeris taylori* (Angas)

Order MYTILOIDA
 Family MYTILIDAE
 Subfamily MYTILINAE

270. *Perna viridis* Linnaeus
 271. *Septifer bilocularis* (Linnaeus)

Subfamily LITHOPHAGINAE

272. *Lithophaga cinnamomea* (Lamarck)
 273. *Lithophaga nigra* (d'Orbigny)
 274. *Lithophaga teres* (Philippi)

Order PTERIOIDA

Suborder PINNINA

Family PINNIDAE

275. *Pinna bicolor* Gmelin

276. *Atrina (Atrina) vexillum* (Born)

Suborder PTERIINA

Family PTERIIDAE

277. *Pinctada chemnitzii* (Philippi)

278. *Pinctada fucata* Gould

279. *Pinctada sugillata*

Order OSTREOIDA

Suborder PECTININA

Family PECTINIDAE

280. *Pecten crassicosatus* Sowerby

281. *Minnivola pyxidata* (Born)

282. *Volachlamys tranquebarica* (Gmelin)

Family SPONDYLIDAE

283. *Spondylus layardi* Reeve

Family ANOMIIDAE

284. *Anomia achaeus* Gray

285. *Placuna placenta* Linnaeus

Suborder OSTREINA

Family OSTREIDAE

286. *Crassostrea gryphoides* (Newton and Smith)

287. *Crassostrea madrasensis* Preston

288. *Saccostrea cucullata* (Born)

Order VENEROIDA

Family TELLINIDAE

289. *Tellina coarctata* Philippi

290. *Tellina emarginata* Sowerby

291. *Tellina pristis* Lamarck

Family DONACIDAE

292. *Donax cuneatus* Linnaeus

Family PSAMMOBIIDAE

293. *Sanguinolaria (Soletellina) diphos* (Linnaeus)

Family SEMELIDAE

294. *Semele crenulata* (Sowerby)

295. *Semele striata* (Puppell)

Family TRAPEZIIDAE

296. *Trapezium vellicatum* (Reeve)

Family VENERIDAE

Subfamily CIRCINAE

297. *Gafrarium tumidum* Roeding

298. *Circe scripta* (Linnaeus)

Subfamily SUNETTINAE

299. *Sunetta scripta* (Linnaeus)

Subfamily MERETRICINAE

300. *Meretrix casta* (Gmelin)

301. *Meretrix meretrix* (Linnaeus)

Subfamily VENERINAE

302. *Periglypta (Tigammona) chemnitzii* (Hanley)

303. *Periglypta reticulata* (Linnaeus)

Subfamily PITARINAE

304. *Callista erycina* (Linnaeus)

305. *Pitar nobilis* (Reeve)

Subfamily TAPEIINAE

306. *Paphia malabarica* (Schroeter)

307. *Paphia textrix* (Schroeter)

Family GLAUCONOMIDAE

308. *Glaucanome cerea* (Reeve)

Order MYOIDA

Suborder MYOINA

Family GASTROCHAENIDAE

309. *Gastrochaena lamellose* (Deshayes)

Suborder PHOLADINA

Family PHOLADIDAE

Subfamily MARTESIINAE

310. *Martesia striata* (Linnaeus)

Subfamily JOUANNETIINAE

311. *Jouannetia cumingi* (Sowerby)Class **CEPHALOPODA**Subclass **COLEOIDEA**

Order VAMPYROMORPHA

Suborder INCIRRATA

Family OCTOPODIDAE

312. *Octopus cyaneus* Gray313. *Octopus hongkongensis* Hoyle314. *Octopus niveus* LessonPhylum **ARTHROPODA**Class **CRUSTACEA**

Order DECAPODA

Suborder REPTANTIA

Section BRACHYURA

Family DROMIIDAE

315. *Pseudodromia integrifrons* Henderson

Family CALAPPIDAE

316. *Calappa lophos* (Herbst)317. *Matuta lunaris* (Forsk.)318. *Matuta palmipes* Fabricius

Family LEUCOSIIDAE

319. *Leucosia sinna* Alcock

320. *Arcania septemspinosa* (Fabricius)

Family HYMENOSOMATIDAE

321. *Elamena cristatipes* Gravely

Family MAJIDAE

322. *Menaethius monoceros* (Latreille)

323. *Chlorinoides aculeatus* (H. Milne Edwards)

Family PARTHENOPIDAE

324. *Cryptopodia angulata* H. Milne Edwards and Lucas

Family PORTUNIDAE

325. *Portunus (Portunus) pelagicus* (Linnaeus)

326. *Portunus (Portunus) sanguinolentus* (Herbst)

327. *Thalamita prymna* (Herbst)

Family XANTHIDAE

328. *Atergatis integerrimus* (Lamarck)

329. *Atergatis roseus* (Ruppell)

330. *Platypodia cristatus* (Milne Edwards)

331. *Leptodius euglyptus qudrispinosus* Chhappgar

332. *Medaeops granulosis* (Haswell)

333. *Etisus laevimanus* Randall

334. *Actaea savignyi* (H. Milne Edwards)

335. *Pilumnus longicornis* HilGendorf

336. *Pilumnus vespertilio* (Fabricius)

337. *Heteropanope laevis* (Dana)

338. *Eriphia smithi* Macleay

Family GONEPLACIDAE

339. *Litocheira setosa* (Milne Edwards)

Family PINNOTHERIDAE

340. *Pinnotheres placunae* Hornell and Southwell

Family OCYPODIDAE

341. *Uca annulipes* Latereille

342. *Macrophthalmus (Mareotis) pacificus* Dana

Family GRAPSIDAE

343. *Grapsus albolineatus* Lamarck

344. *Metapograpsus messor* (Forsk.)

Suborder NATANTIA

Section PENEIDEA

Family PENEIDAE

Subfamily PENEINAE

345. *Penaeus canaliculatus* (Olivier)

346. *Penaeus indicus* Milne Edwards

347. *Penaeus japonicus* Bate

348. *Penaeus latisulcatus* Kisghinouye

349. *Penaeus merguensis* de Man

350. *Penaeus monodon* Fabricius

351. *Penaeus pencillatus* Alcock

352. *Penaeus semisulcatus* de Haan

353. *Metapenaeus affinis* (H. Milne Edwards)

354. *Metapenaeus brevicornis* (H. Milne Edwards)

355. *Metapenaeus moyebi* (Kishinouye)

356. *Metapenaeus kutchensis* George and Rao

357. *Metapenaeus lysianassa* (de Man)

358. *Metapenaeus monoceros* (Fabricius)

359. *Metapenaeus stebbingi* Nobili

360. *Metapenaeopsis stridulans* (Alcock)

361. *Parapenaeopsis hardwicki* (Miers)

362. *Parapenaeopsis sculptilis* (Heller)

363. *Parapenaeopsis stylifera* (H. Milne Edwards)

364. *Trachypenaeus granulatus* (Haswell)

Subfamily SOLENOCERINAE

365. *Solenocera crassicornis* (H. Milne Edwards)

Family SERGESTIDAE

366. *Acetes indicus* H. Milne Edwards

Section **CARIDEA**Family **PALAEMONIDAE**

367. *Exopalaemon styliferus* (H. Milne Edwards)
 368. *Nematopalaemon tenuipes* (Henderson)
 369. *Palaemon (Paleander) semmelinkii* (de Man)

Family **HIPPOLYTIDAE**

370. *Hyppolysmata ensirostris* Kemp
 371. *Saron marmoratus* (Olivier)

Family **ALPHEIDAE**

372. *Alpheus digitalis* de Haan

Phylum **SIPUNCULA**Class **SIPUNCILIDEA**Order **SIPUNULIFORMES**Family **SIPUNCULIDAE**

373. *Sipunculus robustus* Keferstein
 374. *Sipunculus indicus* Peters
 375. *Siphonosoia cumanense* (Keferstein)
 376. *Siphnosma vastum* (Selenka and Bulow)

Order **GOLFINGIFORMES**Family **THEMISTIDAE**

377. *Themiste lageniformis* Gray

Class **PHASCOLOSOMATIDEA**Order **PHASCOLOSOMATIFORMES**Family **PHASCOLOSOMATIDAE**

378. *Antillesoma antillarum* (Grube and Oersted)
 379. *Apionsoma misakiana* (Ikeda)
 380. *Apionsoma trichocephala* Sluiter
 381. *Phascolosoma agassizii* Keferstein
 382. *Phascolosoma albolineatum* Baird
 383. *Phascolosoma granulatum* Leuckart
 384. *Phascolosoma nigrescens*
 385. *Phascolosoma pacificum* (Keferstein)

386. *Phascolosoma perlucens* Baird

387. *Phascolosoma scolops* (Selenka and de Man)

Order ASPIDOSIPHONIFORMES

Family ASPIDOSIPHONIDAE

388. *Aspidosiphon steenstrupii* Diesing

389. *Cloeosiphon aspergillus* (Quatrefages)

390. *Lithacrosiphon cristatus lakshadweepensis* Haldar

Phylum ECHIURA

Class ECHIURIDA

Family BONELLIDAE

391. *Acanthobonellia maculata* Fisher

392. *Acanthobonellia miyajimai* (Ikeda)

393. *Acanthobonellia pirotanensis* Jose

394. *Acanthobonellia rollandoe* (Menon, Dattagupta and Johnson)

395. *Bonellia valida* Fisher

396. *Ikedella misakiensis* (Ikeda)

Family THALASSEMATIDAE

397. *Anelassorhynchus branchiorhynchus* (Annandale and Kemp)

398. *Listriolobus brevirostris* Chen and Yeh

399. *Listriolobuscapensis* (Jones and Stephen)

400. *Ochetostoma bambayensis* Prashad and Awati

401. *Ochetostoma erythrogrammon* Leuckart and Ruppell

402. *Ochetostoma zanzibarensis* Stephen and Robertson

403. *Thalassema diaphanes* Sluiter

404. *Thalassema thalassema* (Pallas)

Family IKEDAIDAE

405. *Rubricelatus pirotansis* (Menon and Dattagupta)

Phylum PHORONIDA

406. *Phoronis australis* (Haswell)

Phylum **BRYOZOA**
 Class **GYMNOLAEMATA**
 Order **CTENOSTOMATA**
 Family **ALCYONIDIIDAE**

407. *Alcyonidium mytili* Dalyill

Family **VESICULARIIDAE**

408. *Amathia distans* Busk

Order **CHEILOSTOMATA**
 Family **BUGULIDAE**

409. *Bugula neritina* (Linnaeus) var. *rubra* Thornley

Family **CELLARIIDAE**

410. *Cellaria gracilis* Busk

Family **CELLOPORIDAE**

411. *Cellopora albirostris* (Smith)

412. *Cellopora tridenticulata* Busk

Family **EPISTOMIDAE**

413. *Synnotum aviculare* (Pieper)

Family **FARCIMINARIIDAE**

414. *Nellia orculata* Busk

Family **MICROPORELLIDAE**

415. *Microporella ciliata* (Pallas)

Family **SMITTINIDAE**

416. *Smittina trispinosa* var. *bimucronata* Hincks

417. *Porella compressa* (Sowerby)

418. *Porella concinna* var. *gracilis* Hincks

Family **STOMACHAETOSELLIDAE**

419. *Lepralia gigas* Hincka

420. *Lepralia japonica* Busk

Family **THALAMOPORELLIDAE**

421. *Thalamoporella rozieri* (Audouin)

Family STEGANOPORELLIDAE

422. *Steganoporella magnilabris* BuskClass **STENOLAEMATA**Order **CYCLOSTOMATA**Family **TUBULIPORIDAE**423. *Idmonea radians* (Lamarck)**Others (not classified)**424. *Brettia tropica* Waters425. *Catenicella buskii* Wyv. Thomson426. *Buskia setigera giganteum* (Busk)427. *Pherusa tubulosa* LamarckPhylum **BRACHIOPODA**428. *Lingula anatina* (Lamarck)Phylum **ECHINODERMATA**Class **CRINOIDEA**Order **ARTICULATA**Family **COMASTERIDAE**429. *Comanthus wahlbergi* (Mueller)Family **MARIAMETRIDAE**430. *Stephanometra indica* (Smith)Class **ASTEROIDEA**Order **PAXILLOSIDA**Family **LUIDIIDAE**431. *Luidia maculata* (Mueller and Troschel)Family **ASTROPECTINIDAE**432. *Astropecten vappa* Mueller and TroschelOrder **VALVATIDA**Family **GONIASTERIDAE**433. *Anthenea rudis* Koehler

Family ASTERINIDAE

434. *Asterina lorioli* Koehler

Order SPINULOSIDA

Family ECHINASTERIDAE

435. *Echinaster luzonicus* (Gray)436. *Echinaster purpureus* (Gray)Class **OPHIUROIDEA**

Order OPHIURIDA

Family AMPHIURIDAE

437. *Amphiura (Amphiura) ambigua* Koehler438. *Amphiura (Lymanella) sp.*439. *Amphipholis squamata* (Delle Chiaje)

Family OPHIACTIDAE

440. *Ophiactis savignyi* (Mueller and Troschel)

Family OPHIOCOMIDAE

441. *Ophiocomella sexradia* (Duncan)

Family OPHIOTHRICIDAE

442. *Macrophiothrix aspidota* (Mueller and Troschel)443. *Ophiothrix foveolata* Marktanner-Turneretscher

Family OPHIONEREIDAE

444. *Ophionereis dubia* (Mueller and Troschel)

Family OPHIODERMATIDAE

445. *Ophiocormus compsus* (Clark)446. *Ophiopeza fallax arabica* Clark

Family OPHIURIDAE

Subfamily **OPHIOLEPIDINAE**447. *Ophioplocus imbricatus* (Mueller and Troschel)Class **ECHINOIDEA**

Order TEMNOPLEUROIDA

Family TEMNOPLEURIDAE

448. *Salmacis bicolor* A. Agassiz

449. *Temnopleurus toreumaticus* (Leske)

Order CLYPEASTEROIDA

Family LAGANIDAE

450. *Peronella oblonga* Mortensen

Class **HOLOTHUROIDEA**

Order ASPIDOCHIROTIDA

Family HOLOTHURIIDAE

451. *Holothuria ocellata* Linnaeus

452. *Holothuria pardalis* Selenka

453. *Holothuria scabra* Jaeger

Order MOLPADIIDA

Family MOLPADIIDAE

454. *Acaudina molpadioides* (Semper)

Order DENDROCHIROTIDA

Family PHYLLOPHORIDAE

455. *Actinocucumis typicus* Ludwig

456. *Oschimella ehrenbergi* (Selenka)

Family CUCUMARIIDAE

457. *Stolus buccalis* (Stimpson)

Phylum **CHORDATA**

Class **CHONDRICHTHYES**

Subclass **ELASMOBRANCHII**

Order ORECTOLOBIFORMES

Family ORECTOLOBIDAE

458. *Stegostoma fasciatum* (Hermann)[#]

Family HEMISCYLLIIDAE

459. *Chiloscyllium griseum* Müller and Henle

Order LAMNIFORMES

Family ODONTASPIDIDAE

460. *Eugomphodus taurus* (Rafinesque)^{*}

Order CARCHARHINIFORMES

Family CARCHARHINIDAE

- 461. *Carcharhinus dussumieri* (Müller and Henle)
- 462. *Carcharhinus macroti* (Müller and Henle)
- 463. *Scoliodon laticaudus* (Müller and Henle)

Order TORPEDINIFORMES

Family NARCINIDAE

- 464. *Narcine brunnea* Annandale*

Order RAJIFORMES

Family PRISTIDAE

- 465. *Anoxypristis cuspidatus* (Latham)*
- 466. *Pristis microdon* Latham*

Family RHINOBATIDAE

- 467. *Rhinobatos granulatus* Cuvier*
- 468. *Rhinobatos thouniana* (Shaw)

Order MYLIOBATIFORMES

Family DASYATIDAE

- 469. *Dasyatis bleekeri* (Blyth)*
- 470. *Gymnura poecilura* (Shaw)*
- 471. *Hypolophus sephen* (Forsskal)*

Class OSTEICHTHYES

Order ANGULLIFORMES

Family OPHICHTHIDAE

- 472. *Pisodonophis boro* (Hamilton)

Family MURAENESOCIDAE

- 473. *Congresox talabonoides* (Bleeker)*
- 474. *Muraenesox cinereus* (Forsskal)*

Family CONGRIDAE

- 475. *Uroconger lepturus* (Richardson)*

Order **CLUPEIFORMES**Family **CLUPEIDAE**Subfamily **ALOSINAE**476. *Tenualosa ilisha* (Hamilton)477. *Hilsa kelee* (Cuvier)Subfamily **CLUPEINAE**478. *Sardinella gibbosa* (Bleeker)Subfamily **DUSSUMIERIINAE**479. *Dussumieria acuta* ValenciennesSubfamily **DOROSOMATINAE**480. *Anodontostoma chacunda* (Hamilton)481. *Nematalosa nasus* (Bloch)Family **PRISTIGASTERIDAE**482. *Opisthopterus tardoore* (Cuvier)483. *Pellona ditchella* ValenciennesFamily **ENGRAULIDIDAE**484. *Coilia dussumieri* Valenciennes485. *Coilia neglecta* Whitehead486. *Coilia reynaldi* Valenciennes487. *Thryssa dussumieri* (Valenciennes)488. *Thryssa hamiltonii* (Gray)489. *Thryssa mystax* (Schneider)490. *Thryssa purava* (Hamilton)491. *Thryssa setirostris* (Broussonet)Order **GONORHYNCHIFORMES**Family **CHANIDAE**492. *Chanos chanos* ForsskalOrder **SILURIFORMES**Family **ARIIDAE**493. *Arius maculatus* (Thunberg)*494. *Arius thalassinus* (Ruppell)*

495. *Osteogeneiosus militaris* (Linnaeus)

Order AULOPIFORMES
Family SYNODONTIDAE

496. *Saurida micropectoralis* Shindo and Yamda

497. *Saurida tumbil* (Bloch)

Family HARPADONTIDAE

498. *Harpadon nehereus* (Hamilton)

Order GADIFORMES
Family BREGMACEROTIDAE

499. *Bregmaceros mccllellandi* Thompson

Order SYNGNATHIFORMES
Family SYNGNATHIDAE

500. *Hippocampus trimaculatus* Leach

Order PERCIFORMES
Suborder PERCOIDEI
Family AMBASSIDAE

501. *Ambassis gymnocephalus* (Lacepede)

Family SERRANIDAE
Subfamily EPINEPHELINAE

502. *Epinephelus chlorostigma* (Valenciennes)*

503. *Epinephelus merra* Bloch*

Family TERAPONIDAE

504. *Terapon jarbua* (Forsskal)

Family SILLAGINIDAE

505. *Sillago sihama* (Forsskal)

Family LACTARIIDAE

506. *Lactarius lactarius* (Schneider)

Family CARANGIDAE

507. *Alectis ciliaris* (Bloch)

508. *Alectis indicus* (Ruppell)

- 509. *Atropus atropos* (Bloch)
- 510. *Carangoides malabaricus* (Bloch)
- 511. *Megalaspis cordyla* (Linnaeus)
- 512. *Trachinotus blochii* (Lacepede)

Family LEIOGNATHIDAE

- 513. *Gazza minuta* (Bloch)
- 514. *Leiognathus daura* (Cuvier)
- 515. *Leiognathus equulus* (Forsskal)
- 516. *Secutor ruconius* (Hamilton-Buchanan)

Family GERREIDAE

- 517. *Gerres limbatus* Cuvier

Family HAEMULIDAE

- 518. *Pomadasys hasta* (Bloch)
- 519. *Pomadasys kaakan* (Cuvier)
- 520. *Pomadasys maculatus* (Bloch)

Family SCIAENIDAE

- 521. *Johnius elongatus* Mohan*
- 522. *Otolithoides biauritus* (Cantor)*
- 523. *Pennalia anea* Bloch*
- 524. *Paranibea semiluctuosa* (Cuvier)*
- 525. *Protonibea diacanthus* (Lacepede)*

Family MONODACTYLIDAE

- 526. *Monodactylus argenteus* (Linnaeus)

Family EPHIPPIDAE

Subfamily EPHIPPINAE

- 527. *Ephippus orbis* (Bloch)
- 528. *Platax pinnatus* (Linnaeus)

Subfamily DREPANINAE

- 529. *Drepane longimana* (Bloch and Schneider)

Family SPARIDAE

- 530. *Acanthopagrus berda* (Forsskal)

531. *Acanthopagrus latus* (Houttuyn)

532. *Argyrops spinifer* (Forsskal)

Suborder MUGILOIDEI

Family MUGILIDAE

533. *Liza macrolepis* (Smith)

534. *Liza parsia* (Hamilton)

535. *Valamugil seheli* (Forsskal)

Suborder SPHYRAENOIDEI

Family SPHYRAENIDAE

536. *Sphyraena blochii* (Cuvier)* [? *Eusphyra blochii* (Cuvier) Family Sphyrmidae, Order Carchariniformes, Subclass Elasmobranchi]

537. *Sphyraena flavicauda* Ruppell

Suborder POLYNEMOIDEI

Family POLYNEMIDAE

538. *Eleutheronema tetradactylum* (Shaw)

539. *Polydactylus heptadactylus* (Cuvier)

Suborder SCOMBROIDEI

Family TRICHIURIDAE

540. *Lepturacanthus savala* (Cuvier)

541. *Trichiurus lepturus* Linnaeus

Family SCOMBRIDAE

542. *Rastrelliger kanagurta* (Cuvier)

Suborder STROMATEOIDEI

Family STROMATEIDAE

543. *Pampus chinensis* (Euphrasen)

Suborder GOBIOIDEI

Family GOBIIDAE

544. *Apocryptichthys cantoris* (Day)

545. *Glossogobius giurus* (Hamilton)

546. *Scartelaos histophorus* (Cuvier)

Family TRYPAUCHENIDAE

547. *Trypauchen vagina* (Bloch and Schneider)

Order PLEURONECTIFORMES

Family BOTHIDAE

548. *Pseudorhombus arsius* (Hamilton)549. *Pseudorhombus elevatus* Ogilby550. *Pseudorhombus malayanus* Bleeker

Family CYNOGLOSSIDAE

551. *Cynoglossus dubius* Day552. *Paraplagusia blochii* (Bleeker)

Family SOLEIDAE

553. *Euryglossa orientalis* (Bloch)

Order SCORPAENIFORMES

Family SYNANCEIIDAE

554. *Pseudosynanceia melanostigma* Day

Order TETRAODONTIFORMES

Family TETRAODONTIDAE

555. *Logocephalus lunaris* (Bloch and Schneider)

Class REPTILIA

Order TESTUDINES

Family CHELONIDAE

556. *Chelonia mydas* Green Turtle557. *Eremochelys imbricata* Hawksbill Turtle558. *Lepidochelys olivacea* Olive Ridley Turtle559. *Dermochelys coriacea* Leatherback Turtle

Class AVES

Waterbirds

Order GAVIFORMES

Family PODICIPEDIDAE : Grebes

560. *Podiceps cristatus cristatus* (Linnaeus) **Great Crested Grebe**561. *Podiceps nigricollis nigricollis* Brehm **Blacknecked Grebe**

Order PELECANIFORMES

Family PELECANIDAE : Pelicans

562. *Pelecanus onocrotalus* Linnaeus **White or Rosy Pelican**

563. *Pelecanus philippensis crispus* Bruch **Dalmatian Pelican**

Family PHALACROCORACIDAE : Cormorants and Darter

564. *Phalacrocorax carbo sinensis* (Shaw) **Large Cormorant**

565. *Phalacrocorax fuscicollis* Stephens **Indian Shag**

566. *Phalacrocorax niger* (Vieillot) **Little Cormorant**

567. *Anhinga rufa melanogaster* Pennant **Darter or Snake-bird**

Order CICONIIFORMES

Family ARDEIDAE : Herons, Egrets, and Bitterns

568. *Ardea alba modesta* J. E. Gray **Eastern Large Egret**

569. *Ardea cinerea cinerea* Linnaeus **European Grey Heron**

570. *Ardea purpurea manilensis* Meyen **Eastern Purple Heron**

571. *Butorides striatus javanicus* (Horsefield) **Little Green Heron**

572. *Ardeola grayi grayi* (Sykes) **Indian Pond Heron**

573. *Bubulcus ibis coromandus* (Boddaert) **Cattle Egret**

574. *Egretta intermedia intermedia* (Wagler) **Smaller or Median Egret**

575. *Egretta garzetta garzetta* (Linnaeus) **Little Egret**

576. *Egretta gularis schistacea* (Hemprich and Ehrenberg) **Indian Reef Heron**

577. *Nycticorax nycticorax nycticorax* (Linnaeus) **Night Heron**

Family CICONIIDAE : Storks

578. *Ephippiorhynchus asiaticus asiaticus* (Latham) **Blacknecked Stork**

579. *Mycteria leucocephala* (Pennant) **Painted Stork**

Family THRESKIORNITHIDAE : Ibises, Spoonbill

580. *Platalea leucorodia major* Temminck and Schlegel **Spoonbill**

581. *Pseudibis papillosa papillosa* (Temminck) **Indian Black Ibis**

582. *Threskiornis aethiopica melanocephala* (Latham) **White Ibis**

Family PHAENICOPTERIDAE : Flamingos

583. *Phoeniconaias minor* (Geoffroy) **Lesser Flamingo**

584. *Phoenicopterus roseus* Pallas **Flamingo**

Order ANSERIFORMES

Family ANATIDAE : **Ducks, Geese, and Swans**

585. *Anas acuta* Linnaeus **Pintail**
 586. *Anas clypeata* Linnaeus **Shoveller**
 587. *Anas crecca crecca* Linnaeus **Common Teal**
 588. *Anas poecilorhyncha poecilorhyncha* J. R. Forster **Spotbill Duck**
 589. *Tadorna ferruginea* (Pallas) **Ruddy Shelduck or Brahminy Duck**

Order FALCONIFORMES

Family ACCIPITRIDAE : **Hawks, Vultures etc.**

590. *Circus aeruginosus aeruginosus* (Linnaeus) **Marsh Harrier**
 591. *Haliastur indus indus* (Boddaert) **Brahminy Kite**
 592. *Pandion haliaetus haliaetus* (Linnaeus) **Osprey**

Order GRUIFORMES

Family GRUIDAE : **Cranes**

593. *Anthropoides virgo* (Linnaeus) **Demoiselle Crane**
 594. *Grus grus lilfordi* Sharpe **Eastern Common Crane**

Family RALLIDAE : **Rails, Coots**

595. *Fulica atra atra* Linnaeus **Coot**

Order CHARADRIIFORMES

Family JACANIDAE : **Jacans**

596. *Hydrophasianus chirurgus* (Scopoli) **Pheasant-tailed Jacana**

Family HAEMATOPODIDAE : **Oystercatchers**

597. *Haematopus ostralegus ostralegus* Linnaeus **Oystercatcher or Sea-Pie**

Family CHARADRIIDAE : **Plovers, Sandpipers, Snipe**Subfamily CHARADRIINAE : **Plovers**

598. *Charadrius alexandrinus alexandrinus* Linnaeus **Kentish Plover**
 599. *Charadrius hiaticula tundrae* (Lowe) **Eastern Ringed Plover**
 600. *Charadrius leschenaultii* Lesson **Large Sand Plover**
 601. *Charadrius mongolus atrifrons* Wagler **Pamirs Lesser Sand Plover**
 602. *Pluvialis dominica fulva* (Gmelin) **Eastern Golden Plover**
 603. *Pluvialis squatarola* (Linnaeus) **Blackbellied or Grey Plover**

604. *Vanellus indicus indicus* (Boddaert) **Redwattled Lapwig**

Subfamily SCOLOPLACINAE : **Curlews, Sandpipers, etc.**

605. *Arenaria interpres interpres* (Linnaeus) **Turnstone**

606. *Calidris alba* (Pallas) **Sanderling**

607. *Calidris alpina alpina* (Linnaeus) **Dunlin**

608. *Calidris canuta canuta* (Linnaeus) **Knot**

609. *Calidris minuta* (Leisler) **Little Stint**

610. *Calidris rufficolis* (Pallas) **Eastern Little Stint**

611. *Calidris tenuirostris* (Horsefield) **Eastern Knot**

612. *Calidris testacea* (Pallas) **Curlew-Sandpiper**

613. *Limicola falcinellus falcinellus* (Pontoppidan) **Broadbilled Sandpiper**

614. *Limosa lapponica lapponica* (Linnaeus) **Bartailed Godwit**

615. *Limosa limosa limosa* (Linnaeus) **Blacktailed Godwit**

616. *Numenius arquata orientalis* C. L. Brehm **Eastern Curlew**

617. *Numenius phaeopus phaeopus* (Linnaeus) **Whimbrel**

618. *Philomachus pugnax* (Linnaeus) **Ruff**

619. *Tringa erythropus* (Pallas) **Spotted or Dusky Redshank**

620. *Tringa glareola* Linnaeus **Wood or Spotted Sandpiper**

621. *Tringa hypoleucos* Linnaeus **Common Sandpiper**

622. *Tringa nebularia* (Gunnerus) **Greenshank**

623. *Tringa ochropus* Linnaeus **Green Sandpiper**

624. *Tringa stagnatilis* (Bechestein) **Marsh Sandpiper or Little Greenshank**

625. *Tringa terek* (Latham) **Terek Sandpiper or Avocer-Sandpiper**

626. *Tringa totanus totanus* (Linnaeus) **Common Redshank**

Subfamily PHALAROPINAE : **Phalaropes**

627. *Phalaropus lobatus* (Linnaeus) **Rednecked Phalarope**

Family RECURVIROSTRIDAE : **Stilts, Avocets, and Ibisbills**

628. *Himantopus himantopus himantopus* (Linnaeus) **Indian Blackwinged Stilt**

629. *Recurvirostra avosetta* Linnaeus **Avocet**

Family DROMADIDAE : **Crab Plovers**

630. *Dromas ardeola* Paykull **Crab Plover**

Family BURHINIDAE

631. *Esacus magnirostris recurvirostris* (Cuvier) **Great Stone Plover**

Family LARIDAE : Gulls, Terns

632. *Chlidonias hybridus indicus* (Stephens) **Indian Whiskered Tern**
 633. *Chlidonias leucopterus* (Temminck) **Whitewinged Black Tern**
 634. *Gelochelidon nilotica nilotica* (Gmelin) **Gullbilled Tern**
 635. *Hydroprogne caspia caspia* (Pallas) **Caspian Tern**
 636. *Larus argentatus heuglini* Bree **Yellowlegged Herring Gull**
 637. *Larus brunnicephalus* Jerdon **Brownheaded Gull**
 638. *Larus fuscus fuscus* Linnaeus **Lesser Blackbacked Gull**
 639. *Larus genei* Breme **Slenderbilled Gull**
 640. *Larus ichthyaetus* Pallas **Great Blackheaded Gull**
 641. *Larus ridibundus ridibundus* Linnaeus **Blackheaded Gull**
 642. *Ryncops albicollis* Swainson **Indian Skimmer or Scissorbill**
 643. *Sterna albifrons albifrons* Pallas **Little Tern or Ternlet**
 644. *Sterna anaethetus anaethetus* Scopoli **Brownwinged Tern**
 645. *Sterna bengalensis bengalensis* Lesson **Indian Lesser Crested Tern**
 646. *Sterna bergii velox* Cretzschmar **Red Sea Large Crested Tern**
 647. *Sterna hirundo hirundo* Linnaeus **European Common Tern**
 648. *Sterna repressa* Hartert **Whitecheeked Tern**
 649. *Sterna sandvicensis sandvicensis* Latham **Sandwich Tern**
 650. *Sterna saundersi* Hume **Blackshafted Sternlet**

Order COLUMBIFORMES

Family PETROCLIDIDAE : Sandgrouse

651. *Petrocles exustus erlangeri* (Neumann) **Indian Sandgrouse**

Family COLUMBIDAE : Pigeons, Doves

652. *Columba livia neglecta* Hume **Blue Rock Pigeon**
 653. *Streptopelia decaocto decaocto* (Frisvaldszky) **Indian Ring Dove**
 654. *Streptopelia senegalensis cambayensis* (Gmelin) **Indian Little Brown or Senegal Dove**

Order PSITTACIFORMES

Family PSITTACIDAE : Parrots

655. *Psittacula krameri borealis* (Neumann) **Northern Roseringed Parakeet**

Order CUCULIFORMES

Family CUCULIDAE : Cuckoos

656. *Centropus sinensis parroti* Stresemann **Southern Crow-Pheasant**
 657. *Eudynamys scolopacea scolopacea* (Linnaeus) **Indian Koel**

Order CORACIIFORMES

Family ALCEDINIDAE : Kingfishers

658. *Alcedo atthis pallasii* Reichenbach **Central Asian Blue Kingfisher** or
A. a. bengalensis Gmelin **Indian Small Blue Kingfisher**
 659. *Halcyon pileata* (Boddaert) **Blackcapped Kingfisher**
 660. *Halcyon smyrnensis smyrnensis* (Linnaeus) **Whitebreasted Kingfisher**

Terrestrial birds

Order FALCONIFORMES

Family ACCIPITRIDAE : Hawks, Vultures, etc.

661. *Milvus milvus milvus* (Linnaeus) **European or Red Kite**
 662. *Milvus migrans migrans* (Boddaert) **Black Kite**
 663. *Circus macrourus* (S. G. Gmelin) **Pale Harrier**
 664. *Circus pygargus* (Linnaeus) **Montagu's Harrier**

Family FALCONIDAE : Falcons

665. *Falco peregrinus babylonicus* P. L. Sclater **Redcapped or Barbary Falcon**
 666. *Falco tinnunculus tinnunculus* Linnaeus **European Kestrel**

Order GALLIFORMES

Family PHASIANIDAE : Pheasants, Partridges, etc.

667. *Francolinus pondicerianus interpositus* Hartert **North Indian Grey Partridge**
 668. *Pavo cristatus* Linnaeus **Indian Peafowl**

Order CHARADRIIFORMES

Family GLAREOLIDAE : Coursers (Courier Plovers), Pratincoles

669. *Cursorius cursor cursor* (Latham) **Creamcoloured or Desert Courser**
 670. *Cursorius coromandelicus* (Gmelin) **Indian Courser**

Order STRIGIFORMES

Family STRIGIDAE

Subfamily STRIGINAE : **Owls**671. *Athene brama indica* (Franklin) **Northern Spotted Owlet**672. *Asio flammeus flammeus* (Pontopidan) **Shorteared Owl**

Order CAPRIMULGIFORMES

Family CAPRIMULGIDAE

673. *Caprimulgus asiaticus asiaticus* Latham **Indian Little Nightjar**

Order APODIFORMES

Family APODIDAE : **Swifts**

Subfamily APODINAE

674. *Apus affinis affinis* (J. E. Gray) **Indian House Swift**

Order CORACIFORMES

Family MEROPIDAE : **Bee-eaters**675. *Merops orientalis beludschicus* Neumann **Sind Small Green Bee-eater**676. *Merops superciliosus persicus* Pallas **Bluecheeked Bee-eater**Family CORACIIDAE : **Rollers or Blue Jays**677. *Coracias benghalensis benghalensis* (Linnaeus) **Northern Roller or Blue Jay**Family UPUPIDAE : **Hoopoes**678. *Upupa epops epops* Linnaeus **European Hoopoe**679. *Upupa epops ceylonensis* Reichenbach **Ceylon Hoopoe**

Order PICIFORMES

Family PICIDAE : **Woodpeckers**Subfamily JYNGINAE : **Wrynecks**680. *Jynx torquilla torquilla* Linnaeus **European Wryneck**

Order PASSERIFORMES

Family ALAUDIDAE : **Larks**681. *Ammomanes phoenicurus phoenicurus* (Franklin) **Indian Rufoustailed Finch-Lark**682. *Calandrella cinerea longipennis* (Eversmann) **Yarkand Short-toed Lark**683. *Calandrella raytal adamsi* (Hume) **Indus Sand Lark**

684. *Eremopterix grisea* (Scopoli) **Ashycrowned Finch-Lark**
 685. *Galerida cristata chendoola* (Franklin) **Indian Crested Lark**
 686. *Galerida malabarica* (Scopoli) **Malabar Crested Lark**
 687. *Galerida deva* (Sykes) **Deccan or Sykes's Crested Lark**
 688. *Mirafra erythroptera erythroptera* Blyth **Redwinged Bush Lark**

Family HIRUNDINIDAE : **Swallows**

689. *Hirundo daurica nipalensis* Hodgson **Himalayan Striated or Redrumped Swallow**
 690. *Hirundo daurica japonica* Temminck and Schlegel **Japanese Striated or Redrumped Swallow**
 691. *Hirundo rustica rustica* Linnaeus **Western Swallow**

Family LANIIDAE : **Shrikes**

692. *Lanius cristatus cristatus* Linnaeus **Brown Shrike**
 693. *Lanius excubitor lahtora* (Sykes) **Indian Grey Shrike**
 694. *Lanius schach erythronotus* (Vigors) **Rufousbacked Shrike**
 695. *Lanius vittatus vittatus* Valenciennes **Indian Baybacked Shrike**

Family ORIOLIDAE : **Orioles**

696. *Oriolus xanthornus maderaspatanus* Franklin **South Indian Blackheaded Oriole**

Family DICRURIDAE : **Drongos**

697. *Dicrurus adsimilis macrocercus* Vieillot **South Indian Black Drongo or King Crow**

Family STURNIDAE : **Starlings, Mynas**

698. *Acridotheres ginginianus* (Latham) **Bank Myna**
 699. *Acridotheres tristis tristis* (Linnaeus) **Indian Myna**
 700. *Sturnus pagodarum* (Gmelin) **Blackheaded or Brahminy Myna**
 701. *Sturnus roseus* (Linnaeus) **Rosy Starling or Rosy Pastor**

Family CORVIDAE : **Crows, Magpies, etc.**

702. *Corvus splendens splendens* Vieillot **Indian House Crow**
 703. *Dendrocitta vagabunda pallida* (Blyth) **Western Tree Pie**

Family PYCNONOTIDAE : **Bulbuls**

704. *Pycnonotus cafer humayuni* Deignan **Central Indian Redvented Bulbul**
 705. *Pycnonotus leucogenys leucotis* (Gould) **White-eared Bulbul**

Family MUSCICAPIDAE

Subfamily TIMALINAE : **Babblers**706. *Turdoides caudatus caudatus* (Dumont) **Common Babbler**707. *Turdoides malcolmi* (Sykes) **Large Grey Babbler**Subfamily SYLVINAE : **Warblers**708. *Acrocephalus stentoreus brunnescens* (Jerdon) **Indian Great Reed Warbler**709. *Hippolais caligata rama* (Sykes) **Indian Booted Tree Warbler**710. *Orthotomus sutorius guzuratus* (Latham) **Indian Tailor Bird**711. *Sylvia communis icterops* Menetries **Indian Whitethroat**712. *Sylvia curruca minula* Hume **Small Whitethroat**713. *Sylvia hortensis jordani* (Blyth) **Eastern Orphean Warbler**714. *Sylvia nana nana* (Hemprich and Ehrenberg) **Desert Warbler**Subfamily TURDINAE : **Thrushes and Chats**715. *Oenanthe deserti deserti* (Temminck) **Central Asian Desert Wheatear**716. *Oenanthe isabellina* (Temminck) **Isabelline Chat**717. *Oenanthe picata* (Blyth) **Pied Chat**718. *Phoenicurus ochruros phoenicuroides* (Moore) **Kashmir Black Redstart**719. *Saxicoloides fulicata cambaiensis* (Latham) **Brownbacked Indian Robin**Family MOTACILLIDAE : **Pipits and Wagtails**720. *Anthus campestris campestris* (Linnaeus) **Tawny Pipit**721. *Anthus similes decaptus* Meinertzhagen **Persian Rock Pipit**722. *Anthus similes jordani* Finsch **Brown Rock Pipit**723. *Motacilla alba personata* Gould **Masked Wagtail**724. *Motacilla alba dukhunensis* Sykes **Indian White Wagtail**725. *Motacilla caspica caspica* (Gmelin) **Grey Wagtail**726. *Motacilla citreola calcarata* Hodgson **Blackbacked Yellowheaded Wagtail**727. *Motacilla flava bema* (Sykes) **Blueheaded Yellow Wagtail**728. *Motacilla flava thumbergi* Billberg **Greyheaded Yellow Wagtail**Family NECTARINIDAE : **Sunbirds, Spiderhunters**729. *Nectarina asiatica asiatica* (Latham) **Indian purple Sunbird**Family ZOSTEROPIDAE : **White-eyes**730. *Zosterops palpebrosa palpebrosa* (Temminck) **Indian White-eye**

Family PLOCEIDAE : Weaver Birds

Subfamily PASSERINAE : House and Rock Sparrows

731. *Passer domesticus indicus* Jardine and Selby **Indian House Sparrow**

Family EMBERIZIDAE : Buntings

732. *Emberiza melanocephala* Scopoli **Blackheaded Bunting**

733. *Emberiza striolata striolata* (Lichtenstein) **Striolated Bunting**

Class MAMMALIA

Order SIRENIA

Family DUGONGIDAE

734. *Dugong dugong* (Mueller)

Order CETACEA

Family DELPHINIDAE

735. *Sousa chinensis* Osbeck

Family PHOCAENIDAE

736. *Neophocaena phocaenoides* (Cuviere)

[In addition, Nambiar *et al.* (1995) listed *Balenoptera* sp. and *Delphinus delphis*]

Recorded from Pakistan, Gulf of Kachchh record to be confirmed

* No material, but may occur

TREES, SHRUBS AND HERBS

ACANTHACEAE

1 *Justicia adhatoda* (as *Adhatoda vasica*)

AGAVACEAE

2. *Agave cantula*

ALANGICEAE

3. *Alangium salvifolium*

AMARANTHACEAE

4. *Achyranthes aspera*

5. *Celosia argentea*

FLORA (Nambiar et al. 1995)

ANACARDIACEAE

6. *Lannea coromandelica*7. *Lannea pinnatifida*

APOCYNACEAE

8. *Cascabela thevetia*

ARECACEAE

9. *Cocos nucifera*10. *Phoenix sylvestris*

ASCLEPIADACEAE

11. *Calotropis procera*12. *Calotropis gigantea*13. *Hemidesmus indicus*14. *Leptadenia spartium*15. *Leptadenia pyrotechnica*16. *Periploca aphylla*

ASPHODELACEAE

17. *Aloe vera*

BORAGINACEAE

18. *Coldenia procumbens*19. *Cordia monoica*20. *Trichodesma indicum*

BURSERACEAE

21. *Commiphora wightii*22. *Garuga pinnata*

CACTACEAE

23. *Opuntia elatior*

CAESALPINIACEAE

24. *Senna auriculata*25. *Parkinsonia aculeata*26. *Tamarindus indica*

CAPPARIDACEAE

27. *Capparis grandis*28. *Capparis decidua*

CASUARINACEAE

29. *Casuarina equisetifolia*

CELASTRACEAE

30. *Maytenus senegalensis*

CHENOPODIACEAE

31. *Atriplex stocksii*32. *Suaeda fruticosa*33. *Suaeda maritima*

COMBRETACEAE

34. *Terminalia catappa*

COMPOSITAE

35. *Launaea procumbens*36. *Xanthium occidentale*

CONVOLVULACEAE

37. *Cressa cretica*38. *Rivea* sp.

CYPERACEAE

39. *Cyperus conglomerates*40. *Cyperus arenarius*41. *Cyperus pangorei*42. *Cyperus dichotoma*43. *Scirpus* sp.

EPHEDRACEAE

44. *Ephedra foliata*

ELATINACEAE

- 45.
- Bergia suffruticosa*

EUPHORBIACEAE

- 46.
- Bridelia squamosa*
-
- 47.
- Euphorbia caucifolia*
-
- 48.
- Euphorbia ligularia*
-
- 49.
- Euphorbia tirucalli*
-
- 50.
- Euphorbia nivulia*

FLACOURTIACEAE

- 51.
- Flacourtia indica*

GRAMINEAE

- 52.
- Halopyrum mucronatum*
-
- 53.
- Urochondra setulosa*

HYACINTHACEAE

- 54.
- Drimea indica*

LAMIACEAE

- 55.
- Ocimum americanum*
-
- 56.
- Premna corymbosa*

LEGUMINOSAE

- 57.
- Alhagi pseudalhagi*
-
- 58.
- Butea monosperma*
-
- 59.
- Erythrina variegata*
-
- 60.
- Indigofera cordifolia*
-
- 61.
- Indigofera oblongifolia*
-
- 62.
- Indigofera tinctoria*

LILIACEAE

- 63.
- Asparagus dumosus*

LYTHRACEAE

- 64.
- Lawsonia inermis*

MALVACEAE

- 65.
- Fioria vitifolia*

- 66.
- Thespesia populnea*

MELIACEAE

- 67.
- Azadirachta indica*
-
- 68.
- Melia azedarach*
-
- 69.
- Soymida febrifuga*

MIMOSACEAE

- 70.
- Acacia jacquemontii*
-
- 71.
- Acacia catechu*
-
- 72.
- Acacia leucophloea*
-
- 73.
- Acacia nilotica*
-
- 74.
- Acacia planifrons*
-
- 75.
- Acacia senegale*
-
- 76.
- Acacia ferruginea*
-
- 77.
- Pithecellobium dulce*
-
- 78.
- Prosopis juliflora*
-
- 79.
- Prosopis cineraria*

MORACEAE

- 80.
- Ficus benghalensis*
-
- 81.
- Ficus religiosa*
-
- 82.
- Ficus racemosa*

MORINGACEAE

- 83.
- Moringa oleifera*

MYRTACEAE

- 84.
- Syzygium cumini*

OROBANCHACEAE

- 85.
- Cistanche tubulosa*
-
- 86.
- Orobranchus*
- sp.

PEDALIACEAE

- 87.
- Martynia annua*
-
- 88.
- Petalium murex*

RHAMNACEAE

89. *Zizyphus nummularia*

RUBIACEAE

90. *Morinda tinctoria*91. *Catunaregam spinosa*

SALVADORACEAE

92. *Salvadora persica*93. *Salvadora oleoides*

SAPOTACEAE

94. *Mimusops elengi*

SOLANACEAE

95. *Solanum surattense*96. *Solanum villosum*

STERCULIACEAE

97. *Helicteres isora*

TAMARICACEAE

98. *Tamarix stricta*

TILIACEAE

99. *Grewia tiliaefolia*100. *Triumfetta rotundifolia*

TYPHACEAE

101. *Typha angustata*

ULMACEAE

102. *Holoptelea integrifolia*

ZYGOPHYLLACEAE

103. *Balanites aegyptiaca***MANGROVES**

AVICENNIACEAE

104. *Avicennia alba*105. *Avicennia marina*106. *Avicennia officinalis*

MYRSINACEAE

107. *Aegiceras corniculatus*

RHIZOPHORACEAE

108. *Bruguiera gymnorrhiza*109. *Ceriops tagal*110. *Rhizophora apiculata*111. *Rhizophora mucronata*

SONNERATIACEAE

112. *Sonneratia apetala***ALGAE**Class **CHLOROPHYCEAE**

Family BRYOPSIDAE

113. *Bryopsis indica*114. *Bryopsis plumose*115. *Bryopsis ramulosa*

Family CAULERPACEAE

116. *Caulerpa crassifolia*117. *Caulerpa cupressoides*118. *Caulerpa scalpelliformis*119. *Chaetomorpha indica*120. *Spongomorpha* sp.

Family CODIACEAE

121. *Codium dwarkense*122. *Codium elongatum*123. *Halimeda tuna*124. *Udotea indica*

Class **ULVALES**

Family ULVACEAE

125. *Ulva fasciata*Class **SIPHONOCLADALES**

Family SIPHONOCLADACEAE

126. *Chamaedoris auriculata*

Family VALONIACEAE

127. *Boodlea composita*128. *Dictyosphaeria cavernosa*129. *Valoniopsis pachynema*130. *Hormophysa triquetra*Class **PHAEOPHYCEAE**

Family DICTYOTACEAE

131. *Dictyota bartayresii*132. *Dictyota cervicornis*133. *Dictyota divaricata*134. *Dictyota atomaria*135. *Dictyota ciliolata*136. *Dictyopteris australis*137. *Dictyopteris woodwardii*138. *Padina gymnospora*139. *Spathoglossum variabile*140. *Spathoglossum asperum*141. *Stoechospermum marginatum*

Family ECTOCARPACEAE

142. *Ectocarpus* sp.

Family PUNCTARIACEAE

143. *Colpomenia sinuosa*144. *Hydroclathrus clathratus*

Family SARGASSACEAE

145. *Sargassum swartzii*146. *Sargassum tenerrimum*147. *Sargassum plagiophyllum*148. *Sargassum wightii*149. *Turbinaria ornate*150. *Sargassum johnstonii*Class **RHODOPHYCEAE**

Family BONNEMAISONIACEAE

151. *Asparogopsis taxiformis*

Family CERAMIACEAE

152. *Ceramium* sp.

Family CHAETANGIACEAE

153. *Sciniaia furcellata*

Family CORALLINACEAE

154. *Amphiroa fragilissima*

Family DASYACEAE

155. *Dasya* sp.

Family DELISSERIACEAE

156. *Caloglossa bombayance*157. *Hypoglossum spathulatum*

Family GIGARTINACEAE

158. *Gigartina* sp.

Family GRACILARIACEAE

159. *Gracilaria pygmaea*

Family GRATILOUPIACEAE

160. *Grateloupia felicina*161. *Halymenia floresia*

Family HELMITHOCLADIACEAE

162. *Liagora cerenoides*

Family RHIZOPHYLLIDACEAE

163. *Desmia hornmanni*

Class CERAMIALES

Family RHODOMALACEAE

164. *Neurymenia fraxinifolia*165. *Lophocladia lallemandi*166. *Acanthophora spicifera***Class RHODYMENIALES**

Family RHODYMENIACEAE

167. *Botroycladia leptapoda***Class CHORDARIALES**

Family SPERMATOCHNACEAE

168. *Nemacystus decipiens***Class CRYPTONEMIALES**

Family CORYNOMORPHACEAE

169. *Corynomorpha prismatica***OTHERALGAE**

Class RHODOPHYCEAE; Family?

170. *Chondria ornate*171. *Chondria dasyphylla*172. *Chondria prolifera*

Class ? Family CORADARIACEAE

173. *Myriogloea sciurus*

Class ? Family ?

174. *Cryptopleura* sp.175. *Gastroclonium* sp.176. *Giffordia mitchellae*177. *Haloplegma* sp.178. *Pocockiella* sp.179. *Pseudobryopsis mucronata*180. *Rosenvingia intricate*

PLATE – I



Fig. 1. Mangrove vegetation, Jinda Island



Fig. 2. Mangroves, Pirotan Island

PLATE – II



Fig. 3. Mangrove forest, Baidar Tapu



Fig. 4. Mangrove forest, Baidar Tapu

PLATE – III



Fig. 5. *Caulerpa* sp., algae



Fig. 6. Cormorants, Kalubhar Island

PLATE – IV



Fig. 7. A congregation of birds, Pirotan Island



Fig. 8. Corals and shell on sale, Beyt Dwaraka

PLATE – V

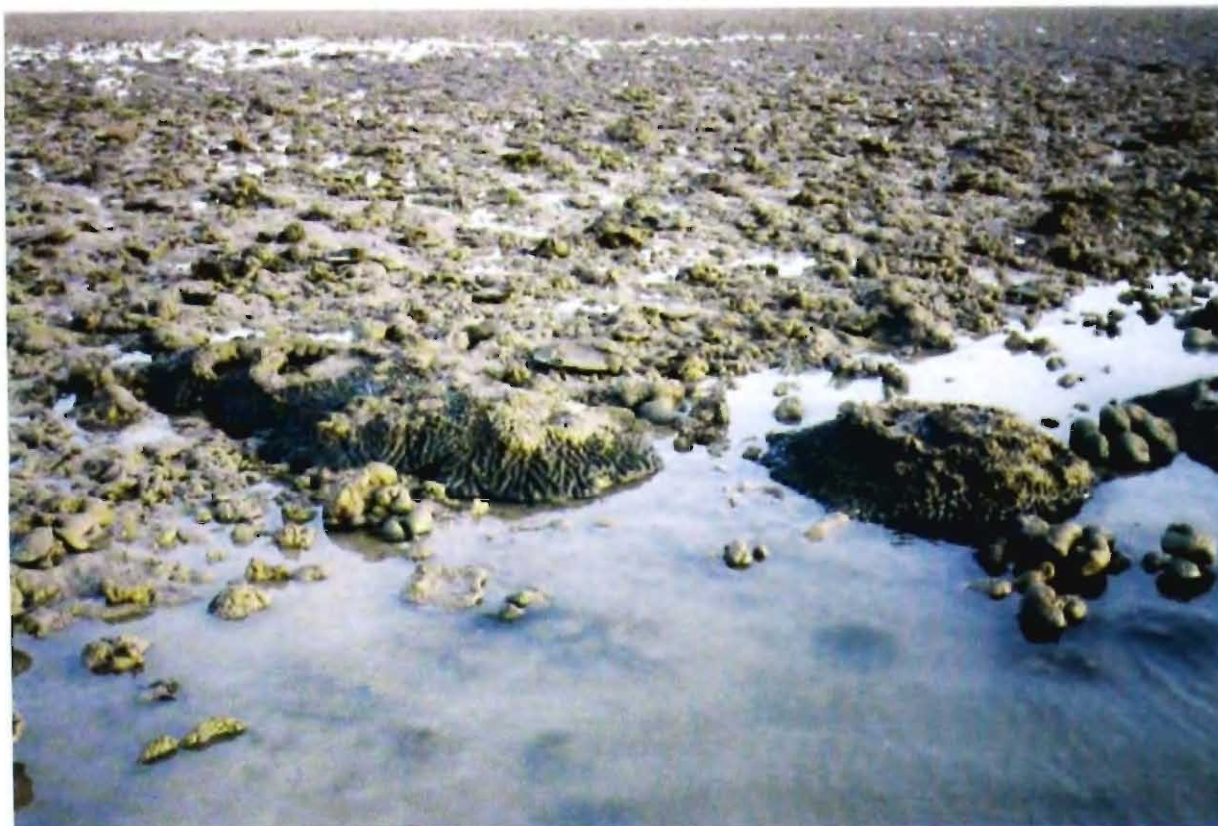


Fig. 9. Exposed reef during minus tide, Ashaba Island



Fig. 10. Exposed Paga reef during minus tide, a common sight in the Gulf

PLATE – VI



Fig. 11. Zoanthids, Kalushar Island



Fig. 12. Exposed sponges, Poshitra

PLATE – VII



Fig. 13. *Goniopora palmulata* threatened by silt



Fig. 14. Massive *Platygyra sinensis* covered by silt and algae



Fig. 15. *Turbinaria mesenterina* during minus tide, Pashu Island

PLATE – VIII



Fig. 16. Massive *Symphyllia radians* surrounded by macroalgae

Fig. 17. *Montipora* mats, Boria reef

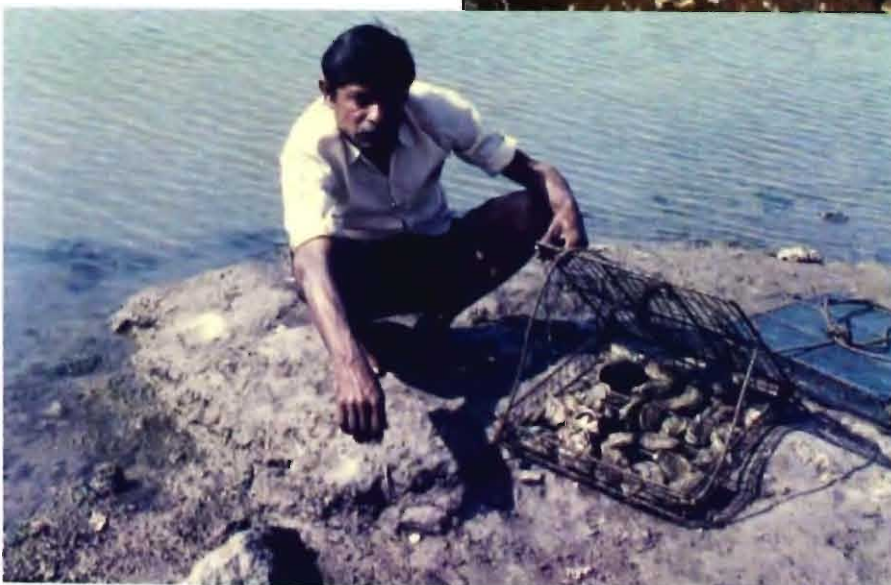
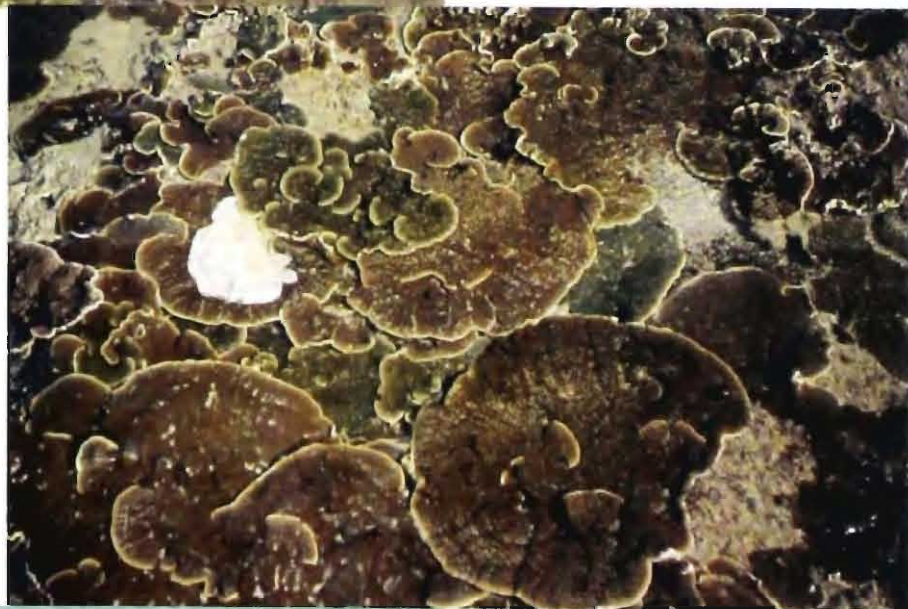


Fig. 18. Pearl oysters in a cage, removed for examination, Sika