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Reef dependent ichthyofauna of the Gulf of Kachchh, Gujarat, Western India

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Abstract

The coral reef environment are very productive of reef associated life comprising of algae, sponges, annelids, molluscs, crabs, prawns, echinoderms, fishes, sea turtles, birds and marine mammals with several other members of minor phyla. Out of total 34 phyla, 32 are reported from the marine ecosystem. The major representative of the chordate fauna is found from the class Pisces. The present study describes species diversity of reef fishes in some of the representative reef areas of the Gulf of Kachchh (Dwarka, Okha, Poshitra, Narara and Goose). This study was carried out from 2008 to 2014 during various biodiversity studies through visual census method. Total 35 genus and 41 species belonging to 27 Families were found in the reef area of Gulf of Kachchh.

Keywords: Coral Reef, Reef Fishes, Gulf of Kachchh.

1. Introduction

India is endowed with a wide diversity of water resources which sustain a large fisheries sector in the country having a coastline of 8,118 km in which Gujarat contributes of approximately 1600 km^[1]. The Gulf of Kachchh forms the north-western boundary of the Indian coast which extends to a length of 170 km covering an area of around 7300 km². It is one of the few coastal zones in the world having rich biodiversity at the same under rapid industrialisation. A vast intertidal mudflat along with mangroves and rich rocky coral reefs make the Gulf of Kachchh a well preferred zone for breeding of many marine organisms. The World Conservation Strategy^[2] identified coral reefs as one of the essential ecological processes and life support systems. Coral reefs are highly productive, and known for the diverse fauna and flora, complex food web and rich sites of living and non-living resources. It is also one of the dynamic ecosystems of throbbing beauty and fantasy^[3]. It harbours good species diversity, maintains distinct pattern of biotic assemblages including rare and endangered species^[4].

In India, there are four major coral reefs that are the Gulf of Kachchh (Gujarat), Lakshadweep Islands, Gulf of Mannar (Tamil Nadu) and Andaman & Nicobar Islands. Estimation of reef flats of Indian reefs by remote sensing has shown that the extent of the area in Gulf of Kachchh is 148.4 km² that of Tamil Nadu coast as 64.9 km² (Pillai, 2010).

Out of total 34 animal phyla, 32 are represented by the taxa in the marine ecosystem^[5] in the world. Total 32,100 species of fishes are enlisted in the world (Fishbase, 2014). India has huge aquatic resources, 29,000 km of rivers and 2.02 million km² area of Exclusive Economic Zone (EEZ) surrounding the sea (8129 km of coastline which includes those of Andaman and Nicobar Islands)^[6]. India is believed to have about 2456 species out of which 402 found in the Gulf of Kachchh, 603 in Lakshadweep, 762 in Gulf of Mannar, 1200+ in Andaman and Nicobar. The exact number of fish species associated with coral reefs of India is still to be found. Various studies have been done in coral reefs for fish diversities. From that it is observed that, the categories of fishes occurring in India includes groups such as damselfish (52 species), Butterfly fishes (32 species), sweet lips (16 species), angel fishes (16 species), parrot fishes (14 species), snappers (42 species), wrasses (53 species), groupers (43 species), surgeon fish (18 species)^[5]. Total 720 species of reef fishes belonging to 90 Families were found in Andaman and Nicobar Islands^[7], 71 species from the reef areas of Gulf of Mannar^[8], 121 species belonging to 27 families from Kavaratti Island of Lakshadweep^[9] and 56 species were recorded from Mithapur reef of Gulf of Kachchh^[10]. However except for the Mithapur

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there is very little reef specific fish diversity data is available; hence there is a need to assess the fish fauna, with reference to the representative reefs in the Gulf of Kachchh. The paper elaborates on the efforts made to document the fish fauna from some of the representative reefs of the Gulf of Kachchh from the year 2008 to 2010.

2. Materials and Methods

2.1 Study Site

The Gulf of Kachchh (GoK) is lying between Kachchh mainland and the Saurashtra Peninsula (22°15'-23°40' N Latitude and 68°20'-70°40' E Longitude). The Gulf is aligned approximately 170 km in the E-W direction and 75 km wide at the mouth which narrows down to 18 km. near Kandla at the head. The northern side shares the boundary with Kachchh while the southern border touches Rajkot district and Jamnagar of Saurashtra region [11]. The western open boundary of the Gulf interacts with the northern Arabian Sea, while the eastern Gulf opens into the shallow creeks of the Little Rann of Kachchh. According to official records, are 42 islands & some islets in the GoK which is covering about area of 410.6km². Out of which Dwarka, Okha, Poshitra, Narara and Goose were selected for the study.

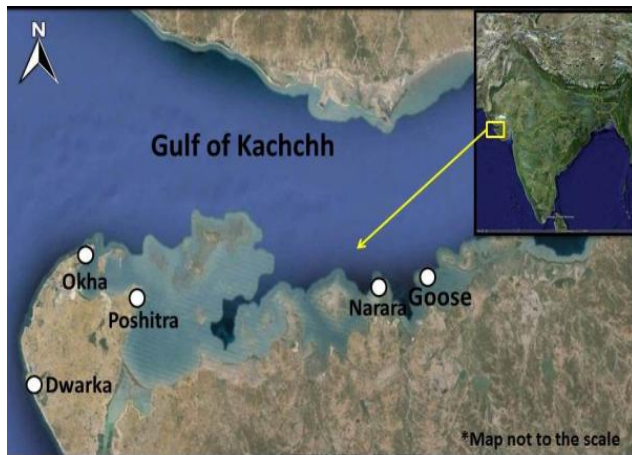


Fig 1: Study site: Gulf of Kachchh

- Okha:** (22° 30'N; 69° 00'E). Okha is situated on a narrow strip of land that project towards sea. It is surrounded by sea on three sides and has a sandy beach on Arabian Sea coast. The reef is attached to the land mass.
- Dwarka:**(22° 23'N; 68° 97'E). Dwarka is located on the westernmost part of the Gulf of Kachchh and directly exposes to the Arabian Sea. The habitat consists mainly rocky shore. The reef is attached to the land.
- Poshitra:**(22° 24' N; 69° 10' E).Poshitra Point is located about 35 km from Dwarka near Poshitra village. Poshitra is a sheltered bay in the Gulf of Kachchh. A group of small islands surrounds this point.
- Goose:** (22°29'N 69°47'E). It is a submerged reef in the innermost Gulf of Kachchh. The island is rocky and submerged in high tide and opens up in the low tide.
- Narara:** (22°28'N; 69°42'E). The Habitat is rocky. Narara Reef is a popular tourist destination and Nature Education Camp site of Marine National Park. It consists of several

islands and is filled with sandy beaches, coral reefs and mangroves.

Observations were carried out using visual census [12]. Intova 7 megapixel camera along with its housing was used for photo documentation and identification. The specimens were identified using standard references [13]. Bray-Curtis similarity was calculated using PAST software.

3. Results

Total 41 species belonging to 35 genera and 27 Families were recorded from the selected five reefs of the gulf (Table 1). Maximum representation was of Trichiuridae family (Fig 3) with 4 genus and 4 species out of 40 species recorded globally. The occurrence may be attributed to the diverse habitat suitability to the family, which is marine as well as brackish water areas and benthic-pelagic on continental shelves and slopes up-to 2000m depth from sea surface. Sparidae contains 147 species in 38 genera globally out of which 3 genera and 3 species were recorded from Gulf of Kachchh. Maximum richness was recorded at Goose reef with 24 species followed by Poshitra and Narara with 21 and 18 species respectively. Grey Mullet (*Mugil cephalus*) and White spotted puffer (*Arothron hispidus*) were recorded from all the five locations in all the seasons. *Mugil cephalus* is the important and abundant commercial fish of the area. *Plotosus lineatus* considered to be invasive [14] species recorded from the reef areas of Poshitra, Goose and Narara. This invasive species is regularly encountered in greater number. Total 8 species were recorded to be an Alien Species viz. *Diodon hystrix*, *Plotosus lineatus*, *Muraenesox cinereus*, *Pomacanthus annularis*, *Epinephelus coioides*, *Oxyeleotris marmorata*, *Terapon jarbua* and *Hemiramphus far* [13].

In total 17 species were confined to any one specific reef only of which 10 were restricted to Goose only. Though the fishing of the species is abundant (Figure 7) throughout the Gulf, and there is a threat of local extinction of the species, the Orange spotted grouper (*Epinephelus coioides*) belongs to Near threatened category of IUCN, whereas 2 were Data deficient (DD), 5 belong to Least Concern (LC) and 32 have not been evaluated [15].

Based on the species similarity, two distinct clusters were established. The first cluster of Poshitra, Goose and Narara and the other cluster of Dwarka and Poshitra, with species similarity of 44% and 68% respectively (Figure 2).

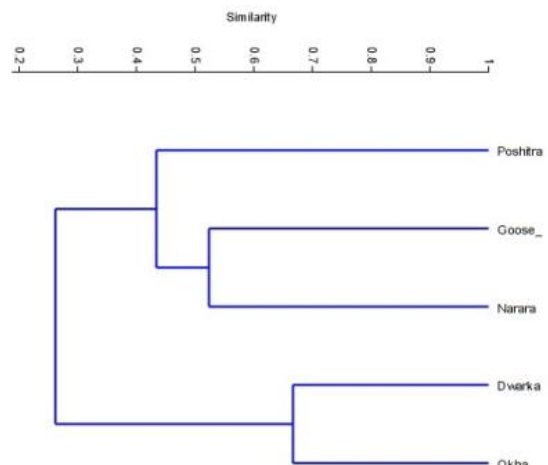


Fig 2: Bray Curtis similarity Index

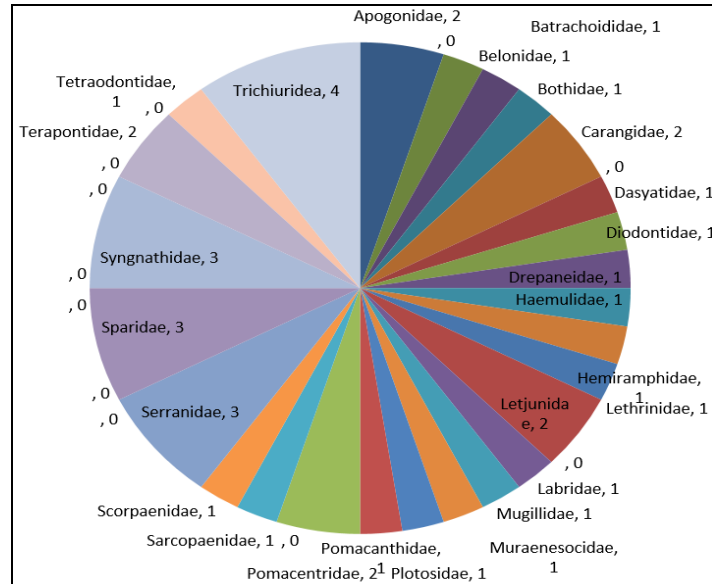


Fig 3: Family wise diversity contribution of Ichthyofauna

Table 1: Fish Diversity in GoK (Figure 4, 5 & 6)

Sr. No.	Family	Scientific Name	Common Name	1	2	3	4	5
1	Apogonidae	<i>Apogonichthyoides pseudotaeniatus</i> (Gon, 1986)	Double bar cardinal fish	-	-	✓	-	✓
2		<i>Ostorhinchus fasciatus</i> (White, 1790)	Broad banded cardinal fish	-	-	-	✓	✓
3	Belonidae	<i>Strongylura strongylura</i> (Van Hasselt, 1823)	Spot tail needle fish	-	-	✓	-	-
4	Batrachoididae	<i>Allenbatrachus grunniens</i> (Linnaeus, 1758)	Grunting Toad	-	-	✓	✓	-
5	Bothidae	<i>Bothus myriaster</i> (Temminck & Schlegel, 1846)	Indo-pacific oval flounder	-	-	✓	✓	-
6	Carangidae	<i>Alectis indica</i> (Ruppell, 1830)	Indian thread fish	-	-	✓	-	✓
7		<i>Caranx sexfasciatus</i> (Quoy & Gaimard, 1825)	Bigeye trevally	-	-	-	✓	-
8	Dasyatidae	<i>Neotrygon kuhlii</i> (Müller & Henle, 1841)	Blue spotted stingray	-	-	✓	-	✓
9	Diodontidae	<i>Diodon hystrix</i> (Linnaeus, 1758)	Spot-fin pocupine fish	-	-	✓	-	✓
10	Drepaneidae	<i>Drepane punctata</i> (Linnaeus, 1758)	Spotted sickle fish	-	-	-	✓	-
11	Haemulidae	<i>Pomadasyus aheneus</i> (McKay & Randall, 1995)	Yellow back grunt	-	-	-	✓	-
12	Hemiramphidae	<i>Hemiramphus far</i> (Forsskål, 1775)	Black barred halfbeak	-	-	-	✓	✓
13	Lethrinidae	<i>Lethrinus ornatus</i> (Valenciennes, 1830)	Ornate emperor	-	-	-	✓	-
14	Lutjanidae	<i>Letjunus lemniscus</i> (Valenciennes, 1828)	Yellow streaked snapper	-	-	✓	✓	-
15		<i>Lethrinus nebulosus</i> (Forsskål, 1775)	Spangled emperor	-	-	-	✓	-
16	Labridae	<i>Halichoeres nigrescens</i> (Bloch & Schneider, 1801)	Bubble fin Wrass	-	-	-	✓	-
17	Mugilidae	<i>Mugil cephalus</i> (Linnaeus, 1758)	Grey Mullet	✓	✓	✓	✓	✓
18	Muraenesocidae	<i>Muraenesox cinereus</i> (Forsskål, 1775)	Daggertooth pike conger	-	-	✓	-	-
19	Plotosidae	<i>Plotosus lineatus</i> (Thunberg, 1787)	Striped eel cat fish	-	-	✓	✓	✓
20	Pomacanthidae	<i>Pomacanthus annularis</i> (Bloch, 1787)	Blue ring angel fish	-	-	✓	✓	✓
21	Pomacentridae	<i>Abudefduf sordidus</i> (Bloch, 1787)	Baga	-	✓	-	-	✓
22		<i>Abudefduf bengalensis</i> (Bloch, 1787)	Bengal sergent	✓	✓	✓	-	-
23	Sarcopaenidae	<i>Scorpaenopsis venosa</i> (Forsskål, 1775)	Pygmy filefish	-	✓	-	-	-
24	Scorpaenidae	<i>Stephanolepis sp.</i> (Cuvier, 1829)	Raggy scorpion fish	-	-	-	✓	-
25	Serranidae	<i>Epinephelus coioides</i> (Forsskål, 1775)	Orange spotted grouper	-	-	✓	✓	✓
26		<i>Epinephelus erythrurus</i> (Valenciennes, 1828)	Cloudy grouper	-	-	-	✓	✓
27		<i>Cephalopholis formosa</i> (Shaw, 1812)	Bluelined hind	-	-	-	✓	-
28	Sparidae	<i>Acanthopagrus bifasciatus</i> (Forsskål, 1775)	Two bar sea bream	-	-	-	✓	✓
29		<i>Acanthopagrus berda</i> (Forsskål, 1775)	Goldsilkeabream	-	-	-	✓	-
30		<i>Acanthopagrus arabicus</i> (Iwatsuki, 2013)	Arabian yellow finseabream	-	-	-	✓	-
31	Syngnathidae	<i>Hippocampus jayakari</i> (Boulenger, 1900)	Jayakari's seahorse	-	-	✓	-	-
32		<i>Hippocampus sp.</i>	Seahorse	✓	-	-	-	-
33		<i>Oxyeleotris marmorata</i> (Bleeker, 1852)	Marble goby	-	-	✓	-	-
34	Terapontidae	<i>Terapon jarbua</i> (Forsskål, 1775)	Jarbuaterapon	-	✓	✓	-	✓
35		<i>Arothron hispidus</i> (Linnaeus, 1758)	White spotted puffer	✓	✓	✓	✓	✓
36	Tetraodontidae	<i>Torquigener pleurogramma</i> (Regan, 1903)	Weeping Toad	-	-	-	✓	✓
37	Trichiuridae	<i>Trichiurus lepturus</i> (Linnaeus, 1758)	Large Head Hairtail	-	-	✓	-	-
38		<i>Blenniella periophthalmus</i> (Valenciennes, 1836)	Blue dashed rock skipper	✓	✓	✓	-	-
39		<i>Oxyurichthys microlepis</i> (Bleeker, 1849)	Maned goby	✓	✓	✓	-	-
40		<i>Pomacentrus trichourus</i> (Gunther, 1867)	Pale tail Damsel	-	-	-	✓	✓
41	Tripterygiidae	<i>Helogramma lacuna</i> (Williams & Howe, 2003)	Cavern triplefin	✓	-	-	-	✓

1 = Okha, 2 = Dwarka, 3 = Poshitra, 4 = Goose, 5 = Narara



Fig 4: (Fishes 1 to 15 as per Table 1)



Fig 5: (Fishes 16 to 30 as per Table 1)

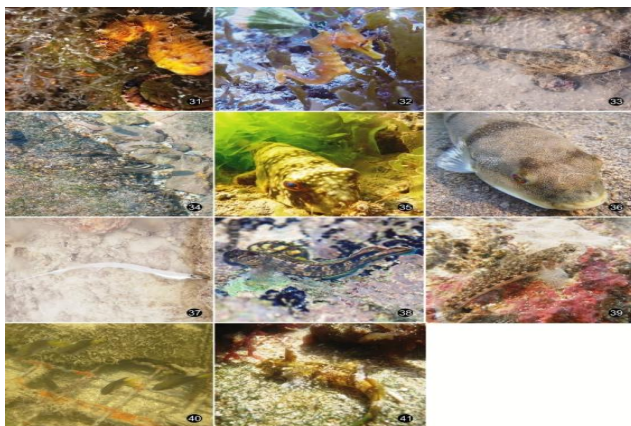


Fig 6: (Fishes 31 to 41 as per Table 1)



Fig 7: Fishing of the Near Threatened (NT) Orange spotted grouper.

4. Discussion

The marine sub - sector contribute 39 % of total national fish production of 7.60 million tonnes [16]. On the other hand, 61% is contributed by Inland fishing. India is World's 3rd largest fish producing nation and 2nd in Inland Aquaculture. There are about 2546 number of species of marine fishes in India out of which about 402 species in Gujarat, 603 species in Lakshadweep, 762 species in Gulf of Mannar [17]. A total of 1434 species of fishes under 576 genera belonging to 165 families is represented from Andaman and Nicobar islands [18]. In India, Lakshadweep is reported to have about 600 species of reef fishes [19]. From the reefs of Gujarat, total 49 species of reef fishes are found belonging to 30 families have been recorded [20]. Among the west coast of India (rocky substrata between Vizhinjam, Kerala and Muttom, Tamilnadu), total 184 belonging to 41 families were recorded [21].

A study in Pirotan Island [4] represented by very few species of reef fishes. However, in the current study, 1 fish species is recorded from Near Threatened, 5 from Least Concern, 2 are Data Deficient and 32 are not evaluated. This indicates that total 34 species are recorded from different locations but there is no adequate data available for the diversity of reef fishes from the Gulf of Kachchh especially reef or location specific data is absent or very scanty. The reasons are lack of knowledge and available reports on distribution of the species that are already have been recorded. Such scanty information gives a poor base for the managers to design a conservation strategy. Reef or the area specific checklists helps the managers in forming a good and sustainable conservation strategy.

The Orange Spotted Grouper (*E. coioides*) is enlisted Near Threatened under the category of IUCN and was found from Poshitra, Goose and Narara. The species is found abundantly and also extensively exploited by fishermen. Thus the quantitative and qualitative data should be collected frequently for such species as the conservation measurements. The present study may help the policy makers and the P.A managers to design a good conservation policy / strategy.

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