

## Ichthyofaunal Diversity in the Vicinity of Marine Protected Areas, Jamnagar, Gulf of Kachchh, India

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**ABSTRACT:** The present study reports ichthyofaunal diversity from four different landing centers namely, Sikka bander, Bed (Rasulnagar), Bedibander and Vadinar located in the vicinity of Marine National Park (MNP), Jamnagar with the help of different fishing gears. Sampling was carried out at monthly interval from September 2012 to May 2013. A total of 109 fish species belongs to 19 orders, 58 families and 93 genus were enumerated during present study. 33 number of IUCN listed species were enlisted in this study. Carangidae and Sciaenidae were two families which recorded highest number of species diversity (8 species) followed by Mugilidae (5 species), Clupeidae (4 species), Haemulidae (4 species), Serranidae (4 species) and Sparidae (4 species).

**Keywords:** Ichthyofaunal Diversity, Marine protected area, Gulf of Kachchh.

### INTRODUCTION

Biodiversity refers to a variety and abundance of life in given area. Among the types of diversity, species diversity is the most common usage of diversity, which pertains to the number of species found in given areas (Gray 1997). The species diversity comprises many levels of variation, which are ranged from genus to ecosystems level. The oceans cover more than 71 percent of the earth, which provides up to more than 99 percent of the space available for life in the ecosystem. But, when compared with the biodiversity reported from terrestrial part, marine environment was least explored. This is largely due to the logistic difficulties for the surveyor during explorations (George *et al.* 2008). The every organism contributes to ecosystem processes, but the nature and magnitude of individual contributions varies considerably according to the organism. Marine ecosystems are extraordinarily diverse in all aspects; it varied from genetic to taxonomic to ecological level (Ray & Grassle 1991). According to Dulvy *et al.* (2003) within the fish population there is a high genetic diversity was present and that may be helpful them to protect them against various environmental stresses and the spread of diseases.

There are 31,362 distinct fish species reported globally (William *et al.* 2010). According to the IUCN (2008) there were about 1,275 species of fishes reported as threatened fishes on earth i.e. Red list species. In India total 2,358 number of finfishes were recorded and among them 877 species are fresh water, while 113 species are brackish water and 2,358 are marine species (Ayyappan *et al.* 2011).

The Gulf of Kachchh area is present along the west coast of India in the state of Gujarat, which occupies an area of up to 7300 km<sup>2</sup>. This area considers as one of the most productive and biologically diversified habitat. Along southern shores of Gulf of Kachchh the water is calm and deep. The Gulf is rich in marine wealth and biodiversity because it consists the variety of mangroves species and coral habitats, which provides a unique productive habitat for a diverse marine life forms.

The Gulf of Kachchh Marine National Park and Sanctuary (MNPS) was formally established in 1982, by a set of state notifications and comprises of 457.92 sq. km area along the coast of Saurashtra in the southern of Gulf of Kachchh (22°15' to 23°40'N and 68°20' to 70°40'E). The Gulf of Kachchh MNPS has

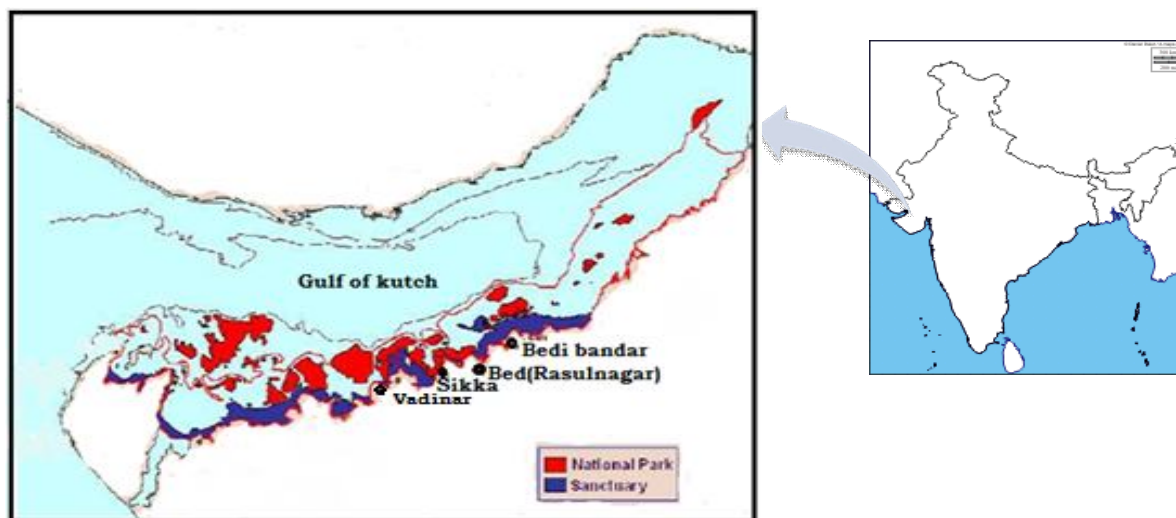
been classified as part of the West Coast Biotic Province by the Wildlife Institute of India (Panwar and Mathur 2002). The notified area includes 148.92 sq. km. of 42 islands in the Gulf and 309 sq. km. of intertidal zone along its coast area covers from Navlakhi to Okha (Biswas 2008).

In present scenario of ocean the major stresses on fish population in the ocean were climate change, habitat loss, invasive species, eutrophication and pollution and these factors accelerate fishing-induced declines and inhibit or prevent recoveries (Garcia 2005) and this ultimately causes an erosion of global biodiversity. Due to these all reasons ichthyofaunal diversity conservation becomes special need for marine life.

Along the Gulf of Kachchh MNPS ichthyofaunal diversity of MNP is least explored. Thus the present study aimed to obtain a more accurate detailed checklist of the fish species present in and around MNP.

## MATERIAL AND METHODS

**Location:** Three landing centers were selected in Jamnagar district for the present study, which were in the Marine National Park (Fig. 1). These landing centers were present at the middle of the MNPS. The selected landing centers for study were Sikka (22°25'N, 69°49'E), Bed (Rasulnagar) & Bedibander (22°32'N, 70°01'E) Vadinar (22°32'N, 69°42'E). Samples were collected from start of the fishing season, i.e., September 2012 up to May 2013.



**Figure 1:** Map showing the study locations along the Jamnagar, MNP area.

**Sampling process:** Data was collected at monthly intervals. Samples were collected from different fishing gears viz., gill net, hook & line, cast net, *vada* (steak net) by using different mesh sizes of fishing gears operated in these landing centers. The photographs of collected fish sample were taken with help of digital camera (Nikon coolpix L810). Then fishes were carried out to Sikka research station and preserved in 10% formalin solution in the separate specimen jar (1000ml/2000ml) according to their size. Small fishes were directly placed in 10% formalin solution while large fishes were dissected and then preserved. Preserved sample placed in museum of Sikka research centre and College of Fisheries, Veraval. Identification of fishes was done up to species level with the help of standard keys, book and standard taxonomic references.

- The Fishes of India (Francis Day, F.L.S. & F.Z.S).
- Handbook for Field Identification of Fish Species Occurring in the Indian Seas (Fishery Survey of India).
- FAO Catalogues (<http://www.fao.org/fishery/org/fishfinder/3,3/en>)
- Fishbase (<http://www.fishbase.org/search.php>).

## RESULTS AND DISCUSSION

In the present study total 109 ichthyofaunal species were identified, which belong to 19 orders 58 families and 93 genus. Among these identified species 33 species were IUCN listed species and amongst them two species under the category of endangered, three species under vulnerable, six species come in near threatened category, 18 species least concern and four species under the category of data deficiency. Perciformes was the order which comprises highest number of families i.e. 26 families. Among the all reported families, two main dominant families were Carangidae (8 species) and Sciaenidae (8 species), which were followed by Mugilidae (5 species), Clupeidae (4 species), Haemulidae (4 species), Serranidae (4 species) and Sparidae (4 species) in the vicinity of protected area of Jamnagar. The species wise availability among different families shows that 34 families comprises one spp., 13 families comprises two species, 4 families comprises three species, 4 families comprises four species, 2 families having eight species and 1 family comprises five species (Table 1 and Figure 2).

**Table 1:** Total ichthyofaunal diversity recorded in the vicinity of Marine National Park, Jamnagar.

Sr. No.	Order	Family	Scientific name	IUCN status
	<b>SHARKS AND RAYS</b>		<b>Class: Elasmobranchii</b>	
1	Carcharhiniformes	Carcharhinidae	<i>Rhizoprionodon oligolinx</i> (Springer, 1964)	LC
2			<i>Carcharhinus macroti</i> (Müller & Henle, 1839)	NT
3		Sphyrnidae	<i>Sphyrna zygaena</i> (Linnaeus, 1758)	VU
4	Orectolobiformes	Hemiscylliidae	<i>Chiloscyllium arabicum</i> (Gubanov, 1980)	NT
5	Myliobatiformes	Dasyatidae	<i>Pastinachus sephen</i> (Forsskål, 1775)	-
6			<i>Himantura walga</i> (Müller & Henle, 1841)	NT
7		Myliobatidae	<i>Aetobatus flagellum</i> (Bloch & Schneider, 1801)	EN
8	Rajiformes	Gymnuridae	<i>Gymnura poecilura</i> (Shaw, 1804)	VU
9		Dasyatidae	<i>Himantura uarnak</i> (Gmelin, 1789)	NT
10			<i>Dasyatis zugei</i> (Muller & Henle, 1841)	NT
11			<i>Himantura bleekeri</i> (Blyth, 1860)	-
12		Myliobatidae	<i>Aetomylaeus maculates</i> (Gray, 1834)	EN
13	Torpediniformes	Narkidae	<i>Typhlonarke aysoni</i> (Hamilton, 1902)	DD
	<b>TELEOST (Bony Fishes)</b>		<b>Class: Actinopterygii</b>	
14	Anguilliformes	Muraenesocidae	<i>Muraenesox cinereus</i> (Forsskål, 1775)	-

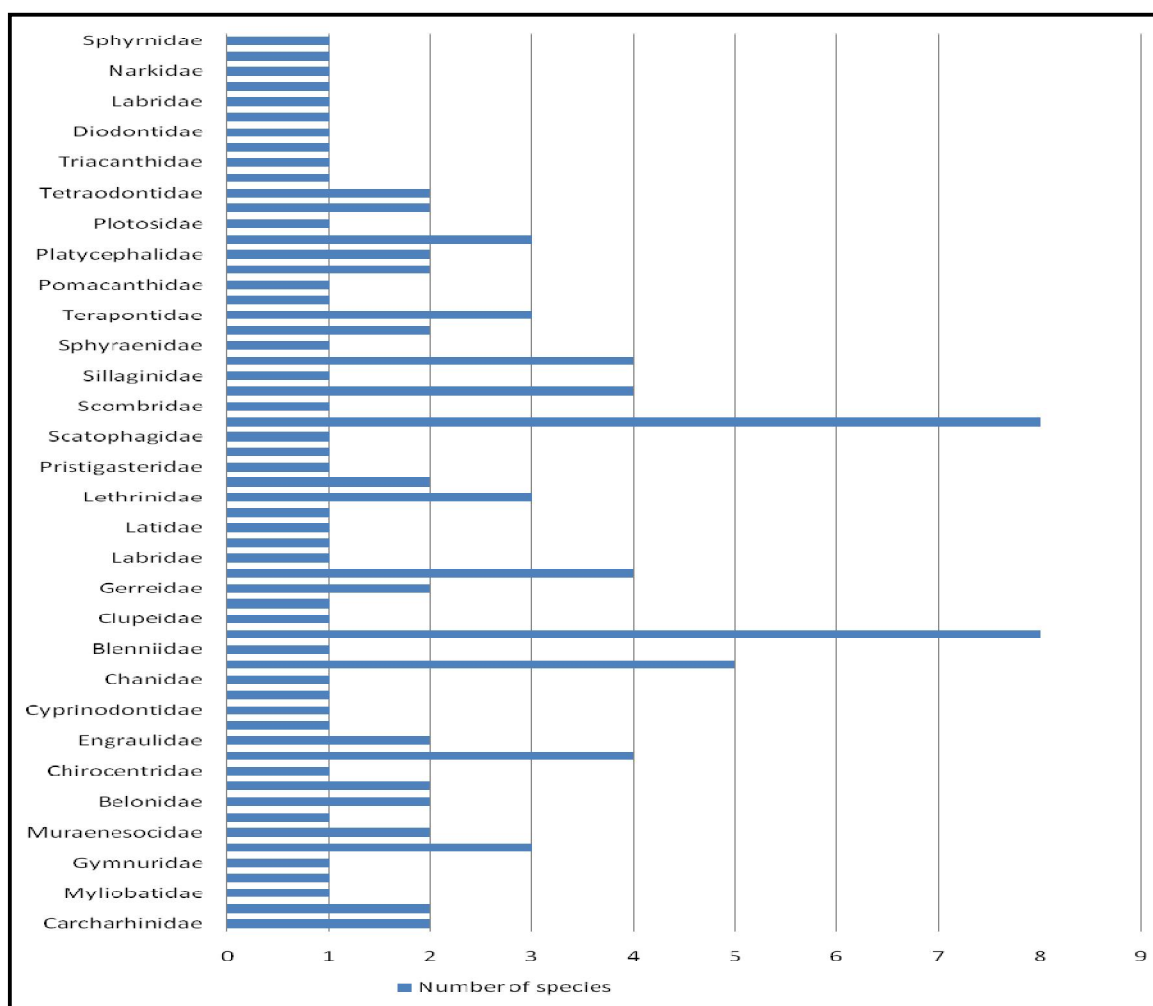
15			<i>Congresox talabonoides</i> (Bleeker, 1853)	-
16	Aulopiformes	Synodontidae	<i>Harpodon nehereus</i> (Hamilton, 1822)	-
17	Beloniformes	Belonidae	<i>Strongylura strongylura</i> (van Hasselt, 1823)	-
18			<i>Strongylura leiura</i> (Bleeker, 1850)	-
19		Hemiramphidae	<i>Hemiramphus georgii</i> (Valenciennes, 1846)	-
20			<i>Hemiramphus far</i> (Forsskal, 1775)	-
21	Clupeiformes	Chirocentridae	<i>Chirocentrus nudus</i> (Swainson, 1839)	-
22		Clupeidae	<i>Tenualosa ilisha</i> (Hamilton, 1822)	-
23			<i>Opisthopterus tardoore</i> (Cuvier, 1829)	-
24			<i>Hilsa kelee</i> (Cuvier, 1829)	-
25			<i>Sardinella brachysoma</i> (Bleeker, 1852)	-
26		Engraulidae	<i>Coilia dussumieri</i> (Valenciennes, 1848)	-
27			<i>Thryssa purava</i> (Hamilton, 1822)	-
28		Pristigasteridae	<i>Ilisha filigera</i> (Valenciennes, 1847)	-
29	Cyprinodontiformes	Cyprinodontidae	<i>Aphanius dispar dispar</i> (Rüppell, 1829)	-
30	Elopiformes	Elopidae	<i>Elops saurus</i> (Linnaeus, 1766)	LC
31	Gonorhynchiformes	Chanidae	<i>Chanos chanos</i> (Forsskal, 1775)	-
32	Mugiliformes	Mugilidae	<i>Chelon macrolepis</i> (Smith, 1846)	LC
33			<i>Mugil cephalus</i> (Linnaeus, 1758 )	LC
34			<i>Moolgarda seheli</i> (Forsskal, 1775)	-
35			<i>Liza parsia</i> (Hamilton, 1822)	-
36			<i>Moolgarda cunnesius</i> (Valenciennes, 1836)	-
37	Perciformes	Blenniidae	<i>Petroscirtes variabilis</i> (Cantor, 1849)	-
38		Carangidae	<i>Alepes djedaba</i> (Forsskal, 1775)	-
39			<i>Atropus atropus</i> (Bloch & Schneider, 1801)	-
40			<i>Carangoides malabaricus</i> (Bloch &	-

			Schneider, 1801)	
41			<i>Caranx sexfasciatus</i> (Quoy & Gaimard, 1825)	LC
42			<i>Megalaspis cordyla</i> (Linnaeus, 1758)	-
43			<i>Trachinotus blochii</i> (Lacepede, 1801)	-
44			<i>Parastromateus niger</i> (Bloch, 1795)	-
45			<i>Scomberoides commersonianus</i> (Lacepède, 1801)	-
46		Clupeidae	<i>Nematalosa nasus</i> (Bloch, 1795)	LC
47		Drepaneidae	<i>Drepane punctata</i> (Linnaeus, 1758)	-
48		Gerreidae	<i>Gerres longirostris</i> (Cuvier, 1830)	-
49			<i>Gerres filamentosus</i> (Cuvier, 1829)	LC
50		Gobiidae	<i>Scartelaos cantoris</i> (Day, 1871)	DD
51		Haemulidae	<i>Diagramma cinctum</i> (Tortonese, 1936)	-
52			<i>Plectorhinchus schotaf</i> (Forsskål, 1775)	-
53			<i>Pomadasys maculates</i> (Bloch, 1793)	LC
54			<i>Pomadasys argyreus</i> (Valenciennes, 1833)	-
55		Labridae	<i>Halichoeres nigrescens</i> (Bloch & Schneider, 1801)	LC
56		Lactariidae	<i>Lactarius lactarius</i> (Bloch & Schneider, 1801)	LC
57		Latidae	<i>Letes calcarifer</i> (Bloch, 1790)	-
58		Leiognathidae	<i>Leiognathus equulus</i> (Forsskal, 1775)	LC
59		Lethrinidae	<i>Lethrinus nebulosus</i> (Forsskål, 1775)	-
60			<i>Lutjanus johnii</i> (Bloch, 1792)	-
61			<i>Lutjanus argentimaculatus</i> (Forsskål, 1775)	-
62		Polynemidae	<i>Eleutheronema tetradactylum</i> (Shaw, 1804)	-

63			<i>Leptomelanosoma indicum</i> (Shaw, 1804)	-
64		Pomacanthidae	<i>Pomacanthus annularis</i> (Bloch, 1787)	LC
65		Pristigasteridae	<i>Pellona ditchela</i> (Valenciennes, 1847)	-
66		Scaridae	<i>Chlorurus sordidus</i> (Forsskål, 1775)	LC
67		Scatophagidae	<i>Scatophagus argus</i> (Linnaeus, 1766)	LC
68		Sciaenidae	<i>Protonibea diacanthus</i> (Lacepède, 1802)	-
69			<i>Johnius dussumiri</i> (Cuvier, 1830)	-
70			<i>Paranibea semiluctuosa</i> (Cuvier, 1830)	-
71			<i>Pennahia anea</i> (Bloch, 1793)	-
72			<i>Otolithus argenteus</i> (Bloch & Schneider, 1801)	-
73			<i>Otolithoides biauritus</i> (Cantor, 1849)	-
74			<i>Johnius borneensis</i> (Bleeker, 1851)	-
75			<i>Johnius belangerii</i> (Cuvier, 1830)	-
76		Scombridae	<i>Scomberomorus guttatus</i> (Bloch & Schneider, 1801)	DD
77		Serranidae	<i>Epinephelus tauvina</i> (Forsskal, 1775)	-
78			<i>Epinephelus malabaricus</i> (Bloch & Schneider, 1801)	NT
79			<i>Cephalopholis Formosa</i> (Shaw, 1812)	LC
80			<i>Epinephelus coeruleopunctatus</i> (Bloch, 1790)	LC
81		Sillaginidae	<i>Sillago sihama</i> (Forsskal, 1775)	-
82		Sparidae	<i>Crenidens crenidens</i> (Forsskål, 1775)	-
83			<i>Acanthapagrus latus</i> (Houttuyn, 1782)	-

84			<i>Acanthopagrus berda</i> (Forsskal, 1775)	-
85			<i>Acanthopagrus bifasciatus</i> (Forsskal, 1775)	-
86		Sphyraenidae	<i>Sphyraena barracuda</i> (Edwards, 1771)	-
87		Stromateidae	<i>Pampus chinensis</i> (Euphrasen, 1788)	-
88			<i>Pampus argenteus</i> (Euphrasen, 1788)	-
89		Trichiuridae	<i>Lepturacanthus savala</i> (Cuvier, 1829)	-
90		Terapontidae	<i>Therapon jarbua</i> (Forsskal, 1775)	LC
91			<i>Pelates quadrilineatus</i> (Bloch, 1790)	-
92			<i>Terapon puta</i> (Cuvier, 1829)	-
93	Pleuronectiformes	Paralichthyidae	<i>Pseudorhombus malayanus</i> (Bleeker, 1866)	LC
94		Soleidae	<i>Brachirus orientalis</i> (Bloch & Schneider, 1801)	-
95			<i>Synaptura commersonnii</i> (Lacepède, 1802)	-
96		Cynoglossidae	<i>Cynoglossus arel</i> (Bloch & Schneider, 1801)	-
97	Scorpaeniformes	Platycephalidae	<i>Grammoplites scaber</i> (Linnaeus, 1758)	DD
98			<i>Platycephalus indicus</i> (Linnaeus, 1758)	-
99	Siluriformes	Ariidae	<i>Osteogobius militaries</i> (Linnaeus, 1758)	-
100			<i>Netuma thalassinus</i> (Rüppell, 1837)	-
101			<i>Arius maculatus</i> (Thunberg, 1792)	-
102		Plotosidae	<i>Plotosus lineatus</i> (Thunberg, 1787)	-
103	Syngnathiformes	Syngnathidae	<i>Trachyrhamphus serratus</i> (Temminck & Schlegel, 1850)	-
104			<i>Hippocampus kuda</i> (Bleeker, 1852)	VU
105	Tetraodontiformes	Tetraodontidae	<i>Takifugu oblongus</i> (Bloch, 1786)	-
106			<i>Lagocephalus lunaris</i> (Bloch & Schneider, 1801)	-

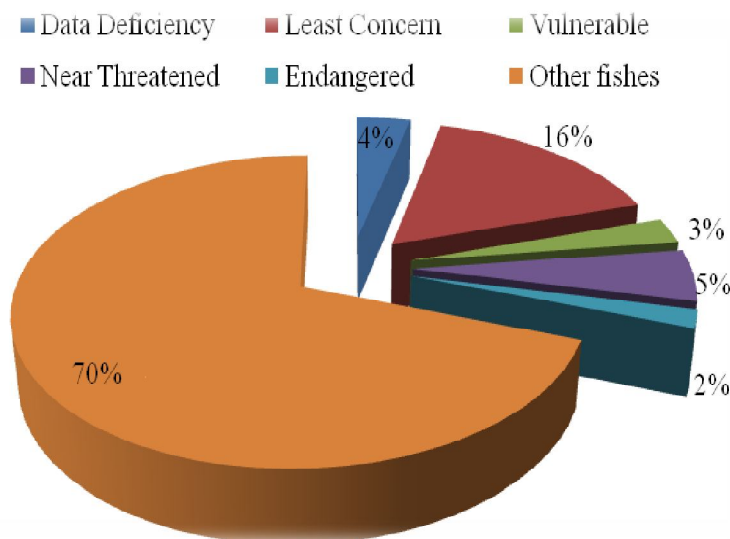
<b>107</b>		Diodontidae	<i>Diodon hystrix</i> (Linnaeus, 1758)	-
<b>108</b>		Ostraciidae	<i>Tetrosomus gibbosus</i> (Linnaeus, 1758)	-
<b>109</b>		Triacanthidae	<i>Triacanthus biaculeatus</i> (Temminck & Schlegel, 1850)	-
<b>Total</b>	<b>19 Orders</b>	<b>58 families</b>	<b>109 species</b>	<b>33 IUCN species</b>



**Figure 2:** Number of reported families with the number of species in each family.

Similar type of explorations were carried out by Lovrenc *et al.* (2003) along the Gulf of Trieste (Northern Adriatic) in three marine protected areas and one unprotected area, where they recorded 64 fish species from 21 families. They also revealed that more than 66% of the species belonging to four families. But in present study, there was no any family which dominated so informity, apart from that it shows highly diverse ecosystem due to presence of protected area. Another study was conducted by Afonso *et al.* (1999) along the coastal marine fishes of São Tomé Island (Gulf of Guinea), where a total 185 coastal species under 67 families were reported. The majorly represented families were Carangidae, Serranidae, Gobiidae and Scombridae. Present study revealed less number of species and families, but shows similarity in the representation of families i.e. Carangidae, Sciaenidae, Clupeidae, Haemulidae, Serranidae and Sparidae.





**Figure 4:** Total percentage of different IUCN listed species

Along Indian waters Bijukumar and Sushama (2000) studied the ichthyofauna of Ponnani estuary, Kerala and identified 112 species belonging of 14 orders, 53 families and 80 genera. That shows along Jamnagar MNP area more number of species were reported. Finfish resources of Karaikal, southeast coast of India were studied by Rajasegar and Sendhilkumar (2009), where they reported a total 195 species belonging to 18 orders, 87 families and 134 genera which includes *Stolephorus indicus*, *Thryssa malabarica*, *T. purava*, *Chirocentrus dorab*, *Arius arius*, *Plotosus canius*, *Mugil cephalus*, *Hemiramphus far*, *Platycephalus indicus*, *Epinephelus tauvina*, *E. malabarica*, *Sillago sihama*, *Caranx sem*, *Scomberoides tol*, *Lutjanus fulviflamma*, *Gerres abbreviatus*, *Upeneus sulphureus*, *Drepane punctata*, *Terapon puta*, *Trichiurus lepturus*, *Pampus argenteus*, *P. chinensis*, *Cynoglossus arel* and *Triacanthus biaculeatus* more abundant throughout the study period. *Cypselurus spilopterus* and *Exocoetus volitans* were recorded only during late May to early July and absent in rest of year.

Kumaran *et al.* (2012) carry investigation on ichthyofaunal diversity in Giryampeta Estuary, Yanam (U. T. of Puducherry). The survey reported the 36 fish species. Fishes belong to the order Clupeiformes ranked first among five reported orders, comprising 13 families and includes 30 species. Among these families Clupeidae comprising of 7 species. The abundance of Ichthyofauna varies with the seasons as postmonsoon shows more, followed by summer, premonsoon and monsoon.

## CONCLUSION

The study revealed a check list of presence of ichthyofaunal diversity in the vicinity of marine protected area. Out of total 109 species, 33 species (30%) observed under IUCN list. Study also revealed that ichthyofaunal diversity uniformly present in all families. It is recommended that further long term intensive monitoring study was needed to trace the impact of anthropogenic activities on the marine fish fauna of marine protected areas of Jamnagar. Implementation of conservation measures are also necessary to protect the locally, as well as globally threatened marine fish species from this area.

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## REFERENCES

1. Afonso, P., Porteiro, M. F., Santos, S. R., Barreiros, P. J., Worms, J. and Wirtz, P. (1999) Coastal marine fishes of São Tomé Island (Gulf of Guinea), *Arquipélago Life and Marine Sciences*, 17 A, 65-92.
2. Ayyappan, S., Moza, U., Gopalkrishna, A., Meenakumari, B., Jena, J. K. & Pandey, A.K. (2011) *Indian Fisheries*, Second Revised Edition. Handbook of Fisheries and Aquaculture, p. 33.
3. Bijukumar, A. & Sushama, S. (2000) Ichthyofauna of Ponnani estuary, Kerala, *Journal of Mararine Biological Assessment of India*, 42 (1&2), 182 – 189.
4. Biswas, N. (2008) The Gulf of Kutch Marine National Park and Sanctuary: A Case Study, pp. 3-4.
5. Dulvy, N.K., Sadovy, Y. & Reynolds, J. D. 2003. Extinction vulnerability in marine populations. *Fish and fisheries*, 4, 25-64.
6. Garcia, S. (2005) Workshop 10, Paris Conference: Biodiversity, Science and Governance, 24-28.
7. George, W.B., Gregory, R.M. & Cathryn, E.T. (2008) Ecological effects of wave energy development in the Pacific Northwest a scientific workshop, 2007 NMFS Southwest Fisheries Science Center, Pacific Fisheries Environmental Group, 1352 Light house Avenue, Pacific Grove, CA 93950-2097, USA.
8. Gray, J. S. (1997) Marine biodiversity: patterns, threats and Marine biodiversity: patterns, threats and conservation needs, *Biodiversity and Conservation*, 6, 153-175.
9. Kumaran, B., Kambala, N. S. & Nadarajan, J. (2012) Assessment of Ichthyo-faunal Diversity in Giriampeta Estuary, Yanam (U.T.of Puducherry), *Bulletin of Environment, Pharmacology and Life Sciences*, 1(9), 17-25.
10. Lovrenc, L., Martina, O.B. & Milijan, S. (2003) Coastal Fish Diversity in Three Marine Protected Areas and One Unprotected Area in the Gulf of Trieste (Northern Adriatic), *Marine ecology*, 24(4), 259-273.
11. Panwar, H .S. & Mathur, V. B. (2002) Wildlife Protected Area Network in India: A Review. Executive Summary. Dehradun: Wildlife Institute of India, 1-19.
12. Rajasegar, R. & Sendhilkumar, R. (2009) Finfish Resources of Karaikal, South East Coast of India, *World Journal of Fish and Marine Sciences*, 1(4), 330-332.
13. Ray, G. C. & Grassle, J. F. (1991) Marine biological diversity, *Bioscience*, 41, 453–457.
14. William, N. E., Ronald, F., Jon, D. F. & Dennis, A. P. (2010) Marine fish diversity: history of knowledge and discovery (Pisces), *Zootaxa*, 2525, 19–50.