

Full Length Research Paper

Echinoderm diversity in Mudasal Odai and Nagapattinam coast of south east India

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Echinoderm diversity was studied from Mudasal Odai (Lat.11°29'N; Long. 79°46' E) and Nagapattinam (Lat. 10° 46' N; Long. 79° 59' E) coast of Tamil Nadu, south east India. We recorded 14 species, 11 genera, 8 families, 5 orders and 3 classes in Mudasal Odai and 11 species, 8 genera, 6 families, 5 orders and 3 classes in Nagapattinam coast. The most diverse families are Temnopleuridae (4 species in Mudasal Odai and Nagapattinam). Among the genera, *Salmacis*, *Astropecten* and *Echinodiscus* has two species each in both study areas. The Echinoderm species *Temnopleurus toromatics* is the dominant in both Mudasal Odai and Nagapattinam coasts. Three species (*Stellaster equestris*, *Ophiocnemis mamorata* and *Salmacis virgulata*) in Mudasal Odai and three species (*Salmacis bicolor*, *Echinodiscus auritus*, *Echinodiscus bisperforatus*) in Nagapattinam coast were recorded as abundant species. Three species (*Pentacaster regulus*, *S. bicolor*, *E. auritus*) in Mudasal Odai and four species (*Stellaster equestris*, *O. mamorata*, *Salmaciella dussumieri*, *Salmacis virgulata*) in Nagapattinam were reported as co-abundant species. Three species are present in two coasts, four species are present in Mudasal Odai. All echinoderm species are present in Mudasal Odai coast; three species are absent in Nagapattinam coast.

Key words: Echinoderm, Mudasal Odai coast, Nagapattinam coast, Temnopleuridae, *Temnopleurus toromatics*, *Salmacis*.

INTRODUCTION

Echinoderms have calcium-rich skeleton, five-part body plan with arms, water-vascular system interconnected canals with thousands of tiny hollow tube feet, and skin gills that are used for respiration and waste removal. There are different classes which include starfish, brittle stars, sea urchins, sand dollars, sea lilies and sea cucumber. Echinoderms are marine and widely distributed in benthic habitats from the intertidal to deep sea zones. About 6000 living species of echinoderms have been described in the world, of which more than 1000 have been listed for the Indo-West Pacific (Guille et al., 1986). Indo-West Pacific shallow-water echinoderm fauna is

considered as rich resources (Clark and Rowe, 1971). Sea stars (Echinodermata: Asteroidea) are of great importance in marine ecosystems because, among other organisms and factors, some act as key species due to their predatory activities (Menge, 1982). The diversity of echinoderms is reported from the near shore regions of the Colombian Pacific coast (Neira and Cantera, 2005), at the Mauritius in the Indian Ocean (Rowe and Richmond, 2004), the Galapagos Islands in the Pacific (Hickman, 2009), coasts along the tropical west Pacific (Pearse, 2009), near the shore region of the Alaska Pacific coast (Chenelot et al., 2007), and in the Atlantic shelf around the British Isles

(Ellis and Rogers, 2000). Echinoderm species are listed in Singapore (Bedford, 1900), China (Liao and Clark, 1995), Taiwan (Chao and Chang, 1989), Vietnam (Dao, 1994), Australia (Rowe and Gates, 1995) and India (Sastry, 2007).

MATERIALS AND METHODS

Echinoderms were collected from Mudasal Odai (Lat. 11°29'N; Long. 79°46' E) and Nagapattinam (Lat. 10°46' N; Long. 79°59' E) landing centers, south east coast of India. Mudasal Odai 150 trawlers and Nagapattinam 500 trawlers were operated during the day and night. Trawlers operated the trawl nets at the depth of 10 – 30 m depth at both study areas. Sampling was made randomly from 5 heaps in Mudasal Odai and 10 heaps in Nagapattinam contributing 100 kg. Samples of each species were collected from 4 to 5 heaps from single trawl. About 100 kg of heaps were randomly sampled every week and consolidated as weekly total. Monthly performance was calculated and repeated. The results are categorized as follows: dominant when above 200 individuals exist (++++), abundant when individuals are about 100 – 200 (+++), co-abundant when individuals are about 50 – 100, and present when individuals number was below 50 (+). The samples were brought to the laboratory, cleaned with brush and identified using appropriate reference (Clark and Rowe, 1971).

RESULTS

The diversity of the echinoderms from two landing centers was 8 families, 11 genera and 14 species (Table 1, Figures 1 and 2). The number of species per family varies considerably (1 to 4 species). The most diverse family is the Temnopleuridae (4 species in Mudasal Odai and Nagapattinam), followed by the Astropectinidae (2 species in Mudasal Odai and Nagapattinam), the Oraesteridae (2 species in Mudasal Odai, 1 species in Nagapattinam), and the Atricypeidae (2 species in Mudasal Odai and Nagapattinam). Among the 14 species only one species (*Temnopleurus toreumaticus*) was dominant in both coastal areas. Three species (*Stellaster equestris*, *Ophiocnemis mamorata*, *Salmacis virgulata*) in Mudasal Odai and three species (*Salmacis bicolor*, *Echinodiscus auritus*, *Echinodiscus bisperforatus*) in Nagapattinam were abundant. Three co-abundant species (*Pentaceraster regulus*, *Salmacis bicolor*, *Echinodiscus auritus*) in Mudasal Odai and four co-abundant species (*Stellaster equestris*, *O. mamorata*, *Salmacis virgulata*, *Salmaciella dussumieri*) in Nagapattinam coast were reported. Three species (*Astropecten bengalensis*, *Astropecten indicus*, *Pentaceraster affinis*) in both coasts, seven species (*Luidia maculate*, *A. bengalensis*, *A. indicus*, *Pentaceraster affinis*, *S. dussumieri*, *Clypeaster humilis*, *E. bisperforatus*) in Mudasal Odai coast, three species (*A. bengalensis*, *A. indicus*, *Pentaceraster affinis*) in Nagapattinam coast were recorded present. All the 14 species were present in Mudasal Odai coast and three species (*L. maculate*, *P. regulus*, *C. humilis*) were absent in Nagapattinam coast. The species *E. bisperforatus* was

recorded as abundant in Nagapattinam coast, but was recorded as a present in Mudasal Odai coast. The *S. dussumieri* was recorded as co-abundant in Nagapattinam coast, but was recorded as present in Mudasal Odai coast (Table 1).

DISCUSSION

A total of 86 echinoderm species were found in different parts of world, Census of Marine Life NaGISA programme (Natural Geography in Shore Areas, www.coml.nagisa.org) during 2003-2009; among these were 32 asteroids, 18 echinoids, 21 ophiuroids and 15 holothuroids (Iken et al., 2010). Echinoderm survey was made through scuba diving in the reef areas around Taiping Island, 39 species of echinoderms were found belonging to 17 families including 5 Crinoidea, 8 Asteroidea, 7 Ophiuroidea, 6 Echinoidea and 13 Holothuroidea at 40 m depth (Jeng, 1998). In Xisha Islands (China) 125 species echinoderms (3 Crinoidea, 38 Ophiuroidea, 17 Asteroidea, 26 Echinoidea, 41 Holothuroidea) were reported (Liao and Clark, 1995). Lane et al. (2000) recorded 982 species of echinoderms (111 crinoids, 227 asteroids, 272 ophiuroids, 167 echinoids and 203 holothuroids) in South China Sea (SCS). Li (1991) listed 197 species of echinoderms in the Nansha Islands (South China Sea) and Clark (1982) observed 95 species of echinoderms in Hong Kong and southern China. India has 651 species (Crinoidea: 65 species, Asteroidea: 158 species; Ophiuroidea: 152 species; Echinoidea: 113 species; Holothuroidea: 163 species) including Andaman and Nicobar Islands: 424 species and Tamil Nadu: 193 species (Sastry 2007). A total of 53 species of echinoderms belonging to 30 genera and 19 families were observed through scuba diving (up to 15 m depth) in 6 different areas (Aves Island, Sound Island, Rail Island, Karlo Island, Interview Island, and North Reef Island) of North Andaman, India (Koushik and Raghunathan, 2012).

Echinoids are one of the more diverse and successful echinoderm groups today. Fourteen species and 11 families were recorded in Taiwan water by Chao (2000). In the present study, 7 species of 3 families in Mudasal Odai coast and 6 species of 2 families in Nagapattinam coast were reported (Table 1, Figures 1 and 2). Asteroids are known with about 1,800 known species. There were 47 shallow water asteroid species recorded in the Gulf of California by Cintra-Buenrostro et al. (2005). In the present study, 6 species are reported to be affiliated with 4 genera (4 families) in Mudasal Odai coast and 4 species are affiliated with 3 genera (3 families) in Nagapattinam coast (Table 1, Figures 1 and 2). Herrero-Perezrul (2008) reported 22 species of echinoderms.

Asteroids were the most abundant, followed by echinoids and holothurians in the southern Gulf of California,

Table 1. Echinoderms recorded in trash fish of Mudasal Odai and Nagapattinam landing Centre.

S/N	Species name	Mudasal Odai	Nagapattinam
Class: Asteroidea			
Order: Paxillosida			
Family: Luidiidae			
1	<i>Luidia maculate</i> Muller and Troschel, 1842	+	-
Family: Astropectinidae			
2	<i>Astropecten bengalensis</i> Doderlein, 1917	+	+
3	<i>Astropecten indicus</i> Doderlein, 1889	+	+
Order: Valvatida			
Family: Goniasteridae			
4	<i>Stellaster equestris</i> (Retzius, 1805)	+++	++
Family: Oraesteridae			
5	<i>Pentacaster affinis</i> (Muller and Troschel, 1842)	+	+
6	<i>Pentacaster regulus</i> (Muller and Troschel, 1842)	++	-
Class: Ophiuroidea			
Order: Ophiurida			
Family: Ophiotrichidae			
7	<i>Ophiocnemis marmorata</i> (Lamarck, 1816)	+++	++
Class: Echinoidea			
Order: Camarodonta			
Family: Temnopleuridae			
8	<i>Salmacis bicolor</i> (L. Agassiz and Desor, 1846)	++	+++
9	<i>Salmacis virgulata</i> (L. Agassiz and Desor, 1846)	+++	++
10	<i>Salmaciella dussumieri</i> (L. Agassiz and Desor, 1846)	+	++
11	<i>Temnopleurus toreumaticus</i> (Leske, 1778)	++++	++++
Order: Clypeasteroida			
Family: Clypeasteridae			
12	<i>Clypeaster humilis</i> (Leske, 1778)	+	-
Family: Astriclypeidae			
13	<i>Echinodiscus auritus</i> Leske, 1778	++	+++
14	<i>Echinodiscus bisperforatus</i> Leske, 1778	+	+++

++++: Dominant; +++: Abundant; ++ Co abundant; +: Present; -: Not recorded.

Mexico. It seems that the community structure of echinoderms in the Gulf is relatively homogeneous and is dominated by asteroids (Reyes Bonilla et al., 2005). Echinoid species are dominating in Caribbean regions and asteroids and holothurians, in Northeast Pacific region (Iken et al., 2010). Ophiuroids were reported as dominant in South China Sea (Lane et al., 2000). In the present study, echinoids are more numerous (7 species in Mudasal Odai, 6 species in Nagapattinam) than asteroids (6 species in Mudasal Odai, 4 species in Nagapattinam) and holothurians are not recorded (Table 1, Figures 1 and 2).

Sea urchin abundance and diversity were more in regional-scale investigation in Mediterranean Sea (Guidetti and Dulcic, 2007). The causes for this pattern are uncertain but may be related to prevalence of thermo-philic species in sea urchins (Francour et al., 1994), latitudinal differences in recruitment success (Ebert, 1983; Tsujino et al., 2010) and/or salinity tolerance (Vidolin et al., 2007), competitive and predatory interactions (McClanahan and Shafir, 1990; Guidetti and Mori, 2005), relief from predation due to overfishing (Sala et al., 1998), as well as high adaptability of sea urchins to environmental stress (Starr

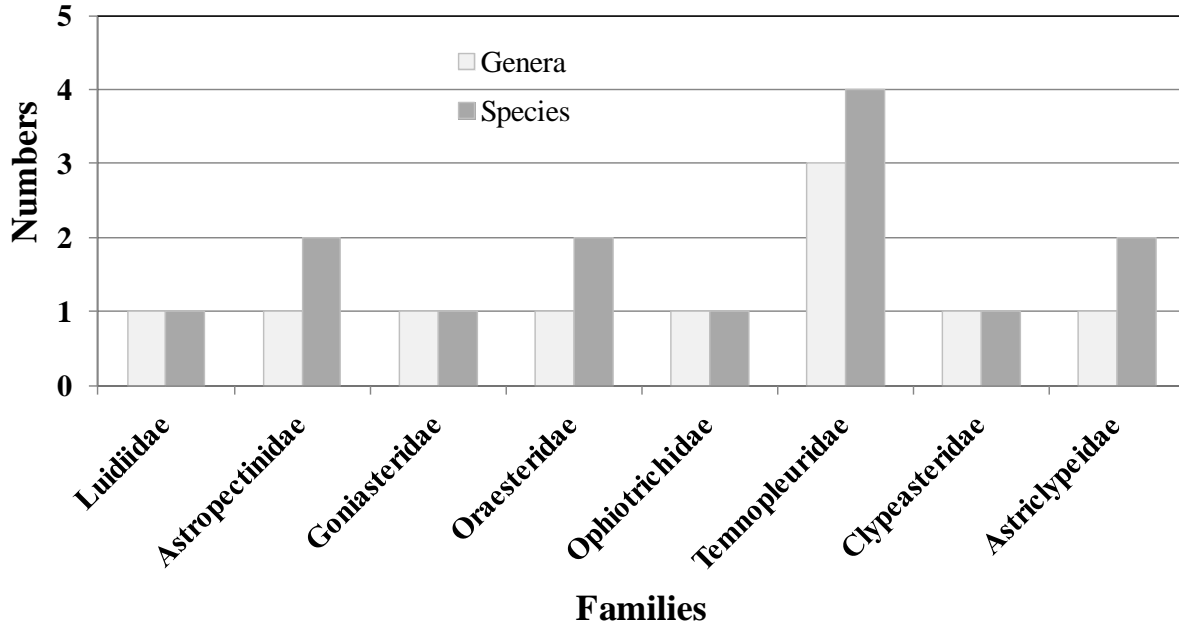


Figure 1. The number of families, genera and species of Echinoderms in Mudasal Odai coast.

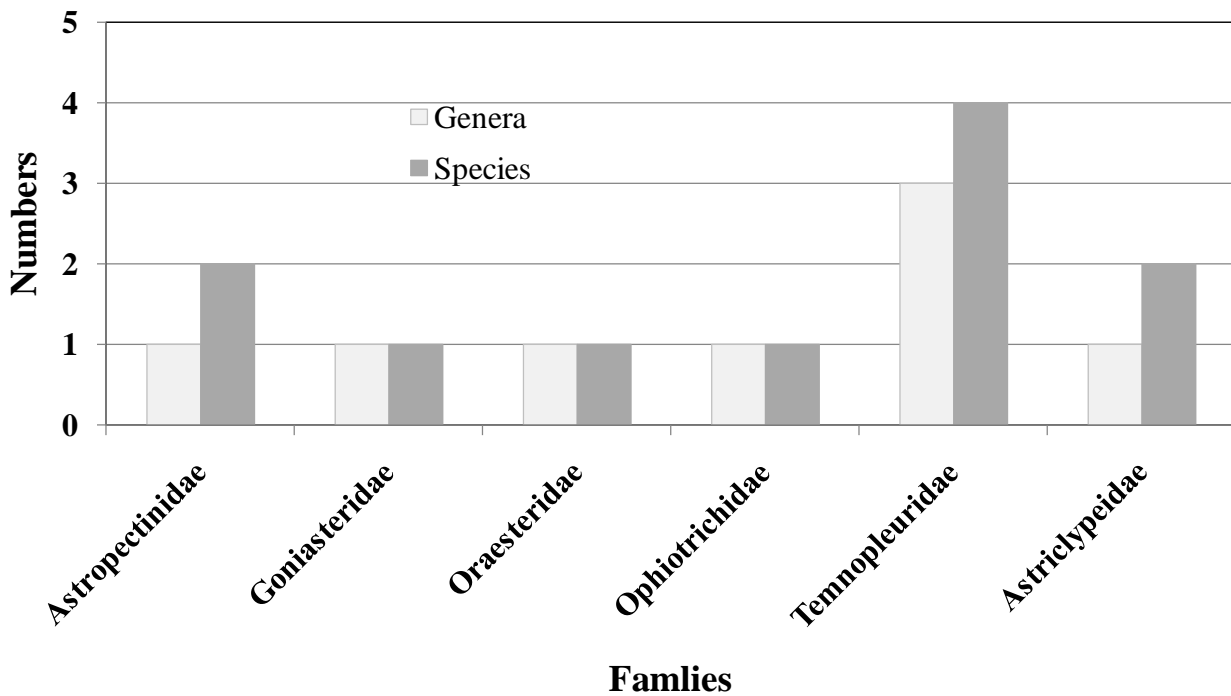


Figure 2. The numbers of families, genera and species of Echinoderms in Nagapattinam coast.

et al., 1993; Pancucci et al., 1993). In the present study, 3 genera and 4 species of echinoids are reported, among them 2 species of *Salmacis* (*S. bicolor*, *S. virgulata*), 1 species of *Salmaciella* (*S. dussumieri*) and one of *Temnopleurus* (*T. toreumaticus*) in both Mudasal Odai

and Nagapattinam coast were recorded (Table 1). In the present study, *O. marmorata* was reported as abundant in Mudasal Odai coast and as co-abundant in Nagapattinam coast. Kanagaraj et al. (2008) reported *O. marmorata* associated with Rhizostome medusa *Rhopilema hispidum*

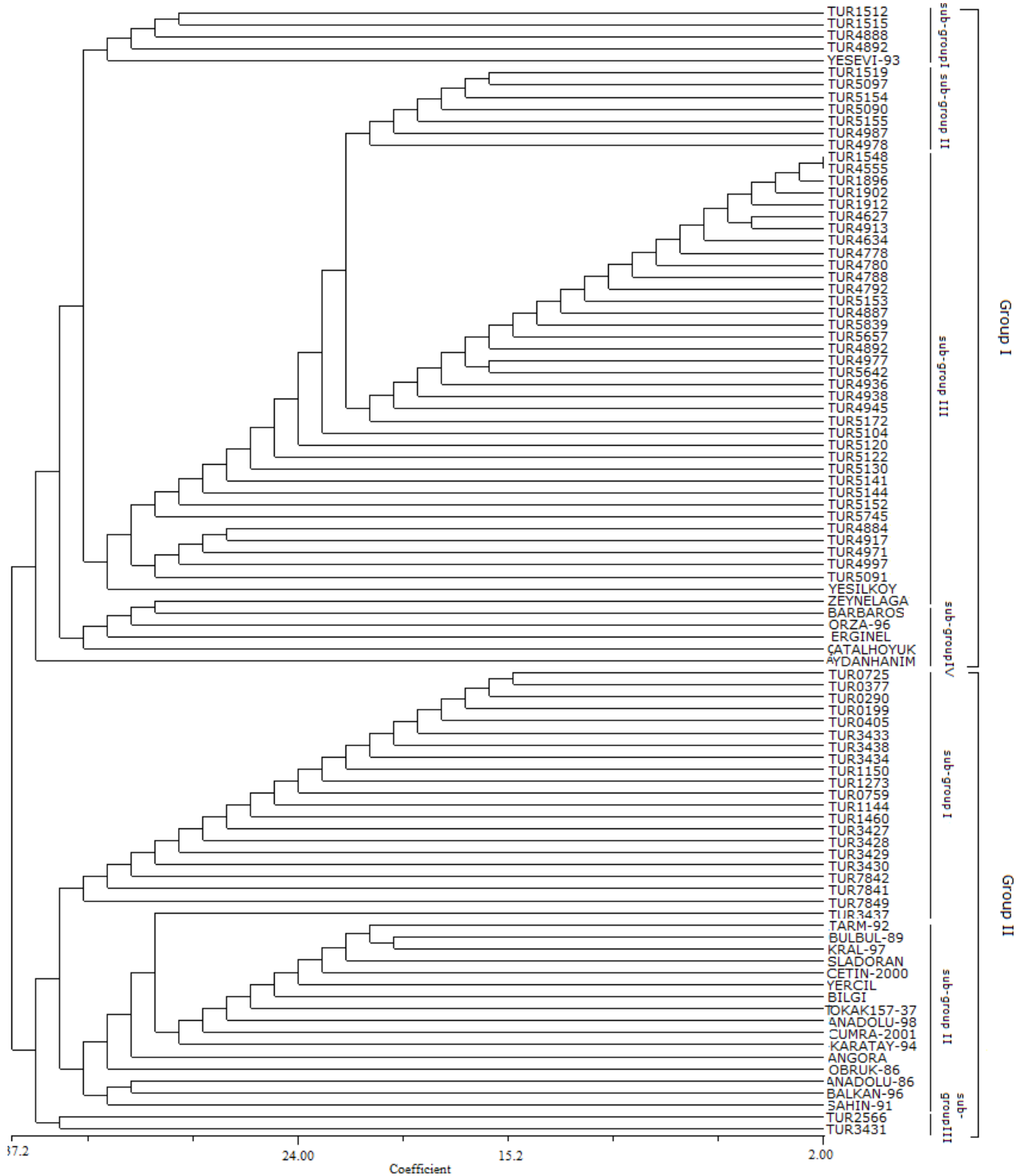


Figure 3. Dendrogram constructed by the UPGMA method.

from Vellar estuary, which is similar to one of our study areas. In Goniasteridea family, 40 species were reported from the sublittoral zone of the Straits of Florida (Halpern,

1970) and 26 species, in cold-water setting ranging from subtidal to abyssal depths of tropical Atlantic and North-east Pacific areas. During the present study, one species

(*S. equestris*) from the Goniasteridae family is recorded as abundant in Mudasal Odai coast and as co-abundant in Nagapattinam coast (Table 1). Sixteen ophiuroid species were reported from the Persian Gulf (Mortensen, 1940), 19 species, from Arabian coast of Persian Gulf (Price, 1981), 2 species, reported from Qeshm Island in the Persian Gulf (Reza Fatemi et al. 2010). The species *O. marmorata* is distributed in the Indian and west Pacific Oceans (Marsh, 1998). In the present study, the species (*O. marmorata*) in the family Ophiotrichidae is reported from the Ophiuroidea class as abundant in Mudasal Odai coast and as co-abundant in Nagapattinam coast (Table 1, Figures 1, 2 and 3).

Conclusion

In this study, 6 species of asteroids, 1 species of ophiuroids and 7 species of echinoids are reported. The family Temnopleuridae is dominant (4 species) followed by the families Astropectinidae and Astriclypeidae (2 species each). The *T. toreumaticus* is the dominant species in the present study. In Mudasal Odai coast, 14 species were present but in Nagapattinam coast 3 species were absent.

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