



ON A COLLECTION OF SHALLOW-WATER ECHINODERMS OF GULF OF MANNAR BIOSPHERE RESERVE, SOUTHERN INDIA

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INTRODUCTION

Echinoderms are exclusively marine and are widely distributed in benthic habitats from the intertidal zone to the deep sea. They are fascinating and enigmatic marine creatures and they include spiny skinned animals like starfishes, sea urchins and sea cucumbers. They live among corals and occur from supra-littoral to the hadal zone. They inhabit the rocky, sandy, muddy and mangrove areas. About 6000 living species of echinoderms have been described, of which more than 1000 have been listed for the Indo-West Pacific (Guille *et al.*, 1986). In

particular, the shallow- water echinoderm fauna of the Indo-West Pacific is generally considered to be very rich (Clark and Rowe 1971). India has 649 species recorded so far and about 428 species are known from Andaman and Nicobar Islands Sastry (2005, 2007).

The Gulf of Mannar is a favourable and suitable habitat for echinoderms. The echinoderm fauna of Gulf of Mannar was reported by James (1988) and Venkataraman *et al.*, (2002). The present study reports an account of the echinoderms collected over a period of three years (April 2008- March 2011).



Gulf of Mannar Biosphere Reserve

STUDY AREA

Gulf of Mannar Marine Biosphere Reserve

Gulf of Mannar Biosphere Reserve extends from Rameswaram island to Tuticorin and lies between 8° 45'N - 9° 25'N and 78° 5' E - 79° 30'E, extends to a distance of 140 km. There are 21 islands running almost parallel to the coastline of Mannar. These islands lies between 8° 47' N - 9° 15'N and 78° 12'E - 79° 14' E. These islands are situated at an average distance of about 8km from the coastline of Gulf of Mannar. It is bounded by Palk Bay, Rameshwaram island in the north side; by Ramanathapuram district in the northwest and west Tuticorin district in the south and by Bay of Bengal in the east. It is endowed with three distinct ecosystems namely corals, sea grass and mangroves.

MATERIALS AND METHODS

This study was conducted from April 2008 to March 2011. Extensive collections of echinoderms were made at major fish landing centre and collections from the intertidal region during the low tide. Mask and snorkel were used on the coral reefs to collect and study the habitats of the echinoderm. Small boats were used to visit all the 19 islands. Scuba diving was used throughout the study, and underwater photographs were taken with a Nikon RS underwater camera. The living posture and substratum recorded for the echinoderms were observed and photo-recorded in situ.

Except for some species of crinoids and brittle-stars, most species were identified on the basis of their morphological features, colors, habitat, and postures, the characters commonly used by field researchers. Some specimens were collected by placing them in sealable plastic bags, and they were preserved in 70% ethanol. These specimens are cataloged and deposited at the Marine Biology Regional Centre, Zoological Survey of India, Chennai. The identification of echinoderm species followed by Clark and Rowe (1971), James (2008, 2011).

RESULTS

Table 1 is the checklist of the echinoderm species found in the shallow waters in Gulf of Mannar Biosphere Reserve. The various bottom strata of the coral reef shelter a diversified fauna of 38 species of echinoderms, among which are 1 crinoid, 12 asteroids, 1 ophiuroids, 16 echinoids, and 7 holothuroids. The echinoderms are listed below in taxonomic order. For each species, information on habitat, locality, and behavior, if known, is given.

Class: CRINOIDEA

Family: TROPIOMETRIDAE

1. *Tropiometra carinata* (Lamarck)

(Fig. 1)

1816. *Comatula carinata* Lamarck. J.B.P.A.de *Hist. nat. anim. s. vert.*, 2:534

1971. *Tropiometra carinata* : Clark, A.M. and Rowe, F.W.E. *Monograph of Shallow-water Indo-West Pacific echnioderms*, 10-11 (distribution) and 25 (key).

Material examined: E-12, E-40 /MBRC/ZSI 2 exs.

Habitat: Reefs, rocks, rocks and coral, sand and shell, dark sand, black specks and rocks (Clark, 1911), Littoral and down to 30 fathoms in Clark (1911). Found attached to rocks in shallow waters; rare **Colour**: Uniformly dark brown

Locality: Mundal, Fish Landing Centre (FLC).

Class: ASTEROIDEA

Family: LUIDIIDAE

2. *Luidia maculata* Muller and Troschel

(Fig. 2)

1842. *Luidia maculata* Muller, J. and Troschel, F.H. *System der Asteriden*, p.77

1971. *Luidia maculata* : Clark, A.M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echnioderms*, 30-31(distribution) and 43 (key).

Material examined: E-54/MBRC/ZSI 1 ex.

Habitat: Mudflats **Colour**: Upper side with characteristic blackish-brown marks and the lower side whitish.

Table 1. Checklist of Echinoderms in the waters of the Gulf of Mannar

Name of the species	James, 1985	Venkataraman <i>et al.</i> , 2002	Present study
Class: Crinoidea			
Family: Comasteridae			
<i>Capillaster multiradiatus</i> (Linnaeus)	*	*	-
<i>Comanthina schlegeli</i> (P.H.Carpenter,1881)	*	*	-
<i>Comanthus parvicirrus</i> (J.Muller)	*	*	-
<i>Comaster gracilis</i> (Hartlaub)	*	-	-
<i>Cometella stelligera</i> (P.H. Carpenter)	*	*	-
Family: Himerometridae			
<i>Heterometra reynaudi</i> (J. Muller)	*	*	-
Family: Mariametridae			
<i>Lamprometra palmata</i> (J. Muller)	*	*	-
<i>Stephanometra indica</i> (Smith)	*	*	-
Family: Tropiometridae			
<i>Tropiometra carinata</i> (Lamarck, 1816)	*	*	*
Class: Asteroidea			
Order: Paxillosida			
Family: Luidiidae	-	*	-
<i>Luidia hardwicki</i> (Gray, 1980)			
<i>Luidia maculata</i> Muller and Troschel, 1810	*	-	*
Family: Astropectinidae			
<i>Astropecten bengalensis</i> Doderlein, 1917	-	*	-
<i>Astropecten indicus</i> Doderlein, 1889	*	*	*
<i>Astropecten hemprichi</i> Muller and Troschel, 1842	*	*	-
<i>Astropecten monacanthus</i> Sladen, 1883	*	*	*
<i>Astropecten polyacanthus</i>	*	-	*
<i>Craspidaster hesperus</i> (Muller & Troschel)	*	-	-
Family: Asterinidae			
<i>Asterina burtoni</i> Gray, 1840	*	*	*
<i>Asterina cornata</i> V. Martens	*	*	-
<i>Asterina lorioli</i> Koehler, 1910	*	*	-
<i>Asterina sarasini</i> (de Loriol, 1897)	-	*	-
<i>Tegulaster ceylonica</i> Doderlein	*	-	-
Family: Goniasteridae			
<i>Anthenea pentagonula</i> (Lamarck, 1816)	*	*	*
<i>Goniodiscaster scaber</i> (Mobius, 1859)	*	*	*
<i>Siraster tuberculatus</i> H.L.Clark, 1915	*	*	-
<i>Stellaster equestris</i> (Retzius, 1805)	*	*	-
Family: Oreasteriidae			
<i>Asterodiscus elegans</i> Gray, 1847	*	*	-
<i>Culcita schmideliana</i> (Ritzius, 1806)	*	*	-
<i>Pentacaster mammillatus</i> (Audoin)	-	-	*
<i>Pentacaster affinis</i> (Muller and Troschel, 1842)	*	*	-
<i>Pentacaster regulus</i> (Muller and Troschel, 1842)	*	*	-
<i>Poraster superbus</i> (Mobius, 1859)	-	*	-
<i>Protoreaster lincki</i> (de Blainville, 1834)	*	*	*

Name of the species	James, 1985	Venkataraman <i>et al.</i> , 2002	Present study
Family: Ophidiasteridae			
<i>Linckia laevigata</i> (Linnaeus)	*	*	*
<i>Linckia multifora</i> (Lamarck)	*	*	*
<i>Andora faouzii</i> (Macan, 1938)	*	*	-
<i>Nardoa mollis</i> de Loriol, 1891	-	*	-
Family: Pterasteridae			
<i>Euretaster cribrosus</i> (V. Mortens, 1867)	*	*	-
Family: Echinasteridae			
<i>Echinaster purpureus</i> (Gray, 1840)	*	*	*
Class: Ophiuroidea			
Family: Ophiomyxidae			
<i>Ophiomyxa australis</i> Lutken, 1869	-	*	-
Family: Gorgonocephalidae			
<i>Astroboa clavata</i> (Lyman)	*	-	-
Family: Amphiuridae			
<i>Amphioplus</i> (<i>Amphioplus</i>) <i>gravelyi</i> James	-	*	-
<i>Amphioplus squamata</i> (D. Chiaje, 1829)	*	*	-
<i>Dougaloplus echinatus</i> (Ljungman)	*	*	-
Family: Ophiactidae			
<i>Ophiactis savignyi</i> (Muller and Troschel, 1842)	*	*	-
<i>Ophiactis modesta</i> Brock, 1888	*	*	-
Family: Ophiotrichidae			
<i>Gymnolophus obscura</i> (Ljungman)	*	-	-
<i>Macrophiothrix aspidota</i> (Muller and Troschel, 1842)	*	*	-
<i>Macrophiothrix longipeda</i> (Lamarck, 1816)	*	*	-
<i>Macrophiothrix variabilis</i> (Duncan, 1887)	*	*	-
<i>Ophiocnemis marmorata</i> (Lamarck, 1816)	*	*	-
<i>Ophiotrix exigua</i> Lyman, 1874	*	*	-
<i>Ophiotrix accedens</i> Koehler	*	*	-
<i>Ophiotrix</i> (<i>Keystonea</i>) <i>neridina</i> (Lamarck, 1816)	-	*	-
<i>Ophiogymna lineata</i> H.L. Clark, 1938	-	*	-
<i>Ophiothela danae</i> Verrill, 1869	*	*	-
<i>Ophiocoma scolopendrina</i> (Lamarck, 1826)	*	*	-
<i>Ophiocoma erinaceus</i> Muller and Troschel, 1842	-	*	-
<i>Ophiocomella sexradia</i> (Duncan, 1887)	*	*	-
<i>Ophinoereis dubia</i> (Muller and Troschel, 1842)	*	*	-
<i>Ophiarchnella gorgonia</i> (Muller and Troschel, 1842)	*	*	*
<i>Ophiarchnella infernalis</i> (Muller and Troschel, 1842)	-	*	-
<i>Ophiogymna elegans</i> (Ljungman)	*	-	-
<i>Ophiomaza cacaotica</i> Lyman	*	-	-
Class: Echinoidea			
Family: Cidaridae			
<i>Prionocidaris baculosa</i> (Lamarck, 1816)	-	*	-

Name of the species	James, 1985	Venkataraman <i>et al.</i> , 2002	Present study
Family: Diadematidae			
<i>Astropyga radiata</i> (Leske, 1778)	*	*	*
<i>Echinothrix diadema</i> (Linnaeus)	-	-	-
Family: Stomopneustidae			
<i>Stomopneustes variolaris</i> (Lamarck, 1816)	*	*	*
Family: Temnopleuridae			
<i>Salmaciella dussumieri</i> (L. Agassiz & Desor, 1846)	*	*	-
<i>Salmacis bicolor</i> (L. Agassiz & Desor, 1846)	*	*	*
<i>Salmacis virgulata</i> (L. Agassiz & Desor, 1846)	*	*	*
<i>Temnopleurus alexandri</i> (Bell)	-	-	-
<i>Temnopleurus toreumaticus</i> (Leske, 1778)	*	*	*
Family: Toxopneustidae			
<i>Pseudoboletia maculata</i> Torschel, 1869	-	*	-
<i>Toxopneustes pileolus</i> (Lamarck, 1816)	*	*	*
<i>Tripneustes gratilla</i> (Linnaeus, 1758)	*	*	*
Family: Echinometeridae			
<i>Echinometra mathaei</i> (de Blainville, 1825)	*	*	-
Family: Clypeasteridae			
<i>Clypeaster humilis</i> (Leske, 1788)	*	*	*
<i>Clypeaster rarispinus</i> de Meijere	-	-	*
<i>Clypeaster reticulatus</i> (Linnaeus)	-	-	*
Family: Laganidae			
<i>Laganum depressum</i> Lesson 1841	*	-	*
<i>Laganum laganum</i> (Leske)	*	-	-
<i>Peronella orbicularis</i> (Leske)	*	-	-
Family: Arachnodiidae			
<i>Fibularia volva</i> L. Agassiz and Desor, 1846	-	*	-
Family: Scutellidae			
<i>Echinodiscus auritus</i> Leske, 1778	*	*	*
<i>Echinodiscus bisperforatus</i> Laske, 1778	*	*	
Family: Echinolampus			
<i>Echinolampas alexandri</i> de Loriol, 1876	*	*	*
<i>Echinolampas ovata</i> (Leske, 1778)	*	*	
Family: Lovenia			
<i>Lovenia elongata</i> (Gray, 1845)	*	*	*
Family: Brissidae			
<i>Brissus latecarinatus</i> (Leske)	-	-	*
<i>Metalia latissima</i> H.L. Clark, 1925	-	*	-
<i>Metalia sternalis</i> (Lamarck)	*	-	-
<i>Rhynobrissus pyramidalis</i> A.Agassiz, 1872	-	*	-

Name of the species	James, 1985	Venkataraman <i>et al.</i> , 2002	Present study
Class: Holothuroidea			
Family: Holothuriidae			
<i>Actinopyga miliaris</i> (Quoy and Gaimard, 1833)	-	*	-
<i>Bohadschia marmorata</i> Jager, 1833	*	*	*
<i>Holothuria (Halodeima) atra</i> Jager, 1833	*	*	*
<i>Holothuria (Halodeima) edulis</i> Lesson, 1830	*	*	-
<i>Holothuria (Lessonothuria) pardalis</i> Selenka, 1867	*	*	-
<i>Holothuria (Mertensiothuria) leucospilota</i> (Brandt, 1835)	*	*	*
<i>Holothuria (Metriatyla) scabra</i> Jager, 1833	*	*	*
<i>Holothuria (Selenkothuria) moebii</i> Ludwig	*	*	-
<i>Holothuria (Semperothuria) cinerascens</i> (Brandt, 1835)	-	*	-
<i>Holothuria (Theelothuria) spinifera</i> Theel, 1886	*	*	*
<i>Holothuria (Thymiosycia) hilla</i> Lesson, 1830	*	*	-
<i>Holothuria (Theelothuria) arenicola</i> Semper, 1868	-	*	-
<i>Holothuria (Thymiosycia) impatiens</i> (Forsskal, 1775)	-	*	-
Family: Stichopodidae			
<i>Stichopus choloronotus</i> (Brandt, 1835)	*	*	-
<i>Stichopus variegatus</i> Semper, 1868	*	*	-
<i>Stichopus herrmanni</i>	-	-	*
Family: Psolidae			
<i>Psolus mannarensis</i> James 1987	*	*	
Family: Cucumariidae			
<i>Havelockia versicolor</i> (Semper, 1868)	*	*	-
<i>Hemithyone semperi</i> (Bell, 1884)	*	*	-
<i>Pentacta quadrangularis</i> (Lesson & Troschel, 1846)	*	*	-
<i>Pseudocolochirus violaceus</i> (Theel, 1882)	*	*	-
<i>Stolus buccalis</i> (Simpson, 1885)	*	*	-
<i>Stolus conjugens</i> (Semper)	-	*	-
Family: Phyllophoridae			
<i>Afrocucumis typicus</i> Ludwig	*	*	-
<i>Phyllophorus (Phyllophorella) parvipedes</i> (H.L.Clark,1938)	*	*	-
Family: Caudinidae			
<i>Acaudina molpadioides</i> (Semper, 1868)	*	*	*
Family: Synaptidae			
<i>Protankyra asymmetrica</i> (Ludwig)	*	-	-
<i>Synapta maculata</i> (Chamisso and Eysenhard)	-	*	-
<i>Synaptula recta</i> (Semper 1868)	-	*	-
<i>Synaptula striata</i> (Sluiter 1868)	-	*	-
Family: Chiridotidae			
<i>Polycheira rufescens</i> (Brandt)	-	*	-
Total	93	103	37

Remarks: This species is commonly found in intertidal regions of coastal waters Keelakari Ervadi and Mandapam

Locality: Tharuvaikulam FLC, Tuticorin

Family: ASTROPECTINIDAE

3. *Astropecten indicus* Doderlein

(Fig. 3)

1888. *Astropecten indicus* Doderlein, L. *Zool. Jb. Syst.*, 3: 828.

1971. *Astropecten indicus* : Clark, A.M. and Rowe. F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 30-31 (distribution) and 45 (key).

Material examined: E-24, E-43, E-56 MBRC/ZSI 36 exs.

Habitat: Sandy shore to depth of 10-20 mm. **Colour:** Light blue with upper marginal plates dark bean orange spot at the base each spine. Lower side is white colour. Common.

Locality: Mandapam, Keelakarai , Ervadi and Mundal FLC

4. *Astropecten monacanthus* Sladen

(Fig. 4)

1883. *Astropecten monacanthus* Sladen.W.P. *J. Linn Soc (Zool)* 17: 216.

1971. *Astropecten monacanthus* : Clark, A.M. and Rowe. F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 30-31(distribution) and 45, 46 (key).

Material examined: E-10, E-25, MBRC/ZSI 21 exs.

Habitat: Sandy bottom, from shore to 20 m depth. **Colour:** V-shaped black markings on upper side and white on the lower side.

Locality: Mandapam, Keelakarai , Ervadi and Mundal FLC

5. *Astropecten polyacanthus*

Muller & Trocchel

(Fig. 5)

1842. *Astropecten ployacanthus* Muller & Trocchel.F.H. *System der Asteriden*. P. 69.

1971. *Astropecten ployacanthus*: Clark, A.M. and Rowe.F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 30-31 (distribution) and 44 (key).

Material examined: E-55, MBRC/ZSI 2 exs

Habitat: Reef-dwelling sea stars are sometimes found on sand and soft bottom, but sand-dwelling forms (with pointed tube feet) are unable to climb on rocky reefs and would have difficulty finding food. **Colour:** Sandy brown

Locality: Mandapam FLC.

Family: GONIASTERIDAE

6. *Anthenea pentagonula* (Lamarck)

(Fig. 6)

1816. *Anthenea pentagonula*: Lamarck, J.B.P.A. de *Hist. nat. anim. s. vert.* 2:554

1971. *Anthenea pentagonula* : Clark, A.M. and Rowe.F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 32-33 (distribution) and 52 (key).

Material examined: E-9, MBRC/ZSI 3 exs.

Habitat: Sandy shore. **Colour:** Upper side red or green lower side yellow colour may vary juveniles and adults.

Locality: Mundal FLC

Family: OREASTERIDAE

7. *Goniodiscaster scaber* (Mobius)

(Fig. 7)

1859. *Goniodiscaster scaber* Mobius, K. *Abh. Geb. naturv. Hamburg.* 4(2):10.

1971. *Goniodiscaster scaber*: Clark, A.M. and Rowe.F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*. 32-33 (distribution). 50 (keys.)

Material examined: E-15, E-44, E-57 MBRC/ZSI 13 exs.

Habitat: Sandy shore. **Colour:** Ash colour on upper side and white on the lower side.

Locality: Mandapam, Keelakarai , Ervadi and Mundal FLC

Family: OREASTERIDAE

8. *Pentacaster mammillatus*

(Audouin, 1826)

(Fig. 8)

1826. *Asterias mammillata* Audouin, V. Explication SOMMARIE DES PLANCHES D'Echinoderms de l'Egypte et de la syrie publiees par J. C. de savignyi. In: *Description de de l'Egypte*. Histoire naturelle. Paris I (4): 203-212pp.

1842. *Oreaster mammillatus* : Muller, J. & Trocchel, F. H. *System der Asteriden*. Braunschweig: XX:134pp.

1875. *Pentaceros mammillatus* : Perrier. *Revision de la collection de Stellerides du museum d' Histoire Naturelle de Paris*. 1-384. [Also published in *Arch. Zool. Exp. Gen.*, 4 (1875): 263-449; 5 (1876): 1-104]

Material examined: E-8, E-13 MBRC/ZSI 195 exs.

Habitat: Sandy shores, Coral reef flats and in Sea weed areas. **Colour:** varies. A number of color varieties exists, sometimes even in the same location. It occurs in intertidal regions throughout the Gulf of Mannar and it is very common, and at 3-5 m depths on the sea grass beds, coral, sandy bottom.

Locality: Mandapam, Keelakarai, Ervadi and Mundal, Vembar, Tharuvaikulam and Tutuicorin FLC.

9. *Protoreaster lincki* (de Blainville)
(Fig. 9)

1830. *Asterias lincki* de Blainville H.M. *Dictionnaire des Sciences Naturelles*. 60: 238

1971. *Protoreaster lincki*: Clark, A.M. and Rowe.F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 34-35(distribution) and 54(key).

Material examined: E-2, E-33 MBRC/ZSI 15 exs.

Habitat: Sandy bottom; 15-20 m deep. **Colour:** Yellow with brick red in colour in reticulate pattern on the upper side lower side is yellow in colour. It occurs in intertidal regions.

Locality: Mandapam, Keelakarai, Ervadi and Mundal, Vembar, Tharuvaikulam and Tutuicorin FLC.

Family: OPHIDIASTERIDAE
10. *Linckia laevigata* (Linnaeus)
(Fig. 10)

1758. *Asterias laevigata* Linnaeus C.*Systema Naturae*, Ed. 10:662

1971. *Linckia laevigata*: Clark, A.M. and Rowe. F.W.E. *Monograph of Shallow-water Indo-West Pacific echinoderms*, 36-37 (distribution) and 62 (keys).

Material examined: E-52 MBRC/ZSI 1 exs.

Habitat: It is found on Coral reefs, young one live among corals and adults lying in sandy areas and sea grass beds this star fish can be easily recognized. **Colour:** Brilliantly blue in colour. When these gills (papulae) are extended they often give the sea star a soft, velvety appearance.

Locality: Mandapam.

11. *Linckia multifora* (Lamarck)
(Fig. 11)

1816. *Asterias multifora* Lamarck. J.B.P.A. de *Hist.nat.anim.s.vert.*, 2:565.

1971. *Linckia multifora*: Clark, A.M. and Rowe.F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 36-37(distribution) and 62 (key).

Material examined: E-17, E-31, E-58 MBRC/ZSI 17 exs.

Habitat: It occurs on reef flats and in shallow water on coral reefs where it feeds on algae and detritus. The species reaches a size of 200 mm. **Colour:** Although well known by its most common colour form, this species is subject to colour variation and may be pink, grey, brown, or yellowish. In one of its juvenile stages it is generally grey with darker patches.

Locality: Mandapam, Keelamundal and Mundal FLC.

Family: ASTERINIDAE
12. *Asterina burtoni* Gray
(Fig. 12)

1840. *Asterina burtoni* Gray. *J.E. Ann. Mag. nat. Hist.*, 6 (37): 289.

2005. *Asterina burtoni*: Sastry, D.R.K. *Rec. zool. Surv. India. Occ. Paper No. 233:23*.

Material examined: E- 59 MBRC/ZSI 1 ex.

Habitat: Coral reefs. **Colour:** Rose-red on upper lower sides.

Locality: Mandapam FLC

Family: ECHINASTERIDAE
13. *Echinaster (Echinaster) purpureus* (Gray)
(Fig. 13)

Materials examined: E-14, E-42 MBRC/ZSI 2 exs.

1840. *Othilia purpurea* Gray, *J.E. Ann Mag. nat. Hist.*, 6 (37): 282.

1996. *Echinaster (Echinaster) purpureus*: Clark, A.M. *Echinoderm Studies*, 5:225 [non: *E.purpureus* Domantay and Roxas. 1938:230 = *E. luzonicus* (Gray)]. *Indian Ocean 0-10 m*.

Habitat: Coral reefs: **Colour:** Brick red.

Locality: Ervadi

Class : OPHIUROIDEA
Family : OPHIODDERMATIDAE
14. *Ophiarachnella gorgonia* (Muller & Troschel)

1842. *Ophiarachnella gorgonia* Muller, J. and Troschel, F.H. *System der Asteriden*, p.105

1971. *Ophiarachnella gorgonia* : Clark, A. M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 88-89 (distribution) and 125 (key).

Material examined: E-21 MBRC/ZSI 1 ex.

Habitat: Yong forms associated with Soft Corals, Sponges and Corals, Adults inhabits sandy bottom. **Colour**: Arms of younger forms with white and green bands and adults brown bands.

Locality: Mandapam FLC.

Class: ECHINOIDEA

Family: DIADEMATIDAE

15. *Astropyga radiata* (Leske)
(Fig. 14)

1778. *Cidaris radiata* Leske. N.G. N.G. *Additamenta ad Kleinii naturalem dispositionem Echinodermatum*, p.116.

1971. *Astropyga radiata* : Clark, A. M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 140-141 (distribution) and 153 (key).

Material examined: E-36 MBRC/ZSI 1 ex

Habitat: Pearl banks , 10-15 m depth. **Colour**: Reddish brown on the upper side with sky blue spots arranged in rows.

Locality: Ervadi FLC.

Family: STOMOPNEUSTIDAE

16. *Stomopneustes variolaris* (Lamarck)
(Fig. 15)

1816. *Echinus variolaris* Lamarck. J.B.P.A. *de Hist.nat.anim.vert.* 3. 47.

1971. *Stomopneustes variolaris* : Clark, A.M and Rowe, F.W.E. *Monograph of shallow-water Indo- West Pacific echinoderms*, 140-141 and 153 (key).

Material examined: E-4, E-39 MBRC/ZSI 3 exs.

Habitat: Rough surge zones of coral reefs. **Colour**: Dark purple to black.

Locality: Mandapam group Islands and Ervadi

Family: TEMNOPLEURIDAE

17. *Salmacis bicolor* L.A. gassiz
(Fig. 16)

1841. *Salmacis bicolor* Agassiz. L. *Mon. Ach. Anat. Echinus*. viii.

1971. *Salmacis bicolor* : Clark, A.M and Rowe, F.W.E.

Monograph of shallow-water Indo-West Pacific echinoderms, 144-145 and 156 (key).

Materials examined: E-20, E-37/MBRC/ZSI 4 exs.

Habitat: Shallow waters, 5-10 m depth, **Colour**: Spines larger banded with red and yellow, smaller ones in red in colour.

Locality: Mandapam, Keelakarai , Ervadi and Mundal, Vembar, Tharuvaikulam and Tutuicorin FLC.

18. *Salmacis virgulata* (L. Agassiz)
(Fig. 17)

1846. *Salmacis virgulata*: Agassiz. L. In: L Agassiz and E. Desor. *Ann. Sci nat.* (3) 6: 359.

1971. *Salmacis virgulata* : Clark, A.M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 140-141 and 156 (key).

Materials examined: E-16 MBRC/ZSI 5 exs.

Habitat: Shallow water and lives coral reef areas.

Colour: Body black , white or greenish spines reddish in colour. Well defined sutural pits at all triple junctions.

Locality: Mandapam, Keelakarai , Ervadi and Mundal, Vembar, Tharuvaikulam and Tutuicorin FLC

19. *Temnopleurus toreumaticus* (Leske)
(Fig.18)

1778. *Cidaris toreumaticus* Klein In: Leske.N.G. *Additamenta ad Kleinii naturalem dispositionem Echinodermatum*. p.155.

1888. *Temnopleurus toreumaticus* : Bell. F.J. *Proc. zool. Soc. Lond.* 1888: 384: Tamil Nadu Gulf of Mannar (Tuticorin).

Material examined: E-60 MBRC/ZSI 1 ex.

Description: It is a long spined urchin, with a diameter of about 8 cm. It is generally black in colour, and always dark. Ambulacra narrow and straight; pore-pairs non-conjugate, uniserial; phyllodes developed adorally. Ambulacral plating trigeminate with single large primary tubercle per plate except adorally where there may be fewer. The spines are closed at the tip; the anal sac is spotted light and dark.

Locality: Mandapam FLC.

Family: TOXOPNEUSTIDAE

20. *Toxopneustes pileolus* (Lamarck)
(Fig. 19)

1816. *Echinus pileolus* Lamarck. J.B.P.A. de Hist. nat. anim. vert. 3. 45.

1971. *Toxopneustes pileolus*: Clark, A.M and Rowe, F.W.E. Monograph of shallow-water Indo-West Pacific echnioderms, 142-143 and 156 (key).

Materials examined: E30, E-38, E-49-MBRC/ ZSI 14 exs.

Habitat: This urchin is commonly found in all the island areas of Tuticorin group Pearl banks and corals areas at the depth of 5-10 m. **Colour:** Look like bunch of yellow with reds spots.

Locality: Vaan, Karaichalli Islands.

21. *Tripneustes gratilla* (Linnaeus)
(Fig. 20)

1758. *Echnius gratilla* Linnaeus. C. Systema Naturae. Ed. 10: 664

1971. *Tripneustes gratilla*: Clark, A. M. and Rowe, F.W.E. Monograph of shallow-water Indo-West Pacific echnioderms, 142-143 and 156 (key).

Materials examined: E-29, E-50 MBRC/ ZSI 2 exs.

Habitat: Shallow water and coral reef areas. **Colour:** Body black, white or greenish in colour, spines reddish.

Locality: Appa Islands, Keelakari.

Family: CLYPEASTERIDAE

22. *Clypeaster humilis* (Leske)
(Fig. 21)

1778. *Echinanthus humilis* Leske, N.G. Additamenta ad Kleinii naturalem dispositionem Echinodermatum, P.121 pl XIX fig A.B.

1971. *Clypeaster humilis*: Clark, A.M and Rowe, F.W.E. Monograph of shallow-water Indo-West Pacific echnioderms, 144-145 and 161(key)

Materials examined: E-28, E-46 MBRC/ ZSI 68 exs.

Description: Shell flat, thickened with small spines distributed all over the body. **Habitat:** Pearl banks off Tuticorin 15-20 m depth, coral reef areas. **Colour:** Spines yellow-brown.

Locality: Mandapam, Ervadi and Keelakarai FLC.

23. *Clypeaster rarispinus* de Meijere
(Fig. 22)

1903. *Clypeaster rarispinu* de Meijere, J.C.H. Tjdschr. ned. dierk. Veeren., (2) 8:7

1971. *Clypeaster rarispinus*: Clark, A.M. and Rowe, F.W.E. Monograph of shallow-water Indo- West Pacific echnioderms, 144-145. (distribution) and 160(key)

Materials examined: E-45 MBRC/ ZSI 10 exs.

Habitat: Pearl banks off Tuticorin 1520 m depth, coral reef areas. **Colour:** Spines yellow.

Locality: Ervadi and Keelakarai FLC

24. *Clypeaster reticulatus* (Linnaeus)
(Fig. 23)

1758. *Echinus reticulatus* Linnaeus. C. System Naturae Ed. 10: 666

1971. *Clypeaster reticulatus*: Clark, A.M. and Rowe, F.W.E. Monograph of shallow-water Indo-West Pacific echnioderms, 144-145 (distribution) and 160 (key).

Materials examined: E-62 MBRC/ ZSI 19 exs.

Habitat: Pearl banks off Tuticorin 1520 m depth, coral reef areas. **Colour:** Spines yellow.

Locality: Ervadi and Keelakarai FLC.

Family: LAGANIDAE

25. *Laganum depressum* Lesson

1841. *Laganum depressum* L. Agassiz, Monographie di Echinodermes II. Monographie des scutelles, p. 110.

1971. *Laganum depressum*: Clark, A.M. and Rowe, F.W.E. Monograph of shallow-water Indo-West Pacific echnioderms, 144-145 (distribution) and 162 (key).

Materials examined: E-18 MBRC/ ZSI 1 ex.

Habitat: Sandy bottom where it buries. **Colour:** Body slightly yellow, spines yellowish-brown.

Locality: Keelakarai, Ervadi FLC

Family: ASTRICLYPEIDAE

26. *Echniodiscus auritus* Leske
(Fig. 24)

1778. *Echniodiscus auritus* Leske, N.G. Additamenta ad Kleinii naturalem dispositionem Echinodermatum, P. 121 pl XIX fig A.B.

1971. *Echniodiscus auritus*: Clark, A.M. and Rowe, F.W.E. Monograph of shallow-water Indo-West

Pacific echinoderms, 144-145 (distribution) and 162 (key).

Materials examined: E-26, E-48 MBRC/ZSI 16 exs.

Habitat: Pearl banks, Coral reef flats 15-20 m depth. **Colour**: Body slightly reddish with white markings, spines yellowish-brown.

Locality: Ervadi and Keelakarai FLC

Family: SCUTELLIDAE

27. *Echinodiscus bisperforatus* Leske

1778. *Echinodiscus bisperforatus* Leske N.G. *Additamenta ad Kleinii naturalem dispositionem Echinodermatum*, P.132.

1971. *Echinodiscus bisperforatus*: Clark, A.M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 144-145 (distribution) and 162 (key).

Materials examined: E-27 MBRC/ZSI 12 exs.

Habitat: Pearl banks, Coral reef flats 15-20 m depth. **Colour**: Shell without spines in white.

Locality: Ervadi FLC.

Family: ECHINOLAMPADIDAE

28. *Echinolampus ovata* (Leske)
(Fig. 25)

1778. *Echinanthus ovatus* Leske, N.G. *Additamenta ad Kleinii naturalem dispositionem Echinodermatum*, P.127.

1971. *Echinolampus ovata*: Clark, A.M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 144-145 (distribution) and 163 (key).

Materials examined: E-41 MBRC/ZSI 1 ex.

Description: Shell egg-shaped, star-shaped marks seen on the upper side.

Habitat: Reef flats,

Colour: White and pale yellow.

Remarks: Occurs in large numbers at one place.

Locality: Ervadi FLC

Family: LOVENIIDAE

29. *Lovenia elongata* (Gray)
(Fig. 26)

1845. *Spatangus elongata* Gray, J.E. *Exped. Australia*, 1: 436

1971. *Lovenia elongata*: Clark, A.M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 146-147. and 164 (key)

Materials examined: E-63 MBRC/ZSI 3exs.

Habitat: Sandy areas, burrows into the sand and feeds on organic matter, **Colour**: Brown-Reddish.

Remarks: Occurs in large numbers at one place.

Locality: Mandapam FLC

Family: BRISSIDAE

30. *Brissus latecarinatus* Leske
(Fig. 27)

1778. *Spatangus brissus var. latecarinatus* Leske, N.G. *Additamenta ad Kleinii naturalem dispositionem Echinodermatum*, p.185.

1971. *Brissus latecarinatus*: Clark, A.M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echinoderms*, 146-147. and 165 (key).

Materials examined: E-11, E-19, E-47 MBRC/ZSI 9 exs.

Habitat: Mostly shallow water sands to shell gravels

Locality: Mandapam, Mundal FLC and Tuticorin group of Islands

Class : HOLOTHUROIDEA

Order : ASPIDOCHIROTIDA

Family : HOLOTHURIIDAE

31. *Bohadschia marmorata* (Jaeger, 1833)

Common Name: Chalkyfish

Local name: Nool Attai (Tamil)
(Fig. 28)

1833. *Bohadschia marmorata* Jaeger.G.F. *De Holothuriis* p.18

Habitat: Lies buried in silty sand. Distributed at depths of 0-15 m.

Location: Mandapam FLC.

32. *Holothuria atra* Jaegar

Common Name: Lolly Fish

Local Name: Kutchii attai.
(Fig. 29)

1833. *Holothuria atra* Jaeger, G.R. *De Holothuriis*, p. 22.

1895. *Holothuria atra*: Thruston E. *Madras Govt. Mus. Bull.* No. 3(11): 115.

Materials examined: E-5, E-53 MBRC/ZSI 3 exs.

Habitat: Dead coral reef flats, sandy, muddy patches occurs in 10 m depth.

Status: Common Value: Low value.

Location: Mandapam and Keelakarai group of Islands, Periapattanam FLC,

33. *Holothuria leucospilota* Brandt

Common Name: Lolly Fish

Local Name: Kutchii attai.

(Fig. 30)

1835. *Stichopus (Gymnochirota) leucospilota* Brandt
Prodromus descriptionis animalium, 1:51

1971. *Holothuria (Mertensiothuria) leucospilota* Clark, A.M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echnioderms*, 176-177 (distribution).

Habitat: It tucks the rear end of the body under coral stones. **Colour:** uniformly velvet blue
Common. Value: Low value.

Location: Mandapam FLC.

34. *Holothuria scabra* Jaeger

Common Name: Sand Fish

Local Name: Vellai attai.

(Fig. 31)

1833. *Holothuria scabra* Jaeger G.F. *De Holothuriis* p.23.

1971. *Holothuria (Metriatyla) scabra* Clark, A.M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echnioderms*, 178-179 (distribution).

Materials examined: E-3 MBRC/ZSI 2 exs.

Habitat: Sandy areas buries into the sand exposing the rear end.

Status: Common,

Value: High value. **Colour:** grey to black on upper side with white or yellow stripes; lower side white with black spots.

Location: Mandapam FLC, Keelakari and Ervadi

35. *Holothuria (Theelothuria) spinifera* Theel

Common Name: Brown Fish

Local Name: Rajaattai or Chena attai.

(Fig. 32)

1886. *Holothuria spinifera* Theel, H. *Rep. Scient. Results. Voy. "Challenger"* (Zool.), 39:175.

1971. *Holothuria (Theelothuria) spinifera* Clark, A.M. and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echnioderms*, 178-179 (distribution).

Materials examined: E-22, E-23 MBRC/ZSI 3 exs.

Description: Body tubular in shape, sharp projections all over the body hence the name maximum length 350mm: **Colour** : Uniform brown lower part is light in colour.

Habitat: Clean sandy areas and deeper in water and buries into the sand completely.

Status: Common,

Value: medium valued.

Location: Mandapam FLC.

Family: STICHOPODIDAE

36. *Stichopus herrmanni* Semper

Common Name: Curry Fish

Local Name: Mullu attai

(Fig. 33)

1868. *Stichopus variegatus herrmanni* Semper C. *Risen Archip. Philipp. 2. Wiss Result Wetlands*, 2 (1): 73.

1995. *Stichopus herrmanni* : Rowe, F.W.E and Gates, J. *Zoological Catalogue of Australia*, 33:324.

Materials examined: E-7 MBRC/ZSI 1 ex.

Description : Body wall gelatinous upper side with large fleshy projections; underside with 3 bands of maximum length 500 mm : **Colour** Uniformly black.

Habitat: Dead coral reef flats, sandy, muddy patches occurs in 10 m depth

Status: Common. Value: Low valued.

Location: Mandapam FLC

Order : MOLPADIIDAE

Family : CAUDINIDAE

37. *Acaudina malpadioides* Semper 1868

(Fig. 34)

1938. *Haplodactyla malpadioides* Semper C. *Reisen Archip. Philipp. 2. Wiss Result*: 41.

1971. *Acaudina malpadioides* Clark, A.M and Rowe, F.W.E. *Monograph of shallow-water Indo-West Pacific echnioderms*, 184-185.

Materials examined: E-6 MBRC/ZSI 1 ex.

Description: Body fusiform with smooth surface; at the front end ten small digit-like

structure surrounding the mouth **Colour:** light pink.

Habitat: Adults bury in the mud, 10-15 m deep

Status: **Common** Value: Low valued.

Location: Mandapam FLC.

DISCUSSION

The echinoderm fauna of Gulf of Mannar has been studied by James (1988) from Central Marine Fisheries Research Institute. General faunal diversity of Gulf of Mannar Biosphere Reserve was studied by Venkataraman *et al.* (2002). In these studies, 9 crinoids, 56 starfishes, 30 Echinoidea, and 33 holothuroids were recorded. Of which 38 species were recorded and 23 species were found common to present study. Species such as *Pentaceraster mammillatus*, *Echinothrix diadema*, *Temnopleurus alexandri*, *Clypeaster rarispinus*, *Clypeaster reticulatus*, *Brissus latecarinatus* and *Stichopus herrmanni* were not recorded earlier and are new to Gulf of Mannar.

In Gulf of Mannar, Holothuroidea and Echinoidea are considered as economically important. The *beeche-de-mer* soup is believed to possess curative properties for whooping cough, bronchial inflammation, and respiratory disorders. This resource is vulnerable for over-exploitation. The population and distribution of most economically important species like *Holothuria scabra*, *Holothuria spinifera* were drastically reduced due to over-exploitation.

Holothurians (sea cucumbers) even though protected under schedule I of Indian wildlife (Protection) Act, 1972 trade is continuing in Gulf of Mannar regions. Species of *Holothuria scabra* and *H. atra* are mainly collected by skin-

diving from a depth of 1-5 m along with ornamental fish and seashells. Sea cucumbers which enter in the trawl nets are also used. Major area of collection includes Dhanuskodi, Mandapam, Keelakarai, Vembar and Tuticorin. The export route is not clearly known, but the collected sea cucumbers are home dried and are handed to a middle man in the village, through him only all trade is taking place. The dried sea cucumbers known as *beeche-de-mer* are a delicacy in south East Asian countries. Fishermen engaged in this activity are well aware that these species are protected and illegal trade can attract heavy fine and punishments, they still continue this because of huge profits from this business. From fishermen point of view sea cucumber numbers are not dwindling, but increasing. The inclusion of holothurians in the list of protected animals under Indian Wildlife (Protection) Act, 1972 has left the holothurian fishery dependent community in wild. Provision of alternate income generating schemes to safeguard the livelihoods of people, conducting regular awareness programmes can only save the echinoderm resources of Gulf of Mannar.

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Fig. 1. *Tropiometra carinata*



Fig. 2. *Luidia maculata*



Fig. 3. *Astropecten indicus*



Fig. 4. *Astropecten monacanthus*



Fig 5. *Astropecten polyacanthus*



Fig. 6. *Anthenca pentagonula*



Fig. 7. *Goniodiscaster scaber*



Fig. 8. *Pentaceraster mammillatus*

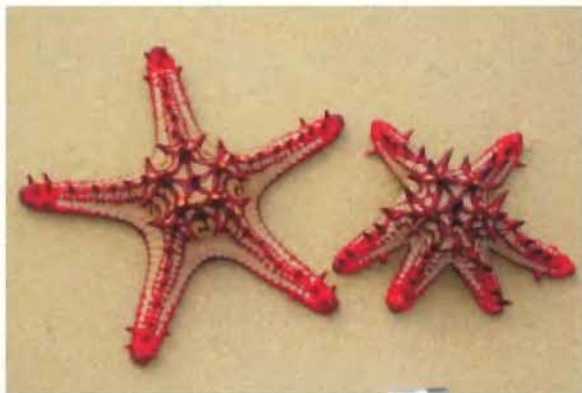


Fig. 9. *Protoreaster lincki*



Fig. 10. *Linckia laevigata*

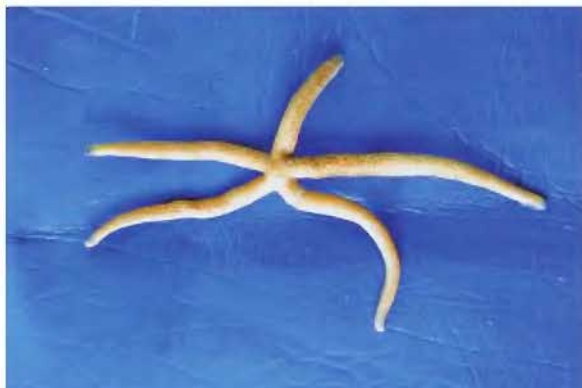


Fig. 11. *Linckia multifora*



Fig. 12. *Asternia burtoni*



Fig. 13. *Echinaster purpureus*



Fig.14. *Astropyga radiata*



Fig. 15. *Stomopneustes variolaris*



Fig. 16. *Salmacis bicolor*



Fig. 17. *Salmacis virgulata*



Fig. 18. *Temnopleurus toreumaticus*

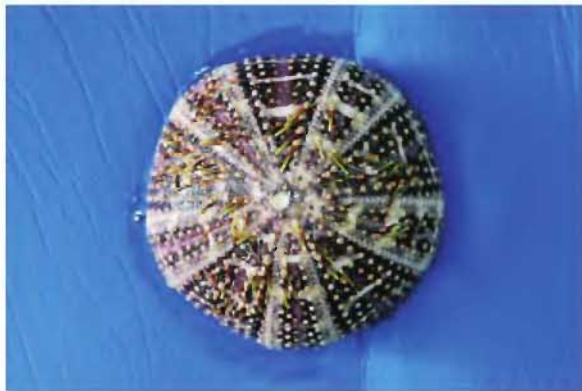


Fig. 19. *Toxopneustes pileolus*



Fig. 20. *Tripneustes gratilla*



Fig. 21. *Clypeaster humilis*



Fig. 22. *Clypeaster rarispinus*

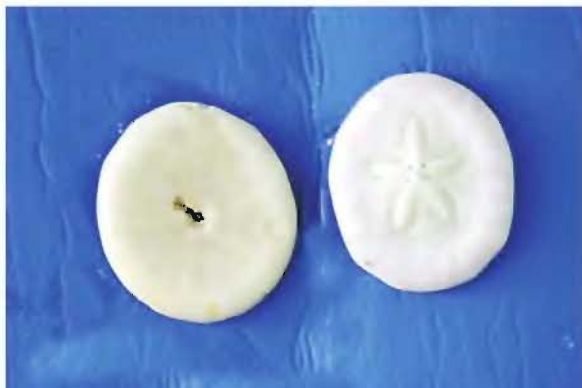


Fig. 23. *Clypeaster reticulatus*

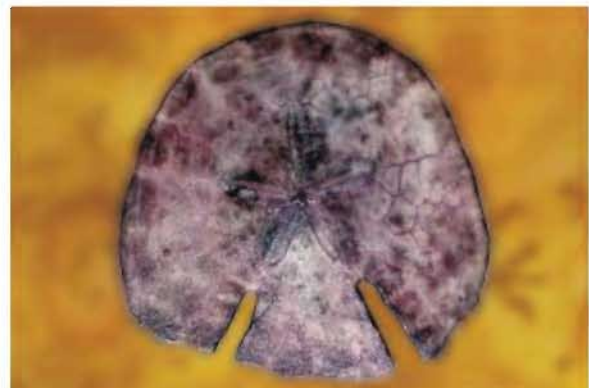


Fig. 24. *Echinodiscus auritus*



Fig. 25. *Echinolampas ovata*



Fig. 26. *Lovenia elongata*



Fig. 27. *Brissus latecarinatus*



Fig. 28. *Bohadschia marmorata*



Fig. 29. *Holothuria atra*



Fig. 30. *Holothuria leucospilota*



Fig. 31. *Holothuria scabra*



Fig. 32. *Holothuria spinifera*



Fig. 33. *Stichopus herrmanni*



Fig. 34. *Acaudina molpadioides*