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STUDIES ON THE ALCYONACEAN FAUNA OF GULF OF MANNAR

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INTRODUCTION

Soft corals are conspicuous and colourful component of coral reef through out the marine national parks of India. The soft corals are the second largest group of organisms in the coral reef environment and play a significant role in the global coral reef ecology. There is a growing interest in the biomedical applications of octocorals. The order Alcyonacea includes the soft corals and the gorgonians. Alcyonacea or soft corals, an order of corals are belongs to the sub class Octocorallia, (Class Anthozoa, Phylum Cnidaria). This class has three distinctly separated orders, Helioporacea (Blue coral), Pennatulacea (sea pens) and Alcyonacea (soft corals and gorgonians) as their name suggests, Octocorallia or Octocorals are characterized by Polyps with eight tentacles. Unlike reef building corals, soft corals do not produce hard calcium carbonate skeletons, instead typified by their internal fleshy skeletons. Soft corals are found in all marine waters; they are found in tropical, temperate and polar seas and accommodate themselves in a variety of habitats including intertidal regions, brackish and muddy water, estuaries, oceanic blue waters and even abysmal depths. Soft corals form fleshy colonies characterized by having polyps aggregated or concentrated into polyparies. The most pronounced feature is that in the subclass Octocorallia, each of the Polyps bears eight hollow tentacles which are fringed on both sides by one or several rows of pinnules.

The Alcyonacea of Gulf of Mannar is little known. No systematic work treats them in detail. Associated organisms include Cling fish, Seahorses, brittle stars, Ctenophores, Snails, Worms, Shrimps and other crustaceans including microscopic copepods, soft corals have no massive sold skeleton. Around 90 genera of Alcyonacea, belonging to 29 families, have been described from the tropical Indo-pacific. Of the 29 families in the order Alcyonacea, 23 are found in the warm, shallow waters of the Red Sea, the Indian and Central- west Pacific oceans. At present the system is in its least complex stage with all soft corals and gorgonians being placed in the single order. Gorgonians are popularly called Sea fan in marine Coelenterates. Their distribution and abundance are influenced by environmental factors such as light, temperature, water flow, current etc. Indo pacific region has a high diversity of gorgonian corals (Goh and Chou, 1996). There are many taxonomic descriptions of gorgonians in most parts of the Asian region.

MATERIALS AND METHODS

Collection of soft corals from the shallow regions of the sea by snorkeling in different islands of Gulf of Mannar during 2009 and 2010. Sixteen stations were chosen for the present study along the coast. Specimens were collected and preserved in 10% buffered formalin is substituted with 70% alcohol. Sclerites were taken from Polyp, surface layer of stalk and Interior of stalk. Sclerites were obtained by treating tissue samples with 10% sodium hypocholorite in microscopic slide with central cavity (La Barre, 1983) to dissolve the

tissue and leaves the spicules intact.The spicules were rinsed with distilled water anddried on hotplate treated with xylol and mounted in DPX.

AREA SURVEYED

The survey was conducted starting from Anaipar, Palliarmunai Island, Appa Island, Keelakarai fish landing includes different stations like Vazhai island, Keelakarai, Mulli island, Ervadi, Mundal Poomarichan island, Mandapam bridge, single island, Hare island, Pamban bridge, Manauli & Manauliputti island, Pullivasal island, Krusadai island, Vedalai and Rameswaram.

EARLIER REPORTS ON ALCYONACEAN FAUNA OF INDIA

Among the Alcyonacean fauna in Indian coral reef area, three families Alcyoniidae, Nephtheidae and Xeniidae are dominant. Previous demographic investigation of reef inhabiting Xeniidae and Nephtheid taxa led to the conclusion that soft corals are ephemeral pioneer organisms, with rapid growth rates by vegetative reproduction. The Alcyonacean fauna of India is very poorly known. Earliest comprehensive report on Alcyonacean fauna from the Indian coast dates back to the collection of James Hornell during 1904-1905,

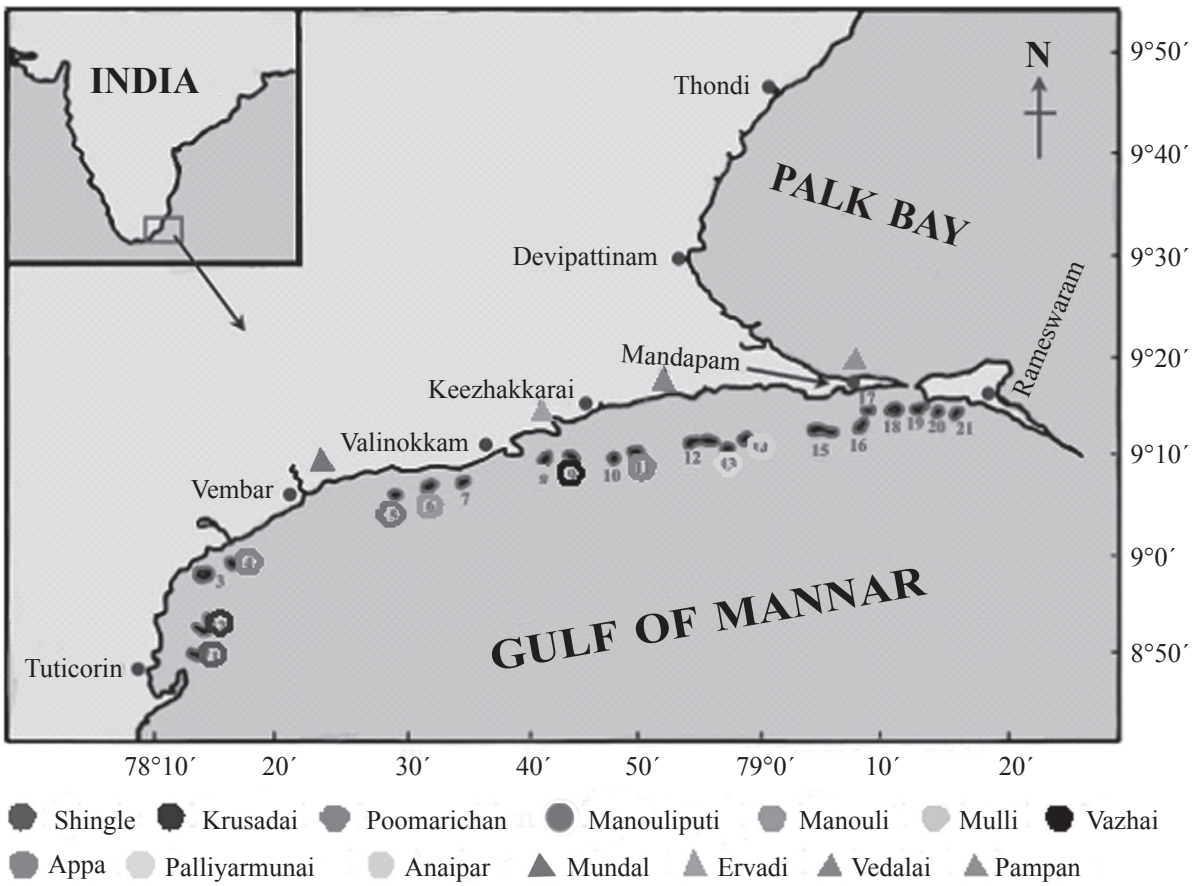

Fig 1. Map of the Study area and localities surveyed

and subsequently by Thomson and Crane (1909) described eight species of soft corals from Okhamandal, Gulf of Kachchh. Patel (1983) did extensive work in Gulf of Kachchh and reported 12 species.

Further studies on soft corals by Hickson (1903, 1905) Pratt (1903), Thomson and Henderson (1906) and Thomson and Simpson (1909) enlightened the knowledge of Alcyonaceans of Lakshadweep. Thompson and Henderson (1905) published an inventory of deep-sea Alcyonaceans collected from the Indian Ocean. Thomson, Simpson and Henderson (1909) also published another inventory of deep sea Alcyonarians from

the Indian Ocean. Distribution of Alcyonaceans off Krusadai Island was recorded by Gravely (1927). Similarly, Jayasree *et al.,* (1997) reported 27 species of Alcyonaceans from Gulf of Mannar Biosphere reserve. The most abundant and dominating genera in Krusadai Island are *Sinularia sp. Sarcophyton* is also one of the most common genus in this area. Ridley (1882) conducted various taxonomic investigations on a few new species of Alcyonaceans collected from Bay of Bengal and Indian Ocean. Ofwegan Van and Vennam (1991) also reported nineteen species of Alcyonaceans (*Alcyonium, Lobophytum, Sarcophyton, Sinularia*) from Lakshadweep. The octocoral fauna of the Lakshadweep was also investigated by Alderslade and Shirwaiker (1991). They reported 17 species in Lakshadweep. Rao *et al.,* (2003) reported 54 species of soft corals in Andaman Islands, Bay of Bengal. According to Thomas *et al.* (1995) In India 27 species of gorgonids under 9 genera were reported from North east Coast of India. In Andaman and Nicobar Islands 10 species of gorgonids under 9 genera were reported

The following 72 Soft coral specimens were identified from the survey tour to Gulf of Mannar, Tamil Nadu as belonging to 12 species under 5 families.

SYSTEMATIC LIST OF SOFT CORALS OF GULF OF MANNAR AND PALK BAY

Classification of Alcyonacea

Kingdom ANIMALIA

Phylum CNIDARIA

Class ANTHOZOA

Order ALCYONACEA

Family ALCYONIDAE

1. *Sinularia Polydactyla* (Ehrenberg)-7 exs
2. *Sinularia peculiaris* Tixier-Durivault-3exs
3. *Sarcophyton troceliphorum* Von Marenzeller-5exs
4. *Sarcophyton tortuosum* Tixier-Durivault-3 exs
5. *Lobophytum sarcophytoides*-4exs
6. *Lobophytum crassum* Von Marenzeller-3exs

Family NEPHTHEIDAE

7. *Capnella parva* Light-1ex
8. *Dendronephthya hemprichii*-1ex

II. Gorgonids

Family PLEXAURIDAE

9. *Echinogorgia reticulata* Kukenthal-5exs

Family SUBERGORGIIDAE

10. *Subergorgia suberosa* Pallas-10exs

Suborder CALCAXONIA

Family ELLISELLIDAE

11. *Verrucella umbraculum* (Ellis & Solander)-5exs
12. *Junceella juncea*

Classification of Alcyonacea

Kingdom ANIMALIA

Phylum CNIDARIA

Class ANTHOZOA

Order ALCYONACEA

Family NEPHTHEIDAE

All these animals have a similar, arborescent appearance with spiculose polyps. Colors are generally brown and cream associated with photosynthetic soft corals. They are found mainly on reef slopes or coral rubble with strong illumination and high water flows.

1. ***Sinularia polydactyla*** (Ehrenberg, 1832)

1832. *Lobularia polydactyla* Ehrenberg, Abhandl, K. Akad. Wiss, Berlin, (**1**): 58.

1980. *Ainularia polydactyla*: Verseveldt, *Zool. Verhand*, Leiden, **179**: 108, fig. 57.

1996. *Sinularia polydactyla*, Jayasree *et al*., *J. Bombay. Nat. Hist. Soc*, **92**: 202-209.

Material Examined: Locality: Manauli island, Date: 24.12.07. Reg. No: SC-07. Collected by: G. Sivaleela & Party.

Description: Colony encrusting with tough stalk; lobes are crowded, large and with finger like branches. Surface layer of the lobes sclerites contains 0.07 to 0.19 mm long. Clubs have warty heads, the length of the clubs varies. Clubs of the surface layer of the stalk sclerites are similar to the

clubs of the lobes but their handles are stout and short; the handles of the larger clubs are straight or slightly curved. The coenenchymal sclerites are straight or curved pointed spindles, up to 4.5 mm long; smaller sclerites are bifurcated at one end. The spindles are rounded. Colour: colonies are creamy brown and Greyish.

Distribution: India (Gulf of Mannar). *Elsewhere*: Indo-Pacific region and Red Sea.

2. ***Sinularia peculiaris*** Tixier–Durivault, 1963

1963. *Sinularia peculiaris* Tixier-Durivault. De la foundation Singer-Polignace. **4**: 279-280, figs.130-132.

1980. *Sinularia peculiaris*, Versveldt, Zool-Verhandle, Leiden, (179): 140-145, figs. 55, pl.34, fig.3.

Material Examined: Locality: Manauli island, Date: 24.12.07.Reg. No: SC-08 Collected by: G. Sivaleela & Party.

Description: Colony encrusted lobes erect and small lobules oblong. The surface layer of the lobes contains clubs, 0.10 to 0.16 mm long, few clubs are up to 0.21 mm long; the clubs have wide heads with blunt warts, some warts are leaf –like with toothed edges; the surface layer of stalk contains many clubs, 0.11 to 0.17 mm long. Interior of the lobes and stalk contains slightly curved and un branched, blunt ended spindles. The stalk contains small multi radiate irregular forms. The internal sclerites are curved, un branched, point or blunt–ended spindles. The lobe sclerites length is 1.80mm and in the sterile stalk is 2.60mm. Colour: Light Grey.

Distribution: India; *Elsewhere*: New Caledonia.

3. ***Sarcophyton troceliophorum*** Von Marenzeller, 1886.

1886. *Sarcophyton trocheliophorum* Von Marenzeller,: 359-362, pl.9, fig.5.

1982. *Sarcophyton trocheliophorum* Verseveldt, *Zool. Verhand*., Leiden, **192**: 83-88, figs. 37-39, pl. 12, fig.1, pl.19, fig. 2, pl. 24, figs. 1, 2.

Material Examined: Locality: Hare island, Date: 4.10.09. Reg. No: SC-09, Collected by: G. Sivaleela & Party.

Description: Colonies are mushroom –shaped. The clubs in the surface of the disc and of the stalk have typical shape and size mentioned above. Spicules are fusiform, a few are thick and oval shaped and bear numerous big warts. The coenenchyme of the disc contains straight or curved spindle. Interior of the stalk is oval shaped sclerites 0.24 mm long. The clubs in the surface layer of the stalk are wider. The spindles in the coenenchyme of the disc are longer, 0.25 mm.

Distribution: Indian Ocean, *Elsewhere*: West Pacific area.

4. ***Sarcophyton tortuosum*** Tixier-Durivault, 1958

1958. *Sarcophyton tortuosum* Tixier-Durivault, 25-28, figs, 17, 17, 20, 21.

1982. *Sarcophyton tortuosum*. Versveldt. Zool. verhand, Leiden, (192): 82-83. fig. 36; pl. 23, fig. 1-3.

Material Examined: Locality: Hare island, Date: 4.10.09, Reg. No: SC-11, Collected by: G. Sivaleela & Party.

Description: Colonies are mush room shaped. The disc is hollow with numerous folds. Surface layer of the disc is slender 0.08mm long. Head of the club is warty with spines. Interior of disc contains spiny rods and spindles. Surface layer of stalk contains clubs similar to the disc. Interior of the stalk contains slender and pointed spindles. Colonies are greenish brown.

Distribution: India (South Andaman), *Elsewhere*: Fiji, New Caledonia.

5. ***Lobophytum sarcophytoides*** Moser, 1919

1919. *Lobophytum sarcophytoides* Moser, *Mitt. Zool. Mus.,* Berlin, **9**(2): 267-268, Fig. 13, pl. 6.

1983. *Lobophytum sarcophytoides Versveldt. Zool. Verhand*., Leiden, **200**: 86-89, fig, 43, pl. 26-27.

Material Examined: Locality: Vallai island, Date: 25.3.10, Reg. No: SC-15, Collected by: G. Sivaleela & Party.

Description: Colony is cup shaped with raised lobes. The lobes are thin and folded. Surface layer of the lobes contains small clubs size is 0.086 mm. Interior of the lobes contains slender pointed spindles size is 0.26 mm long. Clubs of the surface layer of the stalk are 0.097 mm long. Interior of the stalk contains spindles size is 0.18 mm.

Distribution: India (South Andaman), *Elsewhere*: Philippines, New Caledonia.

6. ***Lobophytum crassum*** Von Marenzeller, 1886

1886. *Lobophytum crassum* Von Marenzeller, *Zool. Jahrb* (Syst), **1**: 363-364, pl. 9. figs. 8.

1898. *Lobophytum crassum* Var Sansibaricum, May, pl. 5, fig. 28-29.

1971. *Lobophytum cristagalli: verseveldt, Zool. Verhand, Leiden,* **117**: 16-17, fig. 8.

Material Examined: Locality: Vallai island, Date: 25.3.10, Reg. No: SC-13, Collected by: G. Sivaleela & Party.

Description: Colonies are encrusted; the stalk is wider and the capitulum is disc-like; the lobes are crest-like, and have finger-like lobules. Surface layer of the lobes contains clubs, 0.18 mm long. The longer clubs of 0.21 mm long are also common. In addition, numerous shuttles, 0.12 mm long are also present. In the interior of the lobes sub cylindrical sclerites and their length is 0.08 mm. In the surface layer of stalk are clubs and the length is 0.10 mm.

Distribution: Indo-West Pacific tropical area.

7. ***Capnella parva*** Light, 1913

1913, *Capnella parva* Light, Philipp. *J. Sci*, **8**(6): 446-448, Pl. 1, fig. 8.

1976. *Capnella parva* Verseveldt, *Rev. Zool. Afr*. **90**(3): 509, fig. 5.

Material Examined: Locality: Hare island, Date: 24.12.07, Reg. No: S-10, Collected by: G. Sivaleela & Party.

Description: Colony has numerous lobes and is covered with zooids; sterile stalk longitudinally striped. Spicules of the lobe are clubs have spiny heads; the spines are long and directed one side. Small slender clubs with fewer heads are also present. Surface layer of the stalk has small thick rods and clubs. The rods of 0.12 mm long girdles and clubs of 0.15 mm long spiny head.

Colour: colony light brownish–grey.

Distribution: India (Little Andaman), *Elsewhere*: Comoro Islands.

8. ***Dendronephthya hemprichi***, Klunzinger, 1877

1877. *Spongodes hemprichi* Klunzinger, Berlin, 98 pp.

Material Examined: Locality: Palliarmunai island, Date: 4.10.09, Reg. No: SC-17, Collected by: G. Sivaleela & Party.

Description: Colonies are highly branched or bushy end branches and polyp bunches generally arranged in one of three growth forms. Polyps in small bundles with branching. It has longer tentacles. Polyps of this species contain spindles 2.5 mm. Spindle shaped sclerites are characteristics of genus and the length of the spindle is 5.73 mm.

Distribution: Eastern & Northern Indian Ocean, *Elsewhere*: Tropical Western Pacific Ocean and Great Barrier Reef.

Gorgonids

Sea fans belong to the class **Anthozoa**, subclass **Octocorallia**, order **Alcyonacea** (previously they were considered in an order Gorgonacea). Also the majority of the soft corals belong to the same order (Alcyonacea). Sea fans are colonial animals, made up by polyps. Gorgonids are colonial animals are under the Phylum Coelenterata of the Class Anthozoa. Two major subclasses of anthozoans have been defined; these are the subclass Octocorallia or Alcyonaria and the subclass Hexacorallia or Zoantharia. Gorgonids are popularly called sea fans, sea whips and sea feathers. They are sedentary and most of them are phototropic. Their growth-form may be reticulate or bushy and some in one plane, hence the name ‘sea fans’. The body of gorgonid (sea fan) is divided into an axial part comprising of horny material (hence the name horny-coral) and an outer rind (or skin) containing loosely arranged calcareous spicules or sclerites. Most of the gorgonids are beautifully coloured and hence called ‘flowers of the sea bottom’. The gorgonid fauna play significant role in the global coral reef ecology and biomedical applications of gorgonids. Studied by Thomas and Rani Mary George (1986, 1987, 1995 & 1998) on the gorgonid resources, including its export of 31 species referable to 19 genera and 9 families form the mainstay of Indian gorgonid fishery. Gorgonids are known to be a rich source of bioactive compounds and many of these compounds or derivatives thereof are now classified under ‘Wonder Drugs’.

The sclerites were extracted using 5% sodium hypochlorite (Bayer, 1961) and identified by Bayer et al (1983) Keys.

MATERIALS AND METHODS

Kingdom ANIMALIA

Phylum CNIDARIA

Class ANTHOZOA

9. *Echinogorgia reticulate*
(Ellis & Solander, 1786)

1786. *Annella reticulate*, Ellis & Solander, *Journal of experimental Marine Biology & Ecology*, **273**(2002): 121-130.

1924. *Echinogorgia reticulate* Kukenthal, p. 202.

Material Examined: Locality: Hare island, Date: 26.12.07, Reg. No: G-1, Collected by: G. Sivaleela & Party.

Colony shape: Colonies grow in one plane. The main branches produce very short side branches. The branches are usually not very thick, but colonies can grow quite large. Polyps are monomorphic are completely retractile into spiny calyces. Sclerites: Leaf- clubs. These are petaloid expansion on one side and with tuberculated root-like structures on the other. 0.42 mm. Spindles thesea type, size upto 0.51 mm.

Distribution: India (Tuticorin, Rameswaram and Mandapam & Madras), *Elsewhere*: New Caledonia, Subtropical Australia, Papua New Guinea, Indonesia, Singapore and Red Sea.

10. *Subergorgia suberosa* Pallas, 1766

1766. *Subergorgia suberosa*, Pallas, p. 172.

1924. *Subergorgia suberosa* Kukenthal, Gorgonaria. *Das Tierreich*., **47**: 1-478.

1937. *Subergorgia suberosa* Stiasny, p. 87, pl. 6, fig. 45

Material Examined: Locality: Vedalai, Date: 26.12.07, Reg. No: G-2, Collected by: G. Sivaleela & Party.

Colony shape: Colonies are often large, growing in one plane, and laterally to dichotomously branched. All species have long, smooth sclerites, partially fused. Sclerites are brownish colour and 0.05 to 0.25 mm in average size. In the outer cortex, the sclerites occur as warty spindles or ovals. The width of a layer of sclerites is the width of a sclerite or between 20 and 50 μm. The coenenchyme is a thick layer, about 1 mm thick. Coenenchymal sclerites are amber- coloured spindles, oriented with their long axis parallel to the long axis of the branch. Polyps are medium in size and arranged two sides of the branches.

Distribution: India: Gulf of Manar, Andaman and Nicobar Islands and Gulf of Kachch. *Elsewhere*: Indo-West Pacific, Northern Red Sea, Central Pacific, and Zanzibar, Madagascar, Mauritius, Sri Lanka, Philippines & New Caledonia.

11. *Verrucella umbraculum*
(Ellis & Solanders, 1786)

1786. *Ctenocella umbraculum* Ellis & Solander, *Zool. Meded. Leiden* **63**(3): 27-34.

Family NEPHTHEIDAE

Order GORGONACEA

Family ELLISELLIDAE

Genus *Verrucella* Milne Edwards & Haime, 1857

Species ***umbraculum***

Scientific name: *Verrucella umbraculum* (Ellis & Solander, 1786)

Synonymies taxa: *Ctenocella umbraculum* (Ellis & Solander, 1786) & *Gorgonella umbraculum* (Ellis & Solander, 1786).

Material Examined: Locality: Ervadi, Date: 29.12.07, Reg. No: G-9, Collected by: G. Sivaleela & Party.

Description: Colonies fan shaped and closely reticulate. Branchlets divide and redivide and get interconnected in a scalariform pattern producing small meshes of 4 x 5 mm on an average. Branchlets forming the meshes and its diameter, 1.5 to 2.5 mm. Calyces are conical to hemispherical in shape, diameter 1 mm and height 0.7 mm on an average; calyces small at older parts. Coenenchyme granular.

Sclerite: (1) Spindles. Size, 0.084 X 0.025 mm, (2) Dumbbells size, 0.063 X 0.033 mm, (3) Smaller Dumbbells. Size, 0.025 X 0.021 mm.

Distribution: Indian Ocean distributed up to 100 meters depth. Common along the southwest and South East Coasts of India and Andamans; *Elsewhere*: Red Sea.

12. ***Junceella juncea*** (Pallas, 1766)

1766. *Gorgonia juncea* Pallas, pp. 180.

1905. *Junceella juncea*, Thomson and Henderson, pp. 313, 314, pl, 4, figs. 4,5.

1910. *Junceella juncea* Nutting, C, p. 18, pi. 3, figs. 1-4

1986. *Junceella juncea* Thomas and Rani Mary George, pp.10

Material examined: Locality: Ervadi, Date: 29.12.07, Reg. No: G-21, Collected by. G. Sivaleela & Party.

Description: Colony is whip-like. Diameter of the colony vary from 3 to 7 cm. The surface contains clubs. Surface sclerites are usually coloured. Calyces papillate. Polyps are small. Spicules are Dumbbells size is 0.3 mm, Clubs size is 0.05 mm.

Distribution: Southeast and South west Coast of India (Gulf of Mannar); *Elsewhere*: Indo-Pacific.

DISCUSSION

Soft corals are belonging to seven genera was recorded from these islands. These are *Sinularia, Lobophytum*, *Sarcophyton*, *Capnella* and *Dendronephthya* Among these *Sarcophyton* and *Sinularia* were dominant on Anaipar and Krusadai Island. Soft Corals are found associated with hard coral communities. In terms of diversity, the genus *Sinularia* was the best represented with two species. *Lobophytum* was represented by 3 species and *Sarcophyton* had two species each. Gorgonian is one of the marine invertebrates that play an important role in the marine ecosystem. Gorgonian diversity in Gulf of Mannar was investigated as basic data for gorgonian conservation and restoration.

Other than soft corals 7 species of fishes 5 species of Echinoderms, 5 Species of Sponges and 13 species of Gastropods were recorded during this survey. Soft corals and extensive sea grass beds were noticed on the western regions of the keelakarai group of islands. Sea cucumber, Sea anemone and gobid fishes, common reef fishes such as Snapper sp., Parrot fishes, Groupers, Soldier fishes, and Butterfly fishes were found as usual in reef area were commonly observed among the sea grass beds. Soft corals and Sea grass beds were noticed on the south east regions of the Appa Island. The common seaweeds found here are *Ulva, Sargassum, Gelidiella, Gracilaria, Caulerpa, Halimeda, Padina, Hypnea, Turbinaria, Chondrococcus*, etc. At present *Caulerparacemosa* found abundant in Krusadai island. Distribution and growth were affected due to various anthropogenic factors (Venkataraman, 2000). Minimizing the threats to the coral reefs may increase the associated faunal diversity including corals.

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PLATE - I

1. *Sinularia polydactyla* (Ehrenberg, 1832)

2. *Sinnularia peculiaris* Tixier-Durivault, 1963

3. *Sarcophyton troceliophorum* Von Marenzeller, 1886

4. *Sarcophyton tortuosum* Tixier-Durivault, 1958

5. *Lobophytum sarcophytoides* Moser, 1919

6. *Lobophytum crissum* Von Marenzeller, 1886

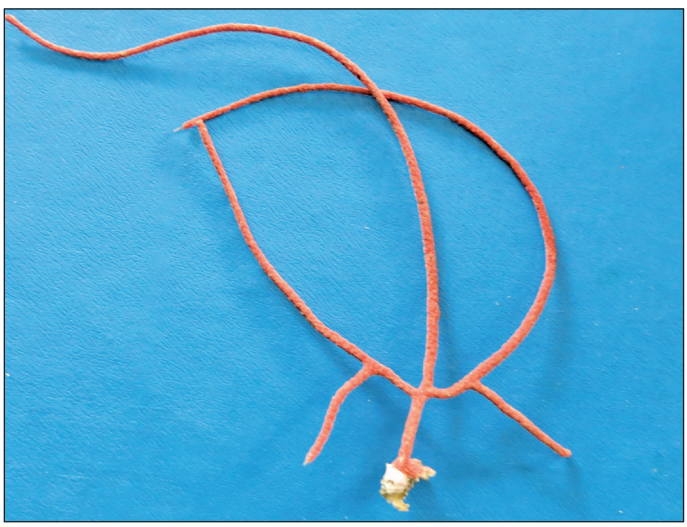
PLATE - II

7. *Dendronephthya hemprichi* Klunzinger, 1877

8. *Capnella Parva* Light, 1913

9. *Subergorgia suberosa* Pallas, 1766

10. *Verucella umbraculam* (Ellis & Soalnders, 1786)



11. *Junceella juncea* (Pallas, 1766)