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DIVERSITY AND DISTRIBUTION OF ECHINODERMS IN RUTLAND ISLAND

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ABSTRACT
An account on the occurrence and abundance of echinodermata collected from Rutland Island in South Andaman, during April'09-September'10 is presented and discussed. The area is characterized by rocky and sandy shore with coral reef ecosystem in between the depth of 2m to 25m depth. A Total of 57 species have been reported during survey period at 3 selected study areas in the depth range of 5m-20m. Data collected by the quadrate sampling methods are processed with statistical tools to compare the distribution and diversity of species in different study areas. Regarding the biology of echinoderms as sessile and slow moving animals, the environment has an important role in their distribution and abundance. The species of Holothuroids (35.09%) and echinoids (31.58%) are mostly distributed with higher percentage of abundance in the reef ecosystem of Rutland Island. In the present paper, the diversity of echinoderms species with their ecological role in the reef ecosystem has been described.

KEY WORDS: Diversity, Echinoderms, Species, Rutland Island, Abundance.

INTRODUCTION

The echinoderms comprise an important group of marine animals that include feather stars, sea stars, brittle stars, sea urchins and sea cucumbers. They are found in all oceans and at all depths, from the littoral zone to 6000 m deep. With the exception of some pelagic holothuroids (*Rynkatropa pawsoni*) all echinoderms are benthic. In deep seas they constitute more than 90% of the benthic biomass (Brusca and Brusca, 1990). The Phylum Echinodermata is a very ancient group, not very distant from the phylum Chordata. Around 6,500 echinoderm species are known at the present time and they are grouped into 5 classes: Class Crinoidea (approximately 700 species), Class Asteroidea (with1, 800 species), Class Ophiuroidea (approximately 2,000 species), Class Echinoidea (with 900 species) and Class Holothuroidea (approximately 1,200 species) (Hendler et al., 1995). The sea around the Andaman and Nicobar Island is Bay of Bengal with Andaman Sea on the eastern side upto the coast of Myanmar. The coastal habitats and the offshore benthic zone of Andaman and Nicobar harbour a rich variety of echinoderms, which is approximately half the echinoderm fauna of the Indian subcontinent. In Andaman and Nicobar Island, more than 200 species of echinoderms occur in the reef ecosystem that belongs to five extant classes with 30 to 60 species of each class (Sastry, 2002). The ecology of many echinoderms with particular references to coral habitats is not extensively studied.

The study of echinoderm's started with the anatomists of the XVIII century. Bell listed the echinoderms from Andaman Island for the first time in 1887. Earlier there were only stray reports of occurrence of individual species off these islands. For example, Blainville (1830) reported the asteroid, *Protoreaster lincki* as *Asterias lincki*, Lutken (1872) reported asteroid *Astropectan euryacanthus*. During the cruises and collections of Royal Indian Marine Survey Steamer *INVESTIGATOR*, specimens of several species of echinoderms were collected from shallow as well as deep waters. These were studied and reported up on mainly under Echinodermata of the Indian Museum in 10 parts and in a few smaller accounts. Chief among are the reports of Crinoidea by Clark, A. H. (1912a, b), Asteroidea by Wood- Mason and Alcock (1891, including a few echinoids), Alcock (1893, 1894), Koehler (1909, 1910), Ophiuroidea by Koehler (1897, 1898, 1899, 1900), Echinoidea by Koehler (1914, 1922a, 1927) and Holothuroidea by Koehler and Vaney (1905, 1908). Julka and Das (1978), Soota *et al.* (1983) James (1986b) and Sastry (1997) reported 12 echinoderms from Ritchie's Archipelago. Sastry (2001) reported the distribution of 44 species from different islands of Ritchie's Archipelago. The present paper represents the diversity and distribution of echinoderm species along the different study sites of Rutland Island. In spite of several accounts on the echinoderm fauna of the Andaman Islands, there are no such reports pertaining to Rutland Island. An attempt has made to describe the diversity and abundance of echinoderms with species distribution along the different study sites with their ecological habitats.

STUDY AREA

Rutland Island is located across the Macpherson Strait from South Andman. The island spans an area of approximately 109.3 km², and has a coastline measuring some 60 Km. It is rich in marine life with the shallow waters near the islands having a good representation of coral reefs. During our survey to Rutland Island, we selected three study sites named as Grass nali (Stn1), Machee dera (Stn2) and Meetha Nali (Stn3). The coordinates of these three islands are as follows:

1. Grass nali: $11^0$27.307'N and $92^0$36.098'E
2. Machee dera: 11°24.233'N and 92°39.952'E
3. Meetha nali: 11028.514'N and E92040.390'E

MATERIALS AND METHODS

Material collection was done by SCUBA diving (up to 15m in depth) and skin diving. during April'09 to September'10. Sampling was done on a transect line, 100 m long and ordinate perpendicularly to the coastal line. In total, three stations were selected and in each area four transects were placed in different depths. PVC framed Quadrate ($1m^2$) was placed along the transect area with an interval of 10m. Apart from the transect sampling, material was collected from 7 localities randomly chosen. All organisms collected were placed individually in plastic container with sea water and were kept in closed containers to avoid heat and light, exposure that give further stress to the organisms. After collection the material was preserved in 70% alcohol for further studies.

For statistical analysis Species diversity index (H) was adopted following the formula given below.

H' = - Σ Pi $\log_e$ Pi (Pi-Proportion of the *i*th species in the collection and H, = Diversity of Theoretically infinite population)

Abbreviation Used: H'- Shanon-Weiner Index; J- Pieoul's Eveness Index; d- Simpson's Diversity Index

RESULTS AND DISCUSSION

A total of 57 species of echinoderms belonging to 13 orders and 23 families were reported from Rutland Island. Among the 57 species encountered, the holothuroids *Actinopyga mauritiana, Holothuria impatiens, Bohadschia marmorata*; asteroids *Culcita novaguineae, Linckia laevigata; echinoids Echinothrix calamaris, Echinometra mathaei*; Ophiuroids *Ophiomastix annulosa, Ophiocoma erinaceus* and the crinoids *Comanthus parvicirrus*, are most commonly distributed in the Rutland Island (Table 1).

TABLE.1- Distribution of Echinodermata in Rutland Island

Sl No	**Class- Holothuroidea** **Order Aspidochirotida** **Family- Holothuriidae**	Stn1 (Grass Nali)	Stn2 (Machhi dera)	Stn3 (Meetha Nali)
1	*Actinopyga mauritiana* (Quoy and Gaimard, 1833)	*	*	*
2	*Actinopyga echinities* (Jaeger, 1833)		*	
3	*Holothuria hilla* (Lesson, 1830)	*		*
4	*Holothuria impatiens* (Forskal, 1775)	*	*	*
5	*Holothuria atra* (Jaeger, 1833)	*		*
6	*Holothuria pyxis* (Selenka, 1867)		*	
7	*Holothuria scabra* (Jaeger, 1833)	*		
8	*Holothuria edulis* (Lesson, 1830)		*	*
9	*Holothuria pervicax* (Selenka, 1867)	*		*
10	*Bohadschia marmorata* (Jaeger, 1833	*	*	*
11	*Bohadschia argus* (Jaeger, 1833)		*	*
12	*Bohadschia graeffei* (Semper, 1868)	*	*	*
	Order- Dendrochirotida			
	Family-Cucumariidae			
13	*Stolus buccalis* (Stimpson, 1855)		*	
	Family: Phyllophoridae			
14	*Phyllophorus parvipedes* (H.L.Clark, 1938)	*		
	Family- Stichopodidae			
15	*Thelenota ananas*(Jaeger, 1833)		*	*
16	*Stichopus chloronatus* (Brandt, 1835)	*	*	*
17	*Stichopus variegatus* (Semper, 1868)	*		*
18	*Stichopus vastus* (Sluiter, 1887)		*	
	Order- Apodida			
	Family- Synaptidae			
19	*Synapta maculata* (Chamisso and Eysenhardt, 1821)		*	*
20	*Euapta godreffroyi*(Semper, 1868) A	*	*	
	Class- Asteroidea			
	Order-Valvatida			
	Family- Asterinidae			
21	*Asterina sarasini* (de Loriol, 1897)	*	*	
	Family- Oreasteridae			
22	*Culcita novaguineae* (Muller and Troschel, 1842)	*	*	*
	Family- Acanthasteridae			
23	*Acanthaster planci* (Linneaus, 1758)	*	*	*
	Family- Ophidiasteridae			

24	*Fromia indica* (Perrier, 1869)	*	*	
25	*Linckia guildingi* (Gray, 1840)		*	*
26	*Linckia laevigata* (Linneaus, 1758)	*	*	*
27	*Nardoa galatheae* (Lutken, 1865)	*		
	Class- Echinoidea			
	Order- Diadematoida			
	Family- Diadematidae			
28	*Diadema setosum* (Leske, 1778)	*	*	*
29	*Diadema savignyi* (Michelin, 1845)		*	
30	*Echinothrix calamaris*(Pallas, 1774)	*	*	*
31	*Echinothrix diadema* (Linneaus, 1758)		*	*
	Order- Echinoida			
	Family- Echinometridae			
32	*Echinometra oblonga* (de Blainville, 1869)	*		*
33	*Echinometra mathaei* (de Blainville, 1825	*	*	*
34	*Heterocentrotus trigonarius* (Lamarck, 1816)	*		
	Order- Temnopleuroida			
	Family- Temnopleuridae			
35	*Temnopleurus alexendri*(Bell, 1884)		*	
36	*Mespilia globulus*(Linneaus, 1758)	*	*	*
37	*Microcyphus ceylanicus* (Mortensen, 1925)		*	*
38	*Salmacis bicolor* (L. Agassiz, 1841)	*		
39	*Tripneustes gratilia* (Linneaus, 1758)		*	*
	Order- Cidaroida			
	Family- Cidaridae			
40	*Prionocidaris verticillata* (Lamarck, 1816)	*		*
	Order: Clypeasteroida			
	Family: Clypeasteridae			
41	*Clypeaster humilis* (Leske, 1778)			*
	Order- Phymosomatoida			
	Family- Stomechinidae			
42	*Stomopneusts variolaris* (Lamarck, 1816)	*	*	
	Family: Laganidae			
43	*Laganum laganum* (Leske, 1778)	*	*	
44	*Laganum decagonale* (de Blainvillae, 1827)			*
	Order: Cidaroida			
	Family: Cidariidae			
45	*Phyllacanthus imperialis* (Lamarck, 1816)	*		*
	Class- Crinoidea			
	Order-Comatulida			
	Family- Comasteridae			
46	*Comanthus parvicirrus*(Muller, 1841)	*	*	*
47	*Comanthina nobilis*(P.H.Carpanter, 1884)		*	*
48	*Comaster multibrachiata*(P.H.Carpanter, 1888)	*	*	*
	Family- Mariametridae			
49	*Lamprometra palmata* (Muller, 1841)			*
	Class- Ophiuroidea			
	Order- Ophiurida			
	Family- ophiocomidae			
50	*Ophiocoma erinaceus* (Muller & Troschel, 1842)	*	*	*
51	*Ophiocoma dentata*(Muller & Troschel, 1842)		*	
52	*Ophiomastix annulosa*(Lamarck, 1816)	*	*	*
53	*Ophiarthrum pictum* (Muller & Troschel, 1841)		*	
	Family- Ophiodermatidae			
54	*Ophiarachna incrassata* (Lamarck, 1816)		*	*
	Family- Ophiotrichidae			
56	*Macrophiothrix propinqua*(Lyman, 1861)	*	*	
56	*Macrophiothrix longipeda*(Lamarck, 1816)	*	*	*
	Family: Ophiactidae			
57	*Ophiactis savignyi* (Muller & Troschel, 1841)	*	*	

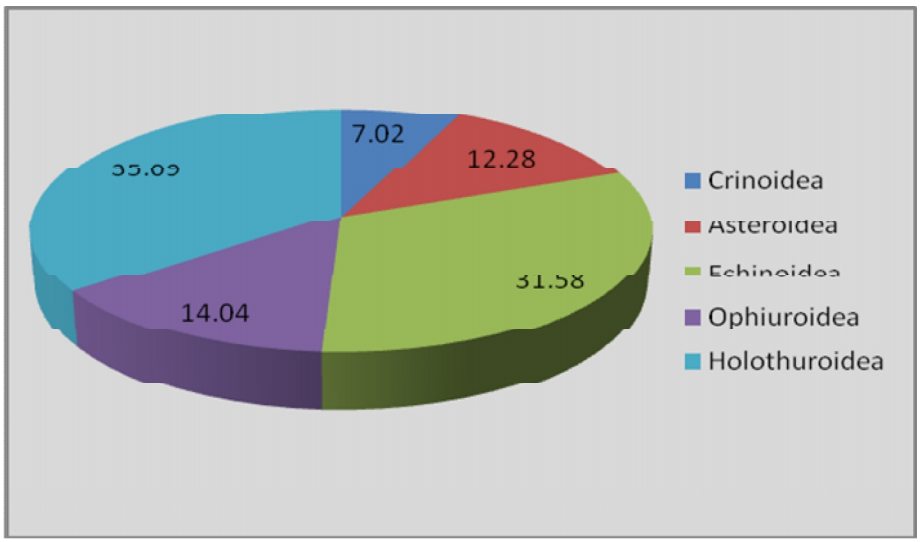

FIGURE1. Percentage of species composition of Echinoderms in Rutland Island

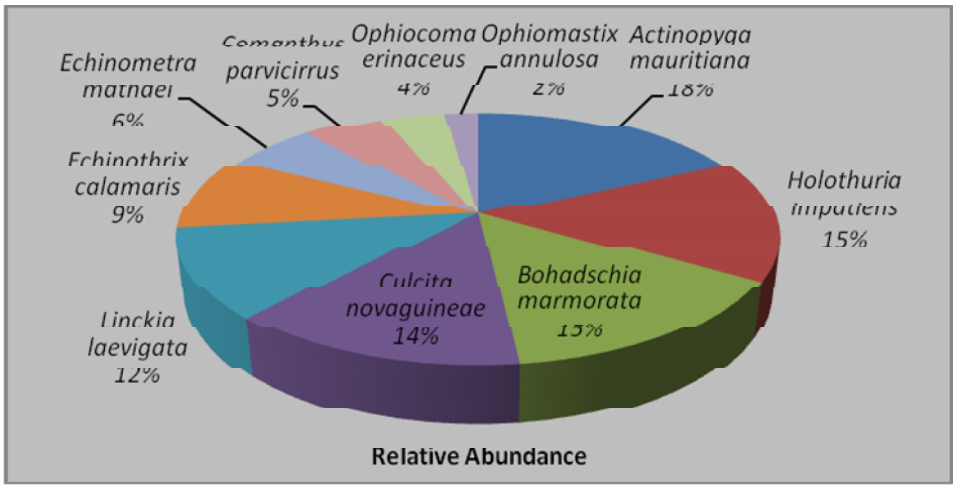

FIGURE 2. Relative Abundance of dominant species of echinoderms in Rutland Island

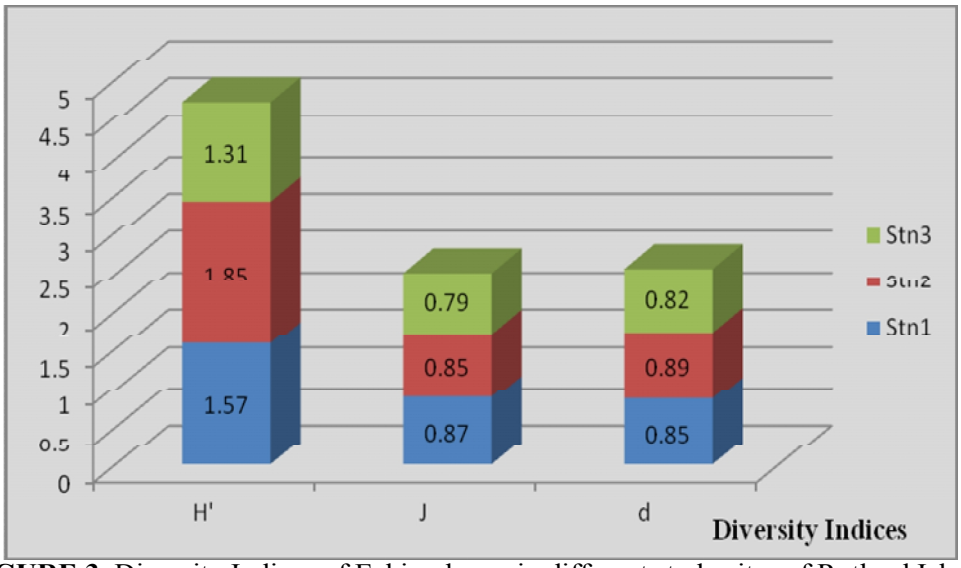

FIGURE 3. Diversity Indices of Echinoderms in different study sites of Rutland Island.

Out of five classes of echinoderms, Holothuroidea has the highest percentage of species composition in Rutland Island constituting 35.09% of echinoderms whereas Crinoidea, Asteroidea, Echinoidea and Ophiuroidea repsresents only 7.02%, 12.28%, 31.58% and 14.04% respectively (Fig.1). In addition, difficulty in preserving in a good condition seems to be another factor that leads to low percentage of identification of the collected material. A determination of the species diversity in the study areas revealed a comparative data that shows dominance of species is higher in Stn 2 than other two study sites of Rutland Island (Fig. 3). The species eveness index which represents maximum number of individuals in study sites shows higher value in Stn 1 than other two stations of Rutland Island (Fig. 3). Among the five classes of Echinoderms, Holothuroidea (20 species) and Echinoidea (18 species) is mostly distributed along the different study sites of Rutland Island (Table.1). The relative abundance (Fig. 2) of *Actinopyga mauritiana* (18%) was higher in Rutland Island followed by *Holothuria impatiens* (15%), *Bohadschia marmorata* (15%) and *Culcita noveguineae* (14%). The coastline of Rutland Island provides varied habitats such as rocks, sand, mud, corals and mangroves that have encouraged a rich settlement of echinoderms in the coastal and offshore habitats. Of the several group of biota inhabiting the reef ecosystem of this Island echinoderms are important because of their size, numbers, living habits and effect on coral cover. Echinoderm diversity, as observed in this study (57), is about 13.4% of the total diversity of echinoderms (425) in Andaman and Nicobar Island (Sastry, 2005).

Among the crinoids, *Comanthus parvicirrus* and *Comaster multibrachiata* are very common in shallow water and found in the dead branches and bases of corals. During daytime crinoids are cryptic. At night they lay perched on vertical surface to feed on the floating microorganisms filtered by pinnules of spread out arms. The feeding on microorganisms does not affect the corals in view of their abundance but it helps corals by trapping the silt in mucus secreted for feeding (Sastry, 2002). Among the Asteroids, such as *Culcita noveguineae, Linckia guildingi, Linckia laevigata* and *Fromia monilis* are commonly distributed in Rutland Island. The inhabitants of hard substratum take shelter under dead coral bases and massive corals or in the crevices conglomerates. Even the large sized *Acanthaster planci*, the crown-of-thorns sea star lies hidden under boulders and massive colonies in the vicinity of live corals. The Ophiuroids family Ophiocomidae, Ophiodermatidae, Ophiotrichidae and ophiactidae only represents 4 species, 1 species, 1species and 1 species respectively. The species such as *Ophiocoma erinaceus, Ophiomastix annulosa* are common undersurfaces and in crevices during low tide periods. The echinoids represent 8 families and 18 species of which Diadematidae contribute 4 species. The diadematids, *Diadema setosum* and *Diadema savignyi* hide under coral bases or in hollows of massive corals extending out their long needle like spines. Holothuroids which has the maximum representation among all echinoderms with 20 species are the most dominant group found in different sites of South Andaman. Holothurians inhabit the protected places of hard substrata provided by the coral reefs and the soft substrata among them and adjoining vicinities. Holothuroids do not feed on live corals or degrade the dead pieces entering the gut (Sastry, 2002). Through burrowing and feeding of the substratum they disturb the natural stratification of the sediment and thus act as substrata re-workers.

At earlier, several workers, mainly Clark and Rowe (1971) for Indi-West pacific shallow water species and James (1986b) for the Indian species gave detailed and comparative account on the abundance and distribution of Indian echinoderms in the indo-West Pacific region and neighboring areas of India. The author is of the opinion that those which at present appear to be restricted to Andaman Islands are likely to be revealed, through intensive search, to occur on the coast of Indian subcontinent including Lakshadweep, as has been found to be the case with many species and also along the coast of Myanmar including the Mergui Archipelago. As such there appear to be no element peculiar or restricted to the Andaman and Nicobar Islands though the fauna is the richest compared to any of the other Indian localities.

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