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Report on Eleven Newly Recorded Scleractinian Corals to Indian Waters from Andaman and Nicobar Islands

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Abstract: The marine biodiversity of Andaman and Nicobar Islands represents pronounced status of Scleractinian corals with enchanting and enriched number of species. The scleractinians contribute an extensive baseline for harboring most of the faunal communities to adhere the entire marine ecosystem. Identification of eleven species of hermatypic corals viz. *Acropora rosaria* (Dana, 1846), *Acropora acuminata* (Verrill, 1864), *Acropora meridiana* Nemenzo, 1971, *Acropora cervicornis* (Lamarck, 1816), *Acropora akajimensis* Veron, 1990, *Anacropora spinosa* Rehberg, 1892 and *Astreopora scabra* Lamberts, 1982 under Acroporidae family; *Favites stylifera* (Yabe and Sugiyama, 1937) and *Favia fragum* (Esper, 1797) under Faviidae family; *Stylophora wellsi* Scheer, 1964 under Pocillopridae family and *Porites mayeri* Vaughan, 1918 under Poritidae family was noted as new record to Indian waters from Andaman and Nicobar Islands. This paper deals with the taxonomical attributes of eleven species of scleractinian corals with their global distribution and IUCN status evaluation.

Key words: Scleractinian Corals · Hermatypic · New Record · Andaman and Nicobar Islands

INTRODUCTION

Coral reefs are the architectural base of most diverse natural ecosystems in the marine world for supporting and nourishing valuable ecosystems and its productivity of goods like fish, shells and other marine products and services such as fisheries habitat and tourism. The occurrence of corals and its intrinsic properties for the sustainable aggregation of a wide number of other associated faunal communities draws the significance of biodiversity value as well as scientific and educational value. The major functional agenda maintain by the coral reefs is the natural protection against wave erosion as well as services of coastal population [1]. Coral reefs are well known as the planet's major and ancient living biological creatures [2]. The tropical regions provide the best physiological environment for the better sustainability of scleractinian corals through the close and physical association of photosynthetic symbionts or zooxanthalle [3]. Andaman and Nicobar Islands is the scattered mountain chain of oceanic islands which are distributed within about 900 km in long stretch, staring from Landfall Island to Great Nicobar Island with the coordinates of 6° to 14°N in latitudes and 92° to 94°E in longitudes which shares the Indo-Pacific tropical marine ecosystem [4]. Landfall Island is the northern most islands separated from Coco Island by Coco Channel while the southernmost Great Nicobar Island is surrounded by Great Channel [5, 6]. Coral reefs are distributed in world's ocean mainly in the form of three types of reefs such as Atoll, Fringing and Barrier reefs [7]. Andaman and Nicobar Islands surrounded by fringing reef of scleractinian corals in the coastal waters. A barrier reef also documented in the western coast of these islands with a length of about 329 km long [8]. This work deals with the taxonomic characterization of eleven newly recorded species from Andaman and Nicobar Islands with their global distribution.

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MATERIAL AND METHODS

A comprehensive study was carried out at the two distinct areas such as Landfall group of islands and Great Nicobar Island of Andaman and Nicobar Islands during April 2013 to December 2013 to document the scleractinian corals of those areas (Fig. 1). Primary observations were made by Manta tow study method of Done *et al*. [9] and Kenchinton [10] to select the reef cover and site of species investigation followed by employment of Self Contained Underwater Breathing Apparatus (SCUBA) diving. Digitization of individual species was made by underwater camera (Canon Power shot G15). Samplings of small portion of colonies were also made to study the corallite structures and morphological features under stereo zoom microscope (Leica, M 205A).Species individual photos were identified in conjunction with Veron [7], Veron and Pichon [11], Veron and Pichon [12], Veron and Pichon [13], Veron *et al.* [14], Veron and Wallace [15] and Wallace [16]. On completion of detailed taxonomical characters, the specimens were registered in National Zoological Collections and deposited at Zoological Survey of India, Port Blair.

RESULTS

Eleven species of scleractinians were recorded as new to Indian waters from Andaman and Nicobar Islands. The details of the recorded species are given below

Systematics:
Order: SCLERACTINIA Bourne, 1900
Family: ACROPORIDAE Verrill, 1902
Genus: *Acropora* Oken, 1815

Acropora rosaria (Dana, 1846) Fig. 1
Material Examined: A small portion of colony was sampled from Landfall Island (Lat. 13°37.376'N and Long. 93°01.091'E) of North Andaman at the depth of 7m on 24.iv.2013 (Reg. No. ZSI/ANRC-8901).

Description: Colonies are usually cream and brown in colour with pink or blue coloured spots. The shapes of the colonies are upright bushes. It can be compared with cushion-like conformation. Secondary and tertiary sub-branches are available in main branch. Axial corallites are large and dome-shaped but not elongate. Radial corallites are bead or pocket-like. All corallites bears thick walls.

IUCN Red List Category and Criteria: Data Deficient, 2014.

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- Australia, British Indian Ocean Territory, Comoros, Fiji, Indonesia, Japan, Kenya, Kiribati, Madagascar, Malaysia, Marshall Islands, Mauritius, Mayotte, Micronesia, Federated States of Mozambique, Nauru, New Caledonia, Palau, Papua New Guinea, Philippines, Réunion, Seychelles, Singapore, Solomon Islands, Somalia, Taiwan, Province of China, Tanzania, United Republic of Thailand, Tuvalu, Vanuatu and Viet Nam.

Acropora acuminata (Verrill, 1864) Fig. 2
Material Examined: A small portion of colony was sampled from Landfall Island (Lat. 13°39.721'N and Long. 93°01.905'E) of North Andaman at the depth of 10m on 09.viii.2012 (Reg. No. ZSI/ANRC-9619).

Description: Colonies are blue or brown and are composed of fused horizontal branches. The shapes of the colonies are like small tables. Branches are with upturned ends which taper to a point. Corallites on horizontal branches are mostly immersed and are with two sizes at upright branches. The larger corallites are tubular, with sharp edges.

IUCN Red List Category and Criteria: Vulnerable, 2014.

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- Australia, Guam, Indonesia, Japan, Kiribati, Madagascar, Marshall Islands, Papua New Guinea, Philippines, Pitcairn Island, Taiwan, Province of China, Thailand, Vanuatu and Viet Nam.

Acropora meridiana Nemenzo, 1971 Fig. 3
Material Examined: A small portion of colony was sampled from Landfall Island (Lat. 13°39.721'N and Long. 93°01.905'E) of North Andaman at the depth of 8m on 09.viii.2012 (Reg. No. ZSI/ANRC-9624).

Description: Colonies are grey in colour, sometimes it can be seen as in tan. Colonies are irregular in shape. Branches are twisted in form. Branchlets are uncommon. The structures of axial corallites are tubular. The incipient axial corallites are irregular. Radial corallites are irregular and immersed to tubular, giving branch surfaces a rough appearance.

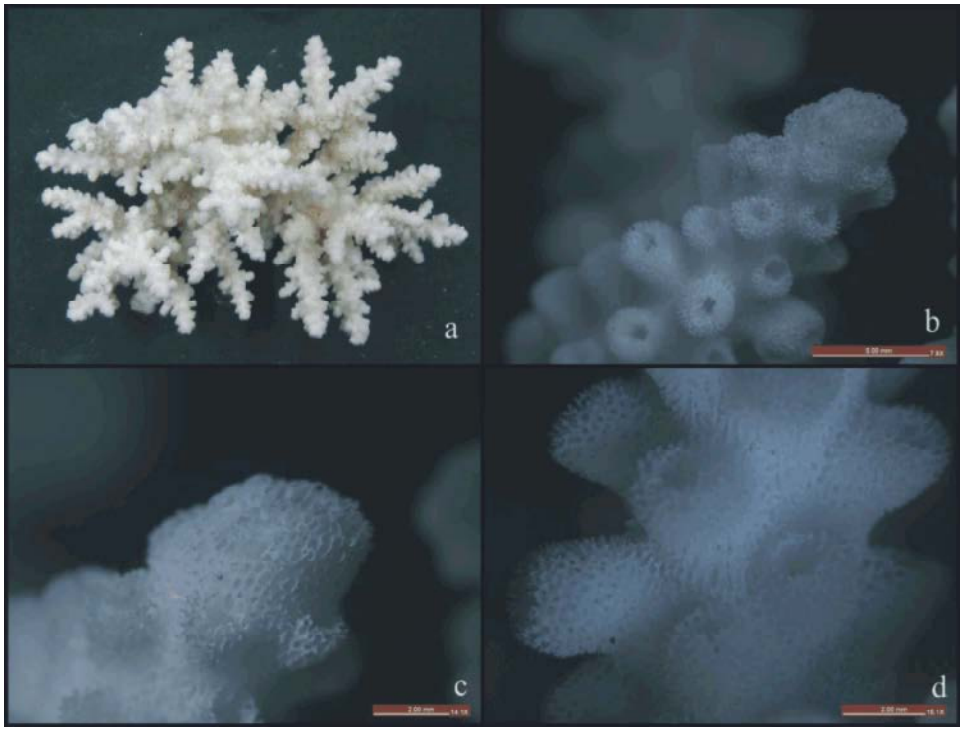

Fig. 1: *Acropora rosaria* (Dana, 1846)
a- Portion of colony; b- Axial corallite; c- Axial corallite; d- Arrangement of corallites

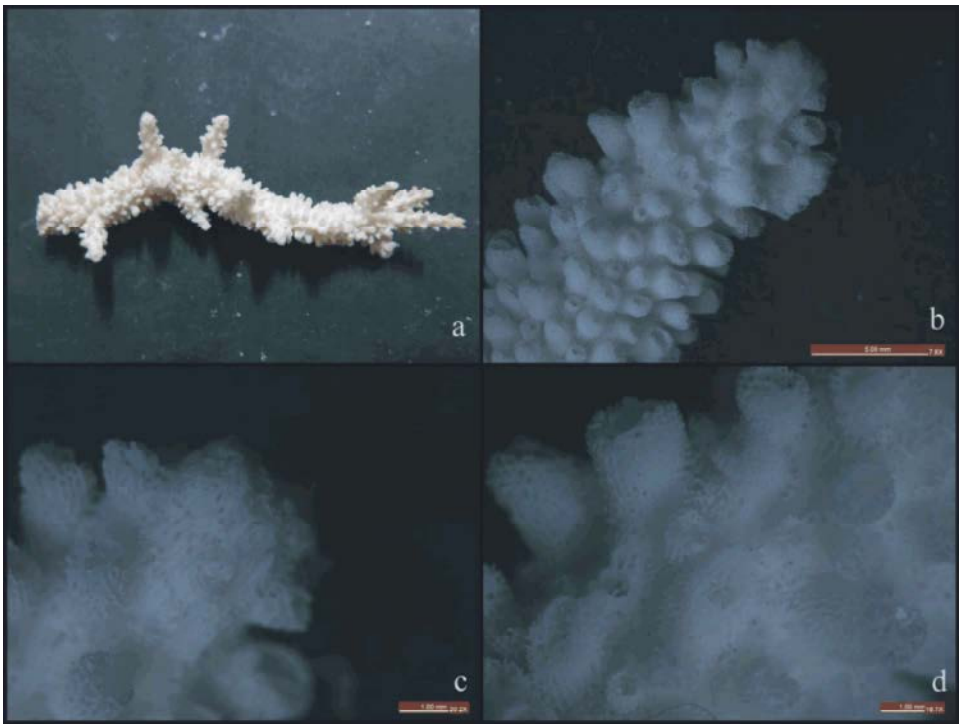

Fig. 2: *Acropora acuminata* (Verrill, 1864)
a- Portion of colony; b- Axial corallite; c- Axial corallite; d- Arrangement of corallites

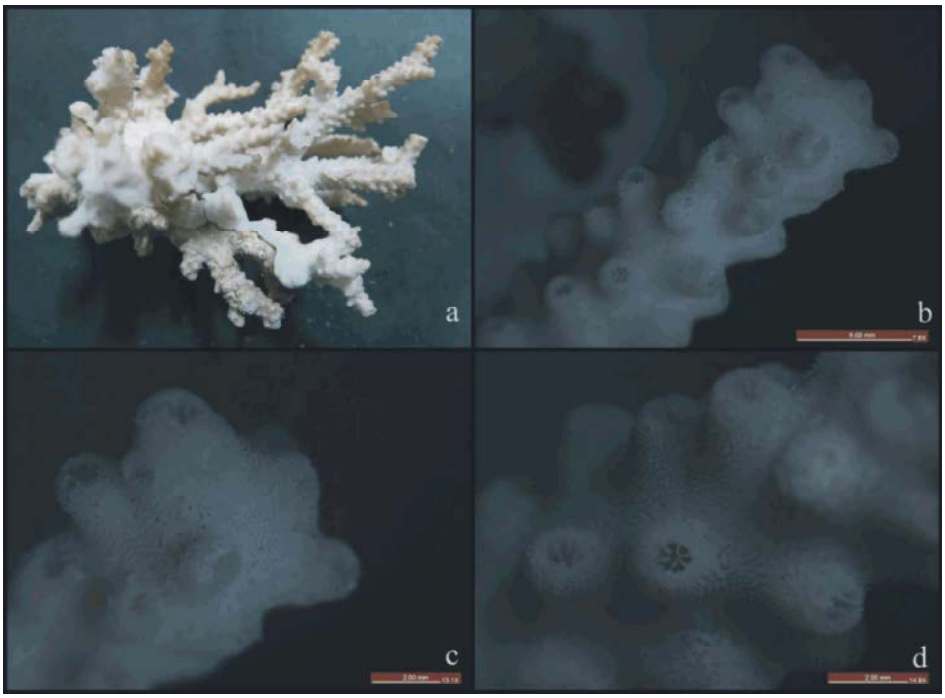

Fig. 3: *Acropora meridian* Nemenzo, 1971
a- Portion of colony; b- Axial corallite; c- Axial corallite; d- Arrangement of corallites

Fig. 4: *Acroporacervicornis* (Lamarck, 1816)

IUCN Red List Category and Criteria: Data Deficient, 2014.

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- Australia, Indonesia, Malaysia, Papua New Guinea, Philippines, Singapore, Solomon Islands and Thailand.

Acropora cervicornis (Lamarck, 1816) Fig. 4

Material Examined: Two small colonies of the said species was observed at Turtle Island (Lat. 13˚18.160'N and Long. 93˚04.268'E) of North Andaman at the depth of 12m and 15m on 19.xii.2013.

Description: Colonies are brown or tan in colour. The tips of the axial corallites are white to cream colour. Colonies are arborescent, composed of cylindrical branches which subdivide infrequently. Corallites are tubular; axial corallites are distinctive.

IUCN Red List Category and Criteria: Critically Endangered, 2014.

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- Anguilla, Antigua and Barbuda, Bahamas, Barbados, Belize, Cayman Islands, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Grenada, Guadeloupe, Haiti, Honduras, Jamaica, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Saint Barthélemy, Saint Kitts and Nevis, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Trinidad and Tobago, Turks and Caicos Islands, United States, United States Minor Outlying Islands, Venezuela and Bolivarian Republic of Virgin Islands.

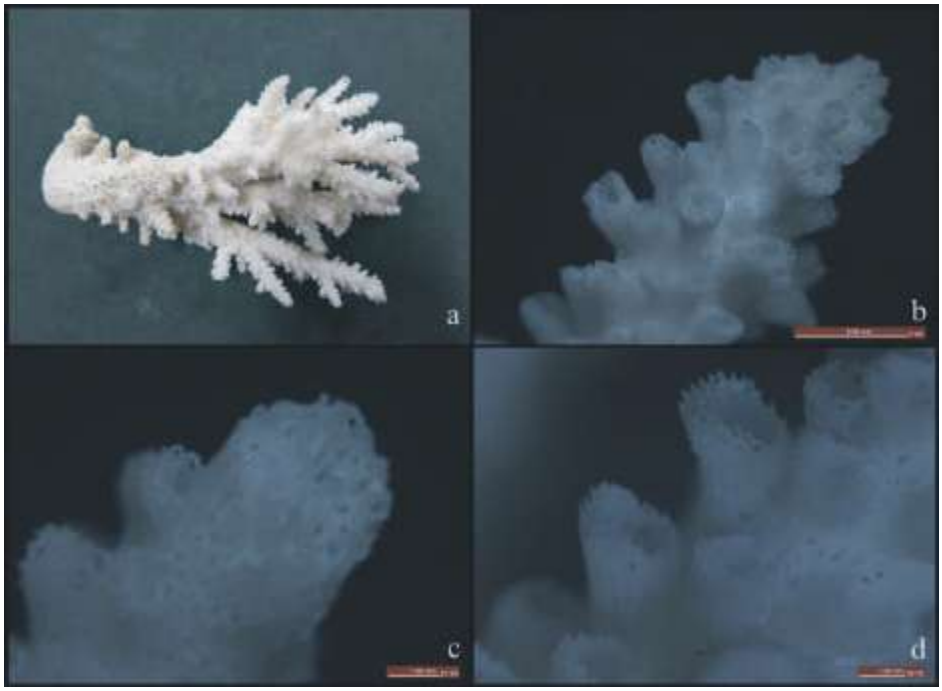

Fig. 5: *Acropora akajimensis* Veron, 1990
a- Portion of colony; b- Axial corallite; c- Axial corallite; d- Arrangement of corallites

Acropora akajimensis Veron, 1990 Fig. 5
Material Examined: Three small colonies of the said species was observed at Durgapur (Lat. 13°16.111'N and Long. 93°02.420'E) of Diglipur, North Andaman at the depth of 4m on 27.iv.2013 (Reg. No. ZSI/ANRC-10183).

Description: Colonies are brown or yellow in colour, sometimes it can be seen as blue in colour. Colonies are with of dense thickets of prostrate tapered branches which are curved and occasionally fuse. Sub-branches are formed at frequent intervals and branch acutely. Axial corallites are reasonably exsert. Incipient axial corallites cover the upper surface of horizontal branches. Radial corallites are of two sizes on main branches. On sub-branches they are exsert and tubular, with fine fluted margins giving colonies a spiky surface.

IUCN Red List Category and Criteria: Data Deficient, 2014.

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- Indonesia, Japan, New Caledonia, Philippines and Taiwan.

Genus *Anacropora* Ridley, 1884

Anacropora spinosa Rehberg, 1892 Fig. 6
Material Examined: A small portion of colony was sampled from B' Quarry, Great Nicobar Island (Lat. 06°59.873'N and Long. 93°56.773'E) of Nicobar at the depth of 12m on 23.ix.2013 (Reg. No. ZSI/ANRC-9647).

Description: Entire colony is pale brown coloured with occasional white tip. Branches are extremely compact, contorted, less than 10 millimeters thick and tapering to a point. Spines are projected towards the underside of corallites. Corallites are elongate, crowded, irregular and are usually not strongly tapered.

IUCN Red List Category and Criteria: Endangered, 2014.

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- Guam, Indonesia, Japan, Malaysia, Palau and Philippines.

Genus: *Astreopora*de Blainville, 1830
Astreopora scabra Lamberts, 1982 Fig. 7
Material Examined: A small portion of colony was sampled from Trilby Island (Lat. 13°24.860'N and Long. 93°04.117'E) of North Andaman at the depth of 11m on 25.iv.2013 (Reg. No. ZSI/ANRC-8804).

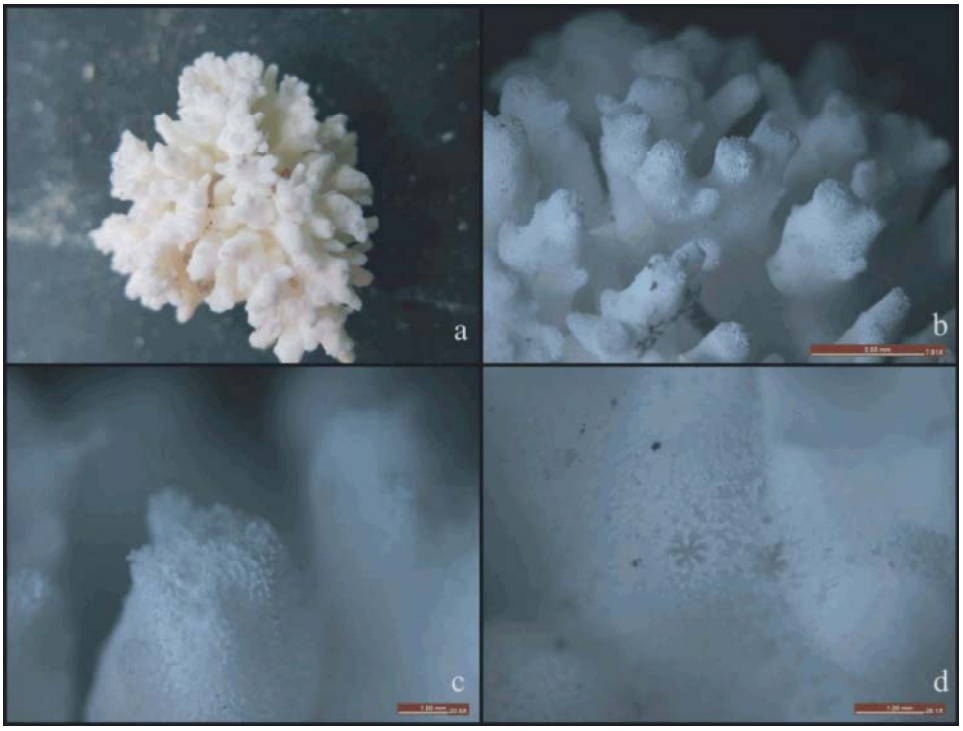

Fig. 6: *Anacropora spinosa* Rehberg, 1892
a- Portion of colony; b- Axial corallite; c- Axial corallite; d- Arrangement of corallites

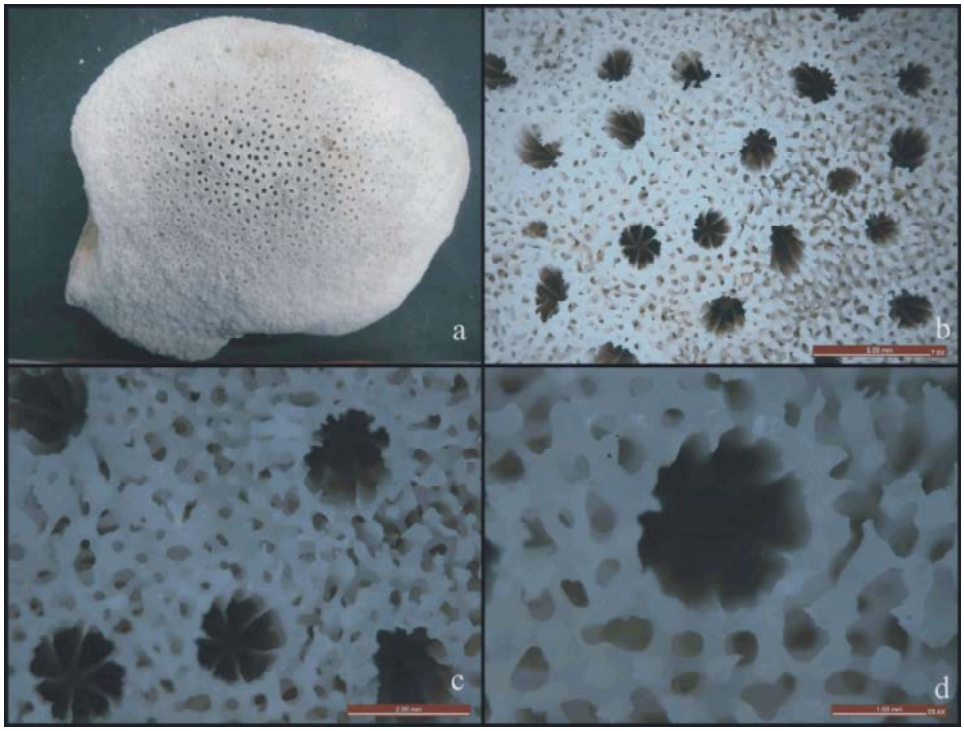

Fig. 7: *Astreoporas cabra* Lamberts, 1982
a- Portion of colony; b- Corallites; c- Corallite and coensteum; d- Corallite

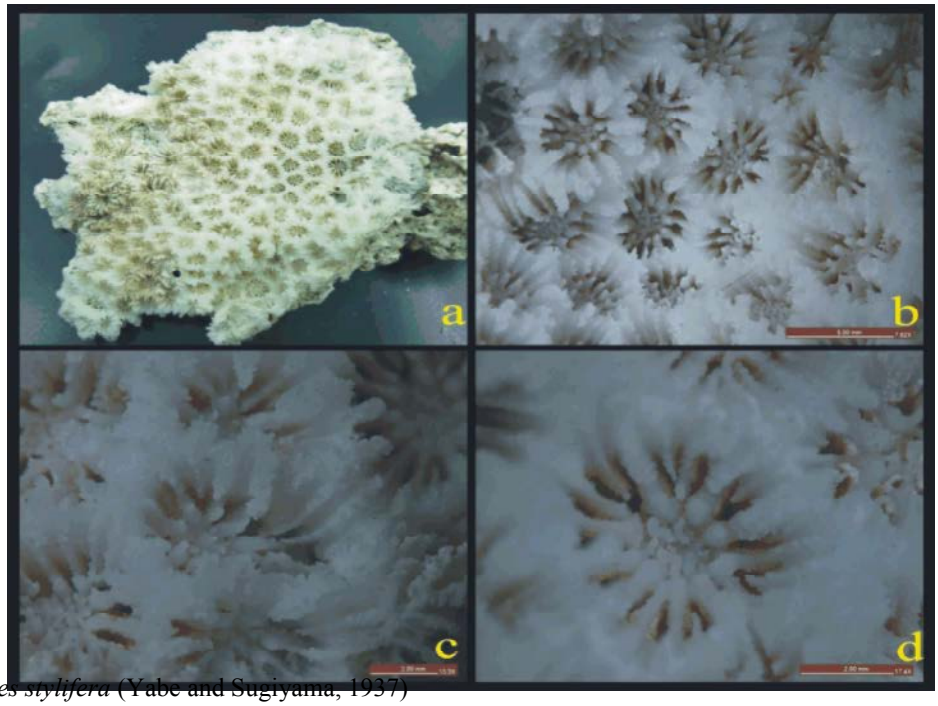

Fig. 8: *Favites stylifera* (Yabe and Sugiyama, 1937)
a- Portion of colony; b- Corallites; c- Septal arrangement; d- Septal dentition

Description: The colonies are brown in colour with hemispherical structural confirmation. Corallites are conical and large, with well developed septa with coarse coenosteum. The papillae are dense covering the ridges.

IUCN Red List Category and Criteria: Least Concern, 2014.

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- American Samoa, Australia, Fiji, Indonesia, Japan, Kiribati, Micronesia, Federated States of Niue, Northern Mariana Islands, Palau, Papua New Guinea, Samoa, Tokelau, Tonga, Tuvalu, United States Minor Outlying Islands, Wallis and Futuna.

Family: FAVIIDAE Gregory, 1900
Genus: *Favites* Link, 1807
Favites stylifera (Yabe and Sugiyama, 1937) Fig. 8
Material Examined: A small portion of colony was sampled from Trilby Island (Lat. 13°24.860'N and Long. 93°04.117'E) of North Andaman at the depth of 6m on 25.iv.2013 (Reg. No. ZSI/ANRC-8781).

Description: Colonies are encrusting to submassive in pale brown coloured structure. Sometime green coloured oral discs are also seen. The shape is irregular. Highly contorted few septa are present with irregular dentition. The paliform crown is weakly developed.

IUCN Red List Category and Criteria: Near Threatened, 2014.

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- Australia, Indonesia, Japan, Kenya, Malaysia, Mozambique, Papua New Guinea, Philippines, Singapore, Solomon Islands, Somalia, Taiwan, Province of China, Tanzania and United Republic of Thailand.

Favia fragum (Esper, 1797) Fig. 9
Material Examined: A small portion of colony was sampled from Landfall Island (Lat. 13°16.595'N and Long. 93°01.202'E) of North Andaman at the depth of 9m on 15.xii.2013 (Reg. No. ZSI/ANRC-9979).

Description: Colonies are small and hemispherical to encrusting with tan to light orange colouartion. Corallites can be seen as immersed, plocoid, subphaceloid, submeandroid and circular shaped with one mouth. Sometimes it can be seen as elongated with several mouths. Corallites are seldom more than 5 millimeters across with neatly rounded walls. Septo-costae are exsert and evenly spaced.

IUCN Red List Category and Criteria: Least Concern, 2014.

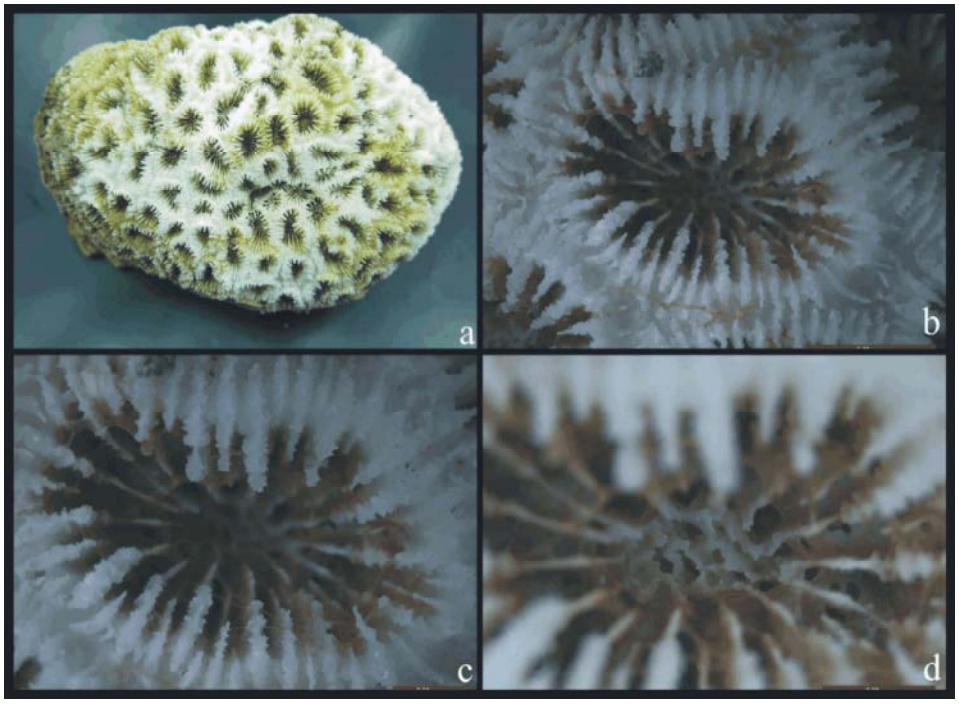

Fig. 9: *Favia fragum* (Esper, 1797)
a- Portion of colony; b- Corallites; c- Septal arrangement; d- Septal dentition

Fig. 10: *Stylophora wellsi* Scheer, 1964

Fig. 11: *Porites mayeri* Vaughan, 1918

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- Anguilla, Antigua and Barbuda, Bahamas, Barbados, Belize, Benin, Bermuda, Brazil, Cameroon, Cape Verde, Cayman Islands, Colombia, Costa Rica, Côte d'Ivoire, Cuba, Dominica, Dominican Republic, Equatorial Guinea, Gabon, Gambia, Ghana, Grenada, Guadeloupe, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Jamaica, Liberia, Mauritania, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Nigeria, Panama, Saint Barthélemy, Saint Kitts and Nevis, Saint Lucia, Saint Martin (French part), Saint Vincent and the Grenadines, Sao Tomé and Principe, Senegal, Sierra Leone, Togo, Trinidad and Tobago, Turks and Caicos Islands, United States, United States Minor Outlying Islands and Venezuela.

Family: POCILLOPORIDAE Gray, 1842
Genus: *Stylophora* Schweigger, 1819
Stylophora wellsi Scheer, 1964 Fig. 10
Material Examined: Seven colonies were observed at Trilby Island (Lat. 13°24.860'N and Long. 93°04.117'E) of North Andaman at the depth of 2-6 on 25.iv.2013.

Description: Colonies are cream coloured with clumps of short, thick, knobby branches of blunt ends. Corallites can be seen as crowded and immersed to conical, with hoods often facing different directions. They have small style-like columellae, six primary septa and rudimentary secondary septa. The coenosteum is covered by coarse spinules.

IUCN Red List Category and Criteria: Near Threatened, 2014.

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- Djibouti, Egypt, Eritrea, Israel, Jordan, Madagascar, Oman, Saudi Arabia, Somalia, Sudan and Yemen.

Family: PORITIDAE Gray, 1842
Genus: *Porites* Link, 1807
Porites mayeri Vaughan, 1918 Fig. 11

Material Examined: Sixteen colonies were observed at Trilby Island (Lat. 13°24.860'N and Long. 93°04.117'E) of North Andaman at the depth of 3-12 m on 25.iv.2013.

Description: Colonies are usually cream or brown in colour, sometimes it can be seen as purple or blue coloured. Colonies are massive with smooth and even surface. Sometimes it can be seen as irregular and humped or lobate surface. The corallites walls have vertical sides and rounded tops. Septa do not reach at the top of the walls. Septa denticles are absent or one per septum is situated against the wall.

IUCN Red List Category and Criteria: Least Concern, 2014.

Distribution: *India*- Andaman and Nicobar Islands; *Elsewhere*- Australia, Bahrain, Cambodia, Comoros, Djibouti, Egypt, Eritrea, Indonesia, Iran, Islamic Republic of Iraq, Israel, Japan, Jordan, Kenya, Kuwait, Madagascar, Malaysia, Mayotte, Mozambique, Oman, Pakistan, Papua New Guinea, Philippines, Qatar, Saudi Arabia, Seychelles, Singapore, Somalia, Sudan, Taiwan, Province of China, Tanzania, United Republic of Thailand, United Arab Emirates, Viet Nam and Yemen.

DISCUSSION

Coral reefs are very diverse and complex inter-connected ecosystems of shallow tropical marine waters since the 100 million years ago to till date [17]. About 500 million people depend directly and indirectly on coral reefs for their livelihoods, food and other resources [18]. Coral reefs can be encountered at 0.02% of the total area of oceans but supports 25% of all marine creatures [19]. Studies on scleractinian corals were carried out in India during the period of 1900 by Alcock on some species of corals from Andaman and Nicobar Islands and Lakshadweep [20]. Andaman and Nicobar Islands is one of the four major reef areas of India with enormous scope of scleractinian diversity which can be justified with the addition of several new records of scleractinian corals during last 5 years with the active exploration of Zoological Survey of India by increasing the species database in a healthy number of species content. Two new species of scleractinian corals such as *Ctenactis triangularis* and *Favites monticularis* were also described from Andaman and Nicobar Islands [21, 22]. Addition on these eleven species of scleractinian corals will increase the scleractinian database up to 577 species from these islands as well as will also ensure the importance of marine biodiversity of Andaman and Nicobar Islands and will be indicator of global interest for taking care about the scleractinian corals by proper implicative measures. Further extensive scleractinian explorations may bring out more number of species from these pristine islands.

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