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Status survey of scleractinian corals at Long Island and adjoining areas of Middle Andaman Archipelago

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Long Island and its adjoining islands of Middle Andaman archipelago are mostly covered by mangrove habitat while the eastern coastal parts of the islands are with scattered fringing reef in the continental shelf region. A total of 253 species of scleractinian corals were recorded from four islands such as Long, Guitar, Round and North Passage with the average species diversity of 3.18 and live cover of 25.28 %. Globally recorded threatened 42 species of scleractinians were recorded from these study areas. The regional occurrence of the species revealed that 32.41 % scleractinian were common and 24.90 % corals were rare. Long Island harbors 29.42 % of scleractinian coral species of Andaman and Nicobar Islands with optimum diversity (H'=4.35) especially in the eastern and south-eastern coast. The present paper focused on the status survey of scleractinian corals from these areas to monitor the health status in Middle Andaman region of Andaman and Nicobar Islands.

[Keywords: Scleractinian corals; Species diversity; Live cover; Middle Andaman]

Introduction

Coral reefs are predominant in shallow water habitat and cover 0.09 % of the total area of the world's ocean with 2,84,300 sq. km. up to the depth of 75 m[1]. The distributional pattern of coral reefs represents around 109 countries in tropical areas, between the Tropics of Cancer and Capricorn[2]. The association of other ecosystem along with the coral reef extends the cover about 9,20,000 sq. km. with the gigantic cover of around 91% in Indo-Pacific[2,3]. The coral reefs are one of the most valuable biodiversity due to its enormous services for the development partitioning. The biological, ecological, physical as well as sociological impact of coral reef ecosystem noteworthy across the globe and the diversity exceeds the rainforests[4,6]. Scleractinian corals are the backbone of the reef ecosystem across the world's oceans. It is estimated that the total net benefit per year of the world's coral reefs is $29.8 billion while the reef ecosystem provides an estimated of $3,52,000/ha/yr. based on their values[7,8]. Andaman and Nicobar Islands represent the Indo-Pacific region of South Asia[9]. The biogenic habitat and environmental clues emphasizes mostly the fringing reefs around the continental shelf of Andaman and Nicobar Islands especially in the eastern coast[10-12]. Coral Reefs are most prevalent baseline animals for the construction of undersea ecological pyramids of Andaman Sea[13]. Andaman and Nicobar Islands harbor a total of 1,021.46 sq. km. of reef habitat within the reported 3,5000 sq. km. of continental shelf area[11,14]. This present study was done on the status of scleractinian corals of Long Island and its adjoining islands of Middle Andaman region.

Materials and methods

out at Long, Guitar, Round and North Passage Islands from January 2011 to August 2017 to record the scleractinian coral species by employing Self Contained Underwater Breathing Apparatus (SCUBA) dives (Figs. 1 and 2). Coordinates of the surveyed places were logged by hand held Global Positioning System, Model GARMIN 12 Channel GPS unit and GARMIN OREGON 550. Initially studies were carried out by "Manta tow" survey method followed by 20 m long Line Intercept Transects (LITs) covering various zones in shallow region- up to 6 m, mid region- 6-15 m and deeper region of reef flat-16-30 m[15].

ACFOR scale (where A = species availability in 30% or more of quadrant squares; C = species availability in 20-29 % of quadrant squares; F = species availability in 10-19 % of quadrant squares; O = species availability in 5-9 % of quadrant squares and R= species availability in 1-4 % of quadrant squares) was also applied to assess the status of corals. The undersea species recording was made for detailed identification with the help Sony - Cyber shot, Model-T900, marine pack, 12.1 megapixels, Sony - Cyber shot, Model-TX1, marine pack, 10.2 megapixels and Canon Power Shot G15 respectively. Identification of the recorded species was made in conjunction[16,21,22,24,25,26,27,28]. The data collected through study were analyzed by Shannon-Wiener Index (H')[29], Simpson's Density Index[30] and Sørensen Index[31] to assess the species diversity and similarities.

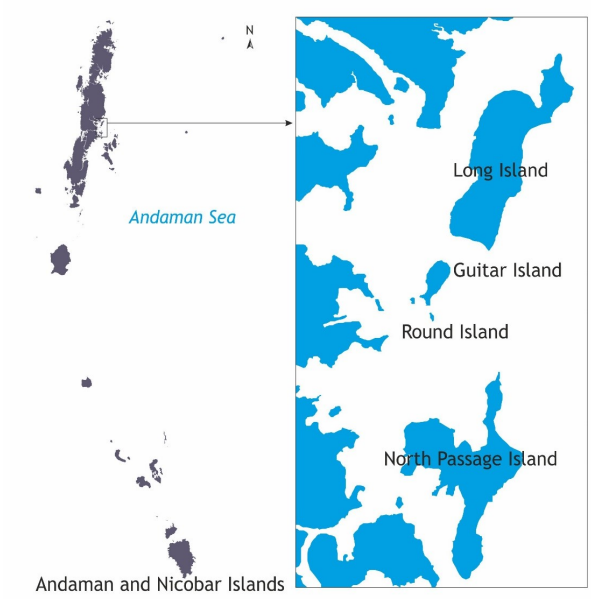

Fig. 1 — Map showing the study areas at Middle Andaman

Results & Discussion

A total of 253 species of scleractinian corals under 63 genera and 16 families were recorded from the four study areas of Middle Andaman region of Andaman and Nicobar Islands (Table 1). Among them, the maximum 173 species under 51 genera and 14 families were recorded from Long Island alone while only 51 species under 25 genera and 13 families were reported from Guitar Island.

The family Faviidae was dominant with a total of 58 species out of the 16 families reported from these four islands, of which 43 species of faviid corals were reported from Long Island. Besides, 35 species of acroporids from Long Island, 33 species of fungiids from Round Island and 15 species of mussid corals were also been reported (Fig. 3). The monospecific coral i.e. *Trachyphyllia geoffroyi* under the family Trachyphylliidae was common to all the four study areas whereas, *Stylocoeniella guentheri* belonging to the family Astrocoeniidae was recorded from Long Island and North Passage Island.

The global status of all the recorded species were assessed on the basis of IUCN Red list category and criteria (IUCN, 2017). It was found that 113 species were under Least Concern (LC) and 3 species were under Endangered (EN) category (Fig. 4).

Fig. 2 — Aerial view of the study areas at Middle Andaman

Table 1 — Species content of the surveyed areas in Middle Andaman

Sl. No.	Taxa	Long Island	Guitar Island	Round Island	North Passage Island	IUCN, 2016	Regional Occurrence
	Family ACROPORIDAE Verrill, 1902						
	Genus *Acropora* Oken, 1815						
1.	*Acropora austera* (Dana,1846)	•				NT	F
2.	*Acropora abrotanoides* (Lamarck, 1816)	•				LC	C
3.	*Acropora sekiseiensis* Veron, 1990	•				DD	R
4.	*Acropora cerealis* (Dana, 1846)	•			•	LC	C
5.	*Acropora cophodactyla* (Brook, 1892)	•				DD	R
6.	*Acropora cytherea* (Dana, 1846)				•	LC	C
7.	*Acropora forskali* (Ehrenberg,1834)	•				DD	O
8.	*Acropora muricata* (Linnaeus, 1758)	•	•	•	•	NT	A
9.	*Acropora horrida* (Dana, 1846)	•				DD	C
10.	*Acropora plantaginea* (Lamark, 1816)			•		DD	C
11.	*Acropora granulosa* (Milne Edwards and Haime, 1860)	•	•		•	NT	R
12.	*Acropora hoeksemai* Wallace, 1997	•				VU	R
13.	*Acropora hyacinthus* (Dana, 1846)				•	NT	A
14.	*Acropora insignis* Nemenzo, 1967				•	DD	R
15.	*Acropora kosurini* Wallace, 1994	•				VU	R
16.	*Acropora loripes* (Brook, 1892)	•				NT	R
17.	*Acropora microphthalma* (Verrill, 1859)	•		•	•	LC	C
18.	*Acropora nasuta* (Dana, 1846)	•			•	NT	A
19.	*Acropora proximalis* Veron, 2000	•				DD	C
20.	*Acropora robusta* (Dana 1846)	•				LC	C
21.	*Acropora polystoma* (Brook, 1891)	•				VU	C
22.	*Acropora selago* (Studer, 1878)	•				NT	O
23.	*Acropora variolosa* (Klunzinger, 1879)	•				LC	C
24.	*Acropora vaughani* Wells, 1954	•				VU	C
25.	*Acropora aspera* (Dana, 1846)			•		VU	C
26.	*Acropora clathrata* (Brook, 1891)	•				LC	R
27.	*Acropora carduus* (Dana, 1846)			•		NT	R
28.	*Acropora divaricata* (Dana, 1846)	•	•		•	NT	A
29.	*Acropora florida* (Dana, 1846)	•		•		NT	F
30.	*Acropora massawensis* (Marenzelles, 1906)	•				DD	O
31.	*Acropora torresiana* (Veron, 2000)	•				DD	R
32.	*Acropora rosaria* (Dana, 1846)	•			•	DD	R
	Genus *Isopora* Studer, 1878						
33.	*Isopora cuneata* (Dana, 1846)				•	NE	C
34.	*Isopora palifera* (Lamarck, 1816)				•	NE	A
	Genus *Astreopora* de Blainville, 1830						
35.	*Astreopora ocellata* Bernard, 1896	•		•		LC	O
36.	*Astreopora myriophthalma* (Lamarck,1816)	•		•	•	LC	A
37.	*Astreopora suggesta* Wells,1954	•			•	LC	F
38.	*Astreopora randalli* Lamberts, 1980	•				LC	R
	Genus *Montipora* de Blainville, 1830						
39.	*Montipora aequituberculata* Barnard, 1897	•				LC	A
40.	*Montipora hemispherica* (Veron, 2000)	•				DD	C
41.	*Montipora samarensis* Nemenzo, 1967			•	•	VU	R
42.	*Montipora grisea* Bernard, 1897	•				LC	C
43.	*Montipora meandrina* (Ehrenberg,1834)	•				VU	R
44.	*Montipora peltiformis* Benard, 1897			•	•	NT	C
45.	*Montipora turtlensis* Veron and Pichon, 1984				•	VU	R
46.	*Montipora taiwanensis* Veron, 2000	•				DD	R
47.	*Montipora vietnamensis* Veron, 2000			•		VU	R
	Family AGARICIIDAE Gray, 1847						
	Genus *Gardineroseris* Scheer and Pillai, 1974						

(*Contd*.)

Table 1 — Species content of the surveyed areas in Middle Andaman (*Contd*.)

Sl. No.	Taxa	Long Island	Guitar Island	Round Island	North Passage Island	IUCN, 2016	Regional Occurrence
48.	*Gardineroseris planulata* (Dana, 1846)	•				LC	C
	Genus *Leptoseris* Milne Edwards and Haime,1849						
49.	*Leptoseris incrustans* (Quelch,1886)				•	VU	C
50.	*Leptoseris mycetoseroides* Wells, 1954	•			•	LC	C
51.	*Leptoseris tubulifera* Vaughan, 1907	•	•	•		LC	R
52.	*Leptoseris papyracea* (Dana, 1846)			•		LC	C
53.	*Leptoseris scabra* Vaughan, 1907		•			LC	C
54.	*Leptoseris solida* (Quelch, 1866)	•				LC	R
55.	*Leptoseris striata* Fenner and Veron, 2000	•			•	NT	R
	Genus *Pachyseris* Milne Edwards and Haime, 1849						
56.	*Pachyseris gemmae* Nemenzo, 1955	•			•	NT	A
57.	*Pachyseris rugosa* (Lamarck,1801)	•				VU	F
58.	*Pachyseris speciosa* (Dana, 1846)	•	•	•		LC	C
	Genus *Pavona* Lamarck,1801						
59.	*Pavona bipartita* Nemenzo, 1980	•			•	VU	C
60.	*Pavona cactus* (Forskal, 1775)	•				VU	C
61.	*Pavona clavus* (Dana, 1846)				•	LC	R
62.	*Pavona decussata* (Dana, 1846)	•		•		VU	O
63.	*Pavona duerdeni* Vaughan, 1907	•			•	LC	A
64.	*Pavona explanulata* (Lamarck, 1816)	•		•	•	LC	C
65.	*Pavona gigantea* Verrill,1896	•				LC	O
66.	*Pavona varians* Verrill,1846	•	•	•	•	LC	A
67.	*Pavona venosa* (Ehrenberg, 1834)	•		•		VU	C
	Family ASTROCOENIIDAE Koby, 1890						
	Genus *Stylocoeniella* Yabe and Sugiyama, 1935						
68.	*Stylocoeniella guentheri* Basset-Smith 1890	•			•	LC	R
	Family DENDROPHYLLIIDAE Gray, 1847						
	Genus *Dendrophyllia* Grey, 1847						
69.	*Dendrophyllia robusta* (Bourne,1905)				•	NE	C
	Genus *Turbinaria* Oken, 1815						
70.	*Turbinaria stellulata* (Lamarck, 1816)	•		•		VU	C
71.	*Turbinaria radicalis* Bernard, 1896				•	NT	F
72.	*Turbinaria mesenterina* (Lamarck, 1816)			•		VU	C
73.	*Turbinaria peltata* (Esper, 1794)	•		•		VU	R
	Family EUPHYLLIDAE Veron, 2000						
	Genus *Euphyllia* Dana, 1846						
74.	*Euphyllia ancora* Veron and Pichon, 1979			•		VU	O
75.	*Euphyllia glabrescens* (Chamisso and Eyscenhardt, 1821)			•		NT	C
	Genus *Physogyra* Quelch, 1884						
76.	*Physogyra lichtensteini* (Milne Edwards and Haime, 1851)			•	•	VU	C
	Genus *Plerogyra* Milne Edwards and Haime, 1848						
77.	*Plerogyra sinuosa* (Dana, 1846)	•				NT	C
	Family FAVIIDAE Gregory, 1900						
	Genus *Caulastrea* Dana, 1846						
78.	*Caulastrea furcata* Dana, 1846			•		LC	O
79.	*Caulastrea curvata* Wijsman-Best, 1972			•		VU	R
	Genus *Cyphastrea* Milne Edwards and Haime, 1848						
80.	*Cyphastrea japonica* Yabe and Sugiyama,1932			•	•	LC	A
81.	*Cyphastrea chalcidicum* (Forskal, 1775)	•		•	•	LC	A
82.	*Cyphastrea microphthalma* (Lamarck, 1816)	•			•	LC	A
83.	*Cyphastrea serailia* (Forskal, 1775)	•			•	LC	R
	Genus *Diploastrea* Matthai, 1914						
84.	*Diploastrea heliopora* (Lamarck, 1816)	•		•	•	NT	A
	Genus *Echinopora* Lamarck, 1816						
85.	*Echniopora fruticulosa* (Ehrenberg,1834)			•		NT	A

(*Contd*.)

Table 1 — Species content of the surveyed areas in Middle Andaman (*Contd*.)

Sl. No.	Taxa	Long Island	Guitar Island	Round Island	North Passage Island	IUCN, 2016	Regional Occurrence
86.	*Echniopora gemmacea* Lamarck, 1816			•	•	LC	A
87.	*Echinopora hirsutissima* (Milne Edwards and Haime, 1849)	•				LC	R
88.	*Echinopora pacificus* Veron, 1990	•	•			NT	A
	Genus *Favia* Oken, 1815						
89.	*Favia favus* (Forskal, 1775)	•		•	•	LC	C
90.	*Favia lacuna* Veron,Turak and DeVantier, 2000			•	•	NT	R
91.	*Favia laxa* (Klunzinger, 1879)	•				NT	R
92.	*Favia matthaii* Vaughan, 1918	•				NT	A
93.	*Favia danae* Verrill, 1872	•		•	•	LC	A
94.	*Favia maxima* Veron and Pichon, 1977			•	•	NT	A
95.	*Favia lizardensis* Veron and Pichon, 1977	•		•	•	NT	C
96.	*Favia pallida* (Dana, 1846)	•			•	LC	A
97.	*Favia amicorum* (Milne Edwards and Haime,1850)	•	•	•		LC	F
98.	*Favia laddi* (Wells, 1954)	•				VU	O
99.	*Favia maritima* (Nemenzo, 1971)			•	•	NT	C
100.	*Favia speciosa* Dana, 1846	•		•	•	LC	C
101.	*Favia stelligera* (Dana, 1846)	•				NT	C
102.	*Favia truncatus* Veron, 2000	•				LC	A
	Genus *Favites* Link, 1807						
103.	*Favites bestae* (Veron, 2000)				•	NT	C
104.	*Favites acuticollis* (Ortmann,1889)	•		•		NT	C
105.	*Favites complanata* (Ehrenberg, 1834)	•			•	NT	A
106.	*Favites flexuosa* (Dana, 1846)	•				NT	C
107.	*Favites halicora* (Ehrenberg,1834)			•	•	NT	A
108.	*Favites micropentagona* Veron, 2000	•			•	NT	C
109.	*Favites spinosa* (Klunzinger, 1879)	•			•	VU	C
110.	*Favites chinensis* (Verrill, 1866)				•	NT	A
111.	*Favites russelli* (Wells, 1954)	•			•	NT	C
112.	*Favites pentagona* (Esper,1794)	•		•	•	LC	A
113.	*Favites vasta* (Klunzinger,1879)	•				NT	C
	Genus *Goniastrea* Milne Edwards and Haime, 1848						
114.	*Goniastrea aspera* Verrill,1905				•	LC	F
115.	*Goniastrea edwardsi* Chevalier,1971	•				LC	A
116.	*Goniastrea favulus* (Dana,1846)	•		•	•	NT	O
117.	*Goniastrea pectinata* (Ehrenberg, 1834)			•	•	LC	F
118.	*Goniastrea retiformis* (Lamarck, 1816)	•			•	LC	C
	Genus *Leptoria* Milne Edwards and Haime,1848						
119.	*Leptoria irregularis* Veron,1990	•				NT	C
120.	*Leptoria phrygia* (Ellis and Solander, 1786)	•		•		VU	A
	Genus *Leptastrea* Milne Edwards and Haime, 1848						
121.	*Leptastrea aequalis* Veron, 2000			•		VU	C
122.	*Leptastrea purpurea* (Dana, 1846)	•		•	•	LC	A
123.	*Leptastrea transversa* Klunzinger, 1879			•	•	LC	A
	Genus *Oulastrea* Milne Edwards and Haime , 1848						
124.	*Oulastrea crispata* (Lamarck, 1816)	•				LC	F
	Genus *Solenastrea* Milne Edwards and Haime, 1848						
125.	*Solenastrea bournoni* Milne Edwards and Haime, 1849	•		•		LC	R
	Genus *Platygyra* Ehrenberg, 1834						
126.	*Platygyra crosslandi* Matthai, 1928	•			•	NT	A
127.	*Platygyra pini* Chevalier, 1975	•	•			LC	A
128.	*Platygyra ryukyuensis* Yabe and Sugiyama, 1936				•	NT	A
129.	*Platygyra carnosus* Veron, 2000			•	•	NT	C
130.	*Platygyra yaeyamaensis* Eguchi and Shirai, 1977	•				VU	R
131.	*Platygyra verweyi* Wijsman-Best, 1976	•		•	•	NT	A
	Genus *Plesiastrea* Milne Edwards and Haime, 1848						

(*Contd*.)

Table 1 — Species content of the surveyed areas in Middle Andaman (*Contd*.)

Sl. No.	Taxa	Long Island	Guitar Island	Round Island	North Passage Island	IUCN, 2016	Regional Occurrence
132.	*Plesiastrea versipora* (Lamarck, 1816)	•				LC	A
	Family FUNGIIDAE Dana,1846						
	Genus *Cycloseris* Milne Edwards and Haime,1849						
133.	*Cycloseris cyclolites* (Lamarck, 1801)	•	•	•		LC	C
134.	*Cycloseris vaughani* (Boschma, 1923)	•	•	•		LC	R
135.	*Cycloseris curvata* (Hoeksema, 1989)	•				VU	A
136.	*Cycloseris costulata* (Ortmann, 1889)	•	•	•		LC	A
137.	*Cycloseris erosa* (Doderlain,1901)	•	•	•		NE	C
138.	*Cycloseris hexagonalis* Milne Edwards and Haime,1848	•		•		LC	C
139.	*Cycloseris patelliformis* (Boschma, 1923)	•		•		NE	C
140.	*Cycloseris somervillei* (Gardiner, 1909)	•	•	•		LC	A
141.	*Cycloseris tenuis* (Dana,1846)	•	•			LC	C
142.	*Cycloseris colini* Veron, 2000		•			NE	R
	Genus *Ctenactis* Verrill, 1864						
143.	*Ctenactis crassa* (Dana, 1846)		•	•	•	LC	A
144.	*Ctenactis echinata* (Pallas, 1766)		•	•	•	LC	A
	Genus *Zoopilus* Dana, 1846						
145.	*Zoopilus echinatus* Dana, 1846	•			•	LC	R
	Genus Diaseris Edwards and Haime ,1849						
146.	*Diaseris distorta* (Michelin, 1843)			•		LC	R
147.	*Diaseris fragilis* (Alcock, 1893)		•			LC	R
	Genus *Fungia* Lamarck,1801						
148.	*Fungia concinna* Verrill, 1864	•	•	•		LC	A
149.	*Fungia danai* Milne Edwards and Haime,1851		•	•		NE	A
150.	*Fungia fralinae* Nemenzo,1955	•	•			LC	C
151.	*Fungia fungites* (Linnaeus,1758)		•	•		NT	A
152.	*Fungia granulosa* Klunzinger, 1879	•	•	•		LC	A
153.	*Fungia horrida* Dana, 1846	•	•	•		LC	A
154.	*Fungia klunzingeri* Doderlein, 1901		•			NE	A
155.	*Fungia moluccensis* Horst, 1919		•	•		LC	F
156.	*Fungia paumotensis* Stutchbury, 1833	•	•	•	•	LC	A
157.	*Fungia puishani* Veron and De Vantier, 2000	•		•		NE	F
158.	*Fungia repanda* Dana, 1846		•	•		LC	A
159.	*Fungia scabra* (Doderlein,1901)	•	•			LC	F
160.	*Fungia spinifer* Claereboudt and Hoekesma, 1987			•		LC	R
	Genus *Cantharellus* Hoeksema and Best, 1984						
161.	*Cantharellus noumae* Hoeksema and Best, 1984		•			EN	R
162.	*Cantharellus jebbi* (Hoeksema, 1993)	•				LC	R
	Genus *Herpolitha* Eschscholtz, 1825						
163.	*Herpolitha limax* (Houttuyn, 1772)			•		LC	F
164.	*Herpolitha weberi* Horst,1921	•	•	•		LC	A
	Genus *Lithophyllon* Rehberg, 1892						
165.	*Lithophyllon lobata* (Horst, 1921)	•		•	•	NT	C
166.	*Lithophyllon undulatum* Rehberg, 1892	•		•	•	NT	C
	Genus *Podabacia* Milne Edwards and Haime,1849						
167.	*Podabacia crustacea* (Pallas,1766)	•	•	•	•	LC	C
168.	*Podabacia sinai* Veron, 2000			•		DD	C
169.	*Podabacia lankensis* Veron, 2000			•		NE	C
	Genus *Polyphyllia* Quoy and Gaimard,1833						
170.	*Polyphyllia talpina* (Lamarck, 1801)		•			LC	C
	Genus *Sandalolitha* Quelch, 1884						
171.	*Sandalolitha robusta* (Quelch,1886)	•		•		LC	C
	Family MERULINIDAE Verrill,1866						
	Genus *Hydnophora* Fischer de Waldheim,1807						
172.	*Hydnophora exesa* (Pallas,1766)	•				NT	C
173.	*Hydnophora microconos* (Lamarck, 1816)	•	•		•	NT	A
174.	*Hydnophora bonsai* Veron, 1990	•				EN	R

(*Contd*.)

Table 1 — Species content of the surveyed areas in Middle Andaman (*Contd*.)

Sl. No.	Taxa	Long Island	Guitar Island	Round Island	North Passage Island	IUCN, 2016	Regional Occurrence
175.	*Hydnophora rigida* (Dana,1846)	•	•	•		LC	A
	Genus *Merulina* Ehrenberg, 1834						
176.	*Merulina ampliata* (Ellis and Solander, 1786)	•	•	•	•	LC	A
	Genus *Scapophyllia* Milne Edwards and Haime, 1848						
177.	*Scapophyllia cylindrica* Milne Edwards and Haime, 1848	•			•	LC	O
	Genus *Astrea* Lamarck, 1816						
178.	*Astrea annuligera* (Milne Edwards and Haime, 1849)	•			•	NT	C
179.	*Astrea curta* (Dana, 1846)	•				LC	C
	Genus *Phymastrea* Milne Edwards and Haime, 1848						
180.	*Phymastrea colemani* Veron, 2000	•				NT	F
181.	*Phymastrea valenciennesi* (Milne Edwards and Haime, 1848)	•				NT	F
	Family MUSSIDAE Ortmann, 1890						
	Genus *Acanthastrea* Milne Edwards and Haime, 1848						
182.	*Acanthastrea echinata* (Dana, 1846)	•				LC	C
183.	*Acanthastrea hemprichii* (Ehrenberg, 1834)			•	•	VU	C
184.	*Acanthastrea regularis* Veron, 2000	•			•	VU	C
185.	*Acanthastrea hillae* Wells 1955	•				NT	R
186.	*Acanthastrea rotundoflora* Chevalier, 1975	•				NT	C
187.	*Acanthastrea faviaformis* Veron, 2000	•			•	VU	R
188.	*Acanthastrea ishigakiensis* Veron, 1990	•				VU	R
	Genus *Cynarina* Brueggemann , 1877						
189.	*Cynarina lacrymalis* (Milne Edwards and Haime, 1848)			•		NT	R
	Genus *Lobophyllia* de Blainville, 1830						
190.	*Lobophyllia corymbosa* (Forskal,1775)	•		•		LC	A
191.	*Lobophyllia hemprichii* (Ehrenberg, 1834)	•	•	•	•	LC	A
192.	*Lobophyllia robusta* Yabe and Sugiyama,1936	•			•	LC	C
193.	*Lobophyllia dentatus* Veron , 2000				•	VU	R
	Genus *Symphyllia* Milne Edwards and Haime, 1848						
194.	*Symphyllia agaricia* Milne Edwards and Haime, 1849	•		•	•	LC	C
195.	*Symphyllia erythraea* (Klunzinger, 1879)	•				LC	R
196.	*Symphyllia radians* Milne Edwards and Haime,1849	•		•	•	LC	A
197.	*Symphyllia recta* (Dana,1846)	•			•	LC	A
198.	*Symphyllia valenciennesii* Milne Edwards and Haime, 1849			•	•	LC	F
	Genus *Parascolymia* Haime, 1852						
199.	*Parascolymia vitiensis* Wells, 1964	•		•	•	NT	R
200.	*Parascolymia australis* (Milne Edwards and Haime, 1849)			•		LC	R
	Genus *Australomussa* Veron, 1985						
201.	*Australomussa rowleyensis* Veron, 1985	•		•	•	NT	F
	Genus *Mussismilia* Ortmann, 1890						
202.	*Mussismilia brasiliensis* (Verrill, 1867)			•	•	DD	R
	Family OCULINIDAE Gray,1847						
	Genus *Galaxea* Oken, 1815						
203.	*Galaxea acrhelia* Veron, 2000			•	•	VU	R
204.	*Galaxea cryptoramosa* Veron, 2000	•		•		VU	R
205.	*Galaxea astreata* (Lamarck, 1816)	•	•	•		VU	C
206.	*Galaxea fascicularis* (Linnaeus, 1767)	•	•	•	•	NT	A
	Family PECTINIIDAE Vaughan and Wells, 1943						
	Genus *Echinophyllia* Klunzinger,1879						
207.	*Echinophyllia echinoporoides* Veron and Pichon, 1979	•		•		NE	R
208.	*Echinophyllia orpheensis* Veron and Pichon, 1980				•	NE	C
	Genus *Mycedium* Oken,1815						
209.	*Mycedium elephantotus* (Pallas,1766)	•		•	•	LC	F
	Genus *Oxypora* Saville Kent,1871						

(*Contd*.)

Table 1 — Species content of the surveyed areas in Middle Andaman (*Contd*.)

Sl. No.	Taxa	Long Island	Guitar Island	Round Island	North Passage Island	IUCN, 2016	Regional Occurrence
210.	*Oxypora crassispinosa* Nemenzo, 1979	•		•	•	LC	A
211.	*Oxypora glabra* Nemenzo, 1959	•	•		•	LC	C
212.	*Oxypora lacera* (Verrill, 1864)			•	•	LC	C
	Genus *Pectinia* Oken, 1815						
213.	*Pectinia alcicornis* (Saville-Kent,1871)	•		•		VU	A
214.	*Pectinia paeonia* (Dana,1846)	•		•		NT	C
215.	*Pectinia teres* Nemenzo, 1981	•		•		NT	O
	Family PORITIDAE Gray, 1842						
	Genus *Goniopora* de Blainville, 1830						
216.	*Goniopora columna* Dana, 1846			•		NT	A
217.	*Goniopora burgosi* (Nemenzo,1955)	•				VU	R
218.	*Goniopora fruticosa* Saville-Kent, 1893	•				LC	A
219.	*Goniopora minor* Crossland, 1952	•		•		NT	A
220.	*Goniopora somaliensis* Vaughan, 1907				•	LC	R
221.	*Goniopora pearsoni* Veron, 2000	•				LC	R
222.	*Goniopora savignyi* Dana, 1846	•				LC	R
	Genus *Porites* Link, 1807						
223.	*Porites annae* Crossland, 1952				•	NT	C
224.	*Porites desilveri* Veron, 2000			•		EN	R
225.	*Porites evermanni* Vaughan,1907	•		•		DD	R
226.	*Porites sillimaniana* Nemenzo, 1976				•	VU	R
227.	*Porites lutea* Milne Edwards and Haime, 1860	•	•	•	•	LC	A
228.	*Porites stephensoni* Crossland, 1952	•			•	NT	F
229.	*Porites horizontalata* Hoffmeister,1925	•				VU	C
230.	*Porites lobata* Dana, 1846	•	•	•	•	NT	A
231.	*Porites murrayensis* Vaughan, 1918			•	•	NT	O
232.	*Porites nodifera* Klunzinger, 1879				•	LC	F
233.	*Porites rus* (Forskal,1775)	•	•			LC	A
234.	*Porites australiensis* Vaughan, 1918	•		•		LC	C
235.	*Porites solida* (Forskal, 1775)	•	•	•	•	LC	A
236.	*Porites vaughani* Crossland, 1952			•		LC	C
	Family POCILLOPORIDAE Gray, 1842						
	Genus *Pocillopora* Lamarck, 1816						
237.	*Pocillopora damicornis* Linnaeus, 1758	•	•	•		LC	A
238.	*Pocillopora meandrina* Dana, 1846			•		LC	A
239.	*Pocillopora verrucosa* (Ellis and Solander, 1786)	•	•			LC	C
	Genus *Stylophora* Schweigger, 1819						
240.	*Stylophora pistillata* Esper, 1797	•				NT	C
	Family SIDERASTREIDAE Vaughan and Wells, 1943						
	Genus *Coscinaracea* Milne Edwards and Haime,1848						
241.	*Coscinaraea columna* (Dana, 1846)				•	LC	O
242.	*Coscinaraea crassa* Veron and Pichon,1980	•		•		NT	R
243.	*Coscinaraea monile* (Forskal, 1775)	•				LC	F
	Genus *Psammocora* Dana, 1846						
244.	*Psammocora contigua* (Esper, 1797)	•	•	•	•	NT	A
245.	*Psammocora digitata* Milne Edwards and Haime,1851				•	NT	A
246.	*Psammocora explanulata* van der Horst, 1922			•		LC	C
247.	*Psammocora haimeana* Milne Edwards and Haime,1851	•			•	LC	O
248.	*Psammocora profundacella* Gardiner, 1898			•	•	LC	F
249.	*Psammocora superficialis* Gardiner, 1898	•				LC	R
	Genus *Pseudosiderastrea* Yabe and Sugiyama, 1953						
250.	*Pseudosiderastrea tayami* Yabe and Sugiyama, 1935			•		NT	F
	Family CARYOPHYLLIIDAE Gray, 1847						
	Genus *Paracyathus* Milne Edwards and Haime, 1848						
251.	*Paracyathus caeruleus* Duncan, 1889				•	NE	R

(*Contd*.)

Table 1 — Species content of the surveyed areas in Middle Andaman (*Contd*.)

Sl. No.	Taxa	Long Island	Guitar Island	Round Island	North Passage Island	IUCN, 2016	Regional Occurrence
252.	*Paracyathus stokesi* (Milne Edwards and Haime, 1848)		•	•	•	NE	R
	Family TRACHYPHYLLIIDAE Verrill, 1901						
	Genus *Trachyphyllia* Milne Edwards and Haime, 1848						
253.	*Trachyphyllia geoffroyi* (Audouin, 1826)	•	•	•	•	NT	R
	Total number of species	173	51	122	111		
	Total number of genera	53	25	51	44		
	Total number of families	14	13	15	14		

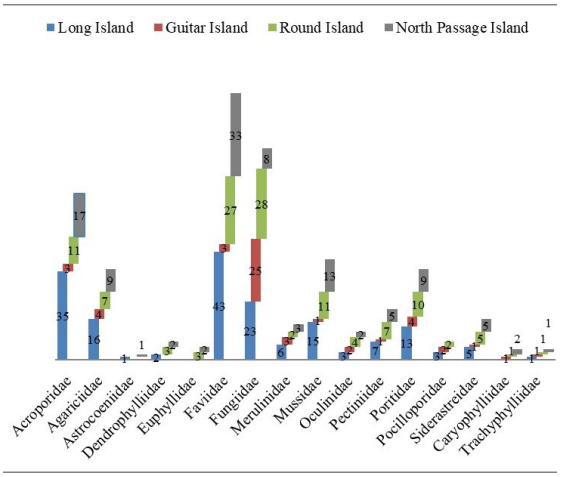

Fig. 3 — Distribution of species on the basis of families from the study areas

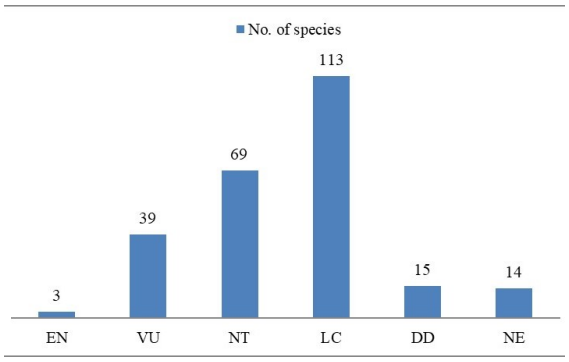

Fig. 4 — IUCN Red list status of the recorded corals from Middle Andaman

The estimation of regional occurrence was evaluated with the help of ACFOR scale and revealed that 82 species were commonly recorded from the studied areas while 15 species were occasionally observed species (Fig. 5).

The species diversity of the studied areas was calculated and it was shown that the maximum diversity (H') (4.35) was observed at Long Island and the minimum (2.21) at Guitar Island. Similarly, species density (D) (0.91) was recorded as high from Long Island while Guitar Island reported with lowest diversity (Fig. 6).

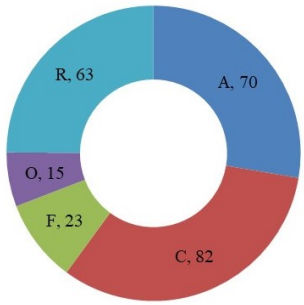

Fig. 5 — Regional species occurrence of scleractinian corals from the study areas

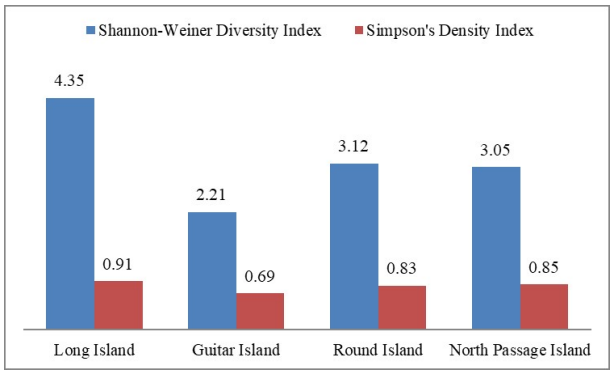

Fig. 6 — Shannon-Wiener species diversity and Simpson diversity indices of the scleractinian corals from the study areas

A thorough investigation on the status of coral reefs was made at the study sites (Table 2). It was seen that the maximum percentage of live coral cover (32.5 %) was recorded at Long Island while the minimum (18.25%) was found at Guitar Island. The highest density of colony or coralla/ 10 sq. m. was seen at Round Island while the lowest was found at Long Island. The density of newly recruited corals was greater (11.75/10 sq. m.) at Long Island while the lower (5.9/10 sq. m.) was recorded from Guitar Island.

Similarity indices of the study areas were calculated on the basis of the availability of scleractinian corals. It ranged from 0.22 between Guitar Island and North Passage Island to 0.45 between Round Island and North Passage Island (Table 3).

Table 2 — Status evaluation of scleractinian corals at the study areas

Status of corals	Long Island	Guitar Island	Round Island	North Passage Island
Percentage of live coral cover	32.5	18.25	26.6	23.8
No. of colony or coralla /10 sq. m.	28..6	45.5	51.2	38.35
No. of new recruitment/10 sq. m.	11.75	5.9	6.4	8.5

Table 3 — Similarity indices of the study areas

	Guitar Island	Round Island	North Passage Island
Long Island	0.33	0.44	0.36
Guitar Island		0.38	0.22
Round Island			0.45

The complexity of coral reef ecosystem is managed by the variety of interconnected benthic habitats and a vast array of associated biota under 32 of the 34 described animal phyla across the globe[2]. The basic requirement for the development and growth of corals depends on the larval attachment with solid substrate especially biogenic substrates of limestone like stony corals and crustose coralline algae[2] to build the calcareous structural architecture by secretion and deposition of aragonite. For the successful completion of the structural affirmed state, the roles of other organisms along with the environmental parameters are significant enough by chemical, biological and physiological durability which epitomizes heterogeneity in surface plains[32]. The reef platforms as well as the habitats extend around 500 m from shore in Andaman group of islands while it is up to 1000 m from shore in the Nicobar group of islands[33]. The reef flats of coastal reefs are seen as fringed arrangement with luxuriant mangroves up to 50 to 100 m wide on the flat and descend steeply in most of the islands of Andaman group of Islands[34]. The present study was carried out at Long Island and its adjoining other three islands surrounded by mangroves in most of the areas especially western side of the islands. The extreme sedimentation load from the various canals and tributaries deposit high level of sedimentation in Middle Andaman region and this can play devastating role for reef ecosystem[34]. The coral reef habitats were documented only at the eastern and south-eastern coast of the islands. In spite of this enormous stress factor, a total of 43.02% species of scleractinian corals of Andaman and Nicobar Islands[35] were recorded from the four study areas with the range of 51 species from Guitar Island to 173 species from Long Island. The species under the family Faviidae have the greater resilience against ecological stress and were as dominant with 22.92 % species from the study areas. Furthermore, these studied areas harbour 18.18 % of the corals under IUCN threatened category. The average live coral cover was recorded as 25.28 % from the study areas while the maximum cover was recorded from Long Island in comparison with others. All the four islands together have 59 km. long coastline of which 33.80 % of the coastal areas are protected by reef habitat. The average species diversity of scleractinian corals from the four study areas was 3.18 attributes at Middle Andaman with the maximum of 4.35 at Long Island. Presence of healthy live corals with greater diversity and species content signifies the enriched island biodiversity of Middle Andaman region in accordance with the other areas of Andaman and Nicobar Islands. The development of scleractinian species and their cover in Long Island and adjoining areas emphasizes the survival strategies of scleractinian corals against the sedimentation logging. Regular monitoring and health surveys are required to estimate the resilience activities of scleractinian against ecological stresses. Due to over increasing tourism and people's interest, Long Island and its adjoining islands were promoted as one of the places for sustainable eco-tourism from this year. There is no specific study was made on marine faunal communities particularly on these four islands till date. It was a decisive time to study and record the scleractinian corals and their cover before the initiation of tourism at Long Island and other three adjoining islands of Middle Andaman archipelago. This study will be helpful as baseline data on scleractinian corals to quantify the effect of tourism after a period of five years. With this crucial note, this study is significant in order to assess the present status of coral with their density, diversity and live cover of coral.

Conclusions

The present studies were carried out at Long Island and adjoining islands of Middle Andaman region. The basic investigation was focused on the species diversity and density of stony corals at the continental shelf regions of the studied areas. Based on studied results and observations, regional occurrence of the scleractinian species were defined.

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