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Community structure and spatial patterns in hard coral diversity of Agatti Island, Lakshadweep, India

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ABSTRACT

Lakshadweep Island cluster is the single atoll reef formation in India, which is reported to be facing climate abnormalities since the past few decades. Scleractinian corals form the structural framework of any coral reefs and are very important in the existence of atoll reef systems. In the present study an attempt was made to investigate the hard coral diversity, live/dead coral cover, as well as health status of reef system surrounding Agatti Island in the Lakshadweep Sea, adopting the Line Intercept Transect (LIT) method. Seventy one species were recorded from the island, of which 37 were new to the reef. *Acropora formosa* (Dana, 1846) with a total cover of 18.3% showed maximum abundance followed by *Porites lutea* (14.8%) and *Porites lichen* (10.7%). Percentage live coral cover was recorded as fair (48.6%) and coral mortality index (0.29) indicated that the reef is in the borderline between healthy and sick state. Proper management measures should be adopted to increase the coral cover of the reef area and to prevent further destruction of the reef.

Introduction

Coral reefs are ancient and extremely complex communities functioning as a single unit. Despite the fact that coral reefs form only 0.2% percentage of marine environment, these are home to one-third of known marine species (Reaka-Kudla, 1997; 2001). The economic value of resources and services derived from them is estimated at $375 billion per year (Costanza *et al*., 1997) which directly or indirectly provides considerable economic benefits to many of the countries. India's coral reef system comprises four major components *viz.,* the Andaman and Nicobar Islands, the Gulf of Kachchh, Lakshadweep Islands and the Palk Bay and Gulf of Mannar Biosphere Reserve. Lakshadweep Islands, a group of scattered coral reef islands in the Arabian Sea are the only atoll type of reefs in the territory of India (Jones, 1986). Raghuraman (2012) compiled the scleractinian diversity of India and made a list of 424 species belonging to 86 genera and 19 families.

The Lakshadweep group of islands, off the west coast of India, constitutes one of the smallest Union Territory (UT), with Kavaratti as its capital. The UT comprises 10 inhabited islands, 17 uninhabited islands, one with attached islet, 4 newly formed islets and 5 submerged reefs. The islands are located between 230 to 400 km west of Kerala coast, between latitudes 8°00' and 12°30' N and longitudes 71°00' and 74°00' E. Most of these islands are aligned in a roughly north-west direction and have a wider lagoon in the western side as compared to the eastern side of the islands with exception in case of Androth Island (James, 1989). Total area of all these islands is 32 sq. km and the inhabited islands vary in size from 0.1 sq km to 4.8 sq km (Department of Planning and Statistics, 2002).

Agatti Island is the western most island in the Indian UT of Lakshadweep, located at 10° 81' to 87' N and 72° 15' to 21' E. The island has an estimated area of 2.7 km^2 and is surrounded by 12 km^2 of lagoon and 14.4 km^2 of reef flat (Bahuguna and Nayak, 1994). As many other islands of the region, Agatti is also aligned north-south (north-east to south-west direction) and has a deeper and wider lagoon in the western region. Kalpitti, a small islet lies south of Agatti within the periphery of the lagoon.

Earlier works on the coral fauna of Lakshadweep initiated by Gardiner (1904, 1905) and later by Nagabhushanam and Rao (1972) were mainly on the fauna of Minicoy Island. Pillai (1976; 1983a; 1986) extensively studied the scleractinian diversity over a range of Lakshadweep islands, which led to the identification of 103 species of hard corals belonging to 37 genera (Pillai and Jasmine, 1989). Further, Pillai (1996) published a detailed status report on the corals, which remains to be the basic document on the coral reefs of India. After a bleaching event during 1998 which reduced the coral coverage by 81% (Arthur, 2000), post-bleaching recovery was found to be significant in western reefs of Agatti than in the eastern side (Arthur *et al*., 2005; 2006) due to differences in settlement pattern and substrate stability (Tamelander and Rajasuriya, 2008). The last report of bleaching was in the year 2010 (Kumar and Subramanian, 2012). An increase in seagrass cover in some of the Lakshadweep slands is attributed to an increase in eutrophication due to anthropogenic pressure (Bahuguna *et al*., 2013). Other than fishing, islanders exploit corals which they use for building houses, roads and for other constructions (Wells and Sheppard, 1988). Despite the regulations imposed by the Ministry of Environment and Forests (MoEF), Govt. of India, the collection of corals from the shores are being undertaken which may weaken the beachfront (Pillai, 1996). Dredging activities in lagoons have resulted in the removal of reef fronts in some areas to allow the passage of boats, which permanently affected current flow in and out of the lagoon (Pillai, 1983a; 1996).

Agatti Island together with its islet, Kalpitti has a vast lagoon of 4 to 5 m deep in the west side and is mostly sandy with mounts and boulders formed by *Porites* spp. Main entrance to the lagoon with passage for mechanised fishing vessels is located towards the northern point. Lagoon is being occasionally dredged from the western entrance, Baliya Alivui for facilitating passage of large cargo vessels. Dredging and wave action carries dead coral fragments and coral rubbles towards the northern side of the lagoon. Studies on demography, socio-economic status of the islanders, use of the coral reef resources and fishing methods have been conducted in the Agatti Island and its territories (Hoon *et al.,* 2002; Hoon 2003; Hoon and Tamelander 2005; James, 2011). Being a fast developing island, the increased interference on the ecosystem is reflected on the present status of the reefs of Agatti. The present study assessed the health of this reef by deriving percentage of live and dead coral cover, diversity indices, as well as the relative abundance of various coral species, aiming at formulation of viable strategies for the protection, conservation and sustainable use of the precious coral wealth.

Materials and methods

Survey and sampling was carried out during March 2013 by SCUBA diving and snorkeling. Line Intercept Transect (LIT) method (English *et al*., 1997) was adopted to describe coral community and composition. A total of 10 transect lengths of 30 m each (3 each in the northern and southern reef crests, 2 in the lagoon and 2 in the south-east reef crest) (Table 1) with three replicates set apart by 5 m were placed parallel to the reef break at 1 to 3 m deep areas of reef crest (Fig. 1). The intercepts of all underlying coral species, dead corals, rock, sand, rubble, algae and others (holothurians, anemones, giant clams and other molluscs) were recorded. Digital photographs and videographs of corals were taken using Canon D10 and Sony Cybershot RX100 respectively. Identification of corals was made *in situ* following Pillai (1967a, b, c; 1973; 1986), Veron (1986; 2000), Wallace (1999) and Venkataraman *et al.* (2003). For statistical analysis of the data, Primer software 6 package was used (Carr, 1996).

Table 1. LIT stations and their respective geographic coordinates

Station	Coordinates
S1	Lat 10.874413 °, Long 72.191788 °
S2	Lat 10.868285 °, Long 72.179571 °
S3	Lat 10.879234 °, Long 72.198802 °
S4	Lat 10.825292 °, Long 72.159697 °
S5	Lat 10.838150 °, Long 72.156683 °
S6	Lat 10.835000 °, Long 72.180980°
S7	Lat 10.823496 °, Long 72.170587 °
S8	Lat 10.848083 °, Long 72.159129 °
S9	Lat 10.811572 °, Long 72.172460 °
S10	Lat 10.821111 °, Long 72.177599 °

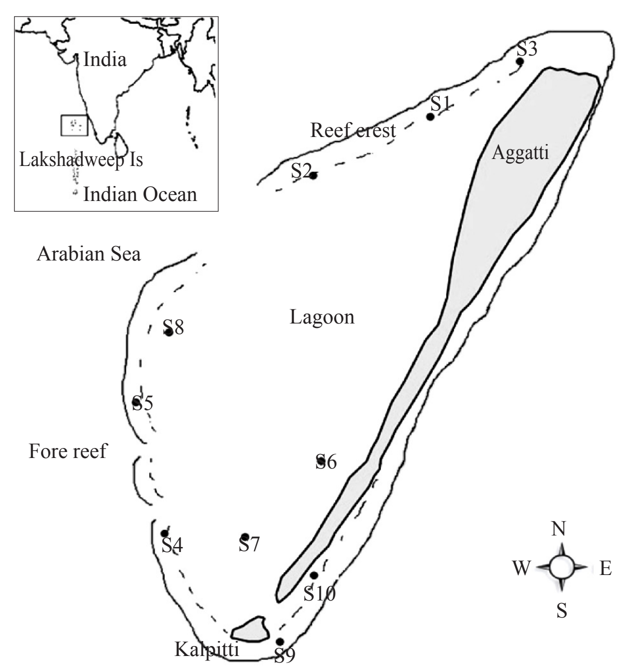


Fig. 1. Map showing positions of the LIT stations covered under the study in Agatti atoll. Stations 1 to 10 are shown in the map as S1 to S10.

Community analysis

The relative abundance (RA), which is an index of commonness or rarity, of each coral species was calculated as (Rilov and Benayahu, 1998):

$$\text{Relative abundance (RA)} = \frac{Pi}{P_{total}} \times 100$$

where, Pi = pooled living coverage of the ith species from all transects at a given site and P_{total} = pooled total living coverage of all species in all transects at a given site.

Resulting values were transformed into abundance categories (%) *viz.,* not recorded (RA=0), rare (0<RA<0.1), uncommon (RA=0.1-1), common (RA=1-10), abundant (RA=10-20) and dominant (RA>20).

Univariate analysis

Based on coral coverage of each individual species on each transect, species diversity indices, Shannon-Weiner diversity index (H') and Gini-Simpson index (1-Lamda) as well as the evenness index, Pielou's index were calculated using natural logarithm values (Gini, 1912; Shannon and Weiner, 1949; Simpson, 1949; Margalef, 1958; Pielou, 1977).

Graphical descriptors

K-dominance curves (Lambshead *et al.,* 1983), a graphical biodiversity descriptor, were constructed for finding out the diversity profile of different sampling sites. The starting point of curve and its inclination is indicative of the diversity of the site *i.e.*, more elevated curves which starts high have lower diversity and *vice versa.*

Multivariate analysis

Data was first transformed [ln (x+1)] to reduce the influence of dominant taxa. A resemblance matrix for different stations was constructed using the similarity coefficient of Bray and Curtis (1957). Similarity pattern, *i.e.*, similarity between each station and their distances were visualised in a two-dimensional plot using non-metric multidimensional scaling (MDS). The contribution of species to variations between the clusters observed in the ordination analysis was examined using the SIMPER (Similarity Percentage Analysis) procedure (Clarke, 1993). Species falling above the 50% similarity threshold were considered to be those most important in determining community structure.

Coral mortality index (Gomez *et al.,* 1994) was adopted to analyse the health of the reefs. As opposed to measure of diversity or percent coral cover, MI is a multivariate index that is a simple ratio between proportions of dead coral cover to both live and dead coral cover.

$$\text{Mortality index (MI)} = \frac{\text{Dead coral cover}}{\text{Live coral + Dead coral cover}}$$

If MI> 0.33, the mortality index is considered to be high and the reef is classified as sick.

Results and discussion

Reef around Agatti atoll showed an average live coral cover of 48.6% (Fig. 2) and the average dead coral coverage recorded was 21.6%, most of which were covered with algae. Bleached corals were observed to be minimum during the present survey. Similar survey undertaken during 2005 reported a coral coverage of 58% and dead coral cover of 24.1%, from the mean values of three transects made around the Agatti atoll (George, 2008). Fewer occurrences of bleaching and algal cover

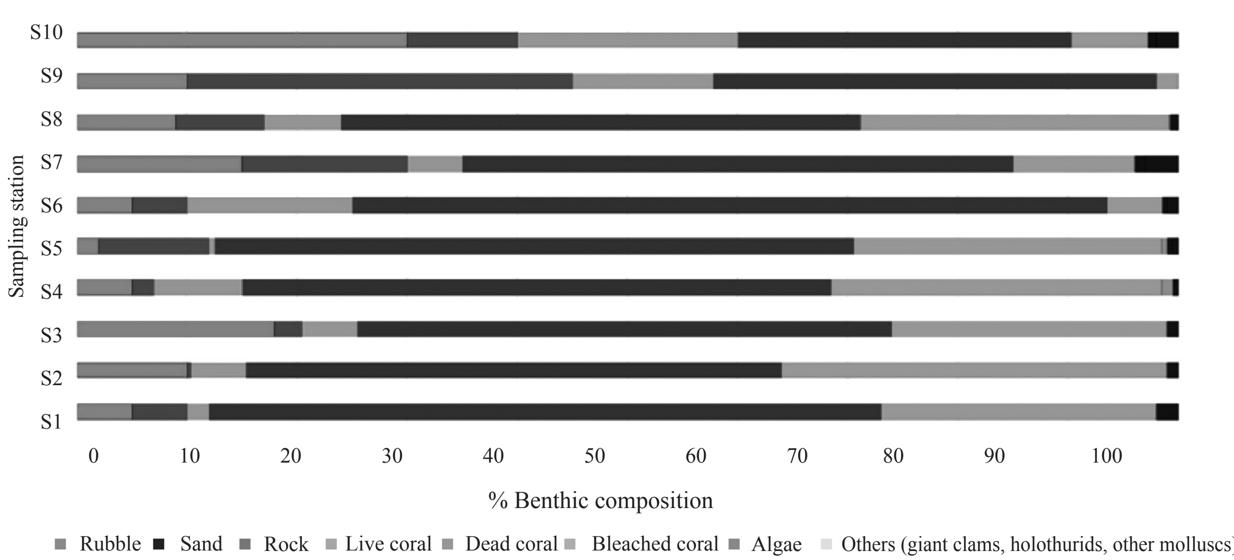


Fig. 2. Overall percentage benthic composition at different sampling sites

on almost all dead corals observed during the present study, can be indicative of a past catastrophe, which may be attributed to the bleaching event in 1998 or tsunami in 2004. During 1998 bleaching event Lakshadweep atolls lost between 43 and 87% of live coral cover (Wafar, 1999). Vivekanandan *et al.* (2008) reported coral bleaching across the coast of south Asian countries, particularly along the Indian coast along Gulf of Mannar and Lakshadweep, which experienced more or less same elevated sea surface temperature (SST). Loss of live coral cover is often associated with phase-shift from a coral dominated community structure to algae dominated ecosystem (Done 1992; McCook 1999). Survey under Lakshadweep Coral Reef Monitoring Network (LCRMN) initiated by Lakshadweep Administration observed encouraging recovery rate of 1.6% and live cover of 39.2% by 2007 after the bleaching event in 1998 (Raheem, 2012). Kumar and Balasubramanian (2012) reported 76.5% bleaching of hard corals in the Agatti lagoon during the pre-monsoon season of 2010.

Seventy one species of hard corals belonging to 28 genera and 13 families including two non-scleractinian species were recorded along the transects. Out of this, 37 species are new records from the Island (Table 2). Earlier works of Pillai and Jasmine (1989) reported 27 species belonging to 10 genera from Agatti Island. However, Suresh (1991) observed a total of 60 stony coral species belonging to 27 genera from Agatti Island following quadrant survey methodology. No single species were categorised as 'dominant' in the present study. *Acropora formosa* and *Porites lutea* belonged to the category 'Abundant' with the relative abundance values of 18.3 and 14.8 respectively (Table 2). Studies on the skeletal extension of *A. formosa* at Kavaratti atoll indicate that the environmental conditions of Lakshadweep waters are conducive for the growth of *A. formosa* (Suresh and Mathew, 1993). Relative abundance values of all other species were less than 10, making 20 of them as common, 37 as uncommon and 11 species as rare. *Acropora nobilis, Acropora valenciennesi, Astreopora ocellata, Echinopora lamellosa, Gardineroseris planulata, Hydnophora exesa, Leptastrea purpurea, Montastrea valenciennesi, Turbinaria mesenterina* and *Euphyllia* sp. were the scleractinians that showed rare occurrence in transects. *Heliopora coerulea* and *Millepora exesa* were the only non-scleractinian corals observed in the current study though Suresh (1991) recorded *Millepora platyphyllia* and *Tubipora musica* also from the island.

Margalef index, which gives weightage to the number of species than the number of individuals, shows that site S7 and S9 have less number of species. Shannon diversity index ranged from 2.25 (S7) to 3.23 (S6). Value of Shannon index above 3 indicates that the structure of habitat is stable and balanced. Value of Simpon's diversity index is near to one, which shows a high diversity in all the sites. High and even value of Pielou's index shows that the individuals are distributed equally (Table 3). This index is similar for all the sites though S7 shows marginally high even distribution of species. With its low starting point and gentle slope, K-dominance curve confirmed high diversity at site S6 and least diversity at S7 (Fig. 4). S6 site was characterised with massive boulders of *Porites solida* upon which grows different species of the genus *Acropora.* This site is being specially looked after and the local divers of Agatti have installed fabrications of boulders with variety of Acroporids for tourism purpose. Similarly S7, a random site selected in the shallow southern half of the lagoon comprised mainly of rubbles, sand and dead coral fragments. SIMPER analysis showed that major species, which contributed to all sites surveyed, were *Acropora formosa* (19.5%) and *Porites lutea* (14.8%). Average similarity in species composition was 44.8% (Table 4). SIMPER analysis between different clusters *viz.,* north-south, lagoon and south-east showed that *Acropora palifera* discriminated northern reefs and *Goniastrea retiformes* discriminated southern reefs from others (Table 5). No common species was identified to represent the dissimilarity between other sites. Analysis between western and eastern side reefs showed *Acropora gemmifera, A. palifera* and *G. retiformis* as the major contributing species (Table 6) for the variation. Bray Curtis similarity as plotted in MDS plot showed clustering of data towards the northern sites and south-east sites with a similarity of 60% (Fig. 5).

Based on reef condition index (RCI) (Gomez and Alcala, 1979) values estimated, Agatti Island reefs fall under the category "fair". Similar live coral coverage of 58% was reported earlier by George (2008). Average coral mortality index (MI) for the reef was 0.29, which shows that the health of the reef is in a better condition, though it is nearing the cut off value of 0.33 to fall under the category 'sick'. Coremap (2001) questions the statistical relevance of coral mortality index and recommends using the coral cover as indicator of reef condition. Nevertheless, both the indices show that the reef is in a borderline state of health.

Atoll islands like Lakshadweep are formed by generations of corals built upon skeleton of their ancestors (Darwin, 1842). These coral reef ecosystems are vulnerable to any changes in their homeostasis due to both natural and anthropogenic reasons (Sorokin, 1992). Variables like temperature, irradiance, calcium carbonate saturation, turbidity, sedimentation, salinity, pH and nutrients influence the physiological processes of photosynthesis, calcification and hence the coral survival (Buddemeier *et al*., 2004; Crabbe *et al*., 2008; 2009).

Table 2. Relative abundance (RA) and status of species reported during various studies from Agatti Island

Species name	Species status recorded in different studies			RA (Present study)
	Pillai and Jasmine (1989)	Suresh (1991)	Present study	
Scleractinian corals				
Acanthastrea echinata (Dana, 1846)		R		
Acropora abratanoides (Lamarck, 1816)		R	C	1.34
Acropora aspera (Dana, 1846)	P	R	C	1.1
Acropora austere (Dana, 1846)		C	U	0.88
Acropora cervicornis (Lamarck, 1816)			U	0.31
Acropora corymbosa (Lamarck, 1816)	P	R		
Acropora cytherea(Dana, 1846)			U	0.2
Acropora divaricata (Dana, 1846)			U	0.25
Acropora echinata(Dana, 1846)		R		
Acropora formosa (Dana, 1846) (Fig. 3a)	P	A	A	18.28
Acropora gemmifera (Brook, 1892)			C	2.55
Acropora gracilis (Dana, 1846))		C		
Acropora hemprichi (Ehrenberg, 1834)			U	0.75
Acropora humilis (Dana, 1846)		C	C	1.05
Acropora hyacinthus (Dana, 1846)	P	R	U	0.23
Acropora intermedia (Brook, 1891)	P			
Acropora irregularis (Brook, 1892))			U	0.32
Acropora lamarcki Veron, 2000			U	0.75
Acropora longicyathus (Milne Edwards, 1860)			C	1.2
Acropora microphthalma (Verrill, 1869)			C	1.07
Acropora millepora (Ehrenberg, 1834)			U	0.11
Acropora monticulosa (Bruggemann, 1879)		R		
Acropora myriophthalma (Verrill, 1869)		C		
Acropora nasuta (Dana, 1846)			R	0.02
Acropora nobilis (Dana, 1846)			U	0.53
Acropora palifera (Lamarck, 1816) (Fig. 3b)		C	C	7.4
Acropora robusta (Dana, 1846)			U	0.42
Acropora tenuis (Dana, 1846)			C	1.65
Acropora teres (Verrill, 1866)	P	R		
Acropora valenciennesi (Milne Edwards, 1860)		R	R	0.06
Agaricia sp.			U	0.66
Astreopora listeria Bernard, 1896			U	0.11
Astreopora myriophthalma (Lamarck, 1816)			U	0.22
Astreopora ocellata Bernard, 1896			R	0.05
Cyphastrea seralia (Forskal, 1775)	P	A	U	0.22
Echinopora lamellose (Esper, 1795)		R	R	0.02
Euphyllia sp.		R	U	0.1
Favia favus (Forskal, 1775)		R	U	0.42
Favia pallida (Dana, 1846))		R	U	0.27
Favia speciosa (Dana, 1846))		R	U	0.55
Favia stelligera (Dana, 1846))		R		
Favia valenciennesi (Milne Edwards and Haime, 1848)		R		
Favites flexuosa Dana, 1846		R		
Favites halicora (Ehrenberg, 1834)		R		
Favites melicerum (Ehrenberg, 1834)	P	R		
Favites pentagona (Esper, 1794)		R		
Favites sp.1			U	0.54
Favites sp.2			U	0.25
Fungia danae Milne Edwards and Haime, 1851)			U	0.21
Fungia fungites (Linnaeus, 1758) (Fig. 3c)	P	C	U	0.64
Fungia repanda Dana, 1846)			U	0.33
Fungia scutaria Lamarck, 1801)	P	A	U	0.17
Galaxea astrea (Lamarck, 1816)			U	0.42

Species name	Species status recorded in different studies			RA (Present study)
	Pillai and Jasmine (1989)	Suresh (1991)	Present study	
Galaxea fascicularis (Linnaeus, 1767) (Fig. 3d)		C	U	0.92
Gardineroseris planulata (Dana, 1846) (Fig. 3e)		R	R	0.05
Goniastrea pectinata (Ehrenberg, 1834)		C		
Goniastrea retiformis (Lamarck, 1816)		C	C	3.03
Goniopora minor Crossland		R	C	1.19
Goniopora stokesi Milne Edwards and Haime, 1851		R		
Hydnophora exesa (Pallas, 1766)		R	R	0.09
Hydnophora microconos (Lamarck, 1816)	P	C	U	0.11
Leptastrea purpurea (Dana, 1846) (Fig. 3f)		A	R	0.06
Leptastrea transversa Klunzinger, 1879		C	U	0.13
Leptoria phrygia (Ellis andSolander, 1786)		C	C	1.52
Leptoseris sp.			U	0.45
Lobophyllia corymbosa (Forskal, 1775)		R		
Montastrea valenciennesi (Milne Edwards and Haime, 1848)			R	0.04
Montipora tuberculosa (Lamarck, 1816)		C		
Montipora sp.			U	0.1
Pavona maladivensis (Gardiner, 1905)		R		
Pavona minuta Wells, 1954		R		
Pavona varians Verrill, 1864			U	0.4
Platygyra daedelea (Ellis andSolander, 1786)	P			
Platygyra lamellina (Ehrenberg, 1834)			C	2.7
Platygyra sinensis (Milne Edwards &Haime, 1849)	P	C		
Platygyra sp.			U	0.65
Pocillopora damicornis (Linnaeus, 1758)	P	A	C	2
Pocillopora eydouxi Milne Edwards, 1860)			C	2
Pocillopora meandrina Dana, 1846	P			
Pocillopora verrucosa (Ellis and Solander, 1786)		R	C	1.54
Porites andrewsi (Vaughan, 1918)	P			
Porites annae Crossland, 1952			U	0.8
Porites australiensis Vaughan, 1918			C	1.63
Porites cylindrica Dana, 1846		C	C	7
Porites lichen Dana, 1846			C	5.73
Porites solida (Forskal, 1775)	P	A	C	2.63
Porites lutea Milne Edwards, 1860	P	A	A	14.75
Porites rus (Forskal, 1775)		C		
Psammacora contigua (Esper, 1794)	P	A	C	1.45
Psammacora digitata Milne Edwards and Haime, 1851		R		
Psammacora haimaenia (Milne Edwards and Haime, 1851)	P		U	0.72
Psammacora profundacella Gardiner, 1898		R		
Symphyllia nobilis (Dana)		R		
Symphyllia radians Edwards and Haime, 1849		R	U	0.42
Symphyllia recta (Dana, 1846)			U	0.41
Symphyllia sp.			U	0.24
Tubastrea aurea (Quoy and Gaimard, 1833)		R		
Turbinaria crater (Pallas)	P			
Turbinaria mesenterina (Lamarck, 1816)	P	C	R	0.08
Turbinaria stelullata (Lamarck, 1816)		C		
Turbinaria sp.	P			
Non-scleractinian corals				
Heliopora coerulea (Pallas, 1766)		R	C	1.5
Millepora exesa (Forskal, 1775)	P		R	0.01
Millepora platyphyllia Hemprich and Ehrenberg, 1834		R		
Tubipora musica Linnaeus, 1758		R		

P: Present; A: Abundant, C: Common, U: Uncommon, R: Rare

Table 3. Biodiversity indices and coral mortality index estimated at different sites

Sites	d	J'	H' (ln)	1-Lambda'	MI
S1	7.493	0.9474	3.05	0.945	0.8903
S2	7.723	0.889	2.787	0.9211	0.8417
S3	7.013	0.9251	2.859	0.9312	0.8639
S4	7.243	0.9473	3.011	0.9445	0.9408
S5	8.051	0.9381	3.092	0.9473	0.9309
S6	8.111	0.9581	3.226	0.9561	0.9411
S7	3.278	0.9773	2.25	0.89	0.8873
S8	6.228	0.9483	2.841	0.9367	0.9443
S9	4.945	0.9377	2.475	0.9058	0.9067
S10	6.392	0.9455	2.832	0.933	0.9211

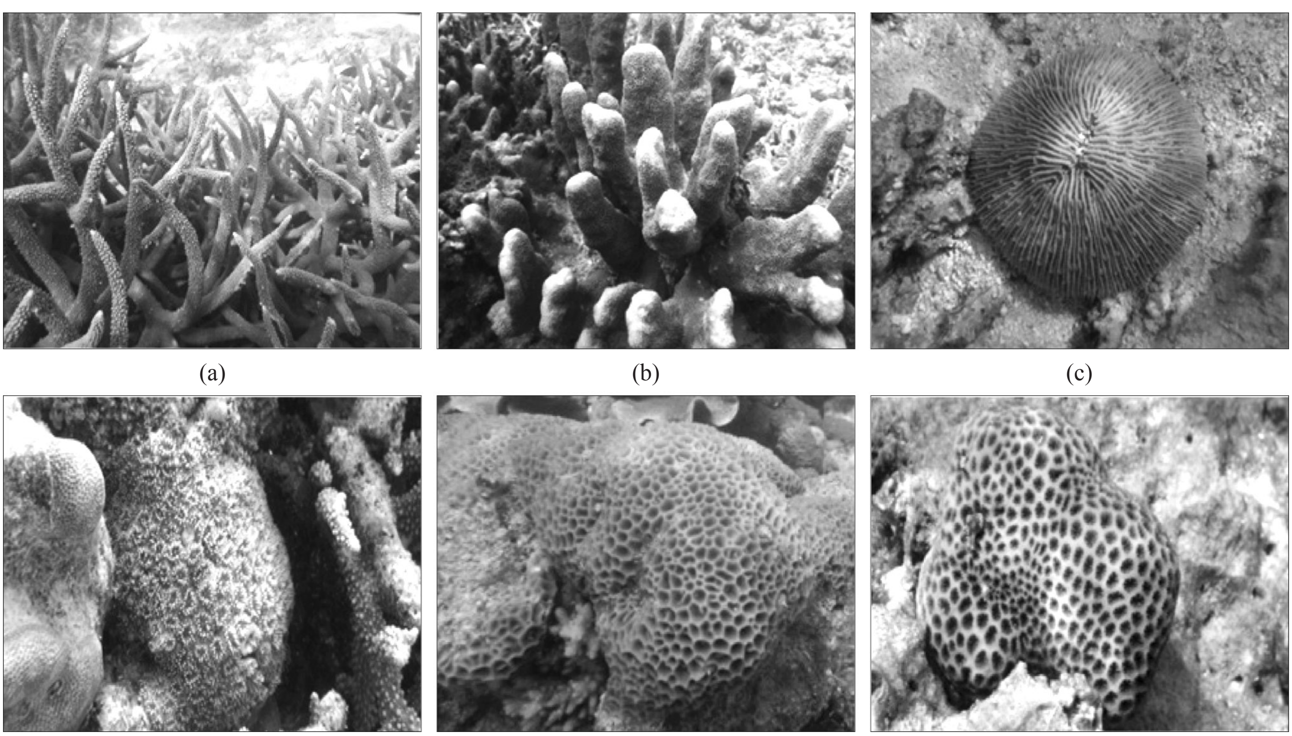
d=Margalef index, J' = Pielou's evenness, H'= Shannon diversity index, 1-Lambda' = Simpson diversity index, MI = Mortality index

Table 4. Major species which contributed to the resemblance of different sites (Average similarity : 44.81%)

Species	Contribution %
Acropora formosa	19.47
Porites lutea	14.75
Porites lichen	10.73
Platygyra lamellina	9.1
Others (holothurids, anemones, giant clams, other molluscs)	7.13
Acropora palifera	6.2
Pocillopora damicornis	5.97

Table 5. Matrix showing major species discriminating different regions

Groups	North	South	Lagoon	South-east
North	0			
South	*Porites cylindrica, Acropora palifera, Porites solida*	0		
Lagoon	*Acropora palifera, Porites lichen, Porites cylindrica*	*Porites lichen, Goniastrea retiformis, Porites solida*	0	
South-east	*Acropora palifera, Platygyra lamellina, Acropora gemmifera*	*Goniastrea retiformis, Pocillopora eydouxi, Acropora gemmifera*	*Porites lichen, Porites cylindrica, Acropora tenuis*	0



(a) (b) (c) (d) (e) (f)

Fig. 3. Selected hard coral species recorded from Agatti Island. (a) *Acropora formosa,* (b) *Acropora palifera,* (c) *Fungia fungites,* (d) *Galaxea fascicularis,* (e) *Gardineroseris planulata,* (f) *Leptastrea purpurea*

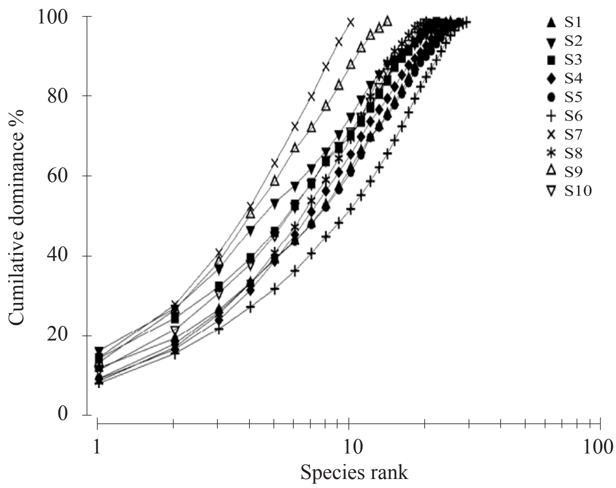


Fig. 4. K-dominance plot for Agatti Island

Table 6. Dissimilarity between western and eastern reefs (Average dissimilarity: 53.56%)

Species	Contribution%
Acropora gemmifera	5.52
Acropora palifera	4.54
Goniastrea retiformis	4.41
Pocillopora eydouxi	4.41
Platygyra lamellina	4.15
Porites solida	4.02
Acropora muricata	3.74
Porites cylindrica	3.7

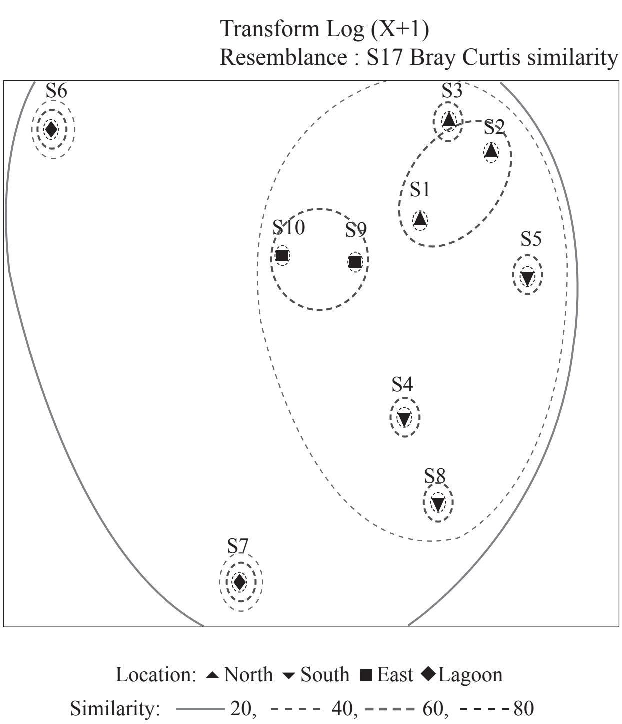


Fig. 5. MDS plot showing similarity between different survey stations

However, these parameters are liable to change due to meteorological or anthropogenic reasons (Sorokin, 1992). Maintaining coral reef populations in the face of large scale degradation and phase-shifts on reefs depend critically on coral recruitment and on sustainable management of coral reefs (Hughes, 1994; Hughes and Tanner, 2000). Diversity can be the indicator of a system's stability to withstand disturbance (McCann, 2000). Agatti Island reef is one among those invaluable atolls with a highly diverse and structured ecosystem, which needs to be protected from overexploitation and deterioration. Islanders depend on the reefs for 90% of their protein intake (Hoon, 2003). Combined effect of increase in human population density in the island and their increased reliance on the natural resources exert pressure on the ecosystem. Adding to these, natural disturbances and global climate change, calls for considerable management interventions. Actions must be taken to transplant live coral buds (from the same reef) to areas having extensive dead coral cover. Further studies need to be undertaken on the reproduction and natural propagation of hard corals that can act as indicators of reef sustenance in the long run. In addition, genetic studies may be encouraged to find the endemicity and overall diversity of hard corals from the island.

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