

## INTRODUCTION

Coral reefs are the most diverse ecosystems on the planet which provide sanctuary to a myriad of marine life and play an important role in protecting the shoreline from storms and surge water. Kalpeni Islands are a group of three islands and is one of the most picturesque areas of Lakshadweep, which are formed exclusively by coral atolls with 36 islands. Kalpeni (Figure 1) encapsulates two major islands viz., Kalpeni and Cheriyan and several small islets located southeast of Kavaratti Island and midway between Androth and Minicoy and aligned in the north-south direction. This Island has a very large lagoon with the depth ranging from 1 to 5m. On the windward side, the beaches are sandy while on the leeward side, the beaches are in general made up of coral boulders and coral shingle. There are a number of surge channels on the leeward margin of the atoll.

## MATERIALS AND METHODS

Underwater survey and sampling was carried out in Kalpeni atoll during November, 2016 for georeferenced mapping of the distribution and diversity of hard corals by SCUBA diving and snorkeling adopting life-form line intercept transect (LIT) method (English et al., 1994). The transects were positioned randomly over the reefs and all conspicuous benthic life forms underlying the transect lines were noted and species-wise distribution was recorded for scleractinian corals. Biodiversity analysis using PRIMER (v.6) was also carried out. The k-dominance curve with a graphical biodiversity descriptor was constructed for finding out the diversity profile. Digital photographs and videos of corals were taken using NIKON AW 130 and Sony Cybershot RX100 respectively.

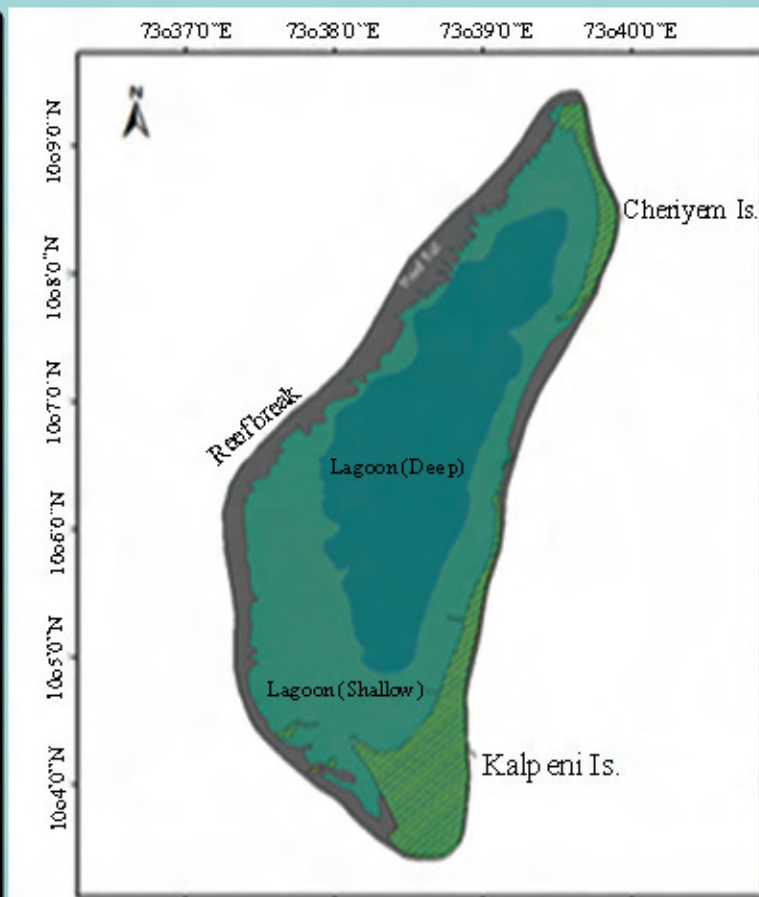


Figure 1: Georeferenced map of Kalpeni Islands

## SALIENT FINDINGS

### CORAL COVER AND DIVERSITY

The reef was found to have comparatively good growth of branched corals in the western reef flats. The algal cover (infestation) over live and dead corals was noticed in most of the transect area of the present study. The infestation was found to be covered with macroalgae species, especially *Caulerpa sp.* and *Halimeda sp.* The rest is contributed by rocks, sand and other benthic flora and fauna. The deeper area of the lagoon was dominated by the massive and sub-massive corals. The reef was having a comparatively good growth of branched corals in the western reef flats. Studies on the coral fauna of Minicoy was initiated by Gardiner (1904, 1905) and later Pillai made extensive studies (1976; 1983a; 1986) and reported 103 species of hard corals belonging to 37 genera (Pillai and Jasmine, 1989). A total of 69 species of reef building corals under 26 genera belonging to 13 families, including two non-scleractinian corals genera *Heliopora* and *Millepora* were recorded in the present study. In terms of species diversity (Figure 2), the genus *Acropora* dominated with 16 species followed by *Porites* (5 species). The genera *Platygyra*, *Favites* and *Pocillopora* are next in abundance, each with 4 species to their credit. The most dominant genera by extent of coral cover were found to be *Acropora* and *Porites*.



Figure 2: Species diversity of corals at Kalpeni Islands

## BIODIVERSITY ANALYSIS

The hard coral community diversity analysis was performed to discern the species status for Kalpeni Islands. The results of the conventional and newly introduced biodiversity analysis were shown in the Table 1 (a & b). The species richness index was comparatively higher i.e. Margalef d (6.38) and Fisher (17.55) in Kalpeni. The Simpson index (lambda) gives information on dominance of species and it was found to be low (0.08) and which was supplemented by Pielou's evenness or equitability J' with the recorded value of 0.89 confirming more evenness in the diversity of hard coral species. The Shannon index of diversity H'(Log2) is the realistic estimate of biodiversity and the estimated value was 4.26. Higher value of Shannon index indicates that both richness and evenness of the community of hard coral increases. The taxonomic diversity index Delta and taxonomic distinctness index Delta\* not only gives the distribution of abundance among the species but also the taxonomic relatedness of the species in each sample and it was found to be 29.39 and 31.60 respectively. The total phylogenetic diversity index gives the phylogeny of the taxonomic tree was estimated as 733.33. These newly introduced biodiversity indices had an additional statistical framework for comparison which gives the clear picture of the biodiversity.

Table 1: Conventional (a) and new (b) diversity indices for hard corals at Kalpeni Islands

(a)	S	N	d	J'	Brillouin	Fisher	H'(log2)	Lambda
	28.00	69.00	6.38	0.89	2.48	17.55	4.26	0.08
(b)	Delta	Delta*	Delta+	sDelta+	Lambda+	Phi+	sPhi+	
	29.39	31.60	31.13	871.60	31.88	26.19	733.33	

The dominance plot (Figure 3) was constructed on the data sets to find out the biodiversity pattern of the Kalpeni and the curve for the Island, which lies on the lower side, extends further and rises slowly due to the presence of more number of species. As the percentage contribution of each species is added, the curve extends horizontally (species number is evident in the x-axis), before reaching the cumulative 100%.

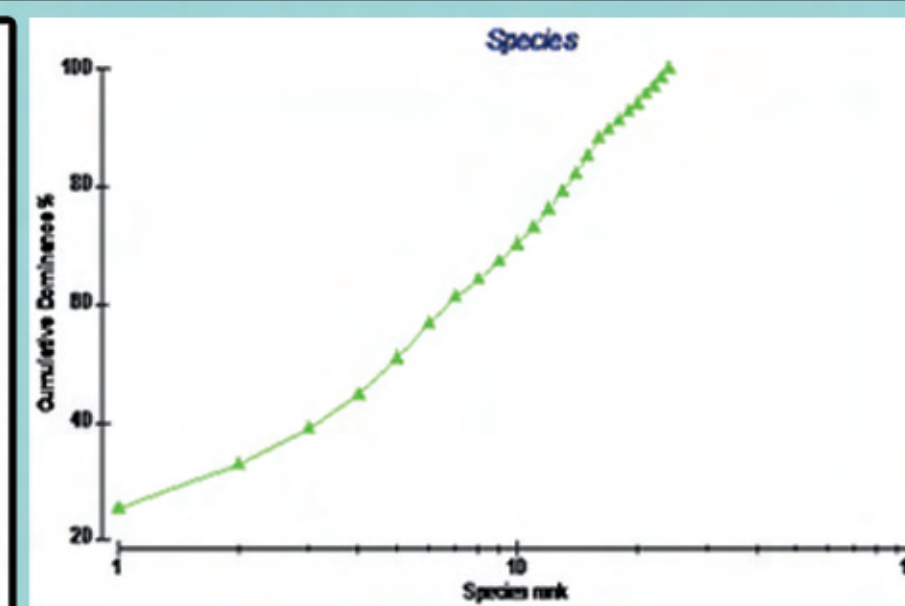
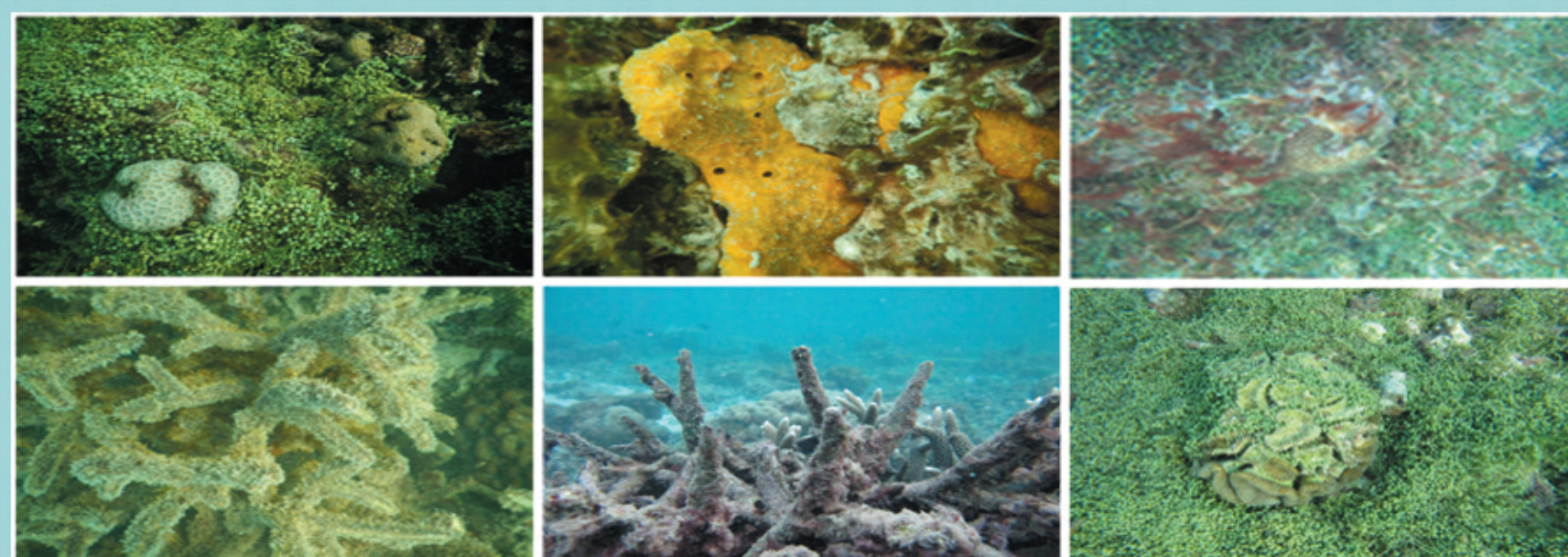


Figure 3: Dominance plot for the Kalpeni Island

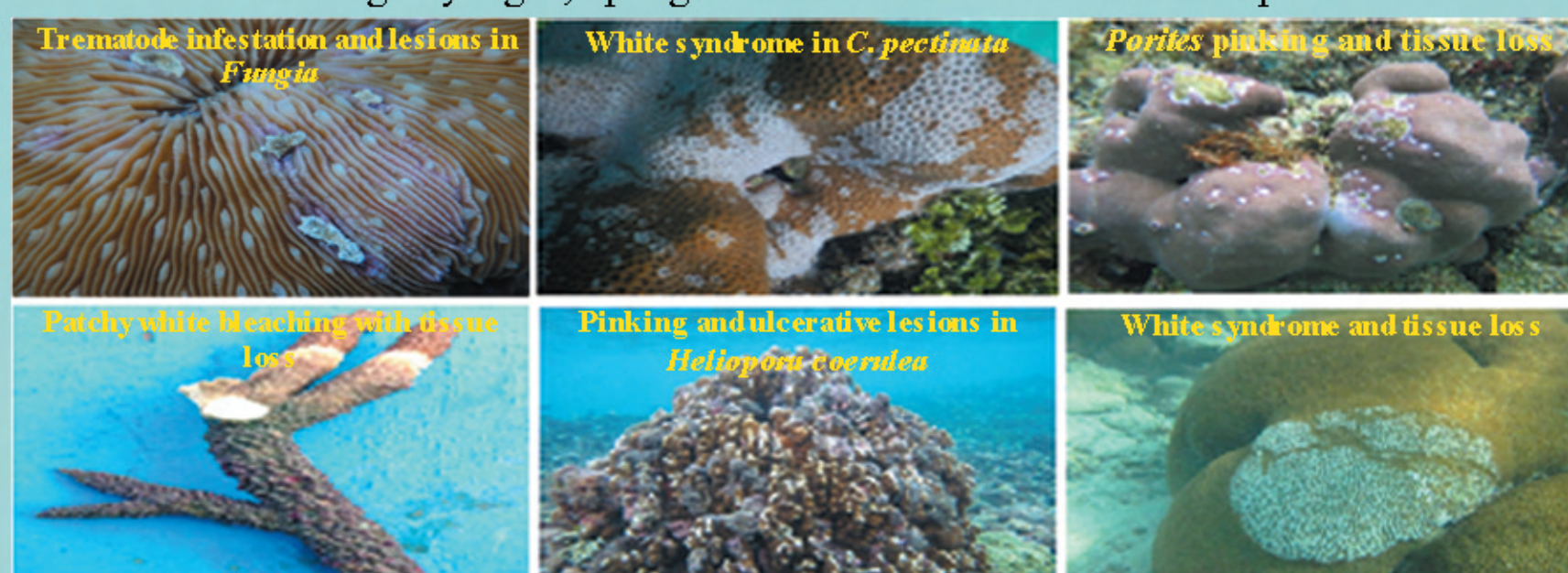
## THREATS FACED BY KALPENI REEF

Disease, predation and stress were the major factors causes mortality of hard corals in any reef. The major threat in Kalpeni was found to be a large scale algal infestation over the hard corals. Over fishing in the lagoon, which removes healthy populations of algal eating fish as well as the nutrient load can be attributed to this phase shift of the reef. Large scale bleaching, ulceration, disease, encrustations by sponges, ascidians were also recorded. Bleaching was most commonly noticed in *Acropora* and diseases were common in the massive *Porites*. Disease conditions such as pinking and ulcerative syndrome in *Porites sp.* and *Fungia sp.*; tissue loss and white band disease in *Acropora sp.*; damage due to trematodiasis, infestation by feather duster worms was noticed. Tissue loss and necrotic patches were observed in the blue coral *Heliopora coerulea*.

The major factor in habitat destruction is through transport of vessel movement and particularly anchorage in the lagoon. Considerable damage is being caused to corals, especially massive forms by the stones and iron anchors used by boats in the lagoon. Damaged corals are susceptible to colonization by algae and diseases. Anchors are deployed indiscriminately without any intention of avoiding coral formations. Increased fishing activity in the lagoon using nets also cause excessive damage to branching forms. Small scale extraction of corals for using as rubble for building construction by the islanders is noticed. Those indulging in the practice did not seem to be aware of the protected status of corals. They were using corals as it is a readily available material as opposed to other construction material which has to be ferried by ship or boat.



Damage by algae, sponges and ascidians observed in Kalpeni



## CONCLUSION

The coral reefs all over the world are undergoing deterioration due to both natural and anthropogenic factors. The Indian reefs are no exception to the worldwide deterioration of the reefs and there has been a significant decline in live coral cover. Reef environment and the associated fauna in Lakshadweep are fast deteriorating and like the other islands in the archipelago. Kalpeni also faced threats from various anthropogenic activities mainly by habitat destruction. Management strategies have to be formulated and implemented to utilise the reefs on a sustainable level and convincing management interventions to create awareness among the various stakeholders to conserve the precious pristine wealth for the future generations.

## LITERATURE CITED

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