

## Status of Coral Reefs in Post-Tsunami Period in Andaman & Nicobar Islands

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**Abstract** Andaman & Nicobar Islands, located in the Bay of Bengal off the eastern coast of India, are one of India's four major sites with coral reefs, mostly fringing types. The survey carried out by the UNDP team along with experts from India in 2001 recorded 197 species of corals in the Andaman group against 179 species reported earlier by Pillai (1983) for the entire Andaman & Nicobar Islands. The survey done by Kulkarni and Saxena (2002) for 24 coral reef sites identified under a coral reef monitoring action plan showed the distribution, status of health and mortality of corals. The Tsunami that struck these islands on 26<sup>th</sup> December 2004 led to vast destruction of coral reefs mainly due to geo-morphological changes resulting in uplifting and exposure of reefs in the northern islands and submergence in the southern islands. A rapid assessment done by the NGO Reef Watch in 2005 showed that there was overall 20% mortality in Andaman group of Islands while in Nicobar group of Islands, up to 80% mortality was observed. The present study is based on the survey being carried out at different coral reef sites to monitor the recovery processes. The initial results show not only recovery but also changes in the distribution pattern of corals.

**Key words:** Tsunami, Live coral cover, Fringing Reefs, Soft Corals, Sedimentation

### Introduction

The Andaman and Nicobar Islands (A & N Islands) constitute one of the hot spots of the biodiversity in India and exhibit a variety of ecosystems such as tropical forests, mangroves and coral reefs. They consist of about 570 islands of varying sizes and are the largest archipelago system in the Bay of Bengal. They are located latitudinally between 06° 45' N to 13° 41' N and longitudinally between 92° 12' E to 93° 57' E. Their total geographic area is 8249 km<sup>2</sup> and the length of coastline is 1962 km. Islands north of 10° N latitude belong to Andaman group of Islands and those south of 10° N latitude fall in Nicobar group of Islands. Only 38 islands are inhabited of which 12 belong to Nicobar group (total islands = 24).

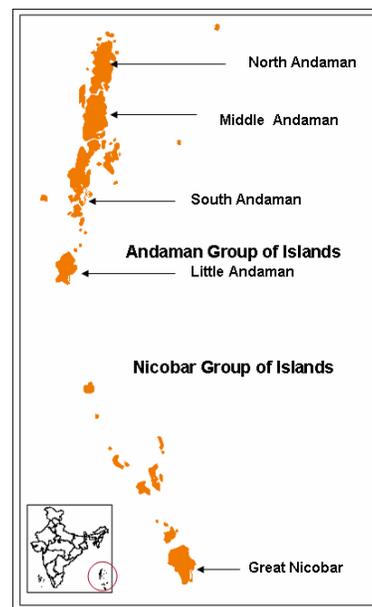


Fig. 1: Location map

### Coral Reefs in A & N Islands

Coral reefs of the A & N Islands are highly diverse and reefs cover about 2000 km<sup>2</sup> i.e., 6% of the total

continental shelf of these islands, mainly as fringing reefs. A barrier reef of about 320 km length with 4 m deep lagoon has been reported on the western side of South and Middle Andaman Islands. It is separated by an 80 m deep channel. The common coral genera contributing to the reef formation in these islands are *Acropora*, *Montipora*, *Pocillopora*, *Porites*, *Gonopora*, *Favia*, *Echinopora*, *Fungia*, *Milleporina*, *Hliopora* etc.

#### *Pre-tsunami status*

The A & N Islands have the richest coral fauna among the four major coral reef sites of India (the other three sites being the Lakhsadweep, Gulf of Mannar and Gulf of Kutch). Alcock (1893) during his visit to Port Blair in 1888 gave a brief description of reefs here and also pointed out the adverse effect of silting in the inshore waters on coral growth. Sewell (1922) described the morphology, community ecology and formation of the reefs of Nicobar. Scheer studied reefs of Great Nicobar and Tillongchang islands. Scheer and Pillai (1974) gave an account of corals of Nicobar Islands. Pillai (1983) reported 135 species belonging to 59 genera and Tikedar et al., (1986) reported 179 species belonging to 61 genera. A recent survey by a UNDP-GOI team who covered selected sites in the Andaman group recorded 197 species of stony corals and estimated the total number of stony coral species to be 234 in Andaman group of islands only (Turner et. al. 2001). Kulkarni and Saxena (2002) studied the status of coral reefs at 24 sites distributed over both groups of Islands under the programme of the Indian Coral Reef Monitoring Network (ICRMN). Wafar (1986) estimated the reef area of the Andaman Islands to be 11,000 km<sup>2</sup> and that of Nicobar Islands to be 2,700 km<sup>2</sup>. Nayak et al. (1994) estimated the total reef area to be 953.3 km<sup>2</sup> using remote sensing. Later, Turner et. al. (2001) estimated the reef area of Andaman Islands using remote sensing data, to be 11,989 km<sup>2</sup>.

#### *Post-tsunami studies*

The Tsunami that struck these islands following a massive earthquake on 26<sup>th</sup> December 2004 caused heavy destruction not only of life and property but also of ecological resources. Reefs were damaged extensively both in Nicobar group as well as in northern islands of Andaman group. No detailed study on impact of Tsunami was carried out, only a few rapid assessments of damage to reefs. The study based on remote sensing data carried out in 2005 by the Space

Application Centre (SAC), Department of Space, revealed that the tsunami caused two main types of damage to reefs- (i) total erosion or breaking up of reefs, and (ii) deposition of sand, mud and detritus on reefs. The report further revealed that the total loss (erosion) of coral reefs in the Andaman Islands was 22978 ha and in the Nicobar Islands it was 17180 ha. Reef Watch Marine Conservation made a rapid survey of selected islands in 2006 and reported that reefs in the North and Middle Andamans suffered mainly because of uplifting of land and exposure of reefs. The damage was less severe (about 20%) in reefs around South Andamans, but it was heavy in Nicobar group of Islands. The present paper deals with the assessments being done in details on selected representative sites in major island groups of A & N Islands.

#### **Methods**

The survey was carried out for Northern group of Andaman Islands in the year 2006 and for Southern Andaman and Nicobar group of Islands in 2008. The survey methods used included LIT (Linter Intercept Transect), Manto Tow and species diversity and area estimation in exposed reefs.

#### **Results and discussion**

The damage to coral reefs took place as a result of two events that occurred on 26<sup>th</sup> December 2004- the first one being the massive earthquake with intensity of 9.3 Richter scale causing geomorphological changes in these Islands. The second was in the form of a giant tsunami wave. The earthquake resulted into uplifting of land by more than 1 m in the North and Middle Andamans and subsidence of land by more than 1 m in the Nicobar group of Islands. This led to exposure of reefs in the northern Islands of the Andamans where mortality ensued due to exposure of reefs while in the Nicobar group of Islands the damage was due to wave action. Many corals were uprooted, broken and turned upside down. Moreover, a lot of sediments was mobilized by wave action and currents, leading to smothering of corals.

#### *North Andamans*

The islands studied included Landfall, East, Smith & Ross, Aves, North Reef and Interview Islands. Significant mortality was observed in all the aforementioned Islands except in Avis Island. Following is the Island-wise account:

*Landfall Island:* Most reefs of Islands were totally exposed. Dead corals constituted of about 85 % of the reef area. *Acropora* constituted 65 % of the coral diversity, the species recorded included *A. florida*,

*A. cytheria*, *A. monticulosa*, *A. humilis*, *A. palythoa*, *A. palifera* and *A. hyacinthus*. Massive and sub-massive corals constituted about 20% and major genera were *Heliopora*, *Pocillopora verrucosa*, *P. eudoxyi*, *Fungia*, *Goniastrea*, *Favites*, *Porites lutea* and *Montipora*.



Fig. 2: Landfall Islands- exposed reefs

**East Island:** Like at Landfall Island, most of the corals were exposed and dead. Mortality was above 70 % and *Acropora* constituted 50 % of species. Massive and sub-massive corals constituted 20 %. Eight *Acropora* species (same as at Landfall Island), *Platygyra pini*, *Ctinactis echinata*, *Hydnopora rigida*, *Pocillopora damicornis*, *P. verrucosa*, *Pocillopora euidui*, *Hydnopora macroconus*, *Symphyllia radians* and *Porites lichen*. were recorded.



Fig. 3: East Island

**Smith & Ross Islands:** Pre-Tsunami assessment by Kulkarni and Saxena (2002) showed live coral cover of 54 % to have declined to 3 %. Earlier dominant species were *Acropora* (45%), *Porites* (16%) and *Montipora* (9%). After the tsunamic, *Porites* (49%) dominated followed by *Favites abtidia* (21%) and *Pavona* (18%).

**Aves Island:** Not much damage was recorded at this island. Pre-tsunami records showed live coral cover to be 62% and a slight decline to 50%. Earlier *Acropora* constituted 40% followed by *Porites* (23 %). After the tsunami, *Acropora*

constituted 83 % and *Porites* 16 % of the community.

**North Reef:** This was one of the best reef sites of the Andaman Islands. Reefs suffered here heavily due to uplifting and exposure of submerged land. Live coral cover which was 74% earlier declined to 13%. *Acropora* dominated the live coral (77 %).

**Interview Island:** Reefs were exposed. Pre-tsunami live coral cover was 68%. post-tsunami the dead coral cover was 80%. Massive and sub-massive coral dominated (70%) and 42 species were recorded. *Diploastrea heliopora* dominates the sub-massive species.

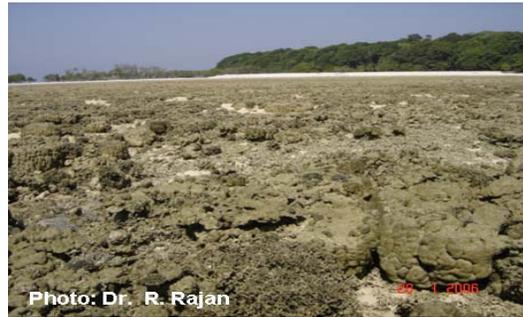


Fig. 4: Interview Island

#### South Andamans

In the South Andamans, seven Islands of the Mahatma Gandhi Marine National Park were studied which included Alexandra, Belle, Baot, Chester, Grub, Snob and Redskin.

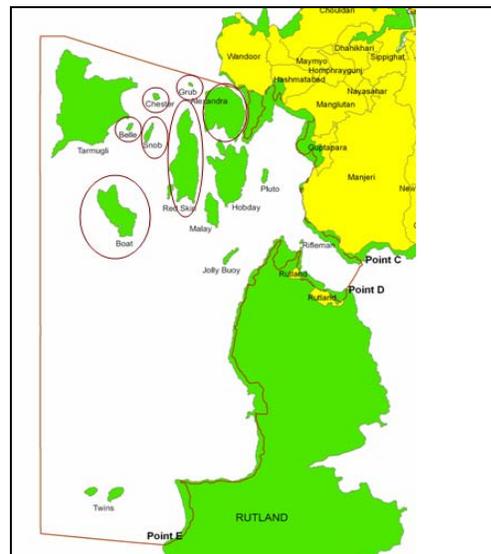


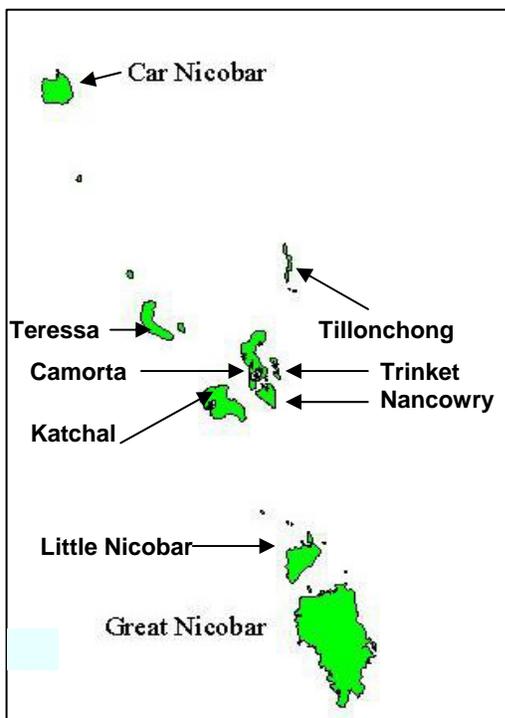
Fig. 5: Mahatma Gandhi Marine National Park

Details of status of coral reefs in pre and post tsunami period are given in Table 1.

**Table 1: Status of coral reefs in MGMNP**

Island	Present Status	% Live Coral	
		Pre-Tsunami	Post Tsunami
<b>Alexendra</b>	Degraded, mostly Boulders	30 %	10-15 %
<b>Bellie</b>	Highly degraded, Massive corals	N. A.	< 10 %
<b>Boat</b>	Highly degraded, Massive corals	16 %	<10 %
<b>Chester</b>	Degraded, mostly Boulder	N. A.	40 %
<b>Grub</b>	Healthy, mostly branching	42 %	Around 60%
<b>Redskin</b>	Degraded, Mostly boulders, soft corals also present	33 %	20 %
<b>Snob</b>	Highly degraded, Massive corals	N. A.	20 %

%) and *Pocillopora* (6 %). Other species included *Acropora* and *Goniastrea*.



**Fig. 6: Nicobar Islands**

Al though the tsunami did affect the reefs, the effect was not very pronounced. The reasons for degradation of reefs in this Marine National Park are mostly local factors that include high sedimentation rate, turbidity and oceanic currents. Corals were in good health around Grub and Chester but not at other islands.

*Nicobar Islands*

Heavy destruction, but also recovery was observed. Impacts were caused by strong tsunami waves as these islands were very near to the epicenter of the quake, as well as the heavy siltation caused due to oceanic currents.

*Car Nicobar*: High mortality (70 %). Live coral only 10 % while in 2003 live coral cover was above 70 %. Some reefs were totally destroyed up to a depth of 20 m. Some patches in shallow waters had survived.

*Teresa*: Less damage with dead corals at 37 %. Live coral cover was 34% and soft corals constituted 14.3%. *Montipora* was the most common genus (21 %), followed by *Porites* (6

*Camorta*: Heavy damage. Dead corals extended over 80% of reef area, live coral on 7 %. Soft corals formed 4 % of total live corals. *Favites* was the most common genus (3 %), followed by *Porites* (2 %), *Siderastrea*, *Platygyra* and *Favia*.

*Katchal*: Signs of recovery. Dead coral covered 49 % of the reef area. Live coral cover 24 % and of this soft corals 12 %. Among live corals, *Heliopora* dominated with 22 %. Other genera include *Montipora*, *Pocillopora*, *Fungia* and *Symphylli*.

*Trinket*: Dead corals covered 62 % of the reef area and live corals only 13 %. Soft corals only in some pockets. *Platygyra* was the most common genus (4.5 %), followed by *Acropora* (4 %) and *Porites* (2 %). Other present genera included *Montipora*, *Goniastrea*, *Pocillopora* and *Heliopora*.

*Nancowry*: better live coral cover (39%) of which 10% was soft coral. Dead coral cover only 13%. Of the live corals, *Pocillopora* dominated with 12 %, followed by *Porites* (6%), *Echinopora* (5 %) and *Favites* (4.5%).

*Little Nicobar*: High mortality due to sedimentation and wave action. Live coral cover less than 10%.

*Great Nicobar*: More than 70 % of corals dead. Maximum damage (80 %) due to direct impact of Tsunami and 20 % damage due to sedimentation. Prior to Tsunami the live coral cover as assessed in 2003 was about 70%, post-tsunami is had declined to 20 %.

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#### **References**

Alcock A (1893) On some newly recorded corals from the Indian Seas. *J Asiatic Soc Bengal* 62(2): 138-149

Kulkarni S, Saxena A (2002), The Conservation Status of Coral Reefs of Andaman & Nicobar Islands, published in 'Coral Reef Degradation in Indian Ocean- Status Report, 2002' by CORDIO, University of Kalmar, Sweden, 2002

Nayak BR, Bahuguna A, Ghosh A (1994) Coral Reef Mapping of the Andaman & Nicobar Group Islands, Scientific note, Space Application Centre, Ahmedabad AC/RSA/RSAG/DOD-COS/SN/08/94:1-13.

Pillai CSG (1983) Structure and Genetic diversity of recent *Scleractinia* of India. *J Mar Biol Assoc India* 25: 78-90

Scheer G, Pillai CSG (1974) Reports on the Scleractinia from the Nicobar Islands, *Zoologica Stuttgart*, 122: 1-72 pls. 1-33

Tikedar BK, Daniel A Subba Rao NV (1986) Sea Shore Animals of the Andaman and Nicobar Islands, *ZSI, Calcutta XII*: 188.

Turner JR, Vousden D, Klaus R, Satyanarayana C, Fenner D, Venkataraman K, Rajan PT, Subba Rao NV (2001) Report of Phase 1: Remote Sensing and Rapid Site Assessment Survey, April 2001. Coral Reef Systems of the Andaman Islands. Government of India, UNDP & GEF.

Wafar WVM (1986) Corals and coral reefs of India. In the proc. Of the Indian Acad Sci Anim Sci Plant Sci Suppl 19-43