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NOTE

# Sedimentation of silt in the coral reef environment of Palk Bay, India

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## Abstract

The sedimentation of silt at five locations in the coral reef environment of Palk Bay was studied during May to October 2004 for a rapid assessment. The rate of sedimentation ranged from 1mg/cm²/d to 42 mg/cm²/d. It was greater during June coinciding with the onset of south-west monsoon season. Areas of greater sedimentation indicated less live coral coverage. Corals of the family Acroporidae were found to be severely affected.

Coral reefs act as natural barriers and protect the shorelines of islands and land-masses against natural calamities. Due to their fragile nature, they can be easily destroyed. The growth rate of coral is very low (Barnes and Lough, 1999). In India, coral reefs are present in the Gulf of Kutch, Gulf of Mannar, Palk Bay, Lakshadweep and Andaman and Nicobar Islands. The Palk Bay reefs are formed along the shores of the mainland. The natural parameters such as light, temperature, salinity and settlement of silt influence the growth of corals. While the first three parameters have either a positive or negative impact depending on the range and intensity, the fourth one viz., silt is definitely a detrimental factor affecting the growth and survival of the coral. Siltation occurs not only due to disturbance of the benthic substratum by anthropogenic activities such as the operation of fishing vessels but also due to natural causes such as monsoon winds. The Palk Bay region along the southeast coast of India is influenced by both southwest and northeast monsoons. Apart from the monsoon effect causing siltation, mechanical damage to corals is also done by cyclones at times in this region (Pillai, 1975). In recent years there have been a lot of anthropogenic activities particularly fishing and related ones leading to siltation in coral reefs in this area. Therefore, the present work was aimed to find out the sedimentation of silt in the coral reef environment of Palk Bay. This rapid assessment study would be of value in view of the proposed *Sethu Samudram* Project.

This study was carried out with funds provided by the Department of Ocean Development of the Government of India through its Ocean Science and Technology Cell based at Berhampur University in Orissa.

## Material and methods

The Palk Bay reefs were monitored as three zones viz., Rameswaram East, Rameswaram North and Mandapam

(Fig.1). Five locations were chosen in these three zones for measuring sedimentation of silt. In the Rameswaram East zone, a location called Olaikudah (09°18.369′ N and 79°20.062′ E) where massive *Porites* are common was chosen. The second area was in Rameswaram North zone called Villunditheertham (09°17.629′ N and 79°15.534′ E). Here, the genus *Favia* is common. In the Mandapam zone three locations viz., Thonithurai (09°17.346′ N and 79°09.808′ E), Bison House (09°17.350′ N and 79°09.184′E) and Mandapam West (09°17.450′ N and 79°09.184′ E) were selected (Fig.1).

Line Intercept Transect (LIT) method (English *et al.*, 1997) was used to assess the live coral covers of the selected sites. A 20 m transect tape was laid on the reef roughly parallel to the shore. The biophysical forms coming under the tape were recorded using underwater slate and pencil with assistance of SCUBA diving. The collected raw data were assessed and the percentage of benthos cover was calculated using ARMDES V1.6 DATA ENTRY PROGRAM provided by the Long-term reef monitoring project of the Australian Institute of Marine Sciences.

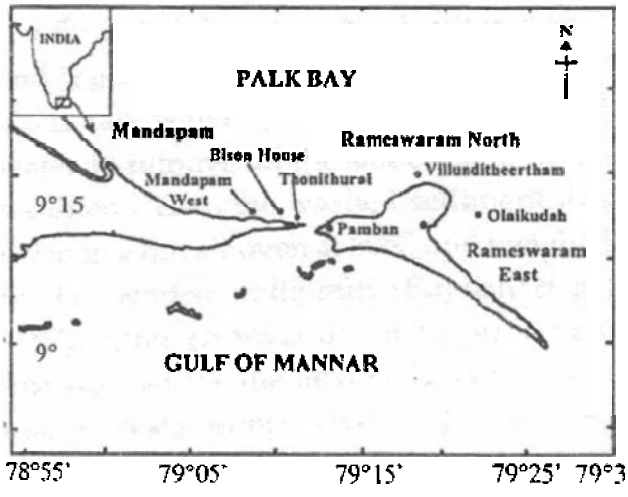


Fig. 1. *Palk Bay map showing the study zones and sites*

To estimate the suspended sedimentation rate in the Palk Bay, sediment traps were placed in all the five locations. These were custom made following the design described by Gardner (1980). Four traps were deployed in each location. The identified location was already marked with a permanent transect for monitoring the corals at periodic intervals. A particular coral of distinct size and dimension was chosen in each of the 20m permanent transects and the traps were laid in all four directions with at least 1m distance from the chosen coral. A steel rod with 4 PVC containers (11.5 cm in height and 5 cm in diameter) at one end was fixed using SCUBA diving in the sea floor at a depth of 3m and 1m away from the permanent transect. In each location, 4 steel rods were placed at right angles to one another to cover all four directions. Thus, 16 PVC containers were placed in each location for collecting sedimented silt (Fig.2).

The sediment traps were removed at monthly intervals for a period of six months from May to October 2004. The mouth portion of the trap was closed with a cap, within the water itself, to avoid sediment loss from the trap while bringing up. The collected sediment traps were labelled immediately and transported to the laboratory. In the lab, sediments were

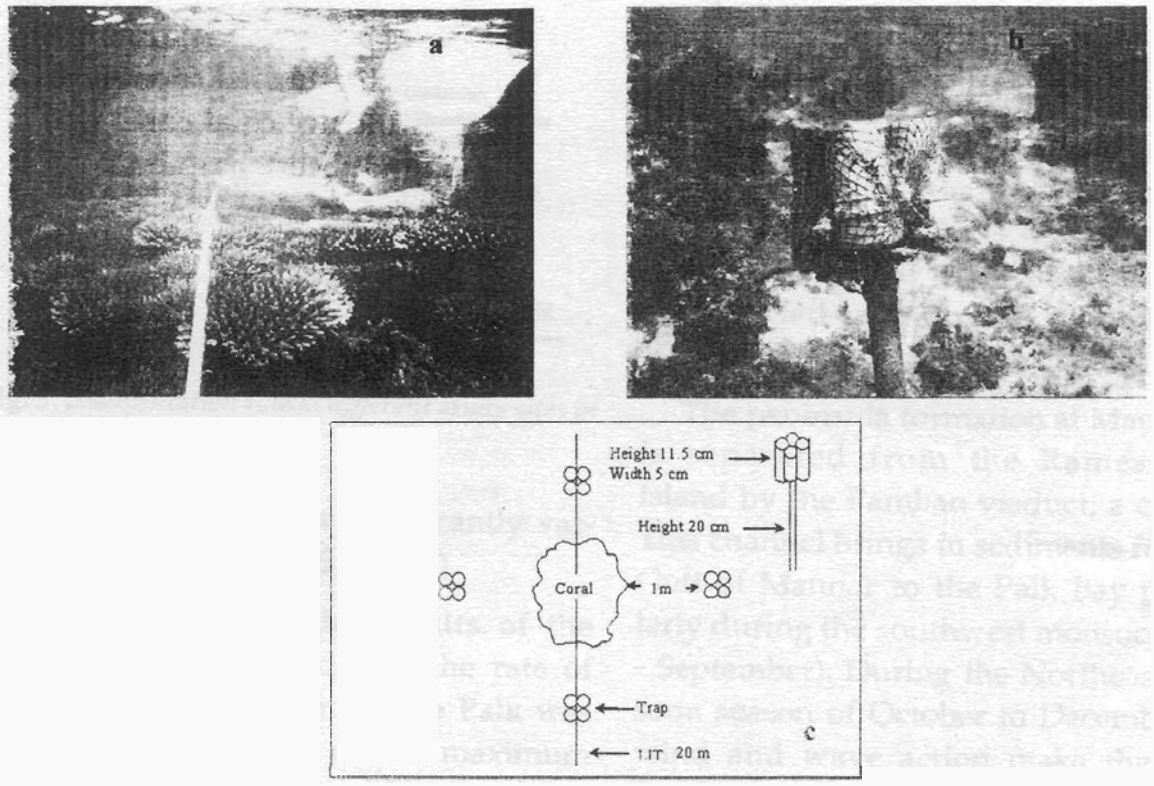


Fig. 2. (a) *Underwater assessment of live coral cover, (b) Sediment trap in-situ and (c) Schematic diagram of in-situ arrangement of sediment traps*

transferred into clean beakers and allowed to settle. The supernatant water was filtered with Whatman No.1 filter paper and the sediment was washed twice with clean tap water and then with distilled water to remove all the salt content in the sediment. Then the washed sediment was dried in a hot air oven at 60°C and weighed to the nearest milligram (English *et al.*, 1997). After removal of each trap, a new one was set for the next collection after a month. Water samples were collected from each zone to analyze the physico-chemical nature of sea water in the study area (Strickland and Parsons, 1977).

## Results and discussion

The quantity of silt collected in the present study varied from place to place. The average sediment level was a minimum of 1 mg/cm$^2$/d as observed in July at Bison House. During June the average quantity of sediment settled was as high as 42 mg/cm$^2$/d as seen in Mandapam West (Fig.3). Among the five sites studied, Villunditheertham and Mandapam West were found to have the maximum siltation during June 2004 (Fig.3). This was due to the June-2004 atmospheric depression. A test of ANOVA on the quantity of sediments in the study sites indicated that

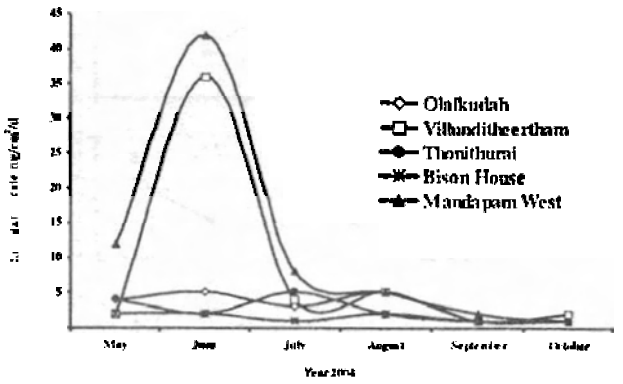


Fig. 3. *Sedimentation rate at different study sites in Palk Bay*

the sedimentation rates significantly varied ($P<0.05$; $F_{5, 29}$ =2.55, 2.612).

A comparison of the results of the present study indicated that the rate of maximum sedimentation in the Palk was 3 times less than that of the maximum (124.49 mg/cm²/d) observed in Lakshadweep. Similarly, the minimum sedimentation rate observed was 3 times lesser than that of the minimum (2.69 mg/cm²/d) seen in Lakshadweep (Suresh, 1991).

Corals in general were found to be healthy and seen with extended polyps except in June. The coloration also was

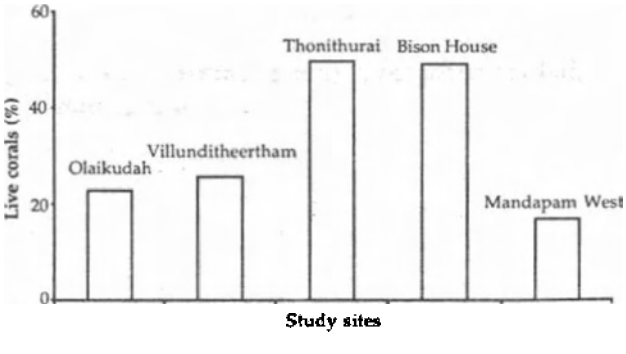


Fig. 4. *Live coral cover (%) at various sites*

good. As a result of sedimentation, the corals of the family Acroporidae were observed to be stressed severely. The percentage of the live coral cover was low at both Villunditheertham and Mandapam (Fig.4). A test of ANOVA also indicated that the live coral cover in all the study sites varied significantly ($P<0.05$; $F_{4, 14}$ =3.11, 8.194).

The peninsula formation at Mandapam is separated from the Rameswaram Island by the Pamban viaduct, a channel. This channel brings in sediments from the Gulf of Mannar to the Palk Bay particularly during the southwest monsoon (June - September). During the Northeast monsoon season of October to December, the wind and wave action make the water turbid in Palk Bay (Pillai, 1975). Although some coral genera such as *Favia, Favites, Goniastrea, Platygyra* and *Symphyllia* are capable of removing sand particles using their long polyps, corals like *Acropora* and *Montipora* with small polyps suffer due to siltation. Some species of corals like *Galaxea* and *Goniastrea* have the ability to remove suspended sediments using their sweeper tentacles. However, their entire energy might be utilized only to remove the sand particles and hence the growth would be affected. Sedimentation affects their mass spawning, reduces light penetration and hence photosynthesis of the symbionts resulting in significant differences in rates of extension and calcification of corals (Lough and Barnes, 2000). In the Gulf of Mannar, reefs are present around the 21 islands, where anthropogenic influence is less. On the other hand, in the Palk Bay,

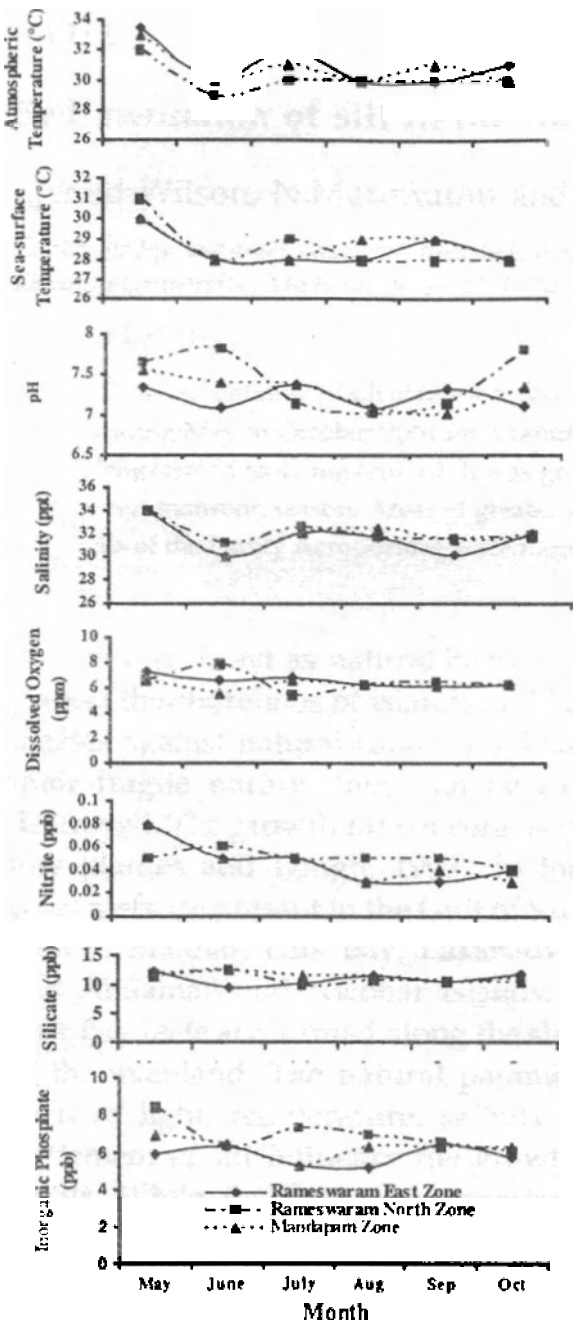


Fig. 5. *Physico-chemical status of the waters of Palk Bay (2004)*

the reefs are lying adjacent to the shore and hence are severely affected. (Mahadevan and Nayar, 1972).

Although there were variations in the sedimentation rates and live coral cover in all the study sites, the estimated physico-chemical parameters did not vary appreciably (Fig.5). It could be discerned that the Palk Bay reefs were hard pressed for survival because of the impact of sedimentation.

## References

Barnes, D.J. and J.M. Lough. 1999. *Coral Reefs.* 18:213-218.

English, S., C. Wilkinson and V. Baker. 1997. Survey manual for Tropical Marine Resources. 2nd Edn. Australian Institute of Marine Science. 390pp.

Gardner, W.D. 1980. *J. Mar. Res;* 38:41-52.

Lough, J.M. and D.J. Barnes. 2000. *J. Exp. Mar. Biol. Ecol;* 245:225-243.

Mahadevan, S. and K.N. Nayar. 1972. Distribution of coral reefs in the Gulf of Mannar and Palk Bay and their exploitation and utilization. In: *Symp. on Corals and Coral Reefs.* Marine Biological Association of India. p. 181-190.

Pillai, C.S.G. 1975. *Seafood Exp. J;* 7(12): 9-21.

Strickland, J.D.H. and T.R. Parsons. 1977. A Practical Handbook of Seawater Analysis. Bulletin 167 (2nd Edn.) Fisheries Research Board of Canada, Ottawa, 310pp.

Suresh, V.R. 1991. Studies on the coral reefs of Lakshadweep. *Ph. D Thesis.* Cochin University of Science and Technology, India. 123pp.