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A PRELIMINARY STUDY ON DIVERSITY, STATUS, THREATS AND MANAGEMENT STRATEGIES OF CORALS OF AMINI ISLAND, LAKSHADWEEP

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Abstract

Amini Island located at 11.123? N 72.724? E. It has land area of 2.71 km² and is 2.8 km long and 1.3 km width at its broadest point. Density of Amini Island is 7843. Amini Island is one of the first islands in the Lakshadweep archipelago to be peopled. The island Amini completely fills the interior of the ring reef and only a very small Lagoon is there on the Western side. In the present study, the diversity of Coral reef was surveyed in Amini Island and a check list was prepared and tabulated. A total of 39 species of corals belonging to 22 genera and 13 families were recorded in this survey. Acropora was the most dominant genera of corals which was observed all along lagoon. Next dominant genera were Pocilloporid followed by Porites and Favites. The status of recording was categorized as Common, Uncommon, Abundant, Rare and Sometimes common. The major threats noticed during the study were classified as Natural, Anthropogenic and Environmental. Some conservation strategies were also recommended and suggested in the present study.

Keywords **:** *Coral diversity, Amini Island, Acropora, Pocilloporid, Porites, Favites Status, Threats.*

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Introduction

The Lakshadweep island lies scattered in the Arabian sea about 225 - 450 Km from Kerala Coast Geographically, the Islands lay between 80 N& 120 SN latitude & 710 E & 740E longitudes. The Island consist of coral formations built up on the laccadive chagos submarine ridge rising steeply form a depth of about 1500 m to 4000 m off the west coast of India. Lakshadweep which is an area biologically significant due to isolation from the major coastal line, remains as one of the least studied areas in the Indian Ocean. The 12 atolls, 3 reefs and 5 submerged banks of Lakshadweep have a reef area of 816.1 Sq. Km. The "International Union for Conservation of Nature and Natural Resources" identified coral reefs as one of the essential life supporting systems, necessary for human survival and sustainable development (IUCN/UNEP/WWF, 1976). All marine ecosystems, coral reefs have the highest productivity and sustain heaviest human use (Wells, 1989). Many of the world coral reefs are under the threat of nature and manmade damages. Lakshadweep coral reefs are no exception to this. Information on corals, their taxonomy and distribution have been elaborated by Pillai (1971,1972,1986 ,1987). Pillai (1996) also reported the coral fauna of Lakshadweep known to harbour 120 species of and 27 genera, his study on 'The Global biodiversity of coral reefs'. Veron (2000) reported 18 families, 111genera and 793 species of scleractinian form the world in his 3 pictoral volumes of the corals of the world. The scleractinian corals of India have rich diversity as compared to the other reefs of the tropical world. Masood (2008) reported the impact of climate change on hard corals of Lakshadweep Islands. IdreesBabu and Suresh Kumar (2016) made a study on status and changing trends of coral reefs in Lakshadweep Archipelago. The present study will provide information on the diversity of corals in Amini Island, its distribution, status, threats and damage faced by the corals, its conservation and management strategies.

Methodology

The area selected for study is the Amini Island (11.123? N 72.72?E) of Lakshadweep group of islands, having an area of 2.71km² with an elevation of 2m. It has a distance of 1994 km south of the city of Delhi, having a length of 2.8 km and width of 1.3 km. Density of Amini Islands are 7843. Based on the weather, the year may be divided in to three seasons, namely pre monsoon (February -May), monsoon (June-September) and post monsoon (October -January). This station is located in east coast direction which is characterized by the interaction of coral leaves, mangroves and sea grasses, ecosystem and has direct contact with open sea. The area is characterized by the patchy sea grass meadow and the presence of coral. Strong tidal currents prevailed here. Intermittent field visits and direct observations

were made along the sea coast for collecting and surveying the corals. Samples were collected on the intertidal areas of Amini island during low tide. Maximum care were taken at the time of data collection to avoid damage and distribution by considering its important and value in our ecosystem. The collected samples soaked in the fresh water for few days to getting the exact skeletal structure for easy identification. The photographs of different species collected in the present study were taken from the field by using 'Kodak digital camera'. Some of the collected species were identified by using field guide of Indo specific field guide and others were identified with the help of concerned literature and experts in the field.

Results and Discussion

The present study on the survey of coral fauna conducted on Amini island of Lakshadweep reveals the diversity of corals, its distribution, status, threats and damage faced by the corals, and some measures on conservation and management strategies. The results of survey was tabulated and presented in Table 1 & 2. Total number of family, genera and species recorded from Amini island is shown in Table 1. A total of 39 species of corals belonging to 22 genera from 13 families along the coast of Amini Islands of Lakshadweep. Acropora was the dominant family corresponding 9 species represents from a single genera constituting 23% of total population. Second dominant family was Favidae represented by 8 species from 2 genera.(20.5%).This was followed by Pocilliporidae with 5 species constituting 15%, Fungidae, Merulinidae and Poritidae with 3 species each with an equal distribution of 7.6%. The remaining 8 families were represented only a single species each.(Fig-1)

The relative abundance of various families recorded during the study can be represented by Acropridae > Favidae > Pocilliporidae > Fungidae = Merulinidae = Poritidae > Siderastreidae > Occulinidae = Scleractinia incertae sedis = Pectinidae = Agaricidae = Tubiporra = Heloporidae = Meandrinidae. The order wise distribution reveals that 37 species were Scleractinians, and the remaining two from Helioporaceae and Stoleniferae respectively (fig-2). Studies on coral reef of Lakshadweep conducted by Suresh (1974) reported a total of 49 species of corals from Amini Island. Compared to this in the present study diversity is little bit less with 39 species only with a decreasing number of 10. This decrease may be due to coral mining, dredging, overfishing, hurricanes, tsunamis, volcanoes earthquakes, bleaching, pathogens.(Wilkinson,2011). The most dominated species was Acropora in Lakshadweep with a total number of 25 species (Suresh 1974). Similarly in the present study also reported that Acropora was dominated with 9 species out of 39 species.

Table-1: Taxonomic classification of coral species

Sl.No.	Scientific name	Class	Order	Family
1	*Acropora valeciennesi*	Anthozoa	Scleractinia	Acroporiidae
2	*Acropora irregularis*	Anthozoa	Scleractinia	Acroporiidae
3	*Acropora selago*	Anthozoa	Scleractinia	Acroporiidae
4	*Acropora Formosa*	Anthozoa	Scleractinia	Acroporiidae
5	*Acropora nobilis*	Anthozoa	Scleractinia	Acroporiidae
6	*Acroporatenius*	Anthozoa	Scleractinia	Acroporiidae
7	*Acroporavallida*	Anthozoa	Scleractinia	Acroporiidae
8	*Acropora humilis*	Anthozoa	Scleractinia	Acroporiidae
9	*Acropora samoensis*	Anthozoa	Scleractinia	Acroporiidae
10	*Favites Complanata*	Anthozoa	Scleractinia	Faviidae
11	*Favia pallid*	Anthozoa	Scleractinia	Faviidae
12	*Leptoria Phrygia*	Anthozoa	Scleractinia	Faviidae
13	*Favites sps 1*	Anthozoa	Scleractinia	Faviidae
14	*Favites sps 2*	Anthozoa	Scleractinia	Faviidae
15	*Favites sps 3*	Anthozoa	Scleractinia	Faviidae
16	*Leptoria sps 1*	Anthozoa	Scleractinia	Faviidae
17	*Leptoria sps 2*	Anthozoa	Scleractinia	Faviidae
18	*Stylopora pistillata*	Anthozoa	Scleractinia	Pocilloporidae
19	*Pocillopora meansrina*	Anthozoa	Scleractinia	Pocilloporidae
20	*Pocillopora eydouxi*	Anthozoa	Scleractinia	Pocilloporidae
21	*Seriatopora caliendrum*	Anthozoa	Scleractinia	Pocilloporidae
22	*Pocillopora verrucosa*	Anthozoa	Scleractinia	Pocilloporidae
23	*Cycloseris cyclolites*	Anthozoa	Scleractinia	Fungiidae
24	*Cantharellus doederleini*	Anthozoa	Scleractinia	Fungiidae
25	*Psammocora contigua*	Anthozoa	Scleractinia	Fungiidae
26	*Cyphastera serailia*	Anthozoa	Scleractinia	Merulinidae
27	*Goniastrea retiformis*	Anthozoa	Scleractinia	Merulinidae
28	*Hydnopora rigida*	Anthozoa	Scleractinia	Merulinidae
29	*Porites sps*	Anthozoa	Scleractinia	Poritidae
30	*Porites lutea*	Anthozoa	Scleractinia	Poritidae
31	*Porites lobata*	Anthozoa	Scleractinia	Poritidae
32	*Ctenella chagius*	Anthozoa	Scleractinia	Meandrinidae
33	*Coscinaraea columna*	Anthozoa	Scleractinia	Siderastreidea
34	*Leptastrea purpurea*	Anthozoa	Scleractinia	Scleractinia incertae sedis
35	*Galaxea fascicularis*	Anthozoa	Scleractinia	Oculinidae
36	*Oxypora lacera*	Anthozoa	Scleractinia	Pectinidae
37	*Leptoseris yabei*	Anthozoa	Scleractinia	Agariciidae
38	*Tubipora sps*	Anthozoa	Stoleniferae	Tubipora
39	*Heliopora sps*	Anthozoa	Helioporacea	Helioporidae

The status of recording of corals and its distribution was presented and tabulated. (Table-2). Among the 39 species 18 were common, 3 uncommon, 4 abundance.,10 rare and 4 some times common. Amini Island have a very shallow lagoon and its major portion set exposed during low tides. Acropora was the most dominant coral colony which was mostly distributed on the entire shallow lagoons of the island. The next dominantly distributed form was Pocillipora, Porites and Favites. The shallow intertidal areas of lagoon are characterized by thick growth of sea grass that favors their distribution. The northern side of lagoon showed a good growth of massive corals mainly porites.

Table 2- Status and distribution of corals in Amini Island

Sl.No.	Scientific name	Status
1	*Acroporavaleciennesi*	C
2	*Acropora Formosa*	A
3	*Acroporahumilis*	C
4	*Acroporanobilis*	SC
5	*Acroporasamoensis*	C
6	*Acroporaselago*	C
7	*Acroporatenius*	C
8	*Acroporavalida*	A
9	*Acroporairregularis*	C
10	*Cantharellusdoederleini*	R
11	*Coscinaraeacolumna*	R
12	*Ctenellachagius*	C
13	*Cyphastreaserailia*	C
14	*Heliopora sps*	SC
15	*Faviapallida*	UC
16	*Favitescomplanata*	SC
17	*Favites sps 1*	R
18	*Favites sps 2*	R
19	*Favites sps 3*	C
20	*Galaxeafascicularis*	C
21	*Goniastrearetiformis*	C
22	*Hydnoporarigida*	SC
23	*Leptoria sps 1*	R
24	*Leptoria sps 2*	R
25	*Leptoria Phrygia*	R
26	*Leptstreapurpurea*	R
27	*Leptoserisyabei*	UC
28	*Oxyporalacera*	C
29	*Pocilloporaeydouxi*	C
30	*Pocilloporameandrina*	C
31	*Pocilloporaverrucosa*	C
32	*Porites sps*	C
33	*Poriteslobata*	A

34	*Poriteslutea*	A
35	*Psammocoracontigua*	C
36	*Seriatoporacaliendrum*	UC
37	*Styloporapistillata*	R
38	*Tubipora sps*	R
39	*Cycloseriscyclolites*	C

*C = Common *UC = Uncomon * A=Abundance * R = Rare * SC = Sometimes common

Fig: 3. Percentage of occurrence of different families

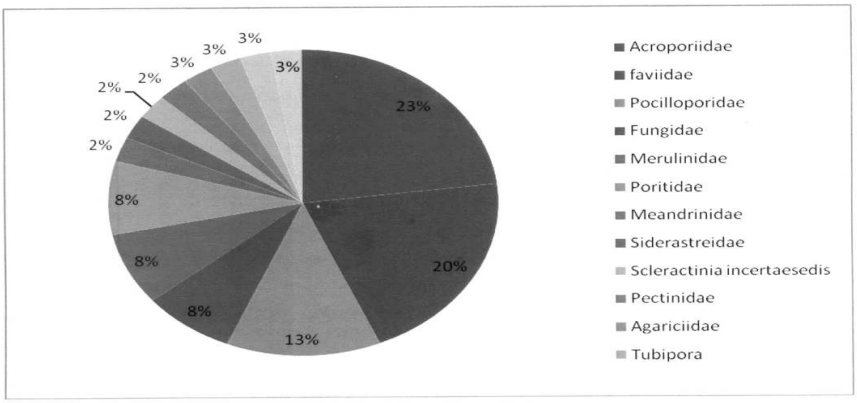
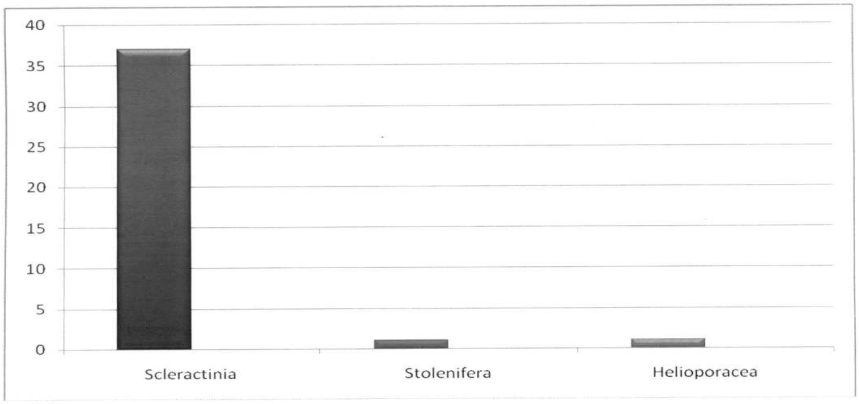


Fig: 4 Order wise classification of Coral species



The lagoon flat looks heavily sedimented. Seaward side is subjected to heavy land erosion and continuous dredging is reported from the island (James et al., 1989). In studies conducted along the Lagoon of Kavaratti Island, by Scientists of National Geophysical Research Institute (NGRI), Hyderabad showed that around 25% decrease in the growth rate (Calcification) of hard corals was observed between 1993 and 2003.(Masood,2008). The mining of coral blocks in Kadmath beach is being done for many years for constructing houses, fences and producing quick lime. The total amount of coral has been removed from the coral flats and that may affect the change of geomorphology of Island. According to Raja Surya et al., (1999), coral mining is prevalent in most south and south East Asian countries. According to Pillai (1983), the rate of siltation in the lagoons of Minicoy and other Islands would have increased due to sea erosion and disturbance to the lagoon. No detailed study on the rate of siltation in Lakshadweep is available. All Islands in the archipelago are subjected to cyclones which may do mechanical damage to coral growth, (Pillai et al, 1986). Study by Rajasurya and Hussain Zahir, (2008) reported that Predicted climate change impacts in South Asia including sea level rise and potential increase in the frequency and intensity of cyclones and storm, all of which have adverse impact on coastal areas. The Crown of thorn of starfish Acanthasterplanci is a large starfish which feeds on coral tissues and has increased mortality rate, especially of Acropora and Pollicopora corals leading to decrease in the population of these species. The same may be reason for decrease in population of corals in the present study, but this area need intense investigation. According to Forbes (2006), the crown of thorns, starfish Acanthasterplanci are predators of corals, they secrete digestive juice out of their bodies and efficiently digest coral polyps. A single crown of thorns starfish can eat up to their body size in coral polyps every day. He also noted that many of the starfish natural predators such as the Humpheadwrasse (Cheilinus undulates) and the Giant triton (Charonia tritonis) have been over-fished in many reefs. When these happen, crown of thorns, starfish can grow unchecked and destroy reefs.

Studies on coral ecosystem have shown that disease outbreak has increased since 1990 (Willikinson 2004). According to him in the Carebian pacific not only has the incidence of increase, but the number of new disease affecting coral has also increased. It is through that increased ocean temperature due to climatic change increases the livelihood of infection. It has also been observed that closeness to human population also increased infection. Invasive Alien species (IAS) are much of a threat in marine environment has they are on land. According to Veron, (2000) habitat of Tubipora were restricted to shallow water and is to be found in sheltered area. It is a common species of reef slopes, but inconspicuous.The features associated with the Islands are reeflats, reef slopes, lagoon and sandy beach and is really suitable for Tubipora. Leptoria phrygia mainly occurs in shallow tropical reef environment particularly on upper reef slopes. It is usually found at a depth between 3 and 15

meters, but may occasionally to be found at both shallow water and a depth below 30 meter. (Veron,2000). As compared to earlier the occurrence of Acropora is lower in the present study. This may be due to cyclones, global warming, soil erosion, bleaching as well as the crown of thorn of starfish Acantha sterplanci , a large starfish which feeds on coral tissues and has increased mortality rate, especially of Acropora and Pollicopora corals leading to decrease in the population of these species (Forbes (2006), and this area need intense investigation.

Results of the observations made in the islands to assess the state of interference and damage caused to the reefs, need for conservation and possible measures for the management of the system are presented. Threats noticed during the study mainly by Natural and Anthropogenic. Major natural threats were due to Hurricanes, Tsunamis, Volcanoes, Earthquakes, Predators and competitors, Bleaching, Pathogens etc. Coral reef ecosystem at Lakshadweep is reported to be deteriorating due to various natural and man-made interferences (Pillai,1983, 1996;).Sharp decline in the percentage live coral cover was observed after the 2010 bleaching event in all the 12 atolls of Lakshadweep archipelago. Bleaching event of 1998 due to El-Nino has been reported to have damaged 70% of corals in Lakshadweep Islands. The other potential threats to coral reef include marine pollution due to oil slicks, disposal of untreated sewage and dumping of non-biodegradable solid waste into the marine ecosystem.(Johannes,1975) Studies carried out by CESS under the project of Coastal Ocean Monitoring and Prediction System (COMAPS) indicate that the coral reef ecosystem is subjected to stress mainly due to anthropogenic pressures.

As the unique marine ecosystems of coral reefs express varying levels of degradation as a result of increasing anthropogenic pressures, the Coral reef protection is the process of modifying human activities to avoid damage to healthy coral reefs and to help damaged reefs recover. For that immediate measures to be taken for the conservation of corals. Awareness programme for creating knowledge and management conservation for the public (Pillai and Venkataraman, 2000). Declared some areas as marine protected areas, and Pollution control should be carried out in all inhabited islands.

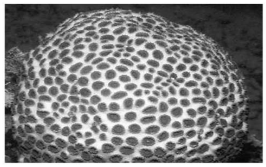
Climate change is one example of the outcome of these global forces, which threatens to disrupt and alter much of the world around us. Coral reefs are one of the early indicators of this change; they are fragile and respond quickly to adverse pressures. These pressures are increasing and coral reefs are coming under greater threat. Their decline is a warning to us all. Management of coral reef resource is lacking, such that coral reef with in designated marine protected areas continue to degrade. Coral reef protection is by the process of modifying human activities to avoid damage on healthy corals and to help damaged reefs recover. Immediate measures to be taken for conservation of corals. It includes awareness programme

for creating knowledge and management conservation for the public, Declared some areas are marine protected areas, Pollution control should be carried out in all inhabited islands etc.

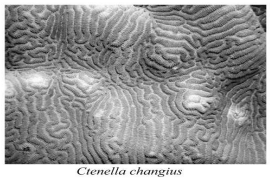
Conclusion

The study conducted during June 2015- June 2016, shows a heavy decrease in the number and diversity of coral reefs especially of Acropora one of the common coral species at all the islands of Laksha dweep. This may be due to cyclone, global warming, soil erosion and mining. Corals reefs continue to be degraded by human impacts associated with growing population and costal development, specifically related to controlled resource exploitation, coral mining and the effects of sedimentation and population. Natural impacts also play a part in coral reef degradation with reefs threatened by crown of thorns starfish and impacts related to climate change, such as coral bleaching and cyclones. Management of coral reef resource is lacking, such that coral reef with in designated marine protected areas continue to degrade. So strict measures are to be taken to prevent further loss by ensuring laws.

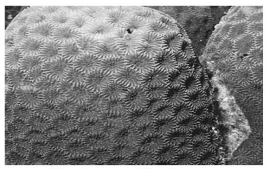
Plate1.Figures of collected corals



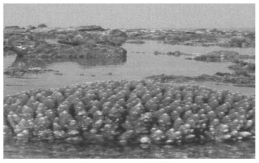
Fabia pallida



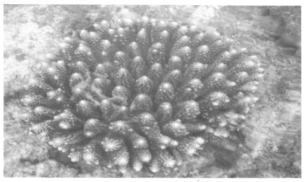
Ctenella changius



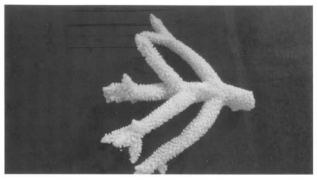
Goniastrea retiformis



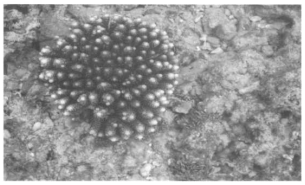
Acropora valida



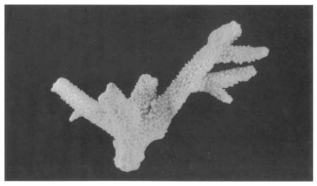
Acropora humilis



Acropora formosa



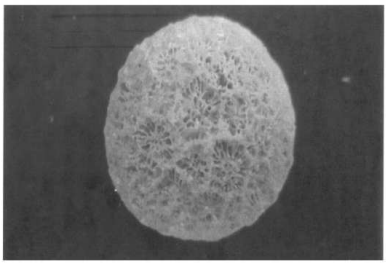
Acropora samoensis



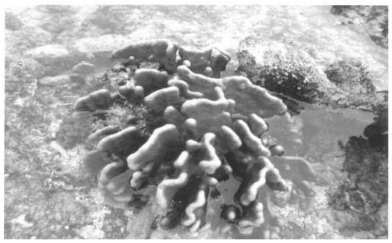
Acropora nobilis

Plate2. Figures of collected corals

Ctenella changius

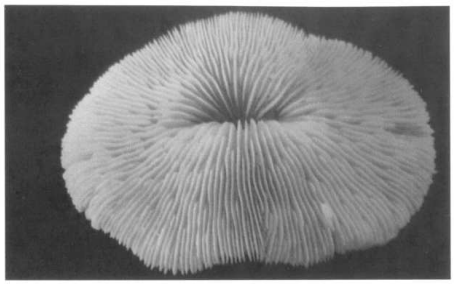


Favia pallida

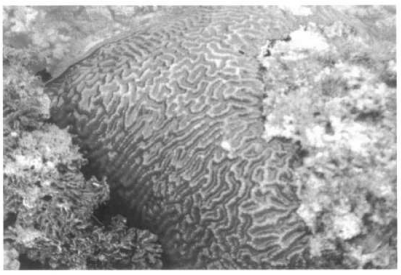


Holiopora sp

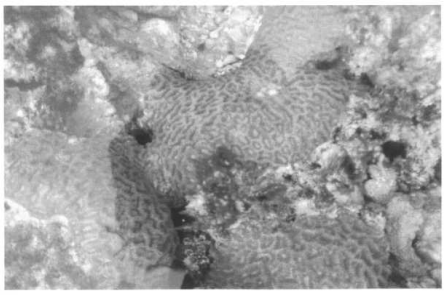
Pocillopora eydouxi



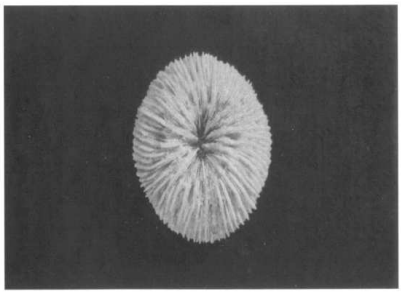
Cantharellus doederleini



Ctenella chagius

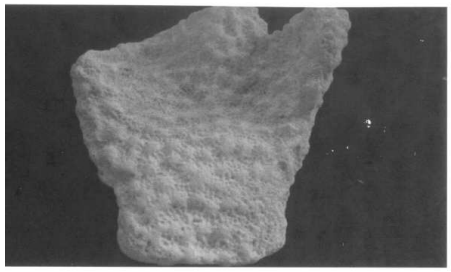


Coscinaraea columna

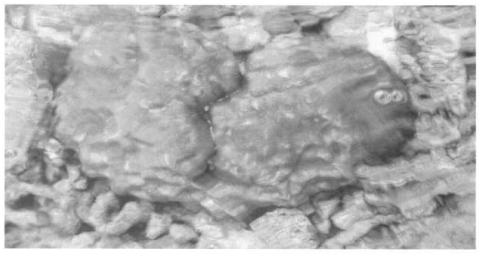


Cycloseris cyclolites

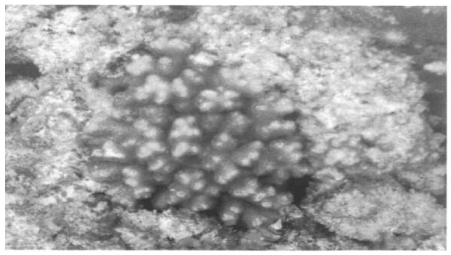
Plate 3. Figures of collected corals



Pocillopora meandrina

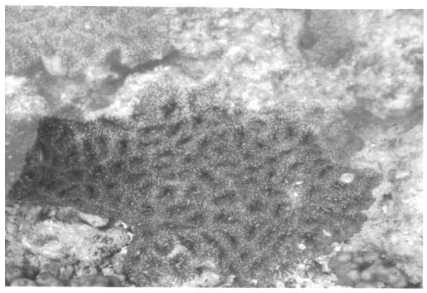


Porites sps



Pocillopora verrucosa

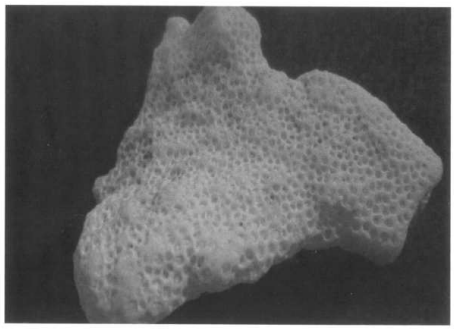
Porites lobata



Leptoria sps

Oxypora lacera

Leptoseris yabei

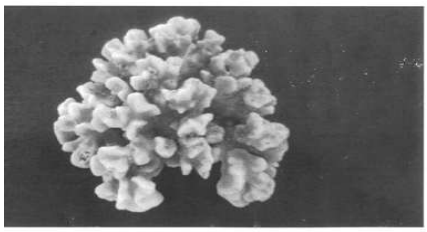


Pocillopora eydouxi

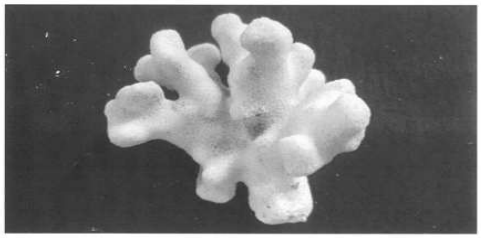
Plate4.Figuresofcollectedcorals

Porites lutea

Seriatopora caliendrum



Psammocora contigua



Stylopora pistillata

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