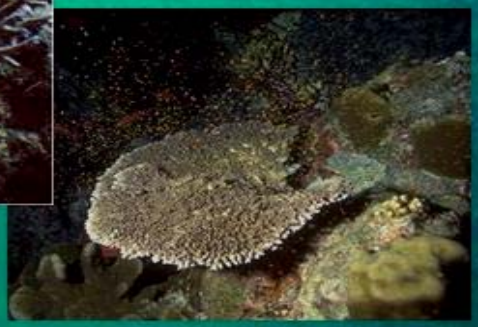
Report on Visit to Lakshadweep – a coral reef wetland included under National Wetland Conservation and Management Programme of the Ministry of Environment & Forests. 30th October – 1st November 2008



Planning Commission
Government of India
November 2008

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1. Context

An Expert Team was constituted by the Planning Commission, Government of India, to review the status of implementation of the National Wetland Conservation and Management Programme (NWCMP) of the Ministry of Environment & Forests, by visiting selected wetlands in the country. The Expert Team made, on-the-spot review and assessment of the Lakshadweep Coral reef wetland ecosystem at Agati and Kavaratii Islands. This was the fifth wetland visited after Chilika, Vembanad-Kol, Deepor Beel and Pichavaram mangroves.

2. Visit itinerary

The Team comprising Dr.Indrani Chandrasekharan, Advisor(E&F), Planning Commission, Dr. M. Ravindranath, Jt. Adviser, Planning Commission, Dr. T. Balasubramanian, Director, CAS in Marine Biology, Annamalai University and Dr. V. Sampath, Ex-Advisor, MoES and UNDP Sr. National Consultant, visited Lakshadweep on 30th October – 1st November 2008 and held discussions with Mr. C.N.Abdul Raheem, Environment Warden, Agatti and Mr. G. Kumar, Deputy Conservator of Forests, Kavaratti and Dr. K. Syed Ali, Environment Warden, Kavaratti. The Team also met Shri B.V. Selvaraj, Administrator, Lakshadweep and Shri. Rajendra Prasad Pal, Collector-cum-Development Commissioner, Kavaratti.

Details of presentations are at Annexure-1. Discussions were held during the site visit to the coral reef wetland at Agatti and Kavaratii Islands, Lakshadweep.

3. On Lakshadweep Islands and the coral reef ecosystem

3.1 Lakshadweep Islands

The Union Territory of Lakshadweep is an archipelago situated in the Arabian Sea between 08° 00' N and 12° 30' N latitude and 71° 00' E and 74° 00' E longitude and at a distance of 220 - 440 km from the west coast of India. Lakshadweep is the tiniest Union Territory of India and lies about 220-440 km from Kochi, Kerala (Fig.1). The length of the coastline is 132 km, which is approximately 1.6 % of India's total coastline. The islands have a lagoon

area of about 4000 sq. km., territorial waters covering an area of 20,000 sq. km, continental shelf of 4000 sq. km and an EEZ of 0.4 million sq. km.

The islands are flat, rarely rising more than two meters, and consist of fine coral sand and boulders compacted into sand stone. Most atolls have a northeast, southwest orientation with an island on the east, a broad well developed reef on the west and a lagoon in between.

All Lakshadweep islands are of coral origin and some of them like Minicoy, Kalpeni, Kadmat, Kiltan and Chetlat are typical atolls. The coral reefs of the islands are mainly atolls except one platform reef of Androth. The height of the land above the sea level is about 1-2 metres.

The Lakshadweep group of islands compise 36 islands, covering an area of 32 sq.km with Kavaratti as the Capital. Lakshadweep is comprised of 11 inhabited islands, 16 uninhabited islands attached islets, four newly formed islets and 5 submerged reefs. The inhabited islands are Kavaratti, Agatti, Amini, Kadmat, Kiltan, Chetlat, Bitra, Andrott, Kalpeni and Minicoy. Bitra is the smallest of all having only a population of 225 persons (Census 1991). The uninhabited island Bangaram has been enumerated during 1991 census operation and has a population of 61 persons.

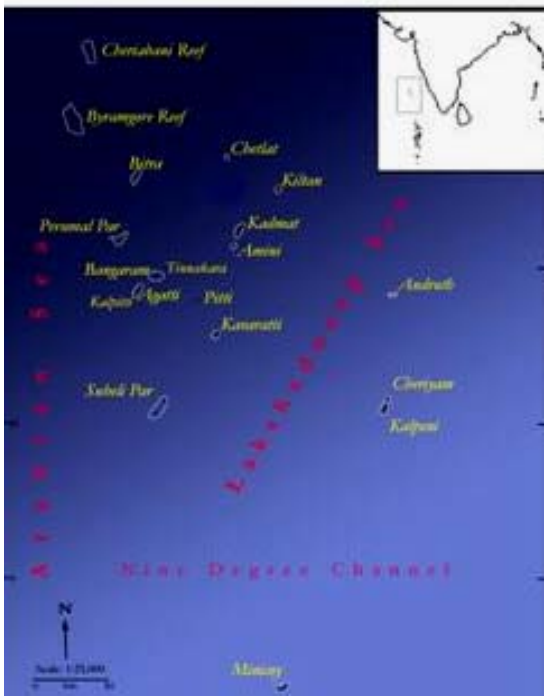


Fig. 1. Lakshadweep Islands

According to the provisional population Data sheet of 2001 Census, Lakshadweep has a population of 60,595 persons. More than 93% of the population who are indigenous, are Muslims and majority of them belong to the Shafi School of the Sunni Sect. **The density of population is 1899 persons per sq.km, which is third highest in the country and cause of concern.**

Reefs of all atolls are evident on the south west side. Androth has no lagoon while Bangaram lies in the center of lagoon. These islands have a warm and humid tropical climate (air temperature - 17-38^{0}C, humidity - 70%), and

receive an annual rainfall of about 150 cm mainly from the southwest monsoon (June to September). The surface water temperature varies between 28 – 31^{o} C while its salinity ranges from 34 to 37 ppt (salinity in Arabian sea is 39.8 ppt and ranges between 39-40 ppt). The lagoons and the surrounding waters and corals reefs are replete with a wide variety of flora and fauna. Coconut and tuna fish form the mainstay of the economy of the islanders.

3.2 Field Visits

3.2.1 Agatti

On arrival at Agatti from Kochi on 30th October,2008, the Team members accompanied by Shri C.N. Abdul Raheem, Environment Warden (EW), Agatti, traversed the entire lagoon on the western side of the main atoll and the barrier reef in the open sea off Agatti for over three hours, to assess the status of coral reef ecosystem and associated flora and fauna. In the lagoon area the Team Members could see patches of different coral species including live *Acropora sp*. (finger corals), *Porites sp*., soft corals and other animals, besides the algal assemblages on dead corals.

Fig.2 Satellite imagery of Agatti Island

Fig. 3: A view of two types of corals at Agatti – Porites & Acropora

The total area under the lagoon on the west coast of Agatti Island is around 17.5 sq.km, as compared to the land area of 2.71 sq.km. The Island has a population of about 7000 persons, as per 2001 Census. The EW informed Members that the live coral cover which declined during the 1998 coral bleaching event, improved over the past decade and now it stands at about

35-40%. The Team was also informed that the S&T Department is implementing the **Lakshadweep Coral Reef Monitoring Network (LCRMN),** funded by the Ministry of Environment & Forests, by involving the NIO Scientists, including Dr. M. Wafar, as an Adviser. Under this programme, regular survey is being carried out in 12 Islands for assessing the extent of live coral cover, the oceanographic parameters including biotic and abiotic factors having impact on the coral reef and associated ecosystem, etc. He also indicated that the Lakshadweep Administration has placed at the disposal of NIO the entire amount earmarked for the project and most of the equipment procured under the project are with NIO at Goa and some of them at Kavaratti.

3.2.2 Kavaratti

On 31st October 2008, the Team left Agatti for Kavaratti to under take field visits and for discussions with the Administrator and the Environment Department officials. The Team was received by Shri G. Kumar, Dy. Conservator of Forests, at the Helipad.

Fig. 4. Satellite imagery of Kavaratti Island.

Kavaratti is the capital of Lakshadweep. The Island land area is around 3.63 sq.km, with a population of 10,113 (2001 Census). Kavaratti has a lagoon on the west coast, which spreads to around 4.9 sq.km. The Team was taken in a glass bottom boat inside the lagoon off Kavaratti for assessing the status of live coral cover, and biodiversity of marine ornamental fishes and associated flora and fauna. The Team observed a number of live coral species in the lagoon, besides shoals of different species of marine ornamental fishes, a large number of sea-cucumbers of varying size, turtles, sea anemones (at Anemone rock as the Scientists put it) (Fig. 5).

The Team could observe that not more than 30% of the corals were live and the rest were dead corals. Patches of sea grass and sea weeds were seen in some shallow water zones.

The team visited the desalination plant set up by the National Institute of Ocean Technology (NIOT) under the Ministry of Earth Sciences, GOI, which is based on pressure and temperature differential in the seawater and not on

membrane (RO) technology. The plant was the sole source of drinking water being piped free of cost to every household in the island. Levy of utilization/connection charges was felt appropriate.

Fig. 5. Coral reef and marine ornamental fishes as viewed from the glass bottom boat at Kavaratti lagoon

4. Observations

4.1 General

From the lukewarm reception received by the Team Members at Agatti on their arrival, it appeared as though the Lakshadweep Administration was unaware of the purpose behind the visit of the Expert Team from Planning Commission. When the Team Members apprised the Administration officials on the objectives of the visit of the Team, they understood the seriousness of the Team's mission and arranged field visits and provided the requisite information on the status of coral reef wetland ecosystem and related aspects.

The Team noting that the females outnumber males in Agatti and Kavaratti, was informed by the Officials that the male to female ratio in these islands was in the vicinity of 1:1.2. However, as per the 2001 Census, in the Lakshadweep, the Females per 1000 Males is 948.

For supply of electricity there are diesel run power plants located in 8 islands. The Islands are totally dependent on the diesel generated power for want of other forms of energy. Some of the options which could be tried out are the Ocean Thermal Energy, Wave Energy and Tidal energy, depending upon their potential in the Lakshadweep sea area.

4.2 Status of live corals in Lakshadweep Islands

The Team was informed by the Environment Wardens at Agatti and Kavaratti that the live coral cover of the Lakshadweep Islands ranged between 17.5% and 44.3% during the past year. The lowest percentage of live coral cover was recorded at Suheli Island and the highest percentage at Bitra Island (Fig. 6).

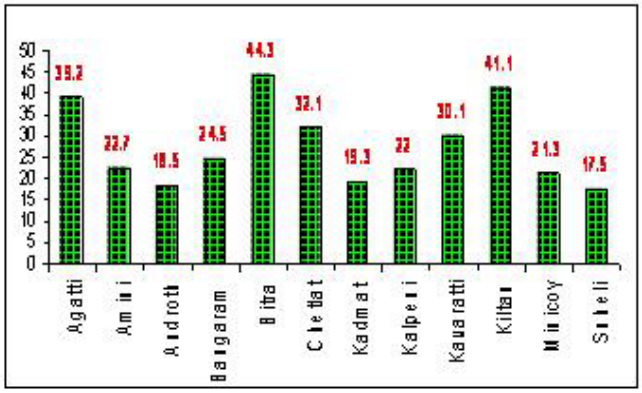


Fig. 6. Status of live coral cover in 12 islands of Lakshadweep (2007)

The Team noted that the rise in sea surface temperature due to *El-Nino* phenomenon during 1998 caused extensive coral reef bleaching impacting over 40 to 90% of live coral cover. Live coral cover was no more than 10% at Kadmat Island after the bleaching had happened. The most seriously impacted corals in all reefs were branching and tabulate *Acropora sp* and *Pocillopora sp*.

It was reported that after the 1998 bleaching, the Lakshadweep reefs recovered by a factor of 2.1 on an average i.e. after 1998 the live coral cover doubled. The highest rate of recovery was in reported in the Amini Island (3.4 times). Decreasing algal coverage in most of the islands indicates the recovery of coral reef beds as “Healthy reef”. With current rate of recovery, it is reported that the reef could fully recover within next 10 years.

4.3 LCRMN surveys

The Team observed that the basic infrastructure created under the project including the diving gears, compressors and boats, was adequate for carrying out the survey. Minimum one survey is conducted in each island every year with 5 Line Intercept Transects around each island. Recording of percentage live coral cover and of bio-physical properties over a 20 m transect laid at 10 m depth is being carried out. Parameters like Live coral cover, dead coral with algae, algal assemblage and sea grass, soft coral, sponge and other animals, abiotic (sand, rubbles and rocks) and dead coral (Fig.7).

Fig. 7. Underwater diving by LCRMN Team for coral reef survey

It was noted that more than 20 participants from the island groups have been imparted training in diving and survey techniques, and that the information collected was subjected to quality checks and cross checks jointly by the Indian and Australian trainees.

4.4 Marine Biodiversity

Corals are represented by 148 species; ornamental fish by 296 species; fish by 126 families and 601 species; crustaceans by 68 species; molluscs by 227 species; sponges by 91 species; mangroves by 2 species; seaweeds by 114 species; echinoderms by 78 species, sea grass by 6 species; sea turtles by 4 species; 101 species of birds and 12 species of cetaceans.

In Pitti Island – around 1.21 ha of sand bank situated about 24 km northwest of Kavaratti is an Island of Birds. This Pitti Island is a breeding ground for 4 species of terns. Pitti is of great importance since such breeding colonies are very rare in the Indian territory.

Fig. 8 Pitti Island bird sanctuary

4.5 Issues of the Islands

Changing life style and the increasing population Pressure have led to increased generation of sewage and solid wastes.

- Population pressure placed an enormous strain on the quantity of fresh water available, leading to saline water intrusion.
- Changing demographic pattern and lifestyle, coupled with resource harvest from the reefs have brought many reefs in the Lakshadweep to various degrees of stress.

- Coastal erosion is a serious problem faced by the islands every year resulting in loss of land. Maximum erosion observed over a period of 35-40 years were in the range 28 to 44 m.
- Degradation of lagoon and coral ecosystems (eutrophication) through developmental activities and land based pollutants.
- Stress on the lagoon and its resources, Unplanned and unmanaged fishing, tuna and bait fishing, reef walking, octopus hunting, shell collection, coral harvesting, tourism and related activities such as diving, snorkeling, operation of glass bottom boats, etc.
- Dependence on one desalination plant recently set up, for supply of safe drinking water.
- Diesel as the sole source of electricity generation.
- Poor Connectivity between islands and main land.
- Lack of alternate livelihood options.

4.6 Organisational gaps

The Team observed that the manpower available for implementation of coral conservation and management or the marine ecosystem and resource conservation for that matter in the island groups is grossly inadequate. There are hardly 6 persons including the Deputy Conservator of Forests, who has also taken charge recently, 4 Environment Wardens (Field level) and one Technical Officer (in the HQ) to implement the coral reef conservation and restoration programme in all the islands of Lakshadweep, as compared to 40 staff in the Dept. of Science & Technology. The entire LCRMN programme is implemented by the Department of Science & Technology, even though it is fully funded by the Ministry of Environment & Forests. It was also observed that there are no promotional avenues for the Environment Wardens (EWs) or the Technical Officer (TO), as they are at the level of Technical Assistants in GOI. The only Class-I post is the Dy. Conservator of Forests, to which these EWs or TOs are not qualified.

The Team was informed by the DCF that a proposal for creation of 65 posts under the Dept. of Environment & Forests, in the 11th Plan period was approved by the Planning Commission. A copy of the letters in correspondence between the Lakshadweep Administration and the Ministry of Environment & Forests, GOI, was also made available to the Team Members. A perusal of the papers indicated that the proposal was very sketchy, not in the prescribed format, no proper justification/duties and responsibilities for each post has been given, the sequence of the posts contained in the list was

not in order (while the post of Peon is at Sl. No. 10, the highest post of the Asst. Conservator of Forests is at Sl. No. 13 and so on).

4.7 Lack of a Master Plan

The Lakshadweep lacks a detailed Master Plan/Plan of Action for assessment of the status of coral reef ecosystem, its biodiversity and their conservation/management, except for the LCRMN Programme. Even the 11th Five Year Plan proposals prepared by the Lakshadweep Administration does not appear to give priority for the programmes of the Department of Environment & Forests, as it is a part and parcel of Department of Science & Technology, as a result of which major chunk of the budget is earmarked for Science & Technology related schemes/programmes. It was noted by the Team that out of Rs. 2.5 crore earmarked for S&T during 2008-09, over Rs. 1.50 crore is for setting up an aquarium and the remaining funds are to be shared by S&T and E&F departments for all other activities.

4.8 Management of liquid and solid wastes

The untreated domestic wastes are discharged into the sea directly without any treatment. The Team observed that solid wastes are dumped on the narrow shore line, behind each house-hold, both at Agatti and Kavaratti, There is therefore an urgent need of proper solid waste management plan/system in the Islands. It is estimated that about 1.2 million litres of waste per day is generated at Kavaratti alone. Major issue concerning the disposal of solid waste is the absence of systematic sewerage system. Most households have constructed soak pits for disposal of latrine waste. Owing to acute pressure on the land, the soak pits have been constructed very close to the open wells. The soil being sandy and porous and the soak pits have been constructed rather unscientifically, faecal matter from the soak pits finds its way into the water in the open wells. The non-degradable solid wastes are dumped at one end of each island by the local bodies.

5. Recommendations

5.1 Organisational

Handling of the National Wetland Management Programme funded by the MoEF, GOI by the Department of Science & Technology of Lakshadweep Administration appears to have diluted the very purpose of initiating the programme for conservation and management of coral reef wetland ecosystem, owing to a number of reasons such as highly inadequate

manpower, diversion of resources, lack of proper understanding of the needs and issues connected with wetland management, etc., in the DST. ***The Team therefore recommends that the Wetland management programme should be directly implemented by the Department of Environment & Forests and the funds allocated and released by the MoEF for the project including for that of LCRMN programme should be placed at the disposal of Dept. of Environment & Forests of Lakshadweep Administration, under a separate head of Account.***

The department has no permanent office in Kavaratti to accommodate Deputy Conservator of Forests with Environment Wardens. The department is functioning in one room in the office of the Superintendent of Police. Necessary vehicles for movement, communication equipment, patrolling boats, and monitoring equipment are also essential for the purpose of scientific and systematic management of natural resources and eco management of the Island's resources.

Since the manpower and the basic infrastructure facilities available either for implementation of coral wetland conservation and management programme or the marine ecosystem and resource conservation programmes in the island groups is grossly inadequate, the ***Team recommends the creation of adequate number of technical and support staff – starting from the level of Assistant Conservator of Forests to the level of Class IV staff under the Department of Environment & Forests with additional basic infrastructure facilities, on the basis of a revised proposal to be submitted in the prescribed format to the MoEF by the Lakshadweep Administration, for consideration and approval.***

5.2 Master Plan for Coral Reef conservation & Management

Considering the fact that there is only year to year plan for assessment of status of coral reef and their management, the Team recommends that a detailed/comprehensive master plan indicating the future long-term plan of action for Coral Reef wetland management in all the island groups in Lakshadweep till the year 2020 should be prepared and placed before the Planning Commission and MoEF for approval and allocation of funds at the appropriate time – annual plans and 5 year plans for its implementation.

5.3 Preventing introduction of exotic weeds

The Team observing that there is no Prosophis in any part of the island, recommends that the Administration should take all precautions against even accidental introduction of this weed in the islands.

5.4 Desalination plant and drinking water

The Team noting that the Ministry of Earth Sciences is in the process of setting up three more desalination plants at Agatti, Minicoy and Amini Islands using the Low Temperature Desalination Technology (LTDT) developed by NIOT for producing safe drinking water to these islands, recommends that the Lakshadweep Administration should initiate steps for setting up similar desalination plants in the remaining inhabited islands with requisite funding support.

5.5 Management of liquid/solid wastes

The Lakshadweep Administration should evolve a detailed and a foolproof liquid and solid waste management plan and put it in place for protecting and conserving the fragile lagoon and coastal marine ecosystems of the islands and their biodiversity. To begin with a pilot project on 'Scientific Disposal of waste water and other non-biodegradable solid wastes' could be initiated in any one of the inhabited islands – particularly at Kavaratti to study its efficacy and reliability of the waste management and treatment options contained there-in under the prevailing local conditions and its future replication in other islands to prevent the environmental degradation and to protect and conserve the critical coastal habitats and their resources. Piles of Plastic waste can be seen thrown around. The bulk of the plastic waste is large bags containing sand, building ,material etc brought to the Island from Kerala. The immediate requirement is collection and retransport or to set up a plastic to diesel convertion plant which will serve two purposes - one disposal and the other reduce diesel import. technology for which is available in the country. The team assured sharing this with the Department of Environment.

5.6 Declaration of Marine National Park

World over, island ecosystems are critically threatened. Lakshadweep Islands are characterized by their small size and distance form the mainland shore. All these islands built of coral reefs from the late Tertiary period, are surrounded by coral reefs with the deep sea on the east and lagoon on the west. These islands are. The exposed coral rock erodes into white coral sand and adds to the formation of land. Coral reefs are amongst the world's most fragile and endangered ecosystems. Although they cover just about 0.02 per cent of the ocean floor, they are home to a quarter of the known marine plant and animal species. The net benefit form these coral reefs to society is estimated to be around 30 billion US$. However 11 per cent of the world's coral reefs have already been lost due to human interference. In

1998, 16 per cent were severely damaged as a result of EI Nino and warming of the oceans. It is expected that 32 per cent of the reefs may be lost in the next thirty years if the threats are not reduced. Loss of healthy coral reefs will lead to elimination of primary sources of food, income and employment for millions of people around the world as well as the extinction of many fascinating and beautiful marine species. At the global level, many international agencies are working together to protect and conserve the corals.

Lakshadweep has many untouched and undisturbed virgin reefs like Suheli par with 78.96 sq.km of lagoon area, Baliyapani par with 57.46 sq.km of lagoon area, Cheiyapani par with 172.59 sq.km of lagoon area and Perumulpar with 83.02 sq.km of lagoon area. *It is recommended that one or two of these lagoons which support the virgin reefs be declared as Marine National Park(s) to protect and preserve the marine biodiversity for the benefit of our future generations.*

5.7 Livelihood Options

Except copra and tuna fish sale the islanders had no other livelihood. The team was informed that every household had one member working for the Government, taking the GOI employed to over 11000. ***There are a number of alternative livelihood options for the islanders, particularly in the fishery sector which include raising bait fish for tuna fisheries, marine ornamental fish breeding and rearing and in the tourism sector – by providing Paying Guest type accommodation to the tourists by providing bed and food, as the accommodation available is grossly inadequate, The gainful utilization of the existing resources and potential by the local community is of atmost importance. The Team therefore recommends that the Lakshadweep Administration d give priority to these aspects and initiate programmes jointly with Central Marine Fisheries Research Institute, CAS in Marine Biology, Annamalai University, NIOT, etc., in the fisheries sector and with the Ministry of Tourism in the tourism sector.***

5.7 Awareness creation

The Team Recommends that a Knowledge Interpretation Centre be set up at Agatti and Kavaratti islands*, to create awareness among the local community including the elders, youth and children and the tourists who visit the islands, and to educate them on the coral reef and associated*

ecosystems, their usefulness to the community and the need for conserving and managing these critical island resources and biodiversity, for which adequate funds should be provided, immediately.

5.8 Development of Critical Habitat Information System (CHIS) for coral reef ecosystem of Lakshadweep

Noting that the Ministry of Earth Sciences, has developed a CHIS for Kadamat Island in Lakshadweep during the year 2000 using Remote Sensing and GIS techniques, recommends that similar studies should be conducted for all the islands (both inhabited and uninhabited islands) using primary and secondary data, to make a realistic assessment of the biodiversity and live coral cover. To begin with it is suggested that such studies could be initiated with adequate funding support from MoEF/DST, Government of India, covering Agatti and Kavaratti Islands. In the case of Kadamat Island, a change analysis on the status of coral reef using the past data (1988-98) collected by MoES and the data during 1998-2008, that could be generated using the satellite imagery and secondary data collected from the field could be made in GIS format. The Environment Wardens of Agatti and Kavaratti could submit proposals in this regard to MoEF/DST seeking requisite funding support.

Annexure

Presentation made by Environment Wardens, Agatti & Kavaratti on 30th & 31st October 2008

LAKSHADWEEP ISLAND ECOSYSTEM

Atoll reefs and Lagoon

- Are annular reefs surrounded by deep waters
- Comparatively shallow salt water separated from the deeper sea by a coral reef, or similar feature from the land.
- The only atoll formation in India and forms the northern most segment of the Chagos – Maldive – Laccadive oceanic ridge

Lakshadweep Archipelago

- Total 36 island
- 11 Inhabited Islands
- 32 sq km Geographical area
- 4200 sq km Lagoon area
- 20000 sq km territorial water
- 400000 sq km EEZ
- 60.595 Population

Marine biodiversity

- Corals - 37 genera, 104 species,
- Fish - 126 families, 601 species
- Ornamental fish - 38 families, 138 species
- Echinoderms - 78 species
- Sponges - 91 species
- Seaweeds - 114 species
- Sea grass – 6 species
- Sea turtles – 4 species

Pitti bird sanctuary

- Locally know as Pakshi pitti means “Island for Birds”.
- 24 kms north west of Kavarathi
- 1.21hecters of sand bank.
- Breeding ground of 4 species of terns. [Sooty Tern (*Sterna fuscata*), Great Crested Tern (*Sterna bergii*), Bridled Tern (*Sterna anaethetus*) and Noddy terns (*Anous stolidus*)]

- Pitti is of great importance since such breeding colonies are very rare in the Indian territory.

Status of Coral Reef In Lakshadweep

Status Before 2000

- The 1998 bleaching affected all reefs, impacting 40 to 90% of live coral cover.
- Live coral cover was no more than 10% at Kadmat Island after bleaching happened.
- The most seriously impacted corals in all reefs were branching and tabulate *Acropora sp* and *Pocillopora sp*.

Strengths of LCRMN surveys

- Infrastructure – adequate diving gears, compressors, boats
- Capacity – 20 participants trained in diving and survey techniques
- Quality check – cross check by Indian and Australian trainers and comparison between data collected by scientist-divers and islander-divers.

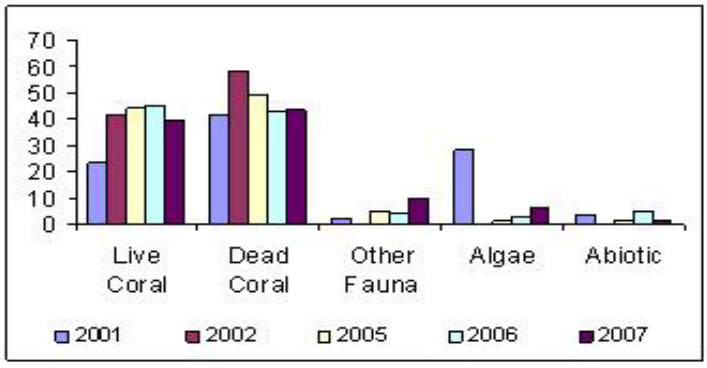
Strategy for surveys

- Minimum one survey in each island every year.
- 5 Line Intercept Transects around each island.
- Recording of percentage cover of bio-physical properties over a 20 m transect laid at 10 m depth.

Traits recorded

1. Live coral (LC) = (Acropora and non Acropora sp.)
2. Dead coral with algae (DCA)
3. Algae = (Algal assemblage and sea grass)
4. Others (OT) = (Soft coral, sponge other animals)
5. Abiotic = (Sand, rubbles and rocks)
6. Dead Coral (DC)
7. Coral Forms
8. Island-wise status of live coral cover and Algal cover and reef recovery during The years 2001 – 2006 in Agatti and Kavaratti.

Example of Agatti Island benthic categories result



Goals and Directions

- Sustain and enhance coral diversity, and associated reef flora and fauna
- Regulate and maintain sustainable use of resources by local communities
- Regulate development activities and tourism to reduce risks to marine environment
- Involve communities in management processes
- Encourage and direct research to fill gaps in knowledge
- Incorporate stakeholders participation in management activities and adaptive management of reefs

Current management initiatives

- Biological Toilets/STP
- Fish Aggregation Devices
- Beach Stability Projects
- Rainwater Harvesting, Water Conservation
- Thermal Desalination Plant
- Establishment of Incinerator
- EIA's on most development activities
- Restricted Tourism

Conclusion

- After the 1998 bleaching, the Lakshadweep reefs recovered by a factor of 2.1 on an average i.e. live coral cover after 1998 doubled so far
- The highest rate of recovery was in Amini Island (3.4 times).
- Decreasing algal coverage indicates return to a "Healthy reef".
- With current rate of recovery, reef could fully recover within next 10 years

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