SEA GRASS ECOSYSTEM - A LAKSHADWEEP PERSPECTIVE

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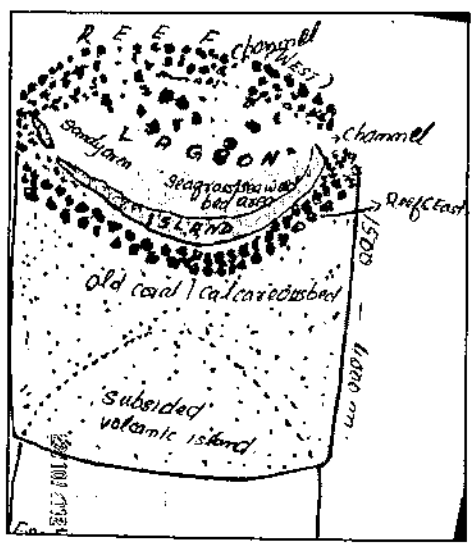
Introduction

The U.T.of Lakshadweep , the little specks in the Arabian Sea ,scattered between 8 °00' N and 12 °30' N Latitude and 71 °00' E and 74 °00' E Longitude located on the Laccadive – Chagos Archipelago is a unique magnificent, but very fragile coral ecosystem . These Islands are believed to be formed **(Fig-1)** on the submerged portions of Aravali mountain cliffs rising from 1500- 4000 m deep ridges as a result of millions of years of reef building process of wide verieties of corals and due to the prolonged geological changes taken place during the period .



(Fig-1) -. Pictorial representation of Island formation

The Lakshadweep group of Islands **(Fig -2)** (consists of 11 inhabited Islands , 0.58 – 4.8 Sq.Km sizes) ,13 uninhabited Islands/Islets , 6 submerged banks and 3 coral reefs), spread in 12 atolls are situated on the South West Coast of India. The total land availability including the inhabited and the uninhabited Island together is 32 Sq.Km (28.5

Sq.Km for revenue purpose) only. Except Androth, all other Islands are protected by a nearly crescent shaped lengthy 'reef wall' with more than two boat channels . The enchanting greenish water area **(Fig -3)** extremely rich in flora & fauna, between the land (Islands) and the 'reef wall' which gets exposed during low tide is known as lagoon .It's depth varies between 0.4 – 15 m during high tide . These lagoons are getting filled up rapidly due to the periodic accumulation of dead corals, coral sand ,molluscan shells etc, Apart from 4,200 Sq.Km of biodiversity rich lagoons and 20,000 Sq.Km of Territorial waters impregment with high value fishery resources , it holds 4 lakhs Sq.Km of EEZ also. Thus it becomes one of the largest territory of our Country .

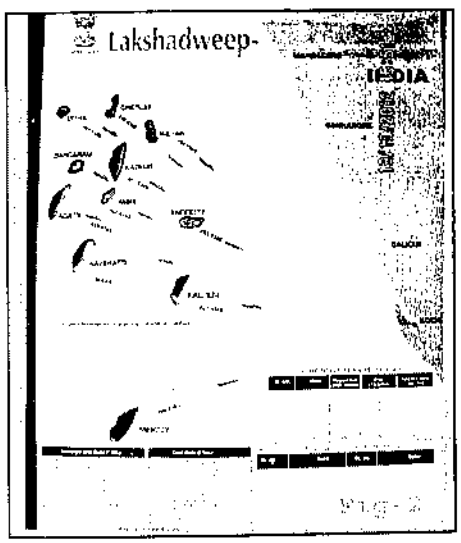


Fig -2 Lakshadweep Islands

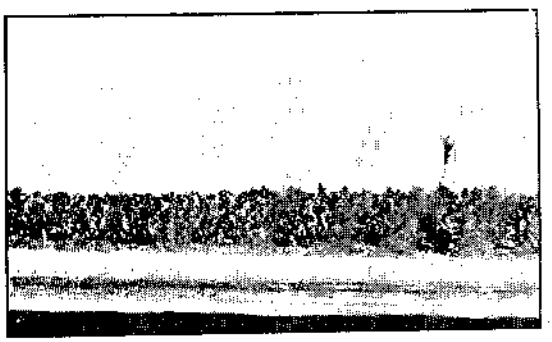


Fig -3 Typical Lagoon(Suheli)

Discussion

A balanced healthy lagoon ecosystem is a complex chain of different communities at equilibrium . Sea grasses form the most important producer community around which others depend for their survival and growth. Sea grass meadows of Lakshadweep coral lagoons are known to harbor dense and rich invertebrate assemblage (Anzari *et al.*,1991). Sea grasses are submerged marine macroscopic flowering plants ,belongs to Potomogetanaceae and Hydrocharitaceae family with well developed rhizome bearing branched or un branched roots at each node and erect shoots bearing several leaves (stolon) which serves as sediment traps . They are also involved in cycling of nutrients from water as well as sediments. The capacity of sea grasses to absorb dissolved CO_2 is quiet high and one Sq.Km sea grass can absorb equal quantity of CO_2 absorbed by 50 Sq.Km of the tropical forests. The sea grass ecosystems are the one of the most productive ecosystems in the world and have very high rates of growth , producing organic matter of about 300-600g dry wt /m^2 /yr (Hartog,1970; Thayer *et al.*, 1975) . Sea grasses have shown decisive role in the productivity and oxygen budget of coral atoll (Qasim &

Bhattathiri , 1971; Nair & Pillai ,1972; Kaladharan & David Raj ,1989). Degradation of the key stone community in an ecosystem leads to the breakage of the complex but balanced web and triggers the total collapse of the ecosystem .

Lakshadweep sea grass – Brief history

Studies on these fragile ecosystem are scanty and the few available were relatively of recent attempts . But the far sighted and the intelligent local elders transplanted the sea grass beds to many of the Northern Islands for controlling the erosion in the 1950s itself. The elderly locals even now call them *Kavarattipullu* as it was introduced from Kavaratti lagoon. Sea grasses thus transplanted established itself in to a healthy ecosystem in short time extending to 40 - 60 m wide area from the tidal line to the deeper zone. Until the last decade, the central 2/3 of each lagoons were covered with dense growths of sea grasses mixed with rich biomass of different sea weed species, particularly *Gracilaria spp.* The sea grass leaves and sea weed fragments regularly formed 'cushion beds' all along the beach when they were seasonally washed ashore . The shoots of sea grass beds, established in the lagoons, trapped the sediments and the rhizomes & roots held the sand particles firmly and effectively arrested the erosion .

Moreover, they helped in establishing a very healthy critical habitat by supporting the multiplication and establishment of wide verities of benthic communities . Furthermore, the 'sediment trappers' protected the fragile coral polyps from getting killed by the sediments . The recent large scale coral mortalities reported from Lakshadweep could be due to the sea grass destruction and its resultant sedimentation. The excessive removal of sea grass shoots leads to stirring up of sands & sediments. Such sediment particles transported by the waves and current, settled on the live polyps would instantaneously kill them. The dead corals, particularly the branching corals, broken in to small pieces (shingles) transported by current & wave actions get deposited in to the relatively deeper parts of the lagoons. This accretion and seasonal filling up of the lagoons reduces the depths at varying levels. The resultant warming of lagoon, particularly during low tides further worsens the conditions of the vulnerable communities and accelerates the imbalances in the ecosystem.

Apart from these the sea grass meadows acted as the breeding and nursery ground not only for the majority of the resident stocks of the animals but also to a major extent to the non resident stocks which seasonally visit the lagoons. Also, the live healthy and productive lagoons intern supported the needy locals with good catches round the year. Till 15-20 years back, almost the entire fresh fish requirements during the monsoon months (July – August) of each Islands were met by the respective lagoons. Presently, many of the lagoons has become barren & non productive. It is believed with high probability that the sea grass habitat destruction is responsible for the reduction in fish availability. It is high time that immediate remedial measures are worked out for the habitat restoration.

Species & status

A total of 6 species of sea grasses , *Cymodocea rotundata, C. serrulata, Halodule uninervis , Halophila ovata, Syringodium isoetifollum* and *Thalassia hemprichii* occurred in the Islands (Kaliaperumal *et al.*,1989). Victor *et al.*, (1989) has reported relatively dense growth of sea grasses in almost all the Islands. Structure of dominant sea grass vegetation from three coral atolls of Lakshadweep was described by Jagtap (1998). Anzari *et al.*, (1991) reported a sea grass vegetation cover of 0.05 Km^2 with 895 g / m^2 wet biomass in Agatti atoll & 0.34 Km^2 with 720 g / m^2 wet biomass in Kavaratti atoll. All these studies conducted 15-25 years back on a nearly virgin habitat with minimal disturbances were mostly aimed at some specific problems only . Subsequently, Jagtap (1998) has reported a sea grass vegetation cover of 0.005 Km^2 only with dry biomass of 0.74 tonnes at Agatti atoll . This shows a drastic reduction in the sea grass vegetation in Agatti atoll . This is the case with many other islands like Kavaratti ,Minicoy ,Kiltan etc. The recent , 2009-11, observations at Agatti,Kavaratti & Minicoy lagoons revealed decline in the sea grass vegetation cover in these lagoons at an alarming proposition. Drastic changes such as exponential increase in the turtle population in recent years has occurred due to increased anthropogenic activities and conservation policies. This necessitates a through detailed study on a holistic basis. The investigations should necessarily look in to the aspects like present status, level of sea grass destruction, coral mortality rate, lagoon filling (accretion) rate, productivity, community assemblage, fish species diversity and catch rates from the lagoon as well as from the open sea around each atoll .

Sea grass destructions

Sea grass habitat destructions are known to be caused mainly due to the increased anthropogenic activities , foraging by sea urchins and turtles. Historical decline in sea grass beds of Maho & Francis Bays, St.john,Vergin Islands has been attributed to heavy boat traffic & grazing by green turtles (Willams ,1988). Over grassing by sea urchins & resultant destructions has been reported from Jamaica (Camp *et al.*, 1973), Florida USA (Rose *et al.*, 1999), Gulf of Mexico & Caribbean (Green way, 1995; Heck & Valentine ,1995) and Kenya (Alcoverro &

Fig -4 Turtle dung

Fig -5 Kavaratti Lagoon

Mariani ,2002). Deraniya gala (1961) ; Frazier (1971) ; Agasthesapillai & Thiagarajen (1979) have recorded *Cymodocea & Halophila* in the turtle stomach. Mortimer (1979) has reported *Thalasia hemperchii* favoritism by *Chelonia mydas*. Kar (1980) recorded *Posidonia oceanic & Syringodiyum sp.* along with some sea weeds in turtle stomach . (Fig -4)

Personal observations from 1987 -88 onwards at 4 important lagoons (Agatti, Kavaratti,Minicoy & Kalpeni) and one artificial bay at Androth showed that the anthropogenic activities and sea urchin caused destruction were almost uniform in all theses lagoons & the bay. However, the turtle densities varied widely . The turtle densities were relatively very high at Agatti (Highest, 205 -250 / Sq.Km in 2008-09) Minicoy & Kavaratti (Fig -5) , the sea grass destruction too was very high in these lagoons . Whereas, sea grass habitat at Kalpeni lagoon (Fig – 6), where turtle population is scarce , remained intact with extensive coverage and profuse growth . In the recent years Kalpeni Dweep Panchayath was forced to divert their labour forces to clean the beaches due to the characteristic foul smell emitted from the dead and decaying (Fig- 7) hick deposits of sea grass /seaweed foliages on the beaches. The Androth Bay (Fig -8) which has experienced maximum anthropogenic activities among the Islands in recent years on account of the construction of break waters , passenger berths and jetties in a relatively very small area. The boats /vessels traffic in the limited (small) Bay area is the highest among all Islands. However, there is very little turtle sighting records at Androth. The sea grass beds here have in fact expanded in rapid speed inside the Bay as well as the reef (Fig -9) around the Island.

Turtle Status

The common species of marine turtles *viz. Chelonia mydas ,Lepidochelus olivacea,Eretmochelys imbricate & Dermochelys coriacea* are known to occur in Lakshadweep Islands (Bhasker ,1978;1979;, Silas,1984). Lal Mohan (1989) recorded sightings and nesting of 4 species . Later , the Wild life Institute of India conducted extensive survey (Triphathy *et al.*2002). Declined predation, due to the decline in the predators like tiger sharks, the legal protection by categorizing them in the endangered group ,its longevity and confinement into relatively smaller (lagoons) areas has led to proliferation and exponential increase of turtle density in many of the lagoons in recent years. While studying the implications of conserving an ecosystem modifier : Lal Aparna *et al. (*2010) cautions that the increasing green turtle (*Chelonia mydas)* densities substantially alters sea grass meadows. The study was conducted in Agatti lagoon. The turtle density in Agatti lagoon in 2008 -09 period was about 205-250 /Km^2 (Personal observation). Subsequent observations in 2010 & 2011 has shown considerable reduction in numbers inside the lagoon, due to their temporary regular migration to the western side, where patches of sea grass beds exists, of the Island during high tides. Simultaneously due to the high pressure and competition at Agatti some of the turtles migrated to Bangaram,Thinnakara, Parali lagoons and probably to Kavaratti lagoons in search of new pastures and due to the invasion these lagoons also are almost completely defoliated (Fig -10). But, the

biomass of rhizomes and roots in an unit area in Agatti – Bangaram lagoons were found to be considerably more compared to shoots. In spite of the migrations the density at Agatti is very high .

Conclusion

The sea grass habitats of Lakshadweep islands is the most important key stone critical habitat in the lagoon ecosystem. The health and very survaival of the various communities (assemblage) of the lagoon ecosystem depends on the existence of the sea grass beds. Mainly 3 factors *viz.* anthropogenic activities, sea urchin foraging and turtle grazing affect the survival of sea grass habitats. In the case of Lakshadweep turtle (grazing) seems to be the most important ecosystem modifier. The rapid increase in the turtle densities, particularly in the Northern Islands & Minicoy, had a very damaging and deleterious impact on the sea grass beds in the respective lagoons.The alterations in the ecosystem, large scale coral mortality and resultant reduction in the lagoon depths ,resultant increase in the sea water temperature in side the lagoon and the open sea (Average temperature increase was highest in Arabian/Lakshadweep Sea in recent years – Vivekanthan, 2011.) might have adversely affected the availability of the fishery resources. This might be one of the reasons for the collapse of life line tuna (pole & line) fishery in Lakshadweep in general and the Northern Islands and Minicoy in particular . In fact, fish landing in Kalpeni has shown remarkable increase in recent years and the decline in the catches at Androth was relatively very less ? . The socio economic impacts on account of the collapse of the Lakshadweep pole & line fishery in recent years has to be looked in to properly. Any further alterations in the habitats has to be prevented immediately, to maintain the equilibrium of the habitats. It is very essential for the very existence of the assemblages including the ecosystem modifier turtles.

Herding the turtles ,confinement in the "link mesh" cages /enclosures and the development of the turtle watch tourism would prevent /restrict the free run. This will support in the restoration of the ecosystem as well as promote ecotourism. A "link mesh" protected lagoon based pen culture extended up to 12-15 feet (during high tide) deep lagoon areas, with fin fishes ,lobsters etc, is another option for the ecosystem restoration. This would instantaneously enable the growth of the shoots (extensive grazing /nibbling has mainly effected the foliages (shoots) only and rhizome biomass with roots remains almost intact). This would also indirectly ensure the increased fresh fish availability as well as employment opportunities to the locals.

Apart from these, It is also suggested that a detailed investigations on a holistic basis may be under taken immediately in order to understand various aspects like the present status of habitats, level of destruction, coral mortality rates, lagoon filling (accretion) rates, productivity, community assemblage, fish species diversity and catches from lagoon as well as the open sea around each atoll.

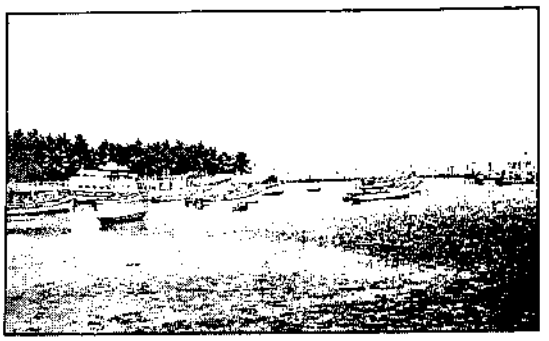


Fig -6 –Kalpeni lagoon

Fig -7– Dead & decaying Sea grass

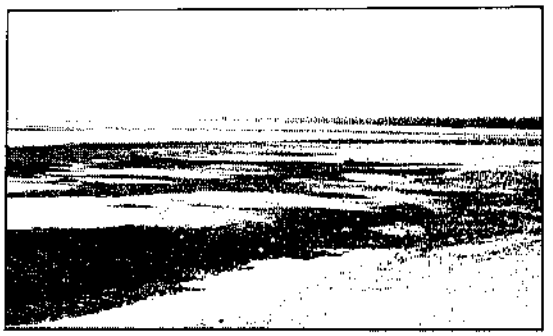


Fig -8– Androth Bay with luxurious growth

Fig -9– Androth reef with sea grass

Fig -10– Grazed meadow in the lagoon

Suggested Reading

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