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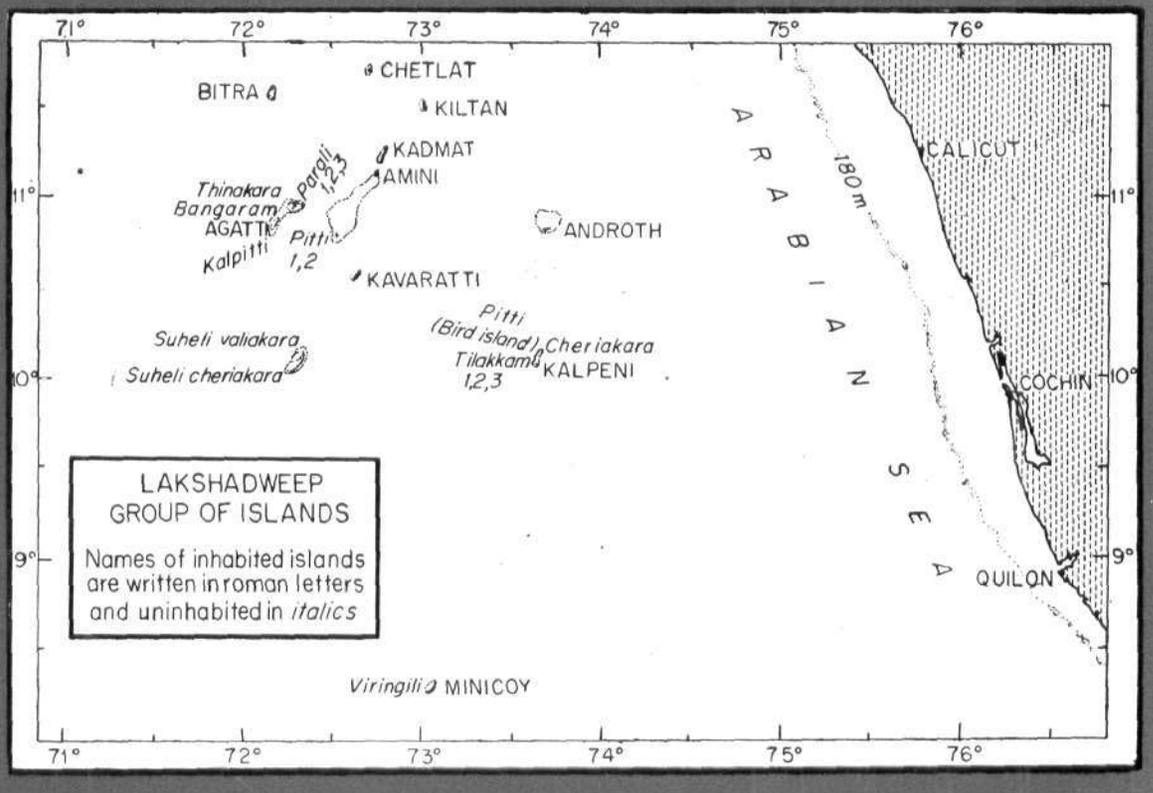
SPECIAL ISSUE ON LAKSHADWEEP



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STATUS OF CORAL REEFS IN LAKSHADWEEP

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Historical

The Lakshadweep still remains to be one of the least studied group of islands in the Indian Ocean for its coral reefs and reef resources. The area is biologically significant in view of its isolation from major continental coastline as well as for its rich and varied marine life. The early studies on the reefs of Lakshadweep are those of Gardiner (1903, 1906) from Minicoy which include detailed descriptions of the reef and some reef corals. Alcock (1902) the surgeon naturalist visited several islands in the Laccadives (Lakshadweep) at the end of the last century. Though his visits to the islands were of short duration he left short but graphic description of many atolls mostly based on Admirality Charts. The islands were re-surveyed by Lt. Comm. C.G. Francis from the survey ship *Sutlej* (Charts by Indian Naval Hydrographic Office, Dehradun). A consolidated report on the icthyofauna by Jones and Kumaran (1980) is the most significant contribution from this area. Pillai (1971a, 1971b, 1982, 1983) Pillai *et al.* (1984) and Nair and Pillai (1972) furthered our knowledge of the various aspects of the reefs of Minicoy in the last more than one decade. A team of scientists from Central Marine Fisheries Research Institute made a detailed study of the fauna and flora of Kiltan Atoll in 1974 in connection with a major oil spill. The above resume of work on the reefs of Lakshadweep indicates that except for some useful information from Minicoy and Kiltan, ie. the extreme south and north of the archipelago, the area remains largely unknown for its reefs and reef resources.

THE REEFS OF LAKSHADWEEP

Morphology: The Lakshadweep has twelve atolls, three reefs and five submerged banks with a total of 27 islands. The total land area is 32 km² and the total extent of lagoon is about 420 km² (Mannadiar, 1977). Most of the islands are located on the windward reef flat at the eastern side. Raised reefs as far as known are found in Kiltan Atoll indicating a relative change in the level of land with sea in this area in the geological past. The surface morphology of Minicoy finds a place in Gardiner's (1903) extensive work, on the fauna and geography of Maldives and Laccadives. Silas *et al.*, (unpub.) have studied the surface morphology of the reefs of Kiltan Atoll (Long. 73°E, Lat. 11°29′N). The windward reef flats of both these islands have well developed algal ridges and spur and grove system. The supralittoral and littoral fringes are mostly devoid of any live corals though the rock pools may harbour isolated coral colonies. The windward reef flats are studded with huge lime stone masses which are under different stages of erosion. This should represent the remnants of elevated reef flat which were later subjected to heavy wave action.

Formation: According to Alcock (1902) "All Laccadive islands appear to be the remains of eroded atolls, raised only a few feet above the sea level and formed entirely of coral rock and coral sand. They rise quite abruptly from the sea that within half a mile of the shore often close upon 1000 fathoms deep." According to Gardiner (1903) the Maldives and Laccadives were formed on a large bank which was part of an ancient land that completely sunk. He also felt that some of the islands are remnants of mountains that existed in the sunken land. The two archipelagoes are located at the northern end of the north-south alinged submarine Laccadive – Chagos ridge. Lakshadweep is located on a large linear aseismic ridge which is made of massive coral capping on massive volcanoes. This volcanism

Fig. 1. A closer view of dead corals lying at the lagoon bottom. Also note dead *insitu* specimens of giant clam *Tridacna maxima*.

is probably Paleozoic -Eocene in age (Stoddart, 1973), No deep drilling has been hitherto made on the Lakshadweep reefs proper to estimate the thickness of coral capping. However, based on geophysical data the thickness in western Indian Ocean including Saya de Malha and Amirantes and Great Chagos Bank is estimated to be between 0.6 to 1.7 km (Glennie, 1936). In general confirmity with the geological history of

Fig. 2. Sea erosion is a major factor for siltation in the lagoon.

the Indian Ocean reefs, it may be stated that the reefs of Lakshadweep were also built in Tertiary and Quartenery eras on volcanic structures and the present day surface features of the reefs are the results of erosional and depositional consequences of Pleistocene and Holocene sea-level changes (Stoddart, 1973).

The structure of the coral fauna

Composition of the coral fauna: To the date there exists no comprehensive account of the coral fauna of Lakshadweep. Our knowledge of the fauna is based only on Minicoy at the south and Kiltan at the north. A total of 28 genera comprising of 73 species of stony corals are hitherto recorded (Pillai, 1971, 1972) (Table 1). The octocorals are represented by *Heliopora coerulea* which form a very conspicuous element in the inner lagoon reefs throughout Lakshadweep. The gorgonids are not found in shallow waters. The hydrozoans are represented by *Millipora* with three species known. The affinities of the fauna of Minicoy with adjacent Indian Ocean areas were discussed by Pillai (1971a). Both ramose and massive corals dominate. The genus *Acropora* is the richest as is the case with all the Indian Ocean reefs, and form about 25% of the total species known from Minicoy. A notable feature of the coral fauna of Lakshadweep is the absence of foliaceous forms such as *Montipora foliosa* and *Echinopora lamellosa*. *Montipora* a very common genus in Indian Ocean reefs is rare and only one encrusting species is hitherto recorded. The massive species of corals are mainly those of *Porites lutea* and *P. solida*. *Diploastrea* was very common till recently in Minicoy though there is a dwindling of this coral at present. Ramose *Porites* is essentially a component of the lagoon both in Kiltan, Minicoy and Kavaratti atolls.

Coral sociology

Based on the major assemblage of dominant genera more or less three distinct coral communities can be defined in the various habitats of reefs and lagoons of Lakshadweep as follows.

Porites *community:* The *Porites* community is dominated by *P. lutea* and *P. solida* and is essentially an inner lagoon reef community. Faviids such as *Favia, Favites, Platygyra* and *Goniastrea* are found mixed with. *Pocillopora* spp. and *Acropora* spp. are also found at the sides and top of large *Porites* colonies.

Acropora *community* The *Acropora* community is predominantly of various species of *Acropora* in the lagoon. Both arborescent and corymbose species thrived in the lagoon till recently. *A. formosa, A. aspera, A. teres, A. corymbosa, A. hyacinthus* and *A. humilis* are the common species. This community forms the most ideal habitat for many reef fishes including important live-baits.

Heliopora *community: Holiopora* forms a very dominant coral both in lagoon reef and open reef flat, especially at the former habitat. Among the *Heliopora* colonies many fungiids and some faviids are found. There is a comparative paucity of reef fishes among the *Heliopora* compared to *Acropora* community.

Coral genera of Lakshadweep

The following is a list of coral genera hithereto recorded from Lakshadweep based on information obained from Minicoy and Kiltan (Table 1). Other islands need further study. It is likely that many more common Indo-Pacific genera may occur in Lakshadweep. A total of 73 species and 28 genera is certainly very low for an area like Lakshadweep, and future investigations are bound to bring forth many more unrecorded species and genera.

Table 1. *Coral species occurring in Minicoy and Kiltan atolls*

Genera	No. of species recorded	
	Minicoy	Kiltan
Scleractinian corlas		
1. *Psammocora*	3	3
2. *Stylophora*	1	1
3. *Pocillopora*	4	5
4. *Acropora*	20	11
5. *Montipora*	1	1
6. *Pavona*	2	2
7. *Cycloseris*	1	1
8. *Fungia*	3	1
9. *Gardineroseris*	1	1
10. *Podabacia*	1	—
11. *Goniopora*	2	—
12. *Porites*	6	4
Porites (Synaraea)	1	—
13. *Plesiastrea*	1	—
14. *Favia*	3	2
15. *Favites*	5	1
16. *Goniastrea*	2	1
17. *Platygyra*	1	1
18. *Leptoria*	1	—
19. *Hydnophora*	1	—
20. *Diploastrea*	1	—
21. *Leptastrea*	3	2
22. *Galaxea*	2	1
23. *Merulina*	1	—
24. *Acanthastrea*	1	—
25. *Symphyllia*	2	—
26. *Lobophyllia*	1	—
27. *Euphyllia*	1	—
28. *Turbinaria*	—	1
Non-scleractinian corals		
1. *Heliopora*	1	1
2. *Millipora*	3	3

Ecological impact on coral reefs

Climate: All islands in the archipelago are subjected to cyclones which may do mechanical damage to coral growth. Both northeast and southwest monsoons bring rains to the islands but the runoff to the reef flat seems to be negligible. There are no fresh water streams. The surface current during the monsoons is a major factor that influences the recruitment of many reef organisms in this area including lobsters (Pillai *et al.*, 1984). Total annual rain-fall range from 1,500 to 1,600 mm.

Primary production: The annual net production in Minicoy lagoon from a reef was estimated to be 3,000 $gC/m^2/day$ (Nair and Pillai, 1972). This is comparable to many reefs in Indo-Pacific that show high rates of production. The Minicoy reefs were also shown to be autotrophic. Future estimations are likely to show a retarding trend due to mass mortality of corals that occurred recently, resulting in a cyclic change of community structure.

Predators: The occurrence of *Acanthaster planci* was recorded both at Kavaratti (Sivadas, 1977) and Minicoy (Murty *et al.*, 1980). These starfishes were

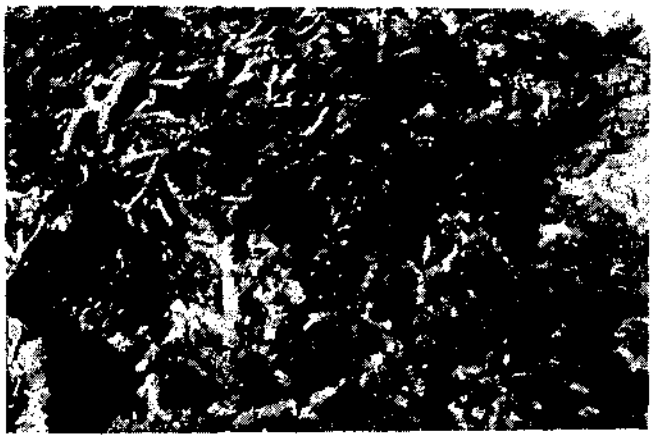

Fig. 3. Dead branches of *Acropora* spp. in lagoon bottom.

observed to leave white patches on live *acropora* thickets in the lagoon of Minicoy thus causing death to corals. However, they were not found in the lagoon from 1981 probably due to many reasons. They might have played a role in the recent mass mortality of corals seen in the lagoon.

Siltation: The interference from silt smother the corals and kills them. The rate of siltation in the lagoons of Minicoy and other islands would have increased due to sea erosion and disturbances to the lagoon (Pillai, 1983). Further, human interferences have also increased siltation rate in the lagoon which brought out large scale death of corals in all the atolls of Lakshadweep. No detailed study on the rate of siltation in Lakshadweep is available. But it is stated that some of the northern islands have a greater degree of silting and the lagoon are fast getting filled up as in Kiltan.

Human interferences: A comprehensive account of the various aspects of human interference on the atolls of Lakshadweep was presented by the author in an earlier communication (Pillai, 1983). Since human settlement started in these atolls, both their terrestrial and marine habitats were subjected to environmental stress. Removal of corals from the shore and reefs, pitting the ground, removal of surface soil, mining of sand stone as in Kiltan for construction work were all being done. The postindependent developmental activities have further deteriorated the ecosystems. Construction of concrete buildings, cutting of natural vegetation, introduction of exotic plants, introduction of cattle and goats, excessive application of pesticides on agricultural crops are all having adverse impact on the natural ecosystems of the atolls. Blasting of reefs and dredging of lagoon to deepen the boat channels have done irreparable damage to lagoon habitat and has almost killed the entire lagoon coral fauna. Any amount of arguments from any quarters will not justify the unwise decision taken to dredge the channels. Infact, it has not served any purpose except killing all the corals in the lagoon which has effected a drastic dwindling of the resident tuna live-baits.

Resources: The major resources of the Lakshadweep still need further survey and proper assessment. The deep water molluscs, lobsters algae and gorgonids need survey and documentation. A proposal is in vogue in this direction from the Central Marine Fisheries Research Institute to carry out a detailed survey of the northern islands in the immediate future.

Conservation: In view of the deteriorating environmental conditions of this archipelago, effective measures of conservation need to be implemented. The present ban on dredging of reef habitats and collecting of corals should continue. The actions taken to prevent sea erosion by the local Administration should serve a long way in conserving one of our most valuable natural resources.