Plantations form second line of defence in beach protection. Very effective in controlling wind-erosion, plants cannot put a halt to sea-erosion if it is in a very severe form. However, their role cannot be underestimated. They serve as wind brakes, check the movement of beach sand and prevent the entry of salt spray into the fertile areas of the interior.

Casuarina equisetifolia is the key species. Other litteral species of significance in coastal afforestation programmes are *Barringtonia asiatica, Terminalia catapa, Thespesia populnea, Calophyllum inophyllum, Pongamia pinnata, Hyphaene indica* a decorative branched species of palm common in Diu and Daman and *Cocoloba uvifera* of Pondicherry. Sand-binding trailers like *Iipomoea pes-caprae, Spinifex squarrosus, Cyperus arenarium* are part of our natural biodiversity.

For greening the salty marshlands (Kharlands) mangrove species are of great value. *Salvadora persica* has the added advantage of its seeds being used in soap industry. The plantations besides providing green cover to combat salinity also provide income for the rural poor.

V.M. MEHER-HOMJI

French Institut
Pondichery - 605 001

673

KRUSADAI ISLAND : THE BIOLOGIST'S PARADISE

INTRODUCTION :

The name Krusadai may symbolically mean Lord Shiva with matted locks - as a manifestation of Lord Dakshinamurti. The exact meaning of the word Krusadai is difficult to fathom. 'Kru' (as a corrupt form of 'Kuru' may also mean short or abridged) is perhaps wrongly spelt for Guru meaning Teacher or Mentor. (in Tamil,in both ways 'Kru' or 'Guru', it could be written). Assuming its Tamil version of the word 'Kru' to mean Guru = i.e., 'Mentor' or Nestor - and 'Sadai' meaning matted locks, we can visualise the picture of Lord Dakshinamurti. In its serene atmosphere, the place is veritably an eternal abode for silent meditation. Lord Dakshinamurti is known to teach and dispel all doubts of 'sishayas' or disciples by transmitting the lessons of discourses and answers and replies to doubts raised "through thought waves" in eloquent silence and in eternal bliss, when and where speech becomes superfluous!

The morphometric features of this island with thick algal seaweeds, mangroves, seagrasses, coral reefs, fringing reefs, patch reefs, shingles, cay etc., may be said to resemble, in abird's eyeview, the matted-locks of Lord Dakshinamurti. Hence the island may have been so named. Nearby, Krusadai is the island of Pamban meaning snake or serpent which is also Lord Shiva wears around His neck and upon which Lord Vishnu reclines.

The island, since time immemorial, belonged to the Raja of Ramnad known by the title 'Sethupathi' (Sethu for Rameswaram), who sold it to then British (Indian) Government of the Presidency of Madras for less than Rs.6,000/- in 1914, largely through the efforts of James Hornell. Thus, the erstwhile Madras Presidency got its foothold here; and, so the Fisheries Department founded here in 1914 or so, established its token presence, although on a small scale, yet vibrant in activities, recognizing its unique potential and rich diversity of life forms. But the scientific

studies in the area of the Gulf of Mannar date back to 1880 or even before (Carter, 1880, Foote, 1888).

The finding of Krusadai is rather difficult on an ordinary map of even peninsular India. Krusadai island is situated in the Gulf of Mannar (lat. 9° 14'N and long. 79°13'E) near the well-known tourist places of pilgrimage of Rameswaram and Dhanuskodi in Ramanathapuram district of Tamil Nadu. The distance to the island from Mandapam on the mainland is 6 km and from Pamban island is 4 km. This Pamban island has a length of 2050 metres and width of 700 metres and is spread over an area of 67 hectares. The coral reefs around the island and the shallow lagoon-like portion between the reef and the shore would form excellent sites for collection of various kinds of flora and fauna. The noteworthy feature of the island is its easy accessibility to a unique number of flora and fauna inclusive of the living coral reefs in natural conditions. Krusadai island has, thus, become the "Biologists Paradise" and attracts a never-ending stream of students, teachers and eminent scientists from India and abroad from about 1898 of recorded history.

KRUSADAI MARINE BIOLOGICAL STATION

The rich biological diversity prompted Mr. James Hornell, the then Director of Fisheries Department of the Government of erstwhile Madras Presidency in the year 1914 to recommend the establishment of a Marine Biological Station on the Krusadai island. The station was established in 1914 or so, with no modern amenities like potable water, electricity, etc. Besides founding the station, a pearl oyster farm and later a fish-farm were also established. The station had a museum (later came to be known as James Hornell Museum), a library, two laboratories (Figs. 7, 8) an aquarium and a photographic room, in addition to store rooms and quarters for the staff.

During the last five decades or so, the old Marine Biological Station has remained closed and the James Hornell Museum and the laboratories (Fig. 9, 11) stand as mute testimony to their hoary past. The other two buildings Krusadai Biological Station (Fig. 6) and the Rest house (Fig. 10) which were constructed later, seem to be maintained in relatively good condition. Due to lack of interest in its adequate maintenance most of the old structures are now in disrepair and in dilapidated condition, no doubt giving refuge to garden lizards (*Calotes versicolar* and *Hemidactylus frenatus*), snakes (*Dendrophis pictus* and *Dendrelaphis tristis*), scropions, antipeds, millipeds, scutigera and spiders. Restoring the Marine Biological Station to its prestine glory is the urgent need of the hour.

SOUTHEAST COAST OF KRUSADAI :

On the southeast side of the Krusadai island is the famous coral reef called *Galaxea* reef (Fig. 4). It would get exposed at low tides. The corals belonging to the genus *Galaxea* have largely contributed to its formation lending the name to this reef. The reef itself is composed of dead coral rocks with full of holes. In many places the reef is highly vulnerable and it is risky to tread on it as it can collapse beneath one's own weight. Once inside the reef, the bottom is sandy with an admixture of mud in places. This reef which is covered with seaweeds slopes steeply into the sea. During the low tide, the water is quite clear and many interesting algae can be conveniently observed and studied in their in their own niches. As mentioned earlier, the outer portion of the reef is exposed to the surf during low tide, but during high tide the waves just roll over and the algae on the reefs are then exposed. The southeast end of island is sandy and is called as 'Sand Point'. (Fig. 1).

The coral reefs on the western part of the *Galaxea* reef give shelter to an interesting and varied potpouri of marine

animals. The corals both live and dead, provide shelter and lebensraum to a variety of sponges, coelenterates, planarians, polychaetes, crustaceans, polyzoans, molluscs, tunicates etc. On the Western end of the island is the Prochordate *Ptychodera* area where two genera of *Enteropneusta* (*Ptychodera* and *Chlamydothorax*). Polychaete worms occur abundantly along with sea-cucumbers, *Holothuria atra* and *H. scabra* the former occurs more abundantly.

NORTHERN COAST OF KRUSADAI :

The Kundugal channel along the northern shore of Krusadai island is an ideal place for tow net collections. There flows a strong current from the Gulf of Mannar to the Palk Bay and *vice versa*. It is an enchanting place where dolphins could be seen in large numbers swimming and diving.

On the Western side of the pier (Fig. 1), anemones, large star fishes and small sea urchins are found. The pearl oyster (*Pinctada fucata*) farm is in the neighbourhood. One joint sector company known as 'Tamil Nadu Pearls' is engaged in commercial 'Pearl culture' venture here in collaboration with the Tamil Nadu State Fisheries Department. The nucleus along with the mantle is implanted into the pearl oysters (*Pinctada fucata*) at Mandapam laboratory and are cultured by suspending them in the rafts near Krusadai island.

Further west,in the Porites Bay (Fig. 1), the bottom is muddy. The Bay is inhabited by immense masses of the corals *Porites* sp. and *Acropora* sp. Large masses of the coral *Favia abdiata* are also common along with representatives of about twenty other species of corals. To the west of Porites Bay, the shore again curves inwards forming another large bay. The Watchman's Bay with the muddy bottom which almost completely gets exposed at low tide. The mud flat is strewn with *Cerithidea cingulata*. Worms especially terebellids are abundant in the mud and hermit crabs on its surface. The seeds of milk fish Chanos chanos are found in large numbers in the Watchman's Bay. From this point onward the shore line is densely covered with mangrove vegetation. The sea front sides of the vegetation are very muddy. If one attempts to tread on the soil where the mud, the mud is thin and fine, the he may go easily down upto his knees. At this spot, the poisonous snakes (*Hydrophis* sp. and *Enhydrina* sp.) also would climb up the ashore at nights and stretch themselves among the roots of the mangrove trees. The Western part of the northern shore is very muddy and hence is known as 'Bushy Point'.

LAND FLORA AND FAUNA OF THE ISLAND:

The island has cultivated coconut, palmyrah and casuarina groves. Creepers like *Ipomea biloba*, *Spinifex squarrosus* and *Launea pinnatifida* and climbers like *Vites negundo* and *Gloriosa superba* grow abundantly on the northern side of the island. Large trees like margosa (neem), banyan and gooseberry are seen in the eastern part of the island. Shrubs of *Dodonea viscosa*, *Indigofera oblongifolia* and *Scaevola frutescens* form dense patches all over the island (Fig. 12). Grasses like *Cymbopogen caesius* and *Fimbristylis spathacea* are found over the sandly tracts.

The fauna on land is represented by beetles, butterflies, moths, dragon-flies, red-cotton bugs, ants, termites, snakes, lizards, scorpions, centipeds and spiders. The following birds reside permanently on the island: the spotted owlet, the house and jungle crows, the king crows, the skylark, the sun bird, the myna and the grey partridge. The black rat *Rattus rufescenes* and the white rat *Tatera cuvieri* are the mammals of the island.

REMARKS AND SUGGESTIONS :

The Krusadai island is under the control of Tamil Nadu State Fisheries Department. The office of the Research Assistant of the Fisheries Department in the

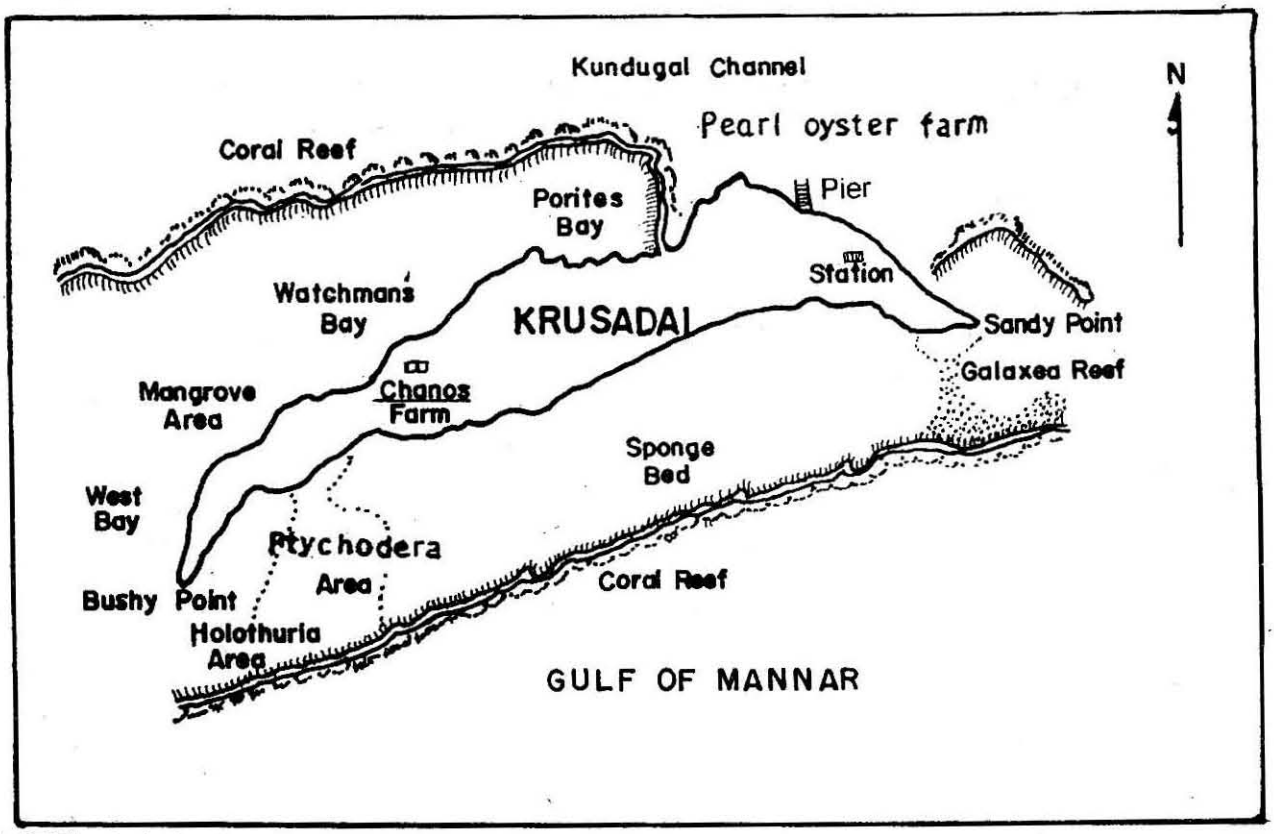

Fig. 1. KRUSADAI ISLAND then (Chacko, 1955)

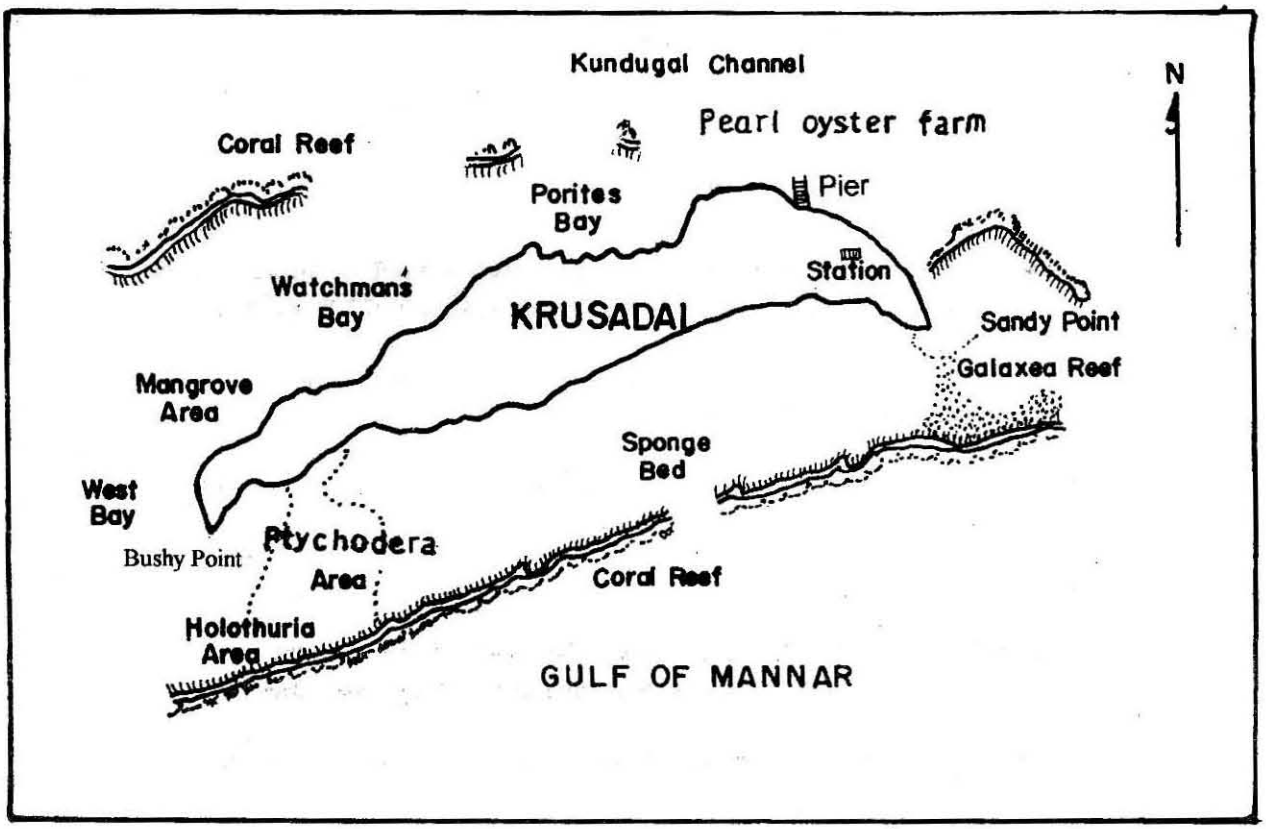

Fig. 2. KRUSADAI ISLAND now

LEGENT TO FIGURES (Krusadai Island : The Biologist's paradise by R. Jeyabaskaran and P.S. Lyla)

Fig. 1. Map showing the Krusadai island then (Chacko, 1955)

Fig. 2. Map showing the Krusadai island now

Fig. 3. Krusadai Marine Biological Station Administrative Office, Mandapam

Fig. 4. Galaxea Reef, Southeastern side of Krusadai island

Fig. 5. Damaged building, built by corals

Fig. 6. Marine Biological Station, Field Research Laboratory, Krusadai island

Fig. 7. Marine Biological Laboratory, Krusadai island

Fig. 8. Marine Biological Laboratory, Krusadai island

Fig. 9. James Hornell Museum, Krusadai island

Fig. 10. Rest House for students and scientists, Krusadai island.

Fig. 11. James Hornell Museum and Laboratory, Krusadai island

Fig. 12. Thick scrubby and coastal vegetation on Krusadai island

Fig. 13. Sea erosion of southeast coast of Krusadai island

LEGENT TO FIGURES (The impact of chemicals used in aquactulture upon the environment by M. Srinivasan *et al.*) Page No. 72

i. A successful harvers of *Penaeus monodon* by using essential chemicals like zeolite, lime, etc.

ii. *Penaeus monodon* affected by protozoan disease (Zoothamnium)

LEGENT TO FIGURE [Manakudy (Kanyakumari) mangroves by G. Santhakumar] Page No. 188

i. Lushy growth of mangroves with the author in the foreground

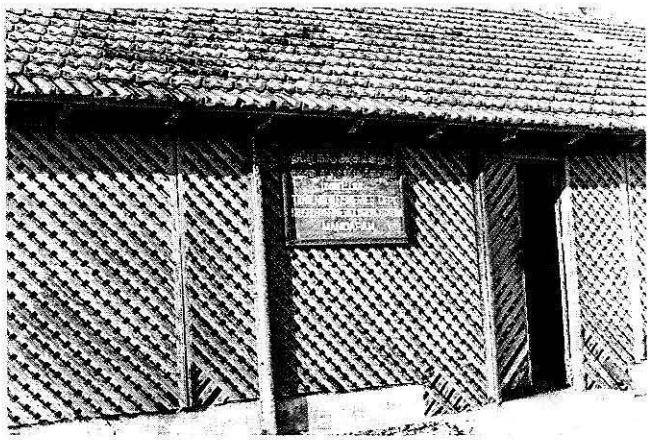

FIG. 3

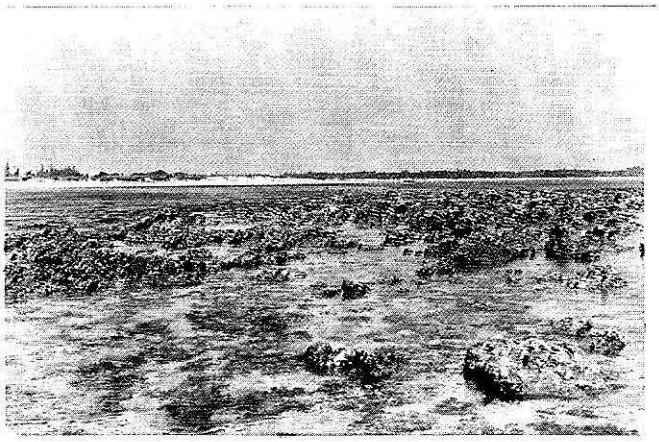

FIG. 4

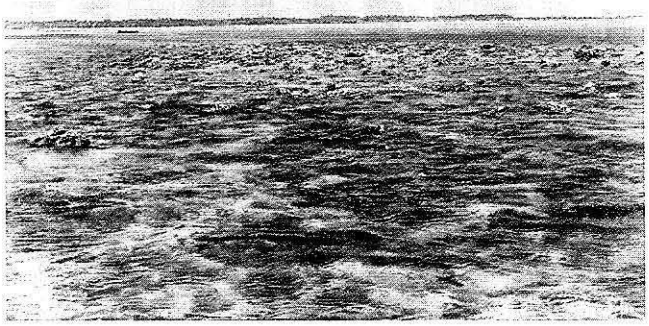

FIG.4

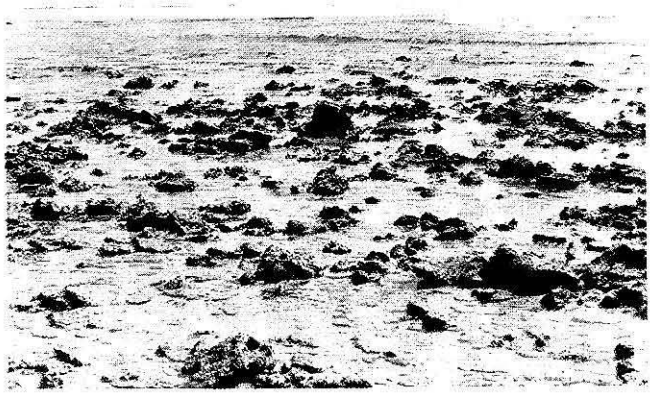

FIG. 4

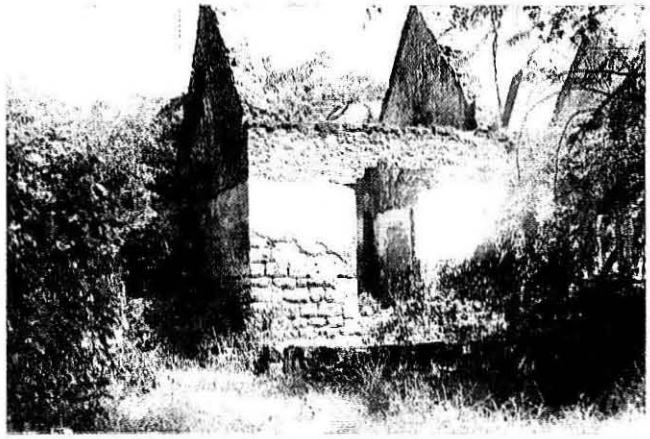

FIG. 5

FIG. 6

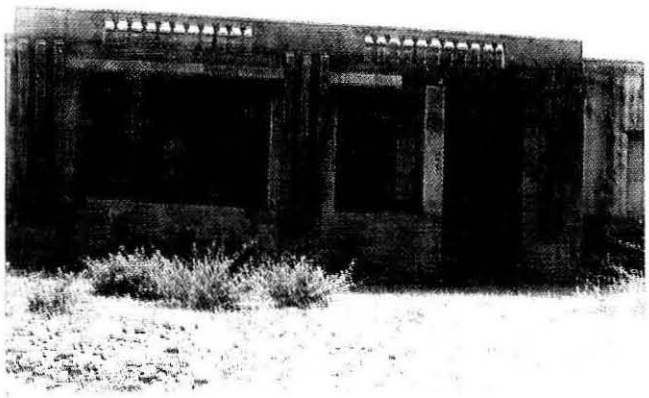

FIG. 7

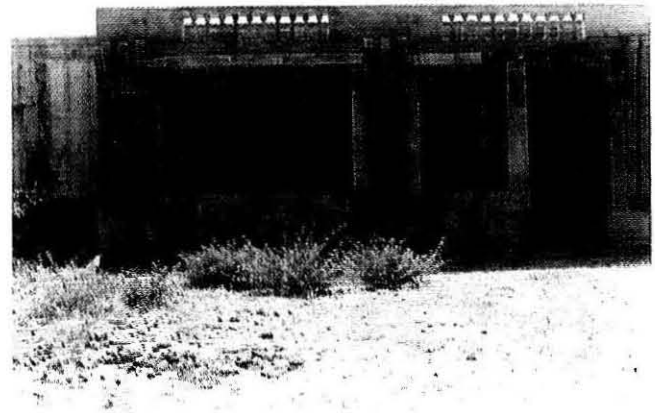

FIG. 8

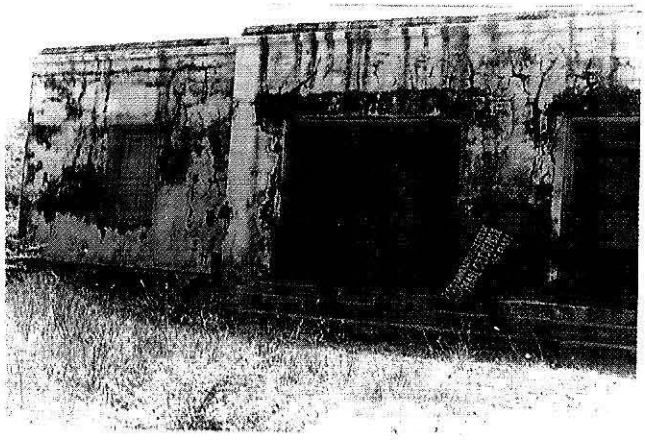

FIG. 9

FIG. 10

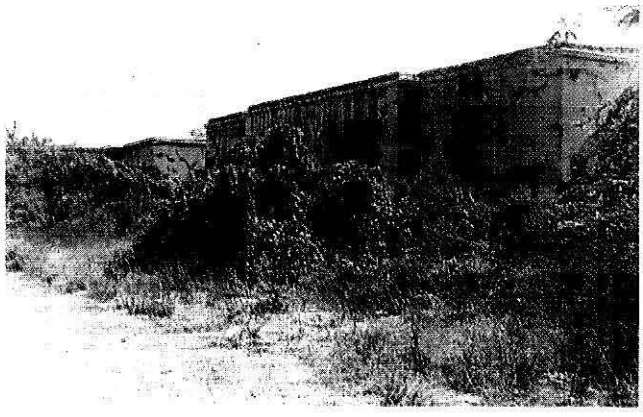

FIG. 11

FIG. 12

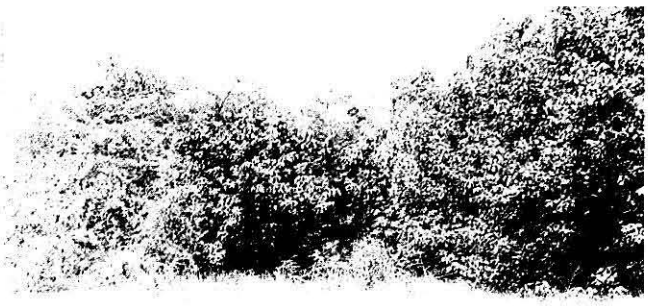

FIG. 12

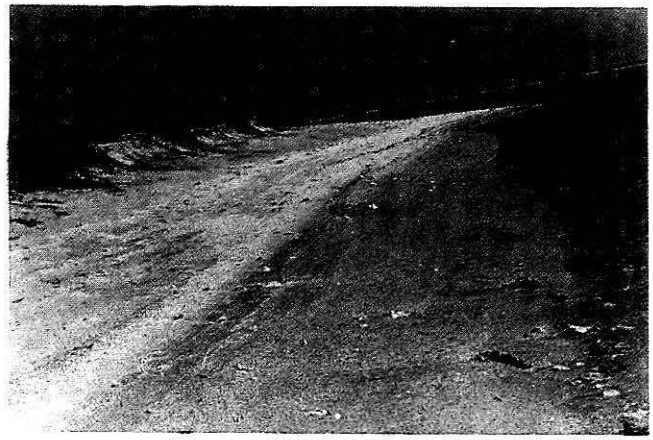

FIG. 13

FIG. (i)

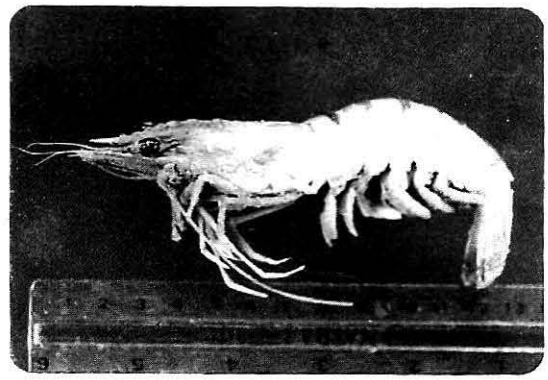

FIG. (ii)

FIG. (i)

area is located at Mandapam, on the mainland opposite the Krusadai island who regulates the visit of the college parties and others to the island. The visiting parties should write directly to the Research Assistant, Krusadai Marine Biological Station, Mandapam - 623 520, Ramnad District, Tamil Nadu, for permission to visit the island and for boat facilities to ferry across. The department also supervises the field work of the visiting parties to the island. This way, the fisheries department in all its earnestness tries to prevent judiciously vandalism and over exploitation of the resources. The visitors,especially the college parties who come in large numbers here every year, cause often irreparable damage to the animal life. In their youthful enthusiasm, the students collect more specimens and discard them after the tours. This should be avoided at any cost. The teachers accompanying the students should instruct them to observe the animals in their natural habitat, to study the behaviour of the animals and to understand the beauty and sophistication they have achieved in the natural habitats. This will go a long way in preserving the rich marine life of the island. The fisheries department must also check the illegal collection of seaweeds from the island which is done through operation of small boats as it leads to reef damage. This "Biologist's paradise" with its rich and varied life forms should be preserved at all costs for posterity. Every effort should be taken in this direction.

REFERENCES:

Burton, M., 1937. Supplement to the littoral fauna of Krusadai island in the Gulf of Mannar : Porifera. Bull. Madras Govt. Mus. Nat. Hist. Ser., pp. 30.

Carter, H.J., 1880. Report on specimens dredged up from the Gulf of Mannar. Ann. Mag. nat. Hist., 5 : 437-457

Chacko, P.I., S. Mahadevan and R. Ganesan, 1955. A guide to the field study of the fauna and flora of Krusadai Island, Gulf of Mannar. Contrib. Mar. Biol. Stn. Krusadai Island, Gulf of Mannar. 3: 10 - 16.

Foote, R. (Bruce) 1888. Notes on Rameswaram Island - I. Madras Christian College Magazine : 828-840.

Gravely, F.H., 1927. The littoral fauna of Krusadai island in Gulf of Mannar. Bull. Madras. Govt. Museum (N.S). N.H. Section Vol.1 No.1. pp1-179.

Iyengar, M.O.P., 1927. Krusadai island flora. Bull. Madras Govt. Mus. N.S., 1 : 185-188.

Lal Mohan, R.S., 1986. The Krusadai island, Souvenir, Published on the occasion of 35th Anniversary of the Recreation club of C.M.F.R.I., Mandapam Camp.

Mathai, G., 1924. On a species of subfossil solitary corals from the Chilka Lake. Mem. Indian Mus., 5 : 999-1003.

The Gulf of Mannar Biosphere Reserve. Project Document No.5, 1987. Government of India, Ministry of Environment & Forests, New Delhi, pp. 105.

R. JEYABASKARAN AND P.S. LYLA

CAS in Marine Biology
Parangipettai - 608 502

THE IMPACT OF CHEMICALS USED IN AQUACULTURE UPON THE ENVIRONMENT

The burgeoning population of India demands adequate food production and employment generation to cope up with the times. After the 'green revolution', India has stepped into the 'blue revolution' with several breakthroughs. Till the last 18th