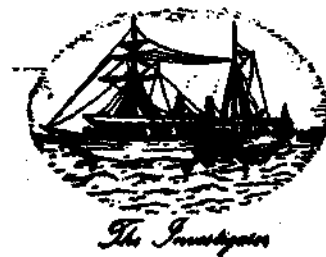


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EXISTING AND PROPOSED MARINE PARKS AND RESERVES IN INDIA—A REVIEW

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ABSTRACT

In many of the developed and lesser developed countries the awareness for the creation of Marine Parks and reserves has never been greater than it is today. In India which has a tradition of established Wildlife Sanctuaries and Conservation Projects, the concept of Marine Parks and reserves is new. Nevertheless, we are seized of the urgency of the problem.

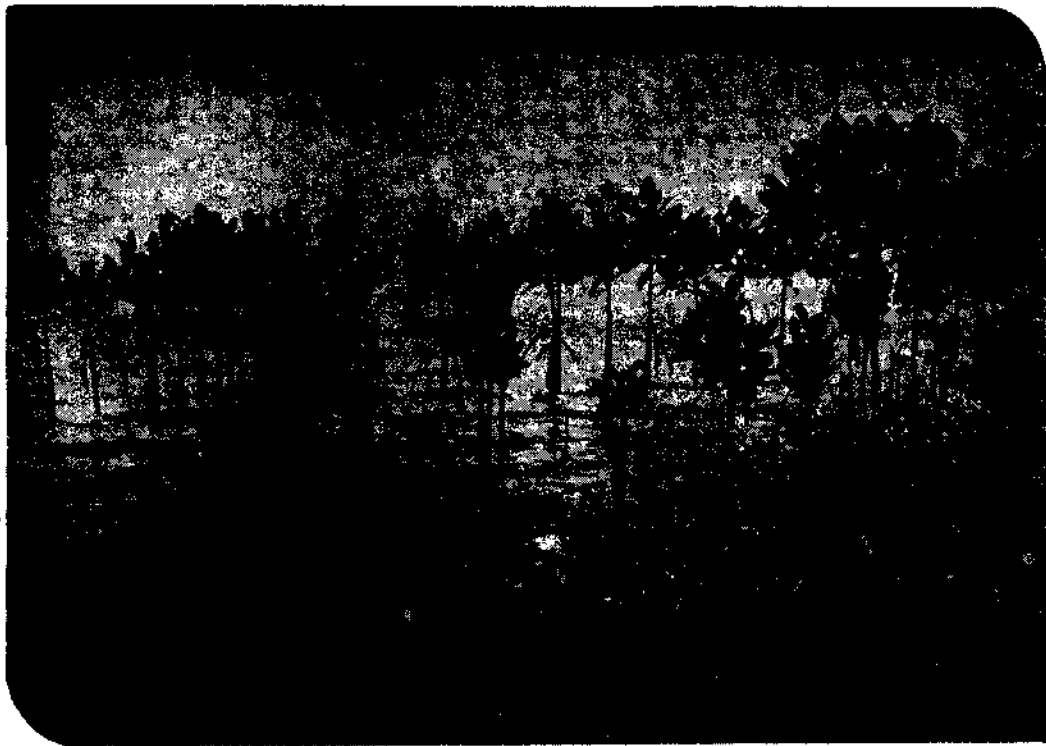
We have a recently established a National Marine Park in the Gulf of Kutch which is still in an incipient stage of development. Two major marine parks have been proposed, one in the Gulf of Mannar, Tamil Nadu and a second along the Malvan-Vengurla Coast, Maharashtra. Some of the wildlife sanctuaries such as Bhitarkanika in Orissa abut on the coastal zone and few of the contiguous beaches which are well known nesting grounds for sea turtles have been included now as protected areas. In the recent past, on the basis of beach surveys a number of potentially important areas of the sea turtle nesting beaches have been identified and possibilities of declaring some of these areas as reserves or for seasonal protection of the habitat needs serious consideration. Similarly, the mangrove habitat needs protection from human depredation in many areas. Sand mining and Coral quarrying has resulted in irreversible damages in some areas. Added to this, industrial pollution, human settlements in the coastal zone, increased fishing, tourism and other activities has brought about large-scale changes in many places including the inshore and estuarine areas. With all these perturbations there is an urgent need for developing a national policy for the setting up of marine parks and reserves. No policy can succeed unless it is an integrated effort taking into consideration interaction with wide ranging human activities such as fishing, land and beach and water use for tourism and agriculture and exploitation of diverse living and non-living resources. It is hoped that this account will help to take stock of the present problems and aid future planning.

INTRODUCTION

THE VAST coastline of India is facing serious problems of stress from human pressures and interference similar to those on land. Rapid industrialisation, human settlement, constrains of man-made engineering works, more intense fishing pressures in coastal and estuarine areas, dumping of unwanted wastes, reclamation of coastal wetlands and deforestation of mangroves and unplanned tourism development are but a few serious threats facing the coastal zone.

The widely increasing pollution problems, extensive destruction and modification of marine habitats in the interest of techno-economic advances and the prodigious over exploitation of renewable resources are definite indications of our heading towards a point of no return in many areas of our country, without concern for the future. Rapid mechanisation processes in the exploitation of marine living and non-living resources with increasing industrial involvement have added to the plethora of difficulties. Because of the conflict of uses in the coastal zone, coast-related island systems

Marine Parks, Sanctuaries,
Reserves,
Zoos and Oceanariums



and surrounding habitats, many facets of the marine ecosystem and habitats are being increasingly tampered with on behalf of activities such as commercial fishing, navigation, energy exploitation, national defence, recreation and quarrying for industrial needs. Conservation of habitats will thus turn out to be the most biologically non-destructive means of reaching 'Zero habitat loss.' Public opinion protecting nature and endangered species run high (Kellert, 1979).

The enormous range of marine environmental problems pose a serious challenge which has evoked both biocentric and anthropocentric arguments in favour of biospheres, natural preserves, parks, sanctuaries, core areas and buffer zones being established to rehabilitate, reconvert, rejuvenate and retain the pristine glory of the ecosystem and habitats.

The recent example of shelving the 'Silent valley project' in Kerala because of the adverse

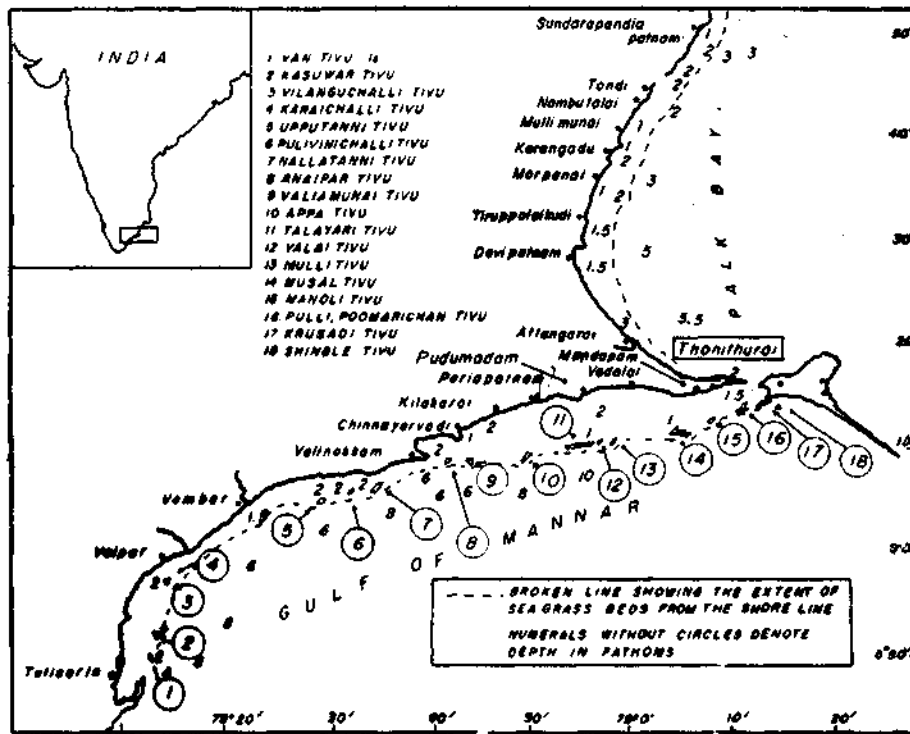


FIG. 1. Map of part of Gulf of Mannar and Palk Bay showing the islands and depth contours.

In recent years, Nature conservation of marine resources and habitats has assumed great significance in developing countries in the context of the role of conservation in Socio-economic development and the recognition of its functional role. The other values attached to this are aesthetic and cultural.

verdict of conservationists is a standing proof of the concern of the national Government in the wild life preserves and the biogeographic pride of the nation. In this context establishment of National Marine Parks in India is not only a means of preserving the endangered marine species and some of the critical habitats,

but also a flexible device for enabling the marine fisheries to be used on a sustainable basis. There are several regions in India with its extensive coastline which need our immediate attention in establishing Marine Parks, reserves and other protective measures.

Eversince the establishment of the first marine reserve sixtyone years ago, several nations have towed the line following the recommendations resulting from base line studies conducted. In recent years, IUCN has provided a set of principles, criteria and guidelines for the selection, establishment and management of marine and coastal areas (IUCN 1980).

NATIONAL MARINE PARKS

We now realise that we should give equal importance to the protection of marine and coastal habitats as has been done by us for some of our endangered and vulnerable land habitats and fauna and flora. There is an urgency to identify critical marine habitats and determine whether they should be brought under a system of National Marine Parks and Reserves. Despite the lack of a national policy on this, at least one National Marine Park has been set up in the Gulf of Kutch and two, one each in the Gulf of Mannar, Tamil Nadu (Silas *et al.*, 1977) and one at Malvan-Vengurla, Maharashtra are in the process of being established (Qasim *et al.*, 1980). It is proposed to critically review the situation as it stands today, so that action could be initiated immediately in developing proper conservation and management plans for the existing and proposed Marine Parks and make them functional.

1. GULF OF KUTCH MARINE PARK

Already along the Gujarat Coast a Marine Park zone has come into effect to cover the 42 islands including Priotan Island in the Gulf of

Kutch. While Pirotan Island has been the focus of attention in the report submitted by the National Institute of Oceanography which came out with a preliminary survey of the area (NIO, 1978), there is a need for the proper zoning and delincation of the Park and the development of a management plan for the same.

The major problem encountered in the area is the mining of sand for the cement industry and the systematic destruction of the mangrove vegetation in some of the Islands. The area is also important for the nesting beaches of sea turtles, especially the green turtle *Chelonia mydas*. While the Government of Gujarat has appointed a skeleton staff for the management of the Marine Park, a lot remains to be done on every aspect including delineation of the core area and the Park limits and the regulation on various human activities in the Park area. The WWF-India sponsored NIO Project Report cited above needs active follow up.

II. GULF OF MANNAR MARINE PARK

The 'Report on the Survey of the Islands of the Gulf of Mannar by CMFRI for the setting up of a Marine National Park' (Silas *et al.*, 1977) highlights the urgent need for setting up of a marine park embracing 22 islands in the Gulf of Mannar extending from Rameswaram Island to Tuticorin.

More recently the Government of Tamil Nadu has also constituted a Committee on Marine National Park under the Chairmanship of Shri B. Sivaraman, ICS (Retd.) for delineating the marine park in the Gulf of Mannar. The CMFRI with its regional centres located both at Tuticorin and Mandapam Camp has taken a leading role in carrying out surveys of all the islands including submerged areas of the reef and beyond upto a depth of 5 m and terrestrial fauna and flora of the islands. The degree of human interference presently

in the proposed park area has been determined and ways and means of phasing some of the activities are under study. We are giving here some highlights of the proposed marine park in the Gulf of Mannar which would be relevant for the Symposium (Plates I and II).

The entire coastline from Tuticorin (lat. $8^{\circ} 55' - 9^{\circ} 15' N$ and long. $78^{\circ} 0' - 79^{\circ} 16' E$) to Rameswaram island is sheltered from the fury of wind and waves by the existence of a chain of 20 islands or sand cays of size ranging from 0.95 ha to 130 ha, lying at a distance 5-7 km from the nearest mainland coast. These island formations are of accumulated sand and coral debris over dead coral core and are surrounded by live fringing coral reef consisting of hermatypic corals and boulder reef: pronouncedly on the seaward aspects.

(i) This entire ecosystem is unique in the east coast of India. Nearly 90 species of live corals have been identified here. These harbour a rich variety of coral reef fauna and flora, typical and rare, cowries, cones, volutes, murices, whelks, strombids, chanks, tonnid, and species of oysters.

(ii) Special mention must be made of *Cypraea talpa*, *C. tigrinus*, *C. serpentis*, *Conus amadis*, *C. textile*, *Strombus cananium*, *Murex adustus*, *Veluta lapponica*, *Murex haustellum*. All these are commercially exploited varieties. In this process the breeding habitats are destroyed on account of exploitation all the year round.

(iii) The corals, live branching varieties of *Acropora* spp. and *Montipora* spp., are hacked and taken out for decorative purposes thus decapitating the growing surfaces resulting in decay and subsequent gradual destruction of the fringing reef barrier.

(iv) The spit and wash of the coral reef brought about by the wave action and natural forces which constitute a strong base for marine algal growth are being scoured and collected for lime manufacture. The luxuriant growth

of industrially important weeds such as *Sargassum* spp. *Turbinaria* spp. *Gracilaria* spp. and *Gelidium* spp. and *Gelidiella* spp. estimated to be of the order of 5000-7000 tonnes (dry weight) a year are being removed daily by nearly 500 fishermen and women. This creates imbalance in the ecosystem.

(v) Extensive areas abundant with seagrass such as *Cymodocea* spp. *Thalassia* spp. and *Enhalus* spp. found in and around these islands are being disturbed by stake-net fishing and wall-net fishing resorted to by fishermen all the year round.

(vi) Destruction of seaweeds deprive the base of attachment for the rare species of medusa *Leucernaria (Halicristis)* sp. which is unique in its occurrence here because it is a form serving as an indicator species for current systems.

(vii) Indiscriminate fishing for *Dugongs*, the most endangered of our mammals, has reduced the population size to the point of endangering their existence in this area. The dugongs find the seagrass beds an ideal feeding ground.

(viii) Depletion of the rich holothurian population, particularly of *H. scabra*, by seasonal collection for Bech-de-mer Industry. The coarse and sandy stretches adjacent to the coral reef are good feeding and breeding grounds for them.

(ix) Indiscriminate tampering with the dead coral reef endangering the rich variety of proso-branch and opisthobranch molluscs.

(x) Large-scale collection of the enteropneust *Ptychodera flava* (*Balanoglossus*) by specimen dealers has virtually annihilated the population density. This is another unique species occurring in the sandy flats of the northern islands at the head region of the Gulf of Mannar.

(xi) Destruction of the mangrove vegetation lining the water front and swampy inlets,

creek and pools of almost all islands has denigrated the areas, biologically upsetting the rhythm of mangrove associated fauna, denying ideal shady hideouts for spawning fish and marine reptile species and depriving the natural nursery grounds for lakhs and lakhs of fry of milkfish, mullets and prawns. Removal of mangrove has also led to erosion in some areas.

(xii) Thoughtless chopping down of the trees in the wooded interior (e.g. *Acacia*, *Pemphis* trees) has adversely affected the rhythm of arrival of migratory coastland birds for rookery.

(xiii) Island based stake-net operations have entailed heavy destruction by fisherfolk of the marine turtle eggs which are laid seasonally by the olive ridley on the sea-ward sandy beaches of almost all islands. Drift-netting in the zone of arrival of turtles traps the breeders coming for nesting. These have greatly affected the turtle nesting. Besides, this area also has been identified as an important feeding ground for the green turtle and the hawksbill. Increased human activities are at direct conflict with this.

(xiv) The most degrading activity has been the quarrying of live and dead coral boulders of *Porites* spp. for industrial purposes carried on in almost all islands. This has resulted in the disappearance of one or two islets, viz., Manuli east and Poovarasampatti where only remnants exist now, exposing portions of what remain, during the lowest low tide periods. Removal of nearly 25000 tonnes of corals annually, from the late fifties to 1980, has denuded the area and brought about visible topographical changes in the islands and along the adjacent mainland coast.

(xv) The sea bed of the shallow stretch of water between the islands and coastal mainland are intensively trawled for prawns during seasons, thus adding another new dimension to the disturbance of the habitat since the early seventies.

(xvi) Perch trap fishing near the islands which is a traditional commercial avocation by mainland people at the head of the Gulf is yet another activity which has left its mark in the overall picture of disturbance to the biological ideal of breeding species of grunters, groupers and breams inhabiting the ledges and crannies of the coral reef areas.

A detailed scientific survey of all islands in the Gulf of Mannar conducted by a scientific team of CMFRI during the years 1977-1981 brought to the light unassailable proof on the above aspects to show the destructive forces at work. These have progressively diminished the value of the entire ecosystem from different angles. Therefore, we consider that the establishment of a Marine National Park in the Gulf of Mannar is one of the priority actions to be taken.

The ecological criteria to be applied for selecting the zone as one of the Marine National Parks are thoroughly satisfying in respect of:

(i) *Representativeness* or *Uniqueness* ranking high in priority as the islands are 'one-of-a-kind.'

(ii) *Naturalness*, related to the perturbation by man and loss of naturalness. The area includes sub-climax and transition zones and other areas which undergo natural changes subsequent to their natural disasters.

(iii) A *Natural unit* and buffer zone compatibility conditions are ideal since the area is large and allows dynamic change, biological and physical, viability, defensibility and integrity to be maintained.

(iv) *Diversity* where several habitat types and biotic associations can fall within the system.

(v) *Criticalness* in that important life stages of entire life histories of species are dependant on the area (e.g.) coral formation, molluscs,

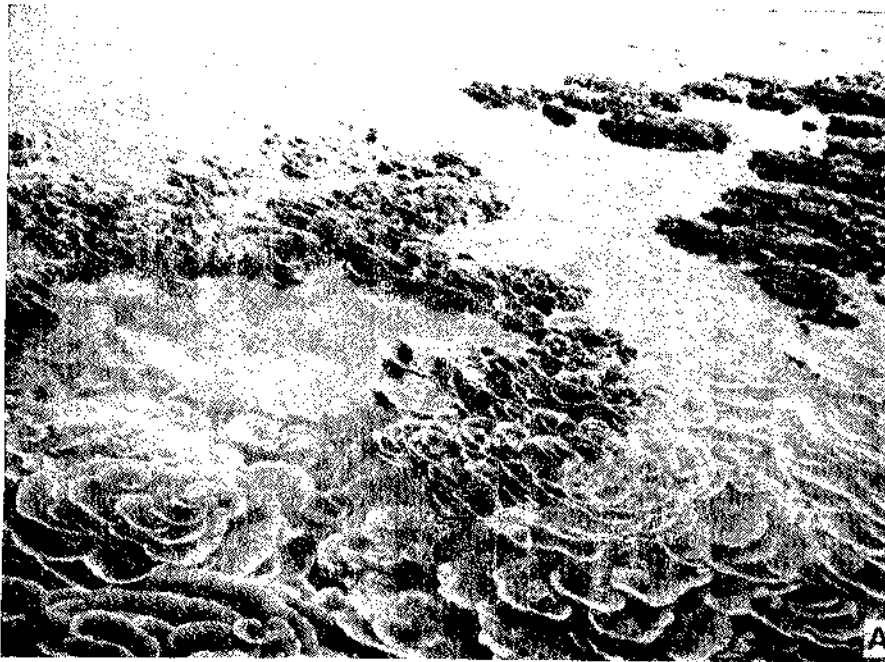


PLATE I. A. *Mangrove* coral growth on the southern shallow region of Karamitalli Tivi, exposed during low tide and B. The seagrass zone amongst dense growth of *Cyrtodactyl* grass.



PLATE II. A. Anchorage at Appa Tivu, northern tip of the island. Two fishing boats beached can be seen. In the foreground are small dunes with *Sphilex* growing on the sand and B. *Avicennia marina* and *Eucoplosa macrocarpa* bushes lining a tidal inlet in Manoli.

breeding, sea algae, seagrass and mangroves as areas of detritus production and conversion. Here endangered species are also considered as also other species of trophic significance.

(vi) *Inclusiveness* covers all habitats. This is an important area for science. Most practical studies of marine bottom community, fauna and flora in the past and in the present pertain to this zone because of scientific interest. The proximity of these islands to user group of scientists is an asset. These values out rank purely tourist or recreational value though these are also very important, particularly Tourism for promoting conservation through education and extension.

(vii) The area is *fragile* and degree of threat is greater due to the proximity to increasing human settlement and development of mainland facilities.

(viii) The *feasibility* aspect is satisfied since, except in one or two islands leased out to private owners, these are regional Government properties and can be brought under jurisdiction of a stable agency. *Redundancy* of the type of control system proposed does not exist. The national and international values rank high as evident from the visits for study by Scientists from distant places all over India and abroad. Krusadai island is internationally well known as a 'Paradise for marine biologists.'

In this context some pertinent points which are worthy of strategic consideration are :

- (i) Zoning and principles involved
- (ii) Delineation of boundaries
- (iii) Developmental programmes
- (iv) Management, administration, regulations and policing
- (v) Maintenance of control
- (vi) Recreational facilities and tourism
- (vii) Educational
- (viii) Ecological supervision
- (ix) Reappraisal and revision

(i) Considering representative areas like Manali island, Hare island, Valai, Mulli, Talayari and Appa tivu for total conservation forming an integral scientific reserve in which utilisation is prohibited and a buffer zone forming the rest of the islands, particularly Krusadai and Nallatanni tivu, are managed for leisure and educational activities, other areas such as Shingle, Pulli, Pullivasal and Manali, Putti, Anaipar, Vallyamunai Tivu forming one concentric group can be managed and strictly controlled, the nearer they are to the central core. These form the part of the central biome and combines reserve and utilisation within regional, economic and social framework. Similarly, in the southern area, Puzuhuni challi, Upputanni tivu, Karai challi and Kaswar should be a total conservation area ; and Van Tivu can be strictly controlled. In this, it is unavoidable that all biotopes from shore to open sea are included, (*i.e.*) the littoral ecosystem on account of interdependence within ecosystem of different biotopes.

(ii) It appears reasonable to suggest a distance of midpoint between the island coastline and the mainland coast on this landward side and 5 km from the seaward coast of the island as the boundary for the Park. In certain cases such as Valai, Mulli, Talayari, Krusadai, Pulli and Pullivasal islands the eastern or western aspects being nearer to one another, making it fordable during low tides and easier for policing. It is difficult to define depth as a criterion for the Park and the zone delineation since there are incongruities of depth in different locations which precludes depth contour specification which runs a zig zag course.

(iii) Fortunately the establishment of marine based industries such as Salt and Chemical factories, the thermal stations using salt water circulation as coolant are located far south of the proposed area of the park. But the pollution aspects arising out of these industries such as acid discharge, dumping of fly-ash of coal burnt and fall out pipes leading very hot

water from thermal factories should be carefully considered in future and the establishment of such industries in the vicinity of the Park zone should be prohibited.

Similarly the impact of the proposed Sethusamudram project canal within the zone of the park is to be critically gone into since the passage will entail constant dredging, throwing up mud deposits on the reefs and thereby smothering the rare biofauna and flora in addition to destroying the sea-weed and sea grass beds and dugong breeding and browsing habitats. The frequent passage of ships will also disturb the habitat by oil spills and other wastes. The classic instance of progressive disappearance of live coral reef inside Tuticorin harbour and surrounding areas due to increased sea traffic and oil discharge should forewarn of such an eventuality. The introduction of harmful exotic biofouling communities in the area by the passage of ships from one geographical area to another through the medium of the hull harbouring them is another serious matter. The introduction of *Congerina sallei* (*Mytilops sallei*), a serious sessile competitor in the Vizagapatnam harbour is a proof of how prolific settlers can get adopted to a new environment and pose a serious threat to endemic bottom living communities. This again is analagous to the *Modiolus* spp. settling in profusion in the pearl oyster beds in the Gulf of Mannar, smothering pearl oyster spat.

These factors should weigh heavily against the location of the Sethusamudram Channel within the park core area. An alternate routing of the project cutting across the Adam's Bridge needs a critical examination.

(iv) There is a vital question to be solved. A long term national level control with international cooperation is envisaged since creation of Marine National Park in a country cannot be restricted to the narrow domains of regional management alone and uniform policies are to be adopted by a high level authority. Fund-

ing and staffing such projects should not be subject to the limitations of the local authorities. This again will be interlinked with many similar measures in future, such as creation of reserves and sanctuaries all along our vast coastline and Bay Islands where guiding principles and yardstick applied are to be uniform. For effective implementation it is advisable that the national body like the Department of Environment, Govt. of India is vested with the responsibility for the overall management of the Marine National Parks and reserves in India including those in the Andaman Nicobars and Lakshadweep islands. The responsibility of the park board is to apply the decisions set out in the master plan as to how various components of the Park are to be managed, within what limits and what infrastructure and with what regulations for the control of human activities. A Committee of investigation and a council of administration (execution) should follow it up. The Council should certainly include in its composition representatives of the State Govt., and of all disciplines and representatives of all private and official local and regional institutions where collaboration constitutes guarantee for success.

Scientific research should be preserved to acquire better knowledge of the ecosystems and to interpret dynamic equilibrium. Periodic survey type of research is needed to measure the environmental quality and checking up key species in the biocoenosis.

(v) It is of paramount importance to train several cadres of competent personnel for handling the conservation programme. Unless specific problems of marine environment are properly understood, the functional efficiency of these people will be weak.

It is quite necessary legislations imposed should be adequate and implemented by co-ordinated conservation policies with terrestrial Parks and resources wherever possible.

It is essential that a critical marine habitats Working Group be established with associated task force for conducting workshops, on topics of jurisdiction, zonation, conservation economic conflict, tourist interpretation, terminologies, classification and definitions of marine parks, reserve land sea interface and other policy matters.

A Central Authority should carry out the policy, co-ordinating the activities of all governmental, non-governmental agencies with departments concerned with fisheries, coastal zone development, conservation, National Parks, tourism and enforcement.

Educational institutions and fisheries should co-operate on research. Public should be in the advisory panel to contribute their expertise to strengthening an integrated policy.

Reviewing existing information and activities, initiating computer compatible descriptions of areas, with data retrieval system, setting up management guidelines, issuing certificates by means of permits or authorisation and ascertaining the activities are consistent with purposes of permits, administering research grants, maintaining consultative process, including fisheries resources, cultural resources, education and research, national security and exploitation of mineral resources, providing ranger and guide training are some of the responsibilities which can be discharged by this agency.

An Advisory Panel as a Scientific Committee of ecologically oriented scientists, Special interest groups, environmental lawyers and land use planners, can also be included in this with the following functions :

1. Consultation on long term goals.
2. Model guidelines to be evolved.
3. Determination of Research needs.
4. Scientific evaluation, surveillance.
5. Specific functions for each reserve/Park Sanctuary to be recommended.

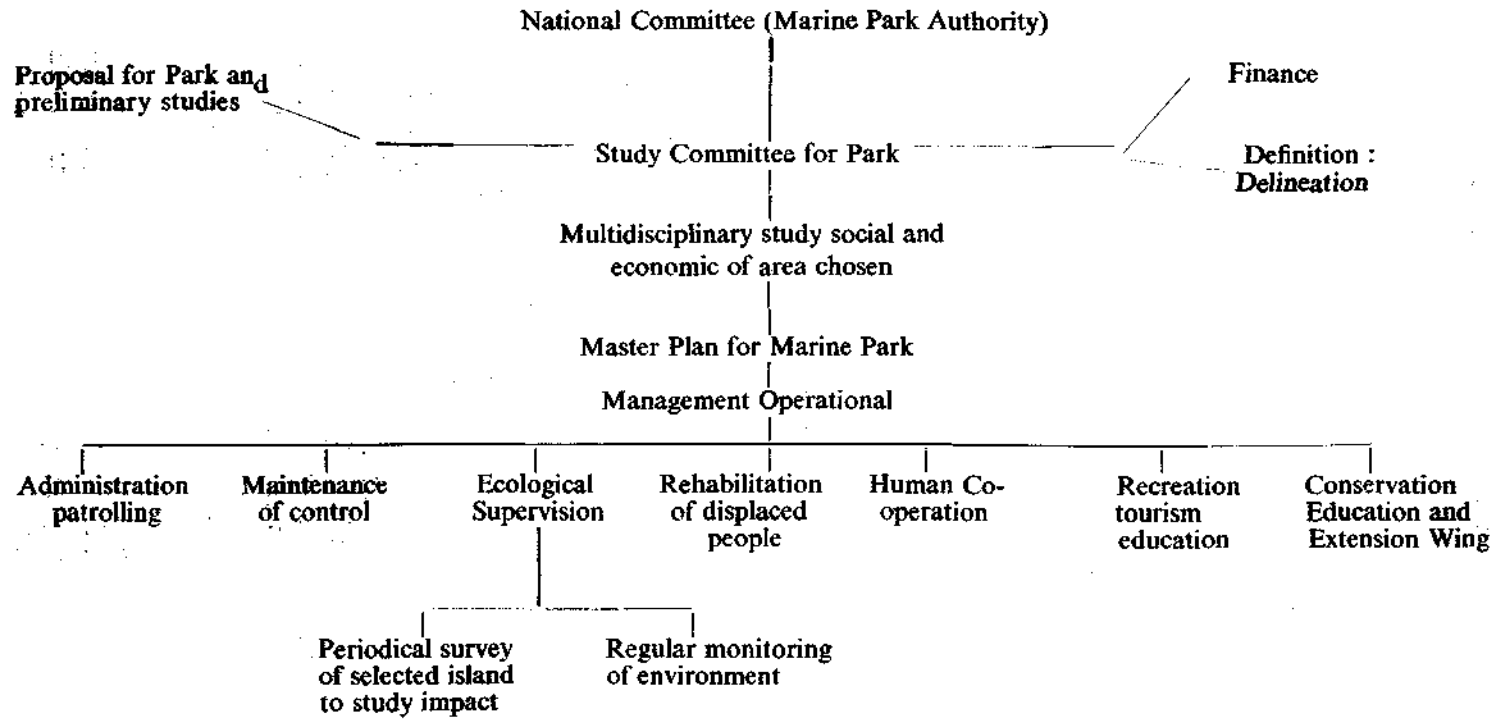
6. Management programmes to be recommended.
7. Advise on regional problems.
8. Help government in developing National Policy.

The proposed set up can be on the model indicated in the flow chart.

(vi) Recreational tours for hand lining and rod and line fishing may be permitted in selected areas. For tourist to derive the benefits of appreciating the beauties of nature, tours should be organised with bases for stay on the mainland and facilities provided in areas such as Krusadai island, Hare island and Nallatannivu for snorkeling and diving. Provision of glass-bottomed boat, inflatable boats, out-board engine fitted boats may be permitted in regulated numbers to facilitate observations. These activities have intrinsic psychological therapeutic value and other vicarious benefits.

The increasing tourism activities are exerting pressures on fragile marine ecosystems and resources all over the world. In India too where tourism is being given great importance in recent years it is bound leave its impact on marine and coastal ecosystems. To cite an example, the promotion of tourism activities in the Pichavaram backwaters (near Cuddalore) is resulting in chopping down of mangrove vegetation for motor launch pathways and creating other disturbances which are beginning to leave their adverse effects on the beauty of the area, its productivity and usefulness in sheltering animal communities. The expansion of tourism development activities should be planned in a way compatible with ecological principles and guidelines and this should be chalked out by the National Committee.

The concept, functions and benefits of conservation are insufficiently known by the public and by the planners. Through local, national and international organisations, this communi-



cation gap can be bridged. Perhaps audio-visual education on this can be adapted towards multiple benefits. Competent specialists can produce films. Initiative from non-governmental organisations should be welcomed and governmental collaboration will ensure greater appreciation by public than when government agency alone tries to administer the systems.

(vii) Such areas protect scenic beauty and enhance areas for enjoyment as well. Public education, training and education of Park officials and specialists, training of managers of environment, area use for higher education and research are very important. Artistic education and sports are two forms. This is a special aspect that should not be lost sight of; culturally the area may not offer anything attractive but this is another item to be reckoned with.

Krusadai appears to be the best suited for education and recreational purpose. In this respect this island can be developed with a possible second choice of Nallatanni tivu where specific zones can be set aside for underwater viewing and swimming, boating, sport fishing, SCUBA diving, and charter boat tours with specified anchor sites. On no account the tourist should be allowed to have staying facilities in any island but only to visit and return. Establishment of an oceanarium cum 'Sea World' at Kundukal Point, Pamban, Rameswaram Island should be taken up as a Centre for tourist attraction.

Visiting Scientists should get all laboratory and field facilities for detailed studies in Krusadai island and Nallatanni tivu and one of the southern islands should be reserved for studies on restoration of the reefs.

(viii) The right should be vested with the Park authorities to intervene and restore the balance of the ecosystem when disruption puts the whole Reserve at risk. This would mean

all control measures needed to remove the causes of such forces. For instance the right to quarry corals for industry, collection of coral bits for Klin burning and calcining, collection of seaweeds and shells etc. which are regular activities in the area.

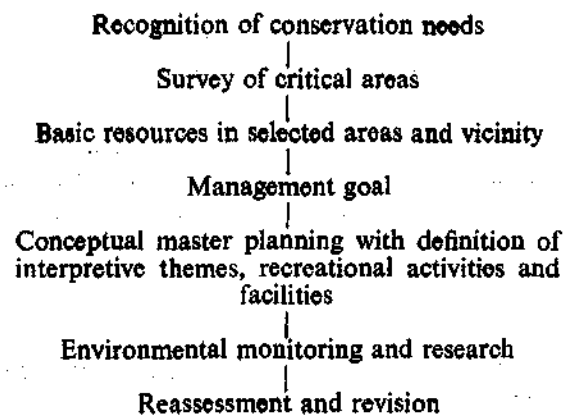
Specific matters

1. *Protection*

This is to guide studies and surveys and guide implementation. This is a highly flexible subject depending on regional diversities and site specific issue. This would naturally preclude rigid approach.

Legislation ultimately aims at a zonation of coastline and takes on itself responsibilities for managing problems beyond the capacity of any single department such as Fisheries or Tourism. We should be sensitive to needs like use of marine areas, resources of people, restoration of damaged environment, preventing further deterioration and other areas of local interest of marine resources exploitation *vis-a-vis* the economy of the people involved.

The subject relating to recreational, interpretive and educational uses needs careful planning and decision. The approach of marine park conservation can be on the model of terrestrial conservation :



III. DEVELOPMENT OF A MARINE PARK AT MALVAN

It has been suggested (Qasim *et al.*, 1980) that the Malvan coast in the Central West coast of India be declared as a Marine Park. The justification given are that it is a clear, unpolluted, healthy area with abundant growth of living corals. From Malvan Bay a chain of submerged and exposed rocky islands extends straight towards south upto 15° 13'N and 73° 27'E. There are several islands including the Vengurla Rocks at the southern tip and Sindurdurg Fort at the northern tip. The algal wealth in the rocky areas here is rich and the entire coast line is a scenic beauty. It has been suggested that a Dolphinarium and marine aquarium can be constructed in the marine land complex at Sindurdurg Fort which is very near the sea with deep channels outside the fort-wall. This Fort itself is a national monument under the Archaeological survey of India. There is a proposal by the Government of Maharashtra to develop this as a tourist spot with financial and technical assistance.

A detailed document issued by NIO, Goa has delineated the Park area adopting a 'two zone system', a 'Buffer zone' and a 'Core zone'. A five point action plan has been outlined emphasising on creating public awareness, framing of rules and regulations, preparation of illustrated extension literature, collection of base line information on park ecosystem and establishment of a park museum as an educational input.

Regulations to cover the 'Core zone' and 'Buffer zone' have been proposed which will include phasing out activities such as fishing from the core area and minimising human interference in the 'Buffer zone' as well. A Dolphinarium and a marine aquarium are proposed. A fourteen point action plan outlines the immediate development programme for the proposed Park.

RESERVES AND SANCTUARIES

The Department of Environment, Government of India has prepared some guidelines for the development of the beaches and coastal zones. While this has given very specific ideas for management of different situations, a national policy on the management of the coastal zone will be necessary. The increasing pressures on the coastal zone by wide ranging activities has resulted in large scale man-made perturbations and biodegradation of many coastal ecosystems. There is an urgent need to identify areas of priority importance for ecosystem conservation and demarcation as reserves, along the coast as well as estuarine areas. It is not only the threatened habitats such as mangrove ecosystem and saline lagoons and coastal wetlands that has to meet our immediate attention, but some of the known nesting beaches of sea turtle, sea grass beds and coral reef areas. The recent focus on the mass nesting of the olive ridley turtle along the Gahirmatha Coast of Orissa and along other beaches on the east coast as well as sporadic nesting of other species of sea turtles in the Bay islands and along some parts of the mainland coast has drawn attention to the need for immediately declaring some of these areas where man-made perturbations are increasing, as reserves. The recommendations of the recently conducted Workshop on the Conservation of Sea Turtles held at Madras in February, 1984 focuses attention on specific areas along the coast as well as in the Andaman Nicobar and Lakshadweep Islands which need immediate attention. The published proceedings (Silas E. G. (Ed.) (1984) has brought out a wealth of information from Forest and Wildlife Departments, various organisations and individuals of the effort that has at present been mounted to help in the sea turtle conservation programmes. We are giving below some of the highlights and specific aspects which need consideration for declaring certain stretches and beaches which are nesting or feeding grounds

of sea turtles which need surveys, evaluation and consideration as reserves. There is also a need for extending some of the wildlife sanctuaries to include also contiguous beaches within its ambit so as to offer protection for nesting turtles and the marsh crocodile and other endangered or vulnerable species.

The areas of special interest are :

1. Spawning grounds for commercially important fishes
2. Important feeding, breeding and nursery grounds such as Mangrove habitats.
3. Nesting, feeding and breeding grounds of Sea turtles.
4. Unique and threatened habitats.
5. Areas of geological, historical, cultural, aesthetic and recreational interest.

NESTING BEACHES, FEEDING GROUNDS AND MATING AREAS OF SEA TURTLES

Wildlife sanctuary for turtles already exist along the Orissa Coast. Bhitarkanika Sanctuary at present does not include Wheeler and Shortts' islands in the north Orissa Coast. Also it was found that Hukitola island and False point (near Paradip Port) are very strategic southern points for ridley nesting. These should be included. In the Workshop on sea turtle conservation held at Madras in February, 1984 it has been recommended that the Bhitarkanika Sanctuary should be suitably extended on the seaward side so that the nesting beaches and the mating areas of the olive ridley could be adequately protected. It will be eventually necessary to develop a biosphere for the Bhitarkanika—Gahirmatha area where the mangrove ecosystem and the beaches are important for the protection of the sea turtle, crocodiles and other vulnerable species.

Another marine reserve at Kujang-Astrang along the Orissa Coast is felt essential since

new olive ridley nesting grounds have been reported near Devi River mouth in Cuttack District. It will be very ideal if the proposed Konarok-Balukhand sanctuary in Puri District is extended to cover also a 48 km beach stretch as a reserve to protect turtle nesting grounds north of Keluni Muhana river mouth.

It was also suggested that the sandy beaches and islands of Sunderbans in West Bengal and Godavari and Krishna deltas of Andhra Pradesh be further studied for the location of turtle nesting sites and be adequately protected.

In Tamil Nadu coast, Point Calimere area is already declared a wildlife sanctuary for the black buck and migratory birds. The importance of the contiguous seaward beaches as sea turtle nesting grounds is important and it is all the more expedient to extend the limits of the Sanctuary further seawards to afford protection to the turtle nesting beach sites in the area. The best nesting places on the West coast of India exist in Gujarat-Bhaidar island in the Gulf of Kutch. This has already been declared a Marine Park area. The beaches south of Dwaraka and the coasts of Diu islands are critical areas for green turtle nesting and should be excluded from sand mining for the cement industry.

As feeding grounds for sea turtles, Andaman and Nicobar islands are very important areas. Most of these islands are now within reach of poachers and this poses problems. The beaches of Kwangtung, North reef island, Latouche, North cinque, South cinque, Interview island and Twin islands are places for nesting of turtles. These should be declared as Reserves.

Great Nicobar is the most important nesting island. Considering the growing importance of developmental activities particularly in the Middle Andamans, Car Nicobar, Comorta and Great Nicobar islands it is highly essential to declare the sandy beach and the tidal inlets

leading to swampy interior in these islands as reserves for protecting the turtle nesting grounds as well as for the marsh crocodile. The areas to be declared as reserves could be properly delineated after a timebound baseline survey is carried out in these areas.

In Lakshadweep Green turtle nesting has been reported from Suheli Veliyakaran, Bangaram, Thinnakara and Parali islands. The entire beaches around these islands should be declared as reserves since the islanders exploit the turtle for flesh and oil. The Hawksbill turtle has been reported nesting on the Minicoy Island and the favourable sites of the beach need protection. The sub tidal and slightly deeper zones abound in luxuriant growth of seagrass which area the green turtle frequents on their feeding sojourns. Hence, it is also necessary to include parts of the Minicoy shore region and the seagrass beds as protected areas. Delineation and marking of boundaries of the reserves can be taken up after baseline studies are completed. Development of a National Seashore system and an integrated system of coastal zone management including social forestry scheme is suggested. Exclusive reservation of certain segments of beach for turtle nesting at specified distance at least 1000 m from high water mark to allow high beach platform for facilitating nesting of turtles and to act as a screen to shield beaches from artificial light at night which will keep turtles away from nesting is a must.

MANGROVE ECOSYSTEM

Destruction of mangrove vegetated shore line zones for industrial activities and coast line development is one of the most insidious and damaging activities of man. This coast line challenge should be curtailed to minimise the set backs that can happen to the mangrove associated ecosystem and to the configuration of the coastal relief.

As such we have scanty scattered data regarding the extent of important mangrove lined beaches. But with the available data and information it appears necessary to take immediate steps to protect the following:

1. Mathupet swamp and the Pitchavaram backwaters along the Tamil Nadu coast where the mangrove vegetation stands the danger of pollution by recreational users as well as chopping down of trees for pathways for the tourists.
2. Already the entire islands in the Gulf of Kutch have been brought under a National Marine Park which affords guarantees on the principles of conservation.
3. The total inlets and the swampy deltaic regions of all the major rivers in the east coast upto a distance of 5 km south and north of the coastline and interior should be declared as reserves.
4. After sufficient data collection similar measures can be taken in Andaman and Nicobar islands and Lakshadweep.

BREEDING RESERVES

Although no precise data are available about the inshore breeding grounds of commercially important and rare marine species, it is still a necessity that with whatever information available breeding reserves are established. A few examples are cited below.

1. In the Palk Bay zone (lat. 9° 15'-9° 30' N and long 79° 30'E) seasonal occurrence of shoals of large sized *Chanos* spawners occur and this inshore movement for spawning is significant. This is also evidenced by the appearance in enormous numbers of *Chanos* fry ascending the tidal creeks and inlets during February to April and September to October of each year in the east coast tidal creeks and

inlets. The fishermen catch these spawners when they occur in the shoreward area by operating gill-nets and drift-nets during this season. This, if permitted, will ultimately spell disaster to the natural milkfish fry and fingerlings resources of the country. We are concerned with this problem in as much as the fish is extensively used in coastal aquaculture operations. Therefore, it is suggested that effective regulatory measures such as observing closed season for fishing of *Chanos* from Rameswaram upto Point Calimere within the Bay area may be observed after a careful study.

2. The Palk Bay squid is a rare species occurring in large quantities in and around Rameswaram island and the habit of the squid and other cuttle fishes to lay the eggs during breeding season on floating objects and submerged weeds is a regular feature during May to July of each year. An area of 50 sq. km off Rameswaram east coast should be declared as a reserve and any attempt to operate seine-nets or stake-nets should be restricted and keenly watched to rescue the egg clusters that will become enmeshed and destroyed by fishing operations.

3. The flying-fish fishery of the east coast from Madras to Point Calimere is another example of how the fish needs protection during its spawning time when it moves shorewards to lay its eggs on submerged bushes intentionally anchored by fishermen to attract and aggregate the fish for laying eggs. This fishery which is unique off the coast of Tranquebar and Nagapatnam in Tamil Nadu coast has dwindled in recent years due to heavy fishing pressures. Therefore, a part of this fishing zone may be declared as a reserved zone imposing restrictions on the season of fishing (viz. May-June).

4. Imposing size restrictions and mesh regulations has in the past given positive result in increasing the chances of the animals

breeding at least once before being fished. This is possible only when the life history of some animals of importance is fully worked out to find out the minimum size at spawning. The Tamil Nadu Government's restriction on fishing of chanks, by diving which are less than 55 mm diameter have given good results. But this needs further strengthening in order to improve the chances of survival. Diminishing size range in commercial catches indicates the lacuna which might exist in the criteria adopted for better yield. Therefore, it is suggested that instead of allowing exploitation of chanks extensively in the Gulf of Mannar and Palk Bay a few protected areas may be demarcated to serve as perennial breeding reserves. The possibility of declaring an extent of 100 sq. km of the sandy seabed lying between 16 m to 30 m in the Gulf of Mannar off Tuticorin and an identical extent between 8 m to 15 m depth off Tondi in Palk Bay should be explored.

5. Extensive and indiscriminate fishing by diving for *Trochus niloticus* and *Turbo* sp. is being done around the Andaman and Nicobar islands. The areas around the little Nicobars and Katchal and Camorta islands should be declared as prohibited zones for fishing these upto a distance of 500 m from shore line all around. Leasing out operations for commercial exploitation should be terminated and not renewed in future.

6. Commercial leasing out of estuarine zones of river beds by all State Government authorities should be controlled by seeking advise from the National Committee on Marine Parks. The classic example of mining the river beds in the vicinity of the sea for dead clam shells and oyster shells has adversely affected the traditional occupation of the fishermen who depend on the live clam resources in these areas for their livelihood. The disturbance to the river bed in all such areas leased out has markedly affected the ideal habitat needed for the growth and survival

of the valuable clams such as *Paphia* sp. and *Meretrix casta*. Recent survey conducted in the Kali river estuary of Karnataka has proved this point. Identical situation may exist in the other estuaries in the Dakshina Karnataka. To start with, it is necessary to declare some of the estuarine areas protected from dredging clams for the lime industry, but permitting traditional subsistence fishing.

7. The development of artificial reefs, especially in the Gulf of Mannar and Palk Bay and other selected stretches of the coast for marine habitat improvement should be encouraged.

CULTURAL AND ARCHAEOLOGICAL

Several submerged areas along the east coast particularly off Tamil Nadu are known for the lost cities which are lying submerged or destroyed by the sea engulfing the settlement in the past. Such archaeological sites are very im-

portant from the point of view of our cultural heritage. Good examples are the cities of Poompuhar off Tanjore coast and Mahabalipuram off Madras coast. Proper demarcation of such areas landward as well as in the littoral zone for declaring them as heritage reserves will be necessary.

It is but an example of an immensely rich cultural heritage of our country's coastal areas of the different maritime states. Several historically famous shrines, past cities and cultural centres may remain submerged or lost by sea erosion during the course of several bygone centuries. Inventories of such instances should be prepared and such coastal zones should come under Underwater Archaeological reserves. The Tamil Nadu Government's initiative in encouraging the Tamil University, Tanjore to embark on a Project Centre at Mandapam for underwater archaeological studies is commendable and should be emulated by other states to unraval the mysteries of the submerged ancient centres of culture.

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