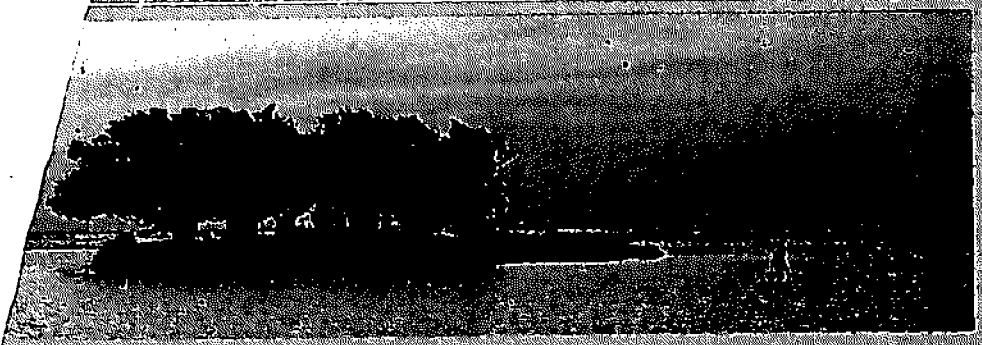
MARINE PARKS AND RESERVES

Management for Coastal Environments in Southeast Asia



Alan T. White

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Association of Southeast Asian Nations/United States
Coastal Resources Management Project Education Series 2

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Published by the International Center for Living Aquatic Resources Management on behalf of the Association of Southeast Asian Nations/United States Coastal Resources Management Project

Printed in Manila, Philippines

White, A.T. 1988. Marine parks and reserves: management for coastal environments in Southeast Asia. ICLARM Education Series 2, 36 p. International Center for Living Aquatic Resources Management, Manila, Philippines.

Cover photos: (Top) *Mangrove islet on shallow reef flat, Pamilacan Island, Bohol, Philippines.* (Left) *Scuba diver on colorful coral reef. Tubbataha Reefs, Sulu Sea, Philippines. (Jim Doran).* (Right) *Highly stinging jelly fish coexisting with a toxin-tolerant fish. (Jim Doran).*

Color photos are by A.T. White, unless otherwise noted.

ISSN 0116-5720
ISBN 971-1022-39-7

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Acknowledgements

This book would not have been possible without the accumulated help of many persons over the past nine years. The East-West Center, Hawaii, provided support for my dissertation travel to many marine reserves in Southeast Asia under the supervision of Dr. Mark Valencia and Dr. John Street. Dr. Angel Alcala, Dr. Celso Roque, the Asia Foundation, the United States Agency for International Development (USAID), many persons at Silliman University and my wife, Gail Savina, have all contributed to my research on marine reserves in the Philippines in recent years. Special mention is necessary for excellent references provided by Dr. Rodney Salm, Ms. Susan Wells, Dr. Garry Russ, and Rahman and Mohamad used in this text. The Association of Southeast Asian Nations (ASEAN)-United States (US) Coastal Resources Management Project under Dr. Chua Thia-Eng and executed by the International Center for Living Aquatic Resources Management (ICLARM) has provided final support for this publication.

Foreword

The coastal waters of Southeast Asian countries have some of the world's richest ecosystems characterized by extensive coral reefs and dense mangrove forests. Blessed with warm tropical climate and high rainfall, these waters are further enriched with nutrients from land which enable them to support a wide diversity of marine life. Because economic benefits could be derived from them, the coastal zones in these countries teem with human settlements. Over 70% of the population in the region live in coastal areas which have been recently characterized by high-level resource exploitation. This situation became apparent between the 1960s and 1970s when socioeconomic pressures were increasing. Large-scale destruction of the region's valuable resources has caused serious degradation of the environment, thus affecting the economic life of the coastal inhabitants. This lamentable situation is mainly the result of ineffective or poor management of the coastal resources.

It is essential to consider coastal resources as valuable assets that should be utilized on a sustainable basis. Unisectoral overuse of some resources has caused grave problems. Indiscriminate logging and mining in upland areas might have brought large economic benefits to companies undertaking these activities and, to a certain extent, increased government revenues, but could prove detrimental to lowland activities such as fisheries, aquaculture and coastal-tourism dependent industries. Similarly, unregulated fishing efforts and the use of destructive fishing methods, such as mechanized push-nets and dynamiting, have caused serious destruction of fish habitats and reduction of fish stocks. Indiscriminate cutting of mangroves for aquaculture, fuel wood, timber and the like have brought temporary gains in fish production, fuel wood and timber supply but losses in nursery areas of commercially important fish and shrimp, coastal erosion and land accretion.

The coastal zones of most nations in ASEAN are subjected to increasing population and economic pressures manifested by a variety of coastal activities, notably, fishing, coastal aquaculture, waste disposal, salt-making, tin mining, oil drilling, tanker traffic, rural construction and industrialization. This situation is aggravated by the expanding economic activities attempting to uplift the standard of living of coastal people, the majority of which live below the official poverty line.

Some ASEAN nations have formulated regulatory measures for their coastal resources management (CRM) such as the issuance of permits to fishing,

logging, mangrove harvesting, etc. However, most of these measures have not proven effective due partly to enforcement failure and largely to lack of support for the communities concerned.

Experiences in CRM in developed nations suggest the need for an integrated, interdisciplinary and multisectoral approach in developing management plans providing a course of action usable for daily management of the coastal areas.

The ASEAN-US CRMP arose from the existing CRM problems. Its goal is to increase existing capabilities within ASEAN nations for developing and implementing CRM strategies. The project, which is funded by USAID and executed by ICLARM in cooperation with ASEAN institutions, attempts to attain its goals through these activities:

- Analyzing, documenting and disseminating information on trends in coastal resources development;
- Increasing awareness of the importance of CRM policies and identifying, and where possible, strengthening existing management capabilities;
- Providing technical solutions to coastal resources use conflicts; and
- Promoting institutional arrangements that bring multisectoral planning to coastal resources development.

One of the information activities of CRMP is to produce or to assist cooperating agencies in producing educational materials on coastal environments which are targetted for general audiences. In the form of books, booklets or leaflets, these materials primarily purport to create public awareness on the importance of rational exploitation of living coastal resources, environmental conservation and integrated CRM and planning.

Marine parks and reserves: management for coastal environments in Southeast Asia is the second title in the education series of the ASEAN-US CRMP and of ICLARM. This book is intended to introduce marine parks and reserves as a means of management for coastal environments in Southeast Asia. The book briefly describes the plight of coastal resource habitats and why and how marine parks and reserves can serve as specific management approaches for these areas. Although marine parks and reserves cannot address all the CRM issues in the region, they provide a practical, implementable and logical beginning for effective CRM.

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Introduction

Conservation

The increasing use of coastal resources in Southeast Asia requires that some areas be retained in their natural states. Safeguarding critical habitat for fish production; preserving genetic resources; protecting scenic and coastal areas; and enjoying the natural environment all prompt the strict protection of some natural areas.[51]

Even though national interest in resource management generally arises from economic and practical considerations, Southeast Asian countries are now realizing the need to have pristine coastal areas for biotic preservation and tourism. Fisheries depletion caused by overfishing and destruction of coral reef, mangrove, sea grass and estuarine habitats has become significant in every country. For instance, local cultures are also affected by dwindling populations of endangered sea turtles or giant clams.

While there exist many conflicting uses of coastal resources, careful design and implementation of large coastal zone management (CZM), coastal resources management (CRM) or coastal area management planning (CAMP) schemes will ensure continued benefits from some natural areas. Such plans can include protected areas or what is referred to here as marine parks and reserves. Marine reserves, even though relatively small and geographically well defined compared to CZM or CRM areas and plans, can be designed and managed to address various activities. In this way, pursuing one benefit does not exclude the pursuit of others and allows many management options. But, the underlying theme of marine reserves is conservation and protection of natural resources. This may be contrasted with wider area management plans (CZM, CRM or CAMP) which accommodate resource development actions.[15]

Protected areas or marine parks and reserves have a specific role *within* coastal management. For example, CZM is an administrative, regulatory process, not linked to ownership of land (or water areas) which controls activities that can degrade wide regions of coast. On the other hand, marine parks and reserves are linked closely to ownership and refer to specifically designated pieces of coastal marine space. They require specific and detailed planning and management *within* CZM or CRM programs and/or regions of coast (Clark, pers. comm.).[15]

Conservation is defined by the International Union for the Conservation of Nature as "the management of the natural environment so that it may yield the greatest benefit to present generations without losing its potential to meet the needs of future generations."[21] People need coastal resources now and will increasingly use them. Conservation aims to satisfy those needs in a way that ensures the survival of resources in the long term. CZM or CRM which includes marine reserves helps channel development of resources for long-term use. The goal is to *avoid* sacrificing one resource by harvesting another or to modify the habitat and the resource base.

The World Conservation Strategy has three major goals.[21] Although applicable for all coastal area management, they should be interpreted literally for marine reserves and protected areas which are of comparatively small size. The goals are to: (1) maintain essential ecological processes and life support systems; (2) maintain genetic diversity; and (3) ensure the sustainable utilization of species and ecosystems.

Why Management of Marine Resources?

The coastal zone of Southeast Asia is rich in estuaries, beaches, mangroves, coral reefs, sea grass and algal beds and many small island ecosystems. Each of these marine ecosystems, with its associated habitats, supports a wealth of marine resources. These resources, comprised of various life forms and nutrients, help maintain the ecosystem itself and others associated with it; provide physical protection to the coastal environment; and benefit people directly.

Many economically important marine fish, invertebrates and seaweeds are dependent on both site-specific and more widespread ecosystems for habitats and nutrients. From the region's nearshore, shallow-water, soft-bottom grounds, especially areas near estuaries or concentrated with mangroves, the commercially important catches include shrimps, croakers, snappers, seaperch, catfish, crabs and clams. The soft-bottom demersal grounds farther offshore, both shallow and deep, provide commercially important catches of sea bream, ponyfish, catfish, lizardfish, fusilier, flatfish, conger eels and lobster.[60]

Some of these are also caught from the many coral reef or sea grass areas. Others are dependent on reefs for nutrients or as nursery areas. Reef fisheries are often dominated by such commercial species as snapper, grouper, big eyes, grunt, parrotfish and lobster. Many shallow fishing grounds support commercially important specialty fisheries for seaweeds, sea urchins, sea cucumbers, crustaceans, sea turtles, ornamental shells, pearl oysters and precious corals.

The vulnerable marine animals in the region dependent upon coastal environments above are sea turtles, crocodiles, dugong, seabirds, shorebirds and selected invertebrates.[65]

Sea turtles are the most economically important endangered animals. They nest on sandy beaches and breed in protected estuarine or reef waters. The single largest concentration of sea turtles nesting in the region occurs along the east coast of Malaysia and its offshore islands where more than a million eggs are deposited annually.[55] However, the number of eggs is rapidly declining. The leatherback sea turtle, once common along the Malaysian east coast, is nesting in critically low numbers.[13] Extinction or decline of some populations is attributed particularly to exploitation for meat, shells, hides, eggs, oil and souvenirs. Habitat destruction and disturbances by coastal development and tourism; attraction of hatchlings to light from houses and hotels; and often people watching or playing with turtles during nesting are all important factors in their decline.[58]

Crocodiles frequent estuarine, swampy areas near large river mouths and, occasionally, mangrove areas. Once common throughout Southeast Asia, they have been severely depleted for their skin; and because feared by people, they are thus killed. Now, only remnant populations survive mostly in Indonesia and Papua New Guinea with the exception of Northern Australia where large and viable populations exist.[65,44]

The dugong, the only inshore aquatic mammal occurring in Southeast Asia, inhabit sheltered, shallow areas and feed on sea grasses and algae. Dugong are exploited for their meat, oil and teeth; their populations are now small in most areas except in Northern Australia.[20,58]

The once plentiful giant clam, *Tridacna*, traditionally important as food throughout the region, is now scarce and/or absent in many areas. This bivalve has been overexploited for its meat and shell. The larger shells are used to make floor tiles or as decoration in homes and hotels.[33]

Mangrove forests provide food and shelter during part or all of the life cycles of many marine species. Economically valuable organisms of this sort include penaeid prawns, crabs, shrimps and various species of fish.[31] Mangroves also are direct sources of firewood and charcoal, some medicinal extracts, roof thatching and minor foods. In their natural state, mangroves help stabilize coastal areas by reducing wind damage and wave energy during storms and by checking soil erosion. They build land through slow and long-term trapping of land-derived sedimentation.[18] It has been conservatively estimated that 550,000 t of fish worth US$194 million caught in Indonesia in 1978 were of species that are directly linked to mangroves and estuaries at some stage of their life cycle.[77]

Even though mangroves have a proven long-term value in their natural state, forest alteration, harvesting and alterative use for mangrove habitat are increasing at an alarming pace in Southeast Asia. Indonesia, for example, has allowed logging concession leases on approximately 18% of the total estimated mangrove area in the country.[32] The Philippines has lost about two-thirds of its original mangrove forest cover to among other causes, fish pond conversion and harvesting for wood.[11]

Coral reefs are a distinctive ecosystem rich in species and highly productive. They serve humans in many ways: for food production; for coastline protection; as sources of nonfood products such as medicines, sponges and jewelry items; for aesthetic and related economic benefits; and for scientific and educational use.[67,71]

Coral reefs also support many organisms of economic value. Coral reef fish constitute a significant portion of the recorded catch in most Southeast Asian countries. In the Philippines, it has been estimated that at least 10% of the country's fisheries production is reef-associated; and in western Sabah, around 30% has been suggested.[34,30] Small island reef fisheries comprise even higher portions of the total reef-associated and pelagic catch to small fishing villages.[75]

Despite the obvious value of maintaining reef ecosystems, more than half the reefs in the Philippines and Indonesia are in advanced states of destruction. Only 25% of live coral cover is in good condition and merely 5%, in excellent condition.[78,57] Comparable studies would probably indicate a similar, if not worse, status for reef quality in Thailand and Malaysia.

Coral reef destruction is caused by a variety of activities, most of which are illegal but not easy to prevent. Destructive fisheries methods common in the region include: blasting; trawling over reefs; and muro-ami which uses weighted scareline that breaks corals and is common in southern Philippines; using cyanide in aquarium trade fish collection which also kills invertebrates; use of small mesh nets and traps; and spearfishing.[3,8,45,71]

Equally disturbing to reefs are site-specific activities such as: extraction of corals, limestone and coral sand; reef trampling by people gleaning at low tide; boat anchors dropped by fishermen or tourist boats; and overfishing of fish and invertebrates.[26] Intrusions, less localized but often highly detrimental and widespread, are: runoff of land sediments from deforestation or poor agricultural practices (common in the Philippines and Indonesia); urban and industrial pollution near all large cities in Southeast Asia; pollution from oil spills or drilling; and thermal or salinity changes.[35,68,61] These intrusions occur in varying degrees throughout the region and highlight the need for improved CRM and protection.

Why Marine Parks and Reserves?

The coastal zone resources of Southeast Asia are under severe pressures of exploitation.[68] Most of the infractions on sustainable use can be prevented or minimized with good area management. Large areas can come under CZM administrative management; and protection of particular, well-defined areas and critical habitats can be achieved by marine reserves.[15] A marine reserve, from functional (where some resource use occurs) to preservational, can be a comprehensive response to marine and coastal conservation needs. A marine reserve constitutes a defined space to which specific forms of management are applied which normally include limited entry.[38] A marine park is a specialized version of a marine reserve where various uses are encouraged which emphasize education, recreation and preservation, sometimes implemented by zonation schemes.[51]

When properly designed and enforced, a marine reserve or park constitutes a simple, efficient and logical means of serving various marine and coastal conservation needs. For example, reserves help maintain biotic and genetic diversity; protect endangered species, subpopulations and their habitats; allow for management of fisheries; maintain wild populations; restore depleted populations; serve educational, cultural, recreational and research functions; and generate revenue for management.[49,36,38]

Marine Parks and Reserves

History and Tradition

The first land-based reserve in Southeast Asia was set up as early as 684 AD in Southern Sumatra, Indonesia, by a local ruler.[37] From the 1870s onward, particular types of fishing were prohibited in some sensitive coastal areas: for example, in the Philippines where milkfish fry were collected, and near Jakarta, Indonesia where fisheries resources are protected.[79,54]

The first modern marine reserve was established for Fort Jefferson National Monument in Dry Tortugas Florida, United States, in 1935.[5] In Southeast Asia, probably the first was Hundred Islands National Park, which was established in the Philippines in 1940.[79] For hundreds of years before modern governments considered marine reserves, various forms of traditional marine area prohibitions and territories have existed.[22,23,37] These were common in many small island groups of the western and south Pacific and also in Indonesia.[54] Even today, these traditional territorial rights play a role in the patterns of resource use in some areas in Indonesia and, possibly, the Philippines. Such use patterns need to be considered when marine reserves are established by present governments.

The effectiveness of a marine reserve is closely tied to the traditional resource use patterns of the people who live within or surrounding the site.[23] Thus, in planning for a marine reserve, ecological knowledge of species and their habitat is no more important than a complete perspective on humans in their local environment, both in the traditional and modern senses.

Many marine reserves exist in Southeast Asia (Table 1) but their effectiveness is often in question.[17] Local communities generally do not have

Table 1. Number and status of marine reserves in Southeast Asia.[65]

Country	Existing[a]	Legislated	Proposed
Indonesia	13	66	42
Malaysia	4	5	22
Philippines	9	43	5
Thailand	4	7	14

[a]In a few cases in the Philippines and Indonesia, reserves have been implemented without national legislation.

jurisdiction over marine areas, and public concern with protection of the marine environment is deteriorating with increased rates of exploitation. For example, in Hundred Islands National Park, preserving marine life has been unsuccessful because of rampant blast fishing. The area was designated with little provision for ecological and sociological field surveys or local use patterns. Hundred Islands has pleasant beaches, but few living coral reefs remain.

Functions

The function of all marine reserves is the intensive management of specific sites to safeguard valuable resources and activities.[51] (This is contrasted with "forest reserves" which traditionally refers to "reserves" for later exploitation.) The various types of reserves represent a spectrum of degrees of control, each type giving particular emphasis to different objectives (Table 2). The spectrum of possible management objectives is large, and most are mutually compatible. The maintenance of biotic and genetic diversity through habitat and ecosystem preservation is often of prime concern.[36] The protection of endangered species and subpopulations (e.g., giant clams); management of fisheries support systems; and maintenance of wild populations of fish and shrimp important to aquaculture may all be facilitated by reserve management strategies. The restoration of depleted populations (e.g., grouper, sea turtles and dugong) can occur, and sources of recruitment for depleted coral reef fisheries can be provided. For large, migratory species such as tuna fish and dolphins, reserves are difficult to set up, but possible when spawning sites or breeding grounds are known.[58]

Specific resources of fish, invertebrates and seaweeds of a reserve may be subject to use, and designation of a multi-use or a traditional-use management area may be appropriate. Such areas would be included in a "buffer" zone surrounding the more strictly protected "core" area of the reserve (described below). Reserves in most forms serve educational and research functions that are normally not in conflict with biotic and genetic protection. Recreation and tourism areas may need to be confined to specific zones, and if properly designed and controlled, can be significant assets to a marine reserve/park by facilitating education, providing cultural exchange and generating revenue.[51,49]

Some marine reserves/parks and their zones are based on specific or exclusive uses such as fishing, recreation, tourism or the prevention of a negative use pattern such as destructive fishing. Such reserves span natural boundaries of ecosystems, species habitat or land-water interface. More commonly, marine reserves/parks are established to protect specific critical habitats and the inherent value of vulnerable resources. The prime candidates

are the productive ecosystems of the coastal zone such as the coral reef, mangrove, sea grass, estuarine and upwelling areas.

Plans for the formation of such ecologically based reserves need to consider factors such as the intervening distance; relative sizes of the protected and fished areas; ecology of various species; and specific threats and reasons for depletion.[51]

Types

Marine reserves may be designed and designated from different governmental organization levels such as regional, national, provincial (state) or municipal (local). Often, the rationale for designating a marine/reserve park with one or more resource or use zones will vary among the different governmental levels. "Types" of reserves/parks are first defined by level of management (e.g., regional, national or municipal/local), by function and then by ecological, resource and use zones.

Regional biosphere reserves are designed to protect biotic diversity from a regional perspective. The criteria for selecting areas to serve as biosphere reserves include high species diversity, density and endemism; complexity of ecosystems; outstanding wilderness value; uniqueness in species composition; and the geographical variation of the species richness.[27,59] A marine biosphere reserve will include one or more (1) representative examples of natural biomes; (2) unique communities or areas with unusual natural features or exceptional interest; (3) examples of traditional patterns of marine resource use; and (4) modified or degraded ecosystems capable of being restored to more natural conditions.[28] The uniqueness of the area and/or diversity should determine geographical location. Regional biosphere reserves are usually compatible with well maintained national marine parks.

Regional biosphere reserve management has the potential to put the entire regional ocean-land regime in focus, with the sea and the land considered together. Such ecological processes as nutrient flow, species movement, siltation, energy transfer and stream flow between land and sea are key factors in determining the boundaries of regions and potential reserves. Such processes must be integrated with social, economic and political factors to ensure that reserve selection is optimal for the marine resources concerned.

All small reserves will fall within national boundaries, but wide-ranging marine animals such as sea turtle or dugong, or some large threats such as oil spills are best addressed on a regional basis. Reserves involving more than one country do not yet exist in Southeast Asia, but a potential site would be the sea turtle reserve on the beaches of Sabah, Malaysia, and Sulu Sea proposed by the Philippine and Malaysian governments for bilateral management.

Prime candidates for marine biosphere reserves within countries of Southeast Asia include some of the biologically rich areas and existing marine parks/reserves such as (refer to center spread map):

- Aru Archipelago in eastern Indonesia where four species of turtles nest, and dugong and crocodile populations survive in an environment of relatively pristine mangrove forests and some coral reefs with a well preserved traditional fishing culture;[62,52]
- One of several recently formed Indonesian national parks, which include coastal areas with reef and mangrove habitat, some populations of sea turtles and dugong, a few crocodiles and seabirds and indigenous beach vegetation for traditional use and tourism (e.g., Ujung Kulon in West Java, Bali Barat in Bali; Komodo in Nusu Tenggara Province; Pulau Weh, Sumatra; and Pulau Pombo Marine Park in Maluku);[62]
- Teluk Cenderawasih in Irian Jaya where there are extensive coral reef areas; and where thriving populations of giant clams and sea turtles co-exist with traditional fishing cultures;[16]
- Tubbataha Reefs, Sulu Sea, Philippines, an extensive, mostly intact atoll reef ecosystem with increasingly heavy fishing pressure and tourism;[67] and
- Sites in Nicobar Islands where four species of sea turtles reside along with some crocodiles, seabirds and dugong with supporting mangrove, coral reef and beach habitats.

National marine reserves/parks while sometimes serving as biosphere reserves may also be selected for different criteria other than maximum biological diversity. They will normally be designed for accessibility to people and recreational and educational values. The various reserve zones can occur within national marine parks. Variations on the zonation scheme of core and buffer (elaborated below) are appropriate in national marine parks as well as biosphere reserves.[28,27]

Existing national marine parks of importance to the region and national governments, along with some proposed areas, are shown in the center spread map. Most of these protect representative marine biota and ecosystems and are managed in coordination with traditional uses.

National government priorities may sometimes conflict with those of local governments. Where municipalities take initiative and designate reserved areas, it may be difficult for the national government to accept such areas. Whether national governments decide to support local management and jurisdiction or not may determine the fate of many potential municipal reserves with practical conservation value.

Provincial (state) or municipal (local) reserves fit well with traditional reef tenure and community resource use systems. Initiated at the state or local level, they generally have the support of and are understood by local residents who facilitate enforcement. Such reserves may serve several ends ranging from arresting and reversing general degradation of the reef or mangrove ecosystem and augmenting fisheries yields for local use to preservation for scientific research, education, aesthetic values, recreation and tourism.

In most coastal areas of Southeast Asia, strictly maintained traditional reef and land tenure and resource use systems have disappeared in an overt sense.[46] A haphazard assortment of CRM or nonmanagement is now left. National legislation is not usually enforced and local governments generally do not have jurisdiction over marine areas. Although public concern for protecting the marine environment has generally increased, higher rates of exploitation have counteracted conservation efforts.

Nevertheless, as reef degradation has increased, a few communities in the Philippines and elsewhere have recognized the problem and have used the reserve as a method of conserving local marine resources. These reserves mandate strict protection for parts of the management area, with no removal of organisms within a central core portion. Only traditional, nondestructive fishing or collecting methods are allowed in the buffer zone surrounding the central core area.

A sample reserve system (Fig. 1), referred to as the "municipal marine park" by Castañeda and Miclat, fits well with traditional reef tenure and community resource use systems which were in effect before western regulatory ideas became prevalent.[9] The concept of community domain over nearby marine areas is well-established in many local traditions. Johannes pointed out that municipal reserves and regulations, like older, local conservation customs, may be devised by the villagers themselves and can be tailored to fit specific local environmental and social conditions, an example of which in the Apo Island Marine Reserve is discussed below.[22,23]

Managed nature/species reserves are selected areas where manipulative management techniques can be applied to guarantee the stability or survival of certain species or habitats to assure their survival for the future. Although the other reserve management categories play important roles in protecting and providing habitat for flora and fauna, due to widespread destruction of habitat, there is need for specific areas which protect and manage breeding populations of some fish, giant clams and other invertebrates; feeding and breeding grounds; and critical habitat for protection of rare species.[28] This type of reserve will normally come under national or, occasionally, provincial/municipal level management control.

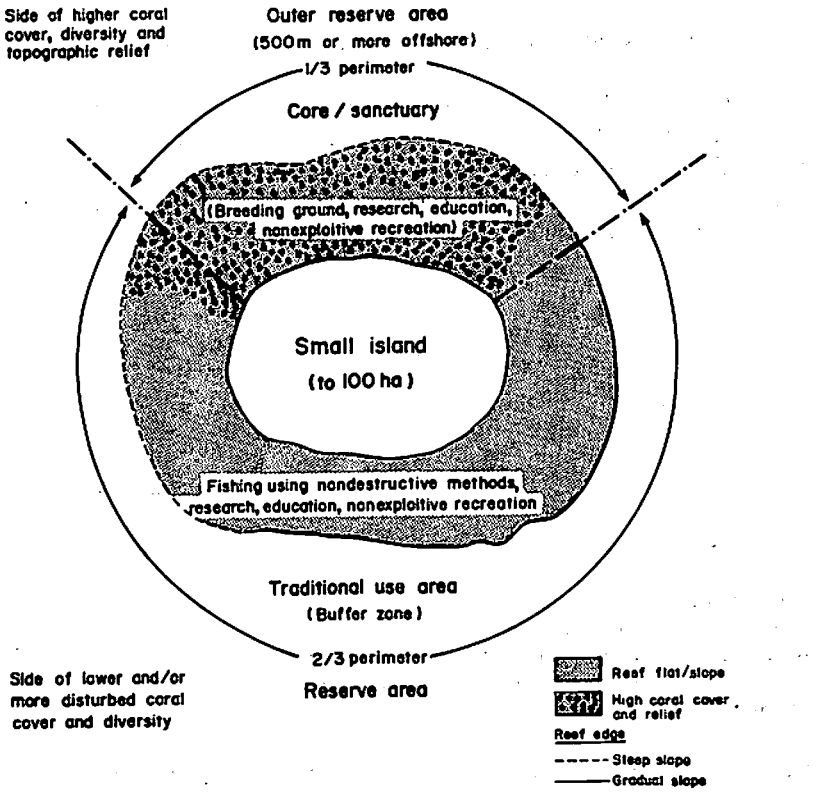


Fig. 1. Sample reserve system with core and buffer areas.

Reserve/Park Zones

Many options exist for management regimes using a combination of techniques to regulate human impact on coastal resources and areas. Examples include limiting fishing effort, mangrove harvesting or tourist boat operators by issuing a limited number of licenses; regulating fishing gear; enforcing anti-pollution laws governing industries and shipping; or monitoring trade in marine endangered species.[73] In contrast, the reserve is an area management technique which limits use within a defined space. What uses are limited, to what extent they are limited and by what means may be defined by different zones within a reserve or park.

A zoning plan provides the basis for management of an area sufficiently large for subareas or zones to justify different forms of management and use. By providing for a gradation of restriction, a zoned management scheme can be

easier to establish and police, since it can satisfy the requirements of a range of resource uses.

There is no definitive list of zones and what they may or may not achieve. Rather, the particular mix of zones appropriate for a given reserve varies. Some possibilities may be gleaned directly from the reserve types already discussed or listed in Table 2. Consistent with those above is a summary of zones based on the concept of "core" and "buffer" areas shown in Fig. 1 and 2.[41,51,38,73]

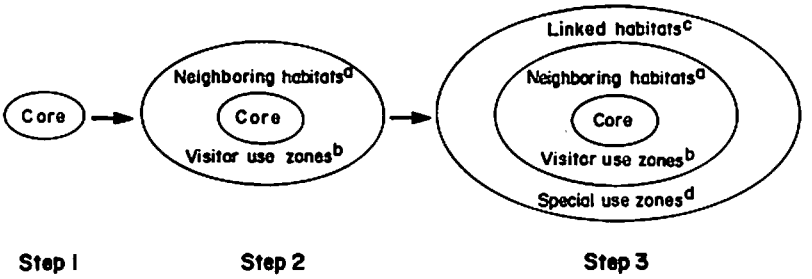


Fig. 2. Principal steps in the design of a coral reef protected area: (1) The core boundary is defined after determining the critical minimum core area. (2) The protected area boundary is defined to maintain ecological processes and support systems and to regulate visitor use. (3) The buffer zone boundary is determined in light of potentially damaging activities in linked habitats.[51]

Table 2. Priorities for various management objectives in the different types of marine reserves and zones.

Objective	Marine reserves and zones[a]									
	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6
Protect ecosystems, habitat, processes of biotic diversity and species	+	+	+	+	+	0	0	0	+	+
Protect aesthetic qualities	+	+	0	0	0	0	+	-	-	-
Protect cultural sites/values	+	+	0	-	0	0	0	+	-	0
Used for education/research	+	+	0	0	0	+	0	-	+	-
Used for recreation/tourism	0	+	0	-	-	+	+	-	-	-
Sustain yields/productivity	0	0	+	+	+	+	-	+	-	+

+: Objective of primary importance
0: Objective of secondary importance
-: Objective not important

[a]A - reserves/parks
1. Biosphere or strict nature reserve
2. National marine park/reserve
3. Provincial/municipal marine park
4. Managed nature/species reserve

B - zones
1. Core/sanctuary/preservation
2. Buffer/neighboring habitats
3. Visitor use (tourism or recreation)
4. Traditional use
5. Research/education
6. Sustained yield/fishery management

The *core area* represents a strictly protected area for one or more of the following reasons:

1. Sanctuary/preservation zone where ecosystems, habitat, species, processes and genetic diversity are protected;
2. Research and education zone where ecologically sound, nondisturbing research and education activities are permitted; and
3. Cultural zone where cultural activities or monuments are preserved.

The *buffer area* represents a transition space between the inner core and the outside area where no management is applied and might include the:[41]

1. Traditional use zone where exploitation is allowed and monitored at sustainable level using ecologically sound methods;
2. Visitor use zone where appropriate recreation and general education activities are allowed;
3. Neighboring habitat zone where ecosystems, habitat, species and processes adjacent to and important for maintenance of the core area are at least maintained; and
4. Sustained yield/fishery management zone where breeding and spawning, sites of concentrated fish stocks or a particular species are closed or regulated for use and access.

Legislation and field management can include zoning so that a reserve/park is divided into different units with different levels of protection and use. These zones depend upon the aims and needs of the people using an area and those setting the management and conservation objectives.

Choice of Reserve Sites and Boundaries

Selection of Sites

The practical implementation of marine reserves starts with complete field surveys. A survey in one country or locale must be comparable with other surveys to make criteria for selection of management sites useful. It is, thus, necessary that standardized methods be used when surveys are made. It is also suggested that methods for surveys be chosen based on their simplicity, completeness in overall perspective, replicability and relevance for management application.[12,25,24]

The criteria for selection of management areas may address how well the area fits the requirements and functions of reserves, and be used to prioritize sites. The following broad criteria may be used for various reserve applications:[41,59,4,51,29]

Ecological (conservational values)

1. *Representativeness and/or rarity.* A rare site is one that is unique to an area, and a representative site is exemplary of a general area.
2. *Diversity.* This determines how large an area is needed to include various habitat types (e.g., mangroves and reefs) and a certain proportion of organism species or genera known to exist in the general geographic vicinity.
3. *Criticalness.* This is the degree to which important ecological functions or species life histories are dependent on an area. Examples are endangered species or feeding, resting and breeding areas essential to species and/or populations.
4. *Naturalness.* This is the degree to which a site has not been changed by human activities or influences.

Practical (economic and use values)

1. Feasibility for management (accessibility and/or existing management);
2. Degree of threat or fragility;
3. Value for food or other fisheries resources (productivity);
4. Aesthetic, recreational and tourism values; and
5. Research and educational values.

The above criteria may be applied to different sites to determine overall usefulness to conservation and economic and other use values. This is

accomplished by correlating general site and reef quantitative data with the criteria categories. Site quantitative data from surveys can be used to evaluate diversity, naturalness, criticalness, value for food or other resources and aesthetic, recreational and tourism values. Subjective evaluation combining general site information must be used to determine representativeness; feasibility for management; degree of threat or fragility; and the value for research, monitoring and education.[67]

The general categories of information necessary for overall site management planning should include:

1. Institutional analysis;
2. Survey of the biological/environmental resources;
3. Information on the socioeconomics and culture of the area; and
4. Definition of management goals and objectives.[76]

Defining Boundaries

The core constitutes that portion of a reserve or park considered the "critical marine habitat" and is often synonymous with the "sanctuary zone". The buffer area surrounds the core and serves as an "ecological buffer" protecting the core area or areas. The buffer area may include traditional fishing or visitor use zones and linked habitats important for ecological maintenance of the core area (Fig. 2).[51]

Theory suggests calculated ecological limits for the core area which are often difficult to implement. Practice normally dictates less extensive and ecologically sound boundaries. Ray emphasized the interdependency between terrestrial and marine environments and that marine reserves should incorporate adjacent land areas either within their boundaries or in their management plans.[41] Salm and Clark more exactly defined the size necessary for "critical marine habitats" to maintain ecological processes through time.[51] For example, the design of a reserve for coral reefs requires knowledge of: (1) the coral habitat to be included in a reserve; (2) the neighboring coastal habitats (i.e., sea grass beds, mangroves, beaches and estuaries); and (3) the linkages among the various habitats, since reefs are intimately linked by dynamic processes to distant areas and may be influenced by activities there (Fig.2).[51]

Maintenance of species diversity within a defined area depends on the size of the area. Theoretically, an equilibrium state means that the extinction rate and the immigration rate of replacement species for a given area must be equal. On coral reefs, the extinction and immigration rates are affected by many environmental and human factors. Large protected areas tend to be more effective in maintaining ecological processes and species diversity, all factors being equal.

Salm contended that core areas need to contain at least 300 ha for each reef type in the Chagos Archipelago.[48] This minimum core area was determined to be the smallest reef area in which all coral genera found in the vicinity would have a 100% chance of being found on all reefs of the same size. Similar studies have not been done for other reef organisms so the 300-ha criterion should be used with caution.

Although theoretical principles should be applied to the design of a marine reserve/park, there is a problem in integrating these principles (i.e., core and buffer zones as determined by ecological constraints) with practical limitations.

Size is one theoretical guideline which has not been adhered to in practice in the existing reserves in Southeast Asia. No managed marine areas in the region include a core or sanctuary zone as large as 300 ha, although several proposed reserves in Indonesia and the Philippines can meet this requirement.

Marine reserves in theory and in practice are two very different realities. The implementation of management plans for reserve areas is lacking in most areas. Such implementation requires techniques which are being developed only now. Several marine reserves which have been successfully implemented are discussed in the next section. In these reserves, traditional use and the feasibility of management were strong factors in deciding the final boundaries and management arrangements.

Some Marine Parks and Reserves and Their Associated Benefits and Management

Though many areas in Southeast Asia have been designated as marine parks or reserves (Table 1), few, however, are being managed in a manner consistent with long-term maintenance of coastal resources because of a lack of technical knowledge, money and law enforcement on the part of national governments. Nevertheless, field surveys and legislation are necessary first steps to begin the management process. In fact, the attention drawn to an important site by legislation and surveys often halts degradation and has saved many areas (Salm, pers. comm). Pulau Seribu in Indonesia is an example where much preliminary work has been necessary before field implementation could begin.[43]

Bali Barat Marine Reserve, Bali, Indonesia

Bali Barat coast and Menjangan Island are examples of effectively protected marine areas in Indonesia. Menjangan Island reefs attract scuba divers from southern Bali and elsewhere whose use of the reef co-exists with traditional uses by Javanese fishermen and Balinese residents of the area.

Located on the northwest corner of Bali Island, Bali Barat is comprised of a wildlife reserve and a marine reserve which jointly comprise a national park (Fig. 3). The coastal area around Bali Barat contains an array of ecosystems. About 6,220 ha of the coastal sea is included within the reserve boundaries. There are approximately 310 ha of mangroves, 40 ha of sea grass beds, 430 ha of reef-flat, and 380 ha of reef-slope. The shoreline is divided among sandy beaches, mangroves and raised limestone rocks.[42,39]

Traditional fishing occurs along the periphery of the reserve and occasionally within the boundaries. Previously common destructive fishing in the area is now strongly discouraged and mostly eliminated.

Local and foreign scuba divers are beginning to visit Menjangan Island. Tour leaders indicate that the island offers the best Bali diving and that groups come almost daily. These visitors pay an entrance fee to the park and hire park-owned boats to ride to the island. Guides enforce the no-spearfishing-and-collecting rules. Two park employees stay on the island to watch visitors; prevent illegal fishing; and maintain the shelter area for visitors.

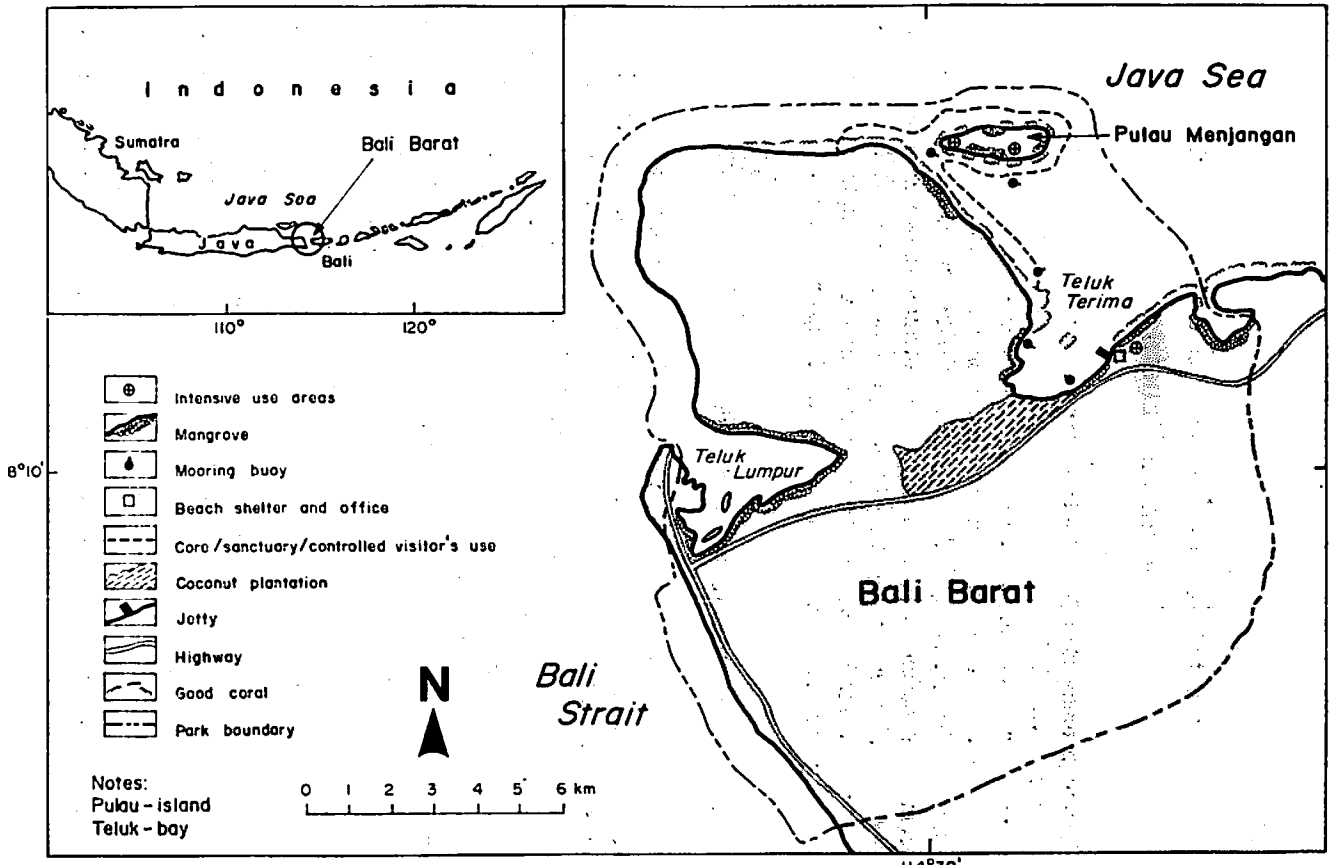


Fig. 3. Bali Barat Marine Reserve, Bali, Indonesia, coastline, park, boundaries and zones.

Bali Barat Reserve is one of Indonesia's first accessible and effective marine protected areas. It is beginning to provide public education in marine ecology and to offer an example of national conservation. Its field policies may help to answer questions about the type of management practically possible in such an area that is used by some local, traditional fishermen and by more and more tourists.

Bali Barat is now under the authority of the Directorate General of Forest Protection and Nature Conservation in Bogor, Java, but is practically managed by the local Denpasar office and the Bali Barat field manager. The Denpasar Nature Conservation Office issues permits to visitors and guides policy development for management of the park. Because national funding is small, most revenue is raised locally from the provincial government, permits, and equipment rental to visitors. Nevertheless, the more exacting management schemes of zonation, education, patrolling and demarkation with buoys and signs are still only in the planning stages. Such additions would enhance the park and help ensure its long-term existence.

Apo Island Marine Reserve, Negros, Philippines

Apo Island impresses one with the relatively good condition of the fringing coral reefs; the self-awareness and autonomy of its residents; and the efforts made by Silliman University and the community to apply a conservation ethic to marine resources. The marine reserve is an example of community-based management which effectively protects the coral reef resources of the island.

Located off the southeast coast of Negros Island in Central Philippines, Apo Island is about 25 km south of Dumaguete City. The island community of 500 is under the jurisdiction of the Municipality of Dauin, a small town on the Negros coast. Apo is a small (72 ha) volcanic island about 200 m high. It has five white sand beaches, and topographically rich and biologically diverse fringing coral reef surrounding the island (Fig. 4).

In 1979, Silliman University extension workers conducted intermittent marine conservation and education programs at Apo Island. During this time, the concept of a "marine sanctuary" on the southeast side of Apo was introduced (Fig. 4).[7] In 1982, an agreement was endorsed between the town of Dauin and the island village with Silliman University to implement the sanctuary area. Guidelines for management were suggested and some protection occurred over the next two years.

In 1984, the Marine Conservation and Development Program of Silliman University was started and included Apo Island as one of its three sites to implement a more comprehensive marine reserve with community support and guidance.

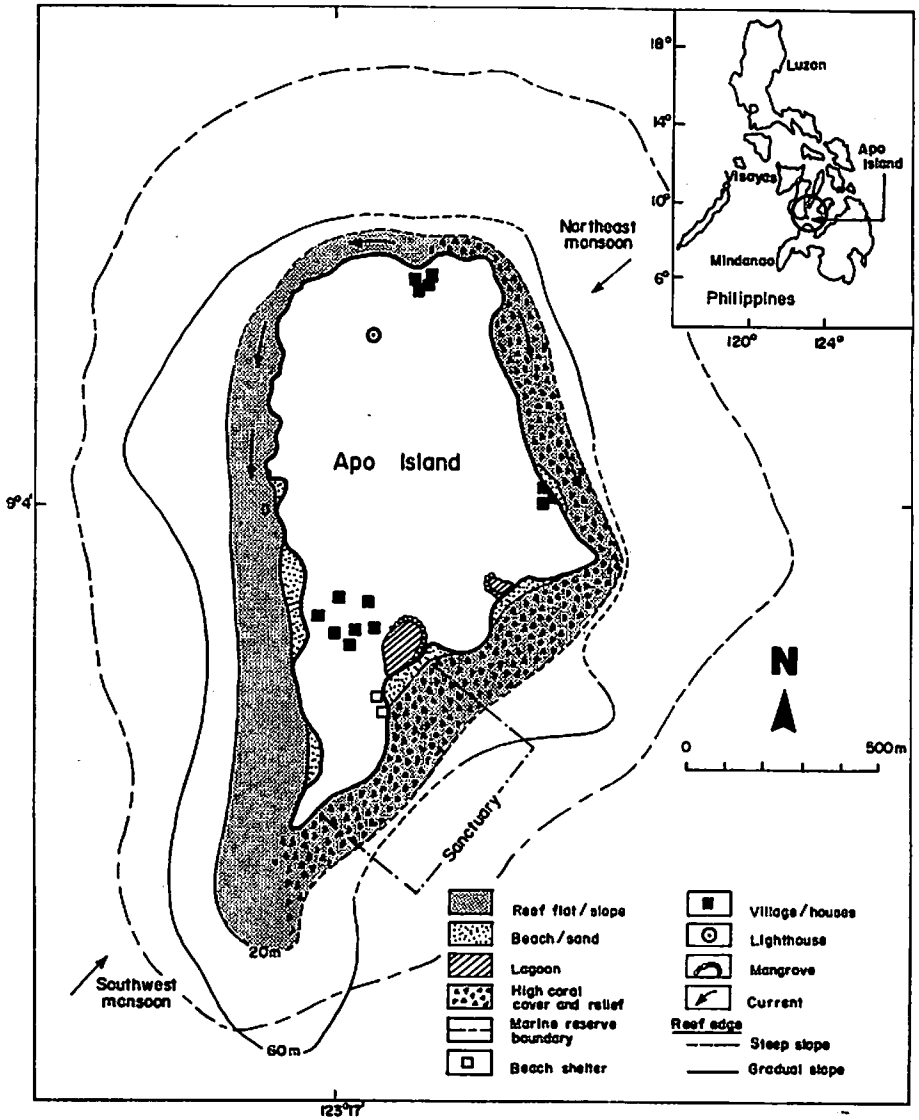


Fig. 4. Apo Island Marine Reserve, Negros, Philippines, showing sanctuary and fringing coral reef.

In April 1985, the Apo community endorsed a comprehensive marine reserve/sanctuary which includes a fish sanctuary of 11.2 ha bordering 450 m of shoreline on the southeast side. A managed reserve covers the remainder of the island's coral reef area to 500 m offshore. This management plan, described below, was formally approved by the municipality and actual enforcement began in August 1985.[74,53]

The island-wide marine reserve and fish sanctuary are marked by buoys and signs. A management committee of island residents patrols for rule infractions by local residents or outsiders. The general management guidelines and the rational use of the reserve were published in a brochure as follows:

1. The entire marine habitat from the high tide mark to a distance 500 m offshore is protected from all fishing methods or other uses destructive to the coral reef habitat. These prohibited fishing methods include: (a) dynamite fishing; (b) muro-ami fishing or related methods using weighted scare lines or poles; (c) spearfishing using scuba; (d) cyanide or other strong poisons; and (e) very small mesh gill nets.
2. Within the coral reef "fish sanctuary" and breeding area, the following rules apply: (a) no fishing or collecting is permitted; and (b) anchoring of large motorized boats is not permitted without an anchor buoy.
3. The marine habitat outside of the fish sanctuary but within the marine reserve is called a "traditional fishing area," where all destructive fishing methods and uses are prohibited (above), but where the following traditional fishing methods are permitted: (a) hook and line; (b) bamboo traps; (c) gill nets; (d) spearfishing without scuba; (e) other types of netting; and (f) traditional gleaning (collecting by hand).
4. The marine reserve and the traditional fishing and fish sanctuary areas are protected by municipal resolution. The reserve is managed by the *barangay* (village) council in conjunction with the municipal council with support from the Philippine Constabulary and management advice from Silliman University.
5. The rationales supporting the marine reserve and fish sanctuary as outlined are that:
    a. The coral reef serves as habitat for fish, and once physically disturbed, it supports fewer and fewer fish;
    b. A fish sanctuary is necessary to allow coral reef fish to breed and grow to maturity without fishing; this allows reproduction rates to increase, and increased numbers of larvae, juveniles and mature fish to circulate around the island into traditional fishing areas, which increases potential fish catch to local fishermen;

c. A fish sanctuary, where increased numbers of tame fish reside, attracts scuba diving and snorkeling tourists to the island; these often donate a small fee to the *barangay*;
d. The entire marine habitat is declared a marine reserve to help prevent illegal and destructive fishing activities by outsiders; and
e. The area was chosen as a fish sanctuary because the topographically diverse drop-off and rich coral habitat provide a good breeding ground and protection for a sufficient number of fish species.[74]

The program for implementing the marine reserve on Apo was duplicated on two neighboring islands, Pamilacan and Balicasag Islands, Bohol. Also the fish sanctuaries on each island have been monitored for changes in fish species and abundances as a result of the absence of fishing pressure in these areas. The changes, shown in Fig. 5, indicate dramatic increases. Those fish which are favored targets of fishermen showed the largest increases over the one-year period.[72]

Sumilon Island Marine Park, Cebu, Philippines

Sumilon Island reef was the first nationally well-managed marine park in the Philippines. A municipal marine reserve was established in 1974 and was designated nationally in 1980 by the Bureau of Fisheries and Aquatic Resources (BFAR). Its longevity makes it a unique case of marine reserve management in the Philippines.[63,64,70]

Sumilon is a low island of about 23 ha (Fig. 6) located near the southeast tip of Cebu Island, Central Philippines. It is an uplifted island characterized by coralline limestone rock with a thin layer of topsoil, some small snatches of hardwood forest and beach vegetation. The fringing reef which surrounds the island has traditionally served as a fishing ground for residents from the towns of Oslob and Santander, Cebu.

From 1974 to January 1980, Sumilon was managed by Silliman University in cooperation with the municipality of Oslob as a marine reserve. Fronting the 750 m shoreline on the west side was a strictly protected area designated as a marine sanctuary (Fig. 6). No fishing or collecting was allowed there, though nondestructive fishing was allowed in the remaining waters surrounding the island. The privately owned terrestrial portion of Sumilon was not included in the agreement, although the university leased several parcels of land from the owners and built two beach-shelters and one field station. It also maintained a caretaker (until November 1984) to monitor fishing activity and to help enforce regulation pertaining to the sanctuary area on the west side.

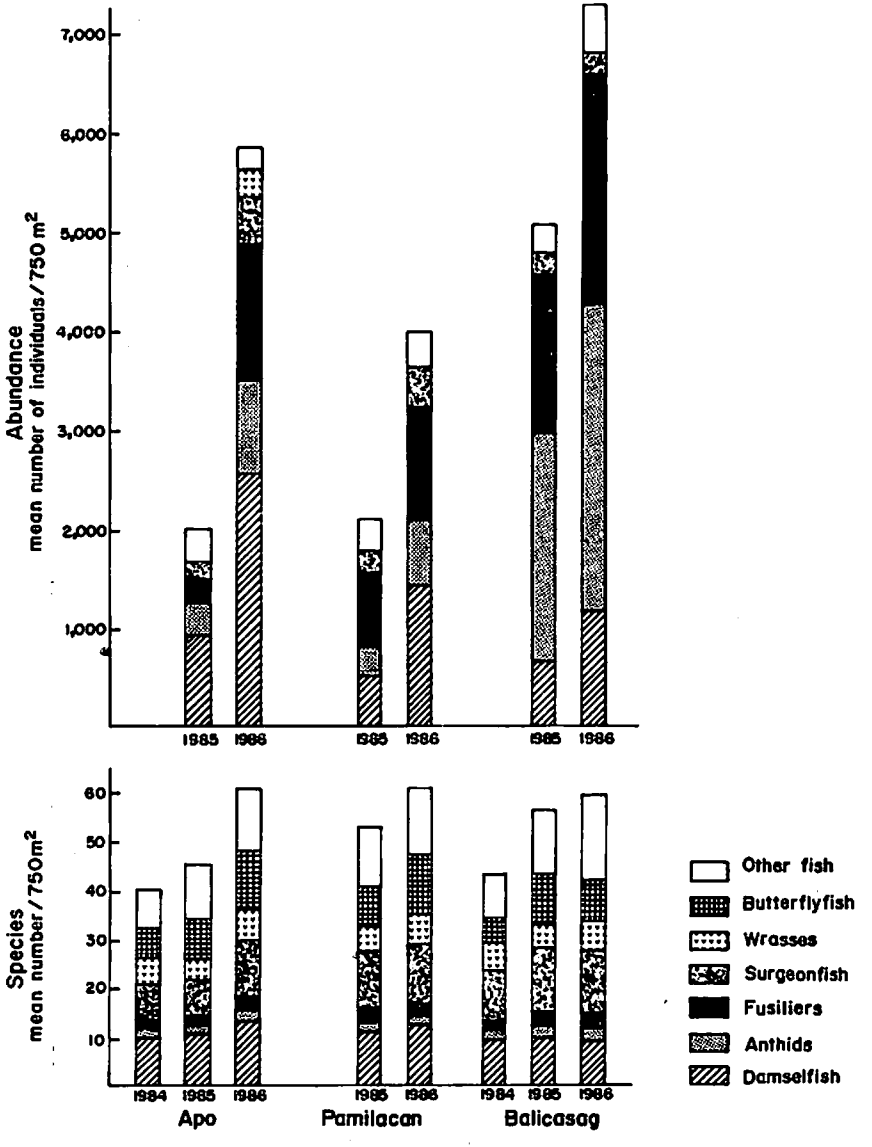


Fig. 5. Summary of the changes between 1984 and 1986 for species richness and abundances for all families of fish censused at Apo, Pamilacan and Balicasag Island Sanctuaries.

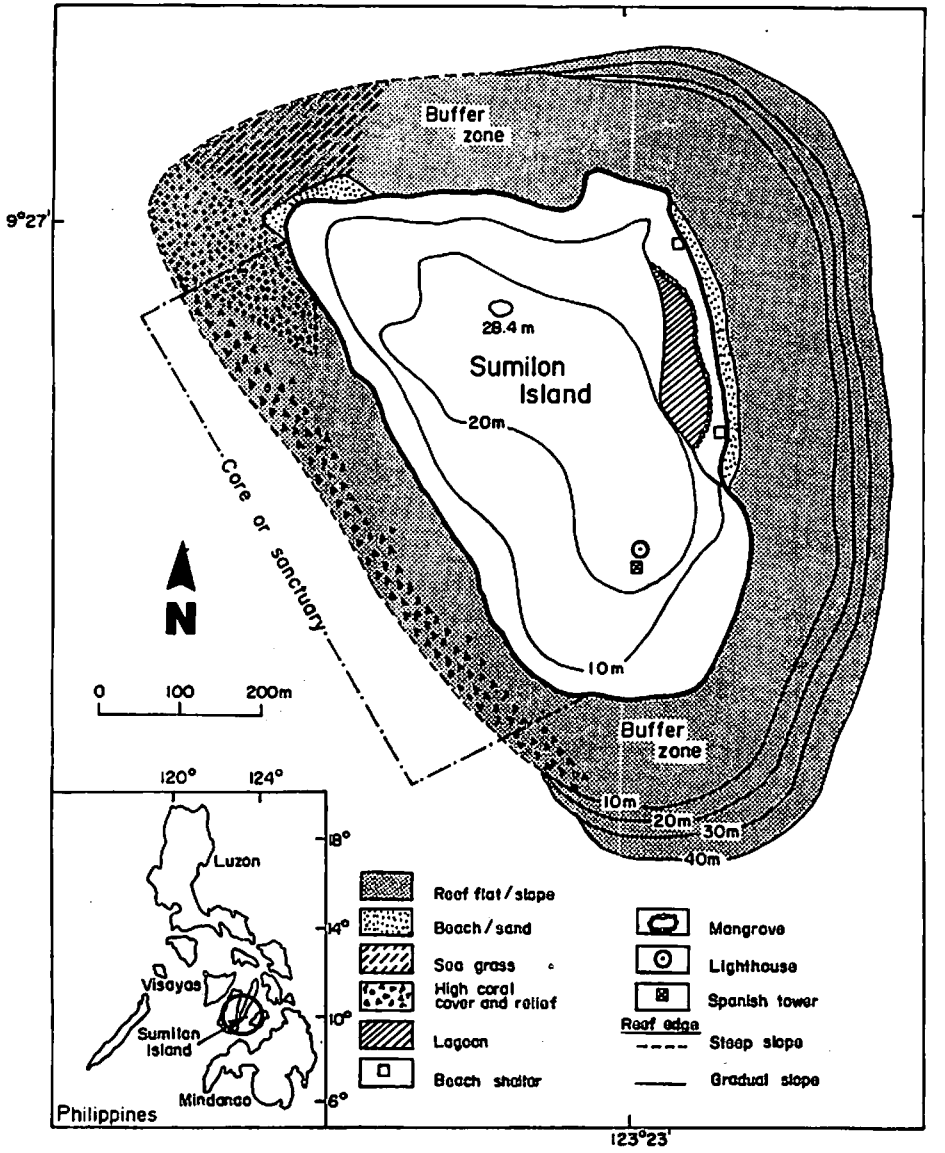


Fig. 6. Sumilon Island Marine Park, Cebu, Philippines, showing the fringing reef and reserve.

In December 1980, a "National Fish Sanctuary" was established at Sumilon by BFAR. The declared fish-sanctuary was superimposed on the 750 m-long sanctuary area on the west shore and the remaining limited-fishing area. This national law resulted from management problems between Silliman University and Oslob, after a new mayor was elected in January 1980. The national law has since been used by Silliman University and the national police to prevent rule infractions by fishermen. In two cases, these infractions were by the mayor of Oslob himself. In November 1984, threats to the Silliman caretaker caused his removal from the island. Since then, there has been no enforcement of the municipal regulations or national law protecting Sumilon Marine Park. BFAR has not been active in field management or in enforcing the national administrative order since its promulgation in 1980.

Until surveillance of the Sumilon reserve ceased in November 1984, traditional, small-scale, artisanal fishing was restricted to the north, east and south sides of Sumilon at levels not significantly different from those of 10 years before. About 100 fishermen frequented the reef in mostly nonmotorized outrigger boats. According to fish-catch assessments began in 1976, the fishermen extracted an increasing tonnage of reef-fish until May 1984.[1]

Sumilon fisheries have been monitored since 1976 in an attempt to document changes in fish catches that may be attributed to the reserve formation.[1] Fish yields in Sumilon during 1977-1980 ranged from 14 to 24 km^2/year for reef fish, representing a more than doubling of the fish catch in the 1976-1979 period. Some of this increase may be due to methodological inconsistency, but some may be attributed to the effects of the sanctuary area. Also, the general yield was high compared with most other places, e.g., 12 km^2/year for American Samoa.[19] Alcala again reported fish-yield data for Sumilon for May 1983-April 1984 at 36 t/km^2, much higher than that for 1979. Alcala contended that the maintenance of this high yield in the midst of active fishing effort was made possible by the sanctuary area. He also pointed out that 85% of the fish caught were reef-dwellers, primarily the planktivorous fusilier fish, which moved around the island and were abundant in the core area.

The high diversity and biomass of fish found in the protected area were the most obvious values of the Sumilon reserve. Monitoring of fish yields suggested that the sanctuary was a breeding ground for numerous species, some of which circulated around the island. The reserve also attracted many visitors to the island.[66,67,47,2]

Observation by the author in March 1985, after heavy fishing began in the reserve area, indicated a much-reduced biomass of important food fish both inside and outside the sanctuary. Fusiliers, surgeonfish, jackfish, snappers and groupers, were noticeably absent which was confirmed by Russ.[47] Alcala recently observed a dramatic decrease in fish yield from the Sumilon reef as a

result of habitat destruction and heavy fishing on the entire reef without the benefit of the sanctuary area.[2]

The central question regarding the small but effective Sumilon reserve is: what went wrong? There is no simple explanation of recent management problems as the mix of sociopolitical-environmental factors affecting the reserve cannot be easily separated.[14]

Early on in the process of the park's formation, Silliman University conducted an educational campaign and sponsored a study of fishermen's attitudes towards marine conservation. Not surprisingly, some fishermen resented the seemingly sudden restriction of their long-standing rights to fish the entire Sumilon reef. They perceived the seas as open to all without restriction, and it was not clear to them how they would benefit from the marine park. The educational campaign addressed this problem, but patience over time was being asked of the fishermen.

By 1984, ten years' management of the marine reserve according to the original plan had convinced most fishermen of the benefits of increased fish catches. Others continued illegal fishing in the reserved area occasionally when the caretaker wasn't watching.[14]

Those problems arose because some local fishermen did not perceive that there was an increased fish catch outside the sanctuary. Thus, the sizeable standing stock of fish in the sanctuary area was tempting to them, though meanwhile problems were being ameliorated with time and education. Problems of another order, however, began in 1980 with the election of politicians who had interests contrary to marine conservation.

Local elections in January 1980 brought a new mayor to Oslob. On 11 February 1980, the mayor personally led a fishing expedition into the reserve area of Sumilon, using the damaging muro-ami fishing technique. Again on 14, 21 and 22 February 1980, the expedition fished in the reserve.

These expeditions clearly violated the Oslob Municipal resolution. According to the mayor, he was trying to fulfill his campaign promise to take back Sumilon Island from Silliman, and to open the restricted area to fishermen. He pointed out that Silliman acted as if it "owned" Sumilon, whereas Oslob actually owns the island and Silliman manages the marine park. Silliman filed a complaint with the head of the national police in Manila, resulting in reprimands to the mayor of Oslob. Illegal activities temporarily ceased.

These misunderstandings and lack of cooperation can be attributed to several factors. First, the Silliman University creation of the reserve did not adequately involve the community. The motivation of the university was, therefore, misinterpreted as antagonistic to the needs of the local residents of

Cebu: the benefits of the marine reserve were not clear, and research activities were often misunderstood. For example, until 1977, Silliman research workers used scuba occasionally to spear fish for food and specimens--an activity believed to be exploitative by the local fishermen.

Traditional rivalry or territoriality may also be a source of conflict. It is uncommon in the Philippines for organizations to have jurisdiction over land in a neighboring province, particularly in marine areas which are traditionally open-access areas. This political problem was overlooked by both the mayor of Oslob and Silliman University at the creation of the reserve in 1974. However, after 1980, the new mayor tried to exercise his power over Cebu's territory. Lack of community rapport and the vagaries of politics have both contributed to this overzealous territoriality.

Finally, the subtleties of such arguments as improved fish-catches over time are difficult to appreciate when benefits are long-term and not easily seen. In this case, an influential community leader, using a strong but spurious argument, has influenced attitudes more easily than could subtle concepts, long-term promises or arguments based on actual data. This exemplifies the importance of community leaders and their influence.

The conservation and management of a small island's fisheries for the benefit of local fishermen, scientists, students and tourists may seem commendable from the perspective of the implementors. However, each of these interest-groups may have a different idea about what constitutes a "benefit". These different perspective can lead to conflict. Ideally, each party should expand its perspective and interest to include those of the others'; otherwise, disputes will negate the ability of anyone to implement useful measures. The presence of a selfish political leader may be more common than not, and it must be handled so as not to arouse excessive bad feelings. A simple show of force may be an effective solution in this case. On the other hand, it may arouse more local resentment. Also, the fear of losing face publicly may serve to change a politician's attitude.

Although the Sumilon reserve is currently (1988) not managed or protected, the laws affecting the areas are intact. Attempts are being made to open communication between Oslob, Cebu, and Silliman University so that proper management can be resumed. It has been suggested that BFAR become more active in management.[63,64,69,70]

These problems serve as concrete examples of the problems encountered in marine reserve formation and management in a developing country such as the Philippines. The author has witnessed similar cases in other parts of the Philippines, and in Indonesia and Malaysia.[67]

Pulau Redang Marine Park, Pulau Redang, Malaysia

Pulau Redang National Marine Park was declared in 1984. A comprehensive management plan has been prepared and was implemented since 1987. In Malaysia, the National Fisheries Department has the authority to establish marine parks and reserves and to manage all marine areas and resources within such a park. The state government has jurisdiction over all land and river waters. Thus, the management of Pulau Redang will be a state and federal cooperative effort. This is not considered ideal but a management strategy with this cooperative arrangement has been adopted. It has also been suggested that the land portion of the park be declared a national land park so that adequate protection would be insured to the marine environment.[40]

Pulau Redang Archipelago lies off the east coast of Malaysia in the South China Sea. It has one large island about 6 km long which is bordered by seven smaller islands on the southeast shore. All the islands are fringed by coral reefs of variable qualities. One fishing community is situated on the main island where 81% of the residents are directly dependent on the marine environment for livelihood. Otherwise, residents engage in minor farming activities. Most people there have indicated support for the marine park because of the potential increase of tourism to the island.[40]

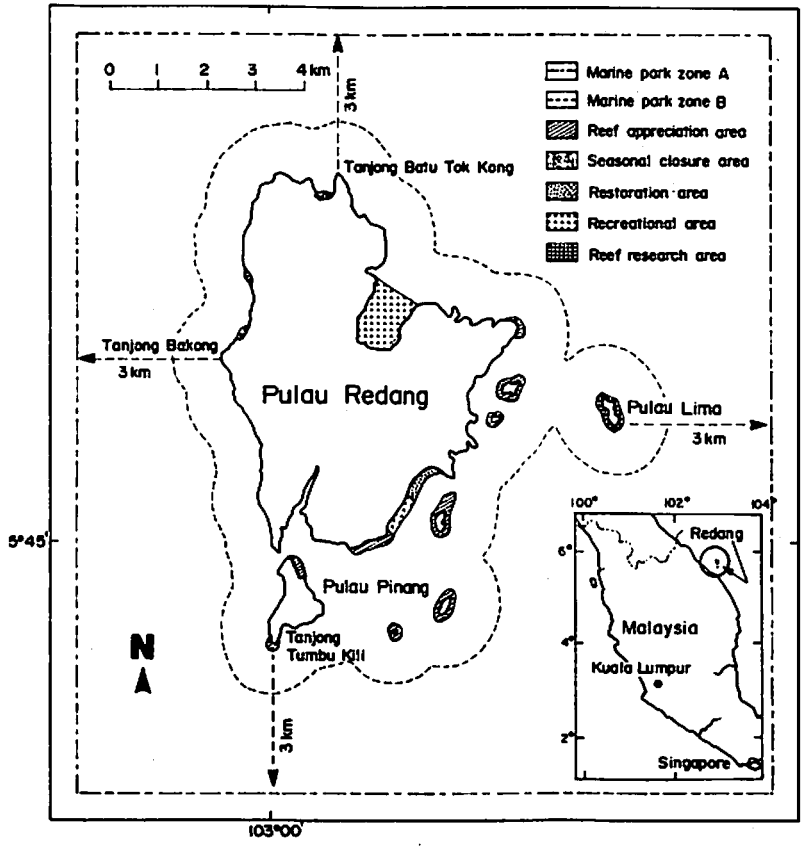
The management plan objectives for the marine park include the following:[40]

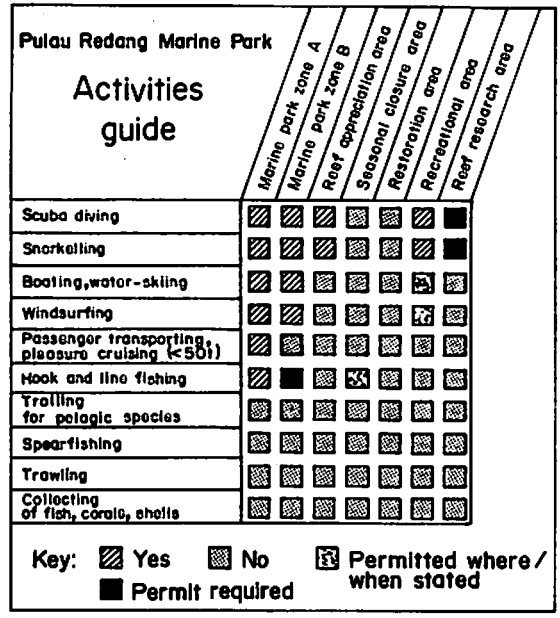
1. To afford special protection to the marine flora and fauna of the area;
2. To protect, preserve and manage the natural habitat and breeding grounds of aquatic life;
3. To allow for the natural regeneration of aquatic life especially where it has been depleted;
4. To preserve and enhance the pristine state of the area;
5. To promote scientific study; and
6. To regulate recreational and other activities to avoid degradation to the environment and promote visitor enjoyment and education in the area.

A zoning scheme (Fig. 7) is the basis for the area's management plan. The Marine Park "A" Zone acts as a buffer zone for the more delicate inner zone or the area between the 1 km line and the boundary of the marine park. The Marine Park "B" Zone is the area enclosed within the 1 km line.

Within the Marine Park "A" and "B" Zones, there is provision to declare areas of periodic restricted use which include: seasonal closure, restoration, reef appreciation, recreational and reef research areas.

The main difference between the two zones is with the permitted activities. Recreational fishing is totally prohibited and only traditional fishing by locals may be allowed in the "B" Zone; whereas both are permitted in the "A" Zone.





Notes:
Pulau - island
Tanjong - cape

Fig. 7. Zonation plan of Pulau Redang Marine Park, Pulau Redang, Malaysia.

Concurrent with the objectives of the zones, permission for activities in the "B" Zone is given only after consideration by the park administration.

Guidelines for management focus on maintaining, enhancing and restoring the value of the different resources in the marine park, with emphasis on the: coral reef areas; fisheries resources; sea turtles; terrestrial agriculture, forestry and water; and human settlements, employment and tourism.

It is intended that joint agency planning for the maintenance and enhancement of the marine park and its adjoining land area will be necessary to ensure success. Also, effective marine park management will require data through research, monitoring and environmental assessment.

Thus, a monitoring program will assess at regular intervals the environmental condition at a number of selected locations as part of the research activity of the marine science laboratory of the park. Monitoring will concentrate on collecting data for the maintenance and restoration of the reef condition; and maintenance of sustainable fish harvest.

On the Pulau Redang Marine Park proper, the minimum staff needed are: one marine park manager; several park rangers; boatmen; and general laborers/caretakers. The staff will undergo training on the implementation of and the public expectations to the multiple use concept of the marine park.

Topics to be covered in the training curriculae include: goals and objectives of the plan; biological resources and ecosystem of the area; socioeconomic character of the area and users; environmental issues; cultural background of, and traditional uses by the inhabitants of the area; specific duties and manner to be conducted; chain of command (supervisors and subordinates); safety and emergency procedures.

The suggested park facilities required to carry out and achieve management objectives are: park headquarters-cum visitor center building with adjoining jetty; research laboratory; boats; living quarters; boat house; park boundary markers; swimming area markers; mooring buoys; and fairway markers.

A program of public interpretation will be designed to take place when visitors enter the marine park headquarters for registration. Positive suggestions techniques through tastefully designed posters, exhibition display and briefings, among others, may be used as a management tool.

The best forms of enforcement suggested for park rules are public education and community involvement. Infringements will preferably be followed by advice and counselling before prosecution to impose legal penalties. It is, thus, suggested that marine park personnel need to be trained carefully to carry out law enforcement function effectively and without public antagonism.

The development of this marine park has involved the recognition of the values of the resources, while considering the biotic, abiotic, socioeconomic, cultural and legal factors.

It has been recognized that no amount of expertise or experiences from other areas in the world may be applied to achieve guaranteed results. Site-specific factors, whether physical, biological, cultural or socioeconomic, have been recognized.[40] Time will tell how effective this marine park will be at meeting its management objectives. Since field management is only beginning, the reality of day-to-day problems may prompt some changes in the original plans for the Redang Park management.

Other Marine Park/Reserve Areas in Southeast Asia

The above four examples of marine reserves represent two different processes of implementation and management. Bali Barat and Pulau Redang were initiated by the national government and are maintained by national government personnel, revenue from tourism and some cooperation of local residents and fishermen. In contrast, the marine reserve at Apo Island was initiated by the community on the island in conjunction with a marine conservation program at Silliman University. It is now maintained by the community management committee with some support from the university, and revenue from tourism and other interested private parties. In the case of Sumilon Island, although initiated by Silliman University in 1974 with support in 1980 from a national law, management has ceased and will probably remain dormant until local perspectives are adequately addressed.

Other regional examples of marine reserves/parks with some field management include (see center spread map):

- Pulau Seribu National Marine Park, an archipelago adjacent to Jakarta with areas for core and sanctuary, buffer zone, recreation sites and traditional fishing zone;[43,52]
- Komodo National Park, an extensive marine area in a remote terrestrial island reserve in the Sunda Archipelago, Indonesia, with potential for zonation and multiple uses;[43,52]
- Dungun Beach in Trengganu, Peninsular Malaysia, which serves as a wildlife sanctuary and observation site for nesting sea turtles;[6]
- Bako National Park near Kunching in Sarawak, Malaysia, a terrestrial park bordering the sea with mangrove forest, beaches and some coral reefs; and is visited by tourists;[10]

- Tarutao Island National Park on the west coast of Thailand with 51 hilly islands that protects sea turtle nesting sites, beaches, mangrove forests, coral reef areas; and has potential for tourist visitation;[62]
- Surin and Similan Islands in the Andaman Sea, which are proposed as a marine park with tourism potential and would protect the best coral reefs in Thailand and preserve some sea turtle nesting and mangrove areas;[62] and
- Mu Ko Ang Thong National Park in the western gulf of Thailand, which is a relatively intact group of coral reef islands adjacent to the increasingly popular tourist area of Ko Samui.[56]

There are many more areas in Southeast Asia where there is some form of marine resource protection and management. Unfortunately, most areas are small, the management varies with time and place; and/or the area is only covered by legislation but not practical field management. There is a tremendous need for those designated marine reserves/parks to be given support for actual field implementation. Most of the more important ecologically rich habitat areas are known and have been surveyed. Many have been designated for reserve status, but adequate field techniques are lacking. In most cases, this will mean working directly with the people who are, in effect, the marine resource managers, rural fishermen and coastal inhabitants.

Conclusion

Marine parks and reserves are an approach to coastal management which focuses on selected geographical areas of particular value. Management within a marine reserve is designed to meet the broad goals of conservation and sustainable use of resources which is compatible with human use and needs in the long term. Short-sighted exploitation which sacrifices long-term benefits to people and the environment is not acceptable. In this respect, the management goals of marine parks and reserves are not significantly different from those of large-scale CRM, CZM or CAMP plans and implementation. But because of the inherent difficulty of implementation of these large-scale management regimes, marine parks and reserves offer a simpler, more focused means of management for specific priority areas. Successful examples of marine parks and reserves in the region can become integral components of larger management frameworks and provide useful lessons and pilot examples for expanding effective and large-scale CRM efforts.

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