

The IUCN
Marine
Programme



Marine and Coastal Protected Areas

A Guide for Planners and Managers

Third Edition

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IUCN
The World Conservation Union

Site Planning and Management

Marine protected areas (MPAs) require a specific planning process, which is best done prior to the management phase, whether they are discrete sites or sites within a larger management framework. The product of site planning is a Site Management Plan.

It is important to differentiate between planning and management. *Planning* provides the basis for decisions on how resources are to be allocated and protected, for example, through the analysis and selection processes (covered in the next section), and through the design or zoning and management programmes discussed below. *Management* addresses the strategies and operations needed to attain the objectives of the management plan.

Site planning should look at past progress, the current issues, and future needs to identify priority actions from the full range of possible management interventions.

2.1 The Site Management Plan

The Management Plan for a particular site is a working document that is updated periodically. Because its arrangement and complexity must be tailored to the needs of the site, generic models may be suggestive but not prescriptive. Each site needs its own customized plan.

There are many practical considerations in designing MPAs that are to be addressed during the planning phase: location of MPA facilities; types of boats and motors for surveillance and transport; boundary demarcations; zoning of activities to separate incompatible uses where necessary; recruiting and training of staff; the

development schedule and budgets; analysis of visitor use compatibility and safety considerations; conflict resolution and cooperative arrangements with local communities and industries; and such ecological factors as the types of habitats to include, and the size of the protected area and its different zones. Also there should be consideration of external impacts on the site and procedures to minimize these effects.

But before these items can be addressed effectively, there is a need to define the process that will be used to determine exactly what needs to be managed (the issues), the prioritization of these, and how they will be tackled (the actions). This is the *issue-action analysis* process, described later in this section, that in this form, or another, is the basis of the management plan.

The general objectives of the Site Management Plan are to conserve habitats and ecological processes in order to preserve the value of the area for tourism, fisheries, research (Figure I-23), education, or other goals, and to protect certain species and biotic communities. All these objectives can be accomplished through an active and appropriate management programme leading to sustainable use of coastal and marine resources.

FIGURE I-23.

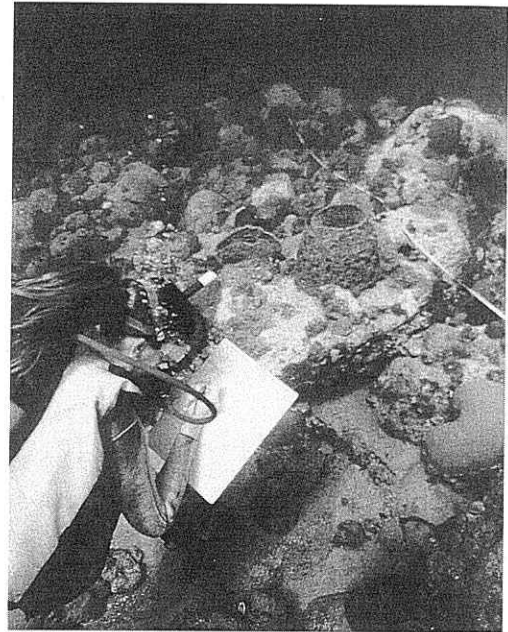


Photo by Erkki Siirila

A diver counting reef fish in the Soufriere Marine Management Area, St. Lucia, to study the benefits of non-fishing zones.

2.2 Planning Approach

As the first step in the site planning sequence, a strategy document (or Preliminary Plan) interprets the policies that need to be implemented, states the programme goals, and lays out a basic strategy for achieving the programme. Planning a strategy involves all the preliminary investigation, data collection, issues analysis, dialogue, negotiation, and draft writing that is necessary to define the problems, to understand the options and to lay the foundation for the Management Plan. Once the strategy document is approved by policy makers, administrators, and stakeholders, the way is clear to create an acceptable management format.

The importance of the strategy planning function cannot be overemphasized—it is the key to all that follows in site management planning and implementation of the MPA programme. It helps to organize the programme, to identify the main issues and anticipate the questions that superiors, politicians, and supporters will ask, and to provide the data to answer these questions.

The initial Site Management Plan should not be considered as final, or cast in stone. On the contrary, new knowledge revealed through management experience and monitoring will reveal additional issues for resolution, actions and approaches that require improvement, and planning mistakes that will have inevitably occurred. Allowance for review and feedback on such matters as boundary delineation, user rights and activities, and even the basic objectives for the area, should be provided for in the Management Plan and used to modify management actions. It is exceedingly important, therefore, that adaptable mechanisms are provided to enable management flexibility, and that management plans include monitoring and feedback mechanisms such as periodic stakeholder meetings, and internal and external reviews.

The MPA site may not need a full management plan to *begin* operations, but it does need one for long term programme development. When circumstances—like shortages of funds, time, or personnel—delay outside participation in site planning for an MPA, managers should take action themselves to initiate plan formulation. In fact, an important general rule for management planning is that the MPA site manager should be identified during planning and should have a high level of participation in the site planning process.

Management goals outlined in the Strategy Plan should address the long-term ideal state and should be somewhat open ended, identifying desired conditions more than specific actions. Management objectives represent short term, measurable steps toward attaining these goals. For example, one goal for a coral reef protected area might be to protect and maintain the integrity and natural quality of the coral reef system. One objective for the MPA, then, might be to implement a specific programme to protect the coral reef habitat from damage. Such a programme might include developing a boater's guide to safe anchoring procedures, re-establishing corals destroyed by visitor related activities, placing moorings at diving sites to prevent anchor damage, and periodically closing heavily used sites to enable their recovery (Figure I-24).

FIGURE I-24.

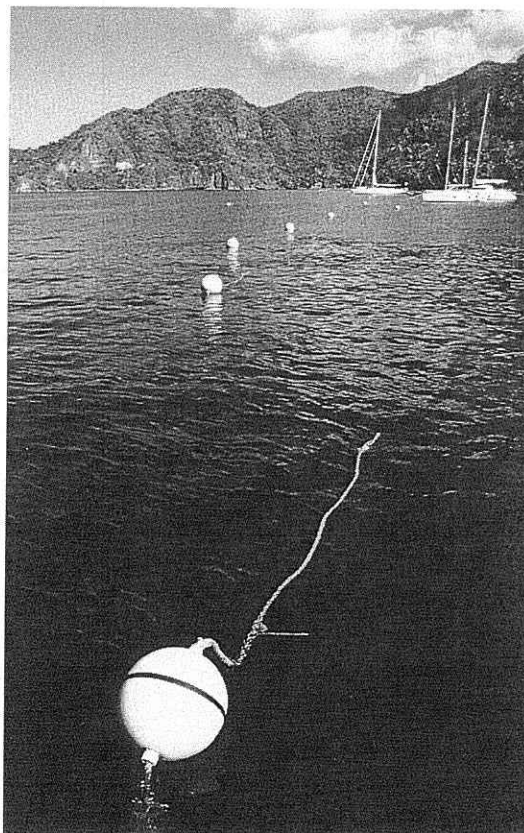


Photo by Erkki Siirila.

Moorings for visiting yachts and dive boats are an important coral conservation tool in marine protected areas (Soufriere, St. Lucia).

Box I-2. Typical Objectives Addressed in the Strategy Document or Preliminary Plan

- Maintain a high quality coastal environment. Coastal habitats are a major resource, providing commerce, food, recreation, and spiritual refreshment. Habitats near coastal settlements can easily become polluted, ugly, and unproductive if protection is not supplied.
- Protect species diversity. A quality marine environment is needed to sustain species and their habitats. MPAs can protect species.
- Protect environmentally sensitive areas. Certain ecosystems are of such outstanding biodiversity and ecological value that they should be set aside and protected from alteration by development.
- Conserve special habitats. Habitats of special importance include stands of mangrove trees, coral reefs, kelp beds, submerged meadows of sea grass, sandy beaches and dunes, and certain tideflat habitats. Wherever these occur on the coast they are presumed to be critical habitats, the loss of which would reduce productivity, species well-being, and ecological balance.
- Conserve critical ecological processes. Certain ecological processes are critical to the productivity of coastal ecosystems; e.g., light penetration through the water (which can be blocked by excessive turbidity), nutrient transfer and trophic balance (which can be disturbed by loss of natural organic materials such as happens when mangroves are clear-felled).
- Maintain water quality. Pollution from point sources and from land runoff as well as accidental spills of contaminants can foul coastal habitats and waters causing human health problems, ecological disruption and reduced productivity, as well as killing organisms or contaminating shellfish beds. The MPA programme should attempt to keep the area clean and productive.
- Combine natural hazards protection with nature conservation. The measures best suited to conserving habitats are often the same as those needed for barriers to storms and flooding; e.g., protection of natural features like coral reefs, sand dunes, and mangrove stands.
- Restore damaged ecosystems. Many otherwise productive coastal ecosystems have been damaged but are restorable by passive or active means. Restoration of coral reefs, mangrove stands and other wetlands, sea grass beds, sand dunes, etc. may be a prime objective.
- Replenish depleted fisheries. MPAs have been shown to be effective in replenishment of depleted fisheries because they safeguard breeding stocks of target fish species. In MPAs these fishes are able to grow large enough to breed and produce juveniles that then move out to settle in depleted areas.
- Involve and educate the community. MPAs can play an important role in creating public awareness of ecological values and needs for coastal and marine conservation.

Source: Modified from Clark, 1996.

2.3 Site Planning Procedure

The site planning process is based on clearly defined conservation *goals and objectives* as interpreted during strategy planning, as shown in Box I-2. To achieve these goals, information on the site is needed, particularly site surveys to determine characteristics of the resource, the uses of the resource, and threats to the resource. The design of the MPA—based on this inventory—can be done following the general guidelines presented in Box I-3 which identify many of the basic elements necessary for designing MPAs and preparing the Site Management Plan.

Box I-3. Site Planning Guidelines

1. The strategy document identifies steps to establish a protected area and forms the foundation for the Management Plan. It is the preliminary document by which approvals are gained and designation of an MPA site is formalized. The strategy document is thus an important part of the management process.
2. The Management Plan for the site is the operational guide for the MPA and identifies actions to resolve specific management issues. It is thus a guiding tool for management.
3. The principal goal of the Management Plan is generally to maintain the natural resource values (seascapes, species habitats, ecological processes) of an area, and to ensure that all uses are compatible with that aim.
4. The Management Plan should aim to conserve natural values, optimize economic uses, and integrate traditional uses. Through zoning, it should attempt to separate incompatible activities, ensuring that particular uses are permitted only in suitable areas and sustainable levels of use are specified.
5. The Management Plan derives directly from management issues and their related objectives and activities. It needs to encompass legal and administrative concerns and educational and social objectives along with ecological and physical ones.
6. The Management Plan should function to achieve interagency coordination and cooperation among stakeholders (management authority, concerned departments of government, neighboring communities and other user groups) and to facilitate communication between MPA administration and management.
7. Initiation of site management need not be delayed until a MPA plan is completed. In countries where lengthy bureaucratic procedures or other factors delay the completion of the plan, an interim management document (operational plan) can be formulated and implemented.
8. Management plans may be required to function as interpretive documents, being designed for the public as well as for management. Planning workshops should be conducted to garner interest from the nearby community as well as certain sectors of the public.
9. Planning should examine the effects that MPAs have on local people and find ways to avoid negative effects or compensate for these. Public consultation is important both to identify current uses and to avoid conflict with local traditions and to encourage participation in planning.

Table I-1. Model Outline for MPA Site Management Plan

Executive Summary

Introduction

- A. Purpose and scope of plan
- B. Legislative authority for the action

Management Content

- A. Regional setting: location and access
- B. Resources (facts pertinent to management; other data in an appendix or separate document)
 - 1. Physical: beaches, dunes, shoals, bars, reefs, currents, bathymetry, hydrology
 - 2. Biological: ecosystems (coral reefs, seagrass beds, mangroves, dunes, forests, Grasslands); critical habitats (nesting, feeding, spawning, roosting); species (endangered, commercial, showy)
 - 3. Cultural: archaeological, historical, religious.
- C. Existing uses (description, facilities, etc.)
 - 1. Recreational
 - 2. Commercial
 - 3. Research and education
 - 4. Traditional uses rights, and management practices
- D. Existing legal and management framework
- E. Existing and potential threats and implications for management (i.e., analysis of compatible or incompatible uses, solutions)
- F. The plan
 - 1. Goals and objectives
 - 2. Management tactics
 - a. Advisory committees
 - b. Interagency agreements (or agreements with private organizations, institutions or individuals)
 - c. Boundaries
 - d. Zoning plan
 - e. Regulations
 - f. Social, cultural, and resource studies plan
 - g. Resource management plan
 - h. Interpretive plan
 - 3. Administration
 - a. Staffing
 - b. Training
 - c. Facilities and equipment
 - d. Budget and business plan, finance sources
 - 4. Surveillance and enforcement
 - 5. Monitoring and evaluation of plan effectiveness
- G. Appendices
- H. References

The value of the written Site Management Plan for an MPA is that it specifies particular courses of action for interested persons, decision makers, and especially the Site Manager for whom it will serve as an operational guide for daily management actions. The plan establishes a philosophy of management to guide managers in the numerous actions they will take over the life of the plan. It is important that the plan sets realistic objectives for available management resources. To do otherwise encourages false expectations and begs failure.

Each Management Plan should include a mechanism for evaluating effectiveness and a schedule for its own revision. As a general rule, plans should have a life span of three to five years. Plans should be flexible enough for managers to modify certain activities based on their experience and on new data received during the implementation phase. A model outline for a Site Management Plan is shown in Table I-1. This outline is more of a guide to the basic elements of a management plan rather than intended as a prescription. It will need to be adapted to each site depending on purposes, scope, and who is implementing management. In cases of community-based management, for example, simpler outlines that are more directly focussed on the control of specific uses (like fisheries) will be ample.

2.4 Boundaries and Optimal Size

A major problem in conserving coastal and marine ecosystems is identifying their ecological boundaries and using these in the protected area design. In the past, protected area boundaries were based mostly on geological features (such as headlands that provide a "natural" boundary), political districts (national, provincial, or district borders), or costs (smaller areas may require less money to maintain). In general, there has been too little ecological reasoning behind the demarcation of coastal and marine protected area boundaries. Failure to recognize and use appropriate ecological boundaries may lead to inappropriate boundaries and zoning of the protected area.

There is no general rule for the optimal size and design of MPAs. There are proponents of "disaggregation" (establishing a number of small protected areas) and of "aggregation" (establishing fewer larger areas). The arguments for "disaggregation" are best applied to the terrestrial protected areas for which they were formulated; they do not seem to hold so well for underwater areas, where aggregation seems the best approach coupled with an effective use zoning scheme (see Box I-4).

Box I-4. Opinions Favoring Disaggregation

The arguments for disaggregation (advantage of selecting numerous small areas) are given below and answered in light of the special characteristics of the marine environment.

1. A number of small areas may support more species. There is no conclusive evidence that this rule is true for underwater areas. Besides, the total number of species may not be as important a parameter as the composition of species. Thus, species should be evaluated, not simply enumerated. Many inconsequential species may not be as valuable as fewer important ones. Also, certain species, such as predatory or non-territorial fishes, may have large area requirements, especially if they are poor at dispersing among separated habitats, and may be absent in smaller habitat areas. In fact, in the Chagos Archipelago certain corals were found only on reefs larger than a minimum size, which varied by species (Salm, 1980b, 1984).
2. A number of small areas may ensure survival of more species in a competitive group. Many coastal and marine habitats normally behave as clusters of areas. They are not continuous, but comprise numerous spatially discrete components that may be divided by headlands, creeks, and river mouths (like mangroves), or surge channels, deep passes, bays, and sandy patches (like coral reefs). These components function as small "islands of habitat" and could provide survival opportunities to different members of a set of competitive species in the context of a larger MPA.
3. A catastrophic event is not so likely to destroy all of a number of small areas. Considering the dispersal ability of many marine species with larval forms, scattered protected areas would seem to be of little consequence in preventing total infestation by disease or hostile species. For example, the way the crown-of-thorns starfish spread from reef to reef over hundreds of miles suggests that a system of small reserves or a single large one, like Australia's Great Barrier Reef Marine Park, would have been equally vulnerable.

2.5 Zoning

It is often difficult to accommodate all the interests and needs of local residents, tourism development, and the conservation values and needs within an MPA. Tourism in MPAs may be compatible with conservation in all but the most ecologically sensitive areas (Figure I-25) if properly managed. Nevertheless, damage may be caused by the construction of tourist facilities around wetlands and beaches that border the MPA.

MPAs are typically designed to permit several controlled and sustainable uses within their boundaries. But often particular uses need to be confined to particular zones within the MPA where they are appropriate or where their uses do not conflict with other uses. Zoning is a widely accepted method to keep people out of the most sensitive, ecologically valuable, or recovering areas, and to limit the impact of visitors.

FIGURE I-25.

As an example, MPAs may border on inhabited coasts whose residents are heavily dependent on fish, shellfish, and other marine resources for food and livelihood but who damage coastal habitats or deplete resources in their pursuits (e.g., dynamite and cyanide fishing). However, simply denying such residents access to the MPA is seldom a viable or desired option for control of the damaging activities. A better approach is a form of management that enables both continued local use and the safeguarding of ecologically valuable elements. Zoning can help accomplish these aims.

In Kenya, for example, the four Marine National parks are adjacent to or surrounded by Marine National Reserves. Tourism activities (glass-bottom boats, snorkeling, diving) are permitted in the Parks, but all extractive activities are prohibited. The Reserves are open to fishing by traditional fishers using approved methods.

The Parks function as no-take zones for replenishment of fishing grounds in the adjacent Reserves and beyond. By way of additional compensation for their loss of access to fishing grounds now in the Parks, local fishers have *exclusive* rights to fish in the Reserves (recreational, tourist and non-resident fishing is prohibited in the Reserves and enforced by the management authority).

The following are some specific uses of zones:

- They permit selective control of activities at different sites, including both strict protection and various levels of use.
- They can establish core conservation areas (sites of high diversity, critical habitats of threatened species, and special research areas) as sanctuaries where disturbing uses are prohibited.
- They can be used to separate incompatible recreational activities (bird watching vs. hunting, or waterskiing vs. snorkeling) to increase the enjoyment and safety of the different pursuits.
- They enable damaged areas to be set aside to recover.

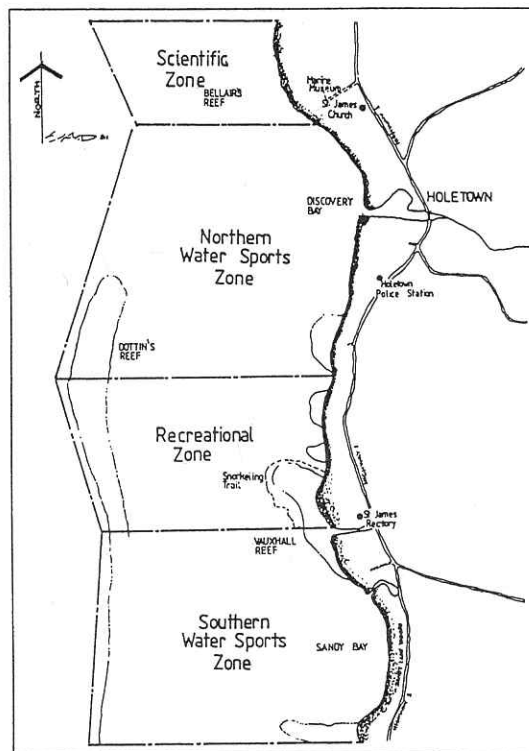


Photo by P.J. Collier.

Conflicting uses are separated by a tourism-based zoning plan for the underwater park at Hometown, Barbados.

- They can protect breeding populations of fishes and other organisms for the natural replenishment of neighboring fishing areas and devastated or overfished areas nearby.
- They are cost-effective means of managing different uses, since manpower and maintenance needs are minimal.

In summary, an MPA may include a variety of habitats that are more suited to one type of activity than another. It is usual to zone areas so that: 1) sensitive habitats are protected from damaging activities, 2) intensive use is confined to sites that can sustain it, and 3) incompatible activities are separated to avoid conflicts.

2.6 Zoning Methodology

Management zones are identified according to the extent of multiple uses to be encouraged. Activities within these zones are planned in accordance with the objectives of the reserve as defined in the strategy document. Certain zones may require intensive management while others may require very little.

1. *Defining the core zones, or sanctuaries.* Habitats that have high conservation values, are vulnerable to disturbances, and can tolerate only a minimum of human use should be identified as "core zones" (or sanctuaries) and managed for a high level of protection. No disturbing uses should be allowed.

The first step in designing a protected area would normally be to delineate the core zones. The sizes of these zones can be most important in determining their usefulness as sanctuaries. Small areas of habitat generally have fewer species than larger ones. For example, a 300-ha coral reef of the Chagos Archipelago in the Indian Ocean contained 95 percent of all the coral genera found in the archipelago (Salm, 1980b, 1984), but smaller reefs or sections of reefs had lower coral diversity. The number of coral genera decreased as reef size decreased. Also, certain genera were found only on reefs larger than a certain minimum area that varied from genus to genus.

It is essential to delimit an area large enough to sustain a breeding population of the key species and their support systems including key habitats. This holds for conservation objectives as well as for replenishing depleted stocks. A core zone should be designated to include as great a diversity of habitats as possible, which is most easily done when there is extensive data (a rare occurrence).

The following categories of information may be helpful:

- The number of species and genera present in a given area.
- The distance of the site from human settlements.
- The levels of use and dependence by people.
- The migratory patterns of key species.
- The feeding patterns and ranges of key species.

- The distance from sources of seeds and larvae for species replenishment.
 - The available prototypes, that is, successful designs from apparently similar situations elsewhere.
2. *Defining the use zones.* Sites that have special conservation value but that can tolerate different types of human uses, and that are suitable for various uses are candidates for dedicated zones in a protected area.

Different neighboring habitats are to be mapped and the protected area boundary extended to include as many of these as is practical.

The types and locations of required zones must be determined to fit the range of activities planned for the protected area (water sports, recreational fishing, commercial fishing, research, education, and special protection zones). Areas remaining among and around these use zones can be classified as general conservation zones.

3. *Defining buffer zones.* There may be need for a buffer zone wherein a more liberal, but still controlled, set of uses may be permitted. The buffer surrounds the protected area and is established to safeguard the area from encroachment and to manage processes or activities that may affect ecosystems within the protected area. Because nutrients, pollutants, and sediments can be transported over great distances by currents, buffer zones may be important in protecting MPAs from external influences.

An external buffer would be administered differently from the MPA, requiring cooperation of authorities outside the MPA, perhaps as part of a designated "Zone of Influence".

4. *Information.* It will be helpful to map any watersheds, rivers, streams, lagoons, and estuaries that influence the MPA. If these open directly into the protected area, they should be included in the buffer zone or Zone of Influence management category (see below). It will also be helpful to map currents and human settlements to identify upcurrent sources of potential stress, such as sewage outfalls, polluted and silt-laden rivers, ports, dredged shipping lanes, oil and gas exploration/production sites, and ocean dumping areas. If the protected area is to be sustained, such current-linked areas must be controlled.

The above zoning procedures delineate representative habitat types that are important to biodiversity protection and economic resource conservation. Most MPAs are comprised of core zone sanctuaries and other zones to enable the simultaneous preservation of critical sites and the continued enjoyment and sustainable economic use of appropriate areas by people.

Diagrams of core and buffer zones in Section I-5 illustrate some applications in the design of coastal and marine protected areas. In Part III, several case studies illustrate planning principles and the planning process.

2.7 Control of External Influences

Successful management of an MPA may depend on how much the influence of adjacent areas can be controlled, as discussed above and as articulated in the following situations:

- All areas that may be linked to the park or protected area should be examined carefully and monitored regularly—activities in remote areas can sometimes affect coastal or marine systems (e.g., deforestation leading to increased sedimentation, or pollution by inland industries along major rivers).
- Buffer zones with controlled multiple use can be established to control certain activities, reducing pressure on the core of the protected area.
- Mechanisms (such as management coordinating committees) can be created to correct unfavorable conditions in adjacent areas.
- Conflicting uses can be controlled if the protected area is incorporated into a general plan for coastal or marine resource uses (e.g., a Coastal Zone Management programme).

In the absence of a Coastal Zone Management (CZM) programme to assist with addressing transboundary effects from pollution (Figure I-26) and other impacts, the MPA planner or manager can attempt to establish a coordinating network composed of agencies with authority in surrounding areas of the land or sea which lie within the Zone of Influence (ZOI) of the MPA (Clark, 1998).

As examples, Spain has established a defined ZOI along parts of its coastal zone (Boelart-Suominen and Cullinan, 1994) and the Gulf Of Mannar Marine Biosphere Reserve (Tamil Nadu, India) has established a type of ZOI coordinating network (Neelakantan, K.S. 1994) to solve transboundary problems (see Part I-5).

FIGURE I-26.

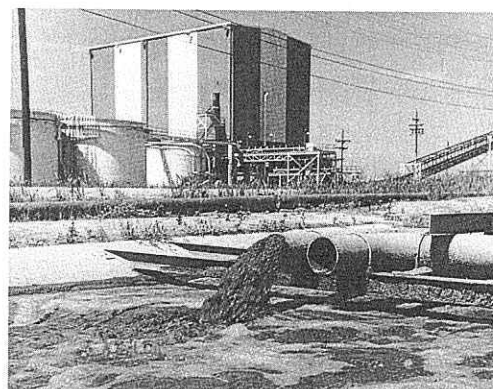


Photo by Mike Fahay

Pollution can be a severe problem for MPAs.

2.8 Advisory Committees

Advisory committees (see Table I-1; F2,a) may be appropriate for any given MPA. They should be established prior to or during site planning. It is less beneficial to activate them after a management plan is completed and ready for implementation. Such committees may be utilized for periodic consultation, for evaluation of the effectiveness of a plan, to review progress and approve work plans, and to authorize budgets or

specific expenditures. Clearly, it is best to activate the Advisory Committee early on for advice in management and site planning.

Advisory committee members are usually appointed by the MPA administration. Some members should be selected from among the local community. In any case, they should represent the spectrum of stakeholders. They serve a useful function in keeping the local population informed of activities within the protected area, and very often they provide management with useful information and recommendations. Once advisory committee members become involved, they also help ensure support for the protected area since it tends to become "their" reserve or park. Administration and management must take great care to be candid with committee members and ensure they believe their advice is valued and is heeded (see also Section I-3).

The committee's role should be carefully planned and limited because once such committees are established it is very poor public relations to attempt to dissolve them. Committees should remain in their advisory capacity and not play an active role in management. If not they may become immersed in trivia, paralyze needed actions, lose appropriate national or international perspective, and preempt the manager's job.

Management decisions by a committee of village representatives may be required in collaborative or community-based management cases. It is important in these instances to ensure equitable representation on these committees by different subgroups of the community; e.g., women, men, elderly, poor, wealthy, fishers, farmers, and other concerned user groups. Where appropriate because of religious doctrine, females may meet separately from males. Also in caste dominated cultures, various castes may need special consideration.

Whatever the nature and composition of the advisory committee, it should be supported and empowered by adequate legislation. In Tanzania for example, the Marine Parks and Reserves Act, 1994, specifically provides for the establishment of an Advisory Committee for each marine park. The functions of the Committee as provided for in the Act are:

- To advise the Board [of Trustees] on the management and regulations of marine parks;
- To oversee the operation of marine parks;
- To consult with the Warden on technical, scientific and operational matters concerning the marine parks; and
- To propose names to the Board for the purposes of appointing a Warden.

See Box I-5 for details of Advisory Committee composition, tenure, and other details. Note that no arrangements are made specifically for women, fishers, and other groups (although women's input was arranged in the field; see Case III-25).

Box I-5. MPA Advisory Committee defined by the Tanzania Marine Parks and Reserves Act of 1994.

1. The Advisory Committee shall consist of members whose number shall not be less than nine and shall not be more than eleven including
 - a. one representative of the ministry for the time being responsible for fisheries;
 - b. two persons who are members of village councils whose villages are in the vicinity of or affected by a marine park;
 - c. one representative of a local authority from an area containing all or part of a marine park;
 - d. two representatives from these business entities:
 - a private commercial concern currently operating in the fish or marine products industry in the vicinity of the marine park;
 - a private commercial concern currently operating in the tourism industry in the vicinity of the marine park or reserve;
 - e. an officer dealing with natural resources at a district level of the district which includes at least part of the marine park;
 - f. two representatives from among the following institutions and organizations-
 - a scientific institution with expertise in the field of marine conservation;
 - non-profit organizations concerned with marine conservation;
 - g. one representative of the regional authority with jurisdiction over the area of the marine park; and
 - h. one member to be appointed by the Director.
2. The members of the Advisory Committee shall select from among their number, a chairman and a vice-chairman who shall hold office for three years respectively unless otherwise their membership is terminated, and shall be eligible for re-election.
3. Members of the Advisory Committee shall hold office for three years and unless their membership is otherwise terminated due to misconduct or any other reason, they shall be eligible for re-election.

2.9 Physical Management Strategy

In the MPA Site Management Plan, the discussion on resources and existing uses (see Table I-1; B, C) should provide concise descriptions of area resources and past and present uses and their effects. This material should be limited to that relevant to management for evaluating conservation values, needs, and alternatives or for making user impact analyses. The bulk of data collected during the planning phase can be placed in appendices or made available in a separate report.

The discussion on threats and their management implications (Table I-1, E) considers resource vulnerability in the face of existing and potential exploitation. Compatible and incompatible uses are identified and management solutions or mitigating measures for problems are briefly outlined (e.g., in the sections on boundaries and zoning, new regulations, the resources studies plan, and the interpretive plan).

Living resources are usually conserved by regulatory controls or by habitat manipulations. Uses can be controlled also by concessions and permits for users. Fish stocks are largely managed by harvest controls; that is, the regulation of fishing such as gear limitations, area closures, or catch limits. Physical management techniques employed in the MPA could include managed flooding to maintain wetland habitat, mangrove planting, restoring eroded sand dunes or cliffs, or even rebuilding of some special coral reefs.

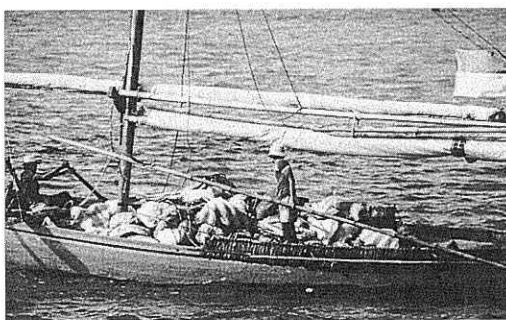
Whenever possible, techniques should be used that alter nature the least. To ensure that natural processes are left alone is in itself a management technique. To work with nature is another. This is especially important in the marine environment, where people still depend largely on natural productivity to sustain resources. This applies in principle to both extractive uses (e.g., recognizing exclusive fishing rights for local people, in the case of fisheries) and non extractive uses (e.g., permitting charter operations to transport limited numbers of tourists into protected areas as at Buck Island, U.S. Virgin Islands). Another example is beach restoration and the safeguarding of shorefront property using natural means such as native plants to stabilize dunes, which can be more effective and sustainable in achieving long-term shore stability than concrete and stone engineering works.

The suggested resource management strategy (Table I-1; F,2,f) should detail specific management activities required to maintain or restore the value of different resources. Typical activities might include any of the following:

- Restoring a damaged habitat, as through replanting dunes;
- clearing blocked mangrove creeks;
- closing sections of the MPA to enable natural recovery;
- special stewardship of vulnerable resources, as by establishing turtle hatcheries; or
- controlling extractive activities, as through limiting catches of fish species or the taking of shellfish (Figure I-27).

The impact of damaging uses can be mitigated by providing such facilities as fixed boat moorings, docks, and walkways. Interpretive programmes can help users understand why limiting and controlling uses are essential management tools (Figure I-28). Continual monitoring of the effects of use is required for corrective measures.

FIGURE I-27.



Living specimens of the giant clam (*Tridacna gigas*) have been eliminated from the reefs of the Seribu Archipelago in Indonesia. The shells of dead clams in the fishermen's craft have been dug from the reef flats and are on their way to Jakarta to be turned into flooring tiles. *T. gigas* is an example of a lost resource and a species threatened with extinction. Its large size and location on the reef flat render it easy to find and collect.

FIGURE I-28.



Photo by Billy Causey

Controlled tourism can be accommodated in coral reef and other special areas without significant impacts on the resource if properly controlled. A ranger at Florida Keys National Marine Sanctuary in Florida offers educational materials to divers.

2.10 Information Base

Site planning requires a variety of information. The following are examples:

1. The types and locations of valuable habitats and their characteristics such as species diversity, size, degree of naturalness, uniqueness, and representativeness, and degree of species dependence on them.
2. The types, locations, and amounts of human use (recreational, commercial, subsistence activities, etc), their effects on the biota and habitats of the site, the degree of dependence of local inhabitants on these uses, and possible alternatives for activities that degrade habitats and deplete species stocks below sustainable levels.
3. The present and potential threats to the site's resources from activities outside the immediate area of concern in the Zone of Influence.

Effective protected area management will depend greatly on specific data generated from research, monitoring, and social and environmental assessment (Table I-1; F2,e). A site-specific plan should first identify critical data gaps (i.e., data necessary for management decisions). For example, reef fish populations may be at very low levels, and the manager may suspect the cause to be fishing pressure. Rather than arbitrarily prohibiting fishing without adequate data, the social and resource studies plan would identify the information needed and suggest a study designed to obtain it (Figure I-29). Such a study would focus on determining who depends on which products from the MPA through monitoring fishing activities (pressure points, activity levels, gear types, size and species of catch, economics). Analysis of the data

should enable the manager to propose and support any necessary controls on fishing or actions to spread the fishing pressure or direct it into alternative pursuits (e.g., from reef fishes to pelagics or from fishing to farming seaweed). It may be valuable to temporarily close a portion of the study area to fishing and monitor the recovery of reef fish populations and safeguard breeding stocks.

The social and resource studies plan should rank the data gaps and studies needed in accordance with management information priorities. It should be emphasized that in many cases the managing agency will not be able to fund all of the needed studies. It will fund those it can and seek other funding sources for the remainder. One inexpensive way to obtain what is usually good data is to interest graduate students in working on studies pertinent to both their needs and those of the protected area manager by paying their out-of-pocket expenses. A second method is to provide small grants to university professors to undertake small projects needed by managers. Also, once researchers have worked in an area, they are more likely to spend other research money at the site, which would generate additional data of use to the manager. But the manager must understand the academic nature of researchers and the problems of getting them to focus on practical issues of direct value to managers.

Other management points that might be studied include the carrying capacity for particular activities, the adequacy of buffer zones, and the status of resources. Finally, the plan should specify mechanisms for the manager to coordinate and follow other relevant research, review proposals and permit requests, stimulate information exchange, and contribute new data to the management and interpretive plans.

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2.11 Carrying Capacity

It is clear that resources are finite and cannot resist unlimited use. Already, in the late 1990s, many coral reefs are degraded, fisheries depleted, and beaches eroded away. The idea that there *is a limit*—a “carrying capacity” for human use—has to be embraced to ensure that natural resources are not destroyed. MPA managers may ask themselves, “How much use can this area stand?” Many researchers have addressed this puzzle trying to find a technical answer, but success has been limited. The answer usually lies in a civil and political process backed by data.

FIGURE I-29.



Photo by Erkki Siirila.

The stakeholders are being consulted as part of a government plan to create a marine protected area in Anse La Raye and Canaries in St. Lucia.

Carrying capacity analysis was created (in the 1960s) as a method of prescribing the limits to development using numerical, computerized, calculation with cold objectivity. It has not achieved much success in influencing government policy because of the complexity of the parameters and because politicians, managers, and administrators are reluctant to have their judgement preempted by a computer. Nevertheless, a non-prescriptive and more qualitative and participative concept of carrying capacity has been useful in influencing control of development, particularly tourism (Clark, 1991b).

With carrying capacity, as with other biological analogies, human nature complicates the procedure for estimating limits (Chua, *et al.*, 1992). Some of the key components—such as tourist or user satisfaction—change when the users themselves or their preferences shift. Therefore, in spite of simulation models, the actual carrying capacity limit—in numbers of users or any other parameter—may be a judgement call based upon the level of change that can be accepted (Clark, 1991b). But an analytic approach conditioned by semi-subjective factors can be useful (Part III, Case No. 5).

2.12 Mapping

It is expeditious to organize the database so that essential information can be mapped and also to display as many categories of data as possible on maps, using approaches ranging from simple handwork to complex GIS technology. The first step in information gathering should be preparation of good base maps at appropriate scales. For example, Goeghegan *et al.* (1984) state: "It has been found time and again that perhaps the most useful way for the environmental planner to discover trends, conflicts, and problem areas that can otherwise be easily overlooked, is by mapping information". Photographs and maps are easily read, interpreted, and transcend language and cultural barriers to communication and analysis.

Maps found most useful will be at a scale of 1:50,000 or larger. But sometimes maps at 1:10,000 are needed for specific studies. In either case, it is more effective if the gathering of information is based on objectives set in advance. These objectives may reflect areas of known management concern, or suspected resource importance or sensitivity.

Most modern large-scale mapping (to show considerable detail within small areas) now relies in part on aerial photography. Aerial photographs can be used to pre-plan field surveys and sampling strategies to reduce cost, improve efficiency, and ensure adequate sampling of all relevant habitats and environments.

"Overlay mapping" is simple and especially useful in MPA programmes, whereby multiple theme maps are used to spatially analyze environmental components, to derive new parameters, or to select "least impact" alternatives. The method was originated by Ian McHarg (1969) as portrayed in his classic, *Design With Nature*.

In this technique, a typical base map is prepared at an appropriate scale and transparent overlay maps are prepared for each of the environmental components or attributes to be compared or analyzed (Classen, 1989). For example, transparent maps of depth, habitats, bottom types, etc can be overlaid and placed on the base map in order to identify areas where nature protection coincides with heavy uses—housing, mining, fishing, etc. Any other mapable information could also be overlain, such as, dive spots, beach erosion susceptibility, or pollutant discharge (Figure I-30).

One can add more environmental components and/or development constraints/attributes as required (e.g., critical habitat, endangered or rare plant communities, historic buildings) until satisfied that all essential aspects have been covered and an optimum scheme (or set of alternatives) has been identified to reduce use conflicts (Classen, 1989).

The same approach could be used to combine maps of shellfish beds, wetlands, and endangered species habitats into a single map of sensitive biological resources (Sorenson and McCreary, 1990). The resulting maps give planners and managers tools to guide the type and intensity of uses to be permitted or denied.

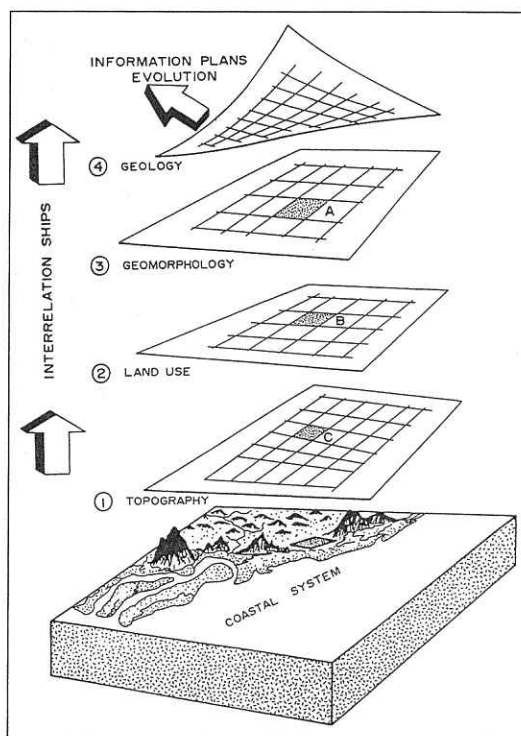


FIGURE I-30.

Overlay mapping can be done with GIS technology or manually, employing transparent sheets.

Source: *Principles and Concepts of a Coastal Management Methodology*. University of Sao Paulo, Brazil (1989).

2.13 Interpretation

MPA programmes address the need to manage human activities that degrade the environment or deplete species stocks. Gaining the cooperation of people (local residents, students, and visitors) through interpretation is an important management tool in this endeavor (Table I-1; F2,g). Interpretation—explanation of the MPAs resources and functions and management issues and needs—enhances public awareness, understanding, and appreciation of different marine resources and of the need to conserve them. An effective interpretive plan often decreases the need for policing the protected area and reduces the cost of management because when people understand the reasons for management they more willingly comply with regulations (Figure I-31).

MPA interpretation programmes are based on circumstances specific to the site. In designing the programme, primary consideration should be given to how the MPA

FIGURE I-31.



Photo by John Clark.

Providing clear instructions to visitors is an important part of MPA interpretation programmes, as here at Xel-Ha, Quintana Roo, Mexico.

site can be maximally used without depleting its resources. Thought should be given to whether the resources are most suitable for direct visitor involvement—guided activities in or under the water on in the shorelands—or for indirect involvement—through remote television, glass bottom boats, lectures, slide shows, posters, and movies.

Nature interpretation can communicate the complexities of issues facing the MPA manager, such as user conflicts and the effects of pollution. Interpretation methods that translate research into information that is understandable to the public may be particularly useful.

2.14 Public Support

The success of conservation management very often depends on local public support. Such public support, which can be regarded as a sign of understanding conservation objectives, leads to adherence to the protected area rules by the local population. Personnel constraints will also often require the help of volunteers. Local public support can be secured by sharing benefits with the local people. Some aspects of community participation are:

- Exclusive user or access rights to particular resources can be one of the strongest incentives to secure local public support, responsibility for specific management activities and compliance with regulations.
- Local communities can be given exclusive rights to certain types of use through appropriate zoning and through issuing permits for these uses only to community residents.
- Once a protected area has been established, local communities that have traditionally managed their marine resources for sustained use can be given responsibility for continued resource management under the general supervision of the conservation authority.

- In local communities with traditional resource management practices, the village heads may by definition become law enforcement officers.
- Job opportunities can be created for local people, both directly and indirectly, in the protected area and in related facilities and services.
- Local user groups can help carry out surveys and monitoring under the supervision of protected area personnel.
- Local tourist guides can be trained as park interpreters (Part III, Case No. 16).

Trained extension or social workers can help influence people's attitudes to conservation and marine park development. They can work inconspicuously, identifying local opinion leaders and overcoming opposition to conservation management. But local communities will want a piece of the action not just fast talk from the MPA agency. The public must be honestly consulted and not just patronized, placated and propagandized.

2.15 Public Awareness

Awareness plays a major role in public support and in the general success of conservation. *General* conservation awareness is needed among all stakeholders—communities, managers, politicians, administrators, and the private sector. The most important goal is to explain, through public information and education, the long-term, sustainable benefits that conservation can provide (Figure I-32). Environmental education aims to provide the community with information and a conservation ethic so that its members can make informed decisions about the use of their resources. Honest efforts to inform the public are essential; education should not be used just as propaganda to promote MPA programmes.

The first step in designing a *specific* education programme is to identify the main audience; for example, artisanal fishermen, dive operators, tourists, hotel owners, port directors, and/or politicians. In educating any group of stakeholders, it is important to use familiar language and concepts.

A particularly important function of an awareness programme is to inform stakeholders what the management authority can and cannot do. In parts of East Africa, for example, community programmes that

FIGURE I-32.



On-site discussion about MPAs in St. Lucia.

Photo by John Clark

experimented with benefits sharing led stakeholders to expect far too much material benefit from management authorities, often seeing them only as a source of funds and technical expertise. These expectations were unrealistic; they left some stakeholders feeling let down by the authorities and antagonistic toward them.

A multifaceted approach, combining printed materials, audio-visual presentations, and face-to-face interaction is probably the best way to start a *specific* education programme. For a *general* education programme, a variety of additional options can be employed: mass media (press, television, radio), fixed exhibits, tours, training workshops, the sale of promotional items such as T-shirts, and informal recreational activities with an educational focus.

2.16 The MPA Manager

As an MPA professional, you become an advocate of good conservation practice based on accurate technical input. Clarity and specificity of programme elements are needed to convince policy makers to make a strong commitment to the MPA. This effort should continue through all stages of development and management.

Through the various stages of planning, the manager is often faced with a shortage of funds or qualified personnel. Sometimes there will be an inadequate legal basis for MPA management or too little detail in the Management Plan for the site. The site manager inherits these deficient products, but nonetheless is expected to manage the site effectively, whether or not the information, materials, and support are adequate.

Regardless of your past experience, as an MPA manager you will become a planner of sorts too. The planner's role is to deal with great complexity and reduce it to simple concepts and programmes that are politically and administratively viable. Typical administrators, engineers, politicians, and most economic planners are not usually well informed about the sea and the seacoast, consequently they will depend on your special expertise.

The MPA manager will need to keep a database and to update it. All modern data handling facilities are electronic. With the advent of reliable low-cost computer systems, computer storage and analysis of geographically oriented databases are now widely available. These computerized GIS databases are now available on PCs (personal computers) and simple workstations, putting the equipment within the budget of many agencies (see Section I-5).

The site manager is responsible for achieving management objectives through the efficient use of funds, staff, and equipment. He or she must participate in evaluating conservation needs, in identifying visitor use conflicts, in defining realistic management objectives, in requesting adequate budgets and equipment, and in selecting suitable staff.

The role of the government should be to fulfill commitments to safeguard both the national and the global heritage. However, governments often fail to show the long-term thinking needed to meet this obligation. Thus, more often than not, MPA managers will have to lobby intensely to obtain sufficient funds. Furthermore, trained coastal and marine protected area managers are rarely available—managing coastal and marine protected areas is a developing, challenging, and exciting field.

2.17 Administration

A section of the management plan describes how the protected area will be administered (Table I-1; F,3). The administrative plan should be carefully coordinated with management goals and objectives for the site to ensure that these can be attained within specified periods. The administration should develop over the life of the management plan. Even when money is no object, two or three years are generally required to reach optimal operation. The first year of operating marine protected areas has sometimes been a one-person effort. When this is the case, it should be made clear that very limited progress can be made.

Adequate personnel are necessary to perform the variety of functions of creating and managing the MPA site, particularly:

- To interpret relevant policies and objectives
- To direct the management of the MPA
- To prepare updated management plans
- To assess logistical requirements
- To undertake field operations, including surveillance and maintenance
- To perform activities related to research, monitoring, visitor use, education, and training

The size of the site management staff depends on circumstances of the particular MPA (see Case Histories in Part III for examples). Staff should be well trained for their responsibilities, so they can carry out their tasks effectively. Managing protected areas effectively calls for an understanding of the resource being protected, an ability to communicate this to local people and visitors, and competence in many other specialized areas.

2.18 Logistics

Certain minimum equipment is needed to ensure proper protection of an area. The equipment needed for any MPA is usually specific for that particular site—binoculars, boats, radios, vehicles, computers, or etc.

Marking marine protected area boundaries in the sea is usually difficult and expensive to do and to maintain and is often unnecessary. Installing buoys may be expensive and difficult. These buoys require regular and costly maintenance and vigilant surveillance against theft. In such cases, the site's boundary can be described by the distance from some discernible feature (beach or reef crest) to control encroachment and poaching. Colour-coded buoys can be used to mark navigation problems (e.g., dangerous reefs) and identify boat channels. Mooring buoys are useful to demarcate snorkeling and diving sites and to prevent anchor damage (Figure I-33).

In tourist zones, however, strategically placed markers, signs, or buoys can contribute to enforcement by encouraging visitors to follow trails and reminding them of zoning regulations. Sign boards above water are often essential (turtle nesting beaches, bird nesting or roosting colonies, dangerous marshes, and vulnerable sand dunes) to which the public would normally have ready access. They remind people of entry restrictions, inform people of behavior codes, carry educational information, and warn people of potential hazards (Figure I-34). It may be necessary to fence off particularly sensitive habitats to discourage public entry.



A sign warns people of stinging jellyfish in Townsville, Australia.

Photo by Erkki Siirila.

FIGURE I-33.

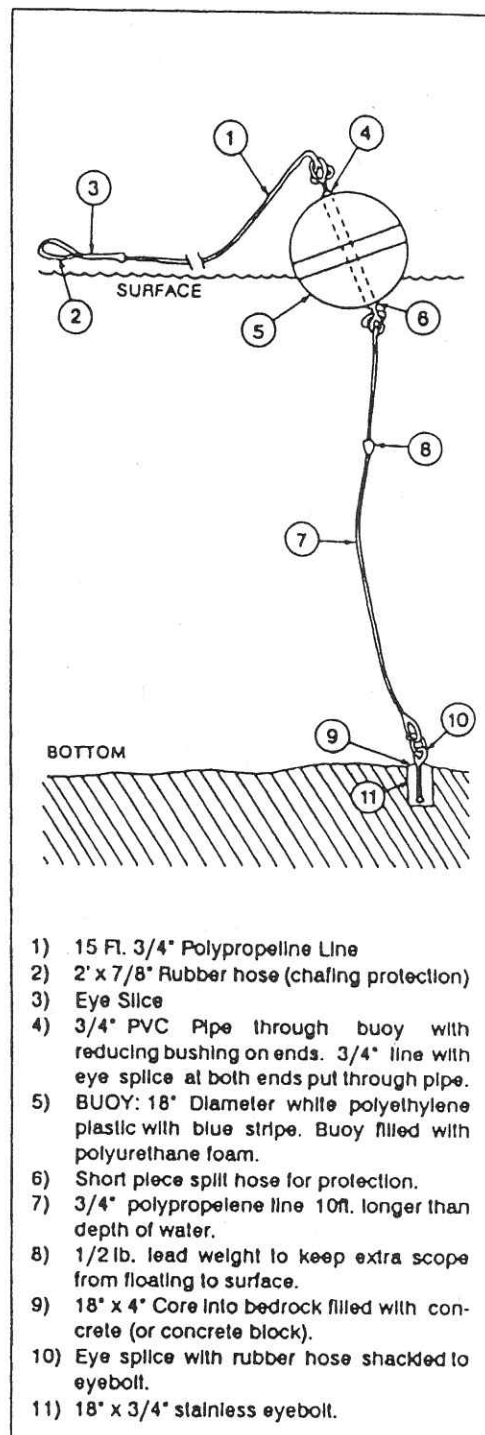


FIGURE I-34.

2.19 Surveillance and Enforcement

An enforcement programme (Table I-1; F,4) is especially important in the early stages of establishing a protected area, before the interpretive programme begins to take effect. Depending on the circumstances of each site and each country, reinforcement officers should initially employ the "soft glove" approach if possible, with explanations and warnings for first offenses. The surveillance and enforcement section of the management plan should describe (in phases if appropriate) the enforcement approach and the number of rangers. Of course, specific areas and timing of patrols should not be revealed. This section should also contain a statement of enforcement policy.

Legislation must be followed by sensitive measures to ensure that its provisions are carried out. The experience of the Gulf of Mannar Marine National Park is a case in point (Box I-6). Some general guidelines are given below (adapted from Kelleher and van't Hof, 1982).

Box I-6. Enforcement in the Gulf of Mannar National Park

The coral formations in the Gulf of Mannar (Tamil Nadu, India) were fast deteriorating due to human disturbance, especially in the four islands of the Chidambaranar District coast. Before the Forest Department of Tamil Nadu took charge of the islands now within the Gulf of Mannar Marine National Park, illicit removal of corals was rampant. The Forest Department made earnest efforts to enforce laws against the illicit removal of corals, with good effect as shown below; from the violations, fines of 183,000 rupees (US\$ 6,100) were collected:

Period	Cases Booked		Number Accused	
	Tuticorin	Mandapam	Tuticorin	Mandapam
Dec. 91 to March 9	4	2	111	2
April 92 to March 93	4	7	109	8
April 93 to September 93	40	—	56	—

Source: Neelakantan, K.S. 1994.

Sharing the burden of enforcement with coastal communities can be effective in controlling miscreants through social pressure. Local-level laws (bylaws) developed by the communities are more likely to be respected as they result directly from within the community in response to a perceived need, rather than being imposed from above.

Major measures in compliance should be public education and enlisting the help of user groups in management. Generally, more indirect, subtle, and less regimenting measures should be employed before police actions and sanctions. Regardless of public support, regulations must still provide adequately for enforcement by protected area staff as well as for suitable penalties.

MPA staff need to be carefully trained to carry out law enforcement functions effectively but without unnecessary public antagonism. Consistent guidelines should be developed for staff charged with enforcement on how to act depending on the type of offence encountered (e.g., when arrest would follow without exception and when a warning is sufficient). In many cases, rotating enforcement officers away from their home communities may be necessary to maintain consistent enforcement standards.

Public attention can be drawn to regulations through local news media, community leaders, brochures, and visitor information centers. Where MPAs are new, community suspicion of management may be high. It is therefore especially important that the first enforcement exercise in the MPA be conducted by the highest professional standards. The first arrest (or other enforcement effort) will leave a lasting impression on the community and must be done to elicit respect, not resentment or animosity.

The autonomy of customary leaders in determining and carrying out enforcement by whatever means should be preserved where this contributes to the objectives of the protected area. But customary law is generally only respected by members of the community to which it applies and needs to be backed up by national legislation and enforcement by government officers when challenged by outsiders. Honorary citizen officers can be used to detect and counsel offenders (but not to carry out legal enforcement). These officers should be trained regarding rights, risks, and proper procedures, and when they detect and report offences they should be fully supported through official means so that offenders are brought to justice.

An important component of enforcement in some countries is inspection of boats, cars, and bags. A system of inspection can lead to marked improvements in compliance with regulations. There can be value in authorizing coast guard, navy, or fisheries officers to enforce the protected area regulations (Figure I-35). They often have more equipment than the MPA authority, they are often better trained in law enforcement procedures, and have the authority to make arrests. Park staff will then not be regarded solely as law-enforcement officers and can devote more time to the public relations and education aspects of their job.

The sophistication of the equipment required for surveillance will depend on the types of incursions likely to be made into the reserve and the help that can be obtained from other law enforcing authorities.

FIGURE I-35.



Ranger is assisted by coast guard officer in patrolling the Key Largo National Marine Sanctuary, Florida, USA.

2.20 Monitoring and Evaluation

Evaluation (Table 1; F,5) should be continuous and should begin with the start of management implementation, if not before. It is the basis for managers' daily decisions and is one of the reasons that plans should be flexible enough to enable necessary shifts in direction. In most instances a formal evaluation mechanism or procedure is desirable. One approach is to require the Advisory Committee to conduct a major review of the effectiveness of the plan at the end of its lifetime and to recommend any needed revisions of management procedures. Brief evaluations can be conducted at the end of each year if circumstances warrant them (e.g., where budget proposals have to be submitted annually). In general, the more detailed the plan, the more it will need revision.

Evaluation by an external team can provide useful insights to on-site staff who may be too close to the problems or reluctant to acknowledge them; too preoccupied with day-to-day issues and activities; or too set in their ways to recognize the need for change and improvements. These external teams can also bring in the experiences from other areas to provide fresh perspectives on how to overcome obstacles and resolve issues.

In addition to involving the public, the management agency may wish to establish an evaluation team of managers from other protected areas for a more technical and objective review of management effectiveness. Whatever the mechanisms utilized, evaluation and revision are essential to a responsive management system.

2.21 Budget and Business Plan

Adequate resources for investment and annual costs (Table I-1; F,3,d) must be made available on time for the proper management of protected areas over the long term. Though some funds may be raised locally through fees and other devices, it has usually been necessary to get most support from government. Developing countries have often been successful in seeking international donor assistance to meet the costs of protected area management and to set up systems designed to achieve self-financing.

Providing incentives for the private sector, NGOs and communities to share in the burden of management through effective partnerships is one way to reduce dependence on revenue subsidies for park management. Several of the MPA Case Histories in Part III speak of experience in cost recovery through collection of user fees.

The budget will need to be divided into start-up capital costs and recurrent expenses for running of the MPA. Capital expenses cover such one-time costs for buildings, other infrastructure, office and field equipment, and recruitment and/or relocation of personnel. The recurrent budget covers the costs of wages, insurance

and other staff benefits, services and utilities, office and vehicle (including boats) running and maintenance, and project activities. These costs are linked directly to the annual operational or work plans.

The business plan takes a long-term view and aims to generate revenues or in kind contributions and services to support the running of the MPA. Its aim should be to achieve financial self-sufficiency, or close to it, for the MPA by reducing dependence on annual subsidies. Revenues collected through this plan should be placed in a special account or established as a trust fund that is managed by an independent board comprising representatives of different stakeholder groups.