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**Marine Protected Areas with an
Emphasis on Local Communities and
Indigenous Peoples: a review**

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**Marine Protected Areas with an
Emphasis on Local Communities
and Indigenous Peoples:
a Review**

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ABSTRACT

This report presents a literature review of marine protected areas (MPAs) throughout the world, with an emphasis on 16 case studies that involve community participation and indigenous peoples. Details of three MPAs, namely the Great Barrier Reef Marine Park in Australia, San Salvador Marine Reserve in the Philippines, and the Fagatele Bay Marine Sanctuary in American Samoa, are included to illustrate the importance of community involvement in establishing MPAs. A table summarises each MPA reviewed in terms of its establishment, purpose, level of protection, planning and management process, enforcement, community involvement, problems and results.

The successful establishment of marine reserves or marine protected areas depends largely on public support and community participation in as early stage as in the planning process. Yet, in practice, many MPAs are established using a traditional 'top-down' approach. Opposition from users groups, resource use conflicts and economic concerns are common and are the most important factors which often lead to MPAs not being fully implemented. Participation of indigenous people is further limited due to barriers in the planning process such as cultural differences, and the time and format constraints. As a result, indigenous peoples' interests and concerns are not well represented in MPA design and planning.

DIRECTOR'S FOREWORD

Few will dispute that marine protected areas (MPAs) can bring many conservation benefits in terms of conserving biodiversity, but their acceptance by the local communities wherein they are emplaced depends on two critical issues. First, MPAs must be perceived as bringing tangible benefits to local fishers. Secondly, the trade-offs among various local usage groups must be broadly accepted by the community. If these conditions are not met, then compliance with MPA regulations will be poor and the establishment of MPAs will be compromised. Moreover, where the local community has an ancient and structured perspective on local natural resources, such as with indigenous and aboriginal Peoples, these issues of acceptance and consent become paramount.

Almost no 'top down' policy initiatives have been able to, or even recognised the need for, a local community perspective. Even the well-meaning conservation movement initiatives usually record success by influence at the top political level of decision making. The concept of complex, interconnected and diverse ecosystems is deeply embedded in the culture of many Aboriginal peoples, but, until very recently, virtually absent from contemporary resource management. Traditional environmental knowledge (TEK) of past abundances casts a particular and defined cultural shadow on the aboriginal view of present seascapes.

This report reviews the world literature on these issues, and describes sixteen case studies that involve indigenous and community participation. One of the principal conclusions is that community support must be present from the planning stage onwards for MPAs to stand a chance of success. And finding a valid and acceptable way of involving the often-disadvantaged communities of indigenous Peoples is not a trivial issue to be addressed by the organisers of such initiatives.

The report is the latest in a series of research reports published by the UBC Fisheries Centre. A list is shown on our web site at <http://fisheries.com>. The series aims to focus on broad multidisciplinary problems in fisheries management, to provide a synoptic overview of the foundations and themes of current research, to report on work-in-progress, and to identify the next steps and ways that research may be improved.

Edited reports of the workshops or research in progress are published in *Fisheries Centre Research Reports* and are distributed to all project or workshop participants. Further copies are available on request for a modest cost-recovery charge. Please contact the Fisheries Centre by mail, fax or email to 'office@fisheries.com'.

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PREFACE

This literature review was prepared at the U.B.C. Fisheries Centre under a contract with the British Columbia Aboriginal Fisheries Commission (BCAFC) to provide a context for understanding the general policy implications of MPAs for First Nations of British Columbia, Canada. It was made available for broader publication as it was recognized that it would also be of interest to a variety of interests including individual First Nations, marine stakeholders, policy analysts and researchers who were interested in MPA planning. The information was gathered in the winter of 1998 to help BCAFC to respond to a draft Marine Protected Area Strategy for the B.C. Pacific Coast that had been developed by the federal and provincial governments. The literature review was complemented by a series of workshops to delve into specific issues that were held in five First Nation communities from December 1998-January 1999. The analysis of the results of these workshops are not included in the present report.

The review illustrates the importance of developing planning processes for the B.C. Pacific Coast that are supported by both The First Nations and local coastal communities. MPAs are management tools that can address broad overall conservation concerns, but their success relies on political support and buy-in by local peoples at all stages of planning and implementation.

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INTRODUCTION

This literature review provides a general overview of selected features of Marine Protected Areas throughout the world with an emphasis on community and indigenous peoples' involvement in planning, management and its relative success. Marine Protected Areas (MPAs), refer to management areas in which usage, often regulated by zoning for different activities. MPAs include marine reserves, which are defined as no-take areas. This review was intended to be of assistance to B.C. First Nations considering involvement in MPA planning in their traditional territories and was generously approved for wider circulation by the B.C. Aboriginal Fisheries Commission. The report provides a starting point for anyone interested in the status of MPAs in other parts of the world, the degree of involvement of local or indigenous peoples and examples of MPAs successes and shortcomings. This report is especially timely here in British Columbia, due to the announcement of the establishment of four MPA pilot projects and the release of a draft discussion paper on a Marine Protected Area strategy.

METHODS

This report is a synopsis of selected reserves by country, which illustrates unique aspects of each reserve, particularly relating to planning and management approaches. The primary literature was searched using the ASFA (Aquatic Science and Fishery Abstract) database for the years 1979-1998. The list of articles extracted consisted mainly of case studies and reviews on marine reserves and their references were used to locate other relevant papers. Although the final list of references may not be exhaustive, it includes the most well documented cases.

A synopsis of information on reserves in different countries is presented including country's policies, the type of organisation and the general problems encountered. This information is summarised for easy reference in a summary table. For each country, the MPAs investigated are listed individually with comments on their special features. Three examples were selected and explored in more detail to highlight the different levels of community involvement, i.e. the Great Barrier Reef Marine Park (GBRMP) in Australia, San Salvador Marine Reserve in the Philippines, and the Fagatele Bay Marine Sanctuary in American Samoa. Both GBRMP and Fagatele Bay involved indigenous groups, while San Salvador

involved a local community that relied on fishing.

SYNOPSIS OF SELECTED RESERVES

Australia

The Great Barrier Reef Marine Park

The Great Barrier Reef Marine Park, or GBRMP, is a good example of a combination of two integrated approaches involving small highly protected (or 'no-take') marine reserves placed within a larger, multi-use management area. Its characteristics include a large size and, management for multiple objectives involving zoning of uses and well developed reef monitoring and education programs. The Park Authority was established to develop a management plan based on the Park Act. The Park is also considered unique in its effort to involve the public in the process, as public participation is required according to the Act. In fact, it was the concern from conservation groups regarding the threat of mining for oil on the reef that led to the establishment of the Park in the mid 1970's. Since then, the Park has undergone several phases of community involvement, starting from a consultative process under the Great Barrier Reef Consultative Committee to a more participatory approach by establishing Marine Resources Advisory Committees. Yet, one important community that has not been properly included in the process is the indigenous people who have long been living in the area. Their concerns have not been fully recognised and the process of involving them in the decision-making has not been very successful. Nonetheless, the GBRMP offers a good example for management of large marine areas that involves active participation of various user groups whose interests may be in conflict.

The GBRMP comprises about 95 per cent of the Great Barrier Reef Region, which is the world's largest system of coral reefs, ranging over 2,000 km. It was established in 1975 by the federal government in response to public concern for the management and protection of the reef region, as it faced rapid economic growth, especially in tourism and aquaculture. The designation of the Great Barrier Reef on the World Heritage List, under the UNESCO convention in 1981, has heightened the obligations of the Australian government to meet global concerns over the protection of the world's natural and cultural heritage. To fulfil this role, the federal government established the Great Barrier Reef Marine Park Act in 1975 and designated the GBRMP Authority to be responsible for the management of the park, as well as the preparation of zoning plans and general policy. As the reef region supports a wide range of

activities such as commercial and recreational fishing, shipping, and other coastal and marine resource related industries, the GBRMP is managed as a multiple use area to provide both protection and wise use. Zoning plans are developed to specify what uses may occur within each zone and to determine the conditions of each use. The current zones and their objectives and uses are summarized as follows (Alder, 1995):

of the committees are to formalise and provide communication links between managers and user/interest groups; to provide advice on marine resource issues, to assist in increasing awareness of the public; and to pursue and endorse the concepts of viable and sustainable use (Tarte and Hegerl, 1996).

Although the management of the GBRMP is an

Zone	Objectives and Uses
General Use 'A'	No restriction on use, except non-research operations for the recovery of minerals and commercial spear fishing using SCUBA.
Habitat Protection or Estuarine Conservation Conservation Park	Same as General Use 'A', with additional prohibition on trawling and navigation of vessels greater than 500 tonnes. Primarily for recreation and tourism purposes; fishing is allowed subject to gear restrictions.
Buffer	Primarily for non-extractive recreation; trolling is allowed.
National Park	Area designated for non-extractive uses and appreciation.
Scientific	Specific provision for scientific research.
Preservation	Management of an area undisturbed by human activities, except for scientific research which cannot be conducted elsewhere.

In formulating these zoning plans, the GBRMP Act requires that public consultation be undertaken in the decision-making processes. This is done in two phases: the first occurs before the zoning plan takes place, to gauge the issues and concerns among members of the public; and the second phase follows the preparation of a draft zoning plan after considering public comments (Smyth, 1995).

The Great Barrier Reef Consultative Committee, established in 1977 under the 1975 Act, was the first forum providing the opportunity for community involvement in the management. The members of the committee, though appointed for their expertise, represent a range of interest groups including government and non-government, commercial and subsistence (Tarte and Hegerl, 1996). The Committee serves the role of information transfer by bringing together individuals who are leaders in their sector to discuss the management issues.

It was not until early 1990's, however, that public involvement shifted from consultation to participation. This came in the formation of the Regional Marine Resources Advisory Committees (RMRAC) and the development of the 25 Year Plan. The eleven RMRACs are run by local representatives and operate on a consensus basis, and are facilitated by the GBRMP Authority and Queensland Department of Environment. The aims

example of a successful program that involves extensive public participation, it has fallen short of recognition of the indigenous peoples' maritime interests, especially those associated with ownership, use and management rights and responsibilities for many clan estates which lie within the marine park (Environment Australia, 1997). Two major indigenous populations with cultural, historical and economic interests in environments and resources contained within the GBRMP are the Torres Strait Islanders and coastal Aboriginal people (Smyth, 1995). Cultural interests include the protection of sacred sites and the ability to conduct ceremonies. Some of the main economic activities are subsistence hunting and fishing, and commercial exploration of marine resources, such as lobster fishing, clam and oyster farming. As for legal interests, the indigenous people have long demanded legal recognition of customary ownership of land and sea and their rights to resources (Smyth, 1995).

The two Land Acts, namely the Aboriginal Land Act and the Torres Strait Islander Act, were passed by the Queensland government in 1991. While they do not provide indigenous ownership of subtidal marine areas, they identify the traditional owners for particular tracts of coastline and emphasise their important involvement in the management (Smyth, 1995). In addition, the customary ownership or the Aboriginal native title to the land in Australia was formally recognised as valid under Australian common law in 1992 under *Mabo*

decision. Although it currently deals with land ownership, there is an anticipation that this native title to land may lead to recognition of customary marine tenure and thus would raise the status of the indigenous people from user groups to owner groups (Smyth, 1995).

A recently formulated strategic plan for the GBRMP, developed over the last twenty years, has now recognised several Aboriginal and Torres Strait Islanders' interests. These include an establishment of the Aboriginal membership of Zonal Advisory Committees and the Aboriginal and Torres Strait Islander Coastal Reference Group to provide advice on indigenous issues relevant to the development and implementation of policies and programs related to coastal land and marine management. Despite the effort to involve the indigenous people in the planning and the management of the GBRMP, the style, the pace and the format used in the process have discouraged the indigenous people from full participation. For example, most of the indigenous people do not have access to newspaper where the invitation to participate is placed and they are not in command of the English language used in the process (Smyth, 1995). Consequently, it took 13 years after the establishment of the GBRMP before the first Aboriginal person was appointed to the Consultative Committee (Smyth, 1995).

In addition to the amendments to the GBRMP Act to provide for indigenous representation on the Authority board and on the Consultative Committee (Environment Australia, 1997), other opportunities include attendance at marine park workshops and conferences, participation in research projects and in community liaison meetings. Moreover, coastal Aboriginal communities act as rangers and some are trained and employed by the Park Authority to assist in research and management of the projects (Smyth, 1995). The Aboriginal and Torres Strait Islanders are also included in the development of the 25-Year Strategic Plan that involves 60 stakeholder groups. The strategic plan outlines five objectives that accommodate the interests of the Aboriginal and Islanders, to be accomplished during the first five-year period. These are (Smyth, 1995):

1. To ensure that the interests of Aborigines and Torres Strait Islanders are reflected in the management of the area.
2. To inform the general public of the cultures and economies of Aborigines and Torres Strait Islanders.
3. To develop a culturally appropriate information program for Aborigines and Torres Strait

Islanders.

4. To establish co-operative management arrangements between Aborigines and Torres Strait Islanders and stakeholder agencies in the area.
5. To ensure that projects relating to social, cultural and economic interests of Aborigines and Torres Strait Islanders are included in research and monitoring programs.

Although the strategic plan does not directly address the native title implications, it does contain provisions which could greatly improve Aboriginal control over customary marine estates within the park (Smyth, 1995).

The experiences in the management of the GBRMP have direct implications for establishment of other marine protected areas. The GBRMP, while being regarded as a good model of a large-scale marine ecosystem management, accommodating multiple uses and providing opportunities for public participation, does not sufficiently address the interests of the indigenous people (Smyth, 1995). Other measures that should be taken into consideration, as suggested by Smyth (1995) include early and ongoing consultation and negotiation process; recognition of indigenous peoples' interests in all enabling legislation; recognition of intrinsic cultural values; and facilitation of ongoing liaison with indigenous communities.

South Africa

Most literature consulted did not consider the fact that management regimes were largely established during the apartheid era. Hence, indigenous rights were unlikely to be considered and traditional uses were considered illegal. This may explain the high degree of non-compliance and "poaching" observed by researchers.

Attwood *et al.* (1997) reviewed the processes and the state of marine reserves in South Africa. The country has 112 marine reserves and restricted areas established by the government for very diverse reasons and that were governed by various legislation and levels of government (Attwood *et al.*, 1997). Proposals for marine reserves sites are reviewed by a committee that receives oral and written submissions. Such committees have been established for short periods (1976, 1984 and 1996) to develop guidelines and assess the current state of affairs. The authors note the lack of clear goals and the frequent accommodation of extractive uses which makes enforcement inefficient, and may turn no-take marine reserves into ordinary fishing zones. The pressure for access to the reserve

resources is rather intense and in consequence, some reserves are not protecting anything of significance. Lack of enforcement is caused by poor demarcation of boundaries, lack of publication of information concerning the reserve and lack of consistencies in the regulations. For example, marine reserves, which are provincial responsibilities, regulate fishing activities but have no power concerning other sources of degradation such as pollution and ecologically unsound urban or recreational development. In comparison, National Parks created under the National Parks Act have regulatory control over such activities, are well staffed and have adequate enforcement resources. In both cases, however, monitoring and research programs are poor because of the lack of trained staff within responsible institutions and/or bias towards terrestrial ecosystems.

The province of KwaZulu-Natal has its own set of regulations that enable better protection. They also have a well organised patrol and an information program for the public. Monitoring and research programs are conducted with local users and achieved through advisory assistance from a research institute which is an excellent start. However, management and enforcement are still insufficient and hence "poaching" is said to be a major problem (Attwood *et al.*, 1997).

Parks and reserves established in the last decade did not encourage extensive community involvement. However current negotiations about the development of new parks show more willingness to formally include the community in the management process (Attwood *et al.*, 1997). The process to develop the new Namaqualand National Park includes a project aimed at facilitating the involvement of interest groups. The Planning Forum (which includes representatives of government departments, farmer's organisations, rural communities and other resources users) is guided by commonly accepted principles of participatory decision-making, equitable access, conservation, and opportunities for education and research.

Subsistence harvesting has been a major source of conflict between the authorities (within an apartheid regime) and local communities. The reserve is seen as curtailing access for traditional and subsistence purposes which lead to massive "poaching". In the KwaZulu-Natal province, there has been some experimentation with the development of controlled subsistence and traditional fisheries. The key element is a joint committee between managers, scientists and the community that starts with workshops and an

assessment of irritants. Typically the problems and the need for research and experimentation are identified. The resulting research program is a joint process and encompasses subjects such as the impact of particular management tools, the level of by-catch, and the quantity of organisms (fish and invertebrates) that can be taken from the grounds. Attwood *et al.* (1997) listed guidelines for these projects to work:

1. Power has to be shared between the authority and the community including decision-making in resource allocation, regulation and planning. Community groups need training in that kind of process to be enabled to participate.
2. The community has to participate in data gathering, and receive regular feed-back, for instance, by visual demonstration of the impacts of different harvest rates. Proper training in recording harvests and in other related tasks has been found to be necessary.
3. Co-management must be based on joint problem-solving. The problems may be arising from conflicting interests within the community or between the community and the authority.

The authors report three examples of conflicts dealing with traditional uses and growing demand for marine resources. The Lake St. Lucia case deals with "illegal" net fishing in an estuarine reserve. Traditional fishing conflicted with the reserve policy and resulted in illegal fishing that was taking close to the sustainable yield. Co-management and a controlled legal fishery were implemented but not without problems and not entirely successfully. Some communities were still not satisfied by the restriction in the fishery and the local leaders did not support the reserve. Consequently, the legal fishing allowances that were part of the agreement were increasingly used as a loophole to scale up illegal fishing activities. Even in communities where poaching decreased, no sense of ownership or self-policing was developed. Some emerging principles from that experience are:

1. The need for well defined harvesting boundaries which may develop a sense of ownership among local communities that can expect to benefit from the reserve
2. Resources users should be restricted to those who live close to the resource areas. It is generally those living close to protected areas that are disadvantaged by restricted access and it is these people who should receive some benefit from resource utilization within the protected areas (Attwood *et al.*, 1997)
3. Resource users must have a good understanding of the concepts behind

management approaches such as sustainable yield.

4. User groups should be small and should have strong leadership. Violations should carry a penalty.
5. Subsistence resource utilisation should be allowed (i.e. sanctioned) by the authority although control of this activity can require enormous management effort. Education, information, monitoring of yield and regular meetings should be part of the process.

Philippines

Creating a marine reserve in a country like the Philippines where reefs are still a major source of protein and subsistence for coastal communities is not a trivial matter. Since practically all reefs are exploited, the unilateral creation of a closed area implies displacing fishers and it would likely create resentment within the community (Castañeda and Miclat, 1981). Marine reserves were not created as a result of a national policy, but due to the basis of local initiatives. However, once created by the local community, the reserve can be supported by national legislation. The Marine Conservation and Development program (MCDP) developed by the Silliman University has been designed to promote the conservation of coral reefs in the Visayas region through community-based management (Savina and White, 1986). This organisation has helped the communities organise themselves by providing education and facilitators to provide support and guidance. All reserves have been created following the same general procedure (although Sumilon Island was created through a more rudimentary process as will be seen below). The process starts with informal education activities and consultation of the community on perceived problems. Most of the times, fishers complaints were about reef degradation and diminished yields. Then, local management plans developed by interested local people, are submitted to the general public lead to a more general discussion. Management actions and control measures to enforce these plans are then defined (Christie *et al.*, 1994). Other aspects of the program such as agroforestry measures and income augmentation, support the central theme of reef restoration and community-based management (White, 1988).

In 1990 there were 18 marine reserves in the Philippines (Alcala and Russ, 1990). The study of the six marine reserves documented here illustrates the importance of community involvement in the planning and management of the reserve. There is evidence that serious degradation of the Philippines coral reefs has occurred and that the majority may be overfished

(Alcala and Russ, 1990). In the Philippines, 10-15% of the yield in fish is taken from the coral reefs and over 50% of this yield is taken by artisanal fishers (Alcala and Russ, 1990) using traditional methods such as hook and line and spear (Savina and White, 1986). In the desperate search for fish, dynamite and other destructive fishing gears have been used throughout the Philippines (Alcala and Gomez, 1987; Gomez *et al.*, 1987; Samoilys, 1988; Russ and Alcala, 1989). Fishers suffered from the decrease in catch caused by the decline in fish abundance due to overfishing and the destruction of corals (White, 1988; Christie *et al.*, 1994). The reserves were aiming at the maintenance of the environment with immediate and long-term benefits to the people who use the immediate ecosystem. The reserve of Apo, Pamilacan, Balicasag, Handumon and San Salvador all have a sanctuary excluding fishing, surrounded by a buffer zone where ecologically sound fishing is permitted. Sumilon Island is fished by fishers residing on Cebu Island, 5 km away. In all other cases, resident communities are totally dependent on the exploitation of marine resources. On Pamilacan and Apo Island fishers feel vulnerable to exploitation by outsiders (Savina and White, 1986). Communities lack alternative livelihood options and do not participate in any tourism activities (Savina and White, 1986; Christie *et al.*, 1994).

Handumon Reserve

The Handumon reserve has been created because of the need to protect sea horses that are an important source of livelihood in the community. Like other Philippines communities presented here, most households live on a combination of fishing, agriculture, firewood gathering and other related activities. The reef was overexploited and as a consequence fishers had difficulty to catch enough fish to feed their families. Catches of sea horses, the source of cash for the fishers, had declined by 60-70% between 1985-1994 (Vincent and Pajaro, 1997). The 25 seahorse fishers identified a need for management and contributed time for meetings, patrols, gathering data and other activities relating to conservation. The reserve was placed in an area accessible for study and that was so degraded that it was not depriving fishers of vital yield. Fishers gathered information on biology and behaviour in collaboration with biologists as well as recording fishing effort and catch for each day. They also donated small seahorses from their own catch to restock the reserve. The information is shared on a regular basis in feedback and planning sessions with the community and problems are solved by fishers and the community in original ways. The sea horse fishery has been improved by a combination of

buyers rules to define acceptable sea horses, changes in fishing techniques and the start of sea ranching. The project also includes education, training, mangrove tree replanting and incentives such as high school scholarships. Alternative sources of income, such as an artisanal craft “industry”, have been developed (Vincent, 1998).

Although the fishers themselves feel that there is progress, the success can be measured by the fact that neighbouring communities are evaluating their resources and asking for help to set up their own marine reserves (Vincent, 1998). On the other hand, replenished resources around the reserve attract fishers from other communities to the point where the establishment of exclusive zones accessible only to the local fishers are being considered (Vincent, 1998).

San Salvador Island

The process used to implement the six Philippines marine reserves presented earlier relied heavily on strong community-involvement. The principles and schedule of implementation are detailed here, using the San Salvador Island as a case study. Differences with the experience from Sumilon Island Reserve, a less successful case, are highlighted.

San Salvador Island has an area of 380 ha. The island became inhabited three generations ago and thus no traditional management system existed (Christie *et al.*, 1994). In 1989, 1500 people (255 families) lived on the island among which 60% derived their income from fishing and 36% from farming. The fishery is a mosaic of subsistence and commercial fishers who operates on a domestic and international scale. However, 75% of fishers rely on traditional methods and sell their catch at the local market. Highly priced fish (tunas, groupers) are bought by middleman and aquarium fish and transported to the capital to be exported. Typically, traditional fishers earn 50% less than aquarium fish collectors. The rapid increase in the number of residents and access to external markets has led to overfishing and habitat destruction and the use of more desperate measures to get fish in order to survive (Christie *et al.*, 1994).

In 1988, fishers complained about the scarcity of fish and the destruction of the reefs (Christie *et al.*, 1994). Preliminary studies on the socio-economic status of the villages revealed that local fishers were concerned about declining resources but felt that resource management was beyond their control (Christie *et al.*, 1994). They were overwhelmed by the market demands along with destructive fishing methods being supported by

some leaders preoccupied by their own gains. In addition, the Philippines government does not have the resources to effectively manage the fishery (Christie *et al.*, 1994).

The community-based approach developed by the Marine Conservation and Development Program (MDCP) of Silliman University aimed at encouraging communities to address the problem of resource mismanagement. The aim of the community-based management plans are to empower the community to participate and become self-reliant, and to train the community members to develop appropriate attitudes, knowledge and skills for sustainable resource management (Christie *et al.*, 1994). The collaboration of external organizations (the US Dept. of Agriculture and the Haribon Foundation Agency) and municipal representatives was found to be instrumental when the project was initiated and for gathering of necessary resources. Typically, a project begins with the assessment of the community's socio-economic status, their needs and perceptions, and their level of understanding of ecological concepts (McManus, 1996). In addition, baseline studies of the environment were conducted which included the informal biological knowledge of the residents. The whole process took one year in San Salvador. The community organiser acted as a facilitator for the community development meetings and developed education activities in informal small groups. Informal and active education activities were found to be more efficient and long-lasting than formal presentations. Already at this stage, community involvement and direct actions were encouraged (Gilman, 1997). Community organisers also formed a community group called the Marine Management Committee (MCPSS), which coordinated the process for creating the reserve. A field trip to Apo Island Reserve inspired the creation of an Environment Management Committee (LTK) who acted as another education and motivation group, and served as a grass-root committee that passed on the peoples resolutions to the MPCPSS. The staff also served as links with the national level (McManus, 1996). Surveys show that the education/involvement program increased the “ecological and environment concepts understanding score” from 68 to 86% within 14 months (Christie *et al.*, 1994).

The community developed and implemented a management plan based on the results of the biological and social surveys. They also set their own rules, tailored to their needs. For instance, the community drafted a resolution, later adopted by the municipality, for the establishment of a 125 ha,

no-take reserve and banned ecologically unsound fishing around the island. The collection of aquarium fish has also been banned because of its historical use of poison. (McManus, 1996). Although fish collectors were first antagonised, training sessions in using alternative gears smoothed the transition. Enforcement was done by both the residents and the municipal governance, and a system of incremental sanctions established. The municipality made a boat available for patrolling purposes. Violations diminished rapidly.

Other community activities such as the building of a public meeting hall and an erosion control program by replanting trees were organised. Mariculture of giant clams has been started although it has encountered low survival rates due to less than optimal marine conditions (Christie *et al.*, 1994). As community leadership skills increased, they relied less on the community organisers and created, for instance, an alternative income committee who is soliciting projects plans from residents of the islands. To this effect small loans were granted to families to develop their project. As all these activities are very demanding on the volunteers, various workshops were held to help define the appropriate role of each committee member, and develop leadership and planning skills. They aimed at ensuring the community's ability to continue the project when the external aid decreases.

Although the restoration process is slower than in Apo Island, probably due to decades of fishing with dynamite and poison (Christie *et al.*, 1994), the project is considered successful. Following implementation of the reserve, coral coverage improved considerably. Fishers have noted increases in juveniles of species previously targeted by blast fishers, and surveys indicate a 43% increase in fish density.

From the social perspective, the project was also very positive. The community went from poorly organised (from their own description) to dynamic, organised and confident in their own institutions. Small-scale projects allowed people to diversify their income. All these changes imply a profound modification of attitude and training in leadership and conflict-resolution helped enormously. Of course, tensions between user groups are inevitable, especially when lucrative activities such as the collection of aquarium fish, are banned completely. Training workshops on other types of gears helped to decrease the tension and to reintegrate the collectors. Also, political rivalry and political inertia within municipal council created conflicts and made the process difficult at times. It

was also found that the need for external community organisers extended beyond the two years initially planned for the process.

Sumilon Island Reserve

Russ and Alcala (1994) provide a detailed account of the tumultuous history of the Sumilon Island Reserve. After an extensive campaign to convince fishers of the potential benefits of a reserve, the municipality and the university, both located on different Islands, designated and declared a no-take reserve. When problems in compliance occurred in 1983, the university made appeals to the national government. The reserve was then declared the first National Fish Sanctuary and thus, a national body controlled the reserve which led to resentment in the community. With the change in local government to people less favourable to the reserve, and as a result of the reserve being perceived as imposed from outside, extreme fishing pressure and the use of destructive fishing practices begun in 1984. Episodes of acute fishing occurred twice: 1984-1987 and 1992-1993. The fishing stopped briefly in 1985 due to an ad hoc decision at the municipality level, in anticipation of the possibility of building a tourist resort on the island. All forms of fishing were banned for the whole island from 1988 to 1992 at which time the resort was completed and fishing resumed. This case brings out the importance of community leadership. When fishers are a minority of the population and not adequately represented or when the representatives (mayor or other) have interests that go against the fishery and conservation objectives, reserves or other constraints are easily overturned (Daniel Pauly, pers. comm). In contrast, the other reserves, rooted more deeply in the community, are considered successful and are deeply supported by the population.

Sumilon Island seems to be a very productive site and was in fact chosen for its richness and productivity (Russ, 1985). Therefore comparisons with other reserves and reefs in the same area were not successful because of intrinsic differences in productivity that confounded the effect of fishing (Russ, 1985). For example, the Apo reserve, which has been successfully protected for 11 years, still shows lower abundance and diversity of large predators than the Sumilon reserve (Russ and Alcala, 1996b).

In 1974, the Sumilon Island Reserve also started with an education program developed by Silliman University. After the campaign, 80% of surveyed fishers approved of the reserve project, which was considered successful (Cabanban and White, 1981).

The main difference between Sumilon and the five other reserves is that the control of the reserve did not stay with the local community but was instead concentrated in the hands of the University staff (Gilman, 1997). In other communities, like San Salvador, people are credited with the reserves success and take responsibility for solving problems. As a result, in Sumilon, the reserve began to be seen as imposed and external and was easily overturned when political leaders changed. When the management process is initiated by a third party such as the Marine Conservation and Development Program of Silliman University, it is essential to form a user group committee to take charge of the management (Gilman, 1997).

The tumultuous history of the Sumilon reserve provides interesting insights by repeated closures and openings to fishing. One or two years of intense unregulated fishing within the reserve were sufficient to eliminate by one-half the gain in density and biomass accumulated during the previous nine years of closure (Alcala and Russ, 1990; Russ and Alcala, 1996b). Catch per unit effort (CPUE) also declined by half after the break down of the closure (Alcala and Russ, 1990). The rebuilding of the populations of large predators occurred slowly over the years. For example, it took 3-5 years to register an increase in biomass within the reserve (Russ and Alcala, 1996b). The Sumilon experience shows that reserves can maintain the yield in the nearby fished area through adult migration (Alcala and Russ, 1990). The presence of several stations located at increasing distances from the Apo reserve, provided evidence of spillover despite intense fishing occurring outside the reserve (Russ and Alcala, 1996a).

Kenya

Kenya's economy is largely dependent on tourism and export of fish. The fishery is largely unmanaged outside parks and reserves (McClanahan and Obura, 1995). Parks exclude all type of fishing, while reserves allow a traditional fishery. In 1986, annual landings were 6,000 tonnes including shellfish of which 50% are from reef-associated organisms. Most of the catch is landed by 12,000 artisanal fishers whose livelihood is strongly dependent on the reefs (Samoylis, 1988). National Parks, which are closed to the fishery, were created between 1968 and 1990 and are very important to the tourism industry with about 124,000 visitors a year in 1985. The creation of the Marine Parks reduced considerably the area of the fishing grounds and resulted in some fishers leaving the fishery (McClanahan and Obura, 1995). Catches per fisher are so low that fishing is rarely adequate to sustain a family, which is attributed to

the overexploitation of the reefs (McClanahan and Obura, 1995).

Samoylis (1988) did not find any difference in fish abundance between unprotected and protected areas because some protected areas have been and/or were still subject to destructive fishing or siltation from terrestrial habitats. However, experiments (McClanahan and Shafir, 1990; McClanahan, 1994) in Malindi and Watamu National Parks showed how fishing changed the interaction between species and modifies the habitat and the community structure (McClanahan, 1994; McClanahan and Shafir, 1990). By targeting large predators such as those of sea urchin, fishing leads to an increase in sea urchin population, followed by overgrazing and erosion of coral, and exclusion of less competitive finfish. Large predators were four times denser and sea urchins 100 times less numerous in protected reefs (McClanahan and Shafir, 1990; McClanahan, 1994). Species diversity were also higher in protected areas.

Mediterranean

France

In France Regional Parks are initiated by local and regional communities and managed through a special organisation formed by local government, that includes all villages in the territory. Because the Corsica Regional Natural Park (Parc Régional Naturel de Corse) includes a long coastline, and since the marine environment is a national responsibility, the national government also participates in the management process (Leenhardt, 1990). Regional Parks objectives are to protect nature and sites of interest and rejuvenate the rural economy with livestock farming and tourism (Leenhardt, 1990). The Scandola and Lavezzi reserves, both related to the Regional Park, were created because of local initiatives and their goals are mainly nature conservation and research. Anthropogenic disturbances such as waste water disposal by adjacent developments, overgrazing by live stock, and over-utilisation by visitors create problems for the reserves that have to be dealt with within a broader management plan.

Spain

In Spain, regional administrations are in charge of declaring marine reserves within their territories. In cases of mixed jurisdictions however, the national government is in charge (Suárez de Vivero and Frieyro, 1994). There are nine marine reserves and parks that have been declared including six along the Mediterranean and three along the Atlantic coast. By 1994, more than 32840 ha had

been declared as marine protected areas (MPA), which encompasses 2.3% of Spain's interior waters, and more MPAs are planned. MPAs differ in their level of protection and purposes (Suárez de Vivero and Frieyro, 1994). MPAs are part of a global strategy of regeneration and marine environmental protection with links to the administration of fishing and are covered in the Fishing Administration's plan (Suárez de Vivero and Frieyro, 1994). Areas protected by MPAs were productive and/or diversified areas and perceived as being over-exploited (Ramos-Espla and McNeill, 1994). The Island of Tabarca reserve, declared in 1986, is the oldest marine reserve in Spain. Management successes are attributed to the clear definition of the reserve goals at their creation, close surveillance and extensive knowledge of the area (i.e. survey before the creation of the park) (Garcia-Rubies and Zabala, 1990).

New Zealand

New Zealand had 13 marine reserves in 1995, ten of which were created in the 1990's (Department of Conservation, 1995). The goal of the present Department of Conservation is to create a network of marine reserves to conserve the variety of habitats and marine life found on the coast and in the sea. Several ministries, local authorities and the New Zealand Conservation Authority (a national body of appointed members standing alongside the Department of Conservation) have a concurrent role in the creation and administration of marine reserves, along with the Department of Conservation.

The first proposal for the Marine Reserve of New Zealand (Leigh Marine Reserve) came from the University of Auckland and was turned down by the Government. It was established after a 10 year effort involving an information campaign and mobilisation of volunteers. The law, created especially for this occasion, required that a non-governmental organisation propose the marine reserve (this rule was abolished in 1987) (Cocklin *et al.*, 1998). The community was not involved in the planning of the Leigh Reserve. As a consequence, there was resistance to any restrictions on access and considerable incentive to pressure politicians and influence the process (Ballantine, 1991). However, the reserve is now considered to be a success and is well accepted by the general public and the fishers who police it (Ballantine, 1991; Cocklin *et al.*, 1998). The reserve has become a major tourist attraction to the point where the new management plan recommended that the access be limited (Cocklin *et al.*, 1998).

The second marine reserve, the Poor Knights

Reserve, was planned without antagonising too many of the existing users. Consultations amongst user groups tended to stress harmful activities. Complex rules made it difficult to set a strict conservation goal and left the reserve open to pressures for increased access (Ballantine, 1991). On several other occasions, opposition by various groups, including commercial fishers, resulted in modification to the proposed reserve size or led to proposal rejection (Cocklin *et al.*, 1998). Loss of rights to fish or practice other activities generates a lot of unrest (Cocklin *et al.*, 1998). In 1987, the Department of Conservation was created which helped modify attitudes. The number of reserves increased from 2 to 13, and more are proposed. The new process includes public consultation and involvement of public interest groups early in the process.

Going back to the Poor Knights Reserve, a new round of consultation was started in December 1995 seeking submissions from all interested groups. Interestingly, the interests of the native community became more important in the debate this time for two major reasons. First, the Maori lived on the Poor Knights Islands before the invasion and slaughters in the early 1800's. The Islands remained uninhabited since. The Maori claim the Islands as part of traditional territory and made a submission strongly in favour of prohibiting all fishing within the reserve. Second, the Treaty of Waitangi (1992) has provisions for the creation of "protected areas" dedicated at the protection of traditionally important areas for local fisheries or other native uses (Sullivan, 1997). The Department of Conservation has the legal responsibility to interpret and administer the Conservation Act (1987) so as to give effect to the Treaty even though it is not mentioned in the Marine Reserve Act (created in 1971). Therefore, consultation with the local tribes early in the process is considered important (Department of Conservation, 1995). Eventually in 1997, all fishing was prohibited in the reserve (Cocklin *et al.*, 1998).

Cocklin (1998) recounts the process for the creation of the Hahei reserve in 1993 and describes the public opinion. In this case, the peninsula communities were consulted about the proper location of the a reserve. Although most respondents supported the reserve, long-time residents, retired people and commercial fishers were concerned about losing their fishing grounds and more generally about the impact of increased tourism in the region. Boundaries were discussed and finally agreed upon. The local tribe of Maori strongly supported the reserve since its initially proposed boundaries would have protected sacred

sites as well as their fishing resources. In the final decision however, Maori interests were overlooked to maintain recreational fishing access to fishing grounds.

Recently, on the other hand, the Maori have gained more control over commercial fisheries. Despite the Treaty of Waitangi signed in 1840 by the Queen of England and the Maori tribes, Maori fishing rights were never respected (Sullivan, 1997). The establishment of the Quota Management System (QMS) in 1986 was done without any provisions for Maori rights. The Maori successfully argued with success that the New Zealand Government was not in a position to give property rights on a resource that belonged to them. This led to a process of negotiation exploring how Maori rights could be given effect. In 1989, the Maori Fishing Rights Act was passed and enabled Maori to obtain 10%, and in 1989, 20% of the quotas and exclusive fishing rights in 12-mile territorial limit (Sir O'Reagan, 1997). The Maori Fisheries Commission actively increased its power in the commercial fishing industry by acquiring a larger proportion of processing and exporting businesses (Sir O'Reagan, 1997). Maori criticism of the present quota management scheme is that it does not account for relationships between species, disturbing the productive balance of those resources (Sir O'Reagan, 1997).

Indo-Pacific

Seychelles

The Seychelles relies almost exclusively on fish exports and tourism for foreign revenues. Marine protected areas are seen as a key approach to assuring the successful co-existence of conservation and exploitation activities. Jennings *et al.* (1996) note that although the Seychelles have several marine reserves, quantitative data about the effectiveness of marine reserves is very rare. They compared four marine reserves with different level of enforcement and fishing effort. From their study it seems that, on coral reefs, even small reserves could be efficient at protecting fish targeted by the fishery. However even a modest amount of fishing (e.g. in Sainte Anne reserve) would be sufficient to eliminate the reserve benefits.

Caribbean

St. Lucia

The Maria Islands Reserve was compared with two other communities: Laborie, where the fishing for urchins was traditionally restricted to one month a year (not for conservation purposes), and Aupicon,

where no restriction was imposed (Smith and Berkes, 1991). Markets for urchins outside the islands led to overexploitation. The village of Laborie, with a population of 800, controls and enforces the informal closure for most of the year. Because collecting urchins is labour intensive, it was traditionally done before the start of school so children could help. After 1987, the density of urchins increased in the reserve and around Laborie where the village controlled harvesting, but remained low at Aupicon. The authors mentioned that even fishers who don't like the reserve enforce it to prevent others from using it. In Laborie, individual harvesters can afford to show restraint because the whole village does the same and because the resource is plentiful when fishing reopens.

The Soufrière Marine Management Area has been created recently and seems promising for future community management. The management area is zoned for different purposes and includes reserves that are closed to fishing. Although the goal was to develop community-based management, coastal fishers were not part of the decision-making process and were deprived of their fishing grounds (secure shallow waters with the right type of habitat). Hence, compliance is rather low, with fishers feeling they have no choice but to fish if they are to feed their family. Zoning may have to change, and already has in two reserves, to accommodate the needs of artisanal fishers.

Belize

In Belize, marine reserves have been established through a grassroots approach. The need for marine reserve and protection came from the general population as they became aware of the impacts of unsustainable exploitation of the reef. The first attempts were resisted because the tourism industry was perceived as the sole beneficiary of any proposed protection activity. A decade later the need for protection was perceived as vital for the whole community and planning meetings took place. The originality of the process is that all interest groups were truly consulted and their needs influenced the management plan. In this case, convenient fishing grounds were kept for coastal fishers using non-destructive methods. Only when artisanal fishers were satisfied, did the Fishery Ministry officially designate the reserve (Vincent Gillett, Fisheries Centre, UBC, pers. comm.). Belize now has several marine reserves established using the same process. The government has created management structures to help establish and manage the reserves and funds are available for special projects (Vincent Gillett, pers. comm.). The reserves have played an

important role in protecting and restoring the reefs. It seems to be generating enthusiasm within the population. However, other sources of environmental degradation such as coastal development, pollution and uncontrolled tourism activities continue to be ecological threats to the reefs (Carter *et al.*, 1994).

USA

The USA has a national program for the establishment and management of marine reserves. The US Marine Protection, Research and Sanctuaries Act was passed in 1972. Title III of this Act authorised federal designation of marine sanctuaries for the purposes of preserving or restoring unique marine environments for their conservation, recreational, ecological or aesthetic values (Harvey, 1983). The National Oceanic and Atmospheric Administration (NOAA) is in charge of reviewing and selecting appropriate sites, as well as formulating a management system. The steps in this process generally include:

1. Identify representative sites for potential marine sanctuaries, a process involving scientists;
2. Select candidate sites and meet with state resource managers to assess interest level;
3. Evaluate candidate sites through a process of public and legislative review;
4. Prepare of a Draft Environmental Impact Statement and a proposed management plan;
5. Hold public hearings and regional meetings for comments;
6. Prepare a Final Environmental Impact Statement and distribute for comments; and
7. Get approval from the US President for designation of the area, which, if there are objections, may be appealed to the US Congress and the governor of the state or territory (Fiske, 1992).

Several marine sanctuaries have been established since the mid-1970s. This synopsis focuses on the largest and the most integrated sanctuary in the East Coast USA, the Florida Keys National Marine Sanctuary, which includes two previously designated sanctuaries, i.e. the Key Largo National Marine Sanctuary and the Looe Key National Marine Sanctuary. As well, the Fagatele Bay (Tutuila, American Samoa) is presented as an example of a process that incorporates socio-cultural factors, and that contributed to the successful in the establishment of the marine sanctuary. Other examples presented in the table, but not in this summary, are the Tortugas Shrimp Sanctuary and the Everglades National Park, a lobster nursery sanctuary.

The Florida Keys National Marine Sanctuary

The Florida Keys National Marine Sanctuary (or FKNMS) encompasses North America's most extensive living coral reef, as well as natural communities of seagrass meadows and coastal mangroves. Human use in the Florida Keys area is very intensive, particularly tourism and recreational activities, with resulting pressures on marine resources in the area. In 1990, FKNMS was established and the National Oceanic and Atmospheric Administration (NOAA) was charged with formulating an integrated management plan by bringing together representatives of user groups and the public with federal and state agency officials (Barley, 1993).

NOAA uses a variety of tools to develop the plan and to gain support of the public. For example, a 'core group' involving different agencies is created to brainstorm about problems and solutions, with help from the public and advisory council. Several meetings are held with various users including scientists, divers, commercial fishers and treasure salvagers (Barley, 1993). The federal-state partnership in the management of Florida Keys is another special feature characterising the FKNMS process. The final management plan for FKNMS includes ten action plans consisting of zoning, water quality, submerged cultural resources, regulation of fishing, channel marking, mooring buoys, permitting, enforcement, research and education (Suman, 1997).

The Fagatele Bay (Tutuila, American Samoa)

The process of establishing the Fagatele Bay Marine Sanctuary in American Samoa is a success story showing the importance of socio-cultural considerations in the process of planning and designating the sanctuary. It serves as an example of management of a small marine area with a relatively complete understanding of the resources and a full recognition of their cultural importance to the local people. The Samoan people participated in the entire planning process. Key factors for successful designation of the sanctuary were the acknowledgement of the cultural importance of traditional lifestyles and existent village regulations as. Fagatele Bay is also an example of co-operative management between the American Samoa Government and the National Oceanic and Atmospheric Administration (USA). The success of Fagatele Bay Marine Sanctuary contrasts with the failure to establish a marine protected area in La Parguera, Puerto Rico. The comparison further emphasises the importance of considering socio-cultural aspects in the planning process.

Fagatele Bay is a small bay with an area of about 160 acres on the southwest coast of Tutuila, the largest and most populated island in American Samoa (Thomas, 1988). The island is surrounded by fringes of coral reefs that provide subsistence fishing grounds and wave protection (Templet, 1986). With its pristine condition, Fagatele Bay provides habitat for fish and coral species as well as humpback whales, sperm whales, hawksbill and green turtles. Activities in the area include subsistence fishing, shellfish gathering from the reefs and commercial fishing (Fiske, 1992). The proposal for designation of Fagatele Bay as a National Marine Sanctuary by American Samoan Government in 1982 came as a result of an infestation of the coral-eating Crown-of-Thorns starfish (*Acanthaster planci*) that destroyed more than half of the coral reefs around the island (Thomas, 1988). Apart from ecological objectives to provide protection to the bay's coral reef ecosystem and to promote research on coral recovery, the bay was intended to contribute to the preservation of the traditional culture of Samoan people. The designation of the bay as a marine sanctuary in 1986 prohibits activities such as spear-fishing, trawling, seining, damaging of natural and cultural resources and the taking of sea turtles. Subsistence fishing and traditional gleaning of shellfish are allowed.

Although American Samoa is an unincorporated territory of the United States, it has an enduring cultural heritage, a traditional communal lifestyle and communal ownership of land and marine areas, all revolving around extended family. *Matai*, the village chief, is responsible for managing the communal economy, distributing and controlling land uses, and has authority over access and activities affecting natural resources in the island (Templet, 1986; Fiske, 1992). As *matai* is generally well respected in the area, his opinion has a strong weight in the decision-making for the island.

The importance of village life, the role of traditional culture and the existence of village regulations were highly recognised during the planning process for the Fagatele Bay Marine Sanctuary. In American Samoa, societal decisions are made based on consensus, starting at the village level where people discuss their problems with their *matai*. The consensus is then related by the *matai* to the village council, to obtain again another consensus decision. This consensus building process, although time consuming, has proven to be essential for the planning of the sanctuary. Through this process, Samoan people were encouraged to participate and their concerns over the lifestyle and continuation of traditional

uses of resources were considered. In 1984, a public hearing on the draft plan was held with a considerably large turnout and compromise was made to redesign the sanctuary to include a commercial fishing zone (Fiske, 1992). NOAA officials met first with the Governor of the American Samoa to gain approval, then with the *matai* to discuss the proposed plan. NOAA agreed to adjust the proposed boundaries to coincide with the customary marine tenure area that belonged to the village (as recognised by their property right system). Samoan territorial agencies helped develop the Draft Environmental Impact Statement and the management plan, that was designed to address the concerns of Samoan elders (Fiske, 1992). The plan was generally supported by the public and was revised as a compromise with commercial fishing interests.

The management plan for the Fagatele Bay Marine Sanctuary included an interpretive centre, an educational program and a community advisory board (Fiske, 1992). The interpretive centre, displaying practices and traditions of the Samoan people, was in response to the concerns of the elders who wanted to prevent cultural loss. The sanctuary designation was seen as an opportunity to enhance public education by providing research findings to the general public and promoting environmental awareness. As well, the education program included the history of traditional rights in Samoa and outline their roles in conservation efforts (Thomas, 1988). Because of the concern about the lack of qualified Samoans to manage the sanctuary, the plan was to provide mechanism to assist in the training of local personnel in resource management techniques.

La Parguera Marine Sanctuary, Puerto Rico

The proposed La Parguera Marine Sanctuary in Puerto Rico provides an interesting comparison to Fagatele Bay. The designation process of La Parguera was initiated in 1979 and ended in frustration and failure for natural resource managers, officials, and citizen supporters in 1984 (Fiske, 1992). The proposed sanctuary was to cover an area of about 230 square kilometres, with the objectives of providing environmental protection, as well as recreational opportunities. Although fishing was to be allowed in the sanctuary, the proposed plan was opposed by artisanal fishers and other interest groups, such as local residents, small businesses and vacation-home owners. Fishers felt that the sanctuary would prevent them from fishing and from maintaining their way of life, while local residents and business were concerned with the loss of revenues due to the closing of the area for recreational fishing and

tourism activities. The vacation-home owners opposed the sanctuary since most of their homes are illegally built without ownership titles and thus may have become public property after the designation of the sanctuary (Fiske, 1992).

One important cultural attribute of life in Puerto Rico that was not considered during the planning process was the highly politicised nature of social activity on the island (Fiske, 1992). Fishers have historically been active in opposing the control and resource allocation policies, and have used the fishermen associations as their lobbying agencies to serve their social, economic and political interests (Valdés-Pizzini, 1990). When they felt that they were not being consulted properly about the sanctuary plan, fishers sought help from government-sponsored legal services and received support from a political party, looking for votes in a new election (Fiske, 1992). This political party (the Puerto Rican Independence Party, or PIP) used this occasion to represent community groups in expressing the general dissatisfaction of many Puerto Ricans in the intervention of the United States government in local affairs (Valdés-Pizzini, 1990).

Clearly, at the time La Parguera Marine Sanctuary was proposed, resource managers were not fully aware of the importance of public participation and socio-economic and political considerations in the development process. When faced with a situation where a recent election brought a new Governor who was not in favour of the designation, all efforts to establish the sanctuary were discontinued (Fiske, 1992).

Canada

The establishment of MPAs in Canada has been exceedingly slow, despite the recent passage of the Oceans Act. This could be due to low public perception of the value of the preservation of the marine environment in relation to terrestrial parks and government policies that generally favour resource harvesting in order to minimise conflicts with historical and subsistence users (Paisley, 1995). Up until a few years ago, public interest groups focussed on a few key sites and in some cases went as far as to develop management plans and education and interpretation programs. Yet, they were less active in identifying and selecting candidate sites (Paisley, 1995).

Both the Oceans Acts and the proposed Marine Conservation Areas Act (which is currently before parliament) can provide protection for marine areas. On the Pacific coast, a joint federal-provincial approach is being taken to develop an

integrated strategy for establishing a comprehensive system of MPAs (Barr *et al.*, 1998). The draft strategy includes a commitment by government agencies to employ an inclusive, shared decision-making process with stakeholders, First Nations, coastal communities and the general public (Government of Canada and British Columbia, 1998). Traditionally, the establishment of protected areas has been done using a top-down approach where government regulations are imposed on resource users (Kelsey *et al.*, 1995), and very little collaboration among government agencies is observed (Government of Canada and British Columbia, 1998). One example of a different approach found in the literature is that of Whytecliff Park.

Whytecliff Park

Although Whytecliff was first declared as marine park in 1973 by the Municipality of West Vancouver, marine resources continued to be depleted as there was no legal authority and a comprehensive management plan (Solin, 1993). With an annual fishery closure of 100 metre from the shoreline, Whytecliff is now considered by many to be the first 'no-take' MPA in Canada, despite the lack of legal designation (Scott Wallace, Resource Management and Environmental Studies, UBC, 1999, pers. comm.). It was not until 1993 that the Whytecliff project was successful in its attempt for bottom-up approach to marine resource management, as a new process-oriented partnership model was being applied (Kelsey *et al.*, 1995). This process involves all stakeholders, government and non-government agencies, in creating a system by which their different knowledge, skills and expertise are shared and common goals may be obtained.

The process of establishing Whytecliff Park was unique in its utilisation of a co-operative, cost-effective management strategy, focussing a diverse group of stakeholders towards achieving common goals, and in its approach towards conservation as a people-oriented process (Kelsey *et al.*, 1995). Regular meetings took place to ensure a steady flow of information between various committees and a negotiation process is used for conflict resolution. Because individuals were actively involved in the Whytecliff project, they felt that their actions contributed to conservation success, and were motivated to bring about changes in the management of the marine protected area (Kelsey *et al.*, 1995).

SUMMARY TABLE

Complete references for this table are listed in Appendix 1

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Australia						
The Great Barrier Reef Marine Park (GBRMP)						
GBRMP is a large biosphere reserve covering 350,000 km ² with 120 core preservation areas, subject to multiple use, including commercial fishing, tourism, recreational fishing, traditional fishing, scientific research, diving, camping and shipping ⁽¹⁻³⁾ .						
<ol style="list-style-type: none"> 1. Conservation of the Great Barrier Reef. 2. Regulation of the use to protect the Reef while allowing reasonable use of the Region. 3. Regulation of activities that exploit the resources so as to minimise their effects on the Reef. 4. Reservation of the area for public appreciation and enjoyment. 5. Preservation of some areas in their natural state undisturbed by man except for scientific research activities ⁽³⁾ 	<ol style="list-style-type: none"> 1. Three major categories of zones: (a) preservation and scientific research zone (only human activity for controlled scientific research is permitted); (b) national park zones (scientific, educational, and recreational use permitted); and (c) general use zones (commercial and recreational fishing allowed subject to some limitations) ⁽³⁾ <p>There are also some short-term zones such as species replenishment regions ⁽³⁾.</p> <ol style="list-style-type: none"> 2. The only activities which are prohibited throughout GBRMP are oil exploration, mining, littering, spear fishing with SCUBA and the taking of large specimens of certain species of fish ⁽²⁾. 3. Only two per cent of GBRMP is closed to all fishing activities ⁽²⁾. 	<ol style="list-style-type: none"> 1. The Great Barrier Reef Marine Park Authority (GBRMPA) was established in 1976 to provide for the protection, wise use, understanding and enjoyment of the Great Barrier Reef in perpetuity through the care, understanding and development of the GBRMP ⁽⁴⁾. 2. Zoning is required by legislation to involve an interactive process with the public and government departments ⁽³⁾. 3. Zoning plans are largely based on how well they satisfy expressed and inferred demands from interest groups, including users, conservationists, and on-site managers ⁽³⁾. 	<ol style="list-style-type: none"> 1. Management is achieved through zoning plans, which are implemented for five year periods after considerable public participation and review ⁽⁴⁾. 2. Existing shipping lanes could not, for political reasons and under international shipping conventions, be relocated in the zoning plan ⁽⁵⁾. 3. Day-to-day management is done by the Queensland National Parks and Wildlife Service (QNPWS) ⁽⁴⁾. 4. Policing is also done by the QNPWS and the Queensland Boating and Fisheries Patrol (a division of the Queensland Department of Primary Industries) ⁽⁴⁾. Coast watch and surveillance aircraft are involved in aerial surveillance ⁽⁴⁾. 	<ol style="list-style-type: none"> 1. GBRMPA promotes public appreciation of the existence value of the Great Barrier Reef and nationalistic pride in the GBRMP and close involvement in zoning plan development ⁽³⁾. 2. Zoning involves public participation in several stages, such as in the first step of drafting up the plans, the draft plan is then released again to the public and account is taken of the reactions of the public in the final plan ⁽³⁾. 3. Commercial Fisheries Consultancy Program is established to provide liaison between the Authority and the fishing industry ⁽⁴⁾. 4. Recently switched from consultative approach (minimal opportunity for indigenous people to provide information and no opportunity to participate in decision-making) to a more interactive approach (see Section 3) ⁽⁶⁾. 5. Because of spillover effect, trawlers have begun to support closures and to concentrate their fishing along the edges of protected areas ⁽⁷⁾. 	<ol style="list-style-type: none"> 1. Zoning plans, although allowing for adjustment for demands by interest groups, can become a way of justifying the opinion of the client whether that opinion is well based or not ⁽³⁾. 2. More research is needed to evaluate the effectiveness and value of zoning in the GBRMP ⁽³⁾. 3. Legislation for zoning is effected for five years and, so is relatively inflexible and not responsive to short-term change ⁽⁴⁾. 	<ol style="list-style-type: none"> 1. Trawl fishery loses less than 5 per cent of trawling area ⁽⁴⁾. 2. A study, using scuba search technique, showed that densities and modal size classes of coral trout (most popular angling species) were considerably lower in fished reefs than in protected, unfished area in the Capricornia Section of the GBRMP, after 5 years of protection ⁽⁸⁾. 3. Another study, comparing size and age of coral trout in reefs that have been protected from fishing for 3-4 years and those unprotected, showed no significant differences in mean size and age ⁽⁹⁾. 4. More prawns caught 'fishing the line' (i.e. in the waters immediately adjacent to MPAs) ⁽²⁾.

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
South Africa						
de Hoop reserve (Western Cape province)						
<p>1. Southern South Africa established in Dec 1985 ⁽¹⁰⁾ 2. 46 km of coastline consisting of sandy beach and rock platforms ⁽¹¹⁾, the reserve covers the surf zone 3. The area was heavily fished by shore anglers ⁽¹¹⁾</p>						
<p>1. Primarily a strategic military zone (Trevor Hutton, pers comm) 2. Fishery management, protection of depleted stocks such as galjoen (Coracinidae) and dassie (Sparidae) that are target species for sport fishery ⁽¹¹⁾</p>	<p>1. Closed to all activities except research with permit (Trevor Hutton, pers comm) 2. Little control of detrimental activities ⁽¹⁾</p>	N/A	<p>1. Monitoring began in 1984 2. Management plans currently being drafted ⁽¹⁾ 3. Provincial authorities in charge ⁽¹⁾ 4. Badly enforced, no sea-going capacity ⁽¹⁾ 5. Monitoring of fish, intertidal communities, visitors number</p>	<p>1. Very little input from user groups except public hearings and written inputs ⁽¹⁾ 2. Coastal land was expropriated ⁽¹⁾</p>	<p>1. Pressure to re-open the reserve by local anglers, authors do not recommend it ⁽¹²⁾ 2. Poaching is frequent; fishing vessels have right of passage ⁽¹⁾ 3. Incomplete monitoring program ⁽¹⁾</p>	<p>1. CPUE higher for 6 species (97% of the catch) ⁽¹⁰⁾ 2. Mark-recapture data show export of adults ⁽¹⁰⁾</p>
Tsitsikamma National Park (Western Cape Province)						
<p>1. 60km of coast and 5.6 km wide; established in 1964 ^(13,14) 2. rocky reefs and sand, high energy environment ⁽¹⁵⁾ 3. Marine reserve supplementing terrestrial reserve (Trevor Hutton, pers comm)</p>						
biodiversity conservation	<p>1. closed to fishing except 3km stretch where shoreline fishing permitted ⁽¹³⁾ 2. control activities (shoreline development, pollution, etc.) which may be detrimental to the Park ⁽¹⁶⁾</p>	N/A	<p>1. Has management plan ⁽¹⁾ 2. Under national government ⁽¹⁾ 3. Badly enforced, shortage of sea-going capacity ⁽¹⁾ 4. Monitoring of offshore reef fish, visitors number ⁽¹⁾</p>	<p>1. Very little input from user groups except public hearings and written inputs ⁽¹⁾ 2. Fishing rights were removed ⁽¹⁾</p>	<p>1. Poaching is frequent; fishing vessels have right of passage ⁽¹⁾ 2. Incomplete monitoring program ⁽¹⁾</p>	<p>1. Subtidal and intertidal community different in reserves and in exploited areas ⁽¹⁵⁾ 2. Increase in number and modal size of targeted species ⁽¹⁵⁾</p>

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Philippines Sumilon Island						
<p>1. Central Philippines 2. reserve comprise 25% of the subtidal coastal coral reef (0.5 km² to the 40m isobath)⁽¹⁷⁾ 750m long⁽¹⁸⁾ closed from Dec. 1974 to May 1984⁽¹⁷⁾ and 1987-1992 3. displaced 100 small-scale fishers (artisanal and subsistence)⁽¹⁹⁾ coming from Cebu the mainland (no resident on Sumilon)⁽²⁰⁾ 4. Nearby area submitted to high fishing pressure and provides very high yields⁽²¹⁾</p>						
1. Conservation of coral reefs	1. Exclusion of all exploitation ⁽¹⁷⁾	1. Declared by municipal government as a result of agreement between Silliman University and Oslob Municipal council ⁽¹⁹⁾	1. Administration, protection and surveillance by caretaker provided by the University ⁽¹⁹⁾ 2. Monitoring of catches by caretaker ⁽²⁰⁾	1. People not really involved in the process; only received information: programs to convince local population of the potential benefits for the fishery ⁽¹⁹⁾	1. Fishers unsure of the purpose of the reserve ⁽¹⁹⁾ 2. Community resented the outsider' authority resulting in fishing violations starting in 1983 ^(19,21)	1. By the late 1970s, fishers convinced that yield had increased ⁽¹⁹⁾ 2. Rapid decrease in size, abundance and densities of fusiliers and large predatory fishes after resuming fishing ^(19,21) 3. Yield increase around reserve ⁽¹⁸⁾ attributed to adult dispersion from the reserve ^(17,20) 4. 50% decrease in yield in CPUE after reserve fished again ⁽²⁰⁾
Balicasag						
<p>1. Established in 1986⁽²³⁾ 2. Sanctuary (8 ha) comprises 26% of the 31 ha of the reef⁽²³⁾ 3. Buffer zone is 147 ha and extends to 500 m offshore⁽²³⁾</p>						
1. Conservation of coral reefs through community-based management ⁽⁷⁸⁾	1. Two zones: No fishing in the sanctuary, non-destructive methods in the reserve (buffer) ⁽²³⁾	1. Supported and managed by the local community ⁽¹⁹⁾	1. Local management committee	1. Involved in planning and management	1. Lack of alternative economic activity	1. After 1 year, increase in number of species and abundance of genus targeted by fishers and some non-target fish ⁽²³⁾

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Pamilacan						
	<ol style="list-style-type: none"> 1. Established in 1985⁽²³⁾ 2. Coral reef, coral coverage of 17%⁽²⁴⁾ 3. Sanctuary (14 ha) comprises 8% of the 18 ha of the reef⁽²³⁾ 4. Buffer zone is 339 ha and extend to 500 m offshore⁽²³⁾ 5. Fishing relies on pelagic species (80% of the catch) because of tradition or lack of reef⁽²⁴⁾ 6. Invertebrate collecting at low tide is very important and is heavily exploited⁽²⁴⁾ 					
1. Conservation of coral reefs through community-based management ⁽⁷⁶⁾	1. Two zones: No fishing in the sanctuary, non-destructive methods in the buffer ⁽²³⁾	1. Supported and managed by the local community ⁽¹⁹⁾ contradicted by Savina ⁽²⁴⁾	1. Local management committee ⁽²³⁾	1. Involved in planning and management	1. Fishing is the principal activity of the 500 residents of the island 2. Lack of alternative economic activities	1. After 1 year, increase in number of species and abundance of genus targeted by fishers and some non-target fish ⁽²³⁾
Apo Reserve						
	<ol style="list-style-type: none"> 1. Established in 1982⁽²²⁾ although legal framework completed in 1985⁽²²⁾ 2. Shallow coastal reef, coral coverage of 64% 3. Reserve, 4.5 km long, constitutes 10% of the total area (1.06 km² to the 60m isobath)⁽²²⁾ 4. Restricted fishing zone is 284 ha and extends to 500 m offshore⁽²³⁾ 5. 200 fishers on the Island generating high fishing pressure; 500 permanent residents⁽²²⁾ 6. Fishing relies on reef (68% of the catch)⁽²⁴⁾ 					
1. Conservation of coral reefs through community-based management ⁽²³⁾	1. Closed to fishing ⁽²⁵⁾ 2. Organised in 2 zones: the reserve (closed to fishing) and the restricted fishing zone (non-destructive methods only)	1. Agreement between the municipality, the university and the community ^{(22) (23)} 2. Marine conservation and education program since 1979 ⁽²³⁾	1. Enforcement not strict ⁽²⁵⁾ 2. Controlled by the community ⁽²²⁾	1. Community involved in the planning 2. Local management committee ⁽²³⁾	1. Fishing is the principal activity of the 500 residents of the island 2. Lack of alternative economic activities	1. Mean density and mean species richness of large predators increased steadily with time after the closure in the reserve and the fished area, attributed to fish dispersing outside the reserve as a consequence of biomass build-up in reserve ⁽²²⁾ 2. Increase in density by eight-fold with time ^(21,22) 3. Serves as example for other communities e.g. Handumon and San Salvador

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Handumon reserve ⁽²⁶⁾						
<ol style="list-style-type: none"> 1. Jandayan Island, Philippines 2. Double barrier reef of 33 ha, includes several habitats: corals, sargassum, mangrove and deeper water 3. Adjacent area closed to destructive fishing techniques 4. This area was once the richest fishing area and key area for sea horses 5. Decline caused by overfishing and destructive fishing techniques 6. Half of the families rely primarily on fishing for income and food 7. Poor community: income lower than the national poverty threshold; sea horses contribute to 31-40 % of annual income for 40% of fishers 						
<ol style="list-style-type: none"> 1. Seahorse conservation project 2. Rebuild ecosystem to sustain viable fishery 3. Associated with creation of alternative economic activities 	<ol style="list-style-type: none"> 1. Sanctuary closed to fishing 2. Reserve open to non-destructive fishing 	<ol style="list-style-type: none"> 1. Area designated by community 2. Team of scientists, social organizers and other workers as facilitators 	<ol style="list-style-type: none"> 1. Community controlled and patrolled (fishers and municipal police) 	<ol style="list-style-type: none"> 1. Fishers do research in biology of sea horses 2. Fishers participate in surveys 3. Community informed regularly of the new results 4. Involved in planning and management 	<ol style="list-style-type: none"> 1. Lack of alternative economic activities 2. Part of the project is to create alternatives for income ⁽²⁷⁾ 	<ol style="list-style-type: none"> 1. Improved yield of fish; abundance and body size of fish reported ⁽²⁷⁾ 2. High compliance
San Salvador Island ⁽²⁸⁾						
<ol style="list-style-type: none"> 1. Legalised in 1989 2. Sanctuary: 125 ha, surrounded by fishing reserve (circling the island to approximately 20 m isobath) 3. Community of diverse ethnic backgrounds and fishing tradition ⁽²⁹⁾ 4. 250 families (1500 people) live on the island; 60% derive income from fishing and 36% from farming ⁽²⁹⁾ 						
<ol style="list-style-type: none"> 1. Better management of resources 2. Rebuild destroyed and overused ecosystems 	<ol style="list-style-type: none"> 1. Sanctuary close to fishing 2. Reserve open to non-destructive fishing 	<ol style="list-style-type: none"> 1. Volunteers and community organisers served as facilitators and had support from international organisation and national government 2. Resolutions drafted in general assembly meetings 	<ol style="list-style-type: none"> 1. Enforcement by residents and municipality 2. Municipality declared reserve and later a national ordinance reinforces it 3. Two organisations: MPSS, a conservation committee for San Salvador) and LTK (management body) ⁽²⁹⁾ 4. Project includes exploration of alternatives economic activities and erosion control by replanting trees ⁽²⁹⁾ 	<ol style="list-style-type: none"> 1. Involved in planning and management 	<ol style="list-style-type: none"> 1. Alienation of people adversely affected by the project 2. Lack of coordination of different leaders for implementation phases 3. Weakness of the management body 	<ol style="list-style-type: none"> 1. Violations decreased with time 2. Survey show substantial increases in population abundances 3. Increase in yield noted by fishers ⁽²⁹⁾ 4. Slow rebuilding because of past destruction ⁽²⁹⁾

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Kenya						
Malindi and Watanu Marine National Park (MNP)						
	<ol style="list-style-type: none"> 1. Protected since 1968 ⁽³⁰⁾ 2. Encompasses shallow reefs close to the coast, very accessible to artisanal fishers ⁽³¹⁾ 3. Malindi is 6 km² and Watanu is 10 km² ⁽³²⁾ 					
N/A	<ol style="list-style-type: none"> 1. No fishing or collecting allowed ⁽³¹⁾ 2. Good record of protection although poaching occurs ⁽³⁰⁾ 	N/A	N/A	N/A	<ol style="list-style-type: none"> 1. Past history of overfishing and destructive practices still have an impact ⁽³¹⁾ 2. Siltation on reef is a problem ⁽³¹⁾ 	<ol style="list-style-type: none"> 1. Level of habitat destruction by dynamiting before closure and siltation decreases the benefits from closure e.g. Malindi ⁽³¹⁾ 2. Increase in density of certain species, increase in predatory species ⁽³⁰⁾ 3. Impact on keystone species such as urchins ⁽³⁰⁾
Mombasa MNP						
	<ol style="list-style-type: none"> 1. Established in 1986 ⁽³²⁾, policed since 1990 ⁽³³⁾ 2. 10 km² ⁽³²⁾ 					
N/A	<ol style="list-style-type: none"> 1. No fishing or collecting ⁽³³⁾ 	N/A	N/A	N/A	N/A	<ol style="list-style-type: none"> 1. Rapid rebuilding of fish and coral population observed ⁽³²⁾
Kisite Marine National Park (KMNP)						
	<ol style="list-style-type: none"> 1. Established in 1974 ⁽³²⁾ but policed since 1989 ⁽³⁴⁾ 2. 28 km² ⁽³²⁾ 3. Coral reef 4. Close to the city of Shimoni and adjacent to the Mpunguti reserve ⁽³⁵⁾ 5. Local population dependent on fishing (often only revenue) and tourism ⁽³⁵⁾ 					
N/A	<ol style="list-style-type: none"> 1. No fishing ⁽³⁴⁾ 	N/A	<ol style="list-style-type: none"> 1. Managed by Kenya Wildlife Service ⁽³⁴⁾ 	N/A	<ol style="list-style-type: none"> 1. Potential conflict between fishers and people related to tourism industry for access to resources. The park is seen as depriving fishers of fishing grounds ⁽³⁵⁾ 	<ol style="list-style-type: none"> 1. Survey in Sept. 1992 and Jan. 1994 for commercial species: higher densities of some commercial species than the Mpunguti MNP ^(34:35) 2. More urchin in the reserve than the park because of overfishing of their predators

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Mpungiti MNP (MMNP)						
	1. Policed since 1989 ⁽³⁴⁾					
N/A	1. Traditional fishing (hand-lining and basket trapping) permitted ⁽³⁴⁾	N/A	1. Managed by Kenya Wildlife Service ⁽³⁴⁾	N/A	N/A	1. Lower densities of commercial species than Kisite MNP
Mediterranean France Scandola Natural Reserve (within the Corsica Regional National Park)						
	1. Created in 1975 at the Corsica Regional Natural Park instigation ⁽³⁶⁾ 2. Peninsula, 1000 ha of marine and 1000 ha of terrestrial habitat, within the Park territory ⁽³⁶⁾ 3. Rocky and steep bottom, shore: sea cliffs ⁽³⁶⁾ 4. Access difficult, low frequenting					
1. Conservation and scientific observation and experimentation ⁽³⁶⁾	1. No underwater and sport fishing, no scuba diving (integral) ⁽³⁶⁾ 2. Commercial fishing permitted in a non-integral part of the reserve ⁽³⁶⁾	1. Initiative of the Park, created by national government ⁽³⁶⁾	1. Within the Regional Natural Park ⁽³⁶⁾ 2. Managed by an organisation under of the Provincial administrator ⁽³⁶⁾ 3. Scientific committee created to help with decisions and research development ⁽³⁶⁾	1. Management organization includes local villages and National government	1. High disturbance in the non-integral part of the reserve by boat anchors and fishing ⁽³⁷⁾	1. Density and biomass (larger individuals) of large and common species increased in integral reserve abundance 4 times of rocky substrata ⁽³⁷⁾ 2. Effect undetectable in seagrass bed because fishing pressure lower in this habitat combine with higher number of predators in the reserve ⁽³⁷⁾ 3. Integral reserve harbour more rare species ⁽³⁷⁾ 4. less seasonal variation in the reserve ⁽³⁸⁾

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Lavezzi Islands Natural Reserve						
		<ol style="list-style-type: none"> Created in 1982 at the instigation of the Association of the Park`s friends ⁽³⁶⁾ Outside the Park territory, 70 ha of terrestrial and 5000 ha marine habitat ⁽³⁶⁾ Archipelago, sheltered beaches, high frequentation 				
1. Conservation and scientific observation and experimentation ⁽³⁶⁾	1. No underwater fishing ⁽³⁶⁾	1. Local people initiative ⁽³⁶⁾	<ol style="list-style-type: none"> Managed by municipal government and the association of the Park`s friends ⁽³⁶⁾ Scientific committee created to help with decisions and research development ⁽³⁶⁾ 	1. See management	<ol style="list-style-type: none"> Excessive number of visitors ⁽³⁶⁾ Degradation by boat anchors and trampling, endangering habitats ⁽³⁶⁾ Overgrazing by stocks ⁽³⁶⁾ Waste water by non-reserve islands with increased urban development ⁽³⁶⁾ 	N/A
Carry-le Rouet ⁽³⁹⁾						
		<ol style="list-style-type: none"> 1.85 ha extending to 26-28m depth Protected since 1982 Near an urbanised area Rocky bottom with mosaic of sandy, rock and seagrass patches A rather common instead of an exceptional site 				
N/A	1. No fishing, no scuba diving, no anchoring	N/A	N/A	N/A	N/A	1. A 3-year census compared reserve with non-reserve sites after 10 years of protection showed large increases in density and size of target species for sport and commercial fishery

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Mediterranean Spain Tabarca Island Reserve ⁽⁴⁰⁾						
1. 1400 ha ⁽⁴⁰⁾ 2. Declared in 1986 3. Rocky reefs, seagrass beds, and several islets 4. Total interdiction of the coastal fishery considered unfeasible because of the economic importance of that activity ⁽⁴¹⁾						
1. Protection of seagrass beds habitats 2. Conserve commercial species, (Reserve would restock the adjacent fishing grounds) ⁽⁴¹⁾ 3. Allow regional development, and traditional uses	1. Management zoning: A. Core area (100ha): no activity except research; B. Buffer area (630ha): around the core area; controlled scuba diving and selective fishing seasonal allowed; C. Peripheral (670ha): selective fishing, sport fishing, swimming controlled scuba diving, vessels mooring in marked sections	1. Created by governmental decree but process not described	1. Strictly enforced: artificial reef prevents trawling ^{b (41)} 2. Management by a specially created commission composed of representatives of all levels of government, central, regional and municipal 3. One scientific advisor coordinates scientific activities ⁽⁴¹⁾ 4. Enforced by 2 fish-keepers who also participate in surveys ⁽⁴¹⁾ 5. Have visual census of fauna, surveys of fishing, monitoring of artificial reefs ⁽⁴¹⁾	1. Commercial fishermen, ecological associations and other organisations may have a representative (at the commission) who may propose resolution but have no decision-making powers 2. Fishers were originally opposed to the reserve	1. Population of 500 in the summer, 25 in winter who make a living from artisanal fishery and tourism 2. Regulation of visitors and surveillance remains a problem	1. Increase in stock size (in 6 years) 2. Increase in yield around the reserve by 50-85%
Medes Islands Reserve						
1. Created in 1990 2. 550 ha 3. Two islets and small emergent rocky reefs, algae beds ⁽⁴²⁾						
1. Protection of benthic communities ⁽⁴⁰⁾	1. Restricted fishing ^(41,42)	1. Created by governmental decree but process not described	N/A	N/A	N/A	1. Target species for spear fishing more abundant in reserve ⁽⁴²⁾ 2. Higher density, larger size and species richness in reserve ⁽⁴²⁾ 4. Lower density of small fish (unexplained) 5. Documented a change in diurnal pattern of fish activity ⁽⁴²⁾

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
New Zealand Leigh Marine Reserve						
<ol style="list-style-type: none"> Established in 1975⁽⁴³⁾ while management committee began its work in Dec. 1986⁽⁴⁴⁾ Voluntary ban on spear fishing since 1970⁽⁴³⁾ Very varied habitat including: hard substrate down to 4m deep covered with algae; echinoid-dominated flats between 4-10 m kelp forest in deeper water⁽⁴³⁾ 500 ha on the North East Coast, 5km of coast line⁽⁴⁴⁾; isolated location⁽⁴⁵⁾ 						
<p>1. Conservation for experimental and scientific value around the University of Auckland Marine Laboratory⁽⁴⁴⁾</p>	<p>1. No fishing or collecting, no disturbance⁽⁴⁴⁾</p>	<p>1. Campaign of information and mobilisation initialised by a professor of the University laboratory⁽⁴⁴⁾</p> <p>2. Several organizations became active in the process and finally the Marine Department produced a legislation specific to that reserve (adopted in 1971). The whole process took 10 years⁽⁴⁴⁾</p> <p>3. The law requires that non-government organizations propose a reserve⁽⁴⁴⁾</p>	<p>1. Appointed management committee of 5 composed of 1 officer of the Fisheries Management Division, 2 from local county, 1 from Auckland University, 1 from N.Z. Underwater Association⁽⁴⁴⁾ that hires the rangers to enforce regulations⁽⁴⁴⁾</p> <p>2. Monitoring began in 1976-1977⁽⁴⁴⁾</p>	<p>1. Not involved at the beginning and people deprived of their usual access. It took several years to convince large sections of the population that the reserve was a good thing⁽⁴⁴⁾</p>	<p>1. Local fishers, divided on the issue are now fishing at the boundary and are vigilant against poaching of rock lobster. They also support the reserve⁽⁴⁴⁾</p>	<p>1. Monitoring within the reserve showed no clear trend between 1976-1982⁽⁴³⁾</p> <p>2. Comparison with control site in 1988 showed larger abundance of commercial species (rock crab, snapper, blue cod, red moki.) within the reserve⁽⁴³⁾</p> <p>3. Increase in size and number of rock lobster in the reserve⁽⁴⁴⁾</p> <p>4. Red moki abundance and body size larger in the reserve than heavily fished adjacent grounds⁽⁴⁶⁾</p>

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Poor Knight Islands						
	<ol style="list-style-type: none"> 1. Uninhabited islands 20km offshore in the path of warm currents ⁽⁴⁴⁾ 2. Habitat of interests, most diverse marine life, best diving site in N.Z. ⁽⁴⁴⁾ 3. Established in 1981⁽⁴⁷⁾ 4. Extend from shoreline to 800 m seaward ⁽⁴⁷⁾ 					
1. Preserve underwater fauna and flora and enhance recreational opportunities ⁽⁴⁷⁾	<ol style="list-style-type: none"> 1. Small no-fishing zone surrounded by a zone where regulated recreational fishing is allowed ⁽⁴⁷⁾ 2. The general population seemed to agree with that proposition at the time of the reserve creation ⁽⁴⁷⁾ 3. The special fishing notice expired in 1989 and this generated a debate opposing local commercial associations related to sport fishery and the general populations (tourists from other regions of NZ) ⁽⁴⁷⁾ 	<ol style="list-style-type: none"> 1. Managed by the Department of Conservation 2. In response to the debate (previous cell) a wider consultation began in Dec 1995. It seeks submissions from natives, fishers, local and national populations ⁽⁴⁷⁾ 	<ol style="list-style-type: none"> 1. Fishing rules are complex ⁽⁴⁴⁾ and some fishing techniques generate a fair amount of by-catch ⁽⁴⁷⁾ 	N/A	<ol style="list-style-type: none"> 1. Ecological issues include the impact of sport fishing (and its by-catch) in a territory dedicated to conservation. The relative small size of the no-fishing zone may not be enough to achieve the protection of the marine organisms ⁽⁴⁷⁾ 2. Sport fishing constitutes the livelihood of several charter boat operators and fishing pressure is likely to increase. Public support is high against fishing ⁽⁴⁷⁾ 3. Fishing rules are complex and confusing complicating law enforcement ^(44,47) 4. Maori people are in favour of prohibiting the fishing ⁽⁴⁷⁾ 	N/A

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Seychelles						
Cousin Island Nature Reserve ⁽⁴⁸⁾						
		<ol style="list-style-type: none"> Established in 1968, also declared as a special reserve by the government in 1975 so all wildlife is protected 1.5 km², 400 m wide No tourist diving occurring Coral reef 				
1. Started as a bird and turtle reserve	1. No fishing, no habitat disturbance	N/A	<ol style="list-style-type: none"> Managed by Bird Life International Enforcement effective; 1 resident Seychellois warden 	N/A	N/A	<ol style="list-style-type: none"> Comparison of diurnally active reef-associated species show: higher species richness, higher biomass than less protected areas (Baie Ternay and Curieuse Parks) Targeted species by fisheries have higher biomass than in less protected sites Efficient protection of turtle adults and eggs
Sainte Anne Marine National Park ⁽⁴⁸⁾						
		<ol style="list-style-type: none"> Established in 1973, enforcement began in 1975 14.2 km² The most popular tourist site for diving Coral reef 				
1. Fish and wildlife protection	<ol style="list-style-type: none"> No fishing, no habitat disturbance Consumptive fishing allowed for residents of the park 	N/A	<ol style="list-style-type: none"> Managed by the Government of Seychelles Actively patrolled but close to the capital so poaching is a problem 	N/A	N/A	<ol style="list-style-type: none"> See Cousin reserve, point #1 No improvement for target fish because of poaching and limited fishing allowed in the reserve

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Baie Ternay Marine National Park ⁽⁴⁸⁾						
	<ol style="list-style-type: none"> 1. Established in 1979 2. 0.8 km² 3. Not widely used by tourist 4. Coral reef 					
1. Fish and wildlife protection ⁽⁴⁸⁾	1. No fishing, no habitat disturbance	N/A	<ol style="list-style-type: none"> 1. Managed by the Government of Seychelles 2. No effort to enforce 	N/A	N/A	<ol style="list-style-type: none"> 1. See Cousin reserve, point #1 2. No improvement for target species
Curieuse Marine National Park ⁽⁴⁸⁾						
	<ol style="list-style-type: none"> 1. Established in 1979 2. 13.7 km² 3. Widely used by tourists 4. Coral reef 					
1. Fish and wildlife protection	1. No fishing, no habitat disturbance	N/A	<ol style="list-style-type: none"> 1. Managed by the Government of Seychelles 2. Patrolled by day only due to lack of resources; in 1995 resources were supposedly increased 	N/A	N/A	<ol style="list-style-type: none"> 1. See Cousin reserve, point #1 2. No improvement for target species

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
<p>New Caledonia Southeast Lagoon of New Caledonia</p>						
<p>1. Four coralline and one continental islands and their reefs in a lagoon, close to Nouméa. Total area: 27 km² ⁽⁴⁹⁾ 2. Declared in 1989, enforced in 1990 ⁽⁴⁹⁾ (contradicted by Jourde 1985 ⁽⁵⁰⁾ who stated that Amedée Lighthouse Island and Maître were declared closed to fishing in 1981) 3. High fishing pressure around Nouméa, the capital, low elsewhere ⁽⁵⁰⁾ 4. Main uses were commercial and recreational fishing (including spear fishing) ⁽⁵⁰⁾</p>						
1. Protect and restore from damages caused by excessive tourism ⁽⁵⁰⁾ and probably overfishing	1. Closed to fishing and harvesting ^(49,50)	N/A	N/A	N/A	1. Islands not equally protected and at different distances from Nouméa	<p>1. Monitoring before and after 5 years of protection for reference and closed stations ⁽⁴⁹⁾ 2. Reserves showed an increase in species richness and density and biomass for exploited and non-exploited species ⁽⁵¹⁾ 3. In fished grounds, no differences in density except for 3 species that were attributed to interannual variation ⁽⁵⁰⁾ 4. Species considered as index of reef health have increased in both reserve and non-reserve which attributed to increase in recruitment patterns ⁽⁴⁹⁾ 5. Reserve effect stronger where patrolling more efficient ⁽⁴⁹⁾</p>

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
<p>Ile de Mayotte (Indian Ocean) Langogori Marine Reserve ⁽⁵²⁾</p>						
<p>1. Created in 1990, enforced in 1992 2. Coral reefs 3. In recent years, observed decreases in CPUE: decrease of yield by 57% and increase in number of artisanal fishers from 1700 to 2600, and changes to motorised and seaworthy boats</p>						
1. Protection from overexploitation and siltation due to mismanagement of the terrestrial habitat	N/A	N/A	N/A	N/A	1. Fishers depend mainly on the lagoon	1. Comparison of reserve and non-reserve site after 3 years (1995) 2. Most exploited species are more abundant and biomass larger in reserve (especially carnivores) 3. Size structure of certain species changed for larger individuals in the reserve
<p>St. Lucia, West Indies Maria Island Marine reserve ⁽⁵³⁾</p>						
<p>1. Declared in 1982 but boundaries settled in 1988, fishing stopped in 1987 2. Fishing for sea urchins went from family-based subsistence to commercial because of high market price 3. Stocks of urchins depleted</p>						
N/A	1. No fishing	N/A	N/A	1. Involved in planning of the reserve and decision-making; boundaries have social approval 2. Fishers informally enforce the boundaries although they may not agree personally with the reserve	N/A	1. Study compares open-access, reserve and traditional control (village-controlled access to the fishery; see Section 1): Increase in densities of white-spined sea urchins in reserve and traditional management

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Soufrière Marine Management Area (SMMA) ⁽⁵⁴⁾						
	<ol style="list-style-type: none"> Became operational in 1995 10 km of coast coral reefs 					
<ol style="list-style-type: none"> Integrated management of the area that allows for non-conflicting sustainable use of marine resources Community-level resource management 	<ol style="list-style-type: none"> Composed of 5 marine reserves (no fishing), 10 Fishing Priority Areas, 4 Multiple Use Areas, 4 Yacht Mooring Areas In 1996, protection relaxed in 3 reserves to allow licensed fishers to fish in specific areas 	<ol style="list-style-type: none"> Created during a series of conflict resolution meetings at the community level where agreement was reached on use and management of the marine resources in the area Near shore fishers were largely unrepresented and hence not adequately considered in zoning 	<ol style="list-style-type: none"> Co-managed under Soufrière Foundation through a Technical Advisory Committee comprising representatives of resources user-groups, NGOs and government management agencies 	<ol style="list-style-type: none"> Fishers, dive operators, yachtmen, NGOs and government 	<ol style="list-style-type: none"> Marine reserves have been set in Near shore fishers' preferred sites (Close to shore, less dangerous. Individuals fishing with small pots and gillnets had difficulty finding suitable grounds outside reserves). Hence, most of them are fishing illegally in the reserve 	<ol style="list-style-type: none"> After the creation of reserves, there has been a turnover of fishers and new fishers chose large pots (used in deeper waters) over gillnets and small pots (shallow grounds), and effort increased By working harder, fishers maintained their CPUE although they lost 50% of their fishing grounds.
Barbados						
Barbados Marine Reserve ⁽⁵⁵⁾						
	<ol style="list-style-type: none"> Established in 1981 Shore length of 2.2 km Fringing reefs separated by sand and hard-bottom 					
N/A	<ol style="list-style-type: none"> No fishing except cast-netting for clupeids 	N/A	<ol style="list-style-type: none"> Management by National Conservation Commission (within a Ministry) Enforcement insufficient to prevent some illegal fishing including spear fishing 	N/A	N/A	<ol style="list-style-type: none"> Comparison of reserve and non-reserve in 1992 Higher density of large trappable fish in the reserve especially for sedentary species Decrease from centre to boundaries for mobile species Larger mean size for some species

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
<p>Bahamas Exuma Cays ⁽⁵⁶⁾</p>						
<p>1. Protected since 1958 but closed to fishing in 1986 ⁽⁵⁷⁾ 2. 456km², 40 km of coastline to the 30 m isobath line, located between developments 3. Shallow platform covered with sand and seagrass, going to deeper water and varied bottoms (sand, hard-bottom, vegetation)</p>						
<p>1. Preserve the natural heritage of the Exuma Cays and not specifically for fisheries management ⁽⁵⁷⁾</p>	<p>1. No collection or fishing</p>	<p>N/A</p>	<p>1. Enforcement by 1 full-time warden</p>	<p>N/A</p>	<p>N/A</p>	<p>1. Study of effect of reserve on queen conch (<i>Strombus giga</i>), compared of fished grounds and reserve 2. Density of adults and larvae higher in reserve 3. Importance of protecting migrating path of the juveniles against exploitation (juveniles migrate to deeper water as they grow) 4. The success of the reserve is due to the fact that it is a natural site of accumulation of larvae from outside and that it is protecting spawning adults. It would be too small to sustain the entire coast by itself. 5. Studies since 1990 on spiny lobster and grouper (targeted by fishery) show greater species diversity, biomass, abundance, potential reproductive output and larval densities ⁽⁵⁷⁾</p>

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Netherlands Antilles						
Saba						
	<ol style="list-style-type: none"> 1. Created in 1987 ⁽⁵⁸⁾ 2. Represent 25% of the circumference of the island ⁽⁵⁸⁾ 3. Mixture of corals, gorgonians and true reefs ⁽⁵⁸⁾ 4. Few commercial fishers (15), intensive fishing in offshore regions. 5. Recreational fishing (handline, spear diving) on reefs ⁽⁵⁸⁾ 					
N/A	1. No fishing in 15% of the Park ⁽⁵⁹⁾	N/A	1. Patrolled by park personnel ⁽⁵⁸⁾ high compliance ⁽⁵⁹⁾	N/A	N/A	1. Comparison between reserve and non-reserve (1991 and 1993) showed increase in density, biomass and size in several target species ^(58,59)

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Belize Hol Chan Marine Reserve						
<p>1. 4 km south of a town, reef and channel ⁽⁵⁸⁾, 2.6 km² ⁽⁶⁰⁾ 2. Created in 1987 ⁽⁵⁸⁾ 3. Subsistence fishing for 100 yrs in the region, snapper and grouper caught by commercial fishing and exported. Offshore fishing has declined by 90% in the 1980's because of involvement of fishers in tourist industry ⁽⁵⁸⁾</p>						
<p>1. Preserve and restore a representative sample of coral reef, mangrove sea grass areas, provide recreation and tourism services and preserve value of the area for fisheries and education ⁽⁶¹⁾</p>	<p>1. 3 zones: A. No fishing, no collecting, no anchoring except in provided mooring, regulated and controlled diving B. local fishers only, no trawling, netting spear fishing; sports such as water skiing and sailing permitted C. fishing under license, no mangrove clearing ⁽⁶¹⁾</p>	<p>1. In 1972, awareness of need for protection and creation of marine reserve but no agreement among interests groups; in mid-1980's, social awareness of need for protection for their livelihood awareness ⁽⁵⁹⁾ 2. Local advisory committee included the Tourism industry, fishermen's cooperative (existing since the mid-sixties), Tourist guide association, Belize fishery unit, and the Wildlife Conservation Society. Help from scientists to guide the process. ⁽⁶¹⁾ 3. Management plan based on questionnaire given to users ⁽⁶¹⁾ 4. Ordinance from the Government when fishers agreed too ⁽⁶¹⁾</p>	<p>1. Small team to manage the park: warden, manager, biologist 2. Links with community maintained and local advisory committee have continued input ⁽⁶¹⁾ 3. Continuous training of staff on research, interpretative activities, permanent moorings, scuba diving ⁽⁶¹⁾</p>	<p>1. Community totally involved in the process and the management</p>	<p>1. Development and habitat alteration adjacent to the reserve (mangrove cutting, increased siltation and pollution) ⁽⁵⁸⁾</p>	<p>1. Census in 1991 and 1993; Although the power is low, census show an increase in density, biomass and size in several target species ⁽⁵⁸⁾</p>

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
USA						
Florida Keys National Marine Sanctuary (FKNMS)						
<p>The largest marine sanctuary on the East Coast, USA.</p> <ol style="list-style-type: none"> Covers 8,899 km² of coastal water and one of the most utilised coral reefs in the world ⁽⁶¹⁾. Includes interdependent and interconnected habitats such as patch and bank reefs, seagrass meadows, soft and hard bottom, and coastal mangroves. FKNMS was designated in 1990, as inspired by a series of ship groundings in 1989 coupled with the growing threats of coral diseases and increased water quality problems (Florida-Keys.info-access.com). Two previously established NMS (Key Largo in 1975 and Looe Key in 1981) are incorporated in the FKNMS. 						
<ol style="list-style-type: none"> Preserving or restoring the conservation, recreational, ecological, or aesthetic values of localised areas ⁽⁶²⁾. The purposes of Florida Keys National Marine Sanctuary and Protection Act (FKNM SPA) are: <ol style="list-style-type: none"> Protect marine resources of Florida Keys. Educate the public about the reef environment. Promote marine research. Develop a sanctuary management plan that would regulate human uses that adversely affect the resources of the FKNMS ⁽⁶³⁾. 	<ol style="list-style-type: none"> Five different types of zones to regulate certain uses within sensitive areas of high ecological value, thus promoting resource protection and separating user groups: (i) wildlife management areas, (ii) ecological reserves, (iii) sanctuary preservation areas (SPAs), (iv) existing management areas, and (v) special use areas ⁽⁶³⁾. 	<ol style="list-style-type: none"> The overall management plan includes enforcement, monitoring and visitor education programmes and a reef-restoration plan. NOAA coordinated development of the Draft Management Plan and Environmental Impact Statement for the FKNMS over a 4-year period and released these documents to the public in March 1995 ⁽⁶³⁾. In September 1996, NOAA released the Final Management Plan, but NOAA, Congress and the State of Florida may revise the plan further before it is implemented ⁽⁶³⁾. 	<ol style="list-style-type: none"> Have a legislation to protect coral reefs and seagrass beds from physical destruction ⁽¹⁾. Has a water-quality protection programme, to control water at the source, which also provides effective control over residential run-off and riverine flow ⁽¹⁾. FKNMS is supervised by the Sanctuary Superintendent and an administrative staff in the central location for the populated portion of the Keys, plus other officers in regional offices (Florida-Keys.info-access.com). NOAA will take the lead responsibility for implementation of zoning and will provide the bulk of the funding for the ecological reserves, SPAs and special-use areas ⁽⁶³⁾. Other agencies, such as the Florida Dept. of Environmental Protection, the US Fish and Wildlife Service, the US Coast Guard and NGOs will 	<ol style="list-style-type: none"> Public hearing followed the release of the document of the Draft Management Plan ⁽⁶³⁾. Use of "citizen governance" system by establishing the Sanctuary Advisory Council (SAC) whose 22 selected members include sanctuary managers, members of government agencies, representatives of conservation groups, recreational and commercial user groups and the scientific community, as well as representatives from the Florida Governor's Office of Environmental Affairs and the Monroe County Board of County Commissioners ⁽⁶³⁾. The SAC members ensure that the interests of user groups are represented in the planning process and implementation. They also serve as liaisons to explain sanctuary policies to their respective interest groups, and they were able to develop an acceptable and feasible plan for the debated sanctuary zones ⁽⁶³⁾. 	<ol style="list-style-type: none"> Large number of different types of federal and state MPAs in the Florida Keys, although is an evidence for a shared concern, suggests potential duplication of resources, coordination difficulties and possibly unharmonious management goals. An organized local opposition to any MPAs in Florida Keys existed since the state attempt to establish a marine reserve in Monroe County, and foreshadows the protracted battles that continue to surround establishment of FKNMS ⁽⁶³⁾. Conch Coalition conducted a persistent grassroots campaign against the FKNMS. Other groups united treasure salvors, commercial fishers, developers and other residents of the country in opposing the plan ⁽⁶³⁾. NOAA's revisions of the Draft Management Plan in an attempt to minimise some public criticism may be viewed by members of 	N/A

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
			provide assistant in various activities. 6. Enforcement by the Florida Marine Patrol (FMP) ⁽⁶³⁾ .	4. Plan to promote stewardship by sanctuary users by involving community through preventive law enforcement, workshops, public lectures, and school programs in environmental education ⁽⁶³⁾ .	the public and NGOs as 'watering down', and significantly weakening the plan so that it hardly deserves their continued support ⁽⁶³⁾ . 4. Funding limitations and uncertainties ⁽⁶³⁾ .	
Looe Key National Marine Sanctuary ⁽⁶⁴⁾						
<p>1. Established in 1981, as prompted by the designation of the Key Largo NMS 70 miles north and the awareness of the threats to the reefs from over-use.</p> <p>2. A 19 km² sanctuary in the only fully developed bank reef in the region. A high productivity reef which attracts a high level of visitation leading to a variety of human-related impacts affecting the resources of Looe Key Reef, such as shell collecting, coral damage, fish removal from spear fishing, tropical fish collecting, wire fish traps and hook-and-line fishing.</p>						
<p>1. To protect the marine environment and resources of the Sanctuary.</p> <p>2. To encourage recreational use that is compatible with Sanctuary resources, commercial uses and research purposes.</p> <p>3. To use interpretation and education to increase public awareness of the resources and significance of the Sanctuary.</p> <p>4. To direct research activities towards increased understanding of the Sanctuary.</p>	<p>1. Ban on coral collecting and damage</p> <p>2. Ban on spear fishing, use of fish or lobster traps, live collection of small tropical and other damaging activities.</p>	N/A	<p>Enforcement has taken several phases.</p> <p>1. The initial phase primarily utilised 'officer presence' as a deterring influence, combining with public education.</p> <p>2. A more aggressive phase was later used with issuance of written warnings.</p> <p>3. The current phase consists of a combination of verbal warnings, written warnings, citations and arrests. The level of compliance is now high, especially in the group of commercial fishers.</p> <p>4. Installation of 52 mooring buoys</p>	<p>Lesson learned -- a combination of clear demonstration of management success and well-executed public information programs best enhances visitor compliance and public support.</p>	<p>1. Although supported by conservation groups, the plan faced opposition from many local businesses (particularly diver-related) who questioned the practical benefits and the extent of resource protection that would result from creating a MPA.</p> <p>2. Commercial fishers also opposed the plan as they felt they would not benefit from it, but rather would suffer.</p>	<p>1. One study compared fish populations on reefs with and without spear fishing. The results showed that the abundance of many fish species increased in the two years following Sanctuary designation (snappers increased by 93 per cent and grunts by 439 per cent). The spear fishing ban is a major reason for the increase.</p> <p>2. Installation of buoys was successful, as measured by the noticeable reduction in the extent of anchor damage suffered by corals.</p> <p>3. A study by Hunt (1991), found that spiny lobster left the small (0.5 km²) core area of the reserve where they were completely protected and each night foraged over a large surrounding area where they were captured by divers and traps. This suggests that minimal protection is provided to cover the night-time foraging range of lobsters ⁽⁷⁾.</p>

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Key Largo National Marine Sanctuary						
1. Established in 1975, total area of 260 km ² , featuring coral reef and hard bottom communities ⁽⁶²⁾ .						
1. Research oriented marine sanctuary. Some of the major research efforts include a study of current and temperature patterns; a study to assess the effects of spear fishing on snappers and groupers; a biological inventory and reef health assessment project; and an interdisciplinary research program to study recovery of reef corals damaged by a tanker grounding ⁽⁶²⁾ .	1. Sanctuary regulations prohibit (i) removal or destruction of natural reef features or marine life (except spiny lobsters and stone crabs), (ii) disruption of any bottom formation or growth, (iii) dredging, (iv) tropical specimen collecting, and (v) contact with coral formations ⁽⁶²⁾ .	N/A	N/A	N/A	N/A	N/A
Tortugas Shrimp Sanctuary						
1. Established in 1981, off southwest Florida, covering part of the Tortugas fishing grounds, to the west of Key West ⁽⁶⁵⁾ .						
1. To increase production of pink shrimp (<i>Penaeus duorarum</i>) by preventing the harvest of undersized shrimp of less than 103 mm in length ^(65,66) .	1. Initially closed to all shrimp trawling in 1981. Later in 1983, a small part was opened to commercial trawling and closed again in 1984 ⁽⁶⁵⁾ .	1. Closing of the area for trawling was done by the State of Florida and the federal government, as recommended by the Gulf of Mexico Fishery Management Council (GMFMC) ⁽⁶⁷⁾ .	1. GMFMC provided funds to conduct studies to evaluate the effectiveness of the sanctuary ⁽⁶⁷⁾ .	Fishing communities were not happy with the plan. For example: 1. Many commercial shrimpers and operators believed that prohibition of trawling in the area would only decrease production and cause financial hardship ⁽⁶⁵⁾ . 2. Seafood industry argued that modern technology enable them to utilise smaller shrimp without waste and it was not in their interest to prohibit trawling.	1. Induced illegal trawling as the area became more productive ⁽⁶⁵⁾ . 2. Council vs. NMFS (see Section 1) ⁽⁶⁶⁾ .	1. High recruitment variability in 1981-83 and illegal trawling inside the sanctuary caused variation in commercial landings and the failure of the sanctuary regulations to increase shrimp size and production ⁽⁶⁸⁾ . 2. However, the 1981-83 survey data indicated the 1981 Tortugas Sanctuary accomplished a major goal of the management plan because it enclosed a high proportion of small pink shrimp as they were recruited to the fishing ground ⁽⁶⁵⁾ . 3. No difference in catch, CPUE or size composition were distinguishable due to the closure (mainly because of poor compliance with the regulation by fishers) ⁽⁶⁸⁾ .

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Everglades National Park (a lobster nursery sanctuary)						
<p>1. First established as a marine park in 1947, with an underwater area of 268,615 ha ⁽⁶⁹⁾. 2. In 1980, a lobster nursery sanctuary was created in the Everglades NP ⁽⁷⁰⁾.</p>						
<p>1. To restore the natural conditions of the bay. 2. To provide more lobsters for harvest in adjacent fisheries ⁽⁷⁰⁾.</p>	<p>1. Only recreational harvest, by net, trap and line fishing, is permitted ⁽⁶⁹⁾</p>	N/A	N/A	N/A	N/A	<p>1. Fishery harvests altered the size structure of the lobster population by selectively removing nearly all of the larger individuals ⁽⁷⁰⁾. 2. Creation of lobster sanctuary displaced about 1000 recreational divers, each of whom enjoyed about 8 days of lobstering in the park each year, but increased availability of lobsters for fisheries adjacent to the park and should have restored the lobster population in the park to near natural conditions ⁽⁷⁰⁾.</p>
Fagatele Bay (Tutuila, American Samoa) ⁽⁷¹⁾						
<p>1. A very small marine sanctuary of 0.85 km², designated in 1985. Habitat of numerous fish and coral species, as well as several threatened or endangered species such as humpback and sperm whales, and hawksbill and green turtles.</p>						
<p>1. To protect the pristine condition of the Bay. 2. To research on coral recovery from infestation of crown-of-thorns starfish.</p>	<p>1. Allow subsistence fishing. 2. Zoning for commercial fishing.</p>	<p>1. Preliminary visit by the federal program officials with the Governor of American Samoa to express interest. 2. Meet with the village head, the Samoan elders and the village council. 3. Worked with Samoan territorial agencies in developing the Draft Environmental Impact Statement and to formulate the management plan.</p>	<p>1. The plan included the establishment of interpretive centre, where Samoan practices and oral traditions would be displayed, an educational curricula-development program and a community board advisory to the manager of the sanctuary.</p>	<p>1. Public hearing on the draft plan. 2. Concerns from commercial fishers were heard and the plan was adjusted accordingly.</p>	<p>1. A traditional cultural value supported the process: the opinion of the village head cannot be challenged by those of lesser standing.</p>	N/A

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Chile						
Mehuín Marine Reserve, and Las Cruces Marine Reserves						
1. Mehuín, a small reserve in the southern Chile, was established in 1978, and Las Cruces, in the central Chile, was established in 1982 ⁽⁷²⁾						
1. To protect intertidal and shallow-water grazers, in particular keyhole limpets and urchins, as they are more vulnerable to human exploitation because of the easy access ⁽⁷²⁾ .	1. Exclusion of exploitation and other disturbances by humans ⁽⁷²⁾	N/A	N/A	N/A	1. Ripple effects and multispecies fisheries. For example, interaction between limpets and algal (more limpets, less algal), and subsequent effects on other organisms ⁽⁷²⁾ . 2. Secondary effects of protection -- protection of these sites has transformed the intertidal reserves into very different communities (presence of locos reduced density of mussels and herbivorous gastropods; barnacles replaced algae) ⁽⁷⁾ .	1. Keyhole limpets in Las Cruces reserves increased in density and size relative to exploited areas, after two years of human exclusion ⁽⁷²⁾ . 2. Similar results found in Mehuín where densities of keyholes limpets almost tripled within two years, and urchins increased in size to reach 140 mm within 4 years (compared to 60 mm in exploited areas) ⁽⁷²⁾ . 3. Study of population densities of intertidal ascidian, Piure (Chile's commercially exploited invertebrate species) at the Mehuín marine reserve, compared with four exploited sites, showed that densities of Piure were more than 3 orders of magnitude higher in Mehuín. Maximum size of Piure in the reserve was 112 g, whereas outside of the reserve, individuals rarely achieved a size of more than 20 g. This study underscored the dramatic effects of human harvesting on rocky intertidal communities, and urged the Chilean authorities to establish more MPAs ⁽⁷³⁾ . 4. Populations of loco gastropods (a key-stone predator) in the two reserves were studied. Results showed increase in size of locos within the reserves when excluding from human harvesting ⁽⁷⁴⁻⁷⁶⁾

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
Venezuela Archipelago de Los Roques National Park						
<p>1. An insular reef complex located on the north-central coast, consisting of 42 islands and more than 200 sandbanks and reefs distributed around a shallow lagoon of 1-5 metre depth⁽⁷⁷⁾. The size of the national park is about 225,000 ha⁽⁷⁸⁾.</p> <p>2. Important habitat for queen conch.</p>						
N/A	<p>1. Zoning is being considered⁽⁷⁸⁾.</p> <p>2. Queen conch fishing is prohibited in some area⁽⁷⁷⁾.</p>	N/A	<p>1. Division of National Parks, Ministry of Agriculture has a management authority over the park⁽⁷⁸⁾.</p>	N/A	<p>1. The size of the park poses a real challenge for management⁽⁷⁸⁾.</p> <p>2. Illegal construction of houses after the creation of the park⁽⁷⁸⁾.</p> <p>3. Illegal fishing⁽⁷⁸⁾.</p>	<p>1. There is a lack of adults and the predominance of juveniles in the fished zone, when compared to the protected zone⁽⁷⁷⁾.</p> <p>2. Queen conch population density and mean shell length were significantly lower in fished than in protected areas⁽⁷⁸⁾.</p>
Indonesia (Overview) ⁽⁷⁹⁾						
<p>1. 24 MPAs, encompassing 2.8 million ha., have been declared since 1973. Most areas are coral-reef dominated, with seagrass and mangrove communities.</p>						
<p>1. Initiated by the government, acknowledging the need for a balance between growth and sustained use of natural resources to meet the country's needs in the next century. MPAs are considered to have a major role in the management of marine resources. The government has set the target of 10 million ha. of MPAs.</p>	N/A	<p>1. PHPA (Directorate General for Forest Protection and Nature Conservation) is responsible for drafting and implementing management plan, but the nomination of MPA is based not only on PHPA 5-year plan, but also on provincial input, and the site inventory in the Marine Conservation Data Atlas. Other sources and agencies such as the Regional Planning Office and the local sub-region administrator's office are also consulted.</p> <p>2. Criteria for site selection of proposed MPAs are adapted from those used in selecting terrestrial protected areas, i.e. diversity, naturalness,</p>	<p>1. Established legislation and organisational structures. Key legislation used for management of all protected areas in Indonesia is the Law no. 5 (1990), Conservation of Living Natural Resources and their Ecosystem Act.</p> <p>2. Department of Forestry is the leading agency for management of marine conservation.</p>	<p>1. Law no. 5 requires community involvement in the management of MPAs.</p> <p>2. All programmes include a community participation component closely linked to community awareness and education.</p> <p>3. Plans at 2 MPAs include proposals for community development officers to help community participation and park awareness.</p> <p>4. Help comes also from WWF and other NGOs.</p>	<p>1. Management planning and implementation have not kept pace with the declaration of MPAs. Only 3 of the 24 MPAs have completed management plans and they have not yet been approved by PHPA and remain unimplemented.</p> <p>2. Reasons: proximity to major urban centres, jurisdictional disputes, co-ordination, conflicting uses, scientists' participation, community awareness and training.</p>	N/A

Purpose	Level of protection	Planning process	Management process/ enforcement	Community involvement	Issues/problems	Results
		<p>representativeness, uniqueness, rareness, size, accessibility and effectiveness.</p> <p>3. The management plan for MPA is prepared by a project leader or the regional conservation staff. The plan should outline the 25-year strategy for park management, the initial 5-year work plan and the first annual management work plan.</p>				

Canada
Whytecliff Park

1. First declared a marine park in 1973, but without any protection to marine life.
2. Whytecliff Park is Canada's first no-take (fishery closure) MPA in 1993⁽⁸⁰⁾ using bottom-up approach. It was not designated as an MPA under the Oceans Act at this time (Jan 1999)

<p>1. Overall purpose: to protect the marine life within the park from all consumptive use⁽⁸⁰⁾.</p> <p>2. Four specific objectives: ecological (protecting biodiversity), multiple-use recreational activities, education and socio-economic⁽⁸¹⁾.</p>	<p>1. Marine resource harvesting closure for all species.</p> <p>2. Prohibition of removal of any plant or animal species from the terrestrial part of the park.</p> <p>3. Prohibition of harmful or damaging activities to species and natural habitats⁽⁸¹⁾</p>	<p>1. Bottom-up and partnership process: using a cooperative, cost-effective management strategy, focussed on diverse group of stakeholders towards achieving common goal⁽⁸⁰⁾.</p> <p>2. Use meetings and negotiation process as a forum for stakeholders and resource users to find solutions to their concerns and to accommodate their interests.</p>	<p>1. Changing the legal status in the water adjacent to Whytecliff Park pursuant to the Fisheries Act.</p>	<p>1. Involving public in the whole process of establishing the MPA, by forming various tactical committees⁽⁸⁰⁾.</p> <p>2. Creating positive attitude, motivation and sense of responsibility among individuals⁽⁸⁰⁾</p>	N/A	N/A
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REFERENCES

This list excludes references from the Summary Table which are given in Appendix 1

- Alcala, A. C., and Gomez, E. D., 1987. Dynamiting coral reefs for fish: a resource destructive fishing method. pp. 51-60. *In*: B. Salvat, ed. Human impacts on coral reefs: facts and recommendations, Antenne Museum Ecole Pratique des Hautes Etudes, French Polynesia.
- Alcala, A. C., and Russ, G. R., 1990. A direct test of the effects of protective management on abundance and yield of tropical marine resources. *Journal du Conseil International pour l'Exploration de la Mer*, 46:40-47.
- Alder, J., 1995. A management analysis of tropical marine protected areas: Indonesia and the Great Barrier Reef Marine Park - two Case Studies. PhD thesis, Department of Tropical Environmental Studies and Geography, James Cook University, Townsville, Australia. 234 pp.
- Attwood, C. G., Mann, B. Q., Beaumont, J., and Harris, J. M., 1997. Review of the state of marine protected areas in South Africa. *South African Journal of Marine Sciences*, 18:341-367.
- Ballantine, B., 1991. Marine reserves for New Zealand. University of Auckland, Auckland, New Zealand, Leigh Laboratory Bulletin, 25, 196 pp.
- Barley, G., 1993. Integrated coastal management: The Florida Keys example from an activist citizen's point of view. *Oceanus*, 36(3):15-18.
- Barr, J., Henwood, B., and Lewis, K., 1998. A marine protected areas strategy for the Pacific Coast of Canada. pp. 161-168. *In*: N. W. P. Munro and J. H. M. Willison, eds., *Linking Protected Areas with Working Landscapes Conserving Biodiversity*. Proceedings of the Third International Conference on Science and Management of Protected Areas, 12-16 May 1997, Science and Management of Protected Areas Association, Wolfville, Nova Scotia, Canada.
- Cabanban, A. S., and White, A. T., 1981. Marine conservation program using non-formal education at Apo Island, Negros Oriental, Philippines. pp. 317-321. *In*: Proceedings of the 4th International Coral Reef Symposium. 1.
- Carter, J., Gibson, J., Carr, A., III, and Azueta, J., 1994. Creation of the Hol Chan Marine Reserve in Belize: A grass roots approach to barrier reef conservation. *The Environmental Professional*, 16(3):220-231.
- Castañeda, P. G., and Miclat, R. I., 1981. The municipal coral reef park in the Philippines. pp. 283-286. *In*: E. D. Gomer, C. E. Birkeland, R. W. Buddemeier, R. E. Johannes, J. A. Marsh, Jr., and R. T. Tsuda, eds., 4th International Coral Reef Symposium, Manila, Philippines, 18-22 May 1981. 1.
- Christie, P., White, A. T., and Buhat, D., 1994. Community-based coral reef management on San Salvador Island, the Philippines. *Society and Natural Resources*, 7:103-117.
- Cocklin, C., Craw, M., and McAuley, I., 1998. Marine reserves in New Zealand: use rights, public attitudes, and social impacts. *Coastal Management*, 26:213-231.
- Department of Conservation, 1995. Marine reserves. A Department of Conservation information paper. Department of Conservation, Northland Conservancy PO Box 842, Whangarei, 21 pp.
- Environment Australia, 1997. Australia's Oceans Policy. Socio-cultural considerations. Department of Environment, Australia, , Issues Paper 6, .
- Fiske, S. J., 1992. Sociocultural aspects of establishing marine protected areas. *Ocean Coastal Management*, 17(1):25-46.
- Garcia-Rubies, A., and Zabala, M., 1990. Effects of total fishing prohibition on the rocky fish assemblages of Medes Islands marine reserve NW Mediterranean. *Scientia Marina*, 54(4):317-328.
- Gilman, E. L., 1997. Community based and multiple purpose protected areas: a model to select and manage protected areas with lessons from the Pacific Islands. *Coastal Management*, 25:59-91.

- Gomez, E. D., Alcalá, A. C., and Yap, H. T., 1987. Other fishing methods destructive to coral reefs. pp. 67-75. *In: B. Salvat, ed. Human impacts on coral reefs: facts and recommendations, Antenne Museum Ecole Pratique des Hautes Etudes, French Polynesia.*
- Government of Canada and British Columbia, 1998. Marine Protected Areas, A strategy for Canada's Pacific Coast. , 28 pp.
- Harvey, S., 1983. Title III of the Marine Protection, Research and Sanctuaries Act: issues in program implementation. *Coastal Zone Management Journal*, 11:169-197.
- Jennings, S., Marshall, S. S., and Polunin, N. V. C., 1996. Seychelles' marine protected areas: comparative structure and status of reef fish communities. *Biological Conservation*, 75:201-209.
- Kelsey, E., Nightingale, J., and Solin, M., 1995. The role of partnerships in implementing a new marine protected area: a case study of Whytecliff Park. pp. 235-239. *In: N. L. Shackell and J. H. M. Willison, eds., Marine protected areas and sustainable fisheries, Science and Management and Protected Areas Association, Centre for Wildlife and Conservation Biology, Acadia University, Wolfville, Nova Scotia, Canada.*
- Leenhardt, M., 1990. Le parc naturel régional et les réserves marines de Corse. pp. 85-92. *In: A. Cossu, V. Gazale, and I. Milella, eds., Marine parks in the Mediterranean. Biological and management aspects., San Teodoro, Sassari, Italy.*
- McClanahan, T. R., 1994. Kenyan coral reef lagoon fish: effects of fishing, substrate complexity, and sea urchins. *Coral Reefs*, 13:231-241.
- McClanahan, T. R., and Obura, D., 1995. Status of Kenyan coral reefs. *Coastal Management*, 23:57-76.
- McClanahan, T. R., and Shafir, S. H., 1990. Causes and consequences of sea urchin abundance and diversity in Kenyan coral reef lagoons. *Oecologia*, 83:362-370.
- McManus, J. W., 1996. Social and economic aspects of reef fisheries and their management. pp. 249-281. *In: N. V. C. Polunin and C. M. Roberts, eds., Reef fisheries, Chapman and Hall, London, 20.*
- Paisley, R. K., 1995. Science and the establishment of marine protected areas. pp. 257-264. *In: N. L. Shackell and J. H. M. Willison, eds., Marine protected areas and sustainable fisheries, Science and Management and Protected Areas Association, Centre for Wildlife and Conservation Biology, Acadia University, Wolfville, Nova Scotia, Canada.*
- Ramos-Espla, A. A., and McNeill, S. E., 1994. The status of marine conservation in Spain. *Ocean Coastal Management*, 24:125-138.
- Russ, G., 1985. Effects of protective management on coral reef fishes in the central Philippines. pp. 219-224. *In: Proceedings of the Fifth International Coral Reef Congress, Tahiti, 1985. 4.*
- Russ, G. R., and Alcalá, A. C., 1989. Effects of intense fishing pressure on an assemblage of coral reef fishes. *Marine Ecology Progress Series*, 56(1-2):13-27.
- Russ, G. R., and Alcalá, A. C., 1994. Sumilon Island Reserve: 20 years of hopes and frustration. *NAGA, the ICLARM Quarterly*, 7 (3):8-12.
- Russ, G. R., and Alcalá, A. C., 1996a. Do marine reserves export adult fish biomass? Evidence from Apo Island, central Philippines. *Marine Ecology Progress Series*, 132:1-9.
- Russ, G. R., and Alcalá, A. C., 1996b. Marine reserves: rates and patterns of recovery and decline of large predatory fish. *Ecological Applications*, 6:947-961.
- Samoilys, M. A., 1988. Abundance and species richness of coral reef fish on the Kenyan coast: the effects of protective management and fishing. pp. 261-266. *In: J. H. Choat, D. Barnes, M. A. Borowitzka, J. C. Coll, P. J. Davies, P. Flood, B. G. Hatcher, and D. Hopley, eds., Proceedings of the Sixth International coral reef symposium, Townsville, Qld, Australia. 2.*

- Savina, G. C., and White, A. T., 1986. A tale of two islands: some lessons for marine resource management. *Environmental Conservation*, 13(2):107-113.
- Sir O'Reagan, T., 1997. Maori fisheries rights and the quota management system. pp. 325-328. *In*: D. A. Hancock, D. C. Smith, A. Grant, and J. B. Beumer, eds., *Developing and sustaining world fisheries resources: the state of science and management: 2nd World Fisheries Congress proceedings*, Brisbane, Australia, August 1996, CSIRO, PO Box 1139 Collingwood, V1C 3006 Australia.
- Smith, A. H., and Berkes, F., 1991. Solutions to the 'Tragedy of the commons': sea-urchins management in St-Lucia, West Indies. *Environmental Conservation*, 18(2):131-136.
- Smyth, D., 1995. Caring for sea country - accommodating indigenous people's interests in marine protected areas. pp. 149-173. *In*: S. Gubbay, ed. *Marine Protected Areas: principles and techniques for management*, Chapman and Hall, London, UK.
- Solin, M., 1993. Final report: Achieving true marine protected areas status for Whytecliff Park. Westwater Research Centre, University of British Columbia, Vancouver, BC, Canada., 18 pp.
- Suárez de Vivero, J. L., and Frieyro, M. C., 1994. Spanish marine policy: role of marine protected areas. *Marine Policy*, 18:345-352.
- Sullivan, K., 1997. Management of New Zealand's snapper fishery: allocation of a limited resource between commercial and non-commercial uses. pp. 344-351. *In*: D. A. Hancock, D. C. Smith, A. Grant, and J. B. Beumer, eds., *Developing and sustaining world fisheries resources: the state of science and management: 2nd World Fisheries Congress proceedings*, Brisbane, Australia, August 1996, CSIRO, PO Box 1139 Collingwood, V1C 3006 Australia.
- Suman, D. O., 1997. The Florida Keys National Marine Sanctuary: A case study of an innovative federal-state partnership in marine resource management. *Coastal Management*, 25:293-324.
- Tarte, D. M., and Hegerl, E. J., 1996. Community involvement in the management of the Great Barrier Reef. pp. 396-402. *In*: *Proceedings of The Great Barrier Reef Science, Use and Management*, James Cook University of North Queensland, Townsville, Australia, 25-29 November 1996. 1.
- Templet, P. H., 1986. American Samoa: establishing a coastal area management model for developing countries. *Coastal Zone Management Journal*, 13:241-264.
- Thomas, W. J., 1988. Fagatele Bay: a sanctuary in Samoa. *Oceanus*, 31(1):18-24.
- Valdés-Pizzini, M., 1990. Fishermen associations in Puerto Rico: praxis and discourse in the politics of fishing. *Human Organization*, 49:164-173.
- Vincent, A. C. J., 1998. Seahorses and subsistence: a tale of overlooked fisheries. *Fisheries Seminar*, Fisheries Centre, UBC, Vancouver, Canada.
- Vincent, A. C. J., and Pajaro, M. G., 1997. Community-based management for a sustainable seahorse fishery. pp. 761-766. *In*: D. A. Hancock, D. C. Smith, A. Grant, and J. B. Beumer, eds., *Developing and sustaining world fisheries resources: the state of science and management: 2nd World Fisheries Congress Proceedings*, Brisbane, Australia, CSIRO, PO Box 1139 Collingwood, V1C 3006 Australia, ISBN 0 643 059857.
- White, A. T., 1988. The effect of community-managed marine reserves in the Philippines on their associated coral reef fish populations. *Asian Fisheries Science*, 2:27-41.

APPENDIX I

1. Attwood, C. G., Harris, J. M., and Williams, A. J., 1997. International experience of marine protected areas and their relevance to South Africa. *South African Journal of Marine Sciences*, 18: 311-332.
2. Rigney, H., 1990. Marine reserves - blueprint for protection. *Australian Fisheries*, 49: 18-22.
3. Tisdell, C., and Broadus, J. M., 1989. Policy issues related to the establishment and management of marine reserves. *Coastal Management*, 17: 37-53.
4. Shorthouse, B., 1990. The Great Barrier Reef Marine Park: how does it work for fishermen? *Australian Fisheries*, 49: 16-17.
5. Cooks, K. D., 1994. A systematic method of public use zoning of the GBRMP, Australia. *Coastal Zone Management Journal*, 12: 359-383.
6. Beaumont, J., 1997. Community participation in the establishment and management of marine protected areas: a review of selected international experience. *South African Journal of Marine Sciences*, 18: 333-340.
7. Rowley, R. J., 1994. Case studies and reviews, Marine reserves in fisheries management. *Aquatic conservation: marine and freshwater ecosystems*, 4: 233-254.
8. Craik, W. J. S., 1981. Underwater survey of coral trout *Plectropomus leopardus* (Serranidae) populations in the Capricornia section of the Great Barrier Reef Marine Park. In: *Proceedings of the 4th International Coral Reefs Symposium*, , , pp. 53-58.
9. Ferreira, B. P., and Russ, G. R., 1995. Population structure of the leopard coral grouper, *Plectropomus leopardus*, on fished and unfished reefs off Townsville, Central Great Barrier Reef, Australia. *Fishery Bulletin*, 93: 629-642.
10. Bennett, B., and Attwood, C. G., 1993. Shore-angling catches in the De Hoop Nature Reserve, South Africa, and further evidence for the protective value of marine reserves. *South African Journal of Marine Sciences*, 13: 213-222.
11. Bennett, B. A., and Attwood, C. G., 1991. Evidence for recovery of a surfzone fish assemblage following the establishment of a marine reserve on the southern coast of South Africa. *Marine Ecology Progress Series*, 75:(2-3) 173-181.
12. Bennett, B. A., and Attwood, C. G., 1993. In defence of the de Hoop Marine Reserve. In: L. E. Beckley and R. P. van der Elst, eds., *Fish, Fishers and Fisheries*. *Proceedings of the Second South African marine linefish symposium*, Durban, South Africa, Oct. 1992, Oceanographic Research Institute, Durban, pp. 175-176.
13. Sauer, W. H. H., 1995. South Africa's Tsitsikamma National Park as a protected breeding area for the commercially exploited chokka squid *Loligo vulgaris reynaudii*. *South African Journal of Marine Sciences*, 16: 365-371.
14. Buxton, C. D., and Smale, M. J., 1989. Abundance and distribution patterns of three temperate marine reef fish (Teleostei: Sparidae) in exploited and unexploited areas off the southern Cape Coast. *Journal of Applied Ecology*, 26: 441-451.
15. Buxton, C. D., 1993. The distribution and abundance of the littoral ichthyofauna in the Tsitsikamma National Park. In: L. E. Beckley and R. P. van der Elst, eds., *Fish, Fishers and Fisheries*, *Second South African Marine Linefish Symp.*, Durban, South Africa, , Oceanographic Research Institute, Durban, pp. 45-51.
16. Attwood, C. G., Mann, B. Q., Beaumont, J., and Harris, J. M., 1997. Review of the state of marine protected areas in South Africa. *South African Journal of Marine Sciences*, 18: 341-367.

17. Russ, G. R., Alcala, A. C., and Cabanban, A. S., 1992. Marine reserves and fisheries management on coral reefs with preliminary modelling of the effects on yield per recruit. In: Proceedings of the Seventh International Coral Reef Symposium, Guam, , , pp. 978-985.
18. Russ, G. R., 1989. Distribution and abundance of coral reef fishes in the Sumilon Island reserve, central Philippines, after nine years of protection from fishing. *Asian Marine Biology*, 6: 59-71.
19. Russ, G. R., and Alcala, A. C., 1994. Sumilon Island Reserve: 20 years of hopes and frustration. *NAGA, the ICLARM Quarterly*, 7 (3): 8-12.
20. Alcala, A. C., and Russ, G. R., 1990. A direct test of the effects of protective management on abundance and yield of tropical marine resources. *Journal du Conseil International pour l'Exploration de la Mer*, 46: 40-47.
21. Russ, G. R., and Alcala, A. C., 1996. Marine reserves: rates and patterns of recovery and decline of large predatory fish. *Ecological Applications*, 6: 947-961.
22. Russ, G. R., and Alcala, A. C., 1996. Do marine reserves export adult fish biomass? Evidence from Apo Island, central Philippines. *Marine Ecology Progress Series*, 132: 1-9.
23. White, A. T., 1988. The effect of community-managed marine reserves in the Philippines on their associated coral reef fish populations. *Asian Fisheries Science*, 2: 27-41.
24. Savina, G. C., and White, A. T., 1986. A tale of two islands: some lessons for marine resource management. *Environmental Conservation*, 13:(2) 107-113.
25. Russ, G., 1985. Effects of protective management on coral reef fishes in the central Philippines. In: Proceedings of the Fifth International Coral Reef Congress, Tahiti, 1985, , pp. 219-224.
26. Vincent, A. C. J., and Pajaro, M. G., 1997. Community-based management for a sustainable seahorse fishery. In: D. A. Hancock, D. C. Smith, A. Grant, and J. B. Beumer, eds., *Developing and sustaining world fisheries resources: the state of science and management: 2nd World Fisheries Congress Proceedings*, Brisbane, Australia, , CSIRO, PO Box 1139 Collingwood, VIC 3006 Australia, ISBN 0 643 059857, pp. 761-766.
27. Vincent, A. C. J., 1998. Seahorses and subsistence: a tale of overlooked fisheries. , Fisheries Seminar, Fisheries Centre, UBC, Vancouver, Canada pp.
28. McManus, J. W., 1996. Social and economic aspects of reef fisheries and their management. In: N. V. C. Polunin and C. M. Roberts, eds., *Reef fisheries*, Chapman and Hall, London, 20, pp. 249-281.
29. Christie, P., White, A. T., and Buhat, D., 1994. Community-based coral reef management on San Salvador Island, the Philippines. *Society and Natural Resources*, 7: 103-117.
30. McClanahan, T. R., and Shafir, S. H., 1990. Causes and consequences of sea urchin abundance and diversity in Kenyan coral reef lagoons. *Oecologia*, 83: 362-370.
31. Samoilys, M. A., 1988. Abundance and species richness of coral reef fish on the Kenyan coast: the effects of protective management and fishing. In: J. H. Choat, D. Barnes, M. A. Borowitzka, J. C. Coll, P. J. Davies, P. Flood, B. G. Hatcher, and D. Hopley, eds., *Proceedings of the Sixth International coral reef symposium*, Townsville, Qld, Australia, , , pp. 261-266.
32. McClanahan, T. R., and Obura, D., 1995. Status of Kenyan coral reefs. *Coastal Management*, 23: 57-76.
33. McClanahan, T. R., 1994. Kenyan coral reef lagoon fish: effects of fishing, substrate complexity, and sea urchins. *Coral Reefs*, 13: 231-241.
34. Watson, M., Righton, D., Austin, T., and Ormond, R., 1996. The effects of fishing on coral reef fish abundance and diversity. *Journal of Marine Biology Association U.K.*, 76: 229-233.
35. Watson, M., and Ormond, R. F. G., 1994. Effect of an artisanal fishery on the fish and urchin populations of a Kenyan coral reef. *Marine Ecology Progress Series*, 109: 115-129.

36. Leenhardt, M., 1990. Le parc naturel régional et les réserves marines de Corse. In: A. Cossu, V. Gazale, and I. Milella, eds., *Marine parks in the Mediterranean. Biological and management aspects.*, San Teodoro, Sassari, Italy, , , pp. 85-92.
37. Francour, P., 1994. Pluriannual analysis of the reserve effect on ichthyofauna in the Scandola natural reserve Corsica, northwestern Mediterranean. *Oceanologica Acta*, 17:(3) 309-317.
38. Francour, P., 1993. Ichthyofauna of the natural reserve of Scandola Corsica, north western Mediterranean : Analysis of the pluriannual reserve effect. *Marine Life*, 3:(1-2) 83-93.
39. Harmelin, J. G., Bachet, F., and Garcia, F., 1995. Mediterranean marine reserves: fish indices as tests of protection efficiency. *P. S. Z. N. I.: Marine Ecology*, 16: 233-250.
40. Ramos-Espla, A. A., and McNeill, S. E., 1994. The status of marine conservation in Spain. *Ocean Coastal Management*, 24: 125-138.
41. Ramos-Espla, A. A., and Bayle-Sempere, J., 1989. Management of living resources in the marine reserve of Tabarca Island Alicante, Spain. *Bulletin de la Société Zoologique de France*, 114:(4) 41-48.
42. Garcia-Rubies, A., and Zabala, M., 1990. Effects of total fishing prohibition on the rocky fish assemblages of Medes Islands marine reserve NW Mediterranean. *Scienta Marina*, 54:(4) 317-328.
43. Cole, R. G., Ayling, T. M., and Creese, R. G., 1990. Effects of marine reserve protection at Goat Island, northern New Zealand. *New Zealand Journal of Marine and Freshwater Research*, 24: 197-210.
44. Ballantine, B., 1991. Marine reserves for New Zealand. University of Auckland, Auckland, New Zealand, Leigh Laboratory Bulletin, 25, 196 pp.
45. Cocklin, C., Craw, M., and McAuley, I., 1998. Marine reserves in New Zealand: use rights, public attitudes, and social impacts. *Coastal Management*, 26: 213-231.
46. McCormick, M. I., and Choat, J. H., 1987. Estimating total abundance of a large temperate reef fish using visual strip transects. *Marine Biology*, 96: 469-478.
47. Department of Conservation, 1995. Poor Knights Islands Marine Reserve, recreational fishing review; discussion paper. Department of Conservation, Northland Conservancy PO Box 842, Whangarei, 15 pp.
48. Jennings, S., Marshall, S. S., and Polunin, N. V. C., 1996. Seychelles' marine protected areas: comparative structure and status of reef fish communities. *Biological Conservation*, 75: 201-209.
49. Wantiez, L. P., Thollot, P., and Kulbicki, M., 1997. Effects of marine reserves on coral reef fish communities from five islands in New Caledonia. *Coral Reefs*, 16: 215-224.
50. Jourde, J. L., 1985. Marine reserves in New Caledonia. In: P. E. J. Thomas, ed. Report of the Third South Pacific National Parks and Reserves Conference, Apia, Western Samoa, , South Pacific Reg. Environment Programme, Noumea, New Caledonia, pp. 74-78.
51. Wantiez, L., Thollot, P., and Kulbicki, M., 1995. Effets de réserve sur les communautés de poissons récifaux de cinq îlots du Parc du Lagon Sud de Nouvelle-Calédonie. In: P. Dalzell and T. J. H. Adams, eds., South Pacific Commission and Forum Fisheries Agency Workshop and the Management of South Pacific Inshore Fisheries, Noumea, New Caledonia, , SPC, pp. 393.
52. Letourneur, Y., 1996. Réponses des peuplements et populations de poissons aux réserves marines: le cas de l'île de Mayotte, Océan Indien occidental. *Ecoscience*, 3: 442-450.
53. Smith, A. H., and Berkes, F., 1991. Solutions to the 'Tragedy of the commons': sea-urchins management in St-Lucia, West Indies. *Environmental Conservation*, 18:(2) 131-136.
54. Goodridge, R., Oxenford, H. A., Hatcher, B. G., and Narcisse, F., 1997. Changes in the shallow reef fishery associated with implementation of a system of fishing priority and marine reserve areas in Soufriere, St. Lucia. In: Proceedings of the 49th Gulf and Caribbean Fisheries Institute, Christ Church, Barbados, Nov. 1996, Gulf and Caribbean Fisheries Institute, Fort Pierce, Florida, pp. 316-339.

55. Rakitin, A., and Kramer, D. L., 1996. Effect of a marine reserve on the distribution of coral reef fishes in Barbados. *Marine Ecology Progress Series*, 131: 97-113.
56. Stoner, A. W., and Ray, M., 1996. Queen conch, *Strombus gigas*, in fished and unfished locations of the Bahamas: effects of a marine fishery reserve on adults, juveniles, and larval production. *Fishery Bulletin*, 94: 551-565.
57. Chiappone, M., and Sullivan Sealey, K. M., 1998. Establishing goals and assessing the success of marine reserves: a case study of the Exuma Cays Land and Sea Park, Bahamas. 1998 William R. and Lenore Mote International Symposium: Essential Fish Habitat and Marine reserves, Sarasota, Florida, .
58. Polunin, N. V. C., and Roberts, C. M., 1993. Greater biomass and value of target coral-reef fishes in two small Caribbean marine reserves. *Marine Ecology Progress Series*, 100: 167-176.
59. Roberts, C. M., 1995. Rapid build-up of fish biomass in a Caribbean marine reserve. *Biological Conservation*, 9: 816-826.
60. Roberts, C. M., and Polunin, N. V. C., 1994. Hol Chan: demonstrating that marine reserves can be remarkably effective. *Coral Reefs*, 13: 90.
61. Carter, J., Gibson, J., Carr, A., III, and Azueta, J., 1994. Creation of the Hol Chan Marine Reserve in Belize: A grass roots approach to barrier reef conservation. *The Environmental Professional*, 16:(3) 220-231.
62. Laist, D., Bigford, T., Robertson, G., and Gordon, D., 1986. Management of corals and coral ecosystems in the United States. *Coastal Zone Management Journal*, 13: 203-239.
63. Suman, D. O., 1997. The Florida Keys National Marine Sanctuary: A case study of an innovative federal-state partnership in marine resource management. *Coastal Management*, 25: 293-324.
64. Clark, J. R., Causey, B., and Bohnsack, J., 1989. Benefits from coral reef protection: Looe Key reef, Florida. In: O. T. Magoon, H. Converse, D. Miner, L. T. Tobin, and D. Clark, eds., *Coastal zone '89: Proceedings of the Sixth Symposium on Coastal and Ocean Management*, Charleston SC, , American Society of Civil Engineers, pp. 3079-3086.
65. Roberts, T. W., 1986. Abundance and distribution of pink shrimp in and around the Tortugas Sanctuary, 1981-1983. *North American Journal Fisheries Management*, 6: 311-327.
66. Klima, E. F., Roberts, T. W., and Jones, A. C., 1986. Overview of the Tortugas Sanctuary studies. *North American Journal Fisheries Management*, 6: 297-300.
67. Gitschlag, G. R., 1986. Movement of pink shrimp in relation to the Tortugas Sanctuary. *North American Journal Fisheries Management*, 6: 328-338.
68. Klima, E. F., Matthews, G. A., and Patella, F. J., 1986. Synopsis of the Tortugas pink shrimp fishery, 1960-1983, and the impact of the Tortuga sanctuary. *North American Journal Fisheries Management*, 6: 301-310.
69. Davis, G. E., 1981. On the role of underwater parks and sanctuaries in the management of coastal resources in the southeastern United States. *Environmental Conservation*, 8:(1) 67-70.
70. Davis, G. E., and Dodrill, J. W., 1989. Recreational fishery and population dynamics of spiny lobsters, *Panulirus argus*, in Florida Bay, Everglades National Park, 1977-1980. *Bulletin of Marine Science*, 44: 78-88.
71. Fiske, S. J., 1992. Sociocultural aspects of establishing marine protected areas. *Ocean Coastal Management*, 17:(1) 25-46.
72. Branch, G. M., and Moreno, C. A., 1994. Intertidal and subtidal grazers. In: W. R. Siegfried, ed. *Rocky shores exploitation in Chile and South Africa.*, Springer-Verlag, Berlin, 103, pp. 75-100.
73. Davis, A. R., 1995. Over-exploitation of *Pyura chilensis* (Ascidacea) in southern Chile: the urgent need to establish marine reserves. *Revista Chilena de Historia Natural*, 68: 107-116.

74. Moreno, C. A., Lunecke, K. M., and Lépez, M. I., 1986. The response of an intertidal *Concholepas concholepas* (Gastropoda) population to protection from Man in southern Chile and the effects on benthic sessile assemblages. *OIKOS*, 46: 359-364.
75. Durán, L. R., and Castilla, J. C., 1989. Variation and persistence of the middle rocky intertidal community of Central Chile, with and without human harvesting. *Marine Biology*, 103: 555-562.
76. Castilla, J. C., and Durán, L. R., 1985. Human exclusion from the rocky intertidal of Las Cruces, central Chile: the effects on *Concholepas concholepas* (Gastropoda). *OIKOS*, 45: 391-399.
77. Weil, E. M., and Laughlin, G., 1984. Biology, population dynamics and reproduction of the queen conch *Strombus gigas* Linné in the Archipelago De Los Roques National Park. *Journal of Shellfish Research*, 4: 45-62.
78. Silva, M., and Desilvestre, I., 1986. Marine and coastal protected areas in Latin America: A preliminary assessment. *Coastal Zone Management Journal*, 14: 311-347.
79. Alder, J., Sloan, N. A., and Uktolseya, H., 1994. Advances in marine protected area management in Indonesia: 1988-1993. *Ocean Coastal Management*, 25: 63-75.
80. Kelsey, E., Nightingale, J., and Solin, M., 1995. The role of partnerships in implementing a new marine protected area: a case study of Whytecliff Park. In: N. L. Shackell and J. H. M. Willison, eds., *Marine protected areas and sustainable fisheries*, Science and Management and Protected Areas Association, Centre for Wildlife and Conservation Biology, Acadia University, Wolfville, Nova Scotia, Canada, pp. 235-239.
81. Solin, M., 1993. Final report: Achieving true marine protected areas status for Whytecliff Park. Westwater Research Centre, University of British Columbia, Vancouver, BC, Canada, 18 pp.