Marine Reserves

A Guide to Science, Design, and Use

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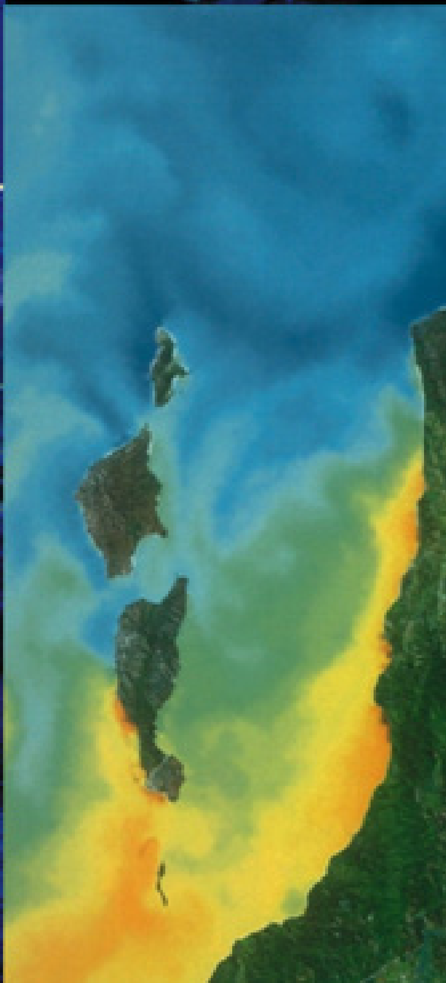

NINE

Bahamian Marine Reserves—Past Experience and Future Plans

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As an archipelago composed of over 700 islands and cays, the Commonwealth of the Bahamas (Fig. 9.1) is reliant upon its marine resources in a variety of ways. The white sand beaches, crystal clear waters, coral reefs, and abundant marine life attract millions of tourists to the Bahamas each year, making marine-based tourism one of the largest sectors of the Bahamian economy.

Marine fisheries in the Bahamas provide the country with one of its chief exports, the Caribbean spiny lobster (*Panulirus argus*), with exports valued at over $60 million in four of the past five years. Similarly, fisheries for queen conch (*Strombus gigas*) and Nassau grouper (*Epinephelus striatus*), which have suffered economic collapse elsewhere in the Caribbean, remain an important part of the Bahamian economy (Fig. 9.2). Fishing provides full employment to 6.8 percent of the Bahamian workforce and partial employment to an additional 8.8 percent (MacAllister Elliot and Partners 1998).

More than just a source of economic gain, the marine environment of the Bahamas is an integral part of Bahamian culture. Many Bahamian legends, traditions, and symbols are closely connected with the sea. This is evident in the Bahamian coat of arms, postage stamps, and money, all of which are adorned with fish and other sea creatures. Based on the close bond between Bahamian economics, history, culture, and the sea, it is only fitting that one of the oldest marine protected areas in the world is located in the Bahamas, the Exuma Cays Land and Sea Park.

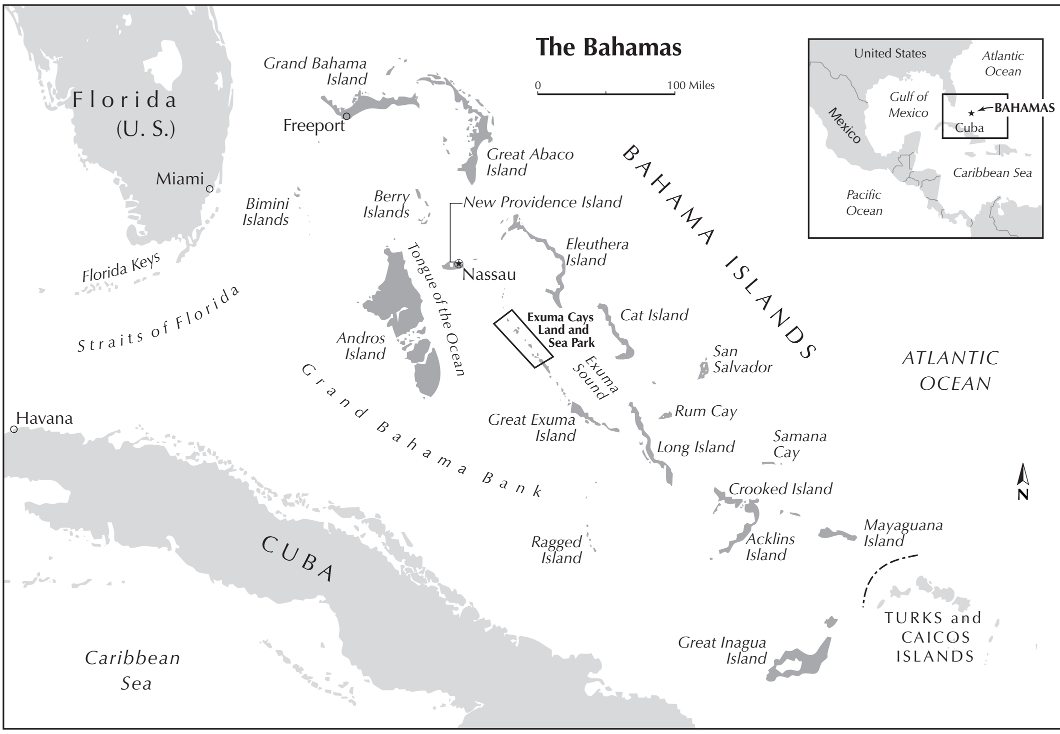

FIG. 9.1 Map of Bahamian Archipelago, Showing its Neighbors and Geographic Context. The Bahamas consists of over 700 islands on large carbonate platforms separated by deep basins such as Exuma Sound and the Tongue of the Ocean. This geological heterogeneity creates a diversity of marine habitats within the archipelago.

THE EXUMA CAYS LAND AND SEA PARK

Although the Bahamas has an abundance of marine life, relatively healthy coral reefs, and high water quality when compared to many other parts of the Caribbean, these resources face threats from a wide range of human impacts (e.g., Dahlgren 1999; Ray 1999; Sullivan-Sealey 2000). As long ago as the 1890s there was concern in the Bahamas over the destruction of coral reefs, as evident in the Sea Gardens Protection Act of 1892, which prohibited dredging or the removal of coral, sea fans, or other organism from the seabed (Mascia 2000). Concern over decreases in the abundance of marine life, particularly species targeted in fisheries, were increasing by the 1940s (Ray 1998). This concern mobilized efforts in both the conservation and the scientific communities to increase protection of Bahamian marine environments. As a result of these efforts, the Exuma Cays Land and Sea Park (Fig. 9.3) was officially created by the Bahamas National Trust Act in 1959.

FIG. 9.2 The Three Most Important Fishery Species of the Bahamas. (A) Caribbean spiny lobster or "crawfish," *Panulirus argus*; (B) the queen conch, *Strombus gigas*; and (C) the Nassau grouper, *Epinephelus striatus*. These three species account for approximately 90 percent of the value of Bahamian fisheries. Local populations of all three have benefited from creation of the Exuma Cays Land and Sea Park.

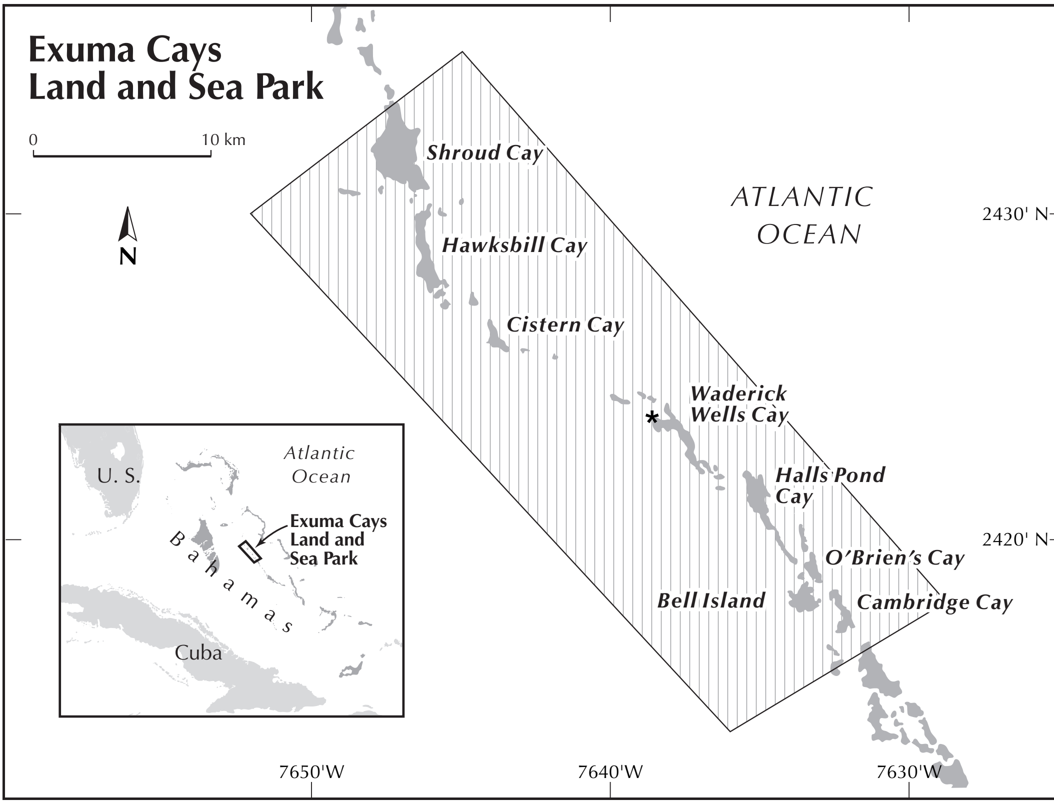

FIG. 9.3 The Exuma Cays Land and Sea Park (map). This park is one of the largest (456 km^2) and oldest (circa 1958) marine protected areas in the wider Caribbean region. Since 1986, it has been managed as a no-take marine reserve. The park includes terrestrial protection to many of the islands within it and encompasses extensive marine areas, including sand and seagrass areas along the Bahama Banks to the west of the islands; mangroves, creeks, sand flats, hardbottom and coral reef systems around the islands; and deepwater environments of Exuma Sound to the east of the islands. *Park headquarters located on Waderick Wells Cay.

Although the creation of the Exuma Cays Land and Sea Park may have been the result of opportunism and several serendipitous events (see Ray 1998 for a history of the Exuma Cays Land and Sea Park), the creation of the park was characterized by foresight into the scientific basis for ecosystem conservation and marine protected area design. In a report assessing the suitability of the area for protection, scientists identified the importance of including interrelated marine and terrestrial ecosystems within a single unit for conservation, emphasized the importance of preserving ecological processes, stressed the role that protected areas can play in conservation education, and even suggested the importance of setting aside reefs "free of fishing pressure" for study in their "primordial state" (Ray 1998).

The resulting Exuma Cays Land and Sea Park encompasses a total of 186 square miles (456 km^2), of which 167 square miles (409 km^2) are marine. This vast marine area includes shallow water sea grass, sand flat, mangrove, patch reef, and other habitats on the Great Bahamas Banks, as well as offshore reefs and deepwater habitats (more than 400m deep) in Exuma Sound. The large size of the park and inclusion of a variety of interconnected marine and terrestrial ecosystems is largely responsible for the park's success in protecting various ecologically and economically important species (discussed in detail below).

The creation of the Exuma Cays Land and Sea Park was unique not only for the large size of the park and inclusion of both terrestrial and marine habitats, but also for the fact that management of the park was charged to a nongovernmental organization rather than the Bahamian government. In the same act of Parliament that created the Exuma Cays Land and Sea Park, the Bahamas National Trust was created as the nongovernmental organization responsible for managing the fledgling Bahamian national park system, which has since grown to include twelve parks. Although a nongovernmental, nonprofit, and self-funded organization, the Bahamas National Trust has the power to enact bylaws governing parks that become laws of the Commonwealth of the Bahamas.

Despite the recommendations of scientists on the initial survey of the Exuma Cays Land and Sea Park, the original bylaws of the park allowed some fishing (Mascia 2000). However, an increase in fishing pressure in the 1980s forced the Bahamas National Trust to change the park's bylaws, so that all fishing and other extractive uses were prohibited from the entire park area in 1986 (Sluka et al. 1996). This made the Exuma Cays Land and Sea Park one of the first no-take marine reserves in the tropical western Atlantic, and one of the biggest no-take marine reserves in the world (at the time of writing, it is still one of the largest no-take marine reserves in the world).

Its large size, no-take status, and inclusion of a wide variety of marine and terrestrial habitats make the Exuma Cays Land and Sea Park an excellent example of effective marine reserve design, yet it is not without its problems. Perhaps the greatest of these problems is ensuring adequate compliance with park restrictions on fishing and other activities. Despite its large size, the park has only a single warden charged with enforcing park regulations. The relatively central location of the park headquarters on Waderick Wells Cay allows for maximum efficiency for a single individual to patrol the park, but the large size of the park limits the ability of one warden to effectively patrol the entire area, particularly near the northern and southern boundaries where fast "dayboat" fishing vessels can move into and outside of the park undetected (see Fig. 9.3). Thus poaching became a significant problem in the 1990s. To effectively enforce park regulations over such a large area, the park warden often relies on visitors to the park reporting any poaching that they observe. Furthermore, the recent addition of armed Royal Bahamian Defense Force (RBDF) personnel to assist the park warden has greatly improved compliance with park regulations. For example, the RBDF boarded and impounded a 72-foot fishing vessel that was found fishing in the park during the summer of 2000.

Despite the increased capacity for enforcement, poaching remains a challenge to management of the Exuma Cays Land and Sea Park, particularly by local dayboats at times when there is a reduced enforcement mechanism in the park (e.g., when the park's primary patrol boat is not functioning). Although the Exuma Cays Land and Sea Park apparently attracts poachers from hundreds of miles away, poaching by local residents and tourists presents a greater problem. One reason why poaching by local residents may occur within the park is that there was little consultation with inhabitants of the small settlements that surround the park when it was created, and again when it was made a no-take reserve. Because there is a growing disparity between the abundance of fishery resources in the park and decreasing resources of surrounding areas (see Fig. 9.4), there is an economic incentive for dayboat fishermen to poach within the park. Furthermore, local resource users were not involved in decision making with respect to the designation of the park, or making the park no-take. Thus many local fishermen do not agree with park management. In addition to poachers from nearby settlements, yachtsmen that frequently cruise the Exuma Cays in the winter and spring also fish within the park. This occurred particularly during the park's early stages as a no-take marine reserve. Effective outreach and education efforts, however, have turned this user group into strong supporters of the park, who often serve as volunteers in various capacities there.

In addition to consumptive threats like poaching, the Exuma Cays Land and Sea Park also faces problems resulting from land use within the park. Although protecting the small cays that made up the terrestrial component of the park has always been a goal of the Bahamas National Trust, several of the privately owned islands escaped protection during the initial creation of the park. Most of these islands have remained largely undeveloped and uninhabited, but a few have been sold and built upon by their new owners in recent years. Much of the development within the park has progressed without following any acceptable environmental protection guidelines. For example, extensive networks of unpaved roads were cleared throughout one small island without any thought to erosion control. In addition to any adverse impact that terrestrial development has to the marine environment of the park, it has also contributed to resentment from much of the local Bahamian community who feel that the foreigners who own islands are getting preferential treatment when it comes to resource use within the park. At the time of writing, however, the Bahamian government and the Bahamas National Trust are addressing several issues related to terrestrial development within the park and its impact on the marine environment.

MARINE RESERVE RESEARCH IN THE BAHAMAS

Although science played an important role in its designation, scientific studies of marine populations, communities, and ecosystems within the Exuma Cays Land and Sea Park since its creation remain limited, and our knowledge is far from complete. This may be due to the limited resources and capacity of the Bahamian government and Bahamas National Trust to support research, as well as the park's relatively remote location. The nearby Caribbean Marine Research Center provides a remote field station in the vicinity and contributes significant supplementary capacity for research within the park. Nonetheless, results from several studies conducted within the park demonstrate dramatic effects of reserve protection for some of the most important fishery species in the Bahamas: Nassau grouper, Caribbean spiny lobster, and queen conch.

Comparisons of Nassau grouper populations within the Exuma Cays Land and Sea Park to those up to 30 km north and south of the park indicate that grouper size, density, and biomass (see also chapter 4, Fig. 4.6) differed between the park and unprotected areas outside it (Sluka et al. 1996, 1997). Within the park, mean density of Nassau grouper was 75 to 100 percent greater and fish were over 20 percent larger on average than outside the park (Sluka et al. 1996). These differences resulted in Nassau grouper biomass being three times greater within than outside the park. Observed differences in density, size, and biomass are believed to result from the protected status of the park rather than other factors (e.g., habitat) that may differ between the park and surrounding areas because there were no significant differences in Nassau grouper abundance among different habitat types (Sluka et al. 1996). Nassau grouper biomass within the park also compares very favorably with more heavily fished areas elsewhere in the Bahamas with up to an order of magnitude difference (See Fig. 9.4)

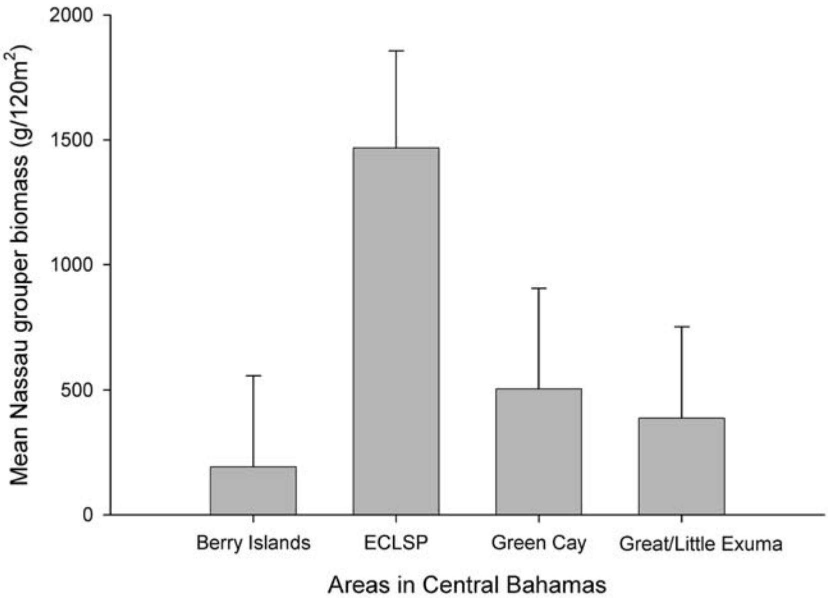

FIG. 9.4 Comparison of Nassau Grouper Biomass, Observed in Transect Surveys on Coral Reefs within the Exuma Cays Land and Sea Park (ECLSP), to Similar Reefs in Other Locations throughout the Central Bahamas. These other locations are all open to fishing and include areas near (Great Exuma, Berry Islands) and far (Green Cay) from human population centers. Several of these other sites include some areas that are proposed as marine fishery reserves and national parks.

There is also indirect evidence that the elevated Nassau grouper biomass within the Exuma Cays Land and Sea Park supports fisheries outside the park. A closer examination of the spatial distribution of Nassau grouper as a function of distance from the center of the park indicates that Nassau grouper biomass immediately outside the park boundaries is more similar to biomass within the park than farther away from the park (see also Fig. 4.6 and Sluka et al. 1997). This provides indirect evidence of spillover of biomass from the park to fished areas (an alternative hypothesis is that poaching within the park may be causing these patterns; however, this explanation does not adequately explain why abundance immediately outside the park is higher than farther outside). Further evidence that Nassau grouper periodically leave the park and enter the fishery comes from studies of movement by tagged fish. Although most tagged grouper exhibited movement over relatively small areas, at least two grouper tagged within the Exuma Cays Land and Sea Park were caught by a fisherman at spawning aggregations hundreds of kilometers away (Bolden 2000; Dahlgren, unpublished data).

Despite the fact that grouper have been observed to migrate extensively outside of the park to spawn, there are reports of spawning aggregations of grouper, snapper, and other species inside the park. Furthermore, complementary efforts by the Bahamian government to close Nassau grouper spawning aggregations to fishing during the spawning season can protect fish that migrate outside of the park to spawn. No matter where spawning takes place, elevated Nassau grouper biomass within the Exuma Cays Land and Sea Park may benefit fisheries via larval replenishment. Based on differences in biomass, Sluka et al. (1997) calculated reproductive output (no. eggs/hectare) of grouper within the park to be more than four times that of surrounding areas. Fully understanding how this potential increase in reproductive output ultimately benefits fisheries requires a better understanding of spawning migrations into and out of the park, and determining whether larvae from these groupers find suitable settlement and nursery habitats where they can survive and grow to enter the fishery (Bolden 2000; Dahlgren 1999; Dahlgren and Eggleston 2000, 2001).

Studies within and outside the Exuma Cays Land and Sea Park have also found the park to be effective at protecting spiny lobster stocks. Lipcius et al. (1997) compared adult spiny lobster abundance within the park to other areas throughout Exuma Sound. Despite the fact that the Exuma Cays Land and Sea Park did not have particularly high rates of postlarval supply and did not contain the most suitable habitat, densities within the park were significantly higher than the other sites examined around Exuma Sound, a difference that appears to be increasing as lobster stocks outside the park are subject to increasing fishing effort. Furthermore, appropriate juvenile and adult lobster habitat covers less area within the Exuma Cays Land and Sea Park than other locations within Exuma Sound, suggesting it may not be ideally located to protect lobsters. Lobster abundance throughout Exuma Sound also decreased on an annual basis from the closed season to the open fishing season and the decrease was similar for all sites, including the Exuma Cays Land and Sea Park. Given these factors, the high abundance of adult lobsters within the park compared to outside is especially noteworthy. Models based on observed lobster abundance and hydrodynamics of Exuma Sound predict that although some reproductive output from the park may be carried to inappropriate settlement habitats, potentially limiting the park's ability to support regional fisheries, the location of the park may result in significant local retention of larvae and support local fisheries (Lipcius et al. 2001). Empirical investigations into the effects of the park on local and regional fisheries, and tests of model assumptions will continue to improve our understanding of how the park affects lobster fisheries in surrounding areas. Studies should also address the indirect effects of increased lobster abundance on ecosystems within the park.

As with Nassau grouper and spiny lobster, queen conch populations also benefit from protection within the Exuma Cays Land and Sea Park. Unlike lobster, however, there is greater evidence that the park benefits conch fisheries throughout the central Bahamas. Within the park, conch densities were significantly higher than in most fished areas throughout the Exuma Sound region (Stoner and Ray 1996; Stoner et al. 1998). Conch densities in only one fished area, the unprotected site around the Schooner Cays off Cape Eleuthera had densities similar to that of the park. High adult conch densities in the Schooner Cays area, however, are likely to be the result of extremely productive juvenile conch populations there, as suggested by the presence of large juvenile conch aggregations in the area and the fact that most adults appeared to be young (Stoner et al. 1998). Recent anecdotal reports from the Schooner Cays area, however, suggest that this is no longer the case and conch stocks there have suffered a dramatic reduction due to high levels of fishing. Although the Exuma Cays Land and Sea Park contains some juvenile conch aggregations, the density and area of these are not much higher than other parts of Exuma Sound, so high adult densities are likely to result from reserve protection. Within the Exuma Cays Land and Sea Park, mean density of adult conch exceeded 49 conch per hectare at all depths from 5 to 30 m, and had a maximum mean density of 270 conch per hectare, the highest observed density anywhere in the region. With the exception of the Schooner Cays, adult conch densities rarely exceeded forty-nine per hectare outside of the Exuma Cays Land and Sea Park (Stoner et al. 1998). Because conch reproduction is density dependent, with spawning not observed at densities lower than forty-eight conch per hectare in Exuma Sound (Stoner and Ray-Culp 2000), high densities maintained within the park may be essential for the maintenance of the population throughout the region.

Further evidence for the ability of the Exuma Cays Land and Sea Park to support conch populations and possibly conch fisheries throughout the region comes from sampling larval conch (veliger) distribution within and outside of the park. Plankton tows throughout Exuma Sound indicate that larval production (density of early-stage larvae) is significantly greater within the Exuma Cays Land and Sea Park than in other parts of Exuma Sound. Early-stage larval densities within the park ranged from 159 to 929 veligers per 100 m^3, but did not exceed 100 veligers per 100 m^3 anywhere else in Exuma Sound (Stoner et al. 1998). Later stage larval conch, however, were not concentrated around the park, but were dispersed throughout Exuma Sound by regional current patterns. Thus, the high densities of conch within the Exuma Cays Land and Sea Park are likely to serve as a source of conch recruits to the fishery throughout the Exuma Sound region.

Based on these studies of the effect of the Exuma Cays Land and Sea Park on important fishery species, we can draw several conclusions. It is clear that the park provides protection against exploitation for conch, lobster, and grouper. This is particularly important for queen conch and Nassau grouper, which have been fished to such an extent that they are threatened throughout most of their range. There is also evidence that the park provides some fisheries benefits on local (e.g., less than 30 km from the park) and regional (e.g., throughout Exuma Sound) scales. These benefits are derived despite the lack of quantitative studies of marine resources of the Exuma Cays prior to the creation of the park, and despite the fact that the park may not protect the best habitat in the region for important fishery species. Thus, despite any ecological and socioeconomic shortcomings, the Exuma Cays Land and Sea Park is an effective tool for marine conservation.

THE FUTURE OF MARINE RESERVES IN THE BAHAMAS

At present, the Bahamas has few marine protected areas and virtually no effective no-take marine reserves aside from the Exuma Cays Land and Sea Park. Other marine protected areas that exist are essentially “paper parks” due to a lack of enforcement, limited protective measures, and/or small size (i.e., Pelican Cays Land and Sea Park near Abaco Island, Union Creek Reserve, and Black Sound Cay National Reserve off Great Inagua Island; Fig. 9.5). However, the Bahamian government is actively building on the Bahamian experience with no-take marine reserves. In November 1999, the Bahamian government announced an ambitious plan to create a network of no-take marine reserves that is intended to encompass at least 20 percent of the Bahamian marine environment. Although achieving this eventual goal may take years, in January 2000, the government identified sites for the first five new marine reserves in this network and began the designation process. The first of these new fishery reserves are expected to be designated in late 2004, and are expected to include areas near Bimini and Southern Berry Islands and Great Exuma Island (see Fig. 9.5). In addition to these new reserves that will fall under the management of the Department of Fisheries, the Bahamas National Trust is creating a number of new parks that will include marine areas zoned for various uses, including several no-take zones. The first of these new National Parks were announced

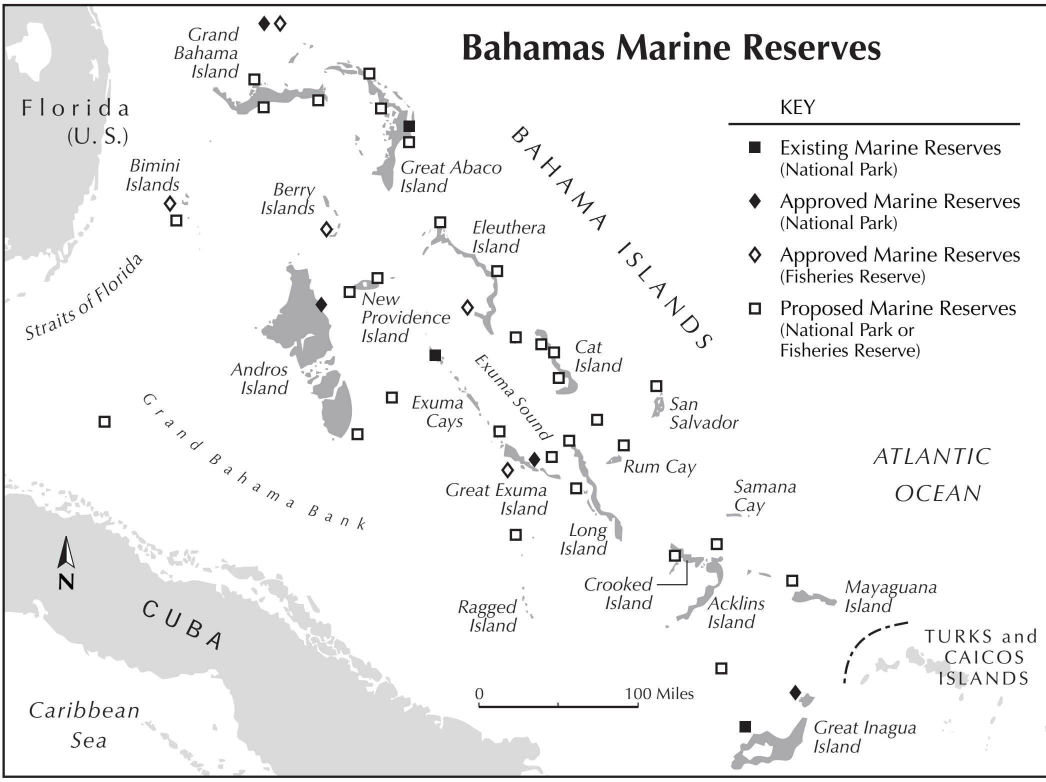

FIG. 9.5 Existing and Proposed Marine Reserves of the Bahamas. Sites shown on this map have either been formally selected or proposed as marine fishery reserves or national parks. Sites that have been selected for protection as fishery reserves are currently subject to public hearings and discussions prior to their boundaries and management plans being finalized.

in April 2002 and include marine areas off Walker's Cay; Central Andros; Little Inagua; and Moriah Harbour Cay, Exuma (see Fig. 9.5).

Initiatives by the Bahamian government and Bahamas National Trust are, in part, a response to vocal support for Bahamian marine reserves from a variety of sources. For a number of years, dive operations and marine research laboratories within the Bahamas have established what amount to "voluntary" no-take areas to reduce user conflicts and have requested official government designation for these areas. Local communities have also formed committees such as the Andros Conservancy and Trust (ANCAT) on the Island of Andros, and the Exuma Tourism and Environment Advisory Committee (TEAC) in the Exuma Cays, to address environmental concerns and petition the government for the establishment of marine protected areas.

The Bahamas Reef Environment Educational Foundation (BREEF), a non-profit organization dedicated to educating Bahamians about their marine environment and the need for protecting it, united several of these local efforts on a national level in 1998, when BREEF held a workshop for local government representatives and Bahamian Department of Fisheries officials on the use of no-take marine reserves for the Bahamas. As a result of this workshop, BREEF and the Bahamas Department of Fisheries, in consultation with local government representatives from nearly all of the major island groups, developed a proposal for the creation of a network of no-take marine reserves covering the entire Bahamian archipelago. Guidelines for site selection within this network were based on scientific criteria (adapted from Ballantine [1995] and Appeldoorn and Recksiek [1998]; see chapters 5 and 11). Within these guidelines, local knowledge of resource distribution and resource use patterns (most of the local government officials were full or part-time fishermen or fishing guides by occupation) were used to select specific sites.

After the marine reserve network proposal was developed, it was subject to an independent review by a panel of scientists who have worked on marine reserves and were familiar with the Bahamian marine environment. This review panel evaluated and ranked the proposed reserve sites (and several additional sites at the suggestion of the Bahamian Minister of Agriculture and Fisheries) according to both socioeconomic and ecological criteria (Table 9.1). Sites were ranked on a scale of 1 to 3 for various criteria, and individual scores were averaged for all socioeconomic and all ecological criteria independently. Overall site ranks were then determined by adding socioeconomic and ecological scores together (Stoner et al. 1999). Similar site selection criteria are also used by the Bahamas National Trust to select National Park sites (Table 9.2).

Based on the marine reserve network proposal and its subsequent review by scientists, the Bahamian government announced that it would be creating a marine reserve network with the ultimate goal of protecting 20 percent of Bahamian marine habitats, and that the first five reserves in this new network were created in 2000. The five sites chosen for protection included the area of Walker's Cay, Bimini, the Berry Islands, Cape Eleuthera, and Lee Stocking Island/Great Exuma (see Fig. 9.5). Although few of these sites were among the highest ranked sites, all were considered to be acceptable marine reserve locations by the scientific review panel (Stoner et al. 1999).

Since the first five new sites were selected for the marine reserve network, the Bahamian Department of Fisheries has held several public meetings on a national level and in communities near the new reserve sites. The purpose of these meetings is to explain the need for marine reserves to the public and get public input into drawing reserve boundaries and developing reserve manage-

Table 9.1 Site Evaluation Criteria Used by the Scientific Review Panel to Rank Sites Proposed as Marine Fishery Reserves

Socioeconomic Criteria

A. Fishing Impact—the degree to which fishing will be displaced due to the creation of the MPA
   1 point = Major displacement of fishing activity
   2 points = Minor displacement of fishing activity
   3 points = Negligible displacement of fishing activity
B. Community Management—the ability of local communities or existing organization to participate in management of the MPA
   1 point = No community nearby and no existing park (or other management organization)
   2 points = Community nearby but support uncertain
   3 points = Supportive community nearby or existing park
C. Community Benefits—likelihood that marine reserve would provide benefits to local communities
   1 point = Both nonconsumptive benefits and spillover effect negligible
   2 points = Minor nonconsumptive benefits and/or spillover effect likely
   3 points = Major nonconsumptive benefits and/or spillover effect likely

Ecological Criteria

A. Habitat Diversity—the diversity of marine habitats important for supporting Bahamian fisheries and marine biodiversity. These habitats included sea grass, mangroves, and coral reefs.
   1 point = habitat sparse or degraded by human activities
   2 points = Healthy reef or seagrass/mangrove (not both) habitats present
   3 points = Healthy reefs, seagrass, and mangrove habitats present
B. Regional Importance—the potential importance of the area for supporting fisheries throughout the Bahamas. Because the prevailing currents in the Bahamas run from SE to NW, larval retention within the Bahamas is likely to be greatest for sites in the SE half of the country.
   1 point = Negligible potential source of larvae for the Bahamas.
   2 points = Minor potential source of larvae for the Bahamas
   3 points = Major potential source of larvae for the Bahamas

Stoner et al. 1999.

For each proposed site, scores for socioeconomic criteria and ecological criteria were averaged separately then added together to give an overall score for each site. The resulting priority scores ranged from 2 to 6 and were used to rank sites.

ment plans. Thus local resource users are having a large amount of input into the planning process in terms of deciding the exact location and boundaries of individual reserves, as well as the development of management plans for the reserves. Because the resources for enforcement of the new reserves are limited, community participation in reserve designation and management is essential for the success of these marine reserves. At the time of writing, local response to marine reserves in the five areas has been mixed. In Bimini, for example, the proposed marine reserve was relatively well received. This may be due to the fact that many residents of Bimini feel that their natural resources are under

Table 9.2 Parks and Protected Area Site Selection Criteria Used by Bahamas National Trust.

Criteria	Subcriteria
Biogeographic importance	Presence of rare biogeographic qualities or representativeness of a biogeographic type
	Unique or unusual geological features
	Characteristic of the biogeographic province or region
Ecological importance	Essential part of ecological process or life support systems
	Area's integrity encompasses a complete ecosystem
	Variety of ecosystem
	Habitat for rare or endangered species
	Nursery or juvenile area
	Feeding, courtship, breeding, rest, or migration areas
	Rare or unique habitat for species
	Genetic diversity
	High level of primary and/or secondary production and attendant higher trophic level communities
Biodiversity importance	Variety and number of life forms and communities that occur within the specified habitat type or within the biogeographic province or region
	Representative variety of species or an important sample of the diversity of ecosystems, communities, species, populations, and gene pools found within the region or habitat
Naturalness/ habitat structure	Extent to which area has been protected from human-induced change
	Unique rare or unusual chemical, physical, geological, and/or oceanographic features, structures, or conditions
Economic importance	
Social importance	
Scientific importance	
International/national importance	
Practicality/feasibility	Degree of insulation
	Social or political acceptability
	Accessibility for education, tourism, recreation
	Compatibility with existing uses
	Ease of management

For each criteria and subcriteria, sites are scored on their value using a scale of low, medium, and high.

increasing threat from habitat loss and exploitation, and local stakeholders have united to protect their resources from these outside threats. Acceptance of a reserve in this area may also be related to the fact that the greatest resource use in the proposed area is catch and release bonefishing, which (after consultation with local stakeholders) will be allowed within the reserve, so the establishing the reserve is likely to have little adverse impact on the local economy. Bonefish guides may even be involved in community-based management and enforcement of the reserve.

In other proposed reserve areas, there has been some opposition to the proposed reserve area, but a general acceptance of the need for marine reserves. In south Eleuthera, where poor economic conditions leave local residents few options other than fishing in nearby areas to support their families, there is concern that creating a reserve there would create undue economic hardship. As in the case of the Florida Keys and other places, conflict among user groups has slowed the marine reserve designation process in some parts of the Bahamas. In Great Exuma, for example, local fishermen objected to the creation of a large marine reserve around Lee Stocking Island because they believed that it would only benefit a marine research lab in the area and actually hurt local fishing since several important fishing areas would be closed. These fishermen, however, recognized the importance of marine reserves for conserving marine resources and suggested an alternative site near Great Exuma that was included in the Department of Fisheries marine reserve network proposal and was ranked high by the scientific review panel. Local support for this reserve largely stems from the fact that commercial fishermen from other parts of the Bahamas use this area and are thought to practice destructive fishing with high rates of bycatch that result in reduced landings for local fishers. The Bahamas Department of Fisheries is currently considering both areas for protection, with the area around Lee Stocking Island likely to be reduced to areas immediately around research sites, but a much larger reserve is being considered for the other proposed Great Exuma reserve site.

To help direct future marine reserve designations, there is increasing interest in forming a national marine reserve advisory panel composed of representatives from the scientific community, marine education and conservation nongovernmental organizations, the government of the Bahamas, and the Bahamas National Trust. This panel will provide further advice to the Bahamian government on the selection of sites for marine reserves, the design of those reserves, and the marine reserve designation process, as well as the development and implementation of marine reserve management plans. The continued interest of this advisory panel will greatly facilitate the creation of an effective network of marine reserves in the Bahamas. On a local level, the Department of Fisheries has encouraged the creation of local advisory panels comprised of various stakeholders, including fishing guides, commercial fishers, recreational and subsistence fishers, as well as conservationists. These local panels are used to make recommendations about the designation and management of individual reserves.

LESSONS LEARNED FROM THE BAHAMIAN EXPERIENCE WITH NO-TAKE MARINE RESERVES

The Bahamas has a long history with the use of marine protected areas and no-take marine reserves, but the Bahamian experience with no-take marine reserves is really just beginning. Based on the example provided by the Bahamas, we can draw several conclusions about marine reserves. First and foremost, the Bahamas provides an excellent example of a large marine reserve that effectively protects some of the most important and most vulnerable fisheries species in the wider Caribbean region and the coral reef ecosystems of which they are an integral component. The Exuma Cays Land and Sea Park effectively protects Nassau grouper, Caribbean spiny lobster, and queen conch populations, despite the fact that it may not contain the greatest abundance of high quality habitat for any of these species. The effectiveness of the park is likely to be the result of its large size and inclusion of a variety of habitats that these species utilize during various life stages. Conservation of these species results in fisheries benefits on local and regional scales for some species, but may not for others with different life-history characteristics.

Based on the Bahamian experience, we can also draw several conclusions from a socioeconomic perspective. The mixed reaction to marine reserves in the Bahamas suggests that acceptance of marine reserves requires consultation with local communities during planning stage of the designation process and ensuring that access remains to at least some traditional fishing grounds. Similarly, public support also depends on ensuring that certain user groups (e.g., foreign scientists and island owners) are not perceived as receiving preferential treatment. Thus all resource users must be treated openly and fairly in the designation process.

Finally, the new reserve network being created in the Bahamas provides an example of how a combination of bottom-up and top-down approaches can be used to create marine reserves. The development of the no-take marine reserve network proposal also involved a balance of socioeconomic and ecological considerations by combining local knowledge of resource use and other socioeconomic factors with scientific criteria. Similarly, the review and ranking process evaluated sites on equally weighted socioeconomic and ecological criteria. Although primarily driven by a top-down approach, involving consultation with both scientists and local representatives, there is much bottom-up participation in the marine reserve planning process by local resource users. Consequently, several new reserve sites being considered by both the Department of Fisheries and the Bahamas National Trust have evolved from local proposals.

Only time will tell how effective these efforts will be, and whether or not a functioning marine reserve network that encompasses more than 20 percent of the Bahamian marine environment will be protected. Fortunately, Bahamian fisheries and marine ecosystems remain relatively healthy, but threats are increasing. Unlike many Caribbean nations and tropical island nations around the world, the Bahamas still has an opportunity to create marine reserves in order to prevent declines in fisheries species and ecosystem health, rather than using reserves to rebuild collapsed stocks and restore severely degraded ecosystems. Although the degree of urgency may not be present, the relative health of Bahamian marine resources may help with the creation of marine reserves. To use an analogy, it is much easier to set aside a piece of pie for the future when everyone can still eat their fill, than when people are fighting to pick up every last crumb. By creating an effective marine reserve network before marine resources are depleted and marine ecosystems degraded, the Bahamas may have sustainable fisheries and healthy marine ecosystems for the economic and cultural benefit of present and future generations of Bahamians.

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