



**FULLY-PROTECTED  
MARINE RESERVES**  
FOR THE FUTURE OF OUR OCEANS

**A Companion Guide to the  
Fully-Protected Marine Reserves Public Exhibition**

**Sponsored by**

**BREEF, The Nature Conservancy, and the Department of Fisheries**

**The Commonwealth of The Bahamas**

**A**round the world, fishermen and fisheries managers have seen a dramatic decline in fish stocks due to factors such as overfishing, pollution, and habitat destruction. To address this problem, fully-protected marine reserves have gained wide acceptance as an important tool for marine conservation, in addition to conventional management tools such as closed seasons, size limits, and fishing gear restrictions. Fully-protected marine reserves are important for the future of our oceans and The Commonwealth of The Bahamas.

*The fishing sector plays an important role in the economy of The Bahamas and the Bahamian way of life. Did you know there are almost 9,000 fishermen in The Bahamas?*

*Vessel owners and operators earned some B\$102.7 million in 2002. Additionally, export of crawfish, scale fish, and inedible marine products (such as sponge and helmet shells) resulted in US\$99.5 million in foreign exchange in 2002.*



The principal commercial fisheries in The Bahamas are crawfish, conch, shallow-water scale fish (groupers, jacks, snappers, and grunts), sponge, stone crab, queen helmet shells, and deep-water scale fish (red snappers).

*Globally, stocks of large fish, such as groupers, cod, swordfish, and tuna have declined by 90% in the last 50 years. Marine reserves have been established to help troubled fisheries in countries including The Bahamas, the United States, Belize, New Zealand, The Philippines, and South Africa.*

## WHAT IS A FULLY-PROTECTED MARINE RESERVE?

**A** fully-protected marine reserve is an ocean or coastal area protected from fishing and other extractive or harmful uses. This protection allows some activities and restricts others, while still offering substantial benefits to biodiversity conservation and fisheries management.



Hello, I am

**Michael T Braynen**  
Director of Fisheries

In considering the great importance of the fishing industry in The Bahamas, The Department of Fisheries pursues a

number of avenues to ensure the sustainability of the country's marine resources. The concept of using fully protected marine reserves as a fisheries management tool has been fully embraced by us, recognizing at the same time that there are other benefits to be derived from them.

Since the decision of the government to establish a marine reserves in 2000 The Department of Fisheries, in conjunction with various partners, has been taking the message throughout The Bahamas and gathering input from those communities closest to the areas where the first five reserves are to be located. This booklet is one important step in that process.

Activities that are regulated or prohibited in fully-protected marine reserves typically include:

- Fishing or collecting wildlife
- Mining, drilling, or dredging
- Dumping, or discharge of any material into reserve waters
- Vessel anchoring or mooring
- Snorkeling and scuba diving
- Feeding, touching or otherwise disturbing wildlife



*Marine protected area (MPA) is a general term for areas that receive any sort of protection, including marine parks, sanctuaries, and fully protected marine reserves. These may have different levels of restrictions on various activities. For example, "no-take reserves" emphasize the restriction on extraction of resources from the area.*

# HOW ARE FULLY-PROTECTED MARINE RESERVES GOOD FOR FISH AND GOOD FOR YOU?

Fully-protected marine reserves have the potential to provide a number of environmental, social, and economic benefits.

## Maintaining fisheries and other ecosystem services

Fish stocks have increased in most existing reserves and there is increasing evidence that these larger populations **spill over** into adjacent areas where fishing is allowed. Reserves can also **seed** adjacent fished areas with **larvae** from spawning that takes place inside the reserve. Spillover and seeding benefit subsistence, commercial, and sport fishermen — and consumers! Fully-protected marine reserves help maintain intact **ecosystems** and ensure that we continue to receive important **ecosystem services**.

## Conserving species and habitats

Fully-protected marine reserves protect habitats and provide the opportunity for different species to thrive and recover from fishing pressures. In addition, scientists can compare environmental processes inside and outside of reserves, thereby improving our understanding of **biodiversity** and the function of ecosystems.

## Insuring against uncertainty

Fully-protected marine reserves provide a refuge and a buffer against some of the uncertainties in traditional fisheries management (such as rates of fish reproduction and environmental variability) that sometimes lead to population crashes. Areas that are protected from pressure from fishing and other human activities maintain healthy **habitats** and recover from catastrophic events (such as hurricanes) more quickly than areas that are not protected.

## Boosting the economy

A healthy marine environment can offer economic opportunities. In addition to or as an alternative to fishing, fishermen can get involved in **ecotourism** by taking tourists out in boats for snorkeling or wildlife viewing. Other people may work in local hotels, restaurants, or shops that cater to tourists.

## Providing recreational areas

Bahamians and tourists alike enjoy a clean and healthy marine environment for recreational activities such as picnicking, snorkeling, and diving.

An **ecosystem** is the sum of interactions between living things and their physical environment.

**Ecosystem services** are the benefits to humans from natural processes such as fish production, water filtration, flood control by mangroves and other wetlands, and natural protection for shorelines provided by barrier reefs.

A **larva** is the immature, free-living, form of most marine invertebrates and fish.

**Did you know that crawfish larvae can float in the ocean for up to a year, traveling several hundred miles before they settle to the bottom as juvenile crawfish?**

Biological diversity, or **biodiversity**, refers to the variety of life in all its forms and the interactions among them. Coral reefs and surrounding waters of The Bahamas are known to contain very high levels of biodiversity. People are only beginning to understand the potential value of many of these plants and animals to humans, and to maintaining healthy ecosystems. We are also only beginning to understand the threats to this biodiversity and the importance of protecting it.

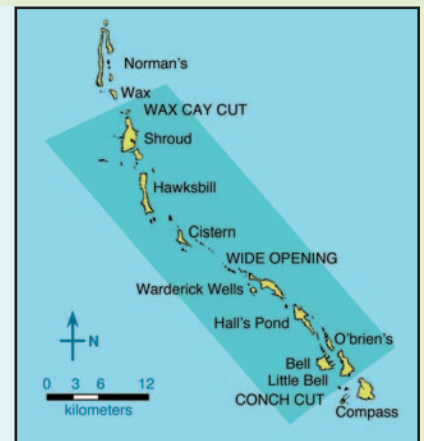
A **habitat** is a place where an animal or plant lives. This “home” has all the necessary environmental conditions for survival.

**Ecotourism** is “responsible travel to natural areas that conserves the environment and improves the well-being of local people.” — The International Ecotourism Society

**“Spillover”** occurs when populations of animals inside marine reserves increase over time, causing some animals to eventually move into less crowded neighboring areas where they can be caught by fishermen. **“Seeding”** occurs when larvae spawned in the reserve drift out and settle in fished areas. These young animals boost populations in surrounding waters. Through the processes of spillover and seeding, reserves can replenish nearby fishing areas.

## EXUMA CAYS LAND AND SEA PARK — BIRTHPLACE OF MILLIONS!

Studies show that the Exuma Cays Land and Sea Park plays an important role as a replenishment area for species that are exploited in surrounding waters. The concentration of conch inside the Exuma Park has been estimated to be 31 times greater than outside the Park. The adult and larval conch that leave the Park provide several million conch for fishermen to harvest each year. Crawfish spawned in the Park could be repopulating areas around Cat Island – 70 miles away. And groupers tagged in the Park were found off both North and South Long Island – 150 miles away!



The 176-square mile Exuma Park was established in 1959 and designated as fully-protected in 1986.

# WHY DO FULLY-PROTECTED MARINE INCLUDE DIFFERENT KINDS OF HABITAT

Many animals use more than one type of habitat during their lives. For example, Nassau groupers spend their early lives in mangrove creeks before moving offshore to shallow patch reefs in seagrass beds. As adults, they live on deeper reefs. During their reproductive season, they migrate to **spawning aggregations** near the edge of reefs and banks. Fertilized eggs, fish embryos, and larvae float in the open ocean. If one or more of these habitats becomes degraded, groupers may not be able to complete their **life cycle**.

For fully-protected marine reserves to ensure the protection and restoration of biodiversity and the enhancement of sustainable fisheries, they must include **critical habitats** — such as breeding grounds and nursery areas, where young fish live and grow. They should also include all habitat areas or types needed for the entire life cycle of most marine species.

A **life cycle** is the series of stages an animal or plant passes through during its lifetime.

**Critical habitat** is a particular habitat that an organism must have in order to successfully complete its life cycle.



I am **Jessica Minnis**, a social science lecturer at the College of The Bahamas. I have been collaborating on the

Bahamas Biocomplexity Project, which aims to understand both the natural and human processes that influence marine reserve networks. We have learned that Exuma residents see the need to support reserves in order to protect their fishing livelihood from poachers and from increasing numbers of fishermen coming in with big nets and bleach that deplete the fishery and damage the coral reef habitat. Residents also want to ensure that in the future there will be fish for their families, that marine life will be conserved and their children will be able to benefit from it. It is essential that local people participate in maintaining reserves so they don't feel they have lost control of their environment and by extension, of their livelihood.



My name is **Tavarrie Smith**. As a student in Ms. Minnis's social research course, I learned about methods for collecting data. I participated as a researcher in the study to better understand the reasons why people do or do not support marine reserves. We talked to people about how important the sea is to their way of life. I learned, especially from senior members of the community, about traditional fishing grounds, fishing methods, and other important parts of our undocumented history. I learned what it truly means to be a Bahamian.

**Bahamians depend on the ocean and coastal habitats for their livelihood and recreation. These habitats form the structure for many of our activities, and are also affected by them.**



Adapted from the mural created by Charlene Carey for the Fully-Protected Marine Reserves Public Exhibition

**Mangroves** are trees that are found in the transition zone between the land and the sea. They form an important habitat for many juvenile fishes (they are a nursery for about 80% of commercially important fish species) and for other animals, such as lobsters, land crabs, bats, and birds. Mangroves also serve as a filter and trap sediments, thereby protecting coral reef habitats.

**Tidal flats** are areas that may be under water at high tide and exposed at low tide. They are important habitats for sand-dwelling species such as conchs, which, as juveniles, bury themselves for almost a year to feed and grow.

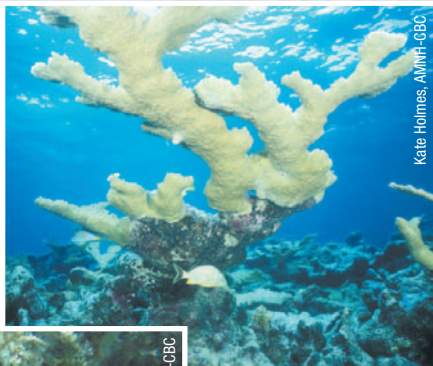
# RESERVES NEED TO PROTECT WHATS?

*“Unlike any other form of management, fully-protected marine reserves are uniquely capable of protecting marine ecosystems — not just a handful of species — and are essential to keep these systems functioning in a way that maintains stability.”*

— Dr. Craig Dahlgren



Phil Bush



Kate Holmes, AMNH-CBC



Kate Holmes, AMNH-CBC



**Spawning aggregations** refer to large gatherings of a species of fish, at a particular place and time, for the purpose of reproducing. Many commercially important fish species in The Bahamas form spawning aggregations. These include several species of snapper and grouper, such as the Nassau grouper and mutton snapper, and also bar jacks. **Spawning aggregations account for a large percentage, if not all, of the reproductive activity of these fishes.**



Hi, I'm **Dr. Craig Dahlgren**, a marine biologist and senior research scientist at the Perry Institute for Marine Science on Lee Stocking Island in the Exumas. I study how the diversity of plants and animals found on the sea floor differs in marine reserves from surrounding areas. I have found out that fish communities within marine reserves are very different from those outside of reserves. In the reserves there is a higher abundance of large top predators — like snappers, groupers and barracudas, and I'm learning about the effects that these have on prey species and other organisms. This research, along with studies I am conducting on the spillover effect, help us understand how marine reserves can support fisheries. They also indicate criteria for effective marine reserve design, such as location, size, shape, and habitats to include.



**Seagrass beds** are areas of submerged grasses that provide habitat and nursery grounds for recreationally and commercially important fish and other animals, including turtles, conch, and ballyhoo. Seagrasses help to trap sediments from the land and stabilize the sea floor.

**Coral reefs** are formed by a variety of corals and other animals and plants. Though reefs cover less than 1% of the Earth's surface, they have the highest biodiversity of any marine ecosystem. Coral reefs provide shelter and food for spiny lobsters, groupers, and thousands of other marine animals. These “rainforests of the sea” are extremely important to Bahamians as a source of food, recreation, and tourism.

The open ocean is called the **pelagic zone**. Here larvae and other tiny organisms are distributed. The open ocean is a major “roadway” for migratory species like turtles, whales, and dolphins.

# WHY IS IT IMPORTANT TO HAVE A NETWORK OF RESERVES?



Katie Holmes, AMNH-CBC

**A** network of fully-protected marine reserves, such as the group of reserves being set up throughout The Bahamas, can be more beneficial in protecting marine life than any reserve can by itself. Together the reserves in a network should include the full range of marine habitats, be large enough and well-connected enough to protect marine populations, and also have the support of the human communities who use the marine resources.



Hello, I am **Tamica Rahming**. I am a marine biologist and Fisheries Officer at the Department of Fisheries with responsibility for conservation, research, and public education activities. The Department of Fisheries' Marine Reserves Network Project

aims to ensure the viability of the nation's valuable fisheries, as well as the long-term protection of the marine habitats that are characteristic of The Bahamas. I have been involved in coral reef monitoring, Nassau grouper and conch research, and I also consult with local communities and fishing interests to determine specific sites and boundaries for reserves.

## Here's what fishermen are saying about how the decline in fisheries affects them and the Bahamian economy:

"In the 70's when I used to dive, you could go in there and get as much conch as you want. You can't do that now. You have to search. They used to say that conch would never run out. That's just how much there used to be, but they're running out and fast too."  
— *Freddy Delancy*

"When a fisherman makes money everyone makes money. When fishermen don't make money everyone suffers."  
— *Hardy McKinney*



**A well-designed network of fully-protected marine reserves is guided by a number of principles:**

### REPRESENTATION

A network should include the full range of species, habitats, and other features important for conservation. In addition, it should represent these in a way that reflects the natural composition of the marine environment. The design process should assess what is protected in existing reserves and determine what other areas are needed to complement these.

### REPLICATION

Including multiple areas with separate populations of the same species and the same kinds of habitats helps to ensure that if there were a catastrophic event — such as a disease outbreak, hurricane, or oil spill — some of the species would survive. In this way, a network can provide a broader “insurance plan” than a single reserve can.

### CONNECTIVITY

A well-designed network is more than just the sum of its parts. In other words, the design should incorporate ecological connections among protected sites so that the whole network can reseed and sustain itself. For example, some species require that certain habitats be close enough so that individuals can move among them as they grow. Other marine species with larvae that disperse over long distances may only be protected if distant sites contain healthy habitats.

### ADEQUACY

A network should provide enough protection for populations, species, and communities to persist into the future. Scientists suggest that networks should protect at least 20% of an entire marine area to allow for sufficient conservation benefits while leaving ample area outside for fishing or other human uses. The actual size and number of individual reserves in a network depend upon the species to be protected and the level of protection desired.

### EFFICIENCY

A network balances costs and benefits. Besides the adequacy principle, efficient network design should consider current and future threats to biodiversity and ecosystems; social, political, and economic opportunities for establishing reserves; and costs of ongoing management and enforcement in different places. Given such factors, network design must be flexible and practical so that conservation objectives can be met along with acceptable social and economic outcomes.

# EVERYONE HAS A STAKE IN MARINE RESERVES



Marine reserves are one of the important management tools for sustaining a healthy environment and the living resources of The Bahamas.

*“By conserving our marine resources, Bahamians will have the opportunity to pass our environmental inheritance on to future generations, as well as safeguard a large portion of our culture and our economic prosperity.”* — Dr. Livingston Marshall



Hi, my name is **Eleanor Phillips**, director of The Nature Conservancy’s Bahamas Program. Prior to joining the Conservancy, I worked at the Department of Fisheries where I helped get the Marine Reserves Network Project started. I have worked with other environmental agencies and consulted with community members to generate support for the implementation of reserves. Marine reserves provide an “insurance policy” against the collapse of fisheries, especially in conjunction with

other regulations, like closed seasons and size limits. Once reserve boundaries are enforced and respected — allowing the organisms within to thrive and reproduce — potential spillover to outside areas can benefit commercial fisheries.

## WHAT CAN YOU DO TO SUPPORT MARINE CONSERVATION?

### Learn about your environment.

- Be familiar with the different marine habitats and their functions in order to make informed decisions.
- Spread the word. Share your knowledge and interest in the marine environment to encourage others to learn the importance of marine conservation.

### Support sustainable fisheries.

- Don’t use harmful or prohibited chemicals.
- Be careful where you drop your boat anchor. Corals and other marine life can be easily damaged.

- Respect catch limits and closed seasons.
- Don’t take juvenile fish, conch, or lobster.

- Be an informed consumer. Consider carefully the fish and marine objects that you buy or sell — is their harvest sustainable?

### Take part in establishing marine reserves.

- Participate in the designation of marine reserves near you by attending meetings and sharing your knowledge.
- Respect the boundaries and regulations associated with existing reserves.
- Support local conservation organizations and governmental agencies that help to protect our marine environment.

### Take action in your community!

- Participate in beach and wetland clean-ups, such as The Ocean Conservancy’s International Coastal Cleanup that takes place every year in September.
- Use cloth napkins and re-useable plates, cups, and utensils. The majority of debris collected on our beaches is paper and plastics from picnics.

- Start your own waste reduction and recycling efforts. Less garbage going to your community landfill means less waste carried into the ocean or seeping into the ground and into the marine environment.
- Inspect your septic system regularly. If septic systems are not maintained properly they can contribute to water quality problems at home and in the ocean.
- Don’t use chemical pesticides and fertilizers in gardens or fields. These products end up in the watershed and impact the marine environment.
- Report dumping or other illegal activities. Environmental enforcement cannot be everywhere, and your involvement can make a big difference.

The first national closed season for Nassau grouper was January 1-31, 2004, protecting grouper in spawning aggregations.

The yearly closed season for lobster is April 1 through July 31.



“I serve as scientific consultant and advisor to the Prime Minister on a range of environmental and especially marine-related issues. This role affords me an opportunity to contribute to policy, research and educational aspects of sound environmental stewardship in The Bahamas.”

— Dr. Livingston Marshall.

Currently marine protected areas account for much less than 1% of the world’s oceans, and of these, only a tiny fraction are fully-protected reserves. Let’s support marine reserves to protect our oceans and our livelihoods.

*“Marine conservation is everyone’s business because we all are affected by, and benefit from, our marine resources.”*—Tamica Rahming



Hello, I am **Casuarina McKinney**, executive director of the Bahamas Reef Environment Educational Foundation. BREEF is a non-profit dedicated to protecting our Bahamian marine environment through

education. We organize conferences to help students, educators, and the public make decisions about how best to benefit from our ocean and the life in it without using it up. Our environment and economy are connected; we all benefit from a healthy environment, and we all suffer if it is degraded.



Stuart Cove's Nassau, Bahamas

## Community-Based Conservation for Bahamian Marine Protected Areas and Critical Marine Habitats

This project aims to educate Family Island communities about nearby fully-protected marine reserves. The Bahamas Department of Fisheries, The Bahamas Reef Environment Educational Foundation (BREEF), and The Nature Conservancy (TNC) have partnered in this educational program to support the Department of Fisheries' initiative to establish a national network of fully-protected marine reserves.



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The CBC coordinates The Bahamas Biocomplexity Project (BBP), a collaboration of scientists with various governmental and non-governmental groups to conduct studies in The Bahamas of the complex environmental and social factors that affect the design, management, and effectiveness of networks of marine protected areas. The BBP is a five-year initiative funded primarily by the U.S. National Science Foundation.

We gratefully acknowledge the following people for their contributions and comments on the text: Craig Dahlgren, Livingston Marshall, Casuarina McKinney, Jessica Minnis, Eleanor Phillips, Tamica Rahming, and Tavarrie Smith. We appreciate the review and insightful suggestions of Bill Alevizon, Louise Barry, Dan Brumbaugh, Lynn Gape, Patricia Ginton, Mark Hixon, Kate Holmes, Jimin Lee, Hamblin Newbold, Amy O'Donnell, Jennifer Stenzel, and Eleanor Sterling.

Written and edited by Meg Domroese and Christine Engels in collaboration with Linda Hammerton and Shenique Albury  
Design by James Lui

Information sources referenced for this booklet include:

Partnership for Interdisciplinary Studies of Coastal Oceans. 2002. The Science of Marine Reserves. www.piscoweb.org

Roberts, C.M. and J.P. Hawkins. 2000. Fully-protected marine reserves: A guide. WWF Endangered Seas Campaign, 1250 24th Street, NW, Washington, DC 20037, USA and Environment Department, University of York, York, YO10 5DD, UK. www.panda.org/endangeredseas/