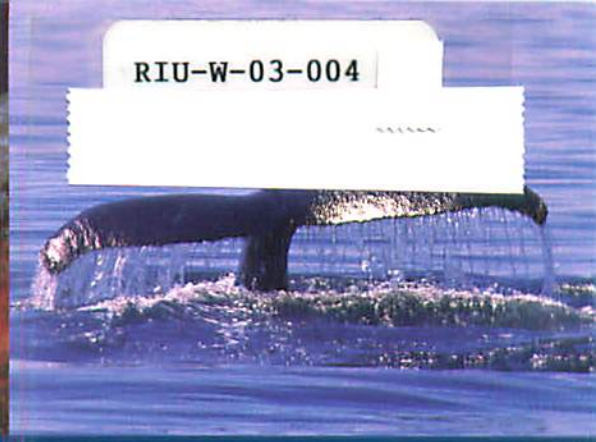
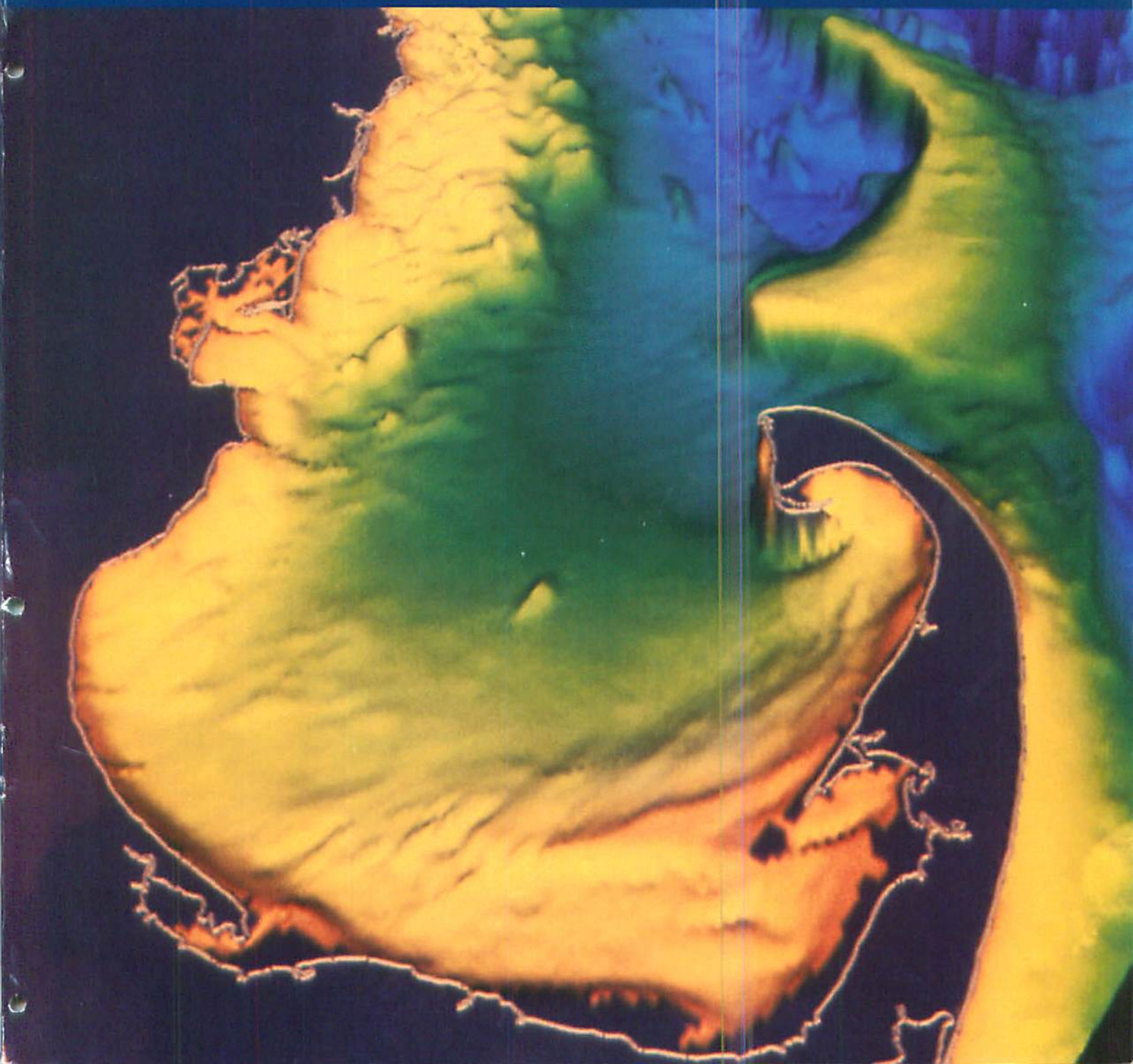


Proceedings of the New England Workshops on Marine Protected Areas

February 27, 2003 - Rockport, ME
March 1, 2003 - Kingston, RI
March 7, 2003 - Portsmouth, NH
March 8, 2003 - Groton, CT



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Compiled by: Margaret Petruny-Parker
Kathleen Castro

Edited by: Malia Schwartz
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Barbara Somers

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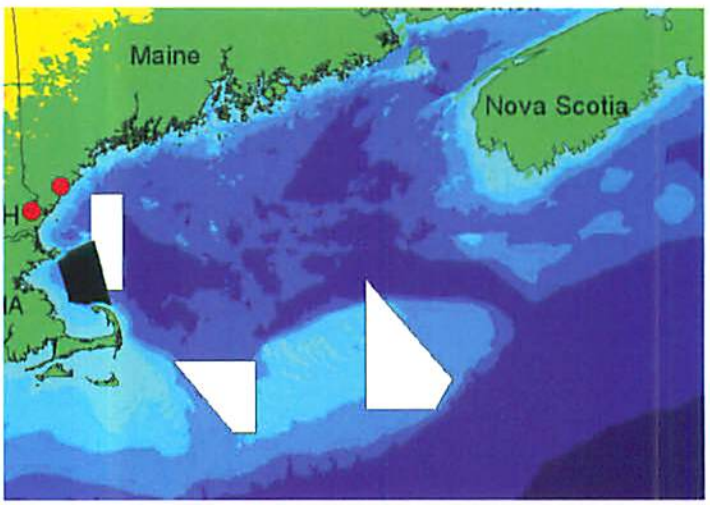


"THE CONCEPT OF MARINE PROTECTED AREAS (MPAS) IS CONTROVERSIAL, DRAWING THE ATTENTION AND EMOTIONALLY CHARGED INTEREST OF A VARIETY OF STAKEHOLDERS, SCIENTISTS, AND RESOURCE MANAGERS, INCLUDING FISHERMEN AND THOSE WORKING IN THE FIELD OF FISHERIES MANAGEMENT."

—Margaret Petruny-Parker

Introduction

Margaret Petruny-Parker, Rhode Island Sea Grant Program

The concept of marine protected areas (MPAs) is controversial, drawing the attention and emotionally charged interest of a variety of stakeholders, scientists, and resource managers, including fishermen and those working in the field of fisheries management. Much of the controversy appears to stem from confusion over exactly what the term means, and what the goals are in establishing a national network of MPAs. For example, how are MPAs different from marine sanctuaries or marine managed areas? How do MPAs function and how permanent are they? In relation to fisheries management, the questions center on whether MPAs can be an effective and economically efficient management tool in rebuilding stocks and providing for sustainable fisheries. More specifically, some question whether the many fishing closures already in place in the New England region qualify as MPAs.

In February and March 2003, Sea Grant Fisheries Extension programs in Rhode Island, New Hampshire, Connecticut, and Maine hosted a series of fisheries educational workshops narrowly focused on the concept of MPAs as they relate to fisheries management. The workshops in Rhode Island, New Hampshire, and Connecticut were a half-day in length and structured to provide a general overview of the concept of MPAs and the ways that protected areas are currently being used for fisheries management purposes in New England waters; an assessment of the theoretical impacts to fisheries, particularly of no-take zones; and an examination of the results from closed areas located on the Scotian Shelf in Canada. The workshop in Maine was presented as a special session during the Maine Fishermen's Forum, and was a full day in length. It included presentations covering the same information as the workshops in the other states, but was expanded to include a facilitated discussion among participants on how Maine could develop a fair and inclusive process for evaluating the possible establishment of MPAs in the Gulf of Maine.

As part of a larger series of educational workshops on key fisheries management issues, the MPA workshops were aimed at providing a foundation of information for future fisheries management and policy discussions and an opportunity for participants to share up-to-date information and observations related to this topic. Commercial and recreational fishermen, managers, environmentalists, students, and interested members of the general public participated in the workshops.

The following document is a composite summary of the four workshops and includes an overview of each of the presentations along with the accompanying comments, questions, and answers generated at each workshop. Also included is a summary of the facilitated group discussion held at the Maine Fishermen's Forum and a summary of the major themes that emerged from all four workshops.

Kraken, *a remotely-operated vehicle, is launched by scientists from the National Undersea Research Center (NURC), University of Connecticut. An operator at the surface directs the "robot" to specific targets for photography or sampling activities.* Photo courtesy of NURC.

PART I

OVERVIEW OF MARINE PROTECTED AREAS

General Overview of MPAs

Presented by Tracey Morin, University of Rhode Island, at the Rhode Island and New Hampshire Workshops

Presented by Robert Pomeroy, University of Connecticut and Connecticut Sea Grant Program, at the Connecticut Workshop

In recent years, there has been a shift towards ecosystem-based marine management. The emphasis of this form of management is on protecting the productive potential of the ecosystem that produces resource flows rather than on protecting a stock as a resource. MPAs are a type of marine resource management tool. These tools are ecosystem-based and include other examples besides physically designated areas. These may include catch limits, wetland restoration projects, and water quality standards. Worldwide, current MPA sites cover less that 0.5 percent of world's oceans, but some are asking for the coverage to be increased to 20 percent of the world's oceans.

The World Conservation Union defines MPAs as:

> *"Any area of intertidal or subtidal terrain, together with its overlaying water and associated flora, fauna, historical, and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment."*

This is the most widely accepted definition of an MPA. The definition points to MPAs as spatially designated areas established by formal law or other effective means used to implement it. MPAs consider whole ecosystems. There are more than 1,350 sites designated as MPAs worldwide.

Types of MPAs and Management Styles

There are different types of MPAs based on the regulation of activities. Some MPAs prohibit entry, some have comprehensive controls on extraction and use, and some have regulations regarding specific activities. According to the National Research Council's (NRC) 2001 report, there are three types of MPAs:

- *Fishery reserves*—Zone where fishing activity is prohibited in order to enhance fishery stocks or habitat
- *Marine reserves*—Zone where removal or disturbance of some or all living resources is prohibited
- *Ecological reserves*—Zone where the disturbance or removal of any living or non-living marine resource is prohibited

The following examples illustrate the spectrum of MPA management approaches:

- *Community-based*—Designated and managed by local village, town, or community ("bottom-up," grassroots, etc.)
- *Comanaged*—Designated and managed by local village, town, or community in collaboration with the state or federal government
- *Federally based*—Designated and managed by federal government with little or no input from the local community ("top-down")

The most effective type of management appears to be that which is community based. Regardless of the type of management scheme chosen, however, there are numerous planning and management considerations associated with MPAs, including:

- Effects on communities
- Stakeholder involvement in planning
- Structure and function of the natural system
- Costs of implementation

Visiting the Channel Islands by kayak is a great way to appreciate its exceptional beauty. Kayaking offers visitors up-close and personal views of the island coastlines and wildlife. Photo by Chris Gotschalk.

- Enforcement
- Changes to current uses of an area
- Existing laws and regulations that are in place to manage an area
- Resource issues outside of MPA boundaries

Benefits and Costs of MPAs

There are many potential benefits to establishing MPAs. They may be used to conserve biological diversity—currently one of the only management tools available for this purpose. MPAs can help protect cultural and historical resources by assuring the continuation of traditional uses, cultural practices, and sacred sites. They can also protect sites with historical significance such as shipwrecks. Another benefit of MPAs is that they can enhance natural resources by limiting impacts to endangered or threatened species, increasing the number and size of exploited populations (e.g., commercially caught fish and shellfish), and maintaining benthic habitats. MPAs also provide opportunities for research and education by providing a control to measure the impacts of human activities and serving as sites for education (i.e., hands-on interactions that support classroom curricula). Lastly, MPAs can enhance non-extractive uses, such as diving, kayaking, and tourism, which can provide benefits, both economic and noneconomic.

Establishing MPAs can yield benefits to fisheries in the protected area, including increasing spawning stock biomass and stock abundance, enhancing age-size composition and yield per recruit, and restoration of healthy trophic levels. MPAs can also have positive spillover effects to enhance local catches, provide insurance against uncertainty, increase aggregate catch levels and better predictability of catch levels, reduce problems of multispecies management, and enhance market value by altering species composition of the catch.

But there are potential costs associated with MPAs, including a loss of earnings (opportunity costs), an increase in illegal activities, an increase in direct costs, such as those costs associated with establishing and monitoring MPAs, enforcing regulations, and the added costs to fishermen of having to fish in other areas, perhaps further offshore. There are also risks associated with how the fishing industry will adapt to closed areas and increased congestion and conflict on remaining open fishing grounds.

MPAs in the United States

In May 2000, President Clinton issued Executive Order 13158 regarding MPAs. The pertinent language is excerpted below:

> *This Executive Order will help protect the significant natural and cultural resources within the marine environment for the benefit of present and future generations by strengthening and expanding the Nation's system of Marine Protected Areas (MPAs).*

The main objectives of Executive Order 13158 were to strengthen the management of existing MPAs and establish new or expanded MPAs; to develop a scientifically based, comprehensive national system of MPAs representing diverse ecosystems and natural and cultural resources; and to avoid causing harm to MPAs through federally conducted, approved, or funded activities. The Executive Order placed heavy emphasis on enhancing and coordinating management of existing MPAs.

The U.S. Department of Commerce (DOC) and U.S. Department of Interior (DOI) were designated the lead agencies charged with meeting the order's objectives. As part of this agency designation, a national MPA Center was established in Washington, D.C., under the DOC's National Oceanic and Atmospheric Administration (NOAA) to facilitate research, training, and education about MPAs. Thirty individuals from various backgrounds have been invited to serve on a Federal Advisory Committee (Appendix 1). The committee was established to provide advice and recommendations to decision-making bodies in the DOC and DOI regarding MPAs.

As of March 2003, a website was created at www.mpa.gov; maps of existing state and federal MPAs in the United States were completed; the National MPA Center was established, with the MPA Training Center set up in South Carolina and the MPA Science Center founded in California; and the MPA Advisory Committee was appointed.

Examples of MPAs

Located off the coast of Cape Cod, Mass., the Stellwagen Bank National Marine Sanctuary is part of the National Marine Sanctuary Program and is one of 13 marine sanctuaries in the United States. The sanctuary was designated in 1992 for the purpose of protecting biodiversity, ecological integrity, and cultural legacy.

STELLWAGEN BANK MARINE SANCTUARY WAS DESIGNATED FOR THE PURPOSE OF PROTECTING BIODIVERSITY, ECOLOGICAL INTEGRITY, AND CULTURAL LEGACY.

Another example of a marine reserve is the Narragansett Bay National Estuarine Research Reserve (NBNERR), which is located on and around Prudence Island in Narragansett Bay, R.I. NBNERR is part of the National Estuarine Research Reserve (NERR) Program and is one of 25 such designated sites from around the country. The research reserve was established in 1980, with the purpose of enhancing research and public awareness about the marine environment.

The Gulf of Maine fishery closure areas are examples of fishery reserves. Designated in the mid-1990s, these areas were established to support the rebuilding of groundfish stocks in the Gulf of Maine and on Georges Bank.

Lastly, the Massachusetts Ocean Sanctuaries were designated through Massachusetts state law in 1970 as a way to prevent alteration of the ocean, seabed, or subsoil.

A glance at the above examples illustrates the variety of reasons for establishing MPAs. They are also one of several available measures for managing fishery resources. But stakeholder involvement, clear and compatible objectives, adequate enforcement and monitoring, and an open and transparent process for establishing and managing MPAs all seem to be critical factors to the success of MPAs. The goals for the scope and purpose of MPAs must reflect a balance between scientific knowledge and economic, social, and political realities. In considering MPAs, the threats to the resource and the potential economic benefits must be identified. And finally, those most impacted need to buy into the decision-making process.

Comments and Questions

- **Q:** MPAs have been established in places such as the Channel Islands in California. How have these worked out?
  A: In the United States, some have been more successful than others.
- **Q:** MPAs might be defined very broadly in which case the entire ocean could be considered an MPA.
  A: There are variations on what is meant by an MPA; the term is vague. MPAs are a spatial tool.
- **Q:** Has work been done regarding the use of MPAs as a temporal tool vs. a spatial tool? Do MPAs have the same value if applied towards the idea of frequency of disturbance?
  A: These are major questions in considering the effectiveness of MPAs in different systems.
- **Q:** Are MPAs equivalent to MMAs?
  A: An MMA is a Marine Managed Area. NOAA came up with this term to encompass these other types of management that may not be considered solely for the purpose of protection. I am not sure of the threshold that differentiates the two.
- An MPA designated by the federal government is not necessarily managed solely by the federal government; there may be stakeholder involvement as well.
- MPAs need to be put in the right areas. Twenty percent of the world's oceans is not necessary.
- There are trade offs between scientific findings and the social and economic impacts in deciding on the size, number, and location of MPAs.
- **Q:** One of the goals is to involve stakeholders in the designation and management of MPAs. When there are conflicts, what are the ways to resolve those conflicts?
  A: For existing MPAs, each agency charged with overseeing each site deals with stakeholders, some through means such as advisory councils.
- **Q:** If there are new MPAs designated as a result of the Executive Order, is there a comprehensive approach to getting input?
  A: This should be considered. There is no framework; the Executive Order simply says that these agencies should work together to coordinate actions.
- **Q:** Is the recreational community represented on the MPA Federal Advisory Committee?
  A: Yes.

- **Q:** Is the definition of MPAs used by the World Conservation Union the accepted definition by the National MPA Center?
  A: There is a difference. The World Conservation Union definition is widely accepted in the international community. There are agencies in the United States that are a part of that World Union and have contributed to that definition. The Executive Order has a different definition. The main difference is that the Executive Order has the phrase "to provide lasting protection" in it.
- There is no agency in charge of controlling MPAs. The Executive Order speaks to existing agencies and tries to enhance coordination among them.
- **Q:** Are fishery closures considered MPAs? Do they meet the criteria?
  A: In the international definition, fishery closures might be considered MPAs. In the Executive Order definition, the phrase "lasting protection" is used and fishery closures may not be considered MPAs by the National MPA Center in that they are not permanent enough to provide lasting protection.
- The MPA Center has defined the term "lasting protection" in draft terms to mean longer than four months and permanent (every year). A Federal Register Notice is about to come out asking for public input on how to define the phrase "lasting protection." We currently have spawning closures that last two-to-three months that do not meet this definition.
- **Q:** Enforcement is an issue. The state enforcement officers and the Coast Guard are already stretched in terms of resources.
  A: Enforcement is a consideration. It has to be thought of in terms of all the possible management options and most effective use of resources.
- There are no new jurisdictions or authorities.
- **Q:** If an MPA is established, will it have to follow all of the other National Environmental Policy Act (NEPA) requirements?
  A: MPAs are already in place under existing agencies and existing authorities. If, under an existing authority, it is necessary to meet NEPA requirements, then that will be the case.
- If the DOI was to establish a new park or monument, or the DOC was to establish a new sanctuary, it could be done through Congress, and the public process could be avoided. If other agencies, such as the New England Fisheries Management Council, were to designate an MPA, there will be a need for NEPA, and if an existing sanctuary was going to develop more restrictions, there would be a need for NEPA.

Introduction to the Issues and Terms

Presented by Deirdre Gilbert, Maine Department of Marine Resources, at the Maine Fishermen's Forum MPA Workshop

The purpose of this presentation is to review some of the terms and definitions used to talk about MPAs. The number of different terms used to refer to MPAs and the lack of consistency in using those terms has led to confusion surrounding MPA designation in marine resource management. This presentation will also cover some of the activities occurring at the federal level to explain, in part, the interest in MPAs and why it is advantageous to start talking about this topic earlier rather than later.

The most commonly used, "official" definition of MPAs comes from the Executive Order on MPAs that was signed by President Clinton in May 2000. An MPA is defined as an "area of the marine environment that has been reserved by Federal, State, territorial, tribal or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein" (Executive Order 13158). In general, this means an area of special protection in the marine environment.

However, this definition is vague. So the first thing that NOAA and the DOI—the agencies charged with carrying out the Executive Order—had to do was to define some of the terms used in the definition. These included the words "area," "marine," and "lasting protection." Some of the terms are relatively straightforward; for example, area means something with specified boundaries (lines on a chart). Marine usually means that the water is at least a little salty, but it has actually been defined here to include the Great Lakes. Lastly, to really understand what is being considered an MPA, the terms "lasting" and "protection" must be defined. After considerable debate, the National MPA Center has decided that "lasting" means some expectation of permanence. Areas with a built-in sunset clause must provide a minimum of four years of continuous protection and must have a specific mechanism to renew protection at the expiration of the sunset period.

Seasonal closures, even if they occur every year, at the same time, forever, and provide adequate protection to the populations they are meant to protect, are not considered MPAs. The rolling groundfish closures that move up the coast each spring are not considered MPAs. It is also important to note that the term protection does not necessarily mean no fishing. It may mean no drilling for oil and gas or mining of sand and gravel as is currently the case on Stellwagen Bank. Or it may mean limitations on certain types of gear. Note that the definition of MPA says nothing about size, so MPAs can vary from less than an acre to thousands of square miles.

MPAs are not a tool intended to achieve one particular goal. Instead, they are viewed as a tool that can be used in conjunction with other management measures. The intent of the MPA will dictate where it needs to be, how large it needs to be, and the degree of protection that it needs to offer. MPAs are established to protect endangered species, such as marine mammals and turtles; protect critical habitat, such as essential fish habitat (EFH); manage fisheries; increase or conserve biodiversity; protect submerged cultural resources, like shipwrecks; reduce user conflicts; and/or provide educational and research opportunities.

Types of MPAs

For some of the goals listed above, proponents believe that total protection of the environment inside an MPA is needed. For example, to conserve biodiversity, there may be a need to protect the entire habitat from disturbance. Likewise, MPAs meant to serve as research areas sometimes must act as a control in an experiment, so there can be no outside disturbance. Even MPAs meant to manage fisheries sometimes are completely protected from takings.

In order to talk about the different levels of protection that MPAs can offer, a number of other terms have cropped up—and they generally have not been used consistently. Often they are used interchangeably. Those most commonly used include:

- Marine reserve
  - No-take reserve
  - Fully protected reserve
  - Ecological reserve
  - Ocean wilderness
- Fishery reserve

The term "marine reserve" is used differently in different places; sometimes it means no extractive activities of any type, other times it means that certain types of extraction, or extraction of certain species, is prohibited with other extractions allowed. An example of this definition can be found in the NRC report: "a zone where some or all of the biological resources are protected from removal or disturbance." Interestingly, all of the terms listed under marine reserve—no-take reserve, fully protected reserve, ecological reserve, and ocean wilderness— are used to mean that extractions of any type, both living and nonliving resources, are prohibited.

Lastly, the term "fishery reserve" is used to mean MPAs designed for the specific purpose of improving fisheries. There are certain management objectives that can be addressed by marine reserves as a supplemental tool for management of fisheries, in addition to some of the management tools that are traditionally used. Some of these objectives are easier to achieve for some species than for others, depending on the species' mobility or other life history characteristics. The objectives include:

- Stock rebuilding — Assist in rebuilding overfished stocks and maintaining them at productive levels
- Biological productivity — Enhance long-term biological productivity (yield)
- Economic productivity — Assist in achieving long-term economic production, while minimizing short-term negative economic impact on all users
- Insurance — Provide protection for the resource against the realities of management uncertainty and the effects of natural environmental variability
- Habitat protection — Conserve and protect EFH
- Research and education — Provide areas not fished for research. These will serve as controls for assessment of the effects of long-term environmental variations and the potential habitat alterations due to fishing and increase our understanding of the role marine reserves may play in fishery management
- Ecosystem approach to management

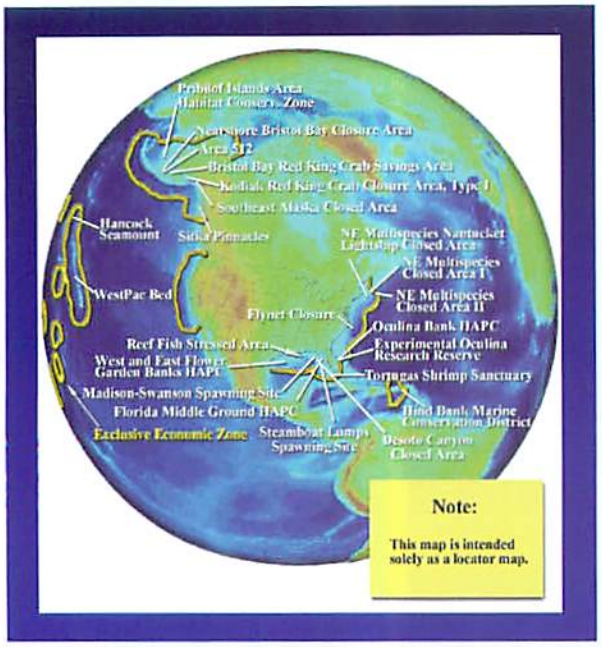


Figure 1.
Examples of MPA and MMA sites around the world.

In existence today are the following types of MPAs, as designated by NOAA: fishery management zones, national marine sanctuaries, NERRs, and critical habitats (Fig. 1).

Federal MPA Initiative

In the belief that MPAs could be used as a tool to improve the condition of marine ecosystems, President Clinton issued Executive Order 13158 in May 2000 to "strengthen and expand the national system of MPAs." President Bush endorsed the Executive Order in June 2001 and announced his intent to move forward with its charge. The Executive Order tasks NOAA and DOI, whose authority provides for the establishment and/or management of MPAs, to enhance or expand protection of existing MPAs and to establish or recommend new MPAs as appropriate. It demands improved communications, coordination, and information-sharing in carrying out this task. The challenge of the Executive Order is to determine a way to use MPAs effectively to reach management goals nationally. Obstacles remain; we do not possess a comprehensive inventory of existing MPAs within U.S. waters, nor do we have a strategy for building a national network from the collection of individual MPAs. We first need to determine what we have and how MPAs are functioning before we can conduct meaningful assessments and implement improved management schemes. The inventory is intended to support the development of science-based management approaches to effectively conserve individual sites and networks of sites, to support the development of a national system of MPAs, and to identify sites so that federal agencies may ensure that the agencies cause them no harm.

To meet these needs, NOAA and DOI were tasked with the following:

- Create an MPA website to provide more information
- Produce an inventory of existing U.S. MMAs
- Establish an MPA Center to provide new science, training, and technologies; assess the effectiveness of current MPAs; and develop a framework for a national system of MPAs
- Create an advisory committee to provide recommendations
- Consult with states, territories, tribes, councils, and others

There are two inventories being created—one of MPAs and one of MMAs. Sites that appear in the MMA inventory may not appear on the MPA inventory. To date, NOAA and DOI have an MPA inventory that includes limited data for 328 sites. Of these, 251 are federal sites from major national programs and include national parks, national wildlife refuges, national marine sanctuaries, and fisheries management areas. There are 25 federal-state partnership sites from the NERR System, 41 sites from Maine and Massachusetts, and 11 territorial sites from the Commonwealth of the Northern Marianas Islands.

Activities at Multiple Levels

At the federal level, fisheries management councils are continuing to gain experience using closed areas for fisheries management. The South Atlantic Council has been working on MPAs for a number of years. Beginning in 2000, council members and staff began meeting informally with both commercial and recreational fishing organizations, conservation organizations, and others interested in the development of MPAs as a fisheries management tool. Public scoping meetings followed as the council continued to review and alter options for management of "reef fish"—those species found in the council's Snapper-Grouper Management Complex. There are a total of 73 species included in this management unit. In 2001, the council held an advisory panel meeting that involved over 75 members of the council's various advisory panels, including members from the following panels: MPA, Snapper-Grouper, Wreck-fish, Habitat and

Environmental Protection, Coral, and Law Enforcement. Scientists, environmentalists, commercial fishermen, charter captains, recreational fishermen, and fish processors all came to the table to discuss management options and possible candidate sites for MPAs. The council held numerous meetings of its own MPA and Snapper-Grouper committees to further explore the use of MPAs to meet the council's mandates outlined in the Sustainable Fisheries Act to protect reef fish species currently considered overfished.

The Pacific Council undertook a two-stage process to consider marine reserves as a tool for managing groundfish. The first part was a "conceptual evaluation" and the second part was to develop alternatives for consideration. The second phase was to be started only if there was a positive result from the conceptual evaluation. The first phase ran from the spring of 1999 through September 2000. During this phase, a technical analysis of marine reserves was prepared and an Ad Hoc Marine Reserve Committee met to develop recommendations for the council. Following these efforts, the council adopted marine reserves as a tool for managing the groundfish fishery. As a result, the goal for the council's Strategic Plan for the Groundfish Fishery is to use marine reserves as a fishery management tool that contributes to groundfish conservation and management goals, has measurable effects, and is integrated with other fishery management approaches. The council recommended that implementation (Phase II) proceed "as appropriate." Phase II involves developing options for the design and location of marine reserves. Since other West Coast states are also considering marine reserves, this phase requires that the council coordinate with state, tribal, and local agencies. A council ad hoc committee met and developed a budget for considering a coast-wide network of marine reserves. It quickly became clear that, given other pressing issues before the council, there was not enough money or staff-time to fully implement this phase. The council is prepared to respond to initiatives developed at the state and local levels as these responses fit in with other council priorities. To date, the council has established two marine reserves off southern California to help rebuild cowcod. These two reserves cover 4,700 square miles. In those areas, all fishing for groundfish species is prohibited, and the state has prohibited prawn trawling and other recreational and commercial fishing except in shallow waters (less than 20 fathoms).

Additional activities on the federal level include the management of national marine sanctuaries located in the Florida Keys, Channel Islands, and the northwest Hawaiian Islands. At the state level, California implements the Marine Life Protection Act, and at the local level, MPA activities exist in Taunton Bay in Massachusetts and Great Salt Bay in New Hampshire. Conservation organizations such as the Conservation Law Foundation and the Ocean Conservancy are also active at the local level.

Challenges and Opportunities

The optimal design and implementation of MPAs poses many challenges and opportunities. We need to consider how to use MPAs effectively as management tools. This involves addressing such questions as: What is the appropriate spatial scale for implementation? Should we establish a few large MPAs or many small MPAs? What is the appropriate temporal scale or period for measuring the performance of an MPA in terms of yielding ecological benefits or improving ecosystem functions? What are the goals of an individual MPA or network of MPAs? We also must consider how to coordinate across jurisdictions (federal, state, tribal, international) and how to develop partnerships to provide scientific and socioeconomic information and to ensure communication. Finally, we must include all interests in the design and implementation of MPAs (e.g., fishing, shipping, tourism, conservation).

Four coastal tribes—the Makah, Quileute, Hoh, and Quinault—depend on the sanctuary for protection of marine resources upon which their people depend. Under treaties, the tribes are comanagers with the sanctuary and other agencies in "Usual and Accustomed Areas" for fishing, shellfish gathering, and other resource uses. The coastal environment and its fish and wildlife are important parts of cultural life. Photo courtesy of the Olympic Coast National Marine Sanctuary.

Perspectives on MPAs from Maine

Presented by George Lapointe, Maine Department of Marine Resources, at the Maine Fishermen's Forum MPA Workshop

The topic of MPAs is a political grenade—if you move too fast, opponents will be critical and if you move too slow, proponents will be critical. There has been a lot of interest in MPAs. The Executive Order set up the MPA advisory panel, and scientists, environmentalists, and fishermen are all interested in this concept. In general, the concept of MPAs is worth considering. This means closing a significant amount of area for a significant amount of time with significant restrictions in use. Establishment of MPAs as a fishery management tool is one purpose; no-take reserves for ecological restoration is another purpose.

In Maine, groups have begun to talk about the concept of MPAs. This has resulted in a couple of problems: People meet to discuss their concerns but do not follow through by interacting with the fishermen. Participants conclude that they have talked with the fishermen and are done with the issue or that the fishermen do not care about this issue. A lack of trust surrounds the issue of MPAs. If this issue is to advance, people need to build that trust. Trust must be built through interactions and on a consistent basis. And it must be built on a number of issues besides MPAs.

To move ahead on the issue of MPAs, academic discussions must move beyond a conceptual framework to consideration of specific proposals. There must be honesty in definitions that address the amount of time the MPA will exist and its purpose. The ability to enforce what is proposed is also an important consideration. Enforcement will be easier to do closer to a shore community, but the impacts are higher on the general public. Finally, stakeholder involvement in the process is critical. For example, in Florida's Dry Tortugas, stakeholders worked until they reached consensus. Compromises were made; nobody was entirely happy, but they kept working on it until agreement was reached.

When the idea for establishing an MPA moves from a concept to an actual location, the impacts on the community become real and stakeholders react. While contentious, discussing an actual area gets people engaged and they begin to take ownership of the concept. The key to addressing the issue of MPAs in Maine is figuring out how to do that stakeholder process correctly.

Perspective on MPAs from Washington, D.C.

Presented by Drew Minkiewicz, Maine's U.S. Sen. Olympia Snowe's Office, at the Maine Fishermen's Forum MPA Workshop

Currently there is no federal legislation that mandates or addresses MPAs. The Executive Order gives permission to establish them, but it does not mandate their establishment. The Executive Order is not law but acts as more of an "interoffice memo" among agencies. The federal Ocean Commission's responsibilities includes reviewing maritime law and making recommendations. It is up to Congress to turn those recommendations into law. However, since MPA establishment is not law, parties do not have the right to sue if no MPA is created. In the New England groundfish situation, there was no federal law requiring the establishment of MPAs, but since other requirements were violated, the court ruled that an MPA was needed to correct the situation. To date, there is no legislation on MPAs pending in the U.S. Senate.

PART II

THEORETICAL IMPACTS TO FISHERIES

Use of Large-Scale Closure Areas for Fisheries Management and Biodiversity Protection: Some Observations From New England

Presented by Steven Murawski, NMFS, at the Rhode Island Workshop
Presented by Michael Fogarty, NMFS, at the New Hampshire Workshop
Presented by Jon Brodziak, NMFS, at the Connecticut Workshop

In this presentation, we will detail the conceptual basis for fishery closed areas or MPAs; offer a historical perspective; discuss the potential effects of closures in New England, especially with respect to groundfish, scallops, and fishing effort; relate complementary goals of fishery management and biodiversity conservation; and draw some conclusions about the future of MPAs in the Northeast, as well as ask: Are there alternative fishery management tools to closed areas?

Conceptual Basis for Closed Areas/MPAs

In the early 1900s, the United States started setting aside terrestrial areas as a way to protect special components of ecosystems. It has taken awhile for that approach to be considered in marine ecosystem management, but it is now receiving a lot of attention. In general, marine reserves can increase species diversity, increase species community stability, enhance habitat quality, create or enhance non-extractive uses, reduce user conflicts, create areas with intrinsic value, and provide baseline systems for study. An important goal of the research in closed areas is to understand the effects on habitats and systems of removing disturbances to natural cycles. For fishery closed areas, MPAs have been proposed to reduce fishing-induced mortality of targeted and non-targeted species, conserve habitat and biodiversity, provide insurance against uncertain effects from other fishery management measures and inherent natural variability, and to distinguish natural variability from human impacts—MPAs provide an opportunity on which this can be assessed.

According to Murray and others (1999), the following are guidelines for development of MPAs:

- Clearly specify goals and objectives
- Broadly represent communities, habitats, and system types
- Match scales of ecological and oceanographic processes
- Replicate reserves of similar communities and habitats
- Apply principles of adaptive management using reserves as a learning tool

In terms of fisheries management, MPAs serve a variety of purposes. They reduce fishing mortality through inefficiency (lower catch per unit effort areas) by forcing fishermen to fish in less productive areas. MPAs can be used to rotate "grow-out" areas for sedentary species, such as scallops. They minimize bycatch or species interactions and would be useful for protected or unexploited species. They may enhance spawning by protecting active breeders, which was the rationale behind seasonal closures in New England. MPAs also enhance export or "spillover," protect critical life stages, and reduce secondary impacts from fishing. The spillover effect is potentially the most important effect of closed areas but it is difficult to document.

Historical Perspective

The Northeast groundfish fishery enjoys four centuries of history and is one of the world's most important case histories of closed areas. It's composed primarily of small independent fishing operations. The fishery was open to foreign fleets until 1976. These foreign fleets were responsible for large removals of groundfish until 1976. Other species show a more stable history reflecting the lack of human exploitation (Fig. 2). The area saw a large increase in investment following establishment of the Exclusive Economic Zone (EEZ), but a history of controversy over ownership of the resource still remains. The area is characterized by the use of input controls rather than output controls on fisheries.

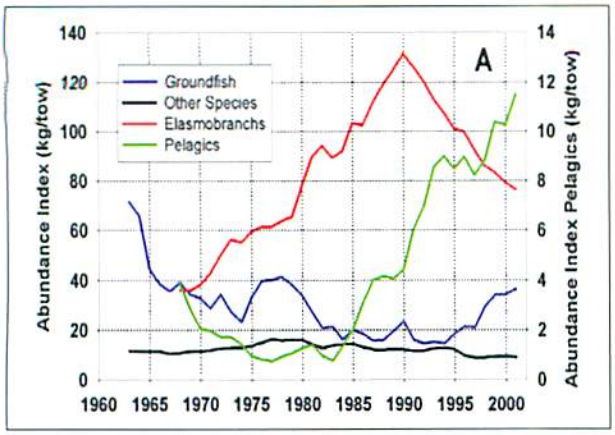


Figure 2. Graph shows general changes in abundance over time for different groups of fish.

Potential Effects of Closures in New England

In New England, 20,200 square kilometers (km^2) have been closed to fishing. These closed areas are the largest in the world in temperate waters, and they are situated on highly productive fishing grounds. Closed Areas 1 and 2 on Georges Bank were closed in 1994 by the U.S. Secretary of Commerce under an emergency action and have been essentially closed to groundfish gear since that time (Fig. 3). There has also been a Gulf of Maine closure to rebuild the cod stock, and a Nantucket Light closure to protect juvenile yellowtail flounder. These closures compose a large fraction of the Continental Shelf area. In addition to the semi-permanent closed areas, there are rolling closures for particular months (Fig. 4). Due to the number of areas closed for at least part of the year, it becomes difficult for fishermen to keep track of what is open and what is not.

A new concept in fisheries management is the idea of using shorter duration closed areas, on a rotating basis, to act essentially as fish farms. There appears to be some support for this idea. But enforcement becomes an important aspect in managing grow-out areas.

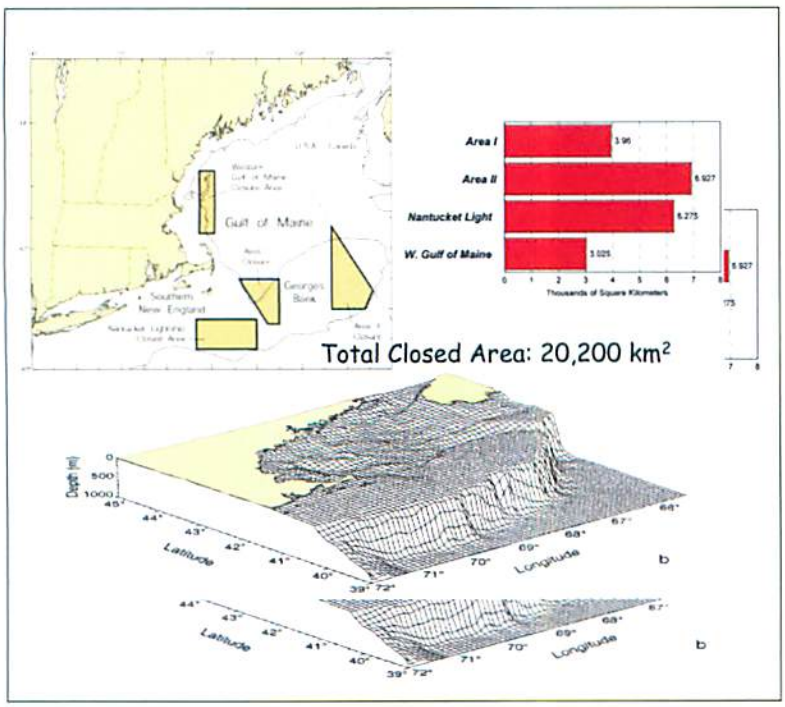


Figure 3. Areas closed to fishing represent 20,200 km^2 in New England waters.

Groundfish vessels have had to move elsewhere in response to the closures. Figure 5 shows the distribution of fishing effort prior to the closures (1991–1993) and in 2000 for the 40 largest trawlers. Reported effort is now concentrated on the flanks of closed areas.

Fishery area closures are intended to allow species to recover from overfishing. But recovery from overfishing depends on a number of factors, including the rate of movement across boundaries, the fraction of the population protected by the closure, redirection in fishing effort, non-catch mortality, and species productivity (recruitment and growth). The effectiveness of closed areas in terms of fishery management may be related to the mobility of the species. Sessile animals like scallops may benefit more from protected areas than a mobile species like cod. And if fishing effort is not reduced, it may simply become more concentrated in another area (Fig. 5). We need to consider if we are creating more problems by concentrating fishing effort into small areas.

While areas were closed to protect groundfish, sea scallops also live in the closed areas (Fig. 6). And because fishermen could not use gear that could *potentially* catch groundfish, such as scallop dredges, sea scallops were given a chance to grow. What resulted was an exponential increase in scallops in the closed areas, and scallop densities increased in the whole area, with spillover effects (recruitment) outside the closed areas as well (Fig. 7). For the scallop industry, this resulted in scallopers working less for more money (Fig. 8). In October 1999, the New England Fisheries Management Council opened a portion of the closed areas to scalloping (Figs. 9 and 10).

So have area closures worked to rebuild groundfish stocks? The results are mixed. Georges Bank yellowtail flounder has shown an 800 percent increase in spawning stock biomass (SSB) since area closures went into effect in 1994 (Figs. 11 and 12). Georges Bank haddock SSB has increased 400 percent since the closures went into effect (Figs. 13 and 14), but cod stocks have not recovered, largely due to the fact that the fish move, as opposed to the more sedentary flounder. Additionally, fishing mortality was never reduced enough to rebuild cod stocks (Figs. 15 and 16).

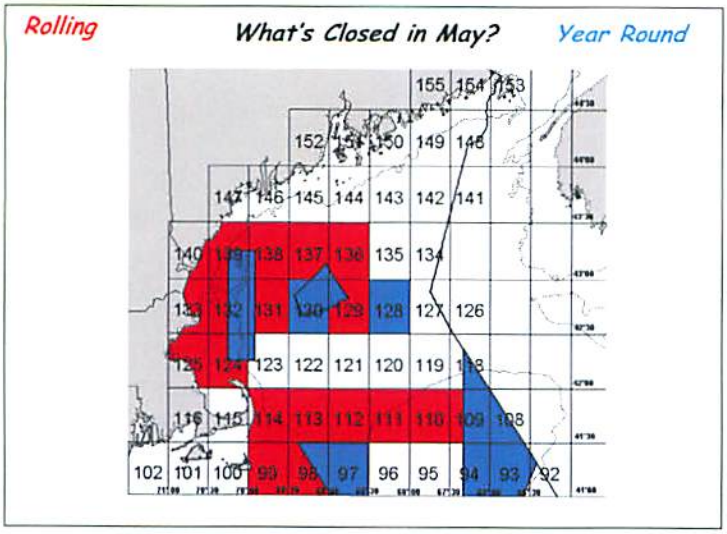


Figure 4. In addition to the semi-permanent, year-round closed areas, there are also rolling closures for particular months. Areas closed in the month of May are shown here.

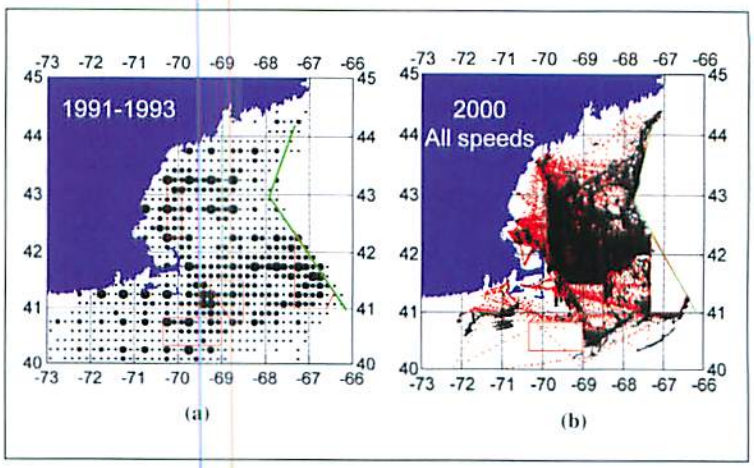


Figure 5. Maps show concentration of groundfishing effort prior to (a) and following (b) area closures. Area closures are outlined as in Fig. 3. Dots represent aggregations of fishing hours.

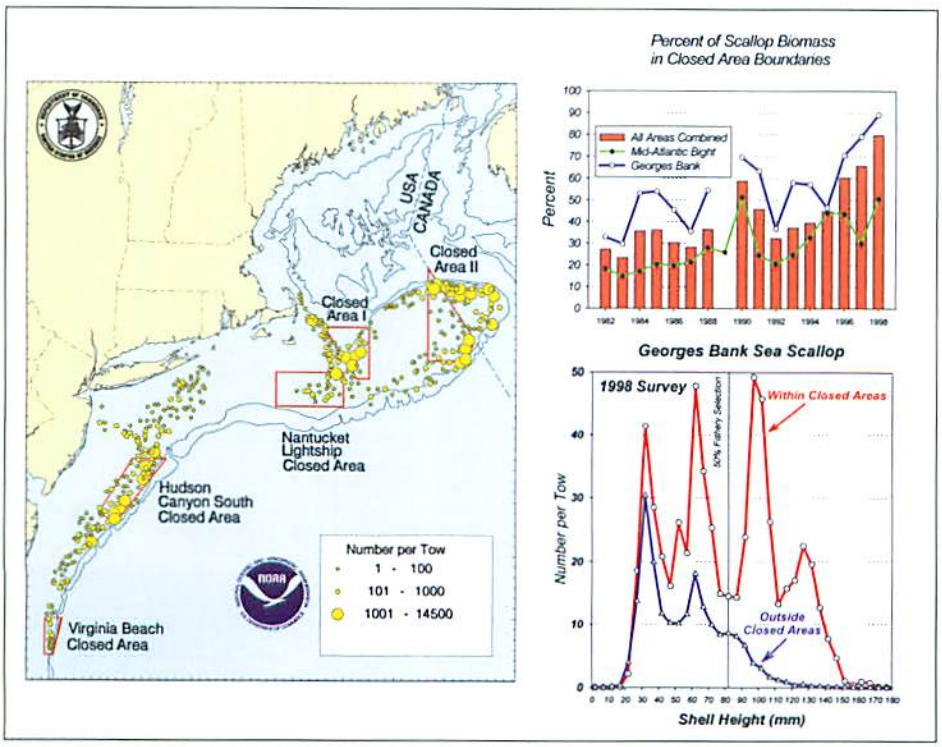


Figure 6. While designed to protect groundfish from overfishing, the closed areas also protected sea scallops concentrated there. Map shows sea scallop distribution during summer 1998 NMFS scallop survey. Closed areas are outlined on map. Top graph indicates percent of sea scallop biomass in closed area boundaries; bottom graph indicates sea scallop distribution on Georges Bank.

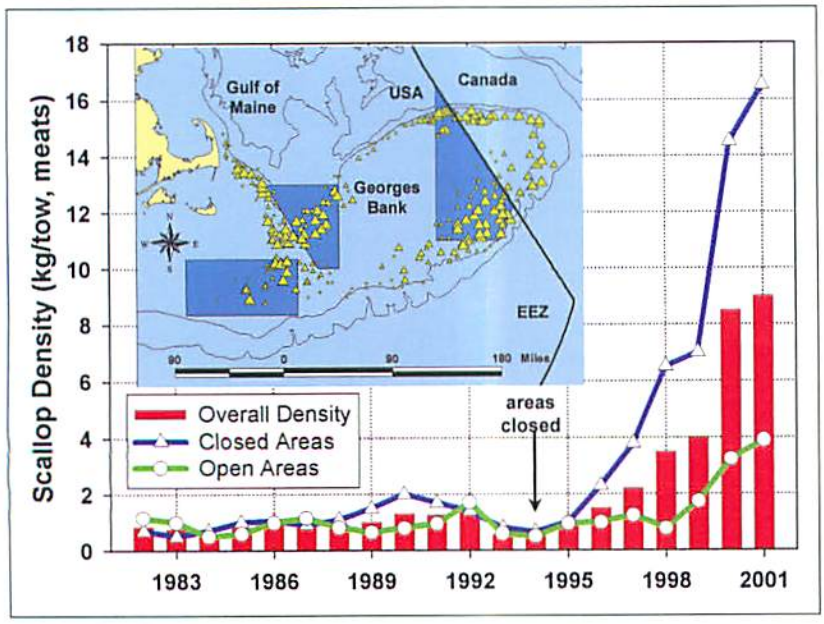


Figure 7. Graph shows an exponential increase in sea scallops in the closed areas, and an increase in scallop densities over the whole area, with spillover effects outside the closed areas.

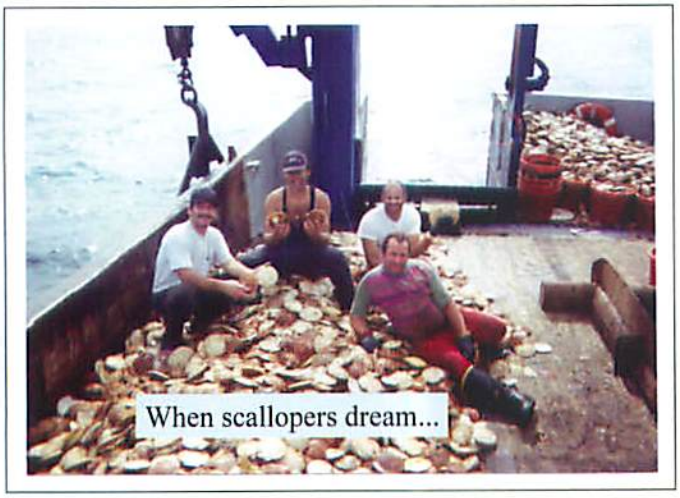


Figure 8. Scallopers aboard the *F/V Santa Maria*, in Nantucket Lightship Closed Area, August 1999, show the bounty from a single, 10-minute tow with one dredge.

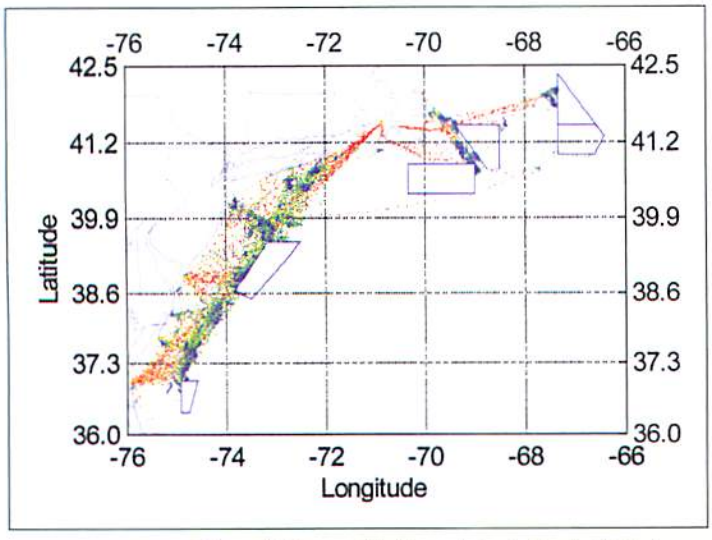


Figure 9. Pattern of fishing activity in March 1999 when areas remained closed to scalloping.

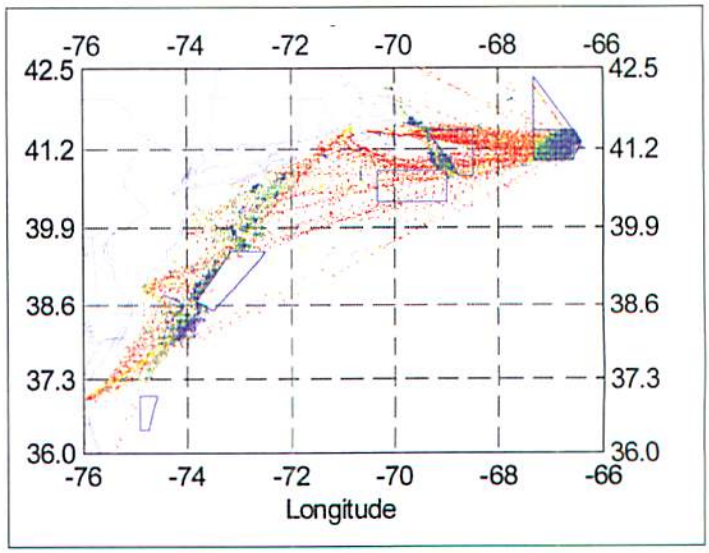


Figure 10. Pattern of fishing activity in October 1999 when the New England Fisheries Management Council opened a portion of closed areas to scalloping.

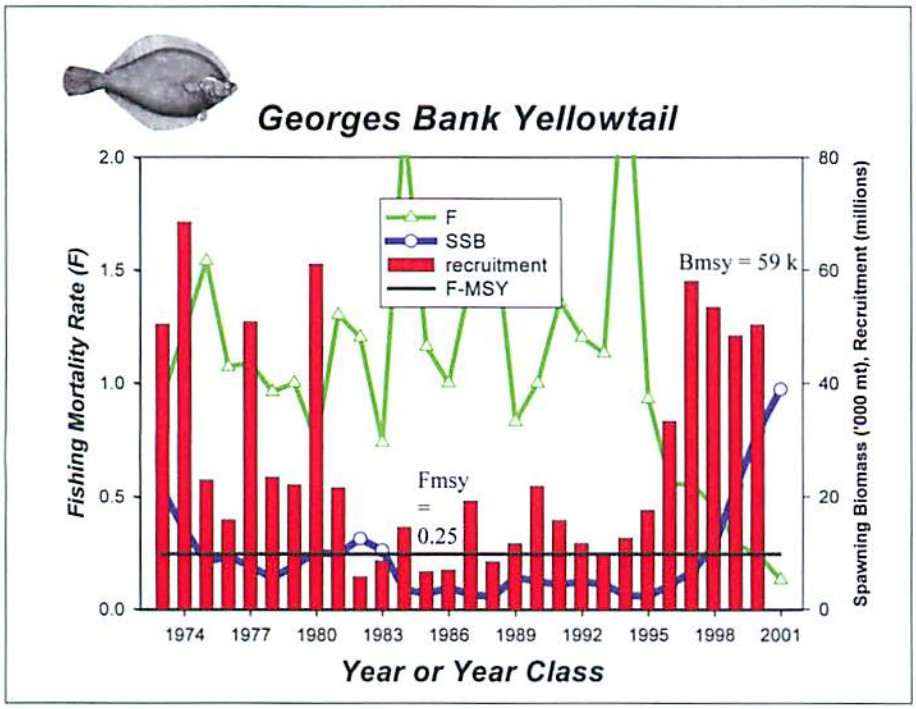


Figure 11. Fishing mortality rate (F), SSB, recruitment, F_{msy}, and B_{msy} data taken over the period of 1973–2001 for Georges Bank yellowtail flounder. Since area closures went into effect in 1994, there has been an 800 percent increase in SSB.

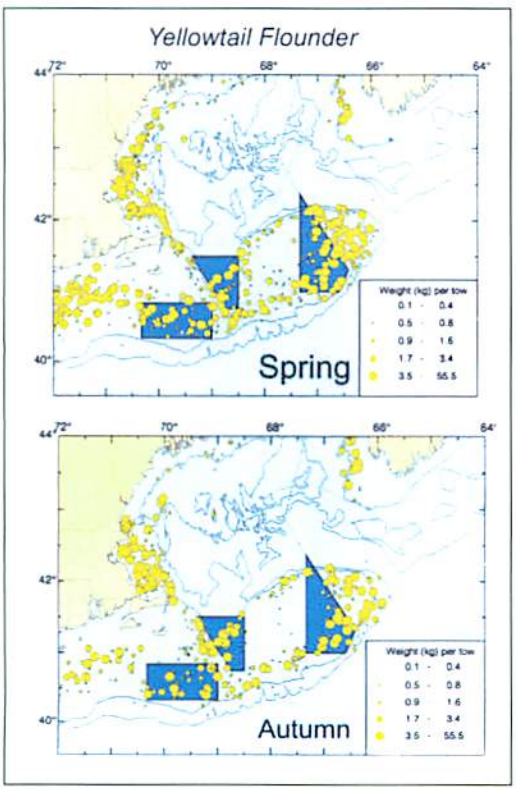


Figure 12. Seasonal distribution (spring and autumn) of yellowtail flounder on Georges Bank, based on NMFS trawl surveys. Dot size indicates fish weight per tow. Closed areas are delineated on the map.

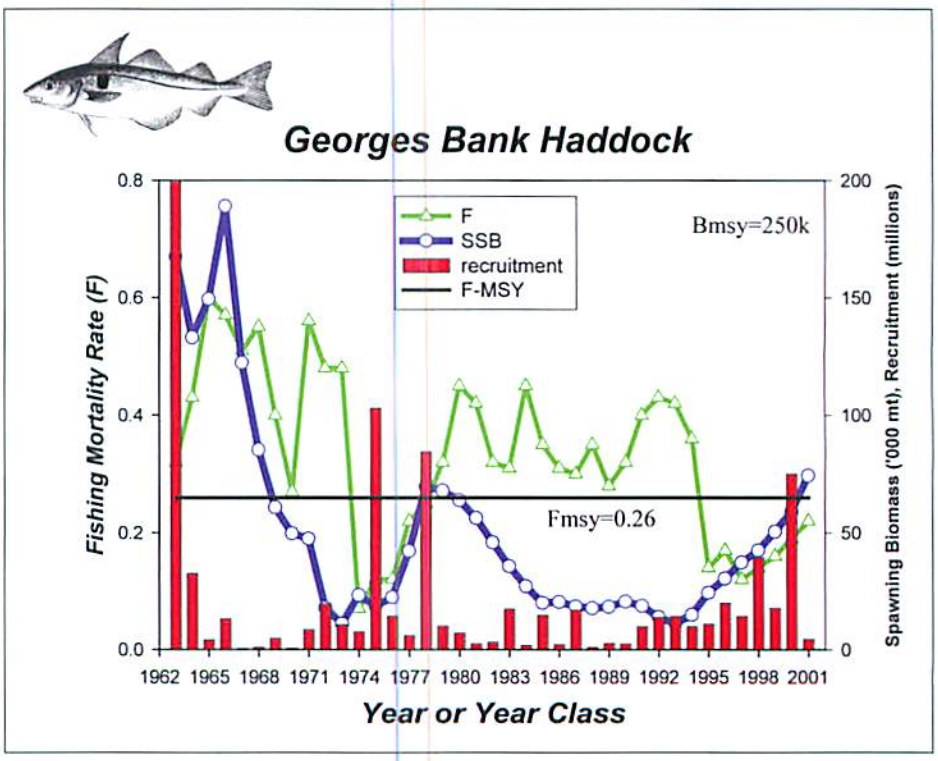


Figure 13. Fishing mortality rate (F), SSB, recruitment, F_{msy}, and B_{msy} data taken over the period of 1963–2001 for Georges Bank haddock. Since area closures went into effect in 1994, there has been a 400 percent increase in SSB.

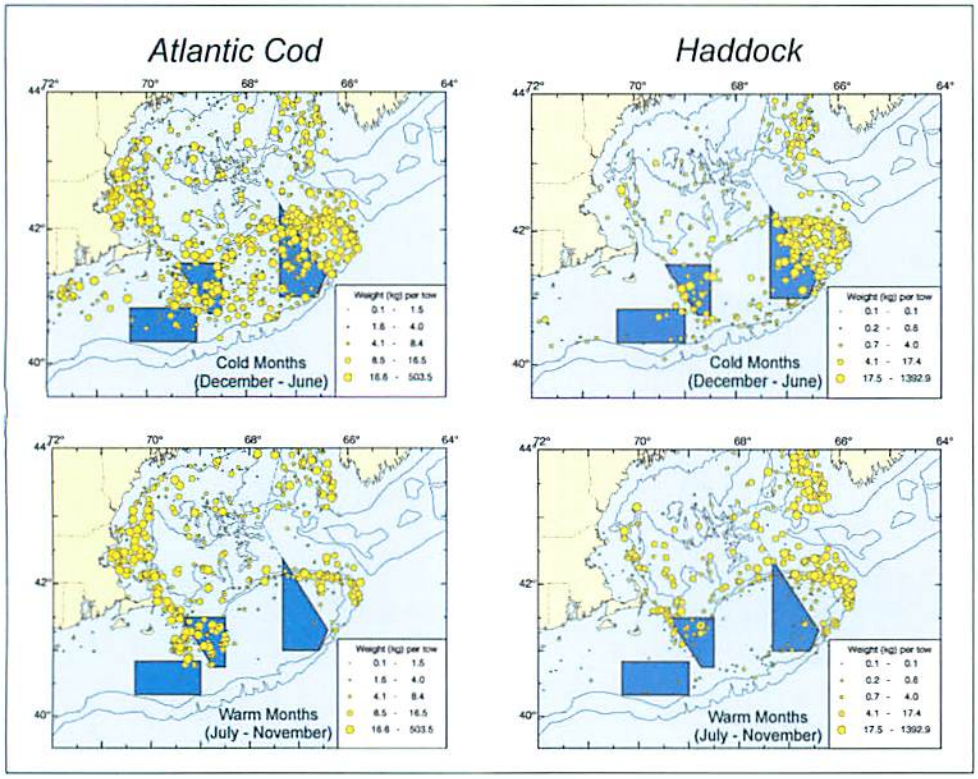


Figure 14. Seasonal distribution of Atlantic cod and haddock on Georges Bank during cold and warm months. Data are based on NMFS trawl surveys. Dot size indicates fish weight per tow. Closed areas are delineated on the map.

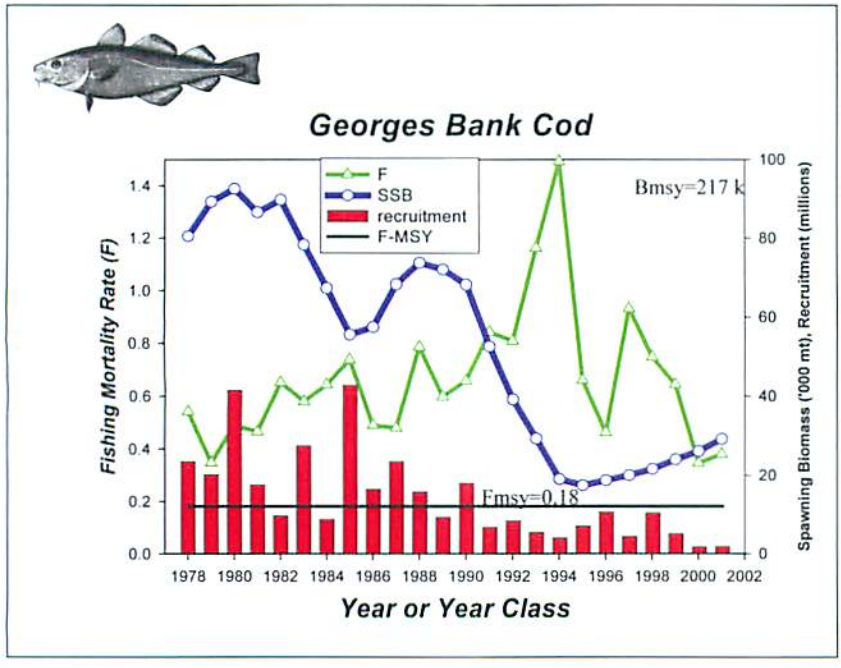


Figure 15. Cod SSB has increased minimally since the 1994 closures, but the stocks have not recovered—likely because the fish move but also because fishing mortality (F) was never adequately reduced to allow stocks to rebuild.

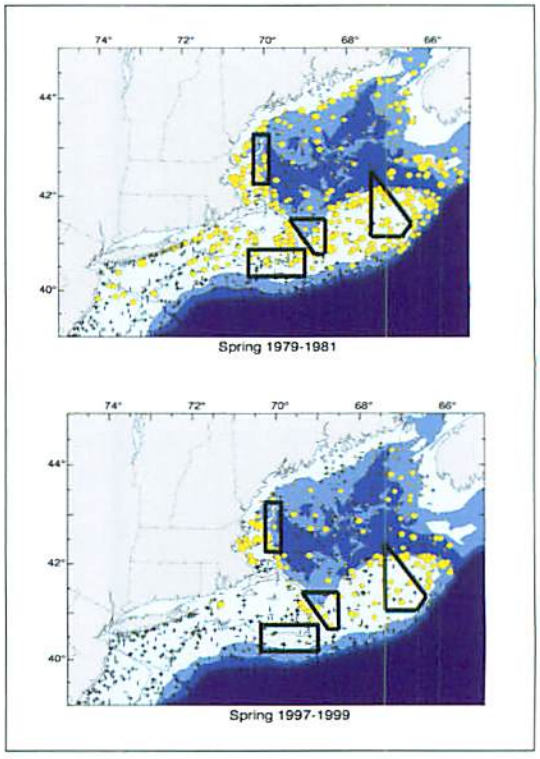


Figure 16. Despite area closures, Atlantic cod stocks have not recovered. This may be due, in part, to the fact that the fish move. Results are based on NMFS trawl surveys in spring 1979–81 and spring 1997–99.

Complementary Goals: Fishery Management and Biodiversity Conservation

There are several important factors to consider when designing MPAs: placement, size, number, and configuration. MPAs are most effective when stocks are overexploited, when fishing activity disrupts habitat, or when source populations are differentially exploited. In simple mathematical models, it is assumed that adults stay within the boundaries of the reserve but send their young both inside and outside the reserve. In these cases, the MPA would be acting as a quota. Different combinations of management measures can give the same result (Fig. 17). You can let a higher fraction of the reserve have the same result as you increase the exploitation rate. However, you would not generally predict that it would be better to have a new reserve rather than an equivalent constraint on the exploitation rate, [which means you can achieve the same result by traditional fishery management techniques].

In standard production models, there is an intermediate level that results in the most yield for a particular level of effort (Fig. 18). A drop in yield can occur with shifting environmental conditions which affects the carrying capacity of an area (Fig. 19). The act of fishing itself can disrupt the habitat so the production is lower (Fig. 20). The maximum sustainable yield is lower as is the fishing effort needed to reach that yield. This might be a situation where it would be desirable to protect a certain amount of the habitat from disruptive fishing.

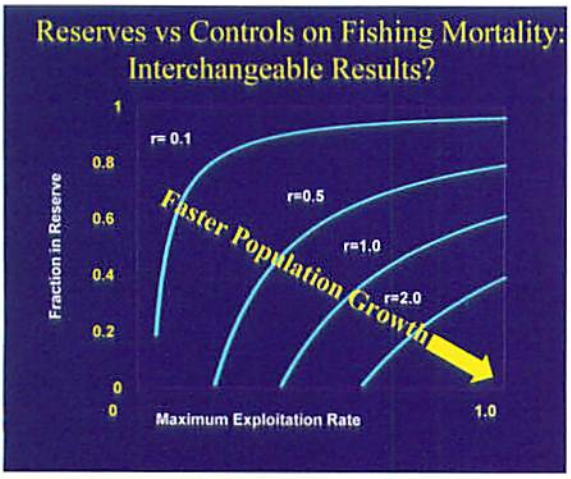


Figure 17.

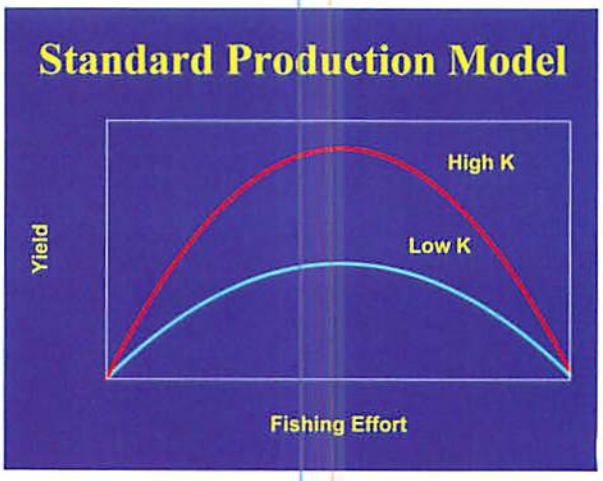


Figure 18. In standard production models, there is an intermediate level that results in the most yield for a particular level of effort in both high and low area carrying capacity (K).

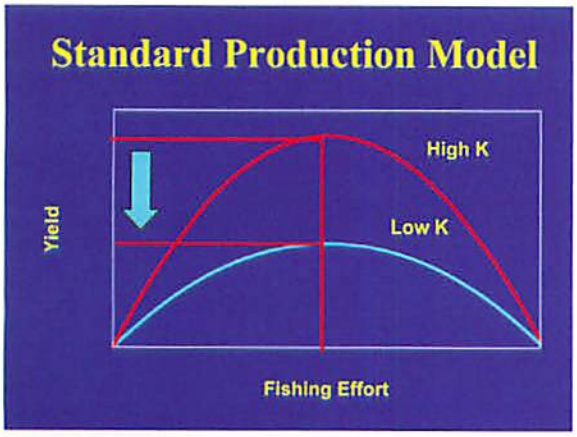


Figure 19. A drop in yield can occur with shifting environmental conditions which affects the carrying capacity of the area.

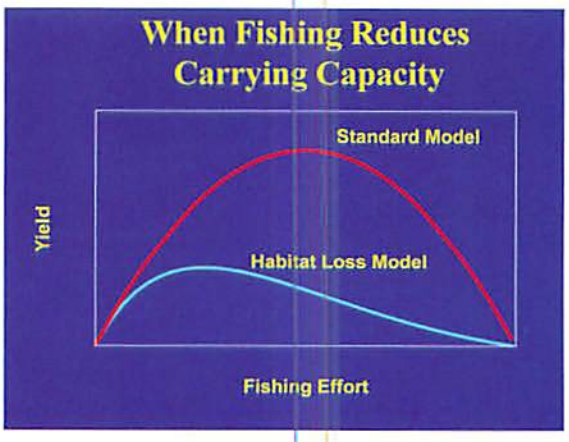


Figure 20. The act of fishing itself can disrupt the habitat so the production is lower. The maximum sustainable yield is lower as is the fishing effort needed to reach that yield.

An MPA could be a site with a source population replenishing other areas (Fig. 21). Open areas would be considered sinks outside the MPA. Care must be taken with allowing fishing in source areas. According to our model, a population that is not serving as a source or "donor" population can take more fishing pressure that a population that is serving as one (Fig. 22). If a source population is being protected, the harvesting amount of the sink population will be affected (Fig. 23). The probability of maintaining the population is dependent on the fraction of the population subject to harvesting (Fig. 24). At zero fishing, 100 percent success is achieved. As fishing increases, the probability of success drops off.

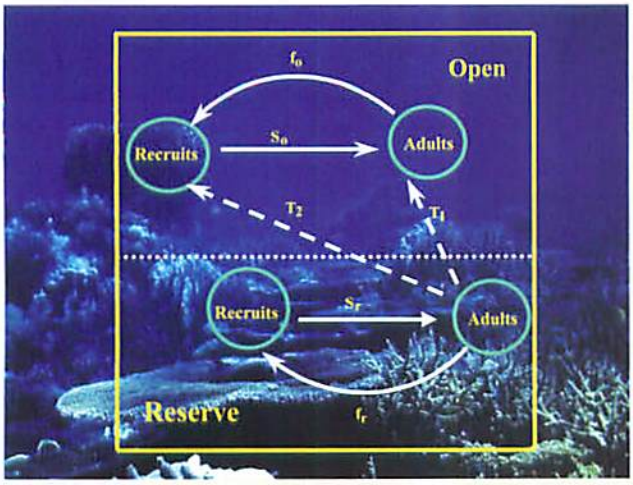


Figure 21. An MPA could be a site with a source population replenishing other areas (T). Open areas would be considered sinks outside the MPA.

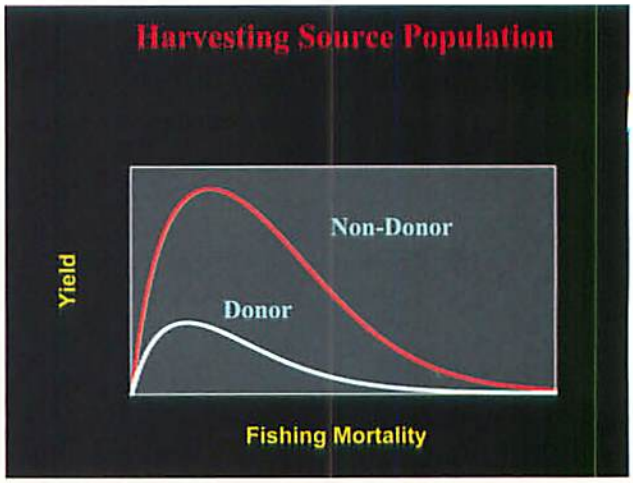


Figure 22. A population that is not serving as a source or "donor" population can take more fishing pressure that a population that is serving as one.

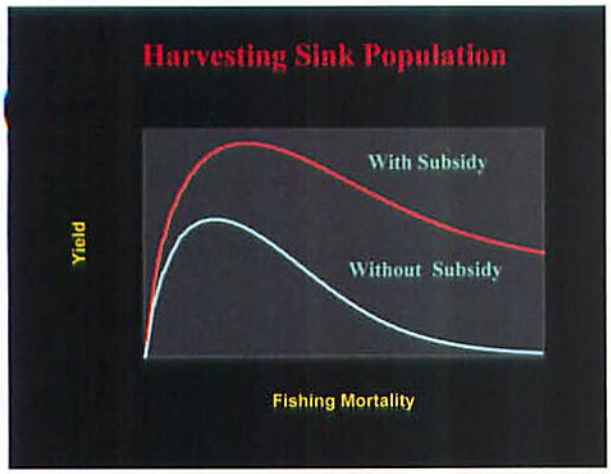


Figure 23. If a source population is being protected, the harvesting amount of the sink population is affected [With Subsidy vs. Without Subsidy].

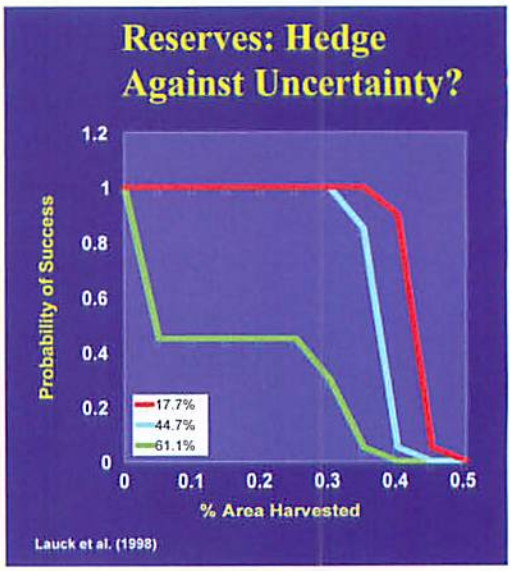


Figure 24. The probability of maintaining the population is dependent on the fraction of the population subject to harvesting in a source area.

In New England, closed areas appear to have provided benefits beyond what would have been expected with effort reductions alone. Putting closed areas in place would likely not have been as effective without overall controls on fishing effort as well.

Future of MPAs in the Northeast

In conclusion, the Georges Bank closed areas have been integral to species recoveries, and there is evidence of improved recruitment. The closed areas have had an unequivocal effect on fishing. The resulting displaced effort is important for some species, and there is the potential to reduce habitat impacts and bycatch. In addition, closed areas are valuable scientific areas and can serve as a basis for rotational area management, though they cannot solve the problem of excess capacity in the fishery.

Where do we go from here? Future uses and considerations for MPAs might include:

- Rotational area management
- Biological reserves for spawning stock
- Hydrodynamic models to develop reproductive footprint
- Experiments within the Sustainable Fisheries Act
- Explicit consideration of tradeoffs: habitat and bycatch
- Stewardship/ownership

MPAs do have limitations. They cannot control for fishery displacement and loss of yield, nor can they control for an increase in fishery effects outside the MPA. Finally, it's important to remember that MPAs are not a panacea—other measures are needed to manage human impacts.

Comments and Questions

- Many MPAs worldwide have been implemented on an ad hoc basis without clearly defining goals and objectives up front. This makes it difficult to assess their effectiveness.
- Setting up an MPA until a stock rebounds does not fit with the definition in the Executive Order that suggests it is permanent. There is confusion in the fishing community about this.
- Theoretical models do not go into detail about fishing pressure in an area, depth of water, location of major populations, etc.
- **Q:** Can you substitute percent of population protected for percent of area harvested?
  A: In the models, it is assumed that they are equivalent.
- **Q:** Are benefits unique to no-take reserves? Can they also apply to partial-take reserves?
  A: Yes. It depends on the nature of the regulations that are put into place for partial-take reserves.
- When MPAs are used for habitat protection, invasive species could destroy the benefits. This would shift the yield of the system.
- **Q:** Is there a minimum size for MPAs to be effective? Is it dependent on sensitive habitats?
  A: One of the issues is whether we have any really fragile habitats. Some of the canyon head habitats might be considered special areas in terms of bottom topography and the species that occur there. Generally speaking we do not have any critically defined habitat areas like coral. The size of the closed areas is dependent on the targeted reduction in fishing mortality. Bigger is generally better. It is more enforceable and more likely to be able to protect a mixed-species complex.
- **Q:** There is a well-developed body of literature on appropriate terrestrial park sizes when aiming to protect biodiversity. Has this been developed for marine areas?
  A: This would be the next major research area—to bring the approach developed for terrestrial systems to the oceans.
- On Georges Bank, the Canadians use a very different management regime to get what they consider to be the proper fishing mortality rate. They close their fishery down from January through June, issue ITQs, regulate mesh size, etc.
- **Q:** How does the Canadian activity on Georges Bank factor into your conclusions?
- **A:** Canadian fisheries are restricted on an output basis by catch. Since the early 1990s they have had a very low quota. For cod they use a separator trawl and avoid cod as much as possible.
- **Q:** Are closed areas in the Gulf of Maine set in stone?
  A: There is some ability to adapt boundaries. Closed Area 2 was shortened because it did not have impact on critical species such as cod.
- **Q:** How is monitoring done in closed areas?
  A: Vessel monitoring systems are voluntarily in place on scallop and groundfish vessels (large trawlers). For other vessels, the U.S. Coast Guard monitors compliance and numerous vessels have been cited.

- **Q:** In the sea scallop case, how did you calculate where the closed areas would be?
  A: Actually, the sea scallops in the closed areas had nothing to do with it. The closed areas were designated to protect groundfish stocks. It just so happened that they were in the right place for the sea scallops.
- Closed areas are forcing people to fish where the fish are not located. This is inefficient. It costs more, fishermen have to do more fishing, and it increases impacts on the bottom.
- **Q:** How is control of days at sea considered a direct control in that it does not control the use of that day at sea?
  A: It is a control on what you have to work with. Days at sea are thought of as a direct control, but fishermen are opportunistic and the use of days at sea varies. Transit time is a factor. Days at sea are one way to reduce effort, but this method is not refined.
- There are a lot of latent permits in New England and this needs to be resolved. Industry *struggles to* rebuild stocks and others who have not been using their permits have an opportunity to come back in when the stocks are rebuilt.
- **Q:** Is there a way to measure if the increase in biodiversity on Georges Bank is attributable to minimizing fish mortality or less habitat destruction?
  A: No. This is a research need.

The State of the Science Related to MPAs and No-Take Marine Reserves

Presented by Robert Steneck, University of Maine School of Marine Sciences, at the Maine Fishermen's Forum MPA Workshop

This presentation focuses on questions that ask, Do we have a problem managing our fisheries? Can MPAs help in the management of fisheries and/or marine ecosystems? Do MPAs work? When don't they work? Should they be part of our management toolbox?

A Problem Managing Our Fisheries?

Is our fishing heritage at risk? Do we have healthy ecosystems? The models and information suggest that there is a problem. In the October 4, 2002, issue of *The Providence Journal*, Pat White's commentary "Preserve America's fishing heritage" points out that "Clearly, fishery management today is not working for the fishermen or the fish. We must begin by placing a premium on protecting fish habitat and the entire ecosystem that produces and supports fish. Without healthy, productive ecosystems, we will not have healthy fisheries."

When I travel and talk to fishermen, I rarely hear that fishing is getting better (Figs. 25 and 26). According to researchers like Daniel Pauly, the North Atlantic abundance of fish is declining, mirroring that occurring globally. In their 2001 *Science* article, "Historical Overfishing and the Recent Collapse of Coastal Ecosystems," Jackson and others wrote, "Ecological extinction caused by overfishing precedes all other pervasive human disturbance to coastal ecosystems, including pollution, degradation of water quality, and anthropogenic climate change."

Have fish and fishing changed in Maine? How do these changes impact coastal ecosystems? Historically, people have been fishing for large groundfish off the Maine coast for thousands of years. It was easy to catch fish such as cod using fishhooks made of bone and other primitive techniques (Fig. 27). In reconstructing the size of cod available over 4,500 years ago, the average size was about 1 meter (m) in length. Fish bones discovered in Indian "kitchen" middens between 500 and 2,500 years ago were comprised of almost 90 percent cod bones (Fig. 28).

The early explorers in Maine found large cod and haddock everywhere, as evidenced in their writings by Rosier (1605) about the Maine coast:

> *"While wee were at shoare, our men aboord with a few hookes got above thirty great Cod and Haddocke, which gave us a taste of the great plenty of fish which we found afterward, wheresoever we went upon the coast."*

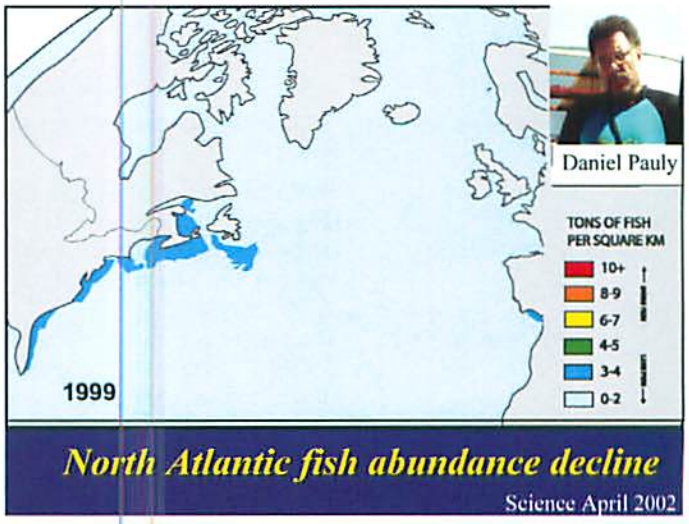


Figure 25. North Atlantic fish abundance is in decline, with only 3 to 4 tons of fish per square kilometer.

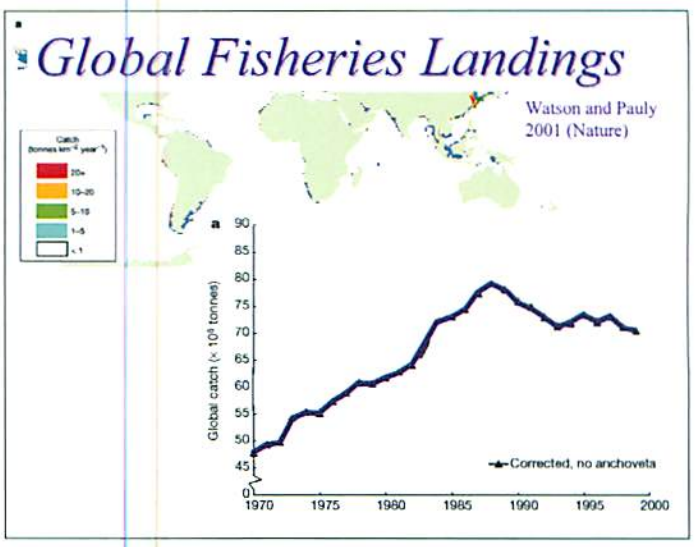


Figure 26. The world's fisheries are coastal, and landings have been declining globally since the late 1980s.

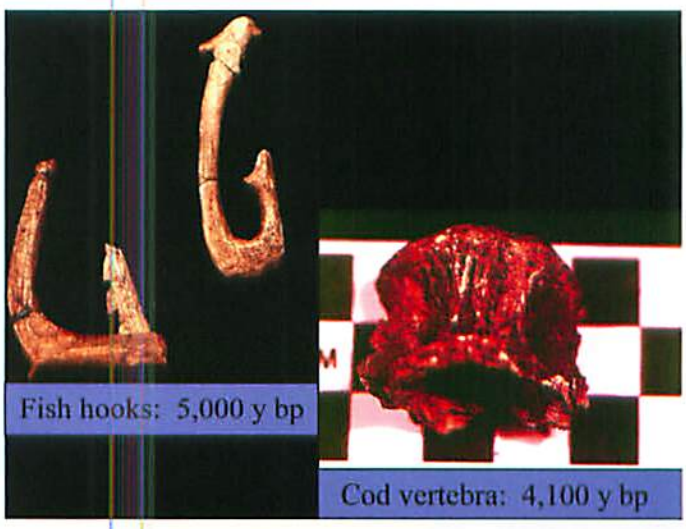


Figure 27. Fishhooks, made from bone, date back 5,000 years before present (y bp). Cod vertebrae, dating back 4,100 y bp, indicate that cod fished at the time averaged about 1 m in length.

Historical maps of the 1800s showed abundant areas of cod in the fishing grounds of coastal Maine (Fig. 29). One hundred years later, in the 1920s, areas of cod abundance remained (Fig. 30). At that time, cod was also the most frequently caught species (occurring over 90 percent of the time) followed by haddock and hake (occurring about 60 percent of the time) (Fig. 31).

The days of big cod and lobster appear to be over. And the fisheries and ecosystems of Maine have changed. Today, all groundfish together comprise only 8 percent of the value of Maine's landings. Groundfish prey such as lobster, crabs, and sea urchin all increased and became "players" in coastal ecosystems.

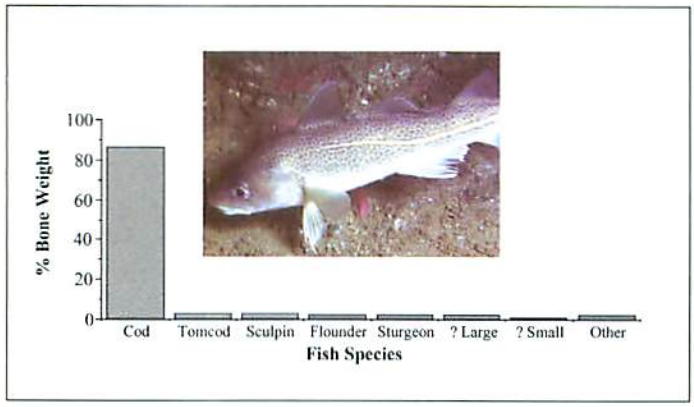


Figure 28. Indian kitchen middens, dating 500 to 2,500 years ago, contained almost 90 percent cod bones.

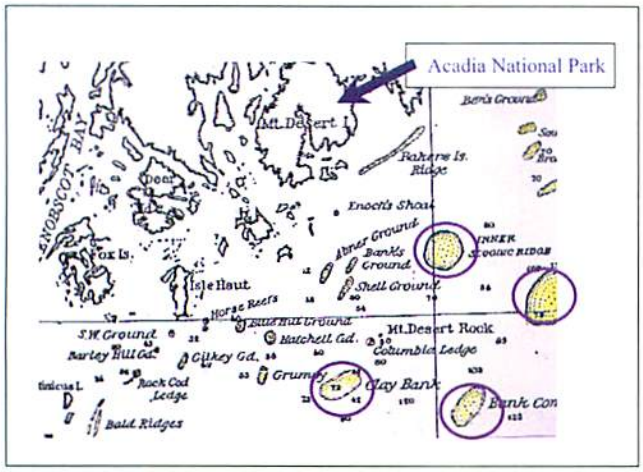


Figure 29. Maps of the fishing grounds of coastal Maine from 1830 to 1880 show large areas of cod abundance (Goode, 1887).

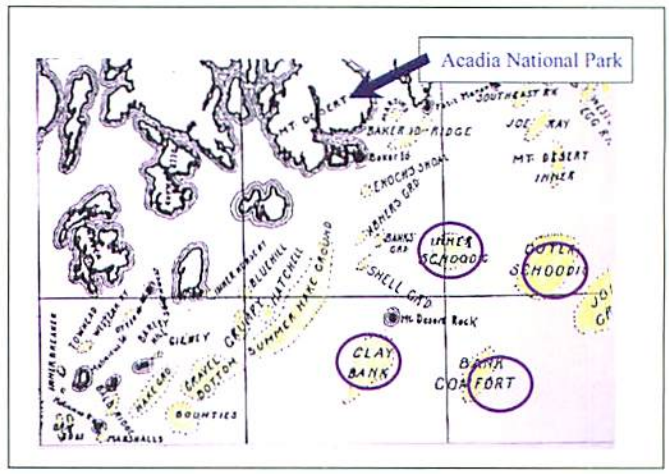


Figure 30. The same area shown in the 1920s depict the same areas of high cod abundance (Rich, 1929).

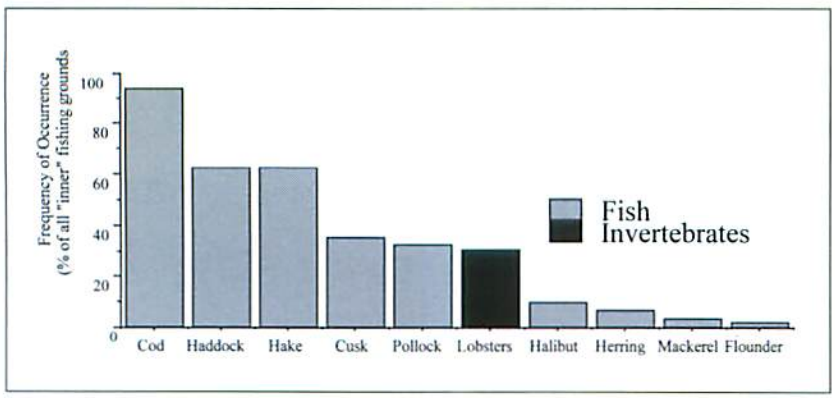


Figure 31. Frequency of occurrence (percent of all "inner" fishing grounds) of species in the coastal fisheries of Maine in 1927.

Can MPAs Help?

Can MPAs help manage fisheries? Can they help manage marine biodiversity? There are stories of both successful and less-than-successful MPAs. In the Philippines, once the Apo Reserve was closed to fishing, a steady rise in the size and abundance of fish was observed. In the Sumilon Reserve, the area was initially not fished and then became fished. It was then closed to fishing, and the size and abundance of fish increased. Globally, most reserves enhance fisheries within their bounds (Fig. 32). They increase biomass of fish relative to areas that are not fished, and some of the percent increases are quite large (Fig. 33).

The Ecology of Marine Protected Areas

TABLE 19.2 Some examples of fisheries enhancement MPAs designed for local effect on abundance or biomass of fish or invertebrates. Establishment of these reserves has generally been by legislation, although two examples are given of reserves established on the basis of community management of local resources

Area	Positive effect?*	Control	Size	Time frame	Target taxa	Reference
Mediterranean	Y	Spatial	1 km	9 yr.	Fish	Bell 1983
Mediterranean	Y***	Spatial	<1 km	6 yr.	Fish	Garcia-Rubies and Zabala 1990
Philippines	Y	Spatial		10 yr.	Fish	Russ 1985
Australia	Y	Spatial			Fish	Ayling and Ayling 1986
Kenya	Y***	Spatial			Fish	Samoilys 1988
Philippines	Y***	Temporal		3 yr.	Fish	Alcala 1988
Philippines	Y*	Spatial/temporal		3 yr.	Fish	Russ and Alcala 1989
Africa	Y*	Spatial			Fish	Buxton and Smale 1989
Florida Keys	Y**	Temporal		2 yr.	Fish	Clark et al. 1989
Kenya reefs	Y***	Spatial			Fish	McClanahan and Shafir 1990
Caribbean	Y**	Spatial	1 km	4 yr.	Fish	Polunin and Roberts 1993
Belize	Y**	Spatial	4 km	4 yr.	Fish Conch Lobsters	Polunin and Roberts 1993
Africa	Y***	Spatial/temporal	46 km	2–5 yr.	Fish	Bennett and Attwood 1991
Florida Keys	Y***	Spatial	>100 km	20 yr.	Fish	Bohnsack 1982
Red Sea	Y***	Spatial		15 yr.	Fish	Roberts and Polunin 1993
Chile	Y*	Spatial/temporal	1.5 km	3 yr.	Snails	Duran and Castilla 1989
Chile	Y*	Spatial/temporal	1.5 km	3 yr.	Limpets	Oliva and Castilla 1986
Japan	Y	Temporal			Crabs	Yamasaki and Kuwahara 1990
Kenya reefs	Y*	Spatial/temporal		25 yr.	Fish	McClanahan 1994
Kenya reefs	Y*	Spatial/temporal		1–3 yr.	Fish	McClanahan 1995
Kenya reefs	Y	Spatial		25 yr.	Snails	McClanahan 1989
Florida Keys	Y	Spatial		2 yr.	Shrimp	Klima et al. 1986
Caribbean	Y**	Spatial		1–3 yr.	Urchins	Smith and Berkes 1991
Puget Sound	Y**	Spatial	1–2 km	4–27 yr.	Fish	Palsson and Pacunski 1995
Central CA	Y	Spatial	1–6 km	4–37 yr.	Fish	Paddock 1996
Florida Keys	Y	Spatial			Lobsters	Davis 1977
Caribbean	Y	Spatial			Conch	Weil and Laughlin 1984
Palau	Y	Spatial			Snails	Hesilnga et al. 1984
New Jersey	Y	Spatial			Clams	McCay 1988
Australia	Y	Spatial			Abalone	Shepherd 1990
COMMUNITY-BASED PROTECTION:						
Caribbean	Y**	Spatial	Traditional		Urchins	Smith and Berkes 1991
Fiji	Y**	Spatial	Traditional		Fish	Jennings and Polunin 1997

*Asterisks represent statistical power (***$p < 0.001$, **$p < 0.01$, *$p < 0.05$)

Globally, most MPAs enhanced fisheries

These did not

Figure 32. Globally, most MPAs enhance fisheries, but the highlighted MPAs in this table did not.

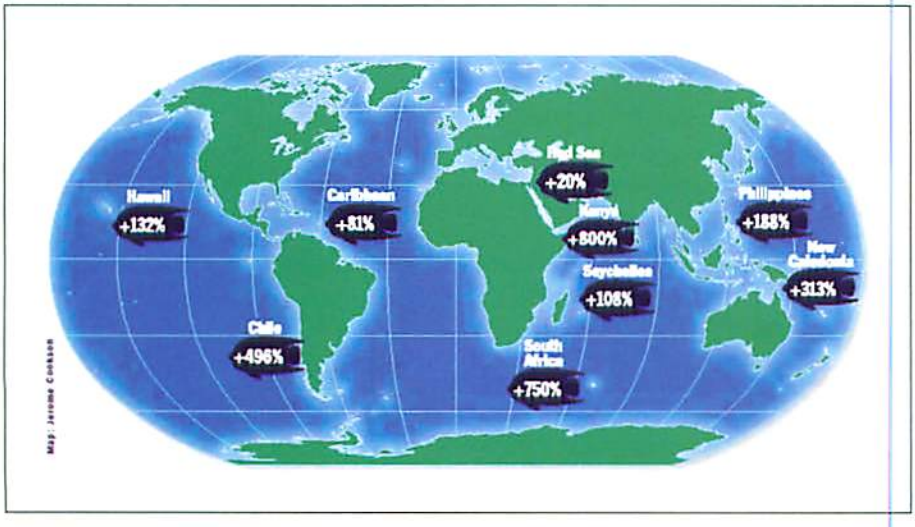


Figure 33. MPAs increase fish biomass inside their borders. The numbers on the map represent the average increase in fish biomass inside reserves. *Source: Data are from 32 studies summarized by Halpern (2002) that were published in peer-reviewed journals.*

An added benefit to an MPA is "spillover" effects, which can increase fish biomass and catch rate adjacent to the reserve (Fig. 34). The area of the spillover is usually very small, but spillover effects can result in larger fish spilling over from the MPA. (Fig. 35). In addition, the reproductive potential of large brood stock can be significant (e.g., Birkeland (1997) estimated that one large fish equals 212 small fish).

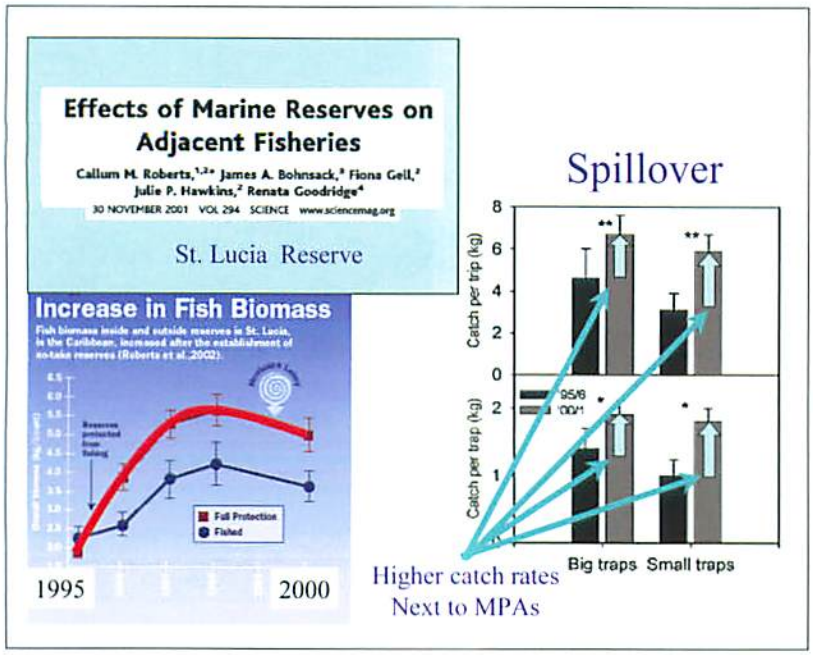


Figure 34. Spillover effects in the St. Lucia Reserve, in the Caribbean, result in an increase in fish biomass and higher catch rates next to MPAs.

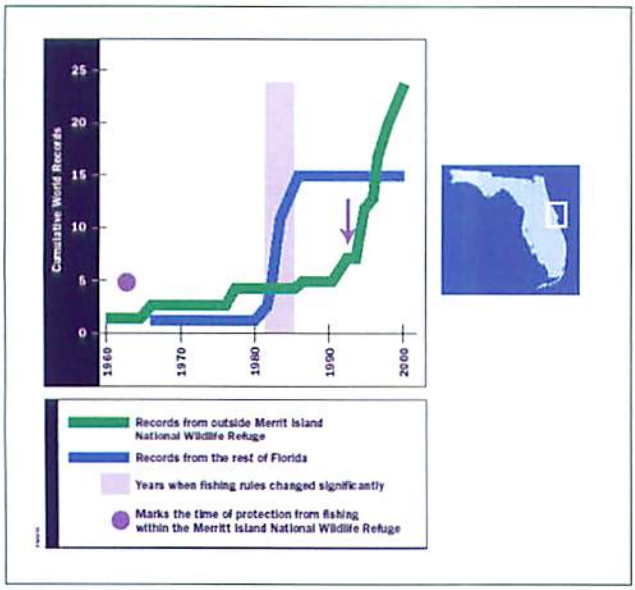


Figure 35. World size records for black drum from outside the Merrit Island National Wildlife Refuge, Fla. Fish caught outside the refuge now dominate the world-record category (Roberts et al., 2001).

In the Gulf of Maine, the coastal cod fishery collapsed. In response, closures were established on Georges Bank in 1994 in an effort to protect the stocks (Figs. 36 and 37). Despite this action, cod stocks did not respond favorably. In contrast, haddock stock biomass increased significantly in response to the fishery closures (Fig. 38). And the density of sea scallops increased since the closures were put in place (Fig. 39). In addition, the closures have resulted in spillover of sea scallops to adjacent waters (Fig. 40).

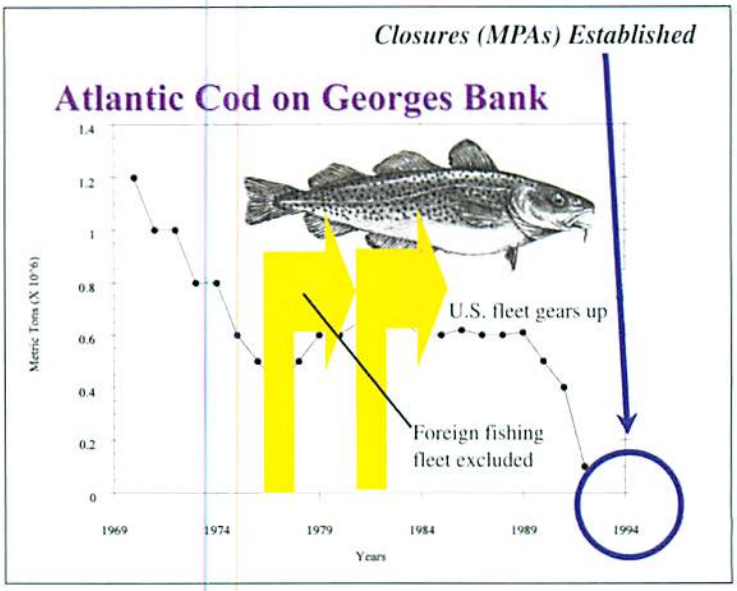


Figure 36. Graph shows the collapse of the cod fishery over time, from 1970 to 1992 prior to area closures instituted on Georges Bank.

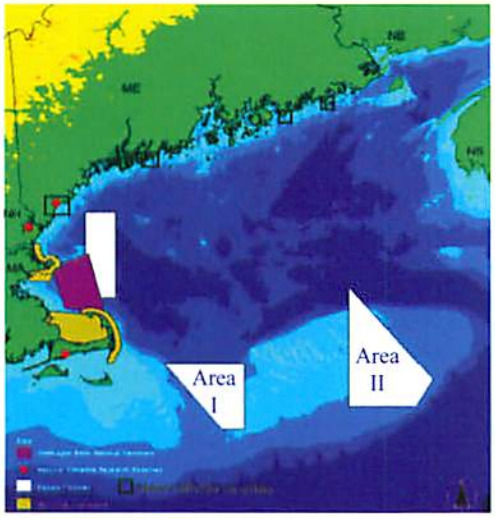


Figure 37. Map of closed areas (MPAs) in the Gulf of Maine to protect groundfish stocks.

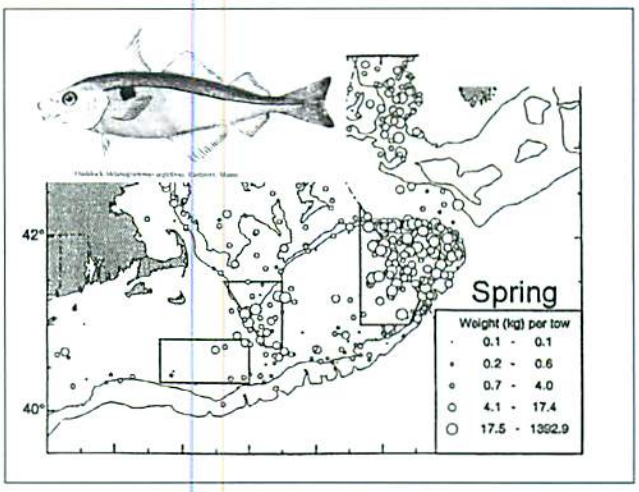


Figure 38. Haddock has responded well to area closures. Size of the circles indicate the increase in biomass in the vicinity of the closures. Data from NMFS groundfish tows, 1989–1998.

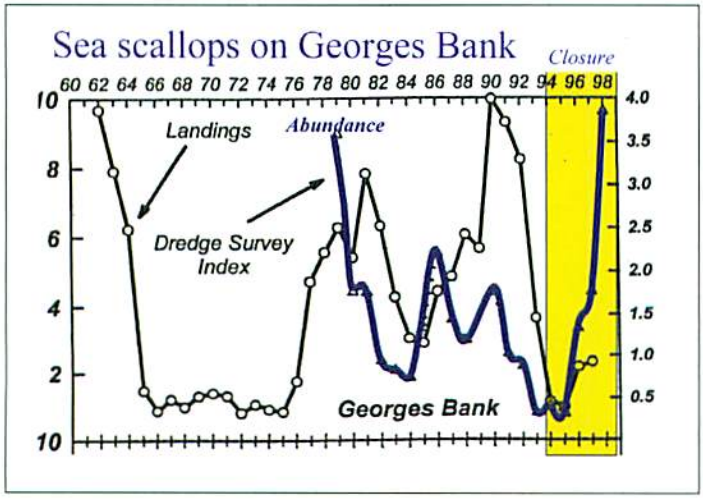


Figure 39. Landings (metric tons, meats) and survey abundance indices for Atlantic sea scallop on Georges Bank and in the Mid-Atlantic Bight, 1960–1998. Abundance indices are stratified mean weight (kg) per survey tow, standardized for dredge selectivity.

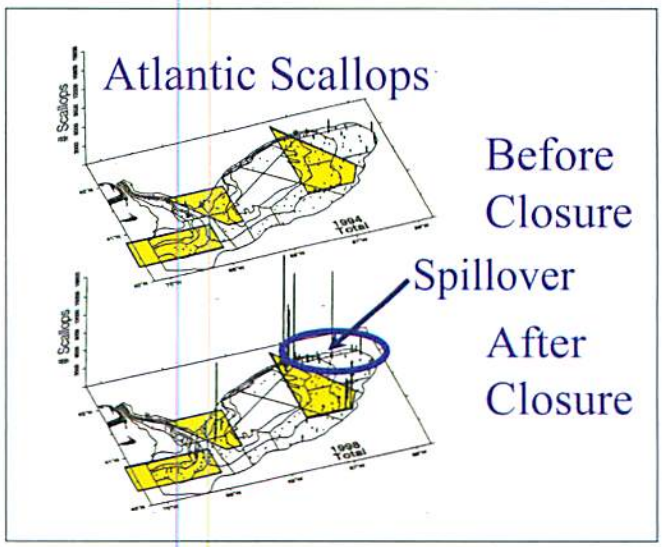
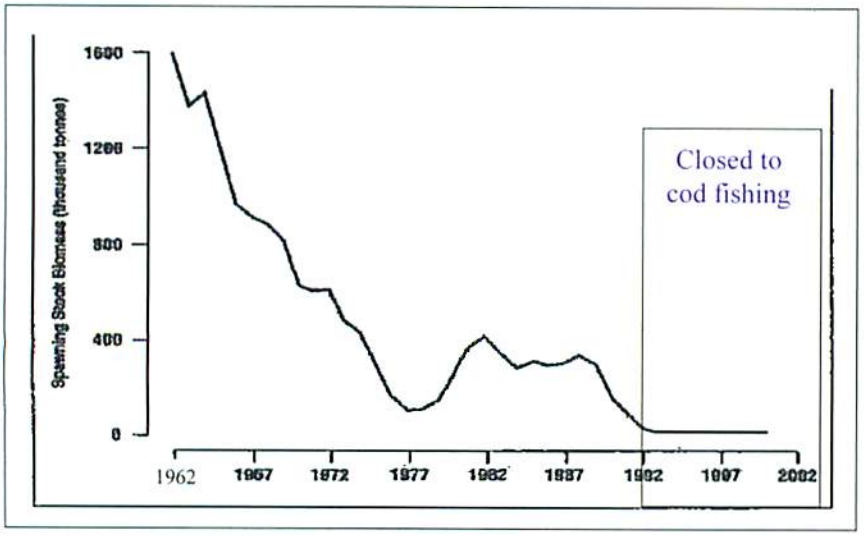


Figure 40. For Georges Bank sea scallops, the spikes to the east of the closed area are a result of spillover effects.



Unfortunately, not all closures work. For Newfoundland's northern cod fishery, targeted fishing ceased in 1992; however, spawner biomass continues to show no sign of recovery (Fig. 41). When populations decline to such a low level that reproductive capacity is eroded, recovery is sometimes impossible.

Figure 41. Spawner biomass of Newfoundland's northern cod shows no sign of recovery almost a decade after the cessation of targeted fishing mortality. *Source: Hutchings, J.A. and R.A. Myers. 1994. What can be learned from the collapse of a renewable resource? Atlantic cod,* Gadus morhua, *of Newfoundland and Labrador.* Can. J. Fish. Aquat. Sci. ***51****:2126–2146.*

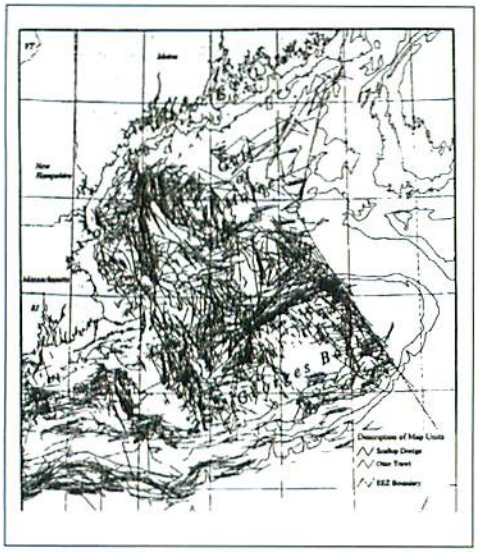


Figure 42. Scallop dredge and trawling effort on Georges Bank and the Gulf of Maine. Data from 14,908 passes. Spatial distribution of effort is aggregated on productive fishing areas. *Source: Auster et al., 1996.*

Preserving Biodiversity

MPAs can be used to preserve biodiversity, especially in areas where fishing has impacts on habitat. Some fishing methods have greater impacts than others. Trawling, for example, is viewed as a potential problem by some. In certain areas, trawling frequencies can be great. In areas containing deepwater corals and anemones, dragging of the bottom can obstruct these long-lived organisms (Figs. 42 and 43). We are turning the Gulf of Maine into a big weed patch. This kind of assertion may involve human value judgments. Some may think there should be wilderness areas that protect species native to this area.

In some cases, however, designating an MPA may not achieve the goal of protecting species. In their 2002 paper in *Marine Pollution Bulletin*, "The three screen doors: Can marine 'protected' areas be effective?" Stephen Jameson and colleagues write, "The great majority of marine protected areas (MPAs) fail to meet their management objectives." In many cases, MPAs may not be the right tool. MPAs should not be expected to solve all problems.

Figure 43. Photos of some of Maine's deepwater corals and anemones. Fisheries practices, such as bottom trawling, can interfere with the longevity of these organisms. *Photos by Les Watling.*

In the Gulf of Maine, MPAs were established in 1996 to protect the sea urchin (Fig. 44). At that time, sea urchin had become rare and seaweeds had flourished. But closing these areas to fishing may not bring back the sea urchin if the urchin decline is the result of a fundamental change in the ecosystem (Fig. 45). An ecosystem change may result in a new urchin-free "stable state."

What causes ecosystem functions to change? In a trophic cascade, apex predators, such as cod, feed on sea urchin (an herbivore), for example, which in turn feeds on seaweed. When apex predators are taken out of the system, herbivores become more abundant (Fig. 46). This change was followed by rapid overfishing of sea urchins (Fig. 47). In the Gulf of Maine, we now have a new system that is a wonderful habitat for baby crabs, which eat the

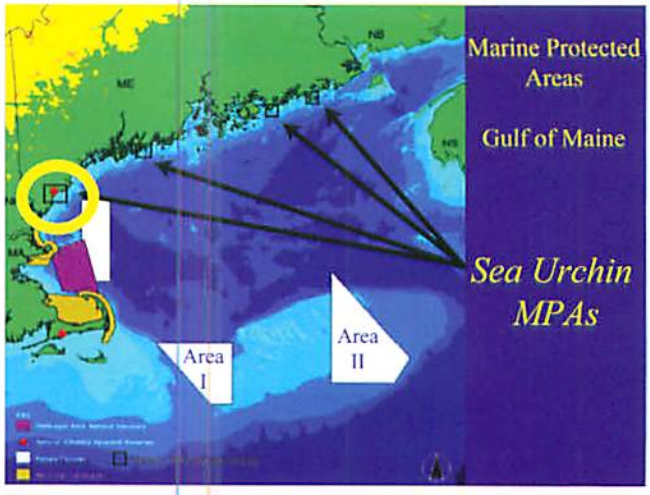


Figure 44. Map shows four areas along the Maine coast that are closed to sea urchin fishing. These MPAs were established in 1996 in response to the declining sea urchin population.

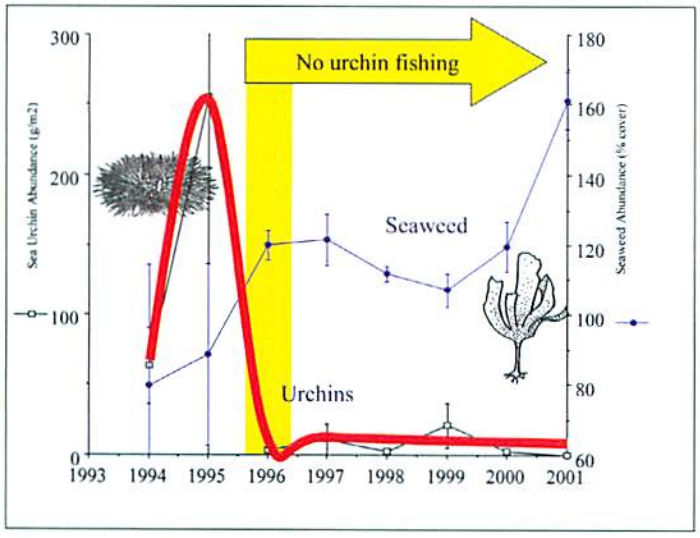


Figure 45. Sea urchin abundance (boxes) vs. seaweed abundance (circles) in the Gulf of Maine. Graph shows that despite fishery closures, the urchin population has not recovered. *Data from Vavrinec, Ph.D.*

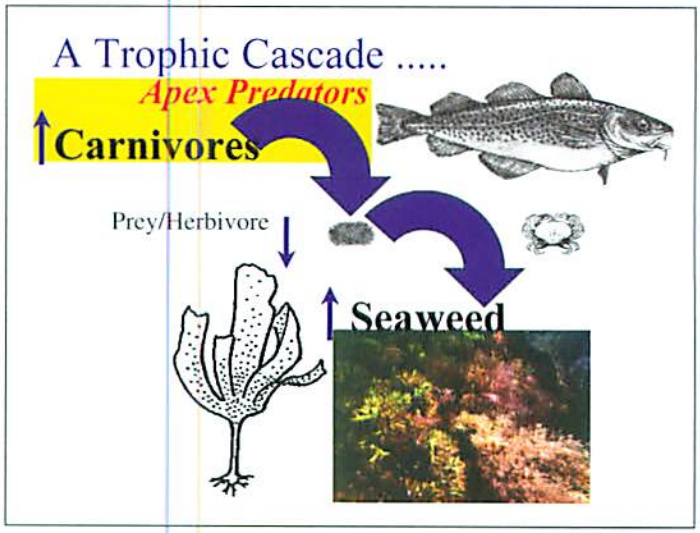


Figure 46. Diagram of a trophic cascade with cod as the apex predator, sea urchin as both prey and herbivore of seaweed, the primary producer.

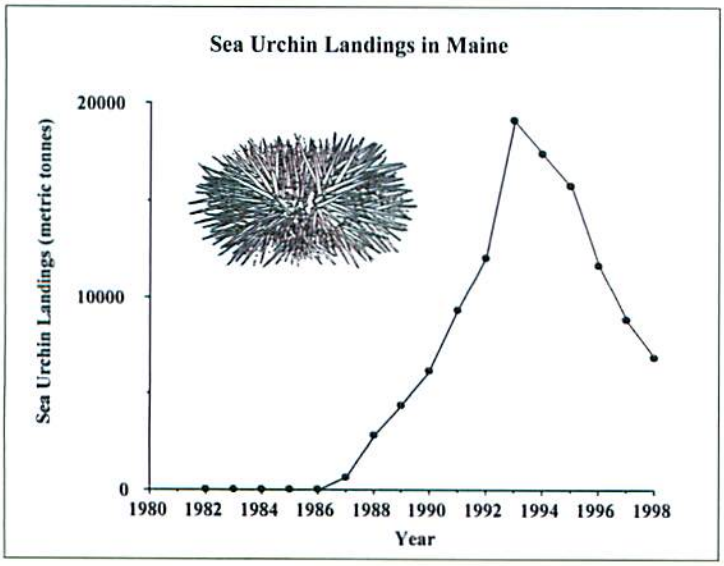


Figure 47. Graph shows sea urchin landings over time. With the decline of cod, sea urchin flourished and fishery landings increased dramatically, ultimately leading to sea urchin overfishing.

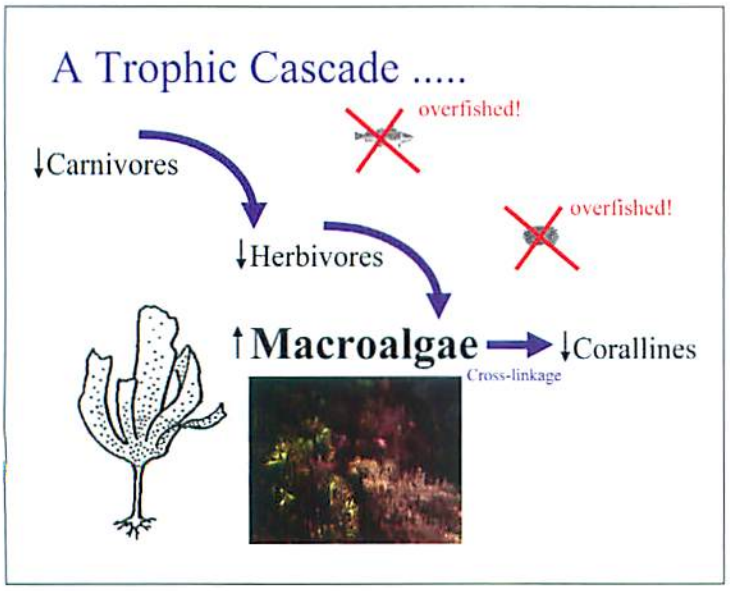


Figure 48. Diagram of a trophic cascade in which both the carnivores and herbivores have been overfished, leading to proliferation of macroalgae which then outcompete corallines.

Figure 49. Photo taken in a Gulf of Maine MPA, showing crab micropredators.

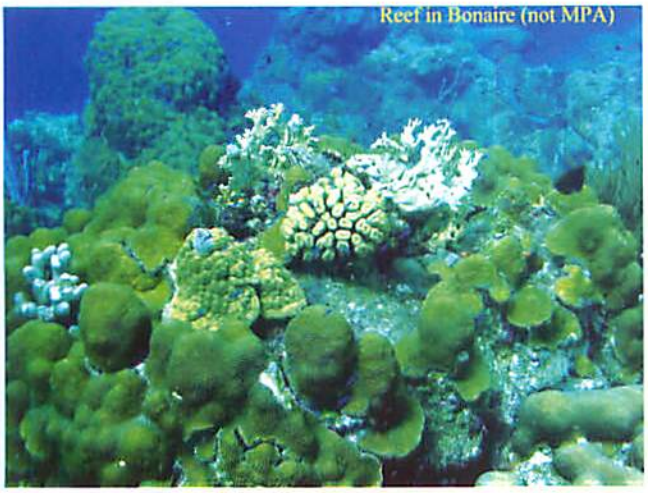


Figure 50. Photo of a coral reef in Bonaire that allows taking of carnivores while protecting parrotfish.

urchins that settle on the bottom. Once the carnivores and herbivores were taken out of the trophic cascade, the seaweeds (macroalgae) began to thrive and outcompeted the coralline organisms (a cross-link in the cascade) (Fig. 48). As structures of ecosystems change due to fishing impacts, so do the way they function (Fig. 49).

Establishing MPAs as no-take areas, such as coral reefs, sometimes results in habitat degradation instead of protection. In a Bonaire reef (not an MPA), the taking of parrotfish is prohibited, but carnivores may be fished. The reef has remained intact (Fig. 50). In contrast, a no-take MPA has been established on a Bahamian reef. This reef is loaded with groupers that eat all the small fish. The protected area appears to be beneficial for the groupers but too small in size to protect the larger predators such as sharks that eat the groupers. The reef has been protected for about 20 years, but it is seriously degraded (Fig. 51). Not all MPAs are effective.

In conclusion, we must recognize that MPAs don't always work. Other factors such as climate, atmosphere, and land use may have large impacts not controlled by MPAs. In addition, resilience of managed stocks may be compromised by the loss of local stocks or spawning potential and changes in the way that ecosystems function. It's important to recognize that when establishing MPAs, compliance is important. Fishermen need to buy into and support MPAs. They need to see how it will improve their lives.

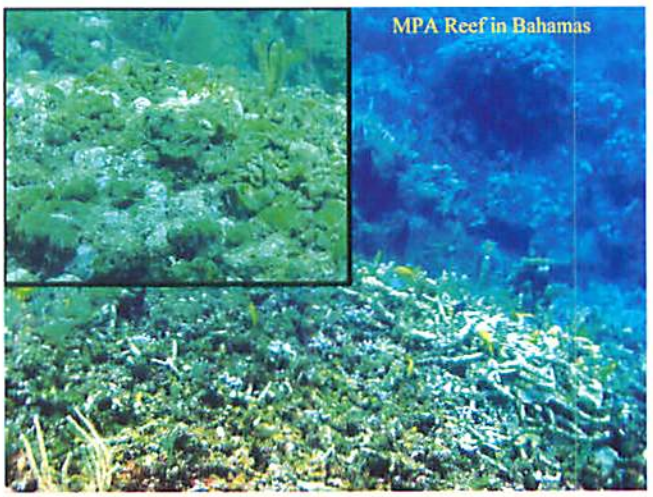


Figure 51. Photo of a coral reef in the Bahamas that has been established as a no-take MPA. While protecting the groupers, which eat all the small fish, it is too small to protect their predators, resulting in reef degradation over time.

Recommendations

- In utilizing MPAs for management purposes, goals and means of gauging progress need to be identified.
- We need to be clear about what's being managed—whether it be for fisheries management, biodiversity, or some other reason.
- Stakeholders (fishermen and environmental advocates) need to be involved.
- MPAs need to be considered part of comprehensive ocean-use planning. Some areas may need to be set aside as "wilderness areas."

Comments and Questions

- We do not need extensive enforcement. This is offensive to fishermen because it assumes violations will occur. We need to consider how we will monitor areas to determine success. We need good science and good participation in this process, and we need to clearly define goals. We need to consider where the money for this will come from.
- **Q:** One of the papers cited stated only about 30 percent of MPAs met their goals. Did they look at whether these goals were reasonable?
  A: The final conclusion appears to be that these MPAs were set up without establishing reasonable goals.
- **Q:** How do we work through the tensions associated with the different goals mentioned, such as establishing MPAs for fisheries management purposes vs. establishing wilderness areas?
  A: Different areas may have different purposes. The key is to be clear about those goals.
- **Q:** There are coral areas in the Gulf of Maine, but we have been fishing heavily in these areas for 50 years. Is there a need to set up protected areas to protect corals?
  A: The bigger issue is that an animal like coral takes a long time to grow. I have seen gear changes that allow fishermen to fish in areas that they did not before. Coral may need protection.

PART III

OVERVIEW OF EXISTING PROTECTED AREAS IN NEW ENGLAND

Overview of Existing Protected Areas in New England and the New England Fisheries Management Council's Perspective

Presented by Paul Howard, New England Fisheries Management Council, at the Maine and New Hampshire Workshops
Presented for Paul Howard by Deirdre Valentine, New England Fisheries Management Council, at the Rhode Island Workshop
Presented for Paul Howard by Eric Smith, Connecticut Department of Environmental Protection, at the Connecticut Workshop

The viewpoints on MPAs from a fisheries perspective are diverse. Everyone seems to have differing opinions on where we are and where we are going. I would disagree with those who say fisheries management is not working. Progress is being made, but this is being overshadowed by lawsuits, distrust of science, and a public thirst for bad news.

Definition of MPAs

On May 26, 2000, Executive Order 13158 defined an MPA as:

> *"Any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein" (FR 65:34909-34911).*

The National MPA Center currently defines the phrase "lasting protection" to mean longer than four months on a permanent basis [every year]. An announcement in the Federal Register will ask for public comment on this definition. From a fisheries management perspective, I intend to ask that a very broad definition of MPAs [such as the international definition] be used.

Types of MPAs

- Strict protection (i.e., nature reserve)
- Ecosystem conservation and recreation (i.e., national park)
- Conservation of natural features (i.e., national monument)
- Conservation through active management (i.e., habitat/species management area)
- Land/seascape conservation and recreation (i.e., protected landscape/seascape)
- Sustainable use of natural ecosystems (i.e., managed resource protected area)

From a fisheries standpoint, the habitat/species management areas and the managed resource protection areas are the primary concern. MPAs are not a new concept in fisheries management. The New England Fisheries Management Council (NEFMC) has many management areas that meet various criteria for an MPA (Fig. 52). These include the following:

- Groundfish Closed Area I
- Groundfish Closed Area II
- Nantucket Lightship Closed Area
- Cashes Ledge Closed Area
- Western Gulf of Maine Closed Area
- Inshore Restricted Roller Gear Area
- Hudson Canyon Scallop Closed Area
- Virginia Beach Scallop Closed Area

Inshore rolling closure areas for spawning cod in the Gulf of Maine may also be considered by some as MPAs. Roughly 28 percent of the areas fished on Georges Bank are closed. Closed areas are an effective management tool but they are one of the most difficult tools to implement. Fishermen do not want them in their backyard. It is difficult to be fair when using a large number of closed areas, so the NEFMC uses them in combination with other tools.

Beginning in 1994, the NEFMC increased its use and reliance on closed areas as a management tool to enhance rebuilding and protect habitat. The council's closed areas on Georges Bank and in the Gulf of Maine have contributed to stock rebuilding. In combination with effort reductions and controls, gear restrictions, and other measures, stocks have shown remarkable recovery. Additional research is encouraged to quantify effectiveness of closed areas as a management tool. Over the next two years the NEFMC will be working with fishermen and scientists to identify and plan for the protection of important habitats.

Groundfishery Rebuilding

In 1994, 30 percent of Georges Bank was closed to fishing; since then, stocks have tripled in biomass (Fig. 53). The NEFMC also keeps data on SSB, which extend back to before 1989 (Fig. 54). The council now manages by SSB. The spawning stock has also tripled. We began to use closed areas in the Gulf of Maine in 1997 in combination with restrictions on days at sea and increased mesh size. Since that time stocks have doubled if you do not include redfish. Gulf of Maine cod recruitment is growing. Georges Bank cod recruitment is not.

Sea Scallop Recovery—An Unintended Benefit

The scallop industry was harvesting only about 12 million pounds of scallops for several years. Many scallopers went bankrupt. When the NEFMC closed Georges Bank to protect groundfish stocks in 1994, it also inadvertantly closed the most productive scallop grounds and now scallopers are harvesting 50 million pounds a year (Fig. 55).

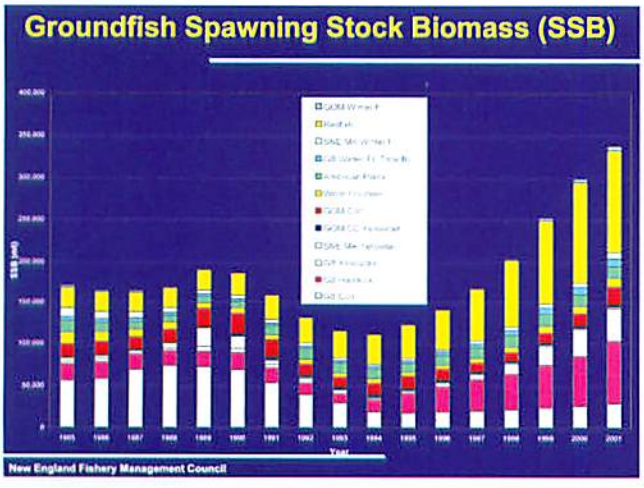


Figure 54. SSB of 12 multispecies groundfish stocks tracked from 1985 to 2001. Since 1994, when 30 percent of Georges Bank was closed to fishing, SSB has also tripled.

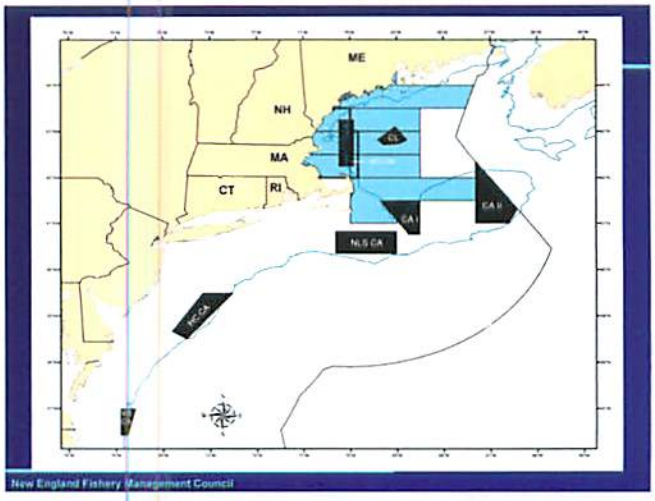


Figure 52. Areas closed to fishing on Georges Bank. Blue areas are spawning closures for cod, which are closed for two to three months at a time.

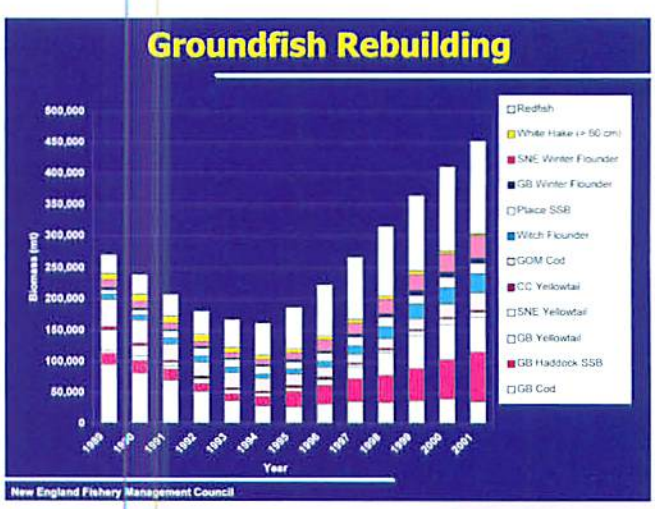


Figure 53. Biomass data of 12 multispecies groundfish stocks tracked from 1989 to 2001. Since 1994, when 30 percent of Georges Bank was closed to fishing, biomass of the stocks has tripled.

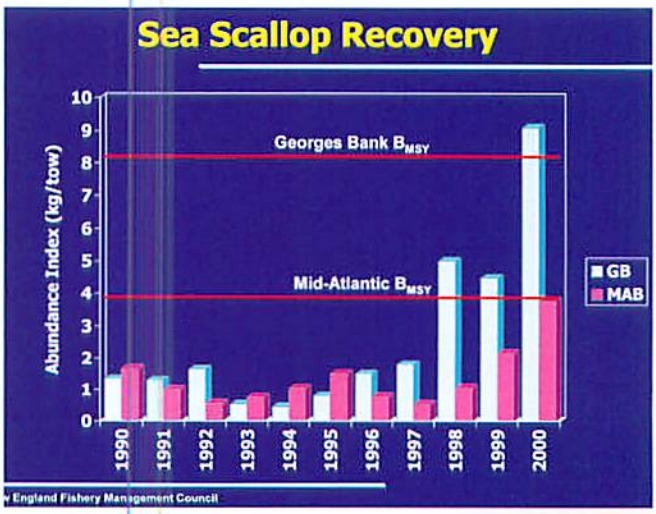


Figure 55. Graph shows abundance of scallops on Georges Bank and Mid-Atlantic waters. The fishery was closed in 1994 to allow groundfish stocks to recover, but had the unintended benefit of allowing sea scallop to recover.

MPAs in Fisheries Management

Closed and restricted areas are an important element of most fishery management programs in the Northeast. The continued use of closed and restricted areas demonstrates that the concept of an MPA is not new to fisheries managers. What may be new to some is the term MPA to describe these common management actions. Fisheries managers will continue to use closed and restricted areas where and when they are appropriate.

In order to be most effective, a comprehensive MPA should address all activities with the potential to adversely affect marine biodiversity, fish populations, and habitats. Narrow authority was granted to the DOC, fishery management councils and/or NMFS, which is housed in the DOC, to regulate only commercial and recreational fishing. There are other concerns that include sand and gravel mining, ocean dumping, oil, gas, and mineral exploration and extraction, channel dredging, dredge material disposal, pipeline/cable installation, and pollution. Control/regulation of these activities is critical to the overall success of any proposed MPA.

An ideal MPA system should provide for integrated management of the area. Councils manage and control fishing activities, but currently have no control over many non-fishing-related activities. Other agencies with management authority include the Army Corps of Engineers (COE) (dredging), Minerals Management Service (MMS) (oil, gas, mineral exploration), and the U.S. Environmental Protection Agency (EPA) (ocean dumping). An ideal MPA system would integrate and coordinate management authority via a regional advisory board composed of the NEFMC, NMFS, the National Ocean Service (NOS), EPA, COE, MMS, and the U.S. Fish and Wildlife Service (FWS), which is housed in the DOI.

Role of the Regional Councils

Under the Magnuson-Stevens Act, the regional fishery management councils will continue to protect fish stocks and habitats in the most appropriate ways, including use of closed and restricted areas. The use of management areas closed and restricted to fishing activities at the sole discretion of the regional councils is consistent with an integrated approach for implementation and management of MPAs. Fishery management decisions should remain with the regional councils as intended by Congress.

The NEFMC has a designated MPA Committee that is charged with developing council policy and strategy on MPAs. The committee also apprises the NEFMC of MPA-related developments and serves as a formal link between the council's MPA activities and the federal advisory panel. The MPA committee also ensures coordination with the DOC and DOI. And the committee keeps the public and other agencies informed of NEFMC roles and responsibilities.

Summary

In conclusion, there is no new comprehensive authority associated with the MPA Executive Order. Each agency retains its regulatory authority. The NEFMC and NMFS regulate fishing activities in the EEZ under Magnuson Act authority (finfish and scallops). The Atlantic States Marine Fisheries Commission (ASMFC) and NMFS regulate lobster activities in the EEZ under the Atlantic Coastal Act. The NOS maintains the authority to regulate all activities within a Congressionally established marine sanctuary under the National Marine Sanctuary Act, though it must consult with the NEFMC.

Fishermen remain the most important and most impacted stakeholder group. To achieve success, fishermen must understand the need for MPAs and support them. They must be at the table from the beginning. It is a difficult time to get buy-in from fishermen for the establishment of no-take, wilderness areas in the ocean because we are in a transition period trying to rebuild stocks, and there is a lack of trust between fishermen and environmental groups due to lawsuits.

But it must be recognized that not all MPAs are no-take zones. All MPAs are not the same and should not be managed in the same way. It is important to define the problem. Use existing regulatory authorities for MPAs. We do not need new and redundant authorities. If MPAs are to be established to help fisheries, the councils are the appropriate place.

Comments and Questions

- **Q:** It seems as though the Executive Order is trying to encourage integrated management. How does the NEFMC anticipate dealing with some of these other agencies?
  A: I don't know if anyone is looking at an integrated approach to doing that. Maybe it is happening at the Washington level between the DOC and DOI, but it has not filtered down to the regional fisheries council level.
- **Q:** For the fishing closures that are in place now, what mechanisms were used to integrate this process with other agencies?
  A: I do not think there were mechanisms to integrate the process. They were not intended to be multi-purpose closures.
- **Q:** The NEFMC has jurisdiction over MPAs if they are implemented to help fisheries. Does the council have jurisdiction if they are implemented for other reasons?
  A: The council does have responsibilities in terms of protecting EFH, but it can only regulate fishing activities.
- **Q:** What is the status of the council's MPA committee? It has met only once in 16 months.
  A: If the lawsuits would go away, we could pay more attention to these kinds of issues.
- **Q:** There is difficulty in trying to manage fisheries. With MPAs, will scientists be able to assess what is happening to the fish?
  A: We need to dispel the notion that we are not capable of assessing fish stocks. The conclusions of recent analyses are that the surveys are still reliable. As far as being capable of assessing the benefits of MPAs, that work is ongoing. Scientists need to continue to assess spillover effects, and the consequences of increased biomass inside closed areas.
- We need more research to develop a comprehensive assessment of critical habitat areas to protect.
- We essentially have a closed area in the center of Long Island Sound due to closed dragging areas for pots. We need to determine if more fish are getting in the lanes.
- **Q:** The scallop success story seems to suggest that closed areas may be more successful for sedentary species. Do closed areas have to be bigger to have an impact on highly migratory species?
  A: It seems that for such species, we cannot rely solely on closed areas. Some stocks are responding better to closed areas than others.
- **Q:** Closed areas appear to benefit more sessile species. Does this imply that the closed areas need to be bigger to benefit more mobile species such as cod?
  A: We are unsure. Haddock swims around but it benefited from the closed areas.
- **Q:** How does the management of birds, marine mammals, and turtles get integrated into fisheries management?
  A: NMFS does a lot with sea turtles and whales through closures when they are spotted in an area.
- **Q:** How do you define stakeholders on Georges Bank?
  A: Our MPA committee includes all interested parties. Whatever federal agency takes the lead needs to make sure the process in inclusive.
- **Q:** It was indicated that stakeholder cooperation is important and that fishermen are the group most impacted. But when the current closed areas were established, this input was bypassed.
  A: In the mid-1990s, haddock abundance was plummeting so an emergency action was taken to address this problem quickly. Then the NEFMC went through a plan amendment process that required public input.
- **Q:** There is an issue of MPAs vs. rights-based fishing. The use of MPAs still involves open access fishing, and the problems of overcapitalization and economic inefficiency are still present.
  A: All the fisheries mentioned are under limited access and effort controls. The rolling closures are designed to close fishing when the fish aggregate and then open to let people fish when the fish disperse. This is with the pretext that no new fishermen enter the fishery. Effective effort has been reduced to about 30 to 40 percent of what it was two years ago, and the allocated effort is reduced to about 50 percent of what it was two years ago. There are many tools in place.
- **Q:** There were major effort reductions during World War II that affected groundfish stocks. What would be the baseline of those stocks?
  A: There was a crash in the 1930s and relative stability from 1930 to the 1960s. Then foreigners drew down the stocks.
- **Q:** As biodiversity increases, what species are showing up?
  A: Dominant species such as haddock, yellowtail flounder, and cod are getting much richer, and unexploited species are also showing up in surveys. It is difficult to determine the cause; it could be due to range extension or MPA protection.
- **Q:** Do non-fishing-regulated activities include aquaculture?
  A: It is a fishing-related activity but is not managed under the Magnuson-Stevens Act. Aquaculture would be another component that states would be more involved in.

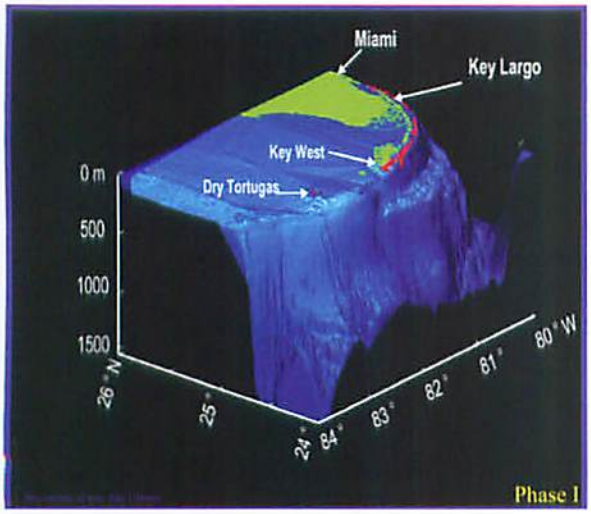


Figure 56. Three-dimensional image showing the location of the Florida Keys-Tortugas sanctuary zone.

MPA Case Studies: Tortugas Ecological Reserve and Stellwagen Bank National Marine Sanctuary

Presented by Ben Cowie-Haskell, Stellwagen Bank Marine Sanctuary, at the Maine Fishermen's Forum MPA Workshop

Florida Keys-Tortugas Ecological Reserve

The Tortugas Ecological Reserve is located within the Florida Keys National Marine Sanctuary and Dry Tortugas National Park sanctuary zone (Fig. 56). The zoning plan for the sanctuary included sanctuary preservation areas, special-use (research-only) areas, ecological reserves, wildlife management areas, and existing management areas (Figs. 57 and 58). The purpose of establishing the reserve was to protect sensitive habitats and biodiversity in the region as well as to respond to threats from tanker's anchors and overfishing practices in the area (Figs. 59 and 60).

Figure 57. The sanctuary zoning plan includes five different area categories.

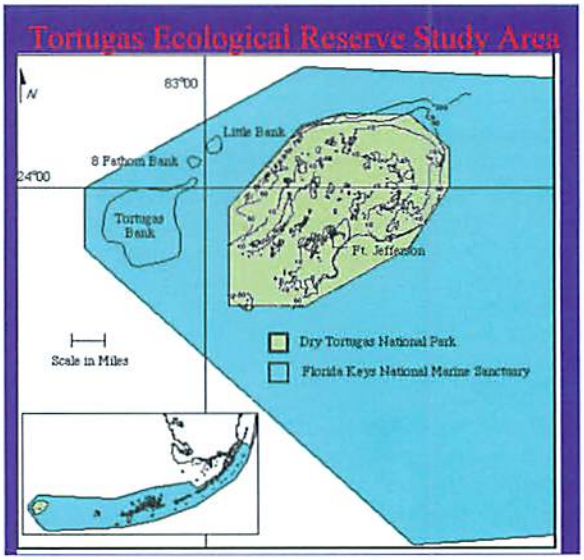


Figure 58. The Tortugas Ecological Reserve is located at the western end of the sanctuary.

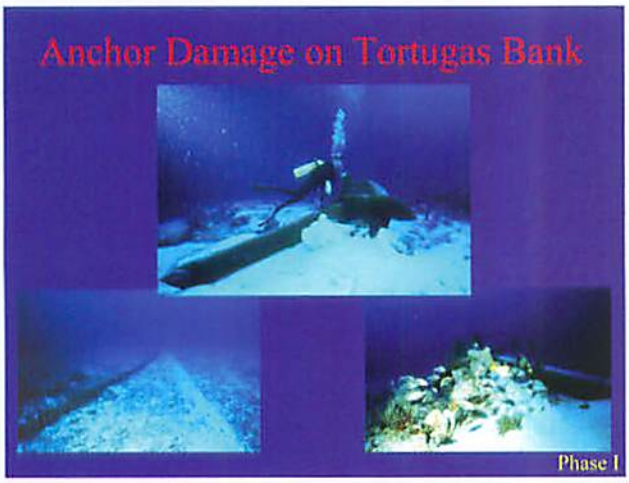


Figure 59. Photos show anchor damage on Tortugas Bank.

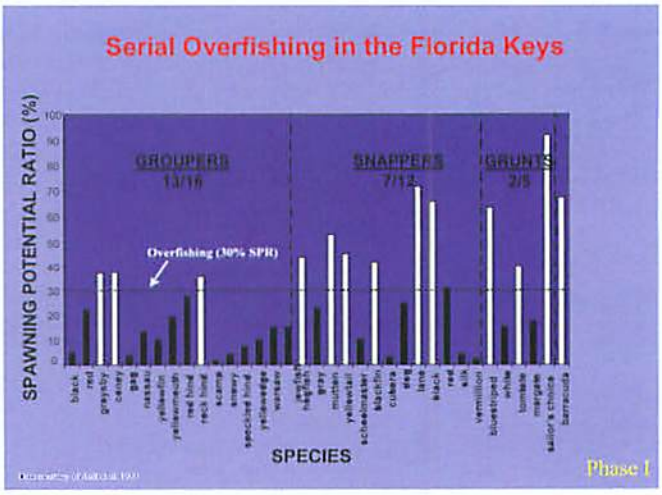


Figure 60. Graph shows the number of species considered overfished in the Florida Keys, based on the spawning potential ratio (SPR). An SPR of 30 percent or more is considered overfished (open bars).

Congress had created the original sanctuary zone. In 1997, there was a network of areas with varying restrictions in place. Some of these areas were no-take zones. The establishment of a large replenishment zone was proposed within the sanctuary area but was opposed by those believing it was in the wrong place and would seriously impact fishing activities. This original proposal was tabled and a process was developed to do it the right way. This involved the formation of a 25-member working group charged with designing a reserve based on the best available information. The working group was composed of representatives from agencies with jurisdiction in the study area, local stakeholders groups (commercial and recreational fishing and recreational diving), and Sanctuary Advisory Council members. An impartial facilitator was used for the working group process and effort was made to strive for consensus. The group began with a series of forums aimed at gathering information about the region from scientists and fishermen. Seven different state and federal agencies with jurisdictions were also involved (Fig. 61). The result was the creation of the Tortugas Ecological Reserve. This three-year collaborative process to create the reserve was divided into three phases that are outlined below:

PHASE I: Design reserve (April 1998–May 1999)
Goal: Design reserve using best available science
Convene working group
Obtain scientific information
Gather public input

PHASE II: Solicit comments (May 2000–Nov. 2000)
Goal: Maximize public comment
Produce alternatives in a draft environmental impact statement
Convene public hearings

PHASE III: Refine and implement (Nov. 2000–July 2001)
Goal: Implement an ecological reserve in the Tortugas
Refine proposal based on comments

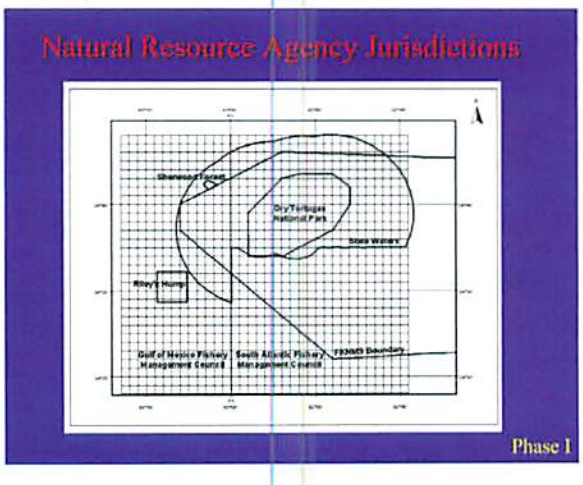


Figure 61. A number of natural resource agencies with jurisdiction in the area were involved from the outset.

In the first phase of designing the reserve, studies utilizing drifter tracking were conducted to assess regional connectivity (Fig. 62). Assessments were also done to determine how the area was currently being used. This included both recreational and commercial fishing practices (e.g., Fig. 63). The working group laid out goals and worked to establish priorities. Priorities identified by the working group at their February 1999 meeting included:

- Biodiversity and habitat
- Fisheries sustainability
- Sufficient size
- Socioeconomic impacts
- Monitoring
- Enforcement/compliance

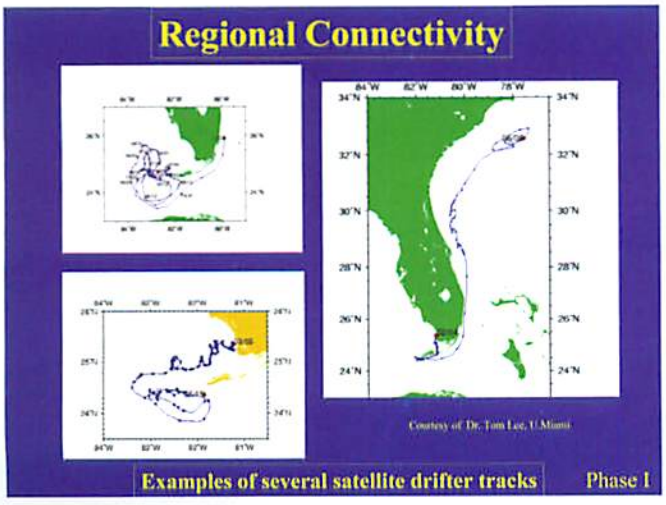


Figure 62. To assess regional connectivity in the sanctuary zone, satellite drifter tracking studies were conducted. Shown here are three examples.

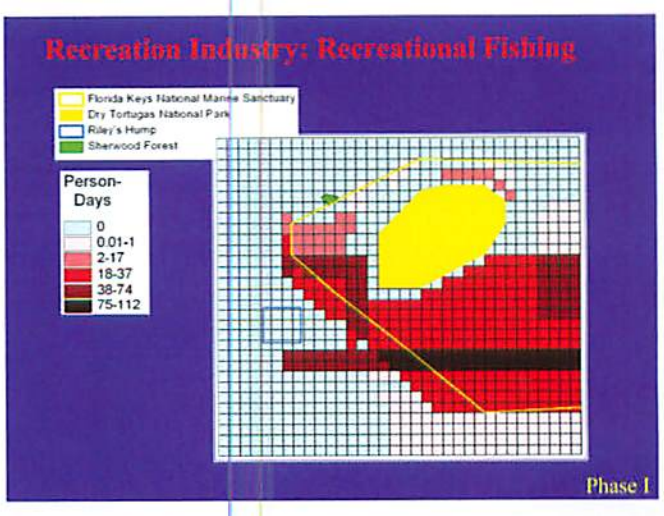


Figure 63. Map shows current recreational fishing use in the proposed reserve area.

Using this information, the group drew up 12 possible boundary alternatives (Fig. 64). The alternatives were evaluated based on ecosystem structure and dynamics and economic and social impacts, and by May 1999, the working group recommended their preferred alternative (Fig. 65).

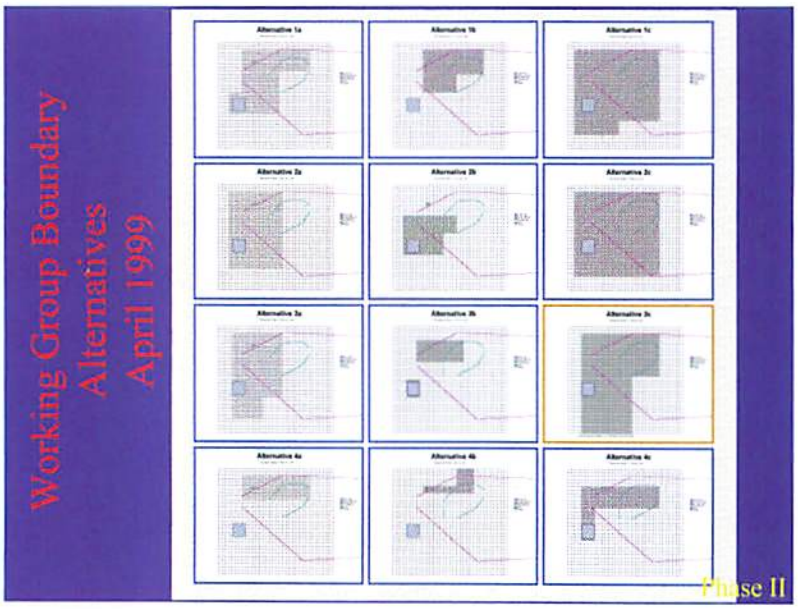


Figure 64. During Phase II, the working group considered 12 alternatives for the boundaries of the reserve.

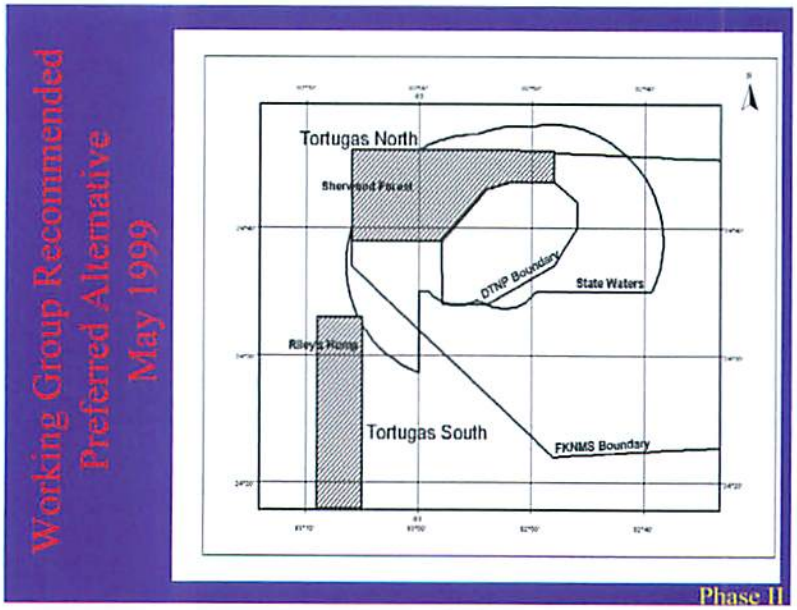


Figure 65. Out of 12 alternatives, this map shows the alternative recommended by the working group.

A performance assessment was conducted for the sanctuary zone by monitoring a series of metrics, including ecosystem structure (size and abundance), ecosystem function (predation, reproduction, etc.), and socioeconomics (revenues, preferences, etc.) (Figs. 66 to 69). Potential benefits, including sustainable fisheries and biodiversity protection, helped gain support for the reserve establishment (Fig. 70).

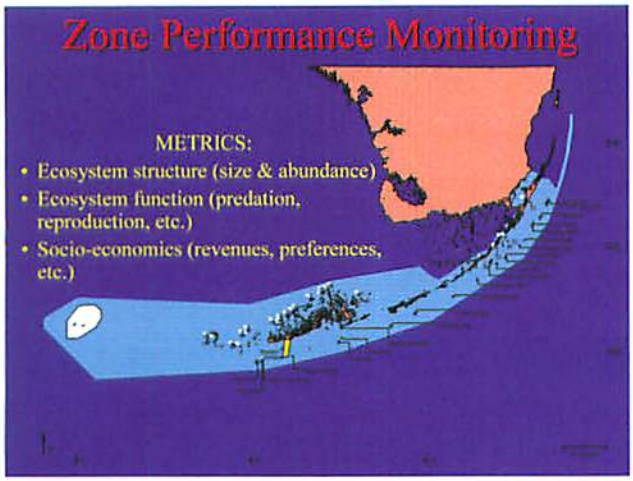


Figure 66. A performance assessment was conducted on the sanctuary zone by monitoring a series of metrics.

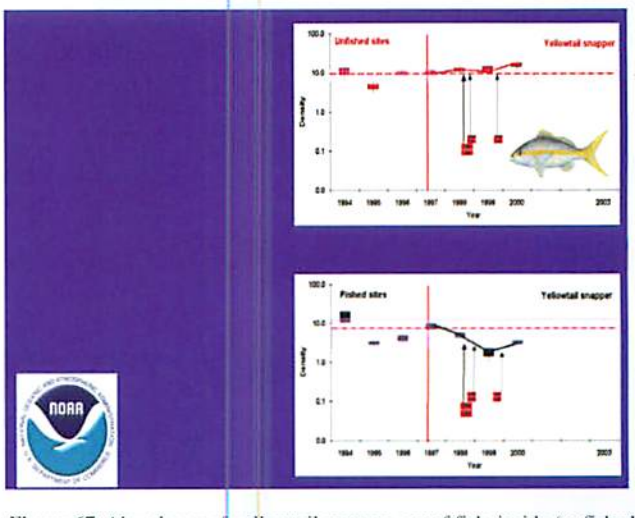


Figure 67. Abundance of yellowtail snapper, a reef fish, inside (unfished) and outside (fished) reserve.

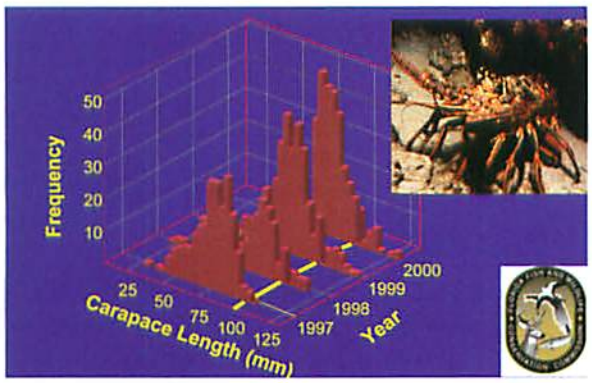


Figure 68. Inside Western Sambo Ecological Reserve, male spiny lobster increased in size each year inside the reserve. Legal size indicated by yellow line on graph.

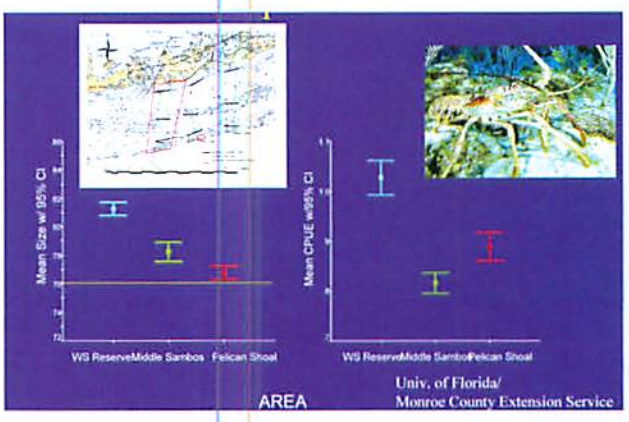


Figure 69. Average lobster size in non-reserve areas (Middle Sambos and Pelican Shoal) was similar to one another and both were significantly smaller than reserve lobsters. Increases in size in Middle Sambos (adjacent to reserve) to levels similar to those in the reserve provides evidence that spillover may be occurring. Catch rate trends did not exhibit expected gradation if spillover was occurring. The results could be confounded due to fishing in non-reserve areas.

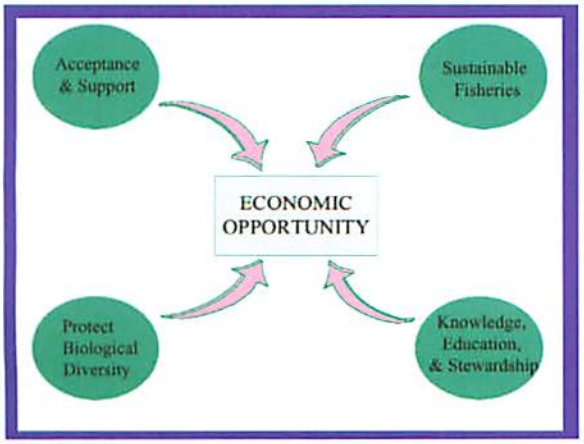


Figure 70. Potential benefits of the Tortugas Ecological Reserve.

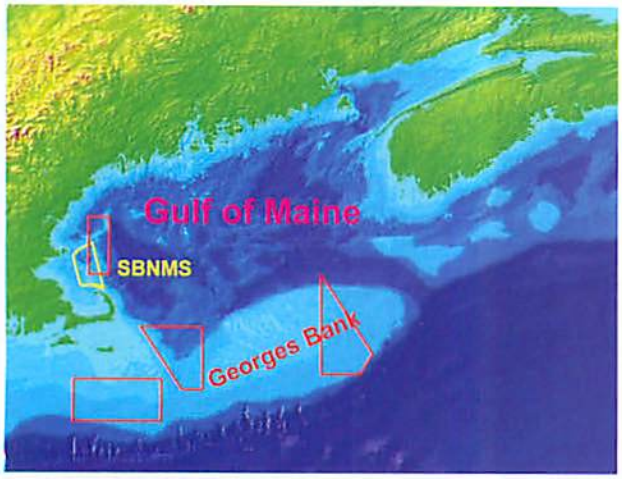


Figure 71. Computer-generated image of the Gulf of Maine and Georges Bank with fishing closed areas and the Stellwagen Bank National Marine Sanctuary (SBNMS) superimposed.

Stellwagen Bank

Located off the coast of Massachusetts in the western Gulf of Maine, the Stellwagen Bank National Marine Sanctuary is one of 13 marine sanctuaries designated around the country (Figs. 71 and 72). The goals established for marine sanctuaries under the National Marine Sanctuaries Act include resource protection, research, education, and multiple-use management.

This MPA is a work in progress. In establishing the reserve, data on humpback whale and tuna occurrences were reviewed (Figs. 73 and 74). Other factors considered in creating this reserve included its education and outreach value, ease of enforcement, and protection of cultural resources such as shipwrecks. Side scan sonar was used to map the seafloor. This was combined with a habitat use assessment (Figs. 75 to 77).

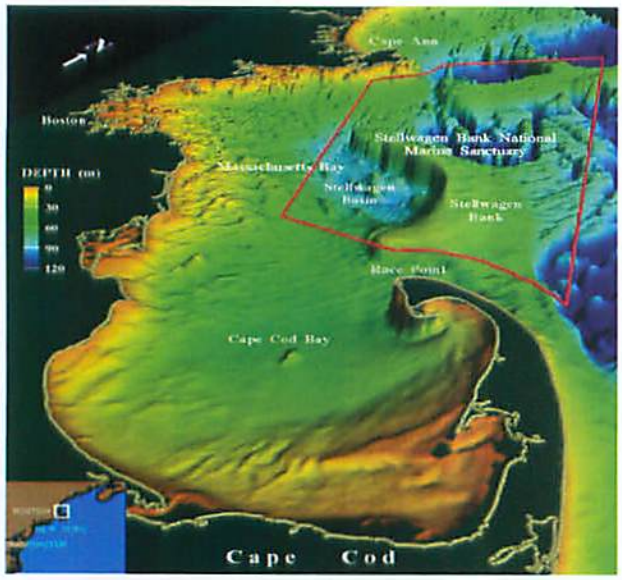


Figure 72. Computer-generated image of the western Gulf of Maine showing Cape Cod Bay and the coast of Massachusetts. The boundaries of the Stellwagen Bank Sanctuary are delineated.

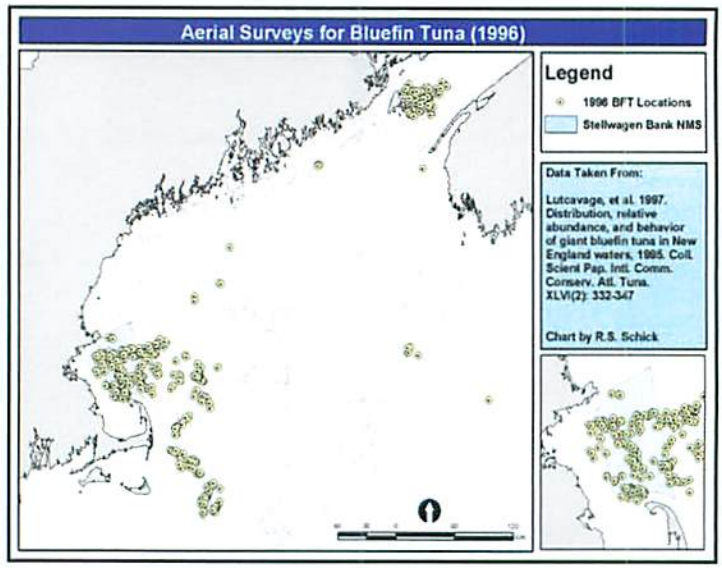


Figure 73. In establishing the Stellwagen Bank Sanctuary, data were collected on bluefin tuna by aerial survey. *Data courtesy of M. Lutcavage, New England Aquarium.*

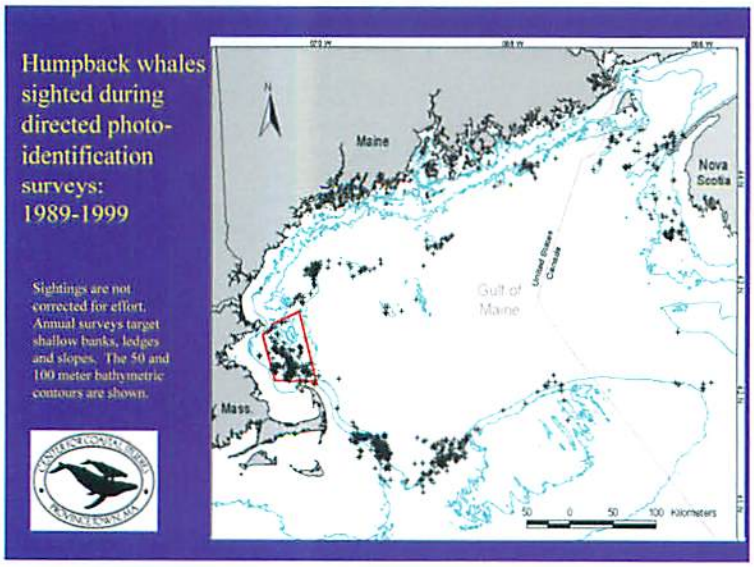


Figure 74. In establishing the Stellwagen Bank Sanctuary, data were collected on humpback whale sightings. *Data courtesy of J. Robbins, Center for Coastal Studies.*

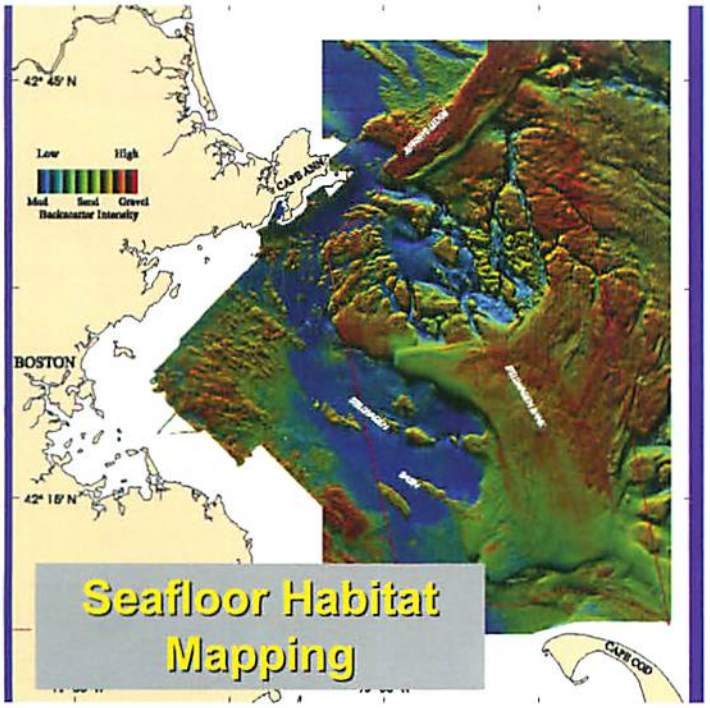


Figure 75. Map of the seafloor in the Stellwagen Bank Sanctuary. Habitat mapping was done using side-scan sonar.

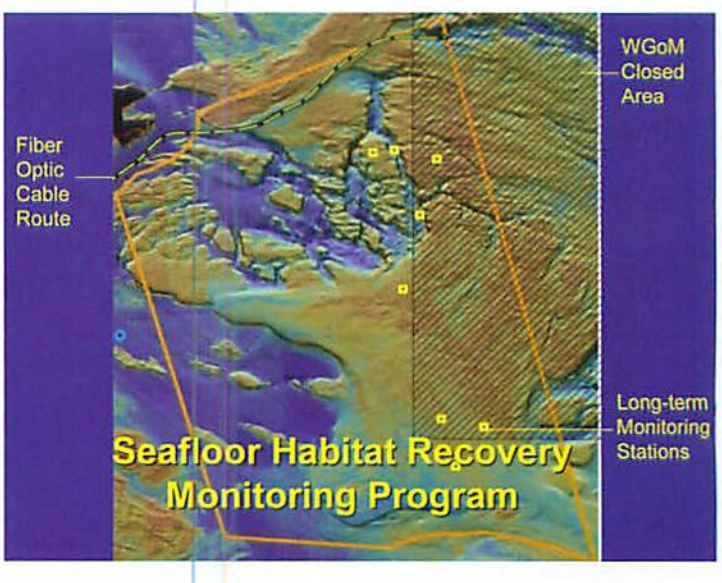


Figure 76. The Stellwagen Bank Seafloor Habitat Recovery Monitoring Program employed side-scan sonar to map the seafloor and pinpoint long-term monitoring stations and other features in the sanctuary.

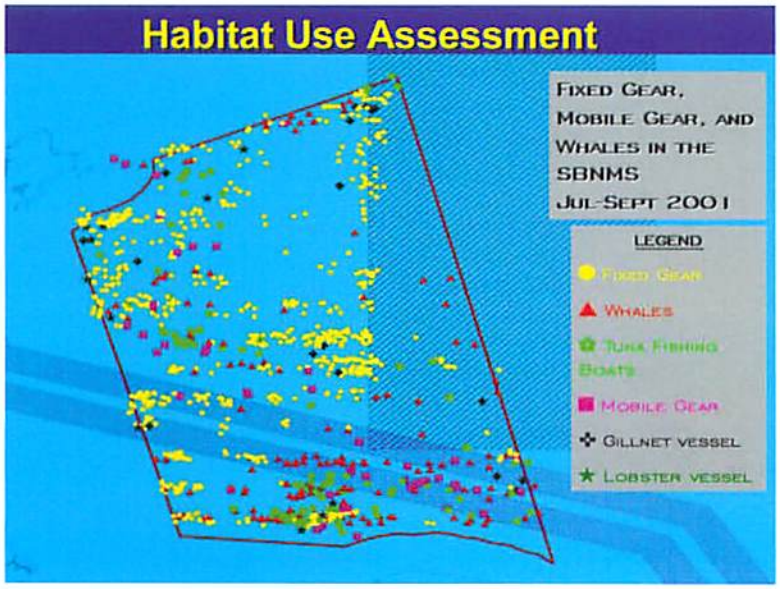


Figure 77. Habitat use map showing the variety of fishing and natural resource uses in the Stellwagen Bank Sanctuary.

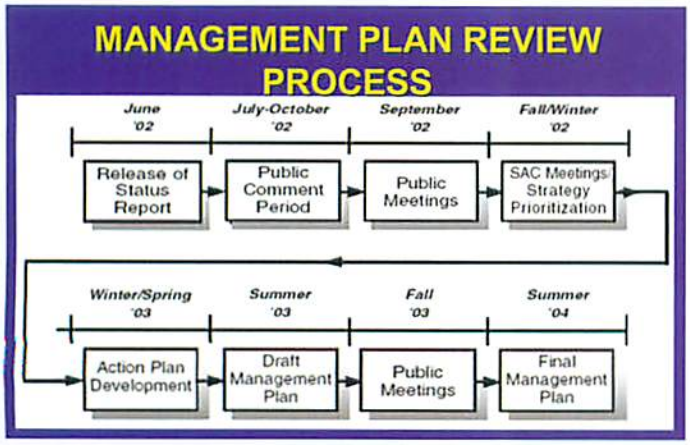


Figure 78. The timeline and process for review of the Sanctuary Management Plan is delineated in this flow diagram.

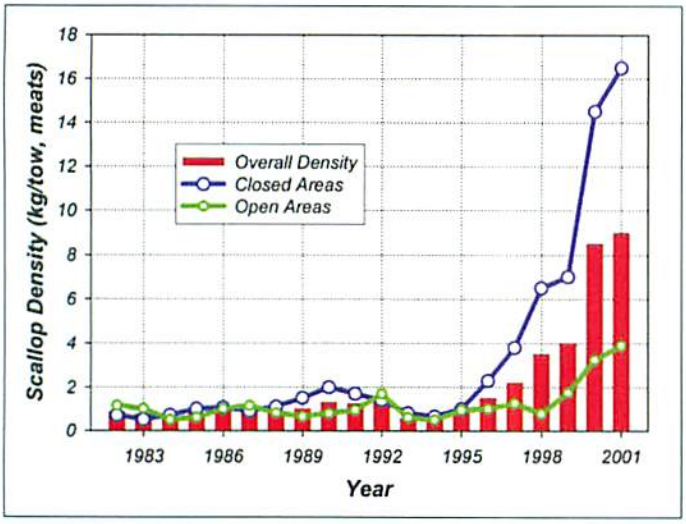


Figure 79. Georges Bank scallop density (kg/tow, meats) has increased 1,600 percent since 1994 area closures went into effect.
Data courtesy of M. Fogarty, NMFS.

A Sanctuary Management Plan was then developed to serve as a site-specific document used to manage the sanctuary. The plan described objectives, policies, and activities within the sanctuary, outlined regulatory goals, defined boundaries, set priorities and performance measures, and will be used to guide development of future management activities. The management plan is currently being revised (Fig. 78). Issues and concerns are being scoped out with assistance from a Sanctuary Advisory Council. There are seven issues of concern:

- Alteration of seafloor habitat and ecosystem protection
- Impacts of human activities on marine mammals
- Condition of water quality
- Lack of public awareness
- Effective enforcement
- Submerged cultural resources
- Interagency coordination

The Sanctuary Advisory Council is composed of individuals representing all goal-area interests. The following individuals/ interest groups serve on the council:

- Recreation: *Barry Gibson, Salt Water Sportsman Magazine*
- Whale watching: *Alan Hill, Yankee Fleet*
- Fixed-gear commercial fishing: *Bill Adler, Massachusetts Lobstermen's Association*
- Mobile-gear commercial fishing: *Bill Amaru,* F/V Joanne A. III
- Business/industry: *Jackson Kent, III, Marine Trades Association*
- Research: *Peter Auster, National Undersea Research Center*
  Mason Weinrich, Whale Center of New England
- Conservation: *Susan Faraday, The Ocean Conservancy*
  Priscilla Brooks, Conservation Law Foundation
- Education: *Peter Borelli, Center for Coastal Studies*
  Kevin Chu, Sea Education Association
- Marine transportation: *Frederick Nolan, Boston Harbor Cruises*
- Members at-large: *Richard Wheeler, Cape Cod Museum of Natural History*
  Sally Yozell, Battelle Laboratories
  John Williamson, fishing community activist

In conclusion, MPAs work for different species with different behaviors. For example, in New England, MPAs have been very effective for sedentary species such as scallops, which have enjoyed a 1,600 percent increase since area closures went into effect (Fig. 79), but the jury is out on demersal species such as cod. MPAs also work in disparate biogeographic zones and at different scales. They produce tangible benefits to users and achieve multiple objectives.

Do MPAs work in the Gulf of Maine? Should we add MPAs to our toolbox? Can we design an inclusive process that includes fishermen and other stakeholders? Is there a way to achieve multiple objectives while minimizing impacts? These are questions that will need answers in order to achieve harmony among sustainable fisheries, biological diversity, and habitat protection.

PART IV

ASSESSMENT OF NO-TAKE ZONES

Assessment of No-Take Zones

Presented by Dennis Heinemann, Ocean Conservancy, at the Rhode Island, New Hampshire, and Connecticut Workshops

MPAs have an important role to play in the protection and conservation of our marine resources. MPAs are a multifaceted tool, and the objectives they are trying to achieve are varied, including biodiversity, habitat protection, and resource recovery. This presentation will address one particular aspect of MPAs—no-take zones—and the evidence of this type of MPA in contributing to the attainment of fishery management goals. No-take reserves should be considered as one more tool in the toolbox of control measures employed by fisheries managers.

Usually in response to a management action, the conservation process begins by establishing a no-take reserve. The no-take reserve is under surveillance and enforcement. As a result, fishing activities cease and the fishing mortality rate is zero (Fig. 80). There are effects on individual stocks. The cessation of fishing results in lower mortality rates that in turn produce greater lifespans, mean age and size, density, biomass, and reproductive potential. There are also reduced habitat impacts. This results in improved habitat quality, spawning habitat, settlement, and larval and juvenile survival.

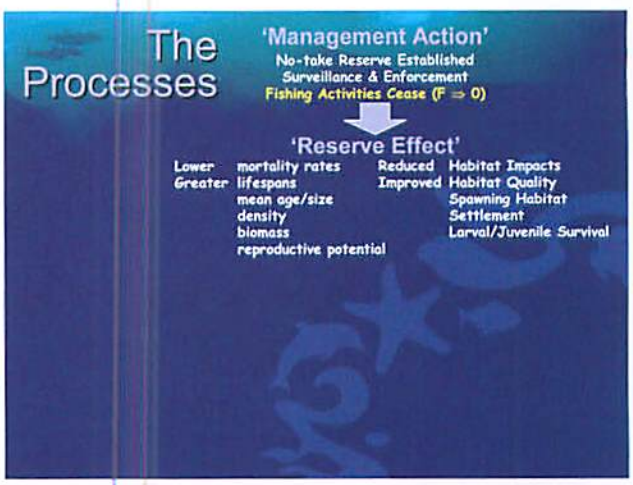


Figure 80. No-take reserves are established in response to a management action. This results in reserve effects on the reserve habitat and the organisms that inhabit the reserve.

Reserve Effects

Does evidence exist from other parts of the world for no-take reserves benefiting fisheries? In 2001, 44 field studies were compiled on the effects of no-take reserves (Fig. 81). The majority of studies demonstrated positive changes in all areas measured. This group of studies included many different habitats in tropical and temperate areas around the world. But not every reserve works for every species. Another compilation of 89 studies looked at reserve effect on density, biomass, size, and diversity. In each of these areas, the changes resulting from the reserve were significant (Fig. 82).

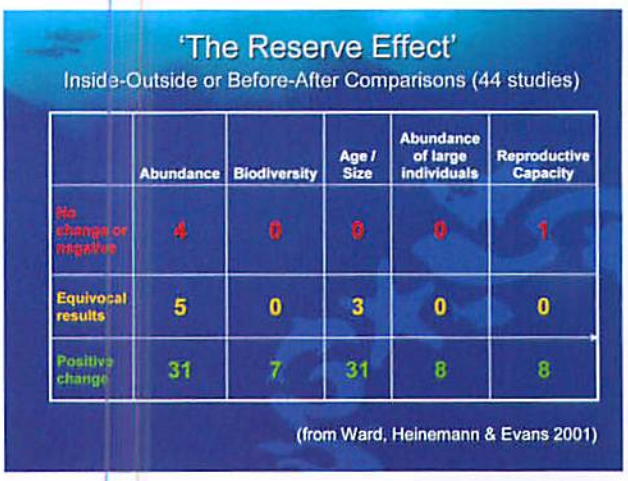


Figure 81. A 2001 compilation of 44 studies showed the reserve effect to have positive changes in the five areas measured.

Spillover Effects

One of the positive effects of a reserve is increased density of the organisms in the reserve. This increased density within a reserve is thought to result in animals leaving at a greater rate than they enter an area. The resulting movement of adults and juveniles out of the reserve is termed "spillover." Spillover has the potential to increase density around a reserve, resulting in increased catches near the reserve. It is affected by the reserve design, fish mobility, and habitat distribution (Fig. 83). Evidence for spillover can be seen in:

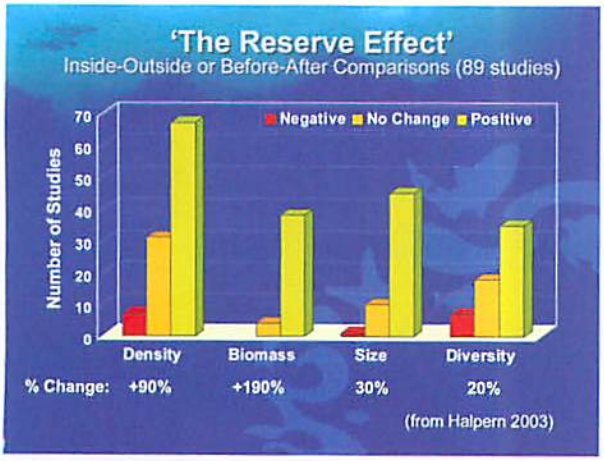


Figure 82. A 2003 compilation of 89 studies showed the reserve effect to have positive changes in all four areas measured.

- Fishing-the-line behavior
- Significant net emigration
- Distance effect
- Time series

Fishing-the-line behavior is commonly seen after a reserve has been in place for a few years, and an aggregation of fishermen begin working around the boundaries of the reserve. Net emigration that is statistically significant has been documented in relatively few studies compared to those studies documenting reserve effects. Net emigration is something that would potentially produce an impact on surrounding fisheries (Fig. 84). The distance effect would result in seeing an increase in animals very close to the reserve, decreasing with distance away from the reserve (Fig. 85). Six studies addressed the distance effect, and all found evidence of it (Fig. 86). Finally, time series data show what has happened over time (Fig. 87). One example is that of a tropical reef study in the Philippines (Fig. 88). The reserve has been in effect for over 10 years. There has been an increase in large predator density over time with a delayed effect outside the reserve.

Figure 83. Spillover has the potential to increase density *around* a reserve, resulting in increased catches near the reserve.

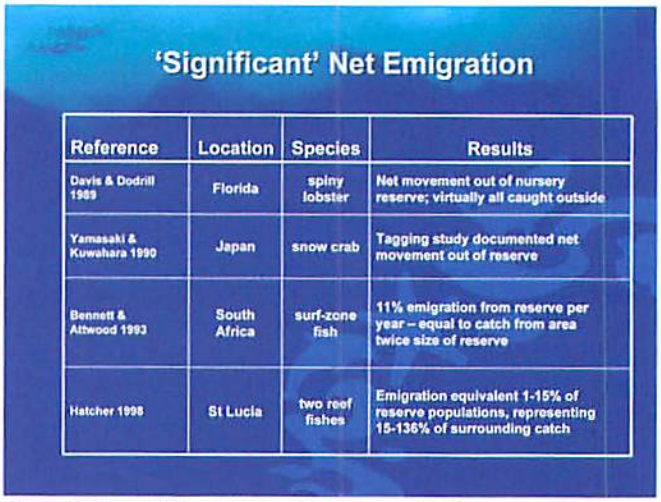


Figure 84. Four different studies documenting significant net emigration, or spillover. All four studies found a significant effect. The South African study is a temperate one, and the snow crab study is a non-reef one.

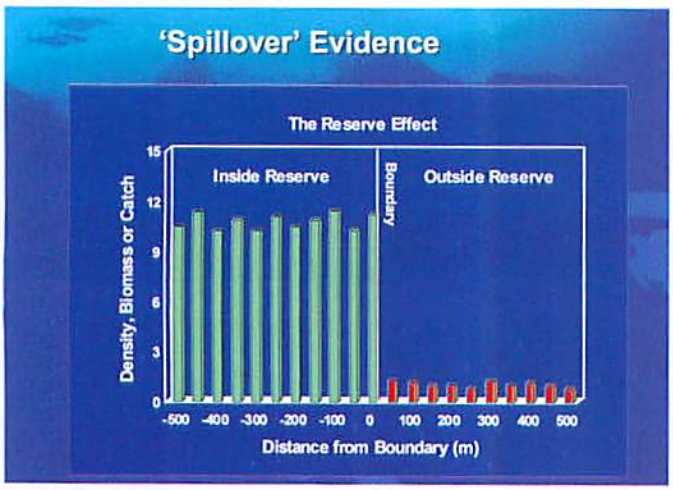


Figure 85a. The reserve effect can be seen by comparing density values inside the reserve to outside.

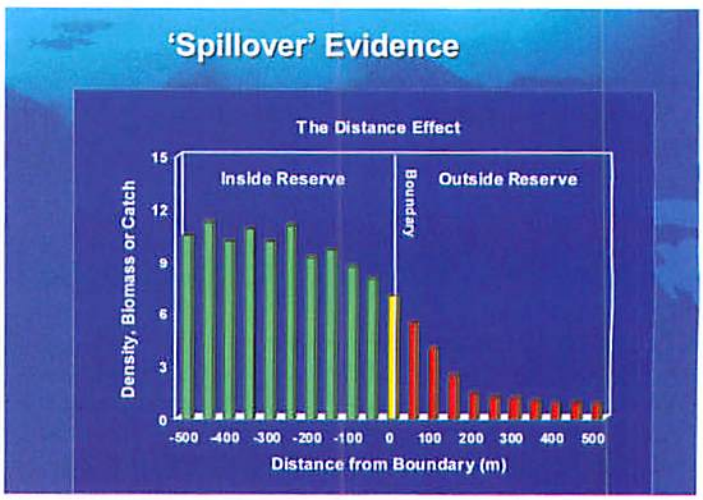
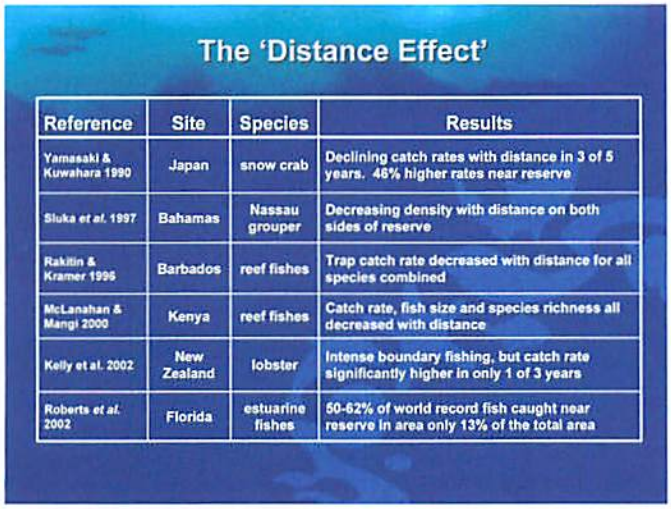


Figure 85b. Evidence of the distance effect (spillover) can be seen by comparing density values inside the reserve to outside and noting the increase in animals very close to the reserve, decreasing with distance away from the reserve.



Reference	Site	Species	Results
Yamasaki & Kuwahara 1990	Japan	snow crab	Declining catch rates with distance in 3 of 5 years. 46% higher rates near reserve
Sluka *et al.* 1997	Bahamas	Nassau grouper	Decreasing density with distance on both sides of reserve
Rakitin & Kramer 1996	Barbados	reef fishes	Trap catch rate decreased with distance for all species combined
McLanahan & Mangi 2000	Kenya	reef fishes	Catch rate, fish size and species richness all decreased with distance
Kelly et al. 2002	New Zealand	lobster	Intense boundary fishing, but catch rate significantly higher in only 1 of 3 years
Roberts *et al.* 2002	Florida	estuarine fishes	50-62% of world record fish caught near reserve in area only 13% of the total area

Figure 86. Six different studies documenting the distance effect. All found evidence of it.

Reference	Location	Results
Alcala 1988, Alcala & Russ 1990	Philippines (Sumilon)	CPUE and total catch higher around reserve. Declined to background levels when unprotected.
Russ & Alcala 1996	Philippines (Apo)	Fish density / diversity increased in and out over time. Outside increases delayed 4-6 years. After 8 years outside densities greatest nearest reserve.
McClanahan & Kaunda-Arara 1996 McLanahan & Mangi 2000	Kenya	Catch decreased 1/3 post-establishment, but catch/fisher increased 110% and catch/area 74%. These levels higher than a comparable distant site.
Roberts *et al.* 2002	Florida	Delay in appearance of world-records near reserve consistent with life histories
	St Lucia	Catch and catch rates increased substantially 5 years post-establishment. No effect in first 2 years.
Fisher & Frank 2002	Scotian Shelf	Increased abundances outside 1-3 years after increases inside. Abundance increases related to geographic range increases.

Figure 87. Evidence for time series spillover can be seen in five different studies.

Export Effect

Export refers to the increase in reproductive potential resulting from a reserve effect (Fig. 89). The net export of larvae can result in increased regional recruitment and increased regional catch. There is strong theoretical and modeling data to suggest this is true, but little direct evidence exists due to the difficulty and expense in studying larvae and eggs. The Northeast closures that benefited scallops give some evidence. Most of the support for export effect comes from theories and models. To document the effect may require large reserves.

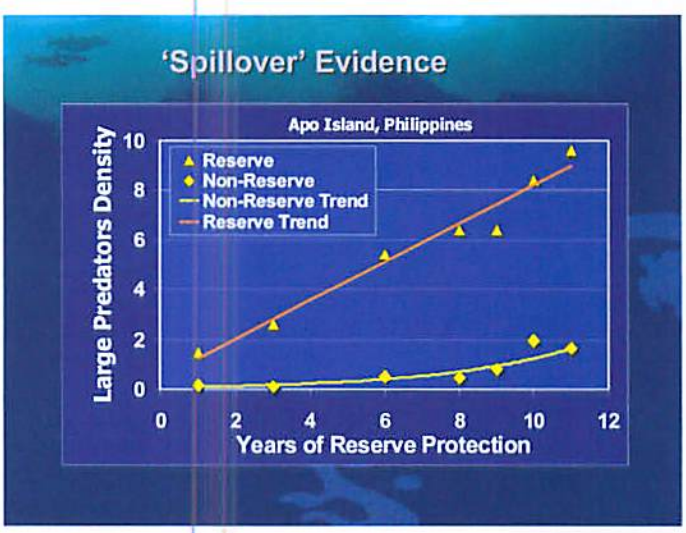


Figure 88. Graph showing time series evidence of spillover in the Apo Island, Philippines, study. Large predator density has increased over time with a delayed effect outside the reserve.

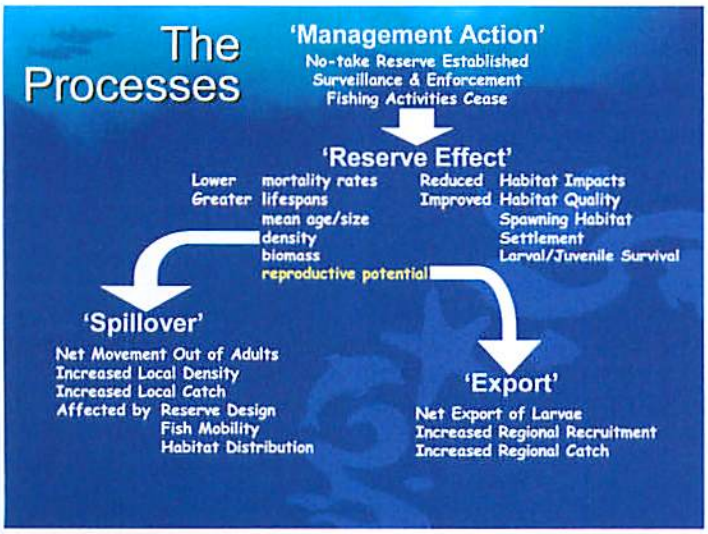


Figure 89. Export refers to the increase in reproductive potential resulting from a reserve effect. The net export of larvae can result in increased regional recruitment and increased regional catch.

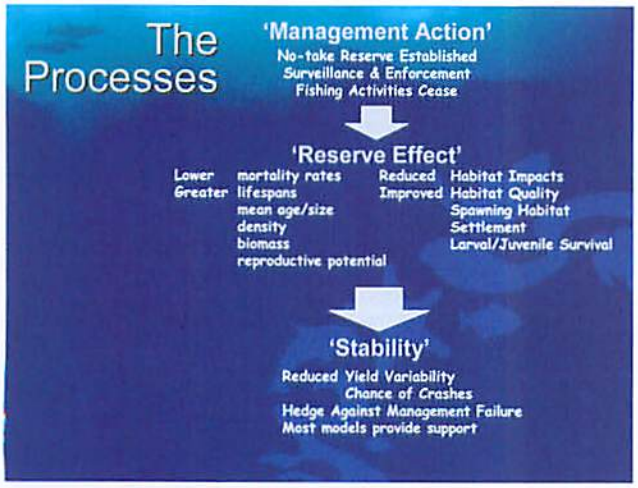


Figure 90. Stability in a reserve may reduce yield variability and the chance of crashes, and may be a hedge against management failures.

Stability

A reserve may stabilize production within a population and reduce yield variability and the possibility of crashes, and may be a hedge against management failures (Fig. 90). Models support this theory but the data do not exist. Some studies have reported a decrease in catch variability but these have not been detailed studies.

In conclusion, there is ample evidence of the reserve effect. Most studies have also found evidence of the spillover effect. There is theoretical and modeling support for export and stability effects. No-take reserves seem to be most effective for overfished stocks, but they are not a panacea. This approach does not work for all species or systems. An informed design is essential. Integration with management measures outside the reserve is critical to the MPA's success. The potential benefits can be much greater than fisheries enhancement.

Comments and Questions

- **Q:** On the studies that were used, were they based primarily on migratory or resident species?
  A: One of the concerns people have is that many of the studies have occurred outside of the United States in tropical reef systems. Not all of the studies fall into these areas. There are a number of studies in temperate areas. The results are not qualitatively or quantitatively different. Many reef fish are highly sedentary, but many species are also highly mobile. The mobility of the species needs to be considered. A reserve for scallops may not work for a species such as cod.
- **Q:** How many of the studies included reef habitats? This type of environment is not equivalent to the habitat found in the Gulf of Maine.
  A: Probably about 75 to 80 percent studied reef habitats. Some studies in this group did not take place in reef habitats.
- **Q:** In Rhode Island, about 80 percent of species are highly migratory. Can no-take reserves be effective for highly mobile species?
  A: No-take reserves were used in the tropics to manage multispecies stocks. At first people thought the reserves wouldn't work, but when looked at more carefully, no-take reserves can work in some situations. It comes down to questions such as, Can you protect an essential habitat during a key stage of the life cycle? If you have shifting MPAs, it could be a management nightmare.
- **Q:** Establishing an MPA for a species such as winter flounder may be difficult because we do not know their migratory patterns. Total closures may be hard to justify.
  A: If a fishery is in dire straights, new ideas may be needed.
- **Q:** MPAs may redistribute effort and make a situation worse.
  A: There is a lot of work that needs to be done to understand these effects.
- **Q:** Are all MPAs rectangles? Why? Is the science of design based on biological factors?
  A: The design process usually involves many factors (economic, social, and ecological). We do not have optimal design just as we do not have optimal management.
- **Q:** Regarding the studies on the reserve effect, how many of the species included in these studies were fish versus shellfish species?
  A: I do not know for sure; I would guess it is about 80 to 90 percent fish species.
- **Q:** In the Apo Islands, Philippines, study, is the trend outside the reserve due to regulations?
  A: One of the problems is that these studies are ad hoc studies that are not well designed. In terms of the reserve effect, we have many studies that demonstrate this effect. This is consistent with what we expect, but we need more studies to prove the spillover effect. This is good data but not conclusive data.
- **Q:** In the case of Merit Island in Florida, there were world records [International Game Fish Association Records (IGF)] of large-sized fish caught in that area well before the reserve was established.
  A: I would like to see the data before and after the reserve was established.
- **Q:** The IGF records are not a good basis for judgment because people may be submitting more catch records than they did in the past.

A: The scientist would have determined this and taken it into account.

- **Q:** Given a situation where a new reserve is created and all uses are banned, how does banning fishing for highly migratory species, such as tuna, with hand line or rod and reel have any effect?
  A: The answer is complicated. Banning the mortality on tuna would benefit that individual stock. In terms of habitat benefits, it has to do with effects on the biological community structure.
- **Q:** For a spillover effect, how big does the area need to be?
  A: It appears that an MPA needs to be 20 to 70 percent of the total area fished for spillover to occur.
- **Q:** Studies do not seem to include highly migratory species. In the Gulf of Maine we have species that move large distances.
  A: The best example from this presentation is the snow crab which can move great distances. But it is true that we do not have studies that have measured the distance effect on highly migratory species.

Assessment of No-Take Zones

Presented by Richard Allen, Fisheries Consultant, at the Rhode Island and New Hampshire Workshops

Presented by John Sorlien, Rhode Island Lobsterman, at the Connecticut Workshop

In order to address the topic of no-take reserves, I tried to use a scientific approach combined with common sense. My presentation focuses on no-take reserves as a fisheries management tool. I want to make it clear that I am not an opponent of no-take reserves. I believe that there are good reasons for the establishment of no-take reserves. But my study of no-take reserves as they relate to fisheries management has convinced me that no-take reserves are more likely to reduce fishery benefits than they are to increase fishery benefits. There is no controversy about MPAs; most people are advocates for MPAs. MPAs become contentious when folks with millions of dollars and high-profile scientists try to create fully protected permanent no-take reserves. These are not fishery closures. It is hard to find examples in our area of permanent no-take reserves.

Maps often give the impression that we already have many MPAs in our region, but advocates of no-take reserves will point out that these are not fully protected, permanent, no-take reserves (Fig. 91). Advocates are looking for some percentage of current fishing grounds to be turned into permanent no-take zones. Fully protected, permanent, no-take reserves are not time-area closures, area rotation to grow out juveniles, spawning area closures, restricted gear-type areas, or critical habitat areas. No-take reserves are being sold on fishery benefits and stem from the widespread dissatisfaction with traditional fishery management. Fishermen pose the biggest opposition. The question is, can we increase fishery yields (more than maximum sustainable yield (MSY)) with marine reserves? Can we get MSY with traditional forms of management?

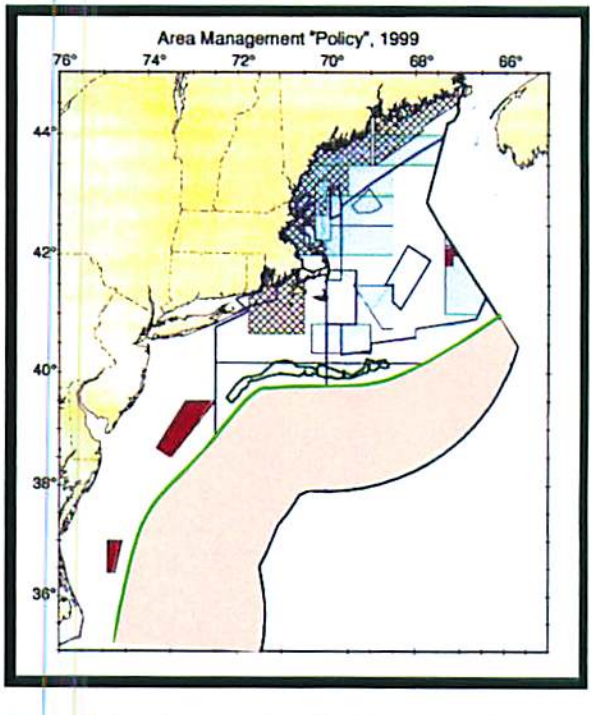


Figure 91. Map shows a number of the diverse types of MPAs found in the Northeast.

Failure of Fishery Management

Is the "failure of fishery management" a failure of traditional tools or the failure to use traditional tools? One can legitimately point to the failure of fishery management. But the failure is not inherent in the tools but in the failure to use the tools. Fishery management requires control over catch and effort. In many fisheries, that basic control has not been exercised. So the issue is not whether traditional fishery management has failed, but whether we are going to get serious about fishery management. If we are, then we have a responsibility to use the tools that give the best results.

In New England it is not a case of depleted coral reef fisheries in impoverished rural communities with no fisheries science or infrastructure. We have a realistic choice between catch-effort controls and no-take reserves. Some of the most prominent scientific literature on no-take reserves is based on research on

depleted coral reef fisheries in impoverished tropical countries with no fisheries infrastructure. Any method of reducing fishing effort on a depleted stock is likely to produce some increase in yield. For New England, with the best fishery science in the world, and a literate population capable of using that science to make wise choices, we do not need to consider no-take reserves just because we do not have the institutional structure or the information to contemplate a more effective approach to fishery management.

Fishery Yield Controls

There are three factors that control fishery yield: Egg production and recruitment are needed to feed the system; the age at entry into the fishery refers to the fish's size able to be attained before being harvested; and the fishing mortality rate—the rate at which the fish are caught while they are growing. If one compares the fishery benefits obtained through no-take reserves compared to traditional management, one must ask, how does a no-take reserve affect the fishing mortality rate on a stock as a whole, and how does it affect the age at which the average fish in the stock becomes susceptible to the fishery? If the reserve does not allow the fish to enter the fishery, as would be the case with a sedentary animal, then the potential yield from those animals must be deducted from the potential yield. Similarly with the fishing mortality rate: There is an appropriate fishing mortality rate that maximizes the yield from a particular stock. If the stock, or a portion of the stock, cannot be fished, the potential yield is lost.

If sedentary animals are protected by a reserve, any benefit to the fishery must come from the export of eggs and larvae. But more eggs and larvae do not necessarily translate into more yield. And, if the production of eggs and larvae is kept high enough by properly managing the fishery outside the reserve, additional eggs and larvae are not likely to increase yield. No-take reserve proponents switch back and forth between the benefits of spillover compared to the benefits of export of eggs and larvae. Spillover is like saying that the animals will be protected until they reach a magic size; export says that good management cannot provide enough eggs and larvae and that the loss of the potential yield from eventually catching the parents in the reserve is more than offset by the contribution to yield from the additional eggs and larvae.

There is no reason to expect that a reserve can control age at entry, the fishing mortality rate, and the stock-recruitment relationship any better than catch-effort controls. The reality is that it would be virtually impossible to design a reserve to accomplish those goals for one species, never mind for multiple species.

Fishery Population Dynamics

One of the basics of fishery population dynamics is that as fishing effort increases from zero, yield increases (Fig. 92). With some number of boats, the removals from the stock exceed the maximum natural biomass production of the stock and the total yield from the fishery starts to decline as the fishing effort exceeds that which will produce the MSY. Recruitment into the stock may be adequate, but heavy fishing pressure doesn't give the fish enough time to grow before they are caught, creating growth overfishing. As long as recruitment and growth balance removals, the stock can remain in equilibrium, even when yield is less than its potential. If fishing doesn't leave enough spawning stock for the parents to replace themselves, the fishery suffers from recruitment overfishing. Recognizing that the natural productivity of a stock fluctuates over time, we can draw the yield curve as a banana, indicating that any particular level of fishing effort may be associated with a higher or lower yield, depending on the natural productivity of the stock.

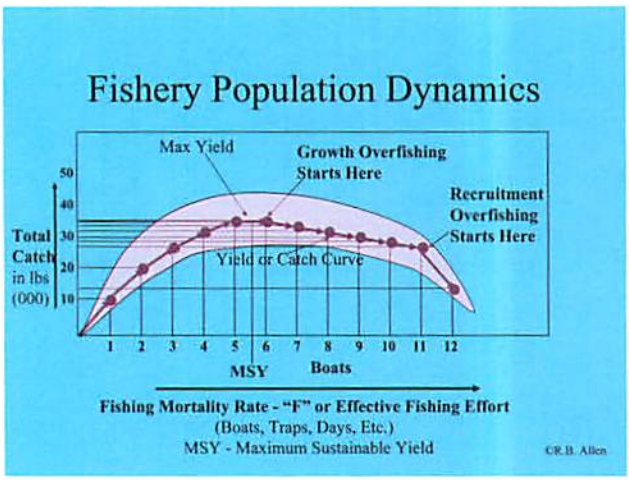


Figure 92. Diagram shows a conceptual interpretation of the classic fishery yield curve showing total catch on the y-axis and fishing mortality rate (F) on the x-axis.

The relationship between biomass and yield is a key concept in the comparison of no-take reserves with traditional management measures (Fig. 93a). A stock can only be at maximum biomass when there is no fishing, which means there is no yield. As fishing increases, the biomass declines. At MSY, stock biomass is about one-half its maximum potential level (Fig. 93b). That is the point at which the stock has the greatest capacity to grow, and it is the stock's attempt to grow back to its maximum level that produces the MSY. While the portion of a sedentary stock in a fully protected no-take reserve is at its maximum level, it does not produce any yield. To the extent that fish stay in a no-take reserve, then, the reserve has to reduce the MSY that can be obtained from the stock.

If a reserve actually retains fish, the biomass will build toward the maximum, characterized by a lot of large, old fish, with low stock production (no yield) (Fig. 94). To reach maximum yield, a stock has to be fished down to a point where the productivity of the stock increases, thus creating the surplus production that becomes available to catch. Compared to good overall management of an entire stock, a marine reserve has to reduce the sustainable yield from the stock to the extent that it protects fish beyond the point where they are growing faster than they are dying (Fig. 95). A productive stock will be characterized by a wide range of sizes, with young, fast-growing fish predominating. We would expect a reserve to hold a lot of large fish with a large total biomass (Fig. 96). If the open area is overfished, the best fishing will be on the boundaries of the reserve, and the likelihood of catching record fish will be high. But the presence of trophy fish is not indicative of a highly productive, high-yield stock; just the opposite is true.

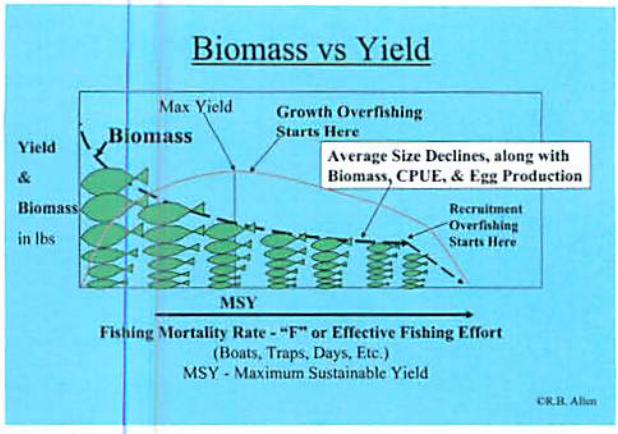


Figure 93a.

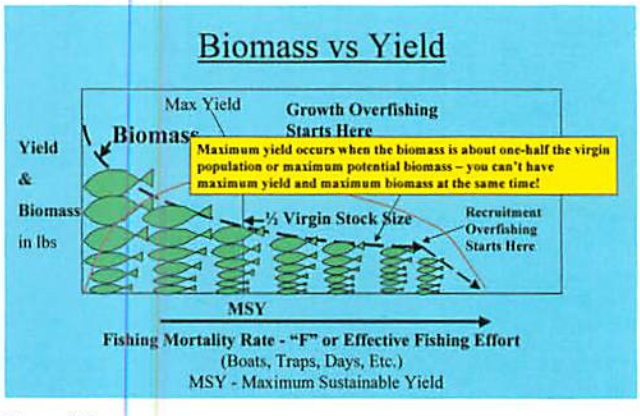


Figure 93b.

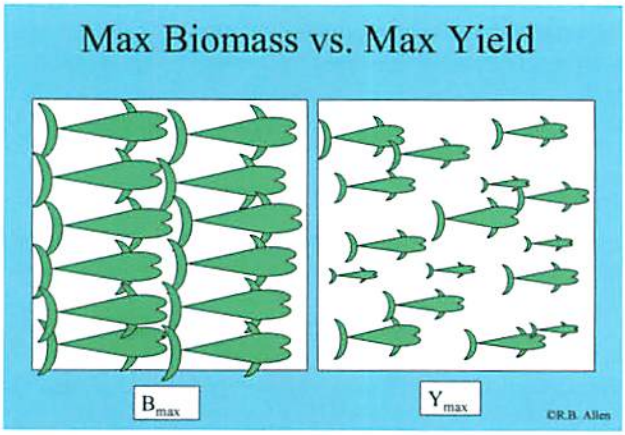


Figure 94. Cartoon illustrating the difference between maximum biomass and maximum yield.

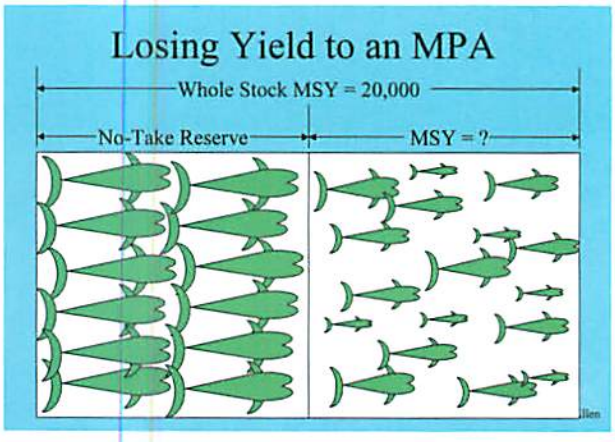


Figure 95. Cartoon illustrating the loss of yield to an MPA.

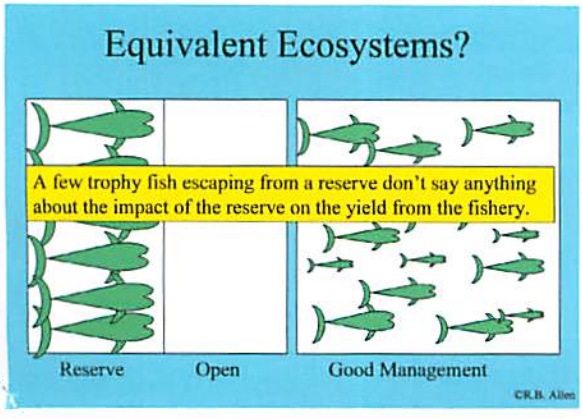


Figure 96. Are MPAs with an adjacent open area and a well-managed fishery equivalent ecosystems? The presence of trophy fish is not indicative of a highly productive, high-yield stock.

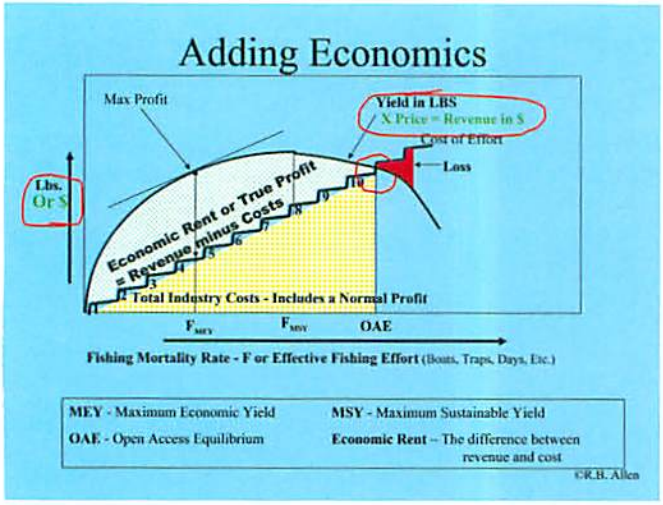


Figure 97a.

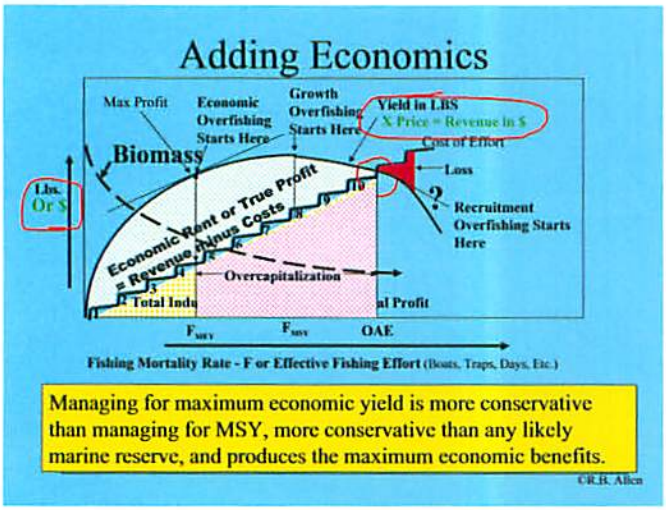


Figure 97b.

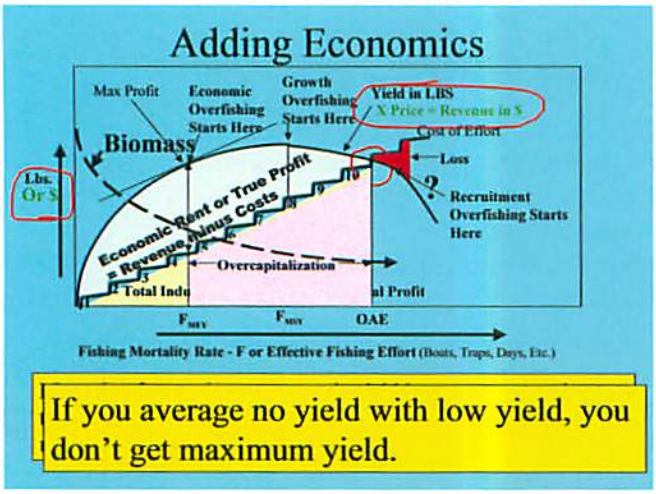


Figure 97c.

The Role of Economics in Fishery Management

In their publication, *Bioeconomic Models of the Florida Commercial Spiny Lobster Fishery,* Milon and colleagues wrote:

"Assuming the goal of resource management is to maximize benefits while sustaining the stock, the appropriate modeling objective is to find the economically optimal level of effort (the MEY [maximum economic yield] *solution)."*

There is a tendency to equate high resource abundance with fishery benefits. Most of the literature concerning no-take reserves looks at what happens to fish inside the reserve. But fishery benefits are determined by what happens outside the reserve.

The yield-effort curve for a fishery can be expressed in both pounds and dollars (Fig. 97a). The costs associated with fishing effort can also be plotted along with the yield curve. The cost line starts from zero with no fishing and increases as fishing effort increases. This cost line includes a normal profit, which is required to keep firms in business. By subtracting total industry costs from total revenue, we can determine the true profit, or economic rent, that is generated by the fishery. Economic rent can be thought of as the contribution made to the economy by the fishery in excess of the costs of producing the catch.

As fishing lowers the biomass and fishing effort continues to increase, the catch per unit of effort starts to decline and total yield and revenue grow more slowly. At the MEY point, the total profit from the fishery has been maximized, because an additional dollar of fishing effort will not produce an additional dollar of revenue, even though both the catch and the revenue continue to increase. But they are not increasing as fast as the cost. This is the profit maximization point at which an individual firm would stop increasing its production in a normal manufacturing business.

MEY is always obtained at a level of fishing less than the MSY and a biomass that is higher. MEY represents a biologically precautionary reference point. Because MEY is the level of fishing that produces the greatest contribution to the economy from the fishery, MEY approximates the level of fishing recommended by economists as a target for fishery management. MEY provides a more conservative biological target than any marine reserve and does so while providing the greatest benefits to society from the fishery (Fig. 97b).

If management relies on a no-take reserve to conserve the stock, while allowing excess fishing effort in the open area, the result will be low yield from the open area and no yield from the reserve. You cannot average no yield with low yield and get maximum yield (Fig. 97c). To the extent that a no-take reserve reduces the yield from a fishery, it

will lower the revenue curve. The reserve is also likely to increase the cost of harvesting the same volume of fish (Fig. 98). That is because fishermen might have to travel farther, or spend time stowing nets as they steam across the reserve, or the fish might congregate in the reserve at certain times of year, where they could be caught less expensively. The combination of lower revenues and higher costs will cause the fishery to reach an open access equilibrium (OAE) at a lower level of fishing effort, but the potential economic rent that could be produced by the fishery will still be dissipated if the fishery relies on a no-take reserve for conservation, rather than effort control. The fishery will therefore not make a positive contribution to the economy.

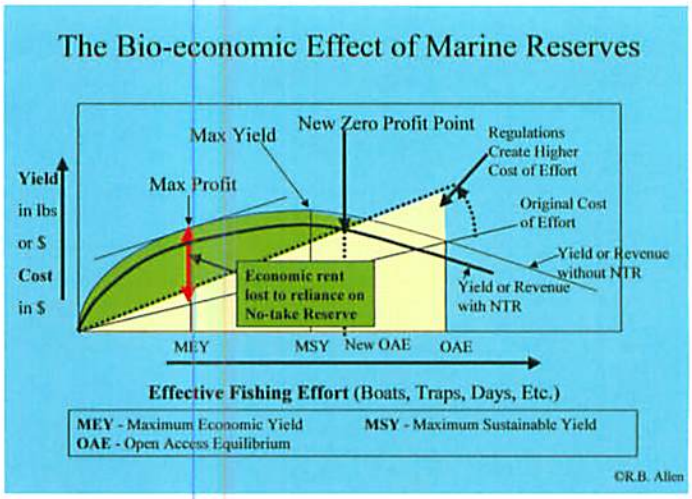


Figure 98.

Biomass Reserves: A Better Alternative for Fishery Management

The following benefits accrue when considering biomass reserves as an alternative for fishery management:

- Inherent in MEY
- Eliminate displacement of effort
- Follows the stock wherever it goes
- Does not create boundary problems associated with creating a reserve to benefit multiple species
- Does not have to negotiate exclusion of people from the area
- Enforcement is different
- Boundary congestion is not a problem

Fishery management targeted at MEY automatically creates biomass reserves that do not require the exclusion of any use from any negotiated area that will never be appropriate for all species and all uses. Biomass reserves avoid the many circular arguments that characterize discussions about no-take reserves, such as the question of whether the objective of a reserve is to create a spawner sanctuary for quahogs that does not need to exclude other uses or whether the so-called quahog reserve is a pretext for a biodiversity reserve.

The scientific literature also suggests that MPAs may not be the answer:

- "If effort can be controlled, marine reserves provide little or negative benefit" (Holland, 1996).
- "Our maximal reserve size will generally not be the economic optimum" (Pezzey et al., 1999).
- "In all cases, the potential sustainable harvest from any given total stock size is reduced for any marine reserve, and the larger the reserve the larger is the reduction" (Anderson, in press).
- "A marine reserve will increase fishing costs and overcapitalization in the fishing industry, to the extent it has any conservation effect on the stock, and in a seasonal fishery it will shorten the fishing season" (Hannesson, 1998).

The literature also contains conflicting statements by the same investigator(s). A 1996 paper by Bohnsack states, "Marine reserves do not require expensive annual data collection and assessment efforts …Elaborate models and extensive knowledge about each species and fishery also are not essential… determining the proper gear, size, or species is not necessary." Later statements by the same author suggest the opposite:

- In practice, ecosystem management requires expanded monitoring of populations, habitat, physical factors, and the human dimension to assess the dynamics, interactions, and performance of key ecosystem components (Bohnsack, in press).
- "It is *essential* that NTRs [no-take reserves] be complemented by other appropriate management practices, such as size limits, bag limits, quotas, limited entry, closed seasons, gear restrictions, and closed areas for specific fisheries" (Bohnsack, in press).

The argument for or against no-take reserves comes down to a fishery management choice: Society makes an investment in fishery conservation in forgone catch, labor and capital productivity impacts, administra-

tive resources, and enforcement resources. Which produces the better cost-benefit ratio: locking up small areas or managing all areas well?

In summary, legitimate reasons may exist to establish no-take reserves other than increases in fishery yields. It may be in the best interest of the fishing industry to cooperate in the establishment of a limited number of no-take reserves. But no-take reserves will not be the basis for an optimum fishery management strategy. Catch-effort control will increase in importance as the primary objective of fishery management and the widespread establishment of no-take reserves poses more of a threat to the productivity of marine fisheries than does overfishing.

Comments and Questions

- **Q:** Is the trend to establish MPAs as a fisheries management tool, or is the trend to establish them as bioreserves?
  A: Whatever the reason for promoting the establishment of MPAs, the fishing industry is going to be one of the biggest problems. Proponents are trying to sell them on the basis of increased fishery yields.
- There is an assumption that no-take reserves are being sold on the basis of fisheries productivity, but we need to assess the truthfulness of that assumption in the worldwide body of scientific literature.
- **Q:** Do you think that no-take areas are beneficial in terms of reducing habitat destruction or do you propose other equivalent catch/effort regulations to meet habitat protection goals? Habitat destruction contributes to stock reduction.
  A: Habitat protection may fall under some of the other societal goals that people are proposing. This presentation focused on using no-take reserves to increase fishing yields. The argument we are trying to make here is that good use of the traditional management tools is a better way to increase fishery yields.
- **Q:** Clarification: D. Holland mentions that there is little or no benefit connected with marine reserves, but this does not apply in issues of overfishing.
  A: Yes, but my point is we have not really tried traditional fishery management.
- **Q:** What other methods of fisheries management would you recommend?
  A: That is a subject for another series of workshops.
- No-take areas could be used as an intermediary step while new fishery techniques are developed. If some fisheries are kept open, they may be depleted while new management techniques are being developed.
- Establishing no-take reserves as a bridge to a better system of management might be useful, but we have heard that it takes time for the benefits of no-take reserves to be realized. We need effective controls over effort and catch.
- Quotas may offer the same protection. We do not have accountability for the existing management structure.
- It is a question of whether managers are able to uphold their public trust. Politics enters into the situation.
- **Q:** In the MPA, only older fish are depicted in graphics. Why would you only have older fish in a reserve?
  A: There would be some small fish—the graphic should show this—but it is like an old growth forest. You have a lot of older trees.
- **Q:** As you get larger and older fish in a reserve, would this lower egg production?
  A: Older fish are usually more fecund but there is a carrying capacity in the environment so more egg production does not necessarily turn in to more productivity of the stock. Having good management everywhere is a better approach than a series of no-take reserves.
- Catching trophy fish coming out of a reserve is good for trophy fishermen but not good for commercial fishermen interested in the overall yield of a fishery.
- **Q:** In terms of economic yield, there is also economic return connected with tourism, diving, etc.
  A: No-take reserves can be established for reasons other than for fisheries management and then trade-offs have to be made.
- **Q:** Cape Canaveral is a sport fishing situation. In New England, we are focused on commercial fishing.
  A: There is a lot of recreational fishing here also. The point is that much has been made about that study.
- If there is a spillover effect, and closed areas are acting as reproductive reserves, this would be an important aspect to consider.

PART V

CANADIAN CASE STUDIES

Closed Areas on the Scotian Shelf: Research Findings

Presented by Jonathan Fisher, University of Pennsylvania and formerly Dalhousie University, Nova Scotia, at the Rhode Island, New Hampshire, and Connecticut Workshops

Presented by Kenneth Frank, Bedford Institute of Oceanography, at the Maine Workshop

Regulation of fishing can take several forms, including gear restrictions, catch limits, sector allocations, and area closures. While a mainstay of some profitable fisheries, including Pacific salmon and tropical reef fisheries, area closures have been largely underutilized as a management tool. On the Scotian Shelf, there have been some seasonal closures for haddock since 1970—about four months per year—and a year-round closure has been in existence since 1979 for lobster and since 1987 for haddock. Evaluations are now available for haddock and multispecies responses in the "haddock box."

The Haddock Box

The closed area for haddock on the eastern Scotian Shelf was initiated by industry at the November 1986 Scotia-Fundy Groundfish Advisory Committee meeting when industry representatives unanimously recommended closing the area. This was precipitated by high discarding during the mid-1980s with shortfalls in total allowable catch due to the presence of numerous small, unmarketable haddock. Year-round closure to mobile-gear fisheries took effect in 1987, but fixed gear was exempt until 1993.

In 1987, the Emerald and Western banks were closed, year round, to trawling (Fig. 99). Coined the "haddock box," the area spanned roughly the size of Connecticut and lay on the edge of a boundary in between two different management zones. The objective of the haddock box was to protect juvenile haddock and allow the stock to rebuild. Prior to the closure, the commercial catch rates of haddock in the area were near or exceeded 500 kg/h—the highest catch rate category (Fig. 100). In addition, data from research survey tows taken pre-closure (1970–1986) indicate that juvenile haddock were concentrated in the area that was closed (Fig. 101). Since the closure went into effect, the fishermen have stayed out of the area (Fig. 102).

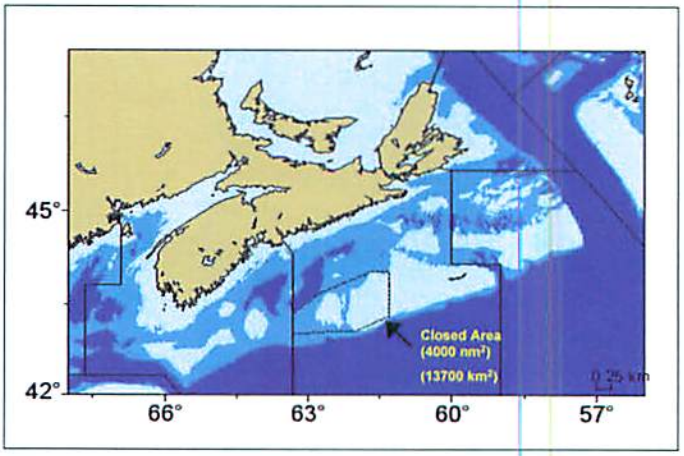


Figure 99. The "haddock box" is an area on the Emerald and Western banks of the Scotian Shelf that was closed to fishing to protect juvenile haddock and allow the stock to rebuild.

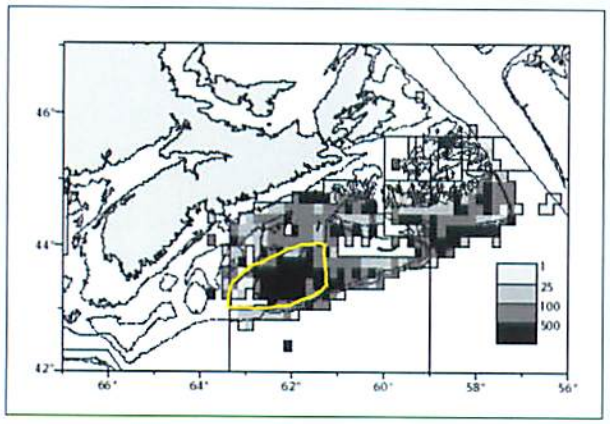


Figure 100. Commercial catch rates (kg/h) of haddock by vessels larger than 150 GRT prior to the area closure (1980–1986). The darker shading corresponds to more catch per hour.

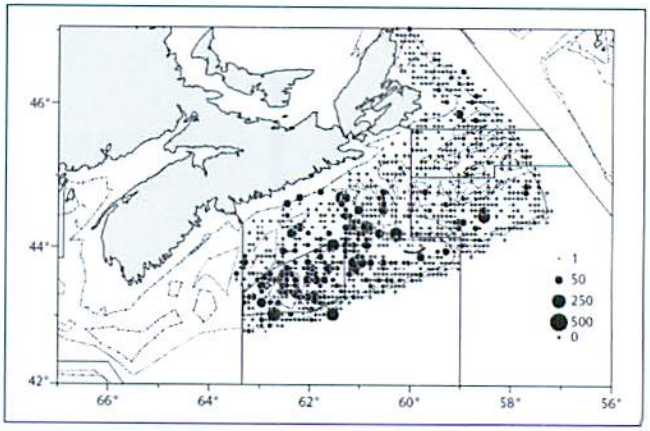


Figure 101. Pre-closure (1970–1986) distribution of juvenile haddock on the eastern Scotian Shelf. Data from research survey tows indicate that juvenile haddock were concentrated in the area that was closed.

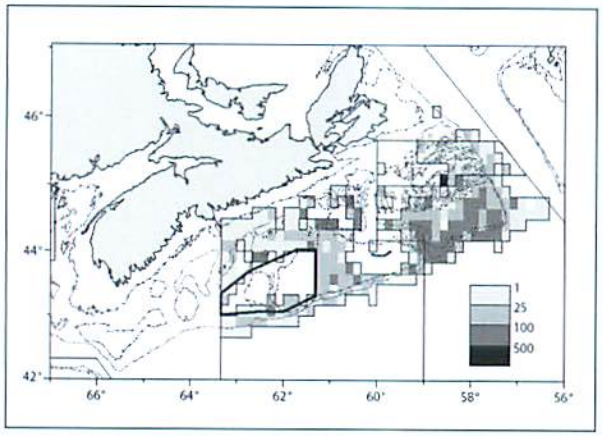


Figure 102. Commercial trawler catch rates of haddock after the closure (1987–1997). Data indicate that the fishermen stayed out of the area.

Since the closure went into effect, there has been a 2.5-fold increase in the abundance of juvenile haddock, which was driven almost entirely by unprecedented recruitment in the years of 1999 and 2000 (Fig. 103). Adult haddock have enjoyed a slight increase (15 percent) following the closure (Fig. 104). It appears that unprecedented recent adult haddock numbers follow high recruitment.

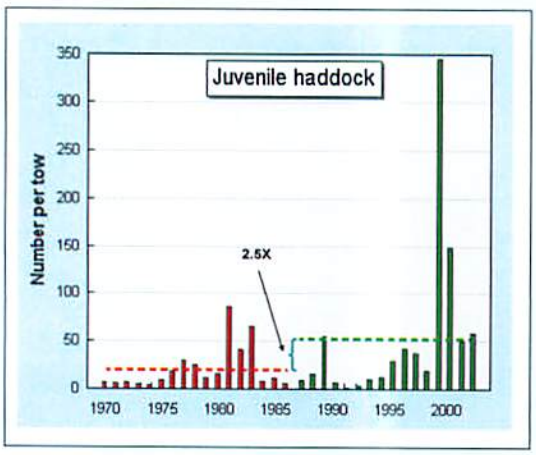


Figure 103. Abundance (number per tow) of juvenile haddock before and after the area closure. Abundance has increased 2.5 fold since the closure.

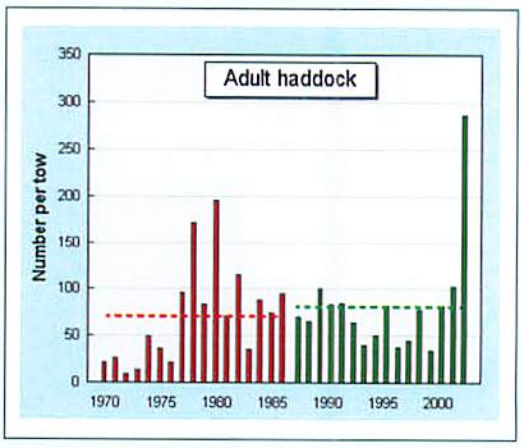


Figure 104. Abundance (number per tow) of adult haddock before and after the area closure. Abundance has increased by 15 percent since the closure.

The potential for spillover is great for the haddock box (Fig. 105). A particle model, based on tracking passive particles originating on the Western and Emerald banks, indicated that some of the particles seeded on Emerald Bank stayed in the vicinity of the closed area, and some flowed outside the area (Fig. 106). Many of the particles seeded on the Western Bank flowed out of the area. A look at the post-closure distribution of juvenile haddock shows a shift to the east in primary concentration (Fig. 107).

In general, compliance in the haddock box has been good. Although a recent phenomenon, haddock abundance has increased following the closure. Spillover to downstream areas may be an added benefit. And there has been an apparent shift in location of juvenile haddock concentrations relative to closed area boundaries. The fishing industry has requested a review of the boundaries, but it continues to support the closure.

In addition to the benefits on haddock, other non-target species have increased in abundance inside the closed area. Winter flounder abundance has increased 32-fold (Fig. 108), American plaice increased 48 percent (Fig. 109), and silver hake abundance doubled

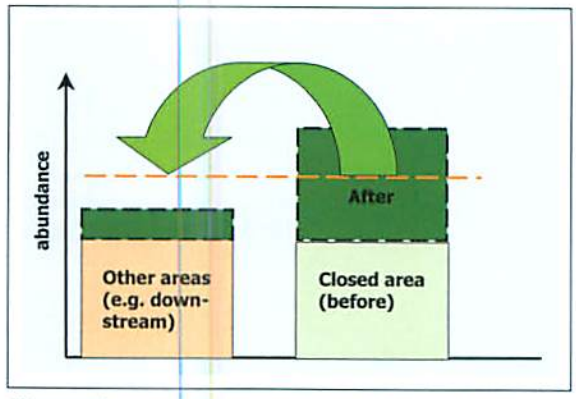


Figure 105. Potential for spillover from the haddock box to adjacent areas is great.

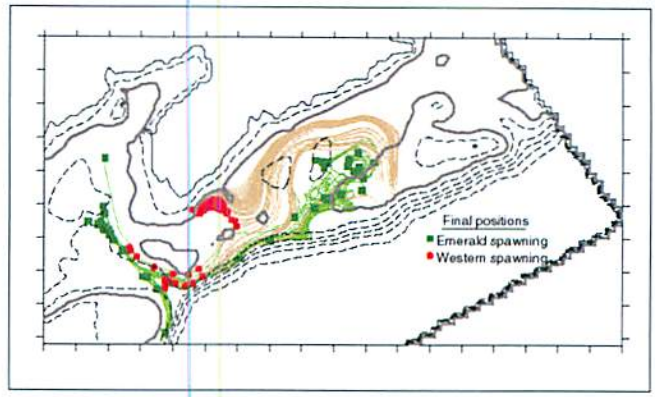


Figure 106. Drift of young haddock from closed area to downstream areas, based on passive particles originating on Western and Emerald banks (tracked 60 days).

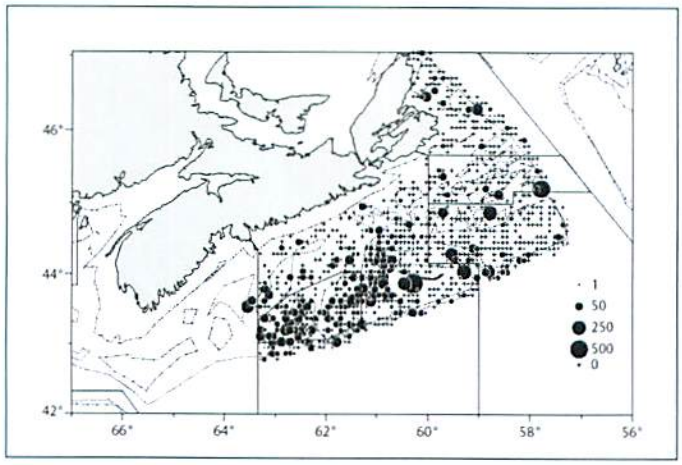


Figure 107. Post-closure distribution of juvenile haddock. Note shift to the east in main concentration.

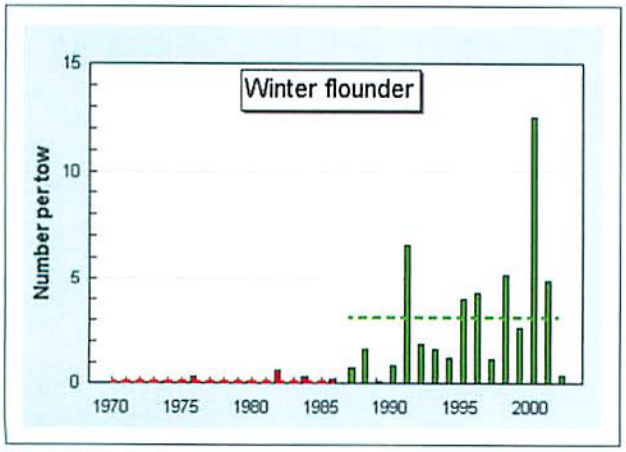


Figure 108. Winter flounder showed a 32-fold increase in abundance (number per tow) following haddock box area closure.

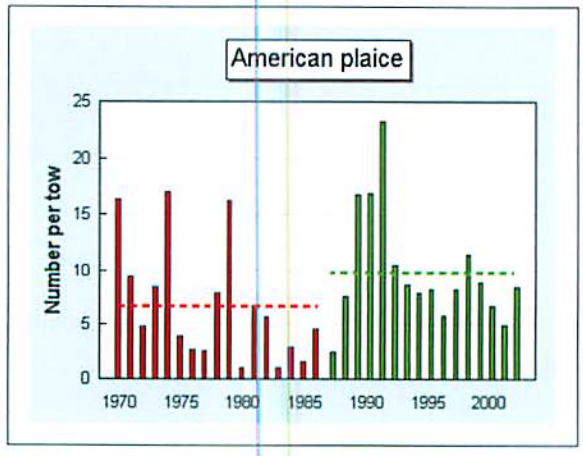


Figure 109. American plaice showed a 48 percent increase in abundance (number per tow) following haddock box area closure.

(Fig. 110). The area also is known for its high larval density. Independent data support the closed area as a source for larvae. For example, larval silver hake was found on the central shelf during sampling in November and December 1997 (Fig.111). Hake larvae was most abundant on the Western Bank with the smallest sizes found there, indicating that the Western Bank is a source. Similar patterns were found for pollock and cod. Herring has enjoyed a 27-fold increase in abundance (Fig. 112), and larval sampling shows the highest abundance and smallest sizes on Western Bank, suggesting this area as a source for herring as well (Fig. 113). Longhorn sculpin has increased 35 percent in the area (Fig. 114).

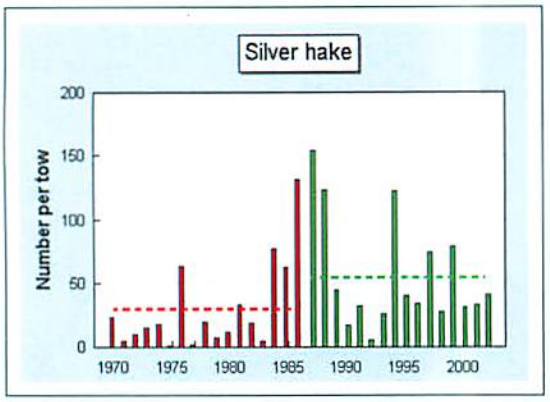


Figure 110. Silver hake doubled in abundance (number per tow) following haddock box area closure.

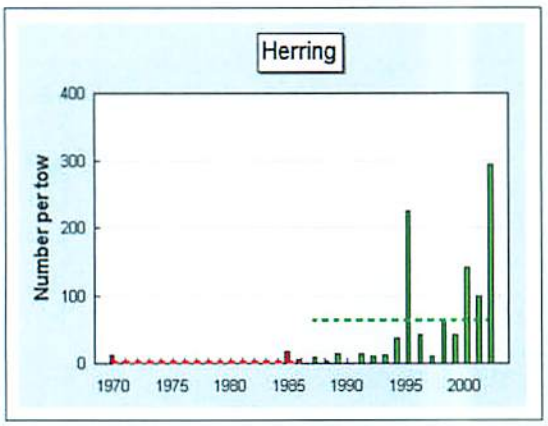


Figure 112. Herring showed a 27-fold increase in abundance (number per tow) following haddock box area closure.

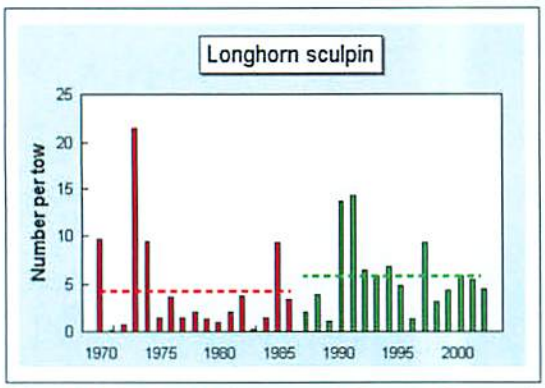


Figure 114. Longhorn sculpin showed a 35 percent increase in abundance (number per tow) following haddock box area closure.

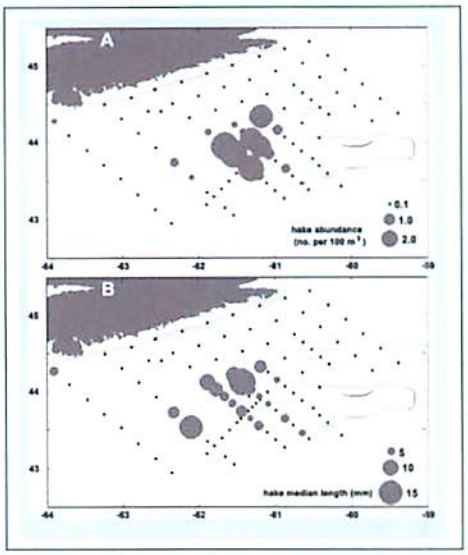


Figure 111. Abundance of larval silver hake (number per 100 cubic meters) (A) and median length (millimeters) (B) taken on Western Bank during sampling in November and December 1997. The fact that the smallest sizes are found on Western Bank indicates the closed area as a source. *Data from Reiss et al. (2000)* Fisheries Oceanography *9:195–213.*

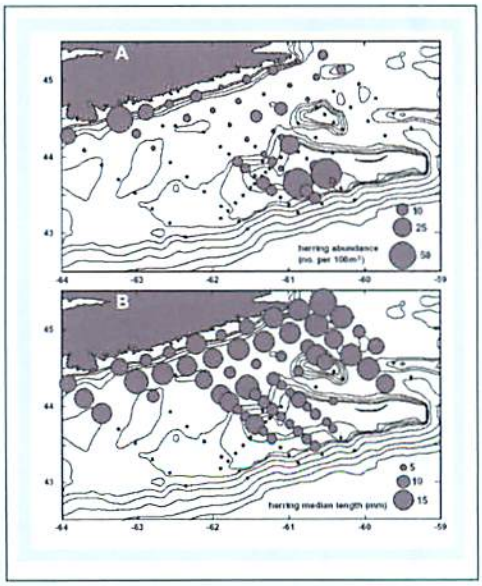


Figure 113. Abundance of larval herring (number per 100 cubic meters) (A) and median length (millimeters) (B) taken on Western Bank during sampling in November and December 1997. The fact that the smallest sizes are found on Western Bank indicates the closed area as a source. *Data from Reiss et al. (2000)* Fisheries Oceanography *9:195–213.*

In order to evaluate the 60-species community change through time, multispecies trawl survey abundance data were examined from 1970 to 2000. These data were input to form a Bray-Curtis similarity matrix of all possible comparisons of years. The similarity values were examined using a multidimensional scaling plot. Distances among years correspond to their community similarity. A test for structure in the multiyear data was undertaken using a randomization/permutation procedure (Fig. 115).

In summary, the elimination of trawling provided a "laboratory" to document the community responses. Numerous, but certainly not all, species show positive responses. There was evidence for both larval/juvenile and adult spillover to downstream areas, including Browns Bank. While adult data are not shown, the results are based on positive abundance distribution and lagged responses downstream. But the overall community has deviated from the structure that supported the active haddock fishery. In the future, the community could take a number of trajectories.

Closed Area for Lobster

In 1979, a rectangular closed area was established by regulation as Lobster Fishing Area (LFA) 40 on Browns Bank. Its purpose was to protect a large concentration of reproductive females on Browns Bank. In addition, offshore areas were part of an annual migration from coastal waters whose offspring reseed inshore areas (Figs. 116 and 117).

Mean circulation patterns were studied in the area (Fig. 118), and seeding experiments were conducted using particle models

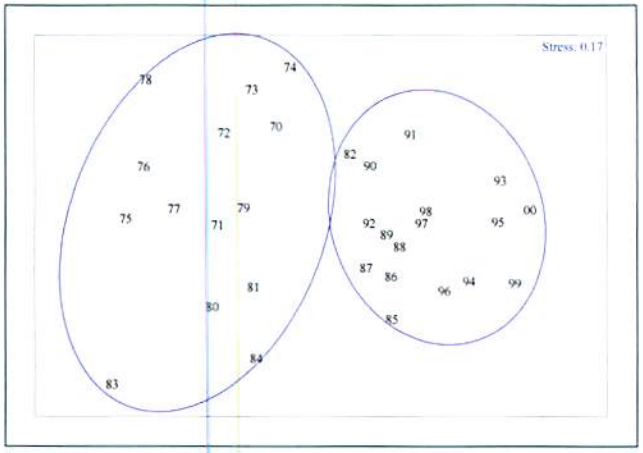


Figure 115. A test for structure in the multiyear data using a randomization/permutation procedure demonstrated closed area temporal changes in community composition (1979–2000). When comparisons are made between pre- and post-closure periods defined a priori, a significant community change was noted ($p<0.0001$).

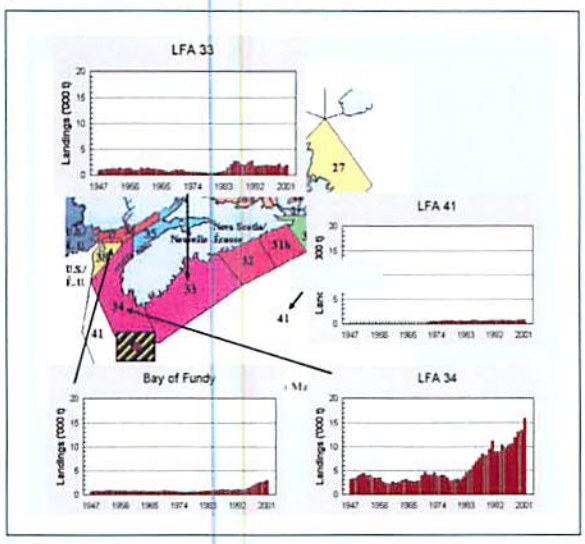


Figure 116. Lobster fishing area (LFA) 40 on Browns Bank and surrounding catches.

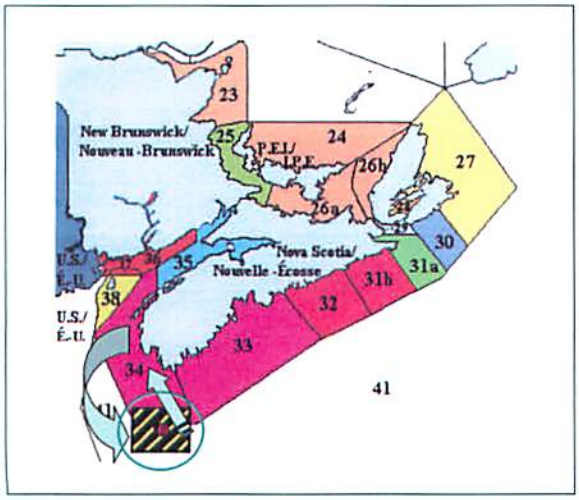


Figure 117. Map of LFAs in Maritime Provinces. LFA 40 is shown in the lower right, overlapping areas 34 and 41.

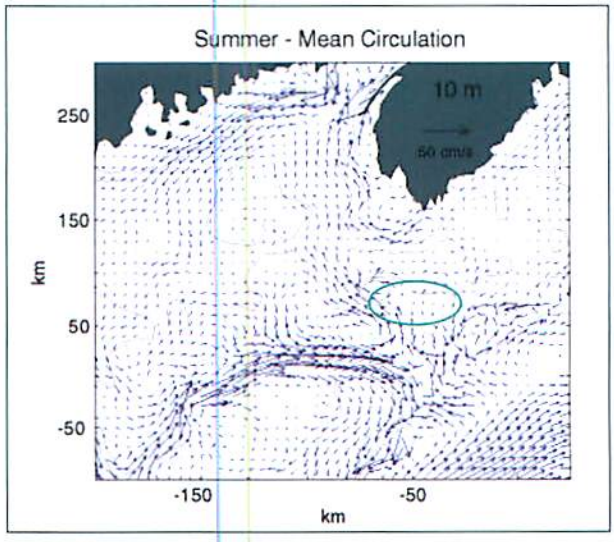


Figure 118. Mean summer circulation patterns in the Gulf of Maine. Circle represents location of Browns Bank.

(Fig. 119). Particle drift of lobster larvae from Browns Bank showed that the particles are swept down towards the Gulf of Maine after 30 days. Based on this model, it was concluded that drift depends greatly upon the depth in the water column and upon wind direction and speed. Generally, few particles make it from the offshore banks inshore to southwestern Nova Scotia. Inshore southwestern Nova Scotia lobster populations may be seeded locally. Most catches are in areas surrounding closed areas (Fig. 120).

The importance of Browns Bank to the large coastal fishery is not as clear-cut as it appeared when the bank was closed in 1979. Lobster distribution, movements, and water circulation patterns are more complicated than was believed at the time. There is a greater reproductive capacity in the near-shore that was recognized in 1979 (near-shore densities are over 100 times greater than in the offshore). The closed area is protecting lobsters but perhaps not the ones originally envisaged in 1979.

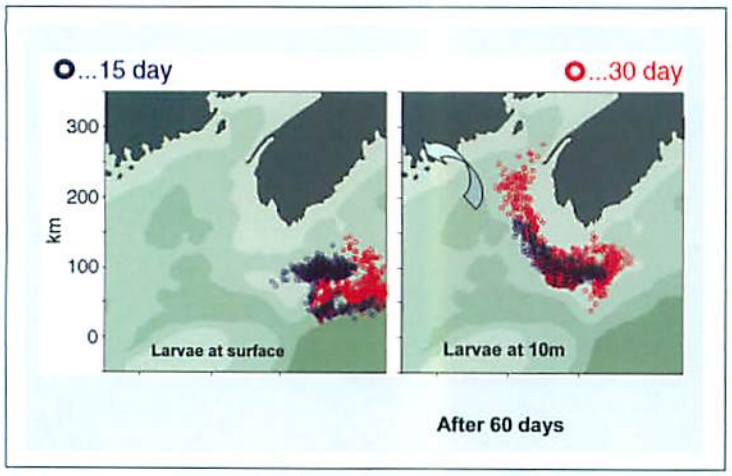


Figure 119. Lobster larvae drift after 15 days (left) and after 30 days (right). After 30 days, the particles are swept down toward the Gulf of Maine.

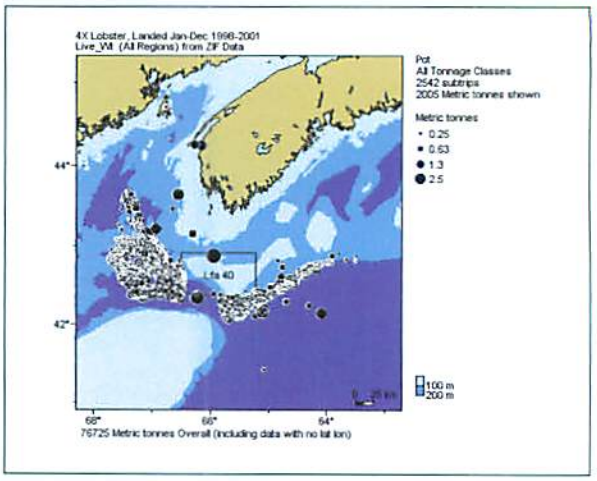


Figure 120. Location of lobster catches from the offshore fleet (1998–2001). LFA 40 was closed only to fixed lobster gear; mobile groundfish and scallop gear were allowed to fish on the grounds.

Scotian Shelf Closed Areas: Conclusions

Fishermen have generally respected these closures as they have a concern for stock maintenance/rebuilding. While areas are closed, they must be monitored and evaluated. Increases in abundance of different species may or may not be a direct result of closed area (design of evaluation is critical). In temperate marine ecosystems, species' responses to closures may be quite long relative to tropical systems (e.g., reefs). This may be due to large home ranges for many species. This requires patience by managers and stakeholders. Some potential benefits of fishery closures may not be realized due to effects of other fisheries or species interactions. Displacement of fishing effort from the closed area can create problems (other areas/stocks depleted). Fishery closures are not meant to be permanent, although reopening criteria are not usually discussed at the outset. The presence spillover may lead to positive benefits regionally. Spillover remains an avenue for additional research.

Comments and Questions

- **Q:** Regarding the post-closure distribution information on juvenile haddock, are the data from commercial catch or survey tows?
  A: This is a stratified random-design survey that is conducted each July.
- **Q:** Has anything been done to measure the effects on the benthic community in these closed areas?
  A: There is no information on this from my own studies, but there have been studies conducted.
- While closed areas are not having the intended effects on lobster, fishermen still support these closed areas and believe that they help them, despite scientific information to the contrary.
- In light of the currents and the way that eggs are distributed in the water column, the information seems to support relocation of the closed areas—to areas of higher productivity.

- **Q:** The Browns Bank closed area did not achieve its original objective of serving as a source of lobster larvae to inshore areas. How is the closed area assessed? Was it a waste of time?
  A: The benefits from it are not clear. But fishermen want to have the closed areas maintained.
- **Q:** Regarding the graphs showing the comparison of different years, is this based on species diversity?
  A: A formula was used that measures the degree of similarity in each of the years (percent similarity). It is a way of looking at a timeline for 60 species.
- **Q:** In cold water, we usually limited diversity to begin with. Does diversity increase after the closed areas have been in effect for a time?
  A: Species richness (the number of species present) was almost identical before and after the closures.
- We need to consider emigration effects into these closed areas from outside areas.
- **Q:** How much confidence is there in compliance in these closed areas?
  A: We have observers and aerial surveillance to look for possible violators. The haddock closed areas were initiated by industry, so we believe that compliance is good. In addition, the haddock stock in this area was going down the tubes so there was not a great deal of fishing effort in the closed areas. In the next two to five years this issue will be tested as the stocks recover.
- **Q:** There was a sea urchin die-off in eastern Nova Scotia recently. Has this been addressed in management proposals?
  A: I do not know as much about that. Researchers are trying to figure out what happened. It may be a response to warmer sea surface temperatures that created favorable conditions for viruses and bacteria.
- **Q:** Are there gear restrictions in effect in areas outside the closed areas?
  A: There were changes on the eastern Scotian Shelf: The cod and haddock fisheries were closed down.
- **Q:** How did you separate out the effects of closed areas from the effects of fishery management regulations?
  A: I have not been in that position so I cannot really say. The closure initially removed the trawling effort. This was followed by measures that removed fixed gear as well. This also coincided with the cessation of fishing for cod and haddock in the area. The real test is coming in the short term in connection to decisions to reopen areas for fishing for haddock.

Closed Areas on the Scotian Shelf: Fishermen's Perspectives

Presented by Hubert Saulnier, Nova Scotia Fisherman and Member of the Maritime Fishermen's Union, at the New Hampshire and Connecticut Workshops

In Canada, we do not have any official MPAs except for a small one on the west coast. MPAs in Canada mean permanently closed fishing areas. The closures that are in effect are not considered to be MPAs. We do not have no-take zones—just "do-not-get-caught" zones. In the Emerald/Western banks area [and the Roseway Bank area nearby], fishermen realized they were catching too many small haddock and requested that the area be closed. Now it appears that the haddock in the area do not get bigger but they do mature faster and produce eggs sooner. When LFA 40 was closed, no one was fishing there so no one was displaced. At this time, fishermen do not want it reopened. They believe it is a source of recruitment to inshore areas. If closed areas are put into effect, fishermen want to make sure that they are put in a location that will benefit the fisheries.

The first MPA in our area may be the gully area at the eastern end of Nova Scotia. This is where there have been a number of right whale interactions. An area known as the "coral box" [along the Nova Scotia side of Georges Bank] is also an area of concern to protect corals. Fishermen cannot really use this area because of damage to gear.

Do we need MPAs? In certain areas, such as key spawning areas, it may make sense to establish them. We need to study the particular situation. Fishermen with access to the Internet now realize what is happening all around the world. They are making a conscious effort to be involved in what is going on early in the process and to work through problems. An example of this is a success story concerning the right whale. Gillnet fishermen on the east coast of Nova Scotia set up a networking system to observe when right whales come into the Bay of Fundy. In one case, a whale was freed of fishing line when an observer plane reported the situation and the boat was identified, alerted, and it returned to the scene to free the whale. This area could have been designated as an MPA to protect the whales but we found a solution working another way.

It is better to work things out at the community level. Sometimes with court decisions, no one wins. A study was conducted that compiled information on right whale interactions and, as a result, shipping lanes are now being moved to avoid interactions with right whales when the whales are in the area. When we see an issue headed our way, we, as fishermen, get involved and try to come up with a solution. Other examples include fishermen working with the government on safety standards at sea, gear modifications to avoid whale entanglements, working with the Native Americans [First Nation] on rights to fish, rotation of scallop fishing areas, etc.

Comments and Questions

- **Q:** The approach you are promoting is one of being proactive and working cooperatively. What involvement do Canadian fishermen have in offshore mineral and oil development measures?
  A: In the Bay of Fundy the only problem at this time is the extraction of gravel. On Browns Bank, there is testing for oil and gas. Fishermen have a concern. Personally, I am not convinced that it is safe or not safe to do so. I am most concerned about the amount of tanker traffic in the Bay of Fundy and I am worried about an oil spill.
- **Q:** It sounds like fishermen in your area are trying to stay out in front on the issues. Do fishermen fear MPAs?
  A: There is a typical response of "not in my back yard." Right now we discuss seasonal closures and the need to study the impact of these. MPAs are a concern because of their permanency—a closure can be reopened.
- **Q:** How are your fisheries managed? Is it total catch vs. days at sea?
  A: In the groundfish fishery, we manage on a community basis starting with an overall quota. We look carefully at allocations on a weekly basis.
- **Q:** Studies from other parts of the world on the relevancy of closed areas are often questioned. How can fishermen be convinced? In cases where they have been successful [Area 2 scallop fishery], fishermen become the biggest advocates.
  A: It is a matter of looking at the science. Fishermen need to have faith in the science. Fishermen are looking for decisions to be based on good information.
- **Q:** You do a great deal of committee work. Would anyone else be doing it if you were not? How do people become motivated to do this?
  A: I started doing this because a friend of mine got burned out. I have gotten to a point that I like it. I do not mind traveling. I like to know the background information. I am not sure how long I will do this—you do make enemies along the way.
- **Q:** There are financial burdens on fishermen when they become involved. It is also stressful and fishermen do burn out quickly.
  A: I have a special permit to run my boat when I am at meetings. The problem is one man is missing on the boat so I have to spend money on a substitute while I am away.

Presented by Richard Nickerson, Nova Scotia Lobsterman, at the Maine Workshop

I fish out of Cape Sable off of southwestern Nova Scotia and have been a lobster fisherman for over 25 years. Browns Bank area lobstermen believe that recruitment is coming from the closed area. Prior to the area being closed, lobstermen did not fish there and had no easy access to the area, so lobstermen were not displaced when it was closed. It was a compromise area between the inshore and offshore fleets and serves as a buffer zone.

Regarding the closed area for haddock, fishermen knew that the haddock landings were going down and they wanted to protect spawning haddock. We really do not know if it has benefited us. There are no cut-and-dry answers when it comes to establishing MPAs, but the support of fishermen is needed.

Another example is the coral box area. This is an example of something that really went wrong. The coral box area fishermen knew there was coral in the area. Some hook-and-line fishermen decided to tell the environmentalists about the coral in the hope of getting this area closed to the mobile fleet. But it was closed to all the fishermen. It was already a protected area in essence because of the coral down there. This was a gear conflict problem that needed to be settled another way.

The term MPA means different things to different people. There is a need to decide at the start what the criteria will be for reopening an area and for simply deciding if an area should be reopened.

Comments and Questions

- **Q:** The larvae coming from that closed area would not be making it to the Maine coast in less than 60 days. This is longer than the life of the larvae stage. You would not expect to see any effect on the Maine coast but looking at Maine's landings, over the same period of time, the pattern of increased landings is the same.
  A: There is no one answer to fish landings. We do not believe that the closed area is our one and only savior.
- **Q:** Was an economic impact study done before the area was closed to determine what the impacts would be?
  A: No, in the case of the lobster closure, there was no need. No one fished there. Lobstermen did not have the capability to go that far from shore.

Presented by Brian Giroux, Scotia Fundy Mobile Gear Fishermen's Association, at the Maine Workshop

At the time that the closed areas for haddock were established, there was a great deal of pressure on the stocks from freezer trawlers. Part of the reason for closing the area was to control effort. Fishermen also felt there was a need to allow the haddock to reproduce. Now there is a movement towards biomass management with the aim being to develop a mixture of sizes in a stock. This seems to give larger year classes. Closing areas for reproductive purposes can be complicated. Cod, for example, has complex mating patterns. We need to consider how much we really know about the systems and the process of spawning.

Closed areas are not universally accepted everywhere. Sometimes an area needs to be moved to be more effective, but there is a problem with adapting regulations. Goals need to be clearly stated in the beginning. There is a big campaign to establish an MPA in the Sable Island gully area because it is a significant geological area. The economic impacts are widespread because many access this offshore area from a variety of shoreline communities. The gully area may not be that special to whales because they move around—they are not residents. The coral box example is a show trial for lawsuits. It is up to the minister to make the decision in such cases. There are ad hoc proposals in the works, but there is a move toward establishing working groups to talk about the issues. The traditional information held by fishermen should be brought into the decision-making process. There is a need to have good science and good stakeholder involvement. Protected areas should be assessed over time and the process must be adaptive to move areas if necessary. Coastal zone management has an impact on adjacent MPAs. Watershed mismanagement can jeopardize MPA goals.

Comments and Questions

- We had a massive sea urchin die-off about four years ago. Animals 60 feet and below survived. A protozoan may be driving it. We have had this kind of die-off documented in the past. Oysters have also been affected.
- A CD-ROM is available about the gully area.
- **Q:** Who are the legitimate stakeholders in an area?
  A: We have logbooks to document who fishes where. There is a general group of people with interests, but there are people who have specific activities in a specific area.
- It can be hard to take concepts that apply to terrestrial systems and move them into the marine environment.

PART VI

FACILITATED GROUP SESSIONS

Summary of Facilitated Group Sessions—Maine Fishermen's Forum MPA Workshop
Prepared by Tracy Hart, Maine Sea Grant Program

Purpose of Discussion: *Devise a fair and inclusive process for fishing interests to be involved in and provide input to MPA processes in the Gulf of Maine.*

Discussion Questions: *Maine will need a fair and inclusive process in place to evaluate the need for MPAs, including no-take marine reserves, and the possible siting of them in the future:*

- *Who should be involved in the process?*
- *How should the process work?*
- *What information would be needed?*

Who Should Be Involved?

Most frequently listed responses:

- Direct stakeholders need to be involved—those most affected and who have a vested interest.
- Industry input is essential. Anyone who makes a living from the resource needs to be involved (all fishing industry sectors, including support businesses such as dealers, fuel, ice, bait companies, etc.).
- Public resources are involved so the public interest needs to be represented.
- All users of the resource should be included.
- Communities need to be involved from start to finish. Their role and value should not be discounted.
- Federal, regional, state agencies, managers: NOAA, Maine Department of Marine Resources, and the fishery councils.
- Who should be involved and who gets involved will depend on the area proposed and the type of MPA proposed.
- Local and national representatives (for credibility).

Others:

- Historical fishing folks—those who have fished the area but are no longer fishing
- Recreational fishermen
- Recreational users
- Fish consumers
- Nongovernmental organizations
- Advocacy groups/environmentalists
- Scientists
- Enforcement staff
- Social scientists
- Business interests

How Should the Process Work?

Establishing the need and data:

- First, determine and prove the need for the MPA. This would involve reviewing data from everyone (fishermen, scientists, etc.).

- Information must be shared among all groups.
- Develop partnerships (academia and university, Sea Grant–like funding) for data gathering and computation, and make data more available.
- Planning documents identifying where MPAs are targeted along with the rationale for why these particular areas were chosen.
- Before talking about siting new MPAs, evaluate what is already in the Gulf of Maine.
- There is a need to develop an economic assessment and plans for establishment, implementation, administration, enforcement, and monitoring.
- A socioeconomic study is needed to estimate the value of MPAs to society.
- Stakeholders need access to all data—both that which supports and does not support MPAs.
- Concrete examples are needed, not theory.

Defining goals and purpose:

- Define the purpose, goals, and objectives clearly and early. This would include addressing questions such as, What is being protected? Who is included? Is the intended use of the proposed MPA a fisheries management tool for promoting biodiversity or for the establishment of wilderness areas?
- A broad, first approach would include agreement on principles.
- Realistic timelines and triggers need to be set.
- The process and criteria for decision making need to be defined early.
- The process should not focus only on fisheries management. MPAs should be considered for pollution abatement, research, etc. In order for MPAs to reach their goal, the designation process needs to be integrated into a comprehensive ocean management approach.

Building common ground, knowledge, and trust:

- Education: A common knowledge base needs to be established early in the process between participants and stakeholders.
- There is a need to build trust in order for people to come together to discuss this concept. This will take time—many barriers to trust must be brought down. People need to become comfortable with the process to be able to move into working relationships.
- It would be helpful for issues and concerns to be shared by each group at the start of the process.

Ideas for a process:

- Use a more community-based or regional approach, rather than a federal approach. For example, local clam closures are MPAs.
- Establish a constructive, multi-stakeholder process with multiple forums where participants are empowered to contribute to the larger process.
- There needs to be a coordinated approach among all of the federal/state/regional management and regulatory agencies that are involved.
- Develop a round table to talk about a process for considering MPAs—a process to determine the process, such as a governor's commission to gather people's input and develop a process. The overall process should begin with a forum where various interest groups come together to talk about MPAs, identify principles and objectives, and share viewpoints about the pros and cons of establishing MPAs.
- Use a tier approach that begins broadly, involving everyone with an interest in the concept. As the process progresses and specific areas are discussed, local stakeholders and those most affected by the outcome of the process would be the key participants. [This model was suggested by the Canadians participating in the forum.]
- Plan a way for input to be gathered from those unable to attend meetings.
- Establish an oversight committee made up of representatives of vested groups.
- Develop a process that has a manageable number of people involved.
- The process could begin with an existing situation such as Taunton Bay. This case could then be used to develop an outline for a process that could be applied to other areas.
- Zone-specific processes should be developed.
- It should begin with local control with regional stakeholders, driven by the big picture, involved (e.g., lobster zone councils).

- Information should be funneled up so others become interested in area-specific discussions and will be supportive of local processes.

Fisheries management and fishermen involvement:

- Fishermen need to be engaged in the process from the beginning. They are the most affected. Involve fishermen in research and pay them. Establish a process for fishermen to share information and data with scientists. Programs such as Adopt a Boat and Sea Grant Extension activities could provide avenues for fishermen involvement.
- Fishermen-based monitoring of sites is needed.
- Consider the broad implications for fishermen at the beginning of the process. Displacement of effort, the social, environmental, and resource impacts connected with the movement of fishers to other areas, subsidies, trickle-down effects of socioeconomic conditions in communities, and the benefits and equity issues connected with MPAs all need to be considered.
- Use the NEFMC structure to proceed when considering MPAs for fisheries management purposes. This would involve developing criteria for designating MPAs (stock assessments, habitat evaluation, etc.).
- MPAs should be looked at as a fisheries management option.

Safeguards and evaluating effectiveness:

- The effectiveness of established MPAs must be evaluated, and a process to modify or discontinue an MPA if it is not accomplishing its goals should be developed. There should be guarantees up front that if MPAs are established, they will be monitored and their life spans evaluated. Flexibility in changing areas that are closed (timing and boundaries) is needed.

What Information Would Be Needed?

- Baseline information should be collected to track if and how things change.
- Data that fishermen collect should be used. Information is already being gathered but is not being used.
- Go to the fishing ports to get information straight from fishermen.
- Practical and usable science is needed (not inaccessible technical information unusable by a lay audience).
- Trusted scientists are needed.
- Ecosystem and biological information is needed.
- A historical perspective of the area should be built. This would involve going back 50, 100, or more years and comparing these findings with current use.
- Historical ecological/population data and political histories should be explored.
- There is legitimacy in seeking fishermen's knowledge. It is not just anecdotal information.
- Available information should be used to promote awareness.
- Existing information should be compiled and analyzed.
- For existing MPAs, what is working and what is not working and the reasons why should be assessed.
- There is a need to comprehensively analyze and understand the concept. What should we be looking for in designing an MPA?
- Information on monitoring methods is needed.
- An economic impact study should be included.
- The effects of existing closed areas should be reviewed.
- Alternatives to meeting goals should be investigated. This needs to be supported by data.
- A method needs to be established for proving that an MPA is meeting its established goals.
- There is a need for stakeholders to understand all impacts to ecosystems. It is not just fishermen that cause negative impacts to marine ecosystems.
- Questions such as, what is enough, how many, and how big should be addressed.
- Conservationists need to present a unified, understandable plan.
- A list of substantiated benefits should be developed.
- The location of benthic habitats, spawning areas, etc. should be determined.
- Make seafloor habitat data available to all participants.
- There must be a clear understanding of goals and criteria.

Summary of Concerns

- Tensions currently exist. Fishermen are asking, Where's the fire? Why rush?
- The idea of permanent protection is hard to sell. Proponents of MPAs might consider more flexibility in closing and opening areas and just leaving a few for lasting protection.
- Fishermen need to develop a more unified voice, across fisheries.
- The expectation needs to be that something will happen. If fishermen and others take the time to participate, they need to be able to expect that their participation and input will actually be taken into account.
- Fishermen and other groups are discussing MPAs independently of each other. Many groups proposing MPAs are not engaging fishermen.
- It is critical to cross boundaries between groups.
- The process for addressing this concept needs to be inclusive.
- There is a significant amount of distrust, and walls are being built. There needs to be more honesty.
- There is confusion about how MPAs relate to the no-take controversies and fisheries management.
- Closures are already in place. MPAs will produce more closures. That is where the block in discussion comes in.
- MPAs are one tool among many for comprehensive ocean management.

Main Points

- Conduct a needs assessment: evaluate what we already have in place
- Make the process inclusive
- Prove the need for and the effectiveness of MPAs
- In the beginning, develop a way to evaluate and change MPAs if necessary
- Look at examples from other case studies and learn from those experiences
- Define goals early
- Develop a process with multiple forums to empower all participants to participate constructively
- Define measurable goals, develop criteria for evaluating success, outline intended benefits, and define duration of MPAs
- Flexibility, coordination, and cooperation are needed
- MPAs are one tool among many
- Consider the impacts on all parties. Understand the broad implications for fishermen from the beginning
- Integrate all the impacts if the process is to achieve success
- Use a community or regional approach. Communities are key stakeholders and sources of information (community-based resources management)
- There is no one example that you can take off the shelf and apply, no one-size-fits-all. A new approach is needed
- Develop solid baseline information that includes ecological and socioeconomic data
- Include those who earn a living from the resource
- Build trust between groups and proceed with openness and honesty
- Include direct stakeholders. Fishermen should be a source of information for identifying MPAs
- Identify who pays for process, development, implementation, administration, monitoring, and enforcement of MPAs and for how long
- Define the problem to determine if MPAs are part of the solution
- Create a safe haven for the exploration of information, needs, and goals before decisions are made
- Look at the issue comprehensively in a coordinated manner regardless of the purpose for the MPAs

Next Steps

- Bring stakeholders together
- Bring to the local level
- Provide comment on the definition of "lasting protection"
- Create a centralized location for current information/status of issues that everyone can access
- Evaluate how current MPAs (closures) are working or not working (science)
- Establish a governor's commission to develop a state-level strategy to define the MPA process

PART VII

SUMMARY

As was apparent during the presentations and accompanying discussions that took place during the four workshops, the term MPA can mean different things to different people, depending on the timeframe and regulatory stipulations attached to the designation. The variety of terms are often used interchangeably—marine reserves, marine sanctuaries, MMAs, closed areas, no-take zones, and MPAs—and may or may not refer to the same situation. The different terminology highlights the need to clearly define what is meant by the concept of lasting protection, and the means that will be employed to ensure that protection.

MPAs can be designated for a variety of purposes: to attain fisheries management goals, to promote biodiversity, to protect historical, cultural, and ecologically significant sites, to promote research and education, or to simply set aside wilderness areas undisturbed by human activities. Workshop participants agreed that identifying the goals and purpose for establishing an MPA, as well as the mechanisms for assessing whether or not those goals are being attained, is a necessary first step in considering their application as a tool for either fisheries or ecosystem management.

In considering the use of MPAs as a fisheries management tool, good data are needed to identify appropriate areas where protection from fishing pressure will produce a desired effect. MPAs for fishery management purposes also must be considered in the context of other management options, with careful consideration given to potential economic and social impacts in addition to biological and ecological effects.

Studies to evaluate the effectiveness of MPAs as a fisheries management tool have been more prevalent in tropical systems than in temperate waters. Fishery closures in the New England region and those examined on the Scotian Shelf do appear to have produced beneficial effects for some species, but more research is needed to fully evaluate their impacts in terms of increased fishery yields, spillover effects, and economic efficiency in fishery operations.

With regard to the use of MPAs in fishery management applications, the Canadian examples of closed areas point to the need for flexibility in MPA site designations to realize potential fishery benefits. This in turn points back to the need for good, up-to-date information for use in designating MPA sites and in monitoring their effectiveness.

The most important theme emerging from all of the workshops, regarding the use of MPAs as a management tool, was the need to establish a fair and inclusive decision-making process early on. Commercial and recreational fishermen, in particular, are primary stakeholder groups impacted by the designation of MPAs, whether they are for the purpose of attaining fisheries management goals or for other reasons. They, together with state, regional, and federal fisheries managers, need to be involved from the start.

From a broader perspective, consideration of MPAs as a fisheries management tool must be part of a continuing larger discussion about how we manage marine resources. The success of efforts to address the issue of whether an MPA should be designated in a particular area will depend on our ability to build working relationships among interest groups and government entities with jurisdictional responsibilities.

Appendices

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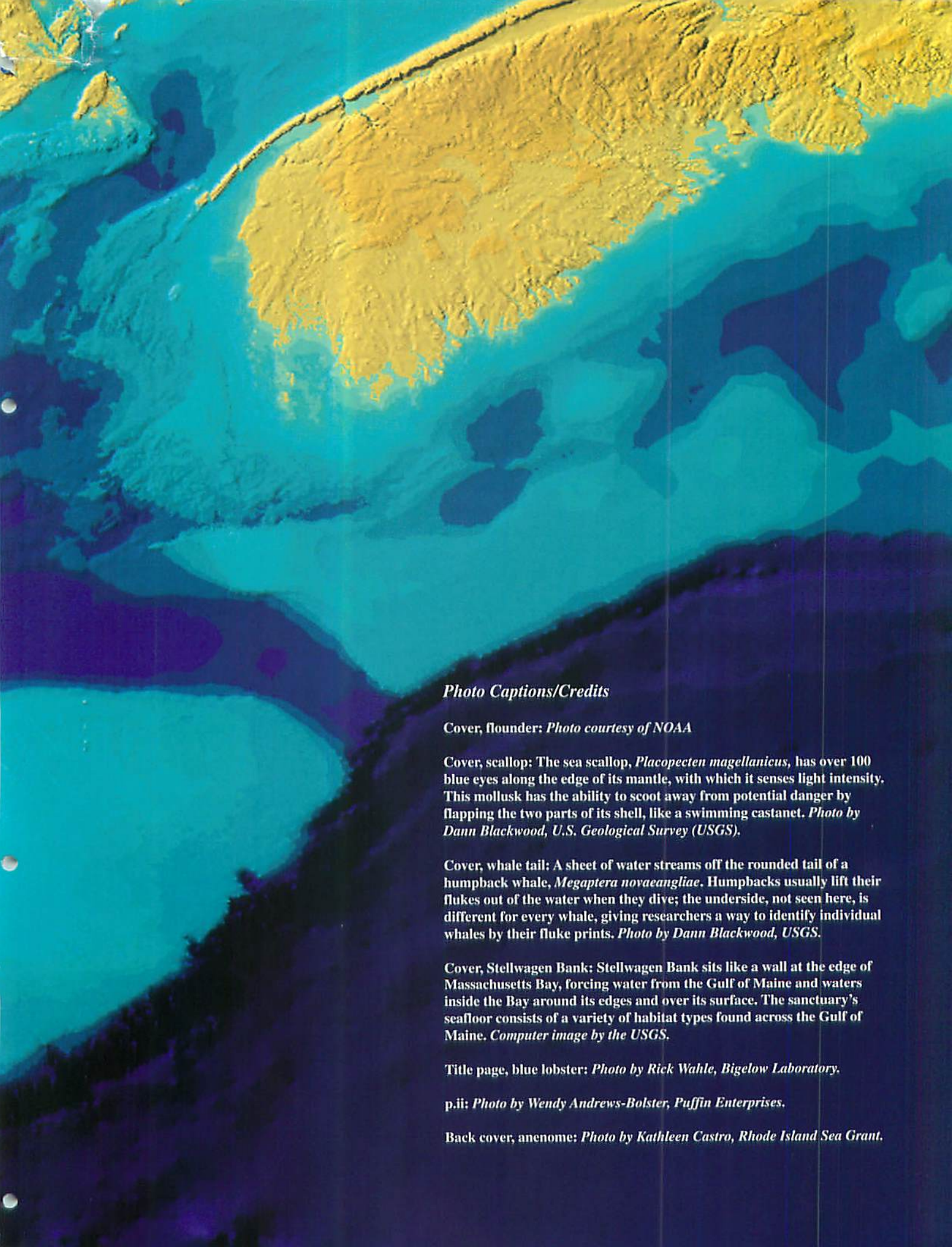

Photo Captions/Credits

Cover, flounder: ***Photo courtesy of NOAA***

Cover, scallop: The sea scallop, ***Placopecten magellanicus,*** **has over 100 blue eyes along the edge of its mantle, with which it senses light intensity. This mollusk has the ability to scoot away from potential danger by flapping the two parts of its shell, like a swimming castanet.** ***Photo by Dann Blackwood, U.S. Geological Survey (USGS).***

Cover, whale tail: A sheet of water streams off the rounded tail of a humpback whale, ***Megaptera novaeangliae*****. Humpbacks usually lift their flukes out of the water when they dive; the underside, not seen here, is different for every whale, giving researchers a way to identify individual whales by their fluke prints.** ***Photo by Dann Blackwood, USGS.***

Cover, Stellwagen Bank: Stellwagen Bank sits like a wall at the edge of Massachusetts Bay, forcing water from the Gulf of Maine and waters inside the Bay around its edges and over its surface. The sanctuary's seafloor consists of a variety of habitat types found across the Gulf of Maine. ***Computer image by the USGS.***

Title page, blue lobster: ***Photo by Rick Wahle, Bigelow Laboratory.***

p.ii: ***Photo by Wendy Andrews-Bolster, Puffin Enterprises.***

Back cover, anenome: ***Photo by Kathleen Castro, Rhode Island Sea Grant.***