OCEAN ZONING:

Can it Work in the Northwest Atlantic?

Halifax, May 10-11, 2004

Workshop Proceedings

Edited by Penny Doherty

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- Atlantic Coastal Zone Information Steering Committee
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- Marine Affairs Program, Dalhousie University
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Executive Summary

A workshop entitled Ocean Zoning: Can it Work in the Northwest Atlantic? was held in Halifax, Nova Scotia on May 10-11, 2004 to explore the concept and effectiveness of ocean zoning as a tool for integrated management of marine resources and activities. Objectives of the workshop were threefold:

- to explore concepts of ocean zoning,
- to learn from other jurisdictions and related integrated management initiatives, and
- to explore potential applications of zoning in the Northwest Atlantic.

To accomplish these objectives, the workshop program included invited speaker presentations, concurrent interactive discussion sessions, panel plenaries and a poster session.

The conference began with a keynote presentation by Hance Smith (Cardiff University, Wales) who provided an overview of historical and geographical experiences in sea use planning and the context for zoning. Sue Nichols (University of New Brunswick, Canada) discussed differences between zoning on land and in the ocean, highlighting rights, restrictions and responsibilities with respect to ocean space. Kenneth Sherman (NOAA Fisheries and Ecosystems, U.S.A.) presented the large marine ecosystem approach to the assessment and management of ocean resources and the environment. John Duff (University of Massachusetts, U.S.A.) discussed the promise and pitfalls of ocean planning and management.

Two presentations examined practices of zoning through international examples. Richard Kenchington (University of Wollongong, Australia) discussed practical aspects of zoning and its application to the Great Barrier Reef Maine Park, with a focus on the planning process and the basis of managing the Park. Billy Causey (NOAA-Florida Keys National Marine Sanctuary, U.S.A.) presented an overview of zoning practices in the Florida Keys National Marine Sanctuary.

In addition to invited speaker presentations, concurrent interactive discussion sessions were held on a variety of topics related to zoning in the marine environment. These interactive discussion sessions occurred twice during the workshop, providing useful and thought-provoking insights and learning opportunities.

Billy Causey facilitated a session about enforcement in marine protected areas, and subsequent challenges and successes in gaining compliance. Outcomes of this session highlighted that gaining compliance is much less expensive than enforcement and that user groups should be involved in the initial planning stages so that a positive attitude towards protection of an area can be fostered.

Bruce Hatcher (Marine Affairs Program, Dalhousie University) led a discussion about the role of science in zoning. The group noted the importance of finding a balance between the use of natural and social sciences, and that scientists need to focus more effort on the identification of indicators to capture emergent properties of marine ecosystems.

Justin Huston (Nova Scotia Department of Agriculture and Fisheries) chaired a session about zoning issues in the Gulf of Maine. Among other discussion points, this group noted that the Gulf of Maine Council, a multi-stakeholder group working toward sustainable use of the Gulf, might be an appropriate forum to coordinate a cross-border integrated management approach in the area.

Richard Kenchington facilitated a discussion on the Australian ocean management experience and lessons for Atlantic Canada. The discussion focused on two key components 1) identifying stakeholders, the issues they would want to identify in the planning process, their core interests, values, and decision rules or operating principles, and 2) building a vision for the coastal planning area.

Kenneth Sherman led a session about scaling, assessment and management of coastal zones and marine protected areas within large marine ecosystems. Participants highlighted the need for stronger linkages of science based assessments and governance, and for a long-term vision for ecosystem-based management.

An ocean sector perspectives panel featured plenary addresses on the significance of ocean zoning to various sectors. Paul Kravis (International Telecom Inc.) noted that the telecommunications industry has yet to see any benefit from a zoning requirement. Ivan Lantz (Shipping Federation of Canada) commented that ocean zoning can succeed from a shipping and navigational point of view as long as rights to navigate are maintained. Tim Hall (Fisheries and Oceans Canada) stated that in a management plan under the Oceans Act, zoning will be developed in the context of agreed-upon management objectives and integrated with existing sector-based zoning. Tony Iarocci

(South Atlantic Fisheries Management Council) and Susan Farady (Ocean Conservancy) emphasized the need for ocean zoning in fisheries management and for conservation, respectively.

A workshop assessment panel consisting of Jan Schrijvers (Maritime Institute, University of Gent, Belgium), Tony Iarocci, Richard Kenchington and Billy Causey, provided recommendations for future directions for marine management on the Scotian Shelf. Recurring themes included the importance of clarifying what is meant by the term ocean zoning, addressing socioeconomic as well as environmental issues in the integrated management process, and exploring partnerships with stakeholders to address their concerns.

The workshop drew varied attendance. Of the 74 participants, government represented the largest group (41%), with Fisheries and Oceans Canada staff from several regions comprising more than one-fifth (22%) of all participants. Non-government organization representatives (22%), academics (19%), students (8%), industry representatives (5%) and consultants (5%) completed the list.

Based on workshop discussions and outcomes, the workshop steering committee identified needs and next steps, and provided recommendations for future directions in spatial planning:

NEEDS

- Discussion on the merits of voluntary, non-regulatory-based zoning within Oceans Act large ocean management areas vs. regulatory-based zoning under existing sectoral legislation but through a DFO-led IM process.
- Research on the legal and jurisdictional implications of ocean zoning.
- Research on issues of scale in relation to various approaches. Which approaches work for all scales and which are particular to specific scales (e.g., community-based management approaches)?

NEXT STEPS

- Identify costs and benefits of zoning in a Canadian context.
- Design and conduct research on ocean zoning effectiveness, for example:
  - Identify a suite of indicators to evaluate zoning. This includes a suite of indicators for regulatory zones within MPAs and 'generic indicators' for larger scale, non-regulatory zones.
- Map ecosystem components, existing sectoral zones and intensity of human uses on the Scotian Shelf.
- Undertake spatial planning analysis and modelling of zoning options as part of a coordinated geomatic evaluation.
- Learn from other jurisdictions, such as Florida or Australia, that have developed processes for effectively engaging all stakeholders.

RECOMMENDATIONS

- Assign levels of risk associated with ocean use activities based on robustness/vulnerabilities of impacted areas before developing a zoning scheme.
- Understand the ecology of the region before zoning (i.e., identify ecoboundaries at various scales so that any subsequent damage can be evaluated in an objective manner).
- Consider socioeconomic, not just biophysical, factors as part of an evaluation process prior to zoning.
- Coordinate data acquisition to ensure that data only need be collected once and can be used for multiple purposes.
- Promote zoning as a management tool in decision support systems for protecting biodiversity and conservation, and for avoiding user conflicts.

- Choose a pilot area, smaller than the Eastern Scotian Shelf, and zone it, either as a charette or as part of an established process.
- DFO should clearly state its position on zoning/spatial planning.
- Use the Eastern Scotian Shelf Integrated Management (ESSIM) Initiative as a vehicle for future work on ocean zoning.
- Choose a short, understandable long-term vision statement for ESSIM;
- Form a spatial planning subcommittee of ESSIM;
- Provide different zoning options to ESSIM stakeholders for discussion; and,
- Integrate DFO/Natural Resources Canada's benthic habitat classification work into ESSIM.

The workshop provided an important opportunity for ocean managers, researchers, policy makers, users and stakeholders with an interest in integrated ocean management to learn from ocean zoning experiences internationally and to consider its application to the Northwest Atlantic region, including waters off Atlantic Canada and New England.

The purpose of these proceedings is to highlight key issues related to spatial planning in the Northwest Atlantic. It is hoped that the outcomes of this workshop will help guide integrated management of marine resources and activities, and will assist in identifying priorities and future directions for ocean planning and management in the Northwest Atlantic.

Introduction

HOW THE WORKSHOP CAME TO BE

The Marine Issues Committee of the Ecology Action Centre (EAC) first became interested in the concept of ocean zoning as a potential tool for managing activities on the Scotian Shelf and in the Gulf of Maine in 2002. The EAC recognized that the current approach to ocean management in Atlantic Canada was not adequately protecting ocean resources and ecosystems, nor would it sustain livelihoods of coastal communities in the long run. Although marine protected areas (MPAs) are often promoted as the primary area-based management tool, the EAC believes that a comprehensive, proactive, ecosystem-focused approach to area-based management of the oceans is required, for both ecological and socioeconomic reasons. Ocean management practices in other jurisdictions suggested that ocean zoning might be an important component of such an approach. Thus the EAC decided to explore the ocean zoning approach to planning.

In 2002, the Ecology Action Centre received funding from the J.M. Kaplan Fund to explore the utility of ocean zoning and its applicability to the Scotian Shelf and the Gulf of Maine. This project was conducted by Penny Doherty and involved a review of the literature and interviews with American and Canadian ocean sector professionals to gain their perspectives on zoning the Scotian Shelf and Gulf of Maine. A report entitled Ocean Zoning: Perspectives on a New Vision for the Scotian Shelf and Gulf of Maine, published in October 2003, contained the results of the interviews.

In addition to the report, the EAC organized a one-day workshop on ocean zoning in Bar Harbour, Maine in April 2003 which followed a workshop on MPAs. The workshop brought together community-based and advocacy organizations from Canada and the U.S. that are interested in the conservation of the Gulf of Maine. Among the recommendations from the workshop and the report was the need to hold a workshop to discuss ocean zoning as a potential tool for managing activities in Atlantic Canada. Thus, the Ecology Action Centre set out to organize such a workshop.

A broadly representative steering committee, including industry, non-government organization, government and academic representatives, was formed to discuss the details of the workshop. After many discussions regarding the purpose of the workshop, the committee decided the goal would be to explore the concept and effectiveness of ocean zoning as a tool for integrated management of marine resources and activities, with the following objectives:

- To explore concepts of ocean zoning
- To learn from other jurisdictions and related integrated management initiatives, and
- To explore potential applications of zoning in the Northwest Atlantic.

To accomplish these objectives, members of the committee designed the workshop with multiple formats, namely, invited speaker presentations, concurrent interactive discussion sessions, panel plenaries, and a poster session (see workshop program in Appendix I). In addition to the varied formats of the workshop, the program was designed to follow a natural progression from basic concepts of zoning through exploring concepts in greater detail, to examining practices of zoning, to the various perspectives of zoning.

OVERVIEW OF WORKSHOP

The first session consisted of oral presentations related to concepts of zoning, with the intention of providing important background information for participants to use during interactive discussion sessions. Hance Smith (Cardiff University, Wales) began the session with an overview of experiences in sea use planning and the context for zoning. This was followed by a presentation by Sue Nichols (University of New Brunswick) who discussed differences between zoning on land and in the ocean. Kenneth Sherman's (NOAA Fisheries and Ecosystems) concluded the session with a presentation on the large marine ecosystem approach to the assessment and management of ocean resources and the environment.

The second session involved small-group concurrent interactive discussions to focus on advancing the collective understanding of various topics as they relate to zoning in the marine environment. Billy Causey (Florida Keys National Marine Sanctuary) facilitated a session about enforcement in marine protected areas (MPAs) and subsequent challenges and successes in gaining compliance. Bruce Hatcher (Marine Affairs Program, Dalhousie University) led a discussion about the role of science in zoning. Justin Huston (Nova Scotia Department of Agriculture and Fisheries) chaired a

session about zoning issues in the Gulf of Maine. Richard Kenchington (University of Wollongong, Australia) facilitated a discussion on the Australian ocean management experience and lessons for Atlantic Canada. Kenneth Sherman (NOAA Fisheries and Ecosystems) led a session about scaling, assessment and management of coastal zones and MPAs within Large Marine Ecosystems. These interactive discussion groups met twice during the workshop, providing useful and thought-provoking insights and learning opportunities. Summaries of the discussions are provided in these proceedings.

The third session examined the practices of zoning through international examples. Richard Kenchington gave a presentation on practical aspects of zoning and its application to the Great Barrier Reef Maine Park. This was followed by a presentation by Billy Causey about zoning practices in the Florida Keys National Marine Sanctuary.

The fourth session was designed to promote discussion on the various user perspectives of zoning. The session commenced with a presentation by John Duff (University of Massachusetts) on the promise and pitfalls of ocean planning and management. This was followed by a panel and plenary about ocean sector perspectives on zoning. Each panellist responded to the question, Ocean zoning: Can it work and how does it apply to your sector? Panellists were Paul Kravis (Vice President, Marine Systems, International Telecommunications Ltd.), Ivan Lantz (Director, Marine Operations, Shipping Federation of Canada), Tim Hall (Oceans and Coastal Management Division, Fisheries and Oceans Canada, Maritimes Region), Tony Iarocci (South Atlantic Fisheries Management Council), and Susan Farady (Ocean Conservancy). This was followed by a full hour of questions and discussion. Panellist addresses and the ensuing discussion are provided in these proceedings.

The final session of the workshop consisted of reports from the various concurrent interactive discussion groups, and a panel of four individuals who provided recommendations for next steps regarding zoning and integrated management in Atlantic Canada. Jan Schrijvers (Maritime Institute, University of Gent, Belgium) gave an overview of spatial planning efforts in the North Sea with some comparisons to Canada. This was followed by comments about key issues addressed at the workshop and recommendations for next steps from Tony Iarocci, Billy Causey and Richard Kenchington. Following the addresses of the four panellists, workshop participants engaged in a question/discussion session about challenges and potential next steps for zoning in Atlantic Canada. A summary of the panellists' recommendations and the ensuing discussion are provided in these proceedings.

Poster displays of topics relevant to ocean zoning and/or spatial planning in the marine environment were exhibited throughout the workshop with time allocated to meet the exhibitors. Topics covered in the poster session included:

- marine and coastal protected areas in the U.S. Gulf of Maine region,
- progress in community-based marine zoning with a focus on Folkestone Park and Marine Reserve, Barbados, and
- a framework for regional MPAs planning in the greater Gulf of Maine and Scotian Shelf.

Poster abstracts are provided in Appendix II.

The workshop drew varied attendance. Of the 74 participants, government represented the largest group (41%), with Fisheries and Oceans Canada staff comprising more than one-fifth (22%) of all participants. Non-government organization representatives (22%), academics (19%), students (8%), industry representatives (5%) and consultants (5%) completed the list.

The purpose of these proceedings is to highlight key issues related to spatial planning in the Northwest Atlantic. It is hoped that the outcomes of this workshop will help guide integrated management of marine resources and activities, and will assist in identifying priorities and future directions for ocean planning and management in the Northwest Atlantic.

Presentation Summaries

Session A: Concepts of Zoning

The following summaries are based on oral presentations of invited speakers. Full papers can be found in Appendix III.

EXPERIENCES IN SEA USE PLANNING AND THE CONTEXT FOR ZONING

Hance Smith presented an overview of sea use planning and the development of zoning. He began by discussing the historical and geographical patterns of sea uses, and noted the importance of historical patterns for understanding current ocean uses. He identified the world's major marine development nodes, based on sea trade and fisheries, one of which is located in the northwest Atlantic Ocean including part of Atlantic Canada's coast and the coast of the northeastern United States. Regional planning patterns suggest that ocean management usually occurs in response to the intensity of sea use. The regional status of sea use planning depends on use systems, stages of development (time scales) and sea use, with each region being unique geographically.

Smith presented a sea use matrix that identifies factors to be considered in a spatial planning framework. Factors such as environment, technology, economic, social and risk are assessed for various uses. In the matrix, the roles and policies of the organizations involved, and the nature and degree of integration required are also considered.

Smith outlined the development of zoning, beginning with the various levels of state control, including internal waters, territorial seas and contiguous zones, Exclusive Economic Zones and the High Seas. He then outlined sea use sector zones such as shipping, fisheries and aquaculture, minerals and energy, research and conservation. Smith's key message was that there is a lot of zoning and there has been for a long time. He noted that with increasing use of the ocean several factors emerged as warranting attention, including environmental, technological, economic, legal (both social and political) and geographic combinations. An integrated management approach, the basis of which is marine spatial planning, was thus developed with the goal of managing sea use and environmental interactions. Integration is a means to reduce use conflict, identify spatial priorities (e.g., conservation), and allow for better enforcement and strategic planning.

Smith presented an analysis of regional zoning progress. In the regional context of zoning, he noted that Canada has the Oceans Act and the Eastern Scotian Shelf Integrated Management project, and subsequently leads the world in regional zoning progress. Some regions don't have the resources or it is not their highest priority. Smith stressed the need to move forward to regional management in the developing world.

In conclusion, Smith stated that time scales are important to sea resource use, and recommended that we need to look 30-50 years ahead and manage resources accordingly. Sea use intensity should be used as a basis of planning. For example, the Scotian Shelf needs a long-term plan. Smith emphasized the long tradition of sectoral zones in the oceans and the need to bring these industries together and to develop and prioritize aims and objectives.

OCEAN ZONING: IS IT REALLY DIFFERENT?

Sue Nichols addressed the concepts of land use zoning and the differences between zoning on land and in the ocean. Nichols began the presentation by defining zoning as "a method of grouping classes of land uses together to achieve defined goals." She discussed how land use zoning implements decisions about new land uses and resolves conflicts among existing land uses. Nichols noted that formal zoning is prescriptive (lets us know what we can do) or proscriptive (lets us know what we cannot do), with the former being the most common.

Nichols stated that zoning is an information-intensive implementation tool for a master plan based on resource potential, current and projected uses, and related attributes such as transportation and property rates and values. Planning depends on information about things such as resource capability, resource value, nearness to something, and adjacent impacts. She listed the benefits of zoning, including coordination and rationalization of activities, protection of the public good, protection of weaker interests, and facilitation of long-term planning and management.

Nichols then went on to discuss whether the oceans are different with respect to zoning. She noted that property rights continue to be important issues in the ocean realm, giving examples of public rights such as for navigation and fishing, riparian rights and private rights (e.g., oil and gas production). Nichols highlighted the increased complexity of jurisdiction, ownership and

administration of marine areas compared to land areas, and noted that spatial limits depend on the particular resource and the type of resource use. Given that the spatial extent of government rights in the ocean is not clearly defined and that spatial limits may change over time, delineating boundaries in the ocean may be difficult.

Nichols commented that although zoning can be a useful tool for isolating and managing particular problems, a master plan with some consensus, flexibility and measurable goals is also needed. She highlighted the need for multidisciplinary, holistic, spatial information as well as the need to link science with local knowledge. Nichols concluded by emphasizing the need for better management that would recognize uncertainties under jurisdiction and ownership, understand the limitations of drawing lines on charts, and respect the rights, values and goals of all parties.

THE LARGE MARINE ECOSYSTEM APPROACH TO THE ASSESSMENT AND MANAGEMENT OF OCEAN RESOURCES AND ENVIRONMENT

Kenneth Sherman began his presentation by identifying various ecosystem-related World Summit on Sustainable Development (WSSD) targets and programs of action. He noted that between the United Nations Conference on Environment and Development (UNCED) 1992 and the Johannesburg Summit 2002 little progress had been made on the targets, and ocean resources continue to be degraded. Specific targets were set in Johannesburg which were not previously set at UNCED. There is now a resurgence of interest for government and industry to go through a paradigm shift from a sectoral approach to addressing multi-sectoral issues and the degradation of coastal ecosystems. Funding is becoming available and organizations are at work to achieve this goal.

Sherman then introduced the concept of Large Marine Ecosystems (LMEs), noting that ecological criteria (bathymetry, hydrography, productivity and trophodynamics) are being used to determine their areal extent. Most of the pollution and habitat degradation in the oceans occurs within these areas. Sixty-four LMEs produce 95% of the world's annual marine fishery catches.

One milestone of UNCED has been the creation of a Global Environmental Facility (GEF) in the World Bank. Billions of dollars have been allocated for ecosystem-based management, global waters, climate change and biodiversity work. As of March 2004, $650 million in funds support GEF projects in 17 of the world's LMEs, producing food and supporting economic activity for over one billion people. One hundred and twenty-one countries are moving to ecosystem-based management of LMEs. These LMEs are global centres of efforts to decrease coastal pollution, restore damaged habitats and recover depleted fish stocks.

Sherman then addressed the indicators of changing states of LMEs that have been categorized into modules. The integrated modules for ecosystem assessment and management were described as including: productivity, fish and fisheries, pollution and ecosystem health, socioeconomics, and governance. Modular assessments will support ecosystem-based restoration and sustainable development, and are developed around the unique transboundary priority issues for each LME project.

Sherman concluded by identifying some of the substantive changes between traditional resource management and ecosystem management. Ecosystem management would require a paradigm shift from individual species to ecosystems, from small spatial scale to multiple scale, from short-term to long-term perspective, from humans independent of ecosystems to being an integral part of ecosystems, and from management divorced from research to adaptive management focused on recovery and sustainability of both goods and services of LMEs.

QUESTION SESSION A

Note that comments during discussions/question periods are attributed to paper authors/panel members where possible, with unattributed comments reflecting those of audience participants. Accuracy of individual comments and positions are based on rapporteur notes. Therefore please check with the authors before quoting specifics.

Question

Hance, your presentation suggests a great deal to be learned by regional comparisons. There are geographic and historic differences between regions. Have you done these comparisons?

HANCE SMITH

I have done a comparison for northern Britain for fishing and shipping sectors. This was the work of my PhD thesis, which later became a book. But not enough is being done. There are not enough researchers working on the sea.

Question

Socioeconomics versus conservation doesn't work. When you try to satisfy the economic and social concerns of fishing communities, the resources will suffer. In the first instance, we undervalued the entire ecosystem. We didn't appreciate the value of the ecosystem to the people of the region. When the economics of communities and fisheries are in balance, then conservation suffers.

KENNETH SHERMAN

This is a key point. In the U.S., this becomes a stewardship determination. We need to think 20 to 30 years downstream. There may be serious pain inflicted by this process but you can reach your objectives if you reach consensus amongst stewards. For instance, developing countries should be in control. In Newfoundland and Labrador, there is a dilemma – they lost cod but gained crab and shrimp of equal or greater dollar value. This was good for economics but bad for communities. The loss of the cod was tragic at a community level.

Question

How do we deal with the survival of fishermen?

KENNNETH SHERMAN

Very poorly. In the U.S. and Canada, we have subsidized communities. The U.S. bought back vessels and implemented re-training programs.

HANCE SMITH

Regarding the survivorship of communities and fishermen, the subsidization of communities has been a band-aid approach. The education process will be difficult. The U.S. purchased vessels at a huge cost and re-trained fishermen, spending $100 million dollars. In Europe, the primary thing is the perception of people in communities. There is a decommissioning program for fishing vessels in Europe. In Europe, the way forward is a regional approach. The Common Fisheries Policy is a regional approach. There will be a very painful transition, with people moving out of the fishery over a timescale of 10 - 15 years. These timescales are needed to develop perceptions and to do them.

In the U.S. there are 10 national standards in the Magnuson-Stevens Fishery Conservation and Management Act to prevent over-fishing and protect ocean communities. Congress subordinated the protection of the ocean to protect ocean communities. We must pick one over the other. We could also use less technology and employ more people but this is artificial in the global economy. Some say there would be more people in the fishery if we went back to dories. This is a false claim because internationally we can't compete.

Question

Zoning raises ire in the U.S. Can we pick a word that is less controversial? What word would we use instead of 'zoning'?

KENNETH SHERMAN

There is no magic word. It is a process. The ecosystem-based approach follows a multi-sectoral process. We can talk about MPAs within the ecosystems. The word 'zone' is confrontational; it implies fences and restricted access. Who gets restricted access? We must be as non-pejorative as possible in this process.

HANCE SMITH

'Regionalization' is a word I use as a geographer. Zoning is a tool, necessary for realities of data. It can't come before the political will is there. Science couldn't ever drive the system. In North America, zoning is a more confrontational term because in Western Europe they have different ways of looking at property rights and the political realities are different.

Question

I believe that the new ecosystem-based management is the way of the future. We are having a hard time selling this approach to fishermen. With MPAs and ITQs (Individual Transferable Quotas), will zoning be another thorn in their side? How do we sell this definition?

KENNETH SHERMAN

This is a key question. What was the process where there have been successes? We should look at lessons learned, at modest successes in ecosystem approach in other places. Southwestern Africa offshore demonstrates this. There was an all-stakeholder meeting, including oil and gas, tourism, etc., with over 100 people in the room. The Benguela Large Marine Ecosystem Programme had to balance the economic interests of different countries, Angola, South Africa, and Namibia. Industry did a transboundary analysis. There was a 12-15 month period to sit with stakeholders.

Question

I just returned from a fourth world fisheries conference. I heard that 60% of fisheries around the world are currently maximized or overexploited. We don't do a good job of protecting the fragility of the ocean floor. I'm concerned about the slow pace of progress to protect the oceans. The only way to stop this is to establish no-take areas. Are we in a crisis situation? Are we going to talk and talk until there are no fish left?

HANCE SMITH

It depends on where you are. It is a good sign that you, as a geologist, are here at this meeting. We do need to get going when it comes to time scales. Time scales will depend on the cultures. Principles are universal but solutions are regional. The weakness lies in relating information to decision makers and the private sector. Executive decisions are being made by the private sector. Fisheries are not in a good state globally but don't generalize – big pelagics have recovered to the south and here there may be recovery. Fisheries are traditional activities in both developing and developed countries, and are often slow to respond. It is possible to look to the new world; do they do things in new ways, not smashing up communities? This is necessary so that the human process of management can get there in time.

SUE NICHOLS

We need to have things to do now but also a plan for later. If you look at the large reforms, they are intergenerational. We need band-aids for the present and long-term dialogue for later.

KENNETH SHERMAN

The tide is turning with ecosystem management. Daniel Pauly says that we are fishing down the food chain and we need to have MPAs everywhere or we will lose everything. This is an overstatement. Six Large Marine Ecosystems around the world are doing well, providing 9.5% of the global marine fisheries yield. The countries bordering these six LMEs are among the world's most populous, and represent one quarter of the world's population. Things aren't going to hell in a hand basket. It takes time but the movement is in the right direction.

Question

How do we drive the paradigm shift? Decision-making at the ecosystem level requires knowledge. Do we have this knowledge? How much data or information do we need to manage an ecosystem? Some very good decisions have been made with little or no data, and bad decisions have been made with tonnes of data. To make decisions about who does what, where, do we need all this information? We need public education, a "marketing of paradigms" of who does what, where and when in the oceans.

SUE NICHOLS

The difference with the ocean is that it's the final frontier on earth. We don't have all the information but there are new technologies to collect it. It is not necessarily all about collecting more data. It also means taking the data we have and marrying it to experience, as is being done at the Ocean Management Research Network.

Session B: Practices of Zoning

PRACTICAL ASPECTS OF ZONING AND ITS APPLICATION TO THE GREAT BARRIER REEF MARINE PARK

Richard Kenchington presented an overview of the basis of managing the Great Barrier Reef Marine Park (GBRMP). He noted that the loss of inshore reefs and the decline of the Crown of Thorns starfish, as well as threats associated with use of the reef area, prompted political response for protection of the reef. As a result the GBRMP Act was enacted in 1975, and the GBRMP Authority was established the following year.

Kenchington then discussed the spatial control framework of zoning. He noted that on land single use class activities or clusters of similar uses can generally be managed sectorally within boundaries or fences. However, multiple use is widespread in the oceans and the same geographic location may be used sequentially or simultaneously for very different and otherwise unrelated uses. Kenchington noted that cross-sectoral management generally becomes necessary as the intensity and range of uses increase. In addition, multiple uses and impacts need to be addressed.

Kenchington addressed the basis of managing the GBRMP. The broad objectives of zoning in the GBRMP are set out in the legislation and include the conservation of the GBR and the regulation of the use of the Marine Park so as to protect the GBR while allowing reasonable human use. An activity that is not specified cannot be undertaken unless it is consistent with provisions of the zone and specifically permitted. The goal and aims (social, environment, economic and general) for management, outlined by the GBRMP Authority in its 1983-1984 annual report, give clear guidance on the scope and basis of multiple use management to provide for conservation and reasonable use within the GBRMP.

The planning process for initial declaration and zoning of the Marine Park was developed in close association with the goal and aims. A case study identified three major interest or user groups, namely fisheries, conservation and tourism/recreation, for each of which a draft zoning plan was developed. The study indicated that multiple use planning was feasible and that a different approach to public participation was needed. In addition, the study concluded that although the available information was imperfect, it was adequate to proceed with zoning the first section of the GBRMP.

The first cycle of zoning took 10 years, had 4.7% no-take zoning, 15.9% habitat protection, and the remainder was for general use. This initial phase of the GBRMP was followed by a strategic planning phase, the outcome of which was a 25-year vision for the future of the GBR World Heritage Area. To meet national commitments under the World Heritage Convention, the second cycle of zoning resulted in 33% no-take zoning, 33% habitat protection and 34% general use.

Kenchington noted the importance of a dynamic management process given changing attitudes and new information. For example, in 1979 the largest direct economic use was fishing whereas by 1990 tourism was four times more important than fishing. In 1979, scientific research was regarded as a beneficial activity. However by 1997, ethical guidelines were needed to ensure that experimental designs could justify impacts on populations, habitats and species. Similarly, activities once seen as reasonable are no longer factors for management (e.g., shell collecting).

Kenchington concluded with an overview of key lessons for marine ecosystem-based management based on the GBRMP experience. Lessons included: the recognition that zoning is a good starting point for multiple use management; the importance of an issues-based approach for setting management objectives; and the importance of clear, publicly discussed and understood guidelines for the planning process.

ZONING THE FLORIDA KEYS NATIONAL MARINE SANCTUARY

Billy Causey began his presentation with an overview of the U.S. National Marine Sanctuaries Program that comprises a network of 13 aquatic protected areas. National Marine Sanctuaries provide protection to a variety of aquatic areas including nearshore coral reefs, deep-sea canyons, whale migration corridors and underwater archeological sites.

Causey then went on to discuss the Florida Keys National Marine Sanctuary that was designated in 1990. The Sanctuary encompasses all of the waters surrounding the Florida Keys up to the mean high tide mark, including 143 km^2 of coral reefs in State of Florida territorial waters and 182 km^2 in federal waters. Other marine communities in the Sanctuary include mangrove islands, seagrass beds, productive hard bottom and a variety of patch reef habitats.

Causey discussed the management programs for the Sanctuary which include research and monitoring, education and outreach, volunteerism, enforcement, threat reduction measures and marine zoning. He noted that marine zoning was one of the most controversial management tools considered in the planning process. The primary topics of concern in establishing the marine zoning plan were the proposed locations, sizes and allowable uses.

Despite a large opposition movement, the Florida Keys National Marine Sanctuary implemented the first network of marine zoning for a National Marine Sanctuary in the U.S. in 1997. At that time, five types of zones were implemented: Sanctuary Preservation Areas, Special-use/Research Only Areas, Ecological Reserves, Wildlife Management Areas and Existing Management Areas.

Causey noted that many lessons were learned during the process to develop and implement a marine zoning plan for the Sanctuary, including: ensuring that the process is open and flexible; involving representatives of all stakeholder groups; establishing goals and objectives for the reserve at the beginning; and allowing stakeholders to help guide the process.

Causey emphasized that planning a no-take reserve must be a bottoms-up procedure that involves a well-balanced group of stakeholders from the local community. He stated that the procedure for selecting participants is important. He stressed the importance of a balanced and representative selection process for participants in gaining public confidence.

Causey noted that the success of implementation of a marine zoning plan depends on the effectiveness of other management programs such as education and outreach; monitoring and research on effectiveness; enforcement; and marking boundaries on charts, with buoys and through inclusion in Differential Geographical Positioning Systems. Causey concluded by stating that marine zoning is critical to achieving the Sanctuary's primary goal of resource protection, and that it does this by preserving sensitive components of the ecosystem through regulation within the zoned areas, while facilitating activities compatible with resource protection.

QUESTION SESSION B

Question
What kinds of people are brought to the table? Social scientists versus natural scientists? Users and those that don't use but feel it should be protected? The larger public has a vested interest in making sure it's there for the future.

BILLY CAUSEY

Fishermen helped draw lines on maps for areas where they didn't fish or where ecological features occurred. One fisherman gave up an area he had fished for 20 years. After the GIS was put on the table, they did a trade-off between areas. Fishermen drew their own boundaries. In the end everyone won. In Tortuga and to the south, fishermen wouldn't come to the table unless Ridley's Hump was not made a no-take zone.

Question
How do you deal with the application of zoning where there are no reefs?

RICHARD KENCHINGTON

The underlying principle is not dissimilar. Reefs are a small part. People need to understand that in places where you can see creatures interacting, the jump of perception is not as difficult. Now that there are benefits in terms of spawning areas, we no longer ask. For the system to work we need to have some framework for containing unrestricted use. It's harder but it can be done.

Comment
People say you need science to drive the process but the community has a Ph.D. in fish science. The community of fishermen can be hardliners after being alienated, especially when Ridley's Hump was identified as a key spawning area. Gyres and drifter buoys showed that fish spawn in certain areas. You need to involve the fishermen, and use and respect their knowledge. The key is getting benefits for everyone. You need to get organizers and representatives who can bring in the hardliners, like oil and gas. Without Billy Causey at the lead, the Florida reserve might not have happened. You need a lot more people skills than science.

RICHARD KENCHINGTON

We had a similar phenomenon in Australia. Don't draw lines before the process begins from an ecological perspective. The process must be ecologically informed.

Question
How do we measure success?

BILLY CAUSEY

Through compliance, acceptance, asking for more, changes in reef fish population we are seeing, diver shops crediting sanctuaries with new fish – it's changes in behaviour. When I don't have to hide when I am shopping in Winn-Dixie [grocery store], that's a measure of success.

Session C: Zoning Perspectives

THE PROMISE AND PITFALLS OF OCEAN PLANNING AND MANAGEMENT

John Duff began his presentation by highlighting the fact that increased uses of ocean space and resources, in addition to jurisdiction and ownership questions, have led to an increase in the number and type of ocean conflicts that merit resolution. Prof. Duff stated that while 'ocean zoning' is often advocated as an attractive concept to deal with these issues, zoning is merely one piece of a larger management puzzle that ought to be assembled. He identified a number of management pieces that ought to be considered: planning, siting, zoning and regulating.

Prof. Duff noted that planning involves the development of a scheme to attain certain goals and objectives. Managers of ocean space ought to consider what their range of objectives is. Not all ocean management objectives are the same. In some instances, the objective is to protect a commercially valuable renewable resource. In other circumstances, the objective is to define areas for safe navigation. In yet other areas, the objective might be the extraction of energy resources. Identification of objectives in the planning process, explained Duff, will set the stage for the next management step: siting.

Ocean siting, according to Prof. Duff, ought to include a surveying and inventorying process that would assist ocean managers in determining which ocean sites are better naturally situated for particular activities. In addition to determining what is out there in the ocean, Prof. Duff also noted that when it comes to ocean management, you need to know who has jurisdiction. Given the various potential issues associated with ocean space (e.g., navigation rights, fisheries rights, seabed use rights, access rights, development rights, etc.), regulatory jurisdiction needs to be clearly established.

At that point, suggested Duff, zoning might be appropriate since siting would set the stage for the designation of certain types of activities and provide some basis for allocating space and/or resource access interests to specific users. These users would now have legal interests akin to private property rights, which is where zoning has been traditionally employed to ensure that a user with a right did not employ that right in a way that might harm the public or another private user.

At the same time, Prof. Duff pointed out that while ocean resource users might acquire legal interests akin to private property rights, they would be qualified to a degree in that the ocean and its resources are ordinarily considered public goods. As a result, Duff suggested that any ocean management system ought to consider regulatory and compensation provisions to ensure that the general public would be afforded some benefit for the 'privatized' use of public resources.

Attempts to zone the ocean, cautioned Duff, will raise concerns among user groups who believe that they have attained certain rights over time. Certain questions need to be addressed: Who will be zoned out or in? Who will be the losers and winners? Do we have enough information to zone the ocean?

Duff noted that a key difference between zoning on land and in the ocean is property rights. While property is often characterized as either private or public, all property has some combination of private and public property elements and influences. Duff concluded by recommending that before considering zoning in the ocean, a closer look should be given to non-zoning public land management models.

Ocean Sector Perspectives Panel

The ocean sector perspectives panel featured plenary addresses on the significance of ocean zoning to various sectors.

PAUL KRAVIS (International Telecom Inc.)

International Telecom is an international fiber/power cable installation company, responsible for the operation and installation of suboptic cables worldwide. We are not an owner of systems; we are a contractor, responsible for installation. We are approached by companies and countries to perform that service. We work worldwide and deal with many organizations and committees for the right to lay cable, and assist our clients in proper permitting functions.

It is important for us to receive permitting from the appropriate regulatory agencies. We cannot complete our job without proper approval and permitting whether it is for sub-sea or terrestrial systems. As part of our functionality we assist clients in permitting for their systems on land and in the sea. There are many departments that must be reached to complete permits as required under the permit laws. They include but are not limited to Navigable Waters Protection Act, Department of Fisheries, Department of Transportation, Natural Resources, and Environmental Impact Assessment, etc. It is worthy of note that there are some very good processes in place but the process needs to be more streamlined due to the number of government bodies involved. A lot of hands are involved in touching a cable.

Does zoning work? For our industry, not really. Zoning, or putting all cables in one area, is not to be grasped by our industry. Cable needs to be well protected, and we go to great lengths to provide this protection to our clients, and in so doing, provide long-term peace of mind that their cable will not be harmed. If all cables were in one area, they would be easier to destroy. Cable owners do not want all cables damaged by one act of outside aggression so planning and placing them in one zone could cause problems.

The biggest problem to cable owners is acts of outside aggression such as with fishing nets, trawlers and anchorage. Education is of the utmost importance to us, as is proper charting. We need to meet with fishermen and communities to let them know cable is going to be in certain areas, and why, and how to mitigate against cable damage. We try to communicate with shipping companies. Cable has to be in a well protected, well advertised place, with all the communities of interest being well aware of its location.

Fiber diversity is a must in most situations. This means route diversity not fiber diversity, therefore indicating multiple locations in and out of a province, a country or islands. In the marine world, the smaller regional systems need a ring-configured system. Ring configurations rely heavily on diverse routing in many areas along the coast and come ashore at different locations. Multiple zones may work in that respect.

We can rely on cable protection devices such as articulated pipe and horizontal directional drills for nearshore end areas but fish trawling, anchors, etc., can cause serious damage to cables, again proving a cable or many cables in one zone could be greatly affected. If zoning was permitted and cables in this zone were damaged, who would pay? The fishing vessel? The ship that dropped anchor or the system owner? The system owners take exception to being held responsible for damages resulting from acts of outside aggression.

Insurance is becoming increasingly harder for cable owners to obtain and to maintain the high premiums, so zoning to them is tough. If cables were in one area and damages occurred, it would be too expensive to insure and to repair. Our cable owners have not fully grasped the concept of zoning and likely will not until it can be proven or guarantees are provided that anything in a zone is insurable and protected, and repair costs can be recouped.

We have recognized the south of Florida issue on coral reefs and fully respect and understand the need to protect these marine habitats. As for such areas in Nova Scotia or the Atlantic region, we rely on our environmental reports and marine survey data to provide us a safe and non-damaging area to lay our systems. Cables, for the most part, are benign. We have seen this in post-lay inspection where the only place active life exits is on the cable, providing some proof that they foster marine life.

Our overall comment on the zoning issue is that the jury is still out, and many of our clients, including telecommunications and power companies, and in some cases governments, have yet to see any benefit from a zoning requirement. Minimizing the damage to the cable is the major

priority. In general we feel that proper upfront evaluation, permitting, environmental screening, good marine survey information, and community involvement and education will provide us the best areas to lay cable.

IVAN LANTZ (Shipping Federation of Canada)

The Shipping Federation is an association of ship owners that turned 100 years old in 2003. Its 80 members are Canadian companies from St. John's to Thunder Bay. Representing ocean shipping and international trade, the Federation's vision is a safe, efficient and sustainable marine transportation system. The Federation is committed to quality shipping.

International shipping carries over 90% of world trade, and will double in cargo volume and value by 2020 to approximately1.5 billion tonnes per year. Ninety percent of Canada's international trade moves by ships represented by members of the Shipping Federation. There are 6000 calls of international ships to Canada every year carrying imports and exports in packaged and bulk form. Shipping carries 95% of Canada's overseas trade but only 55% of its international trade, the rest being high value consumables and trade with the United States.

Marine transportation is the most efficient mode of transportation. It is environmentally sustainable and recyclable. Port and waterway development is now conducted in strict ecological accord and is the most important contributor to ecological improvement/restoration.

Shipping is controlled at the International Maritime Organization (IMO), a United Nations agency with 164 governments represented. International shipping is highly regulated by many international conventions and standards, and enforced by port state control. Canada is a member of both the Pairs and Tokyo Memoranda of Understanding on Port State Control which is the enforcement mechanism for convention ships. Safety, construction, pollution prevention, carriage of dangerous goods, ship operation and safe carriage of cargoes, as well as crewing and certification, are all covered by international conventions emanating principally from the IMO. In Canada, international conventions were adopted through the Canada Shipping Act and enacted through port state control. Transport Canada, Marine Safety Division inspects 25% of foreign flagged ships entering Canada. This helps to keep a level playing field. The program is well recognized. The Federation's inspection service is one of the toughest and the best in the world. Canada sends inspectors to other parts of the world to train them.

The United Nations Convention on the Law of the Sea and other international laws protect the rights of free passage and establish standard instructions for designating ocean shipping lanes in conjunction with World Lighthouse Organization, Comité Maritime International and the International Hydrographic Bureau.

The Shipping Federation is a strong proponent of the Green Ship initiative. It opposes mistreatment of crews and safety violations. In our opinion, it pays to run a quality organization. A good quality ship makes money for owners and is better to operate.

Members of the Shipping Federation are neither systemic polluters nor are they operators of substandard ships. All foreign ships arriving in Canada are represented by an agent and most of them are Federation members. Sometimes they have to work with substandard owners and managers presenting ships that are less than ideal. Federation members are not condoning the practice by representing these owners. Members openly espouse good treatment of crews and the use of good quality ships.

The Shipping Federation is eager to keep routes open. It is interested in maximizing the use of assets but not at any cost. A primary objective of the Federation is to protect trade. With investments in the billions in ships just for Canadian service, ship owners are keen to stay in business, just as Canadians are keen to have jobs and buy imported goods. Efficient trade is important to competitiveness and direct transit with minimal port time and zero delay is the target.

Although the Federation is committed to maintaining international rights to trade and free passage, it recognizes the value of entering into arrangements with other users when needed and when the burden is shared, so we can all benefit from the ocean resource.

The Shipping Federation sees value in a concerted and planned approach to competing ocean uses rather than a piecemeal approach. A piecemeal approach is inefficient and a long-term vision is both desirable and needed. That means working at a national and multilateral level rather than having individual provinces or states each taking unilateral action.

There are various potential impacts of shipping and its interaction with the marine environment, including collision with marine mammals, noise and other disturbances for whales, introduction of unwanted aquatic species through ballast water, and chemical impacts of antifouling paints. These interactions are now recognized and highlighting awareness on the potential impacts of passing ships on whales has resulted in the elaboration of prevention practices in the Bay of Fundy and Gulf of Maine. The Federation supported the Canadian government and its application to the IMO for routing changes at the entrance of the Bay of Fundy to avoid the whales' territory.

Working with the folks at the Saguenay Marine Park, the Federation encourages that speed reductions and observation distances be practiced by commercial shipping, even though most are too slow to make even the minimum recommended speed.

The Shipping Federation was an early proponent of ballast water management some 16 years ago and it continues to update its strategies as new information emerges. Ballast water exchange is now targeted for phase-out in favour of technology treatment under the new IMO convention.

Federation representatives attended an IMO working group on the proposals to phase out the use of tributyltin in anti-fouling paints, and encouraged the Canadian delegation to adopt the phase-out plan (2003-2008). These are just some of the Federation's interactions with regulators in recent years.

There are impacts of shipping on other stakeholders. You might ask how it could be possible for a ship to run into an oilrig. It has happened and unfortunately, will probably happen again! Despite logic and safety measures, idiot proofing is required. Safety continues to be an integral part of conservation and strategic planning/zoning.

Interactions between ships and aquaculture facilities would be the same. It's important to avoid collisions. Positioning aquaculture facilities should take into consideration the proximity to shipping lanes. In addition, ships' ballast water can introduce harmful aquatic species. Ballast water discharges and risks to aquaculture are being addressed, although slowly.

Stakeholders can have various impacts on shipping. For some marine mammal areas, ships must reduce speed or incur deviations. Ships must deviate from their routes, implementing 500 m safety zones around oil and gas marine infrastructure. Ships incur limits on ballast water exchange in areas of aquaculture facilities. In conservation areas, ships incur deviations and limits on ballast water exchange.

Assessing the priorities is important. Ships provide an essential service - they have to sail somewhere. The impacts of shipping, including the risks, are temporary and reversible. Ships are flexible to a certain point; they can deviate from their route, slow down, and adjust their operations, for example, by refraining from ballast water exchange in certain areas.

Canada has used various tools for marine planning, such as enforcement (e.g., illegal discharges), notices to mariners (e.g., whales), notices to shipping, voluntary measures (e.g., speed reduction), guidelines (Transport Publications) (e.g., whales, ballast water), regulations (marine parks, MPAs), change of traffic lanes (IMO), and education.

The Federation has experience in marine use planning in Eastern Canada, including the Great Lakes user Group, St. Laurent Vision 2000, Saguenay Marine Park and Bay of Fundy right whale areas. Shipping has worked with the Saguenay Marine Park project and in the Bay of Fundy, through the Canadian Marine Advisory Council (CMAC), to protect the right whale.

The Federation has worked a lot with the Great Lakes user Group that involved 10 government agencies. The U.S. Coast Guard set up the Great Lakes Waterways Management forum that took on ballast water issues in the 1980s. This was the first time the Shipping Federation had an agenda on environmental initiatives. Now the Federation deals with marine mammals, oil and gas infrastructure, aquaculture, prevention of the spread of aquatic invasive species and the development of conservation areas.

The Federation was involved in the St. Laurent Vision 2000. The St. Laurent Waterways International Joint Commission dealt with boundary water issues, water levels of lakes, impacts of hydro and navigation, riparian interests and wetlands protection and conservation. In 1997-1998 a project was undertaken to increase the draft on the St. Laurent Seaway by a foot. It was a six million dollar project. Three years later, it was a nine million dollar project because 50% of project costs went to the environmental assessment (EA) process. This was unacceptable. The Commission then established a process to do EA more cost-effectively and rapidly.

The lessons learned from the Federation's involvement in marine planning are that there are many advantages to having a central forum with two levels of government and all stakeholders, such as better monitoring of issues, early intervention when problems arise, transparency and creative solutions. The Federation's experience in marine planning shows that we need to educate seafarers. Education is the best tool. The ballast water initiatives showed that if you explain and educate appropriately, you will have an instant collaborator.

What does the Federation think about ocean zoning? Ocean zoning can succeed from a shipping and navigational point of view. We need to maintain rights to navigate freely but not everywhere. We need to take advantage of shipping's flexibility and provide ships with corridors that avoid deviations and delays, and accommodate growing traffic. We need to find the best zones for navigation, and we will cooperate. Can we use an existing forum? I would suggest that CMAC is a forum for multi-level collaboration since it already solicits national and regional cooperation.

TIM HALL (Oceans and Coastal Management Division, Fisheries and Oceans Canada)

One of the reinforcements for me coming from yesterday, is the need for clarity of language. Many of us have different perspectives on the meaning of terms such as zoning and integrated management, and when we embark on a process, it is vital that all participants have a very clear understanding of that process and its expected outcomes, regardless of the label attached to it.

As we have heard, there have been some very successful approaches to spatial planning in the marine environment. The Great Barrier Reef Marine Park and Florida Keys Marine Sanctuary provide excellent lessons and practical advice for those of us embarking on various projects. Lessons learned from public land management experiences also provide us with valuable lessons.

Recent workshops such as in Belgium and the Gulf of Maine Council on the Marine Environment in Boston have explored various approaches. The recently released U.S. Commission on Oceans Policy's Preliminary Report calls for the creation of a coordinated offshore management regime that would address impacts of multiple use, in the context of Large Marine Ecosystems.

DFO's national Policy and Operational Framework for Integrated Management support Canada's approach to spatial planning. Based on Canada's Oceans Act and Strategy, this framework is being operationalized through the ESSIM Initiative, an objectives-based, integrated management framework at the Large Ocean Management Area (LOMA) scale, similar to the Large Marine Ecosystem concept.

This framework requires that both ecosystem and human-use such as socioeconomic and cultural objectives are set and met at the appropriate spatial scale (i.e. LOMA or sub-LOMA). This allows for planning and management to occur at the appropriate geographic scale within the LOMA.

The Oceans Act approach to spatial planning does not allow DFO to establish regulatory zones within a LOMA, except in the case of MPAs, such as the Gully. This will ensure that any proposal for spatial planning will be of a non-regulatory nature, and is being carried out in the context of integrated management, following the principles of the Oceans Act. However, other authorities could establish regulatory zones, as the result of this integrated management planning process.

Currently, spatial planning in Atlantic Canada consists of a patchwork of sector-based management zones, which have been established for a wide variety of purposes. Fisheries and Oil & Gas management zones, ocean dumping zones, Protected Areas, several coastal zones such as aquaculture leases and port anchorage areas, marine transportation management zones as well as many more informal zones, such as vessel transit and preferred fishing, cover much of the LOMA area.

It is widely recognized that this current sector-based approach is inadequate for planning and management within a LOMA. Conflicts between users arise, and ecosystem impacts arise from uncoordinated activities. These must be brought together and prioritized.

In the development of a Management plan for the LOMA under the Oceans Act, zoning will have to be developed in the context of agreed-upon management objectives (such as MEQ objectives) and applied in a balanced manner. As an objectives-based framework is developed, this will have to be integrated with existing sector-based zoning and management within the overall LOMA plan.

As management objectives for the LOMA plan are developed and agreed upon, they will similarly need to be implemented and monitored within the context of existing zones and regimes. This will require that we (a) recognize, incorporate and adapt existing management and planning zones; and

(b) identify, design and implement new tools such as zones, protocols or other mechanisms in the context of objectives-based management or to address specific intersectoral interactions.

Several of the speakers yesterday highlighted the increasing importance of data management. As part of the development of the objectives-based framework, a thorough knowledge and understanding of current spatial and temporal activities and ecosystem sensitivities within the planning area is essential. This is key for risk management and decision support. Within DFO, this knowledge is used for environmental impact assessments of proposed activities and developments.

In conclusion, we are following the path of objectives-based management on an ecosystem basis. We anticipate that when we reach the stage of the development of a Management plan for the ESSIM area we will have a suite of tools and responses that could include a variety of zones, provided they meet the objectives of all participants in the process.

TONY IAROCCI (South Atlantic Fisheries Management Council)

I moved to Florida because of regulation in New England. I moved to the Florida Keys to get away from that and now I'm part of the process. I went to the meetings but didn't want the traditional fishing grounds taken away. I was an outsider there but ended up representing the organized fishermen.

What have I learned about ocean zoning? Outsiders and non locals came to Florida to talk about values of zoning. I wasn't convinced but now I've been involved in the process in Florida and the Gulf of Maine. The key is that local people must be deeply involved in any zoning process from the earliest stage.

Sustainable use and environmental protection are common goals. We have to find the balance between environmental protection and economic well-being. You need more people skills than scientific facts and expertise when starting out. The reality is dealing with fishermen and users. You can't make decisions based on science alone; you have to balance science with local knowledge. You have to look at all activities that affect fishing, habitat, etc., or you'll end up with ocean dumping that defeats the whole purpose.

Ocean zoning is not new, there are lots of zones in New England: Roller closures, gear closures, proposed closed sites, etc. Everybody is at the table and you seeing everyone working together. The times are changing. I see that in the people I've talked to here. But people have kind of blended this in from the lessons learned.

Don't forget the mistakes. We have to do ocean management from a habitat perspective, with a bit of species by species. We need ecosystem zoning. Marine protected areas and zoning can work if they are done right and put in the right place. My advice is to utilize the knowledge of local people, be site-specific and keep it simple so the average person can understand it.

There is definitely a place for zoning in fisheries management and it doesn't have to be at the detriment of the fishing community. There are great people up here. Work with them. Be proactive. But I must stress the importance of involving fishermen.

SUSAN FARADY (Ocean Conservancy)

Can ocean zoning work? Yes, ocean zoning can work, and conservation groups such as the one I work for, the Ocean Conservancy, and our more than 100,000 members, see an urgent need for ocean use planning. From the conservation perspective, we see the need to act to decide where the growing array of existing and new ocean uses should, and should not, be sited, to protect sensitive habitats such as cold water corals, and to ensure all parts of a healthy ocean ecosystem are intact.

As an example of how we're doing right now, I refer you to the study the Ocean Conservancy did a few years ago, mapping and analyzing existing MPAs on the U.S. side of the Gulf of Maine. Results indicate what many here at this conference may already know; there are a lot of lines drawn in the ocean by different government authorities with the result being confusion and a lack of comprehensive protection for valuable and sensitive habitat.

As another example, we have a National Marine Sanctuary Act in the U.S. It sounds as though it should be highly protective and the law says a lot about protecting resources and ecological processes, but there is much variance in how the Act is applied at different sites, from the Florida Keys up to the Stellwagen Bank Sanctuary in New England, where the Sanctuary itself provides little protection to resources.

Ocean zoning needs to proceed by putting resource protection first as the goal since having resources available is necessary before being able to extract or otherwise use them. Our management approach needs to become precautionary as opposed to reactionary, and ocean zoning is a way to do this and provide some clear processes for users and protection to resources before it's too late. Ocean zoning needs to be based on scientific information and to include stakeholders in the decision-making process. Finally, the conservation community sees ocean zoning as an important means for all of us to become better stewards of our valuable yet vulnerable coasts and oceans. We look forward to continued progress on this effort in the U.S. and in the Gulf of Maine.

QUESTION SESSION FOR OCEAN SECTOR PERSPECTIVES PANELLISTS

Question

Much of my teaching is on how to work with communities in coastal areas. If a community group wanted to propose an area for conservation or manage a Bay area, and put in specific provisions for recreation, etc., is there a provision for this under the Oceans Act?

TIM HALL

DFO tries to support initiatives using provisions of the Oceans Act but also by bringing in other interests. DFO has tried in coastal areas to use existing organizations, be it community group or industry, and to support this using the Oceans Act. The coastal approach is somewhat different and we've tried to make it more a community-driven process. Whether a community could put in certain zones, would depend on the process and the activities. It would come at the end of the process. Offshore is different than coastal areas. Whether measures are regulatory or not depends on the situation.

Question

Yesterday we talked about science versus traditional community knowledge. What mechanisms work best to get scientists to listen to communities and to recognize the importance of local knowledge?

SUSAN FARADY

From my experience in New England, one example of bridging the gap is of initiatives of collaborative research. A lot of attention has been paid to the hostility between the scientific community and industry. A lot of money has gone into collaborative research that was designed together. There are a lot of questions about which questions should be answered, which fishermen should be involved and whether this process is meeting the public trust but overall it is a good idea. The larger issue is integrating science into the overall process and clearly defining the role of each of the stakeholders by hearing all perspectives. We must insert science and ecological knowledge into the entire process. This is what they are trying to do in Stellwagen Bank.

TONY IAROCCI

Trawlgate was an instance where the data used for scientific studies was flawed because of mis-set nets and it was the trawlers that brought this to the attention of others. In Florida, industry was alienated. Fishermen said that if we are going to do this, we're going to look at spawning closures. If we are going to do this, we're going to do it right, extend the closures, put them where species really spawn. You can do this when it's site specific. It was industry that decided to do it right. You must involve key players at an early stage. If you know the area, you know who the players are. You also need both science and traditional ecological knowledge from the beginning.

Question

A concern with zoning is that the people I represent and the community I live in have only one thing going for them and that's the fishery. We feel that we are at the end of the power complex and everything you do is going to have some impact on our lives. The people who are going to suffer from this are those that have put nine generations of effort into the fishery. The threat lies in those who do not see the fishery as the economic backbone that keeps Shelburne County going. There's nothing else to do. We can't all be doctors or lawyers. Fishing is the backbone of coastal communities. Someone has to stay to provide the economic backbone of the community. I don't feel that what we are attempting to do with zoning is going to take us where we want to go as a fishing community. We cannot keep moving the kids out of coastal communities to do other things. Unlike the situation in Florida, Nova Scotia does not have large scale tourism - we only have

a small, aging fishing community. How can we tell people they aren't going to be driven from the water by someone who lives in Toronto?

TONY IAROCCI

I felt the same way about the Sanctuary in the Florida Keys and the zoning. I fought it tooth and nail until we decided to come to the table. I'm not talking no-take or fully protected. If done right, an MPA that encompasses a variety of levels of protection might not be detrimental to the community. For example, the protection of spawning areas may be beneficial. Industry has to be there early to deal with scientists and take it back to the community to tell people they have to be part of the process. It is imperative to the process that fishers are involved at an early stage. You need to tell your peers that this is coming and that they need to be ready. You also need all gear sectors represented. Closed areas don't need to be all no-take areas and don't have to be the end of the fishery. Billy Causey was able to mitigate some of the issues. World Wildlife Fund was able to mitigate some of this. It was by people working together. The key was getting to be a player.

Question

One advantage of zoning is that it is a visual way for people to recognize where diverse interests conflict and coincide. Zoning can help diffuse these conflicts. If we accept that one goal of zoning is the conservation of biodiversity and to protect overexploited resources, one approach has been a corridor or strip across the most important gradients that control biodiversity and productivity, for example, from the watershed to the shelf. To what extent can we use corridors to route pipelines, cables, shipping lanes and exclude extractive activities to preserve biodiversity? Could this be a win-win zoning solution?

IVAN LANTZ

Zoning is not just defining areas you need to protect; it's also defining areas to exploit. You need to define all of these. You can have a number of things going on in the same space. If you block out an area for only one purpose, we are destined to failure. If all industrial uses are in a corridor, this is not the best use of zoning. I don't see corridorizing uses as essential at this time. But these things happen naturally; the best route, the path of least resistance, is often the same for many interests. Natural corridors arise on their own. You have to look at all uses and areas, and say we have concerns in each area, we need to protect in these areas, and we need to manage this in this area. Ocean zoning does not need to be stable; it can be dynamic and it can be revised so as to re-open areas if you want.

PAUL KRAVIS

We also have classes of industry that are incompatible. The oil and gas industry doesn't want communications cables in their area. The rationale is if there was a break of one or another, trying to capture the pieces of each one would lead to breakage and cause major environmental disaster. We need to look at some of these issues at the industry level, not just ocean zoning.

TIM HALL

DFO has explored the potential of corridors as a solution and would rather focus on the impacts of specific activities that may be harmful, rather than one use.

TONY IAROCCI

You made a comment that a zone is made to be exploited. You can exploit some zones and have others protected. Corridors should be a consideration but to close off a corridor and put everything in as a no-take probably won't work. Corridors are made by industry.

SUSAN FARADY

It depends on what you are trying to achieve. Any zoning scheme must follow the objectives for what you are trying to accomplish. If you don't want to push activities into some areas, this might be an option. If a corridor is a way to protect habitat and control existing uses then it might be something that works but it depends on the intention. We're looking at hot spots to accommodate the conflicting uses.

Comment

The time element is not always thought of but we can also shift activities over time. We can apply dynamic area management. We can shift activities in the U.S. with the information we have. We can shift shipping routes or relocate gears based on information, for example, about whales. We can make area management more dynamic with buffer zones. Zones don't need to be set in stone.

PAUL KRAVIS

It is common to use fiber cables to connect to science monitoring devices. Cable installation permits can be hard to obtain. You need approval for province to province but it is easier to install subsea cables for the scientific community than for telecommunications or cell phone uses.

Question

Tony, you are basically supportive of the process in the Florida Keys National Marine Sanctuary. Are there people who are still unhappy? The Gully MPA in Nova Scotia has three zones; one with no activity and some with some fishing activity. Some fishermen's groups are always slamming DFO despite the fact that, in my opinion, the process has been reasonably fair. How do you judge whether the process is flawed or there is just opposition to impacts? How do you gauge when the opposition is being unreasonable?

TONY IAROCCI

You need to go to the source of the complaint. Where did the person's information come from? If the person has been participating in the process, this may indicate a real problem. If they complain about something they heard from an outside source, this might be a different story. Stakeholders need to stay involved. There is more credence to people who have come to all the meetings and sat in on the process. It's hard to deal with multi-stakeholder forums. It will take a lot of abuse and friendships will be affected.

Now, I can say I'm proud. The Sanctuary is in the right place and doing what we intended. The people are doing the follow up and going to the meetings. But there are still groups that are opposed. We will never make everyone happy. There are people who break the rules and try to get into the no-take zones. There is still a lot of confusion and so many jurisdictional areas. Some stakeholders haven't figured out who is doing what, when and where. I still get people who say, 'Look what the sanctuary did to me'. I tell them, it's the State Marine Fish Commission [Department of Fish and Wildlife], not the sanctuary.

BILLY CAUSEY

There is an economist with NOAA who has set up panels with different stakeholder groups. Interviews were conducted with these groups at different stages to find out what the gossip was and what the real concerns were. What people tell you anonymously and in a group setting can vary. Those are the things I have to be attuned to all the time. They started to hear that perceptions of what stakeholders thought was going to happen were not nearly as bad as they feared. But, in waterfront communities, there seems to be a need to complain about government.

TONY IAROCCI

I recall someone ranting and raving about how terrible the Sanctuary was and how he couldn't believe they closed the fishing area. After a diving trip, this same person commented on how he saw so many fish. He wanted to get in there and fish. Attitudes are changing but there is no way everyone will come to an agreement.

Question

What made you come back to the table?

TONY IAROCCI

I knew it was inevitable that this was going to happen and I didn't want anyone else sitting in my seat representing my interests. We came and became one of the biggest players. Billy Causey supported our input, they had to, because when they didn't, it didn't work. Also, the timing was right. It was time to work together and make it work right.

Question

For the Great Barrier Reef Marine Park, we had some people who recognized the time had come but others wouldn't come in. How do you build trust? Are there any principles? What do you do about the old bulls that just don't want to give up their fishing spots?

TONY IAROCCI

You're always going to have old bulls. I got death threats. There were people telling me that I didn't represent the industry, that I was getting paid by industry. You will always have a "just say no" element. You have to get the majority. You have to get the consensus. Consensus is when you have the backing of the majority of the right people. If you don't have the right people, then you don't move forward.

IVAN LANTZ

I prefer being part of the solution that is going to regulate me and know who is going to regulate me than part of the problem who will be regulated. I want to get in the way, not out of the way.

Question

There is a slow permitting process within DFO. Can zoning per se offer any solutions to permitting or is it independent of licensing and permitting?

PAUL KRAVIS

It depends where you are. For example, British Columbia probably has the slowest permitting process. In a particular case, one part of the process is held by one office and another part by another office. A properly filed permit should be turned around in 90 days unless we trigger CEAA [Canadian Environmental Assessment Act]. I'm not sure how zoning will affect this or help with this problem.

Question

People on this panel are effective at representing their own interests or the interests of their sectors. How do we move from a group of people who come to sit at the table towards decisions that are actually part of the public interest? How do we move beyond how everyone at the table benefits to where the public benefits?

TIM HALL

That is certainly one of the roles that government brings to the table. In Canada, the federal government has responsibility under the Oceans Act to bring a certain set of principles to the table, including the public good. We take responsibility for that by bringing those principles and obligations to the table.

IVAN LANTZ

We're learning to understand the concepts of planning and zoning. What we don't have clearly is a proponent or interest to move on this, to say we need zoning here. There are advocates for particular interests but there is no proponent for zoning in general. It usually takes this to start developing a process and dialogue around it. Then you get a forum and stakeholders. This is how stakeholders get involved. Without a proponent, you end up with a plan without a project.

TONY IAROCCI

Unless you convey your message right off the bat, you are not going to get the people you need at the table. You have to sell that all the way across to get it started and moving. Still, you will never get everyone at the table.

SUSAN FARADY

I think it depends on the context and the process you are involved in. The processes I am involved with are broken processes. They are hard and they are reactive. Most processes are driven by crises, not by a precautionary approach. We are in the midst of revamping and looking at the system we have to manage this public resource. We are still trying to make sense of roles of government. For the role of stewardship, different people are all over the map in their views. The public trust is going to be best served by having public stewardship and an engaged public.

PAUL KRAVIS

In terms of the cable industry, what is the place of the public? I think they are only interested when they can get money from rights to cross their property. We try to work with crown land so we don't have to deal with private landowners wanting money. Our public interest is to let the community know that high speed cables are in their area and mitigate those who want to profit from this.

Concurrent Interactive Discussion Session Overviews

THE ROLE OF SCIENCE IN OCEAN ZONING

Bruce G. Hatcher
Marine Affairs Program, Dalhousie University

Overview

The goal of this session was to shed some light on the appropriate balance among the various sciences that best contribute to decision support for ocean zoning, including the possible decision not to zone. It was accepted that zoning is a management tool intended to achieve clearly specified objectives including the reservation of access by certain groups of humans, the conservation of exploited marine resources, and the preservation of marine diversity. The challenge was to identify the minimum set of science knowledge necessary to start making decisions about zoning, and to list the science products essential to the decision support system envisioned for the Northwest Atlantic.

Discussion Points

Participants began the session by discussing the criticalness of applying science to marine areas. Communicating to the public and government was identified as an important process of science. A recurrent theme was the need to define zoning, and a plethora of definitions were discussed from 'Zoning is drawing lines' to 'Zoning is the manifestation of ecosystem-based management.' The group did not agree on a single definition.

Six main issues relating to the role of science in spatial planning in oceans were identified. Although many of these issues were not resolved, they may inform the process.

1) *Is the role of science to support decision-making or is science the vehicle for decision-making (to inform or to advocate)? Is the scientist the impartial advocate of decision-makers?* The group thought scientists should be objective suppliers of timely, relevant and focused information. However, scientists also need to speak out when there is uncertainty.

2) *Balance between natural and social sciences.* The group concluded that this issue is context-specific and generalizations cannot be made. There always needs to be both natural and social science.

3) *The dominance of science in decision-making systems in the ocean.* Science is an industry in itself and an expensive one. There is an arrogance and dominance of conventional science versus traditional and local ecological knowledge. Information from users or 'clients' is not seen as important. The group reinforced the general principle that it is essential to recognize the value of different types of knowledge.

4) *Measure what? What are the critical, essential science information requirements for zoning?* There is a long list of things. Scientific approaches that give us synoptic views, such as views in space and time, mapping the seabed and fishing intensity, are critically important to spatial-based management. The group recognized that contributions of technology, especially geomatics (e.g., GIS, satellites), are key to science's contribution (e.g., importance of mapping essential fish habitat).

5) *The role of ecosystem indicators. What are the objectives of zoning for humans and non-humans?* This question may force us to define the objectives of ecosystem-based management. The objectives of ecosystem-based management are the protection of biodiversity and the conservation of resources. Scientists need to focus more effort on the identification of indicators to capture emergent properties of marine ecosystems.

6) *Importance of geomatics for communications.* Geomatics offer a way to make science fun, accessible and useable for non-scientists.

LEARNING FROM THE AUSTRALIAN MANAGEMENT EXPERIENCE: LESSONS FOR ATLANTIC CANADA

Richard Kenchington
University of Wollongong

Overview

The Great Barrier Reef (GBR) experience applies to a large area and covers a wide range of purposes of use, entry and impact with the legal exception of extraction of petroleum and minerals. It uses a wide range of management tools that are applied to achieve outcomes in relation to specified operating principles or decision rules. The logic of the process is to know the area, to know the resource opportunities and constraints, to know the stakeholders, to develop operating principles/decision rules through a participatory process and to develop a plan to assess and amend in the might of performance against goals.

The intention of the discussion was to explore how elements of the GBR experience and process might contribute to addressing the issues of the Scotian Shelf. The session explored the process of creating an integrated coastal zoning plan, utilizing the components and process of the Australian coastal zoning experience to discuss and explore ideas in the local context of Eastern Canada. The intended outcome was that participants would be able to identify which elements of the GBR process are relevant and adaptable to the Scotian Shelf situation.

The discussion focused on two key components 1) identifying stakeholders, the issues they would want to identify in the planning process, their core interests, values, and decision rules or operating principles, and 2) building a vision for the coastal planning area.

Discussion Points

Participants were interested in learning about several aspects of the Australian experience in developing the Great Barrier Reef Marine Park Zoning Plan, including:

- What were the principles in policy establishment?
- How was coastal management of aquaculture incorporated?
- What was the weight of community input to the process?
- In terms of stakeholders, who decided who they were and how their objectives were set?
- How were the linkages between human use and the ecosystem represented?
- What were the impacts of implementing multi-resource coastal legislation?
- How did they prioritize conflicting value systems?
- How did they manage cultural change for pre-existing users that would be a result of the plan?

Ideas were clustered into two categories:

Principles	Integrated Principles
• Try to establish objectives	• Integrate coastal communities
• Principles in policy establishment	• Integrate stakeholders and reduce conflict
• Coastal management, aquaculture	• How to get fisheries integrated
• Identify the stakeholders and their issues	• Linkages between human use and the ecosystem
• Social and economic criteria	• Socioeconomic process
	• Community-led approaches for zoning
	• Temporal planning issues

Participants discussed an important initial step in the zoning process; identifying the stakeholders and the issues they would want to identify in the planning process. This would form a stakeholder framework with an integrated set of working principles. It was noted in the context of Eastern Canada, that the Eastern Scotian Shelf Integrated Management (ESSIM) process has produced an

ecosystem report, identified stakeholders and held meetings with stakeholders. Participants identified the following user/interest groups:

- Aquaculture
- Tourism
- Fisheries
- Oil & gas
- Coastal communities
- Shipping
- Submarine cables
- Conservation
- First Nations
- Government operations
- Academic research
- Naval operations
- Waste Disposal

Participants chose three groups upon which to focus their discussion: conservation organizations, government and fisheries. Core interests/values and decision rules (governance) or operating principles, including constraints, were identified for each of these sectors.

The core interests and values identified for conservation organizations, include:

- Sustainable resource harvest
- Sustainable community
- Ecosystem health and management
- Biodiversity
- Ecological integrity
- Social equity
- Identifying special elements
- Minimizing impacts
- Balancing human use/effects and nature
- Keeping user groups informed of the process
- Promoting education
- Ecosystem-based management
- Precautionary Approach

The main criteria for conservation groups were the definition of indicators.

Core interests/values for the government sector were identified as:

- Obligations to all users
- Recognition of interests
- Facilitator/regulator/stakeholder
- Jurisdictional limits to what government can do
- Legitimacy of decisions

The main criteria for government were jurisdiction and regulations that dictate what can or cannot be done.

Core interest/values for fisheries include:

- Access to grounds
- Maintaining habitat
- Security of tenure
- Financial viability
- Coastal access
- Sustainable resource
- Community integrity
- Social equity

Decision rules for fisheries included minimum benthic disturbance. Species At Risk legislation was given as an example of an operating principle.

Discussion then focused on an integrated coastal zoning plan. In response to a question regarding how socioeconomic values/principles were combined with conservation values in the Australian planning experience, Kenchington noted that they prepared strategic multi-use plans. In addition, a 25-year strategic vision that all stakeholders accepted was developed. This vision showed that in the long-term stakeholders had the same interests although they might be different in the short-term. The process began with the development of decision rules to establish views from different sectors. That process reached its limits and then launched the strategic planning process, in which zoning was used as a tool.

Discussion then focused on the local context of Eastern Canada, specifically the Scotian Shelf. It was noted that there is no vision for the Scotian Shelf. Participants created a list of issues they would like to see addressed in a vision statement for the Scotian Shelf. Issues were placed into three categories: state of the natural marine environment, actions that could occur within the area, and issues related to the connection between human communities and the environment (Table 1).

Table 1. Issues relevant to a vision statement for the Scotian Shelf

State of Marine Environment	Actions in Marine Environment	Human Communities' Connection to Marine Environment
Healthy ecosystem	Fishery	Healthy
Sustainable	Sustainable	Safety
Maintain biodiversity	Managed	Pride/Awareness
Robust	Multiple economic development	Sharing
Resilient	Research Over-arching management structure Restore Balanced approach Protection of heritage Spatially defined Allow new uses Measurable Sharing	

Based on these issues, the group formed a vision statement for the Scotian Shelf.

> The Scotian Shelf should be a robust, resilient, healthy, productive ecosystem that supports healthy coastal communities engaged in stewardship, proud and aware of the iconic Scotian Shelf ecosystem.

A discussion ensued regarding what would be the appropriate agency or overarching management structure. The necessity of having an appropriate institutional arrangement that supports effective, enforceable management was noted. The group discussed whether one agency or overarching structure would be appropriate, whether a Scotian Shelf Act similar to the Great Barrier Reef Marine Park Act would be appropriate or whether the Oceans Act would be adequate. The group did not reach a consensus on this issue.

ZONING IN THE GULF OF MAINE: WHERE DO WE GO FROM HERE?

Justin Huston
Coastal Zone Coordinator, Nova Scotia Department of Agriculture & Fisheries

Overview

The Gulf of Maine (GoM) is recognized as one of the most biologically productive marine environments in the world, but also as one of the most heavily utilized. Numerous jurisdictions (federal, state, provincial, municipal, and First Nation) have developed a multitude of management strategies to manage the many, and often conflicting, uses of the GoM.

Sector-based zoning in the GoM is implemented unilaterally by numerous regulatory departments/agencies, with limited input from other regulators, users, or stakeholders. While this zoning may (or may not) be successful in achieving its specific management objectives, the cumulative effect is a criss-crossing and overlapping of lines and jurisdictions, confusing and frustrating managers and users alike, ultimately undermining efforts toward an ecosystem approach to sustainable utilization of the GoM's resources.

The intention of this session was to address the question, How do we ensure that current and future zoning in the GoM achieves our collective management goals?

Key Issues

The session began with a general discussion about the issue of vocabulary and what is meant by the terms 'zone' and 'zoning'. It was noted that the use of the term 'zoning' in the literature refers to exclusive ocean space use such as leasing rights to areas. The term 'zoning' was thought to be a

restrictive word causing conflict and defensiveness by creating two classes, namely owners and outcasts. It was noted that fishermen's response to the term 'zone' was fear that they would be blocked out of certain zones. The need to find a term that promoted multiple ocean space use was noted. One participant proposed using the term 'ocean planning and management' rather than ocean zoning.

Participants of this session were interested in international oceans management in the GoM. The issue of joint management of the GoM between Canada and the U.S. was discussed. It was noted that there are few or no joint management initiatives, and that the political boundary is inhibiting to such initiatives. In addition, there is a lack of political willingness and political accountability. In short, there are no well defined priorities for how the GoM should be managed.

The Hague Line was seen as a major impediment to integrated management of the GoM because different management regimes and priorities on each side of the border would make integrated management difficult. Participants acknowledged that even if both Canada and the U.S. could manage the ecosystem using the same objectives, coming to agreements might be difficult. For example, oil and gas industry issues on separate sides of the Hague Line may create impediments to international management agreements. Another example of different management approaches that might prove problematic to joint management are the various legislation and policies for aquatic invasive species on each side of the border.

In addition to the political boundary, the group identified other key challenges to integrated management and multiple-use zoning in the GoM:

- Lack of resources or rather the allocation and coordination of resources. There is a lack of management resources, scientific resources for research, and human resources such as ecosystem scientists. As a result, there is little funding or capacity for ecosystem-based science.
- Different management approaches to fisheries and the oil and gas industry (e.g., the possible lifting of the oil and gas moratorium on Georges Bank in Canada).
- The full economic costs of commercial fishing are not always fully realized by industry (subsidies), and the full costs on the resource and ecosystem are not fully accounted for.
- Politics and the lack of an ocean ethic for the GoM. The group noted that public interest in the GoM isn't high and that the political constituency is often directed by industry. The political constraints are therefore not from the public but rather from industry (e.g., shipping, fisheries). Other areas in which integrated management has been successful, such as the Great Barrier Reef and the Florida Keys, have higher public interest. The GoM is not as iconic as these areas. Although much of the western part of the Gulf of Mexico is leased out for oil and gas industry exploration, Florida doesn't want oil and gas exploration in its part of the Gulf of Mexico so there is almost none in that area. Electoral votes in Florida keep the federal government from leasing areas beyond Florida's coastal limits. Differences in political frameworks between the states and provinces bordering the GoM and the lack of a unified ocean ethic for the GoM make a similar process difficult.
- Lack of coordination between academics, non-government organizations and other groups involved in GoM.

The group noted that the GoM requires integrated ocean management that will employ zoning, policy, stakeholder discussions and economics. There also needs to be a willingness among regulators to be flexible; to stand back, to determine if a management approach is working and to adjust the approach as necessary.

The group identified the need to find existing mechanisms that work functionally and successfully in terms of integrated management and to get agreement between two nations. Questions that arose include:

- How do we engage middle management and bring them onboard?
- How do we fully engage the GoM Council?
- Does the GoM Council have a mechanism that addresses all of these issues?
- What management issues is the Council not addressing regarding the GoM and bi-national issues?
- What can the GoM Council do to augment this work?
- What's the next easiest thing to do?

- What type of planning is there in the GoM at the large planning area scale and what can be done in Minas Basin? This will determine the communities that need to be engaged in the process.
- What mechanisms exist for cross-border coordination?

Discussion Points

- The people most affected by management plans should be involved in the process.
- Need a flexible approach to allow for evolution of management strategy.
- Municipalities and users should co-manage with those holding federal jurisdiction.
- You have to make issues important and sell it to the public. The public owns the GoM right now so it's the best time to be doing this. Waiting until it's private property is too late.
- Need a standard approach to map ecologically important habitat. There should be a layer that maps out what groups are doing work in GoM.
- Need a set of standardized practices and methodologies on how to do things, must be coordinated and standardized.
- Don't wait forever to get everyone's agreement before moving forward. The challenge after developing an approach is 1) to get agreement of all parties, and 2) to ensure that a product will be delivered at a certain time.
- Lines on a map scare people. People skills are almost more important than knowledge.
- Need a governance structure so people will know the rules of engagement. Set ground rules and objectives.
- We need to move away from sector by sector toward holistic integrated management approach.
- We need to build a constituency and get people involved.
- We need a literature review of natural and social sciences to build an inventory about classification and management of coastal issues for the Atlantic coast of Canada and the U.S.
- There should be a standard that has to be met with fisheries management.

The group identified the need to better understand how the GoM ecosystem functions. Toward this end, the need to assemble the people who have relevant information was identified.

It was noted that a pilot project within the GoM Council is moving toward gathering this information by taking a census of integrated management projects around the GoM and the various groups involved. Thus the GoM Council is convening people who have knowledge about the GoM ecosystem and how it works. Although this process is already happening in different parts of the GoM, the sharing of information is not standardized.

The group noted that the GoM Council, a multi-stakeholder group working toward sustainable use of the GoM, might be an appropriate forum to coordinate a cross-border integrated management approach in the GoM. Participants would task the Council with working toward integrated ocean management by:

- Operationalizing language and terms
- Educating the public on the value of the GoM's coastal and marine resources
- Playing a key role in bringing together key players/participants to discuss the role of governance, share information, etc.
- Developing a regional approach

The first step for the Council could be to promote discussion and produce a fact sheet about vocabulary and terminology used in management. This issue was thought to be important since some sectors have adopted different vocabulary for terms. The need for clear standardized terminology in an integrated management approach was emphasized.

The Council could also develop a discussion paper about uses, management priorities and practices, challenges and opportunities in the GoM (e.g., political boundaries, fisheries, oil and gas) as they relate to integrated management. Some background information about GoM Council history,

successes, challenges, and how to move forward in integrated ocean management would be valuable components of the document. Strengthening public awareness about the value of coastal and marine resources in the GoM would also be an important action.

Action item: Justin Huston will take recommendations/issues from this session to GoM Council, specifically the Habitat Conservation Sub-Committee. He will discuss what role the GoM Council has in integrated ocean management in the GoM.

SCALING, ASSESSMENT AND MANAGEMENT OF COASTAL ZONES AND MARINE PROTECTED AREAS WITHIN LARGE MARINE ECOSYSTEMS

Kenneth Sherman
Fisheries and Ecosystems, NOAA

Overview

Participants in this session addressed the utility of the Large Marine Ecosystem (LME) approach to marine assessment and management. The basic premise was that marine protected areas (MPAs) and reserves, and coastal management zones are fully compatible with the LME approach to the management of marine resources and marine environments. Thus, the focus of the session was on scaling and integrating, specifically in the context of MPAs and the coastal zone.

Discussion points

- A systematic approach to planning is needed but the approach shouldn't be called zoning; to only focus on zoning is to have too narrow a view and may be counterproductive. Zoning could be seen as a tool or technique for ecosystem-based management or integrated management. Instead of 'ocean zoning', we could say that we are trying to identify zones in oceans.
- Is the regional approach amenable to scaling up/down?
- The term 'scaling' is from the area of coastal zone management. In the U.S., there are 30 years of history of coastal zone management in a formal sense but we don't have this history in Canada.
- At what scale does management need to happen? Large Marine Ecosystems or Large Ocean Management Areas or smaller units? Zoning tends to happen as the need appears.

Key Issues

Participants discussed the multi-dimensional nature of scales for ecosystem-based management (community, regional, national, global) and the various gradations of scaling, such as

- Individual to community to state
- Single species to Large Ocean Management Areas (Canada) or Large Marine Ecosystems (International)

Participants reviewed the Canadian experience with ecosystem-based management. They began by compiling current examples of community involvement in oceans management (Table 2).

Table 2. Examples of community involvement in oceans management

Site	Scale	Characteristics/Issues
Eastport, Newfoundland & Labrador	Community	• Voluntary closures for lobster fishery • Release of egg-bearing females • Monitoring outside the protected areas is ongoing • Enforcement is less of an issue because there is buy-in by the fishermen • Has reduced conflict in the area • Seems to be enhancing lobsters on a small scale • In relation to larger lobster fishery, this is a very small area
Musquash, New Brunswick	Community	• "Area of Interest" for potential MPA under the Oceans Act • Would protect marsh area as well as an outer harbor area • Came out of a community level initiative • If established, most activities already underway will continue in this MPA (Status Quo) • Community may not have been completely happy with the boundaries of the MPA, but didn't want to speak out for fear of stalling the process • Still have not identified the objectives of the possible MPA
Gully MPA, Scotian Shelf	National	• Large submarine canyon • Initially identified/driven by academics, scientists and non-government organizations • Will be declared Canada's first Atlantic MPA under the Oceans Act in the near future • MPA will be approximately 2000 km^2 and will contain a core "no-take" area • Will protect Species at Risk (Northern Bottlenose Whales), areas of high productivity, cold-water corals
Haddock Box fisheries closure, Scotian Shelf	National	• Established under the Fisheries Act to protect juvenile Haddock • Closed to mobile gear since 1987, closed to fixed gear since 1993 • Total area of 13,000 km^2
Bras d'Or Lakes, Nova Scotia	Community	• Multi-stakeholder initiative, driven by First Nations • Recent initiative

The group noted that many initiatives were community-driven, at least in the initial stages (e.g., Eastport, Musquash, Bras d'Or Lakes), and that even larger scale initiatives (e.g., Gully) were also initially proposed by stakeholders.

Participants listed some challenges of community-based management in Canada:

- Community members often have a visceral response to management initiatives.
- There are no governance tools for municipalities; most tools are for federal and provincial governments.
- Jurisdiction in the coastal zone and oceans is confusing and complicated.
- Although the coastal/community scale might be smaller, the complexity often increases around inshore areas (e.g., Musquash) because there are more interests and jurisdictional issues than in the offshore (e.g., Gully).
- Most decisions are made by the federal government (e.g., Fisheries and Oceans Canada prepares stock assessments, makes the decision to open/close fisheries, sets quotas, etc.).
- Communities often do not have the resources or expertise to manage their own fisheries.
- There isn't always harmony within communities.

Participants discussed the factors that may aide community-based initiatives, including:

- If communities with broad-based support buy into the process, the relevant government agencies/departments will most likely follow as they are driven by what communities want.

- If we begin to view communities and the natural environment as related, we may see that this changes the views of communities and helps them to realize how resource use and the environment are linked.

The group discussed various challenges to ecosystem-based management in Canada, including legislative, public participation/stakeholder involvement and resource challenges.

Legislative Challenges

- The Oceans Act is still relatively new; managers, resource users and communities are still trying to figure out what the Act means on the ground.
- The Oceans Act contains good language but few regulations are outlined, and there is currently little implementation.
- We don't have consistent policies in Canada. Federal policies do not relate to provincial policies and vice versa.
- The Oceans Act fails in coastal areas. There is no comprehensive coastal zone management policy. There are bits and pieces of legislation here and there but nothing to hold it all together.
- Communities become frustrated because of the lack of consistency between different levels of government.

Public Participation/Stakeholder Involvement

- We do not have agreement between all resource users.
- There are still some important players missing at the table (e.g., Parks Canada, Canadian Wildlife Service, some gear sectors for fisheries).
- Downsizing in government agencies/departments means that both governments and communities do not have sufficient resources to do the education, outreach and stakeholder consultations necessary for ecosystem-based management.

Resources

- Government is saying it wants to move in a direction towards ecosystem-based management but it's not giving the resources needed to support this kind of activity.
- How can we find a way forward in ocean management if there are only limited resources to do so?
- Ecosystem-based management should have a strong base in science but the Canadian government has significantly cut back scientific research activities.
- The cost of enforcement in offshore areas is very high.
- There is a need for valuation studies to determine the goods and services provided by the ecosystem; humans do a poor job at valuing ecosystems.
- There is a need to make a better case for the socioeconomic benefits of an ecosystem-based approach.
- Provinces don't get money from the federal government to deal with coastal issues.
- We haven't yet quantified the economic benefits and liabilities of the consequences of action/inaction in oceans management.

The group noted that the lack of governance structures at the provincial level might explain why community-driven initiatives seem to work. Canada has good national policies but communities are missing the resources. At the provincial level, basic government policies and planning activities are missing. Not enough resources are devoted to make federal polices work. The Oceans Act proposes drawing lines in the water but there is a gap between communities and the federal level. Initiatives that work often start at a community or sectoral level and then gain support at federal or provincial levels. There is a need for government of all levels to be harmonized.

Participants discussed current work on ecosystem-based management in Canada and stated that Canada has:

- oceans policy (e.g., Oceans Strategy and an Oceans Action Plan),

- legislative authority (e.g., Oceans Act, Fisheries Act), and
- the beginnings of outreach (e.g., Eastern Scotian Shelf Integrated Management [ESSIM] Initiative).

There was some discussion about integrated oceans management in Canada. It was noted that the ecosystem approach is very fisheries oriented and comes out of fisheries literature, but doesn't have to be fisheries oriented. The group recognized the need to use integrated management but stated that it was more complicated than ecosystem-based management and cited ESSIM as an example.

Participants discussed multi-sectoral oceans management initiatives that have failed such as the Bonavista Bay National Marine Conservation Area (NMCA) (Newfoundland) and the Bay of Fundy NMCA (New Brunswick and Nova Scotia). The group highlighted some of the reasons why these initiatives failed. In particular it was noted that feasibility studies used a very top-down approach and that the idea of "Parks" was not well received in these areas. It was suggested that integrated management might be better accepted in these locations.

To conclude, the group discussed potential next steps for ecosystem-based management in Canada:

- There is a need for stronger linkages of science based assessments and governance.
- There is a need to have a long-term vision for ecosystem-based management.
- More effort must be put into making ecosystem-based management work, not just on paper but in reality.
- It is important to include human activities in ecosystem-based management.
- DFO must take the lead with implementing the Oceans Act but other government agencies must also be involved.
- There is a need for cross-sectoral communication and integration of science and traditional ecological knowledge into management plans.
- Management plans should be revisited on a regular basis (i.e., adaptive management) (e.g., Report Card Approach for indicators for the state of the ocean).
- Consultation, science and resources are all needed to identify and designate management areas.
- More effort should be put into socioeconomic studies that show the estimate of true costs and benefits of ocean and coastal zone management. Once a dollar value can be communicated to politicians and the local community, the problems appear more real.

MARINE PROTECTED AREA ENFORCEMENT: CHALLENGES AND SUCCESSES IN GAINING COMPLIANCE

Billy D. Causey
Superintendent, Florida Keys National Marine Sanctuary

Overview

Mr. Causey presented a case study of the Florida Keys National Marine Sanctuary (FKNMS) as an example of enforcement in a marine protected area (MPA) where the primary goal is compliance. The most effective means of ensuring compliance to legislation in MPAs is through public education and enlisting the help of user groups in management. This makes education and peer pressure important components of an enforcement initiative. When education and peer pressure do not work, which is true of a small percentage of MPA users, other more traditional enforcement tools must be utilized.

The FKNMS (9,850 km^2), established in 1990, is an excellent case study in enforcement and compliance protocols. Lessons learned can be applied to other MPAs, both inshore and offshore. Enforcement is an essential component in the management of MPAs and must be implemented as a management tool if use and access to specific areas changes upon habitat protection. To achieve success in attaining management goals, it is of primary importance that the general public knows and understands the rationale for restrictions on their activities, and that basic compliance is obtained.

It is critical that Sanctuary management policies, practices, and initiatives ensure that human activities in sanctuaries are compatible with long-term protection and conservation of Sanctuary

resources. This requires a commitment to implementing education programs and outreach campaigns, research and monitoring activities and enforcement of management restrictions.

Key Issues

There are enormous challenges to overcome in the enforcement of FKNMS regulations:

- No single point of entry
- Large geographic boundary
- Visitor access by air, land and sea
- Three million annual visitors
- Intense use of the marine environment
- Diverse languages
- Multiple extractive uses allowed
- Commercial and recreational use of the marine resources
- Lack of awareness as to the health of the marine environment
- Lack of understanding regarding habitat health and species richness
- Disseminating regulations to the Sanctuary users
- Interpreting the boundaries and purpose of marine zones

Sanctuary enforcement and gaining compliance is a continuous challenge and complete success is difficult, if not impossible to claim. Listed here are some successful approaches and tools for MPA managers to consider:

- Promoting public stewardship of the marine environment through interpretive enforcement efforts
- Seeking voluntary compliance through education
- Maintaining active relationships with citizen groups
- Conducting community outreach programs to educate user groups about regulations
- Involving citizens in reporting violations
- Working with Auxiliary Programs such as U.S. Coast Guard
- Strengthening partnerships with local, state and federal agencies
- Facilitating communication between agencies to avoid duplication of efforts
- Cross deputizing officers from different local, state and federal agencies to increase the efficiency and effectiveness of enforcement
- Standardizing training

Participants of this session compiled a list of activities that may occur in an area to be protected, and that should be considered when designing an enforcement plan. These uses/behavoiurs include:

- Diving (consumptive and non consumptive)
- Fishing
- Recreational boating
- Commercial boating
- Research
- Waste disposal
- Ocean dumping
- Shipping
- Bilge and ballast dumping
- Military use and blasting
- Oil and gas extraction
- Oil and gas exploration
- Marine infrastructure (wharf construction)
- Aquaculture
- Drug trafficking
- Cable laying
- Whale watching
- Sand and gravel mining
- Ocean dumping (dredging)
- Cruise ships

The group noted that an enforcement system should be designed to gain compliance through:

- Interpretive law enforcement (proactive)
- Education
- Outreach - Team Ocean, strictly information outreach, to sanctuary users, local businesses, dive shops, recreational boats, maintaining lines of communication and increasing public awareness of regulation
- Community policing
- Cooperation between jurisdictional agencies (community, Coast Guard, local sheriff's office, sanctuary squad, Fish and Wildlife Conservation Officers)
- Combination of resources

Participants then drafted a model for compliance and enforcement in MPAs, where the importance of different enforcement measures varies with the level of compliance (Figure 1).

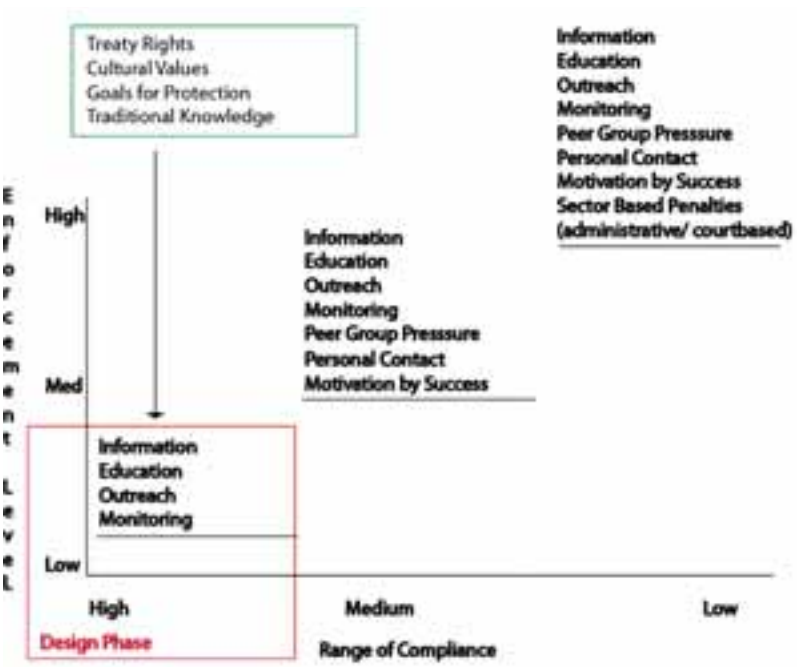


Figure 1. Draft model for compliance and enforcement in marine protected areas

The general process to inform a management plan should include:
- Motivation behind non-compliance for each sector (e.g., fishing, recreation, shipping, cruise ships, First Nations)
- Enforcement Compliance Model for each sector (e.g., range of tools, extent of use)
- Tools should be linked with legislative bodies and jurisdictional powers (e.g., international, national, state/provincial, sanctuary).

Discussion points

DESIGNING MANAGEMENT OBJECTIVES

- Do not create any rules in an MPA that you cannot enforce.
- Different enforcement tools will be successful in different situations so it is important not to overgeneralize. Initial understanding of the motivation behind compliance may be dependent on the sectors involved.
- There has to be equal treatment of all users in no access areas.
- Compliance and enforcement tools should be put into appropriate legislative and jurisdictional areas (i.e., international, national, state/provincial).

- It is important to design the rules with compliance in mind. The cheapest enforcement plan does not always work.
- Peer to peer explanations of conservation implications, the rules and why the rules have been established are effective at communicating information.
- Activities outside the protected boundary are out of the jurisdiction of the MPA. Through the Environmental Assessments of these activities, there are opportunities to develop mitigation processes and avoid chronic impacts.
- It is important to consider how the protected area arose - who wanted it and for what reasons. Do the reasons for the MPA designation play a major role in compliance? Was there engagement of stakeholders at the outset?
- Enforcement options depend on the particular focus. You can have people observing, use remote sensing techniques, flyovers (e.g., Coast Guard), and navigational checks (e.g., vessel monitoring systems, boat patrols, racon beacons). Satellite technology is available but not legal.
- The penalty must be high enough to dissuade repeat offences and to make compliance an easy choice (e.g., loss of license, seizure of catch, fine equal to value of catch).
- When collecting fines, the money could be spent on 1) restoration of the damage, 2) covering the response to the incidental, 3) a monitoring program to measure success of restoration, and 4) compensatory projects.
- Dumping of bilge and ballast water is a threat to MPAs/reserves. This is of particular concern for the Eastern Scotian Shelf Integrated Management process as U.S. restrictions are much more broad and are enforced. Boats tend to dump in Canada where compliance is voluntary. Shipping needs to be dealt with through the Canada Shipping Act and the International Maritime Organization. One way to address this is to create a Particularly Sensitive Sea Area (PSSA) or Area To Be Avoided (ATBA). If an area is designated as a PSSA it is on international nautical charts so the information is out there.

CHANGING ATTITUDES

- The words sanctuary, zone and MPA are controversial. People are afraid of who will be included and excluded and what type of enforcement there will be.
- To build confidence in the enforcement system, you need to build a network of people who know that if they call in about an enforcement/compliance issue they will get a response.
- There needs to be an attitudinal change within the research community; researchers must accept that science also has its boundaries and that there are restrictions depending on the risk of damage or harm from scientific research. The enforcement of research permitting and restrictions needs to be consistent because scientists need to know that they cannot get away with violating the rules. There is resistance to research restrictions within DFO.

GAINING COMPLIANCE

- Erosion of compliance occurs when a few people are gaining by non-compliance and there is a lack of incentive for others to maintain compliance. The key is to be very proactive and maintain a high level of information dissemination.
- Key issues in gaining compliance are proactive education and outreach at the very early stages so that everyone understands the reasons for the restrictions, and ensuring multiple use management.
- In the FKNMS, the most successful compliance is through community-based enforcement. Peer pressure is very effective in gaining compliance. After the expansion of the reserve, the dive shops complained about the lack of enforcement. Divers were enlisted to inform officers about violation of Sanctuary rules. They were given permission to let people know that they were in violation of the rules.
- It is important to have motivation by success. If people can see the results of a closure and those results are positively affecting them, they will be more inclined to comply. Monitoring is important.

FISHERIES SPECIFIC ENFORCEMENT CONSIDERATIONS

- As fisheries become more corporate and are prosecuted less and less by independent fishermen, problems with community enforcement and compliance arise. Peer groups only work on a certain scale, where there are diverse fishing interests and fishing is occurring where people can observe violations. To enforce compliance, the penalty must be commensurate with the violation. There have to be consequences that are extreme enough to discourage violation. A large stick has to be used.
- First Nations rights should be considered in the design of an MPA. It might not matter what enforcement rules you have because the native fishery could disregard these rules based on treaty rights. You can invite First Nations to the table at the outset but the protection of an area may not be a priority for them at that time.
- The key to gaining compliance in the protection of endangered species is temporal and spatial closures, and education and outreach (e.g., turtle nesting grounds).
- There needs to be a reversal in the burden of proof; the users should have to prove that their activity is not causing harm rather than the regulator having to prove how the activity could be harmful.
- Canada does not currently acknowledge the potential damage done by different gear types, although differentiations between long-lines and trawls have been made in the Northeast Channel Coral Conservation Area.

Participants discussed and summarized key recommendations and lessons learned from the FKNMS, many of which apply generally to all MPAs, from small inshore protected areas to large offshore sites.

1) In the designing of a protected area or marine zone where some activities will be restricted it is important to:

   a. make a complete list of the current and potential users,

   b. understand the behaviours that are not allowed within the zone, and

   c. design the enforcement regime accordingly so that all objectives of the area are protected through education and enforcement when necessary.

2) User groups should be involved in the initial planning stages and an understanding of what motivates rule violation should be obtained. The fear factor should be mitigated early on; a positive attitude towards protection of an area is the greatest success in reducing the amount of enforcement.

3) In general, approximately 80% of users will act in full compliance with the various restrictions and regulations surrounding a protected area or marine reserve. Fifteen percent are relatively indifferent but when approached and educated will then comply. Five percent do not act in compliance and will require good, well-funded enforcement. There are various levels of enforcement that are needed, from public education to prosecution.

4) Gaining compliance is much less expensive than enforcement. When enforcement is necessary, it must be consistent, accountable and the punishment must make it not worth violating the rules. The consequences of non-compliance must help gain compliance.

Workshop Assessment Panel

JAN SCHRIJVERS (Maritime Institute, University of Gent, Belgium)

Jan Schrijvers gave an overview of the issues being dealt with in Belgium regarding marine spatial planning, and the various interests involved. The big difference between marine issues in North America and Belgium is scale. The Belgian part of the North Sea is only 3000 km^2. All of the user groups in North America also occur in the North Sea but they are condensed in this small area with a high user intensity. Each year 300,000 ship movements link the English Channel with the southern part of the North Sea and three million tourists visit the coastline of about 65 km.

In this area of the North Sea, 'zoning' is replaced by 'spatial planning'. The Maritime Institute's project involves developing a spatial plan for this marine area. In general, the Belgian North Sea has been well managed but there are many challenges. There is intense pressure from the European Union to have greener energy (e.g., windmills), however, MPAs also need to be established and tourism needs to be considered. In addition, fisheries and sand extraction are industries that warrant attention.

To meet these challenges the Belgian Federal Science Policy Office has asked for a management plan. One of the issues that needs to be addressed in the search for a strategic vision for spatial planning at sea are the transnational and supranational level issues such as shipping and fisheries but also many other industries on an European level. This is similar to Canada's transnational issues with the U.S. and its transprovincial issues.

Acting as the devil's advocate, Schrijvers suggested that with such intense, dense use patterns, it might be interesting to think on a long-term basis. If green energy needs to be produced there should be no question of banning windmills from the sea. But also, if coastal fisheries only feed a social network without contributing to the gross national product, one might ask the question "Does Belgium really need traditional coastal fisheries in about 20-30 years down the road?" Before actually producing a plan, questions and issues surrounding the bigger picture need to be posed.

Schrijvers noted that Canada starts the discussion from a protection or exclusion framework vs. Belgium's need to protect pockets. It's important to start from the "we need MPAs" point of view. But that is just a start. We then need to project how these small pockets can actually be protected within the whole structure and how other users can still be allowed in the vicinity of these pockets. There are a lot of conflicts outside MPAs both in terms of overlap, competition and exclusion. Belgium's problem is not only a search for the establishment of MPAs but also of managing the sea beyond those MPAs. Issues such as opportunistic use of space and temporal closures of fisheries or extraction become more evident.

Belgium faces a big challenge to institutionalize public participation. How do you institutionalize public participation and involve stakeholders in planning? For example, when windmill farm planning in the coastal area was planned for, a single elderly lady with a North Sea view from her apartment was the factor in pushing the farm planning further offshore. The whole controversy could have been avoided if they had involved the public in the proposal to build the farm close to the coast.

A final remark was given regarding the task of science within the project. Schrijvers noted that mainly scientists are involved in the project but science lags behind while on the ministerial and policy level results are asked for. It is only by a rigid interaction between science and policy that the final plan can make a change.

TONY IAROCCI (South Atlantic Fisheries Management Council)

Iarocci commented that it was good to see a workshop bringing together a core group of NGO, government and industry representatives to discuss priority issues of ocean planning and management.

Recommendations

- Get a core group of individuals to work on this issue and bring it forward.
- Timing is key. Take your time and do it right.
- Key in on the big players. For example, let the oil & gas industry know what went on at this workshop.

- Use new blood (e.g., graduate students) to work on these issues.
- You can go over definitions forever; a spawning area closure can be an MPA and so can a coral area closure, or a Haddock box. Define and fine tune your terms.
- Prioritize and simplify both the positive and the negative aspects.
- Get the local media involved so that no stakeholder can say you're having a "secret zoning meeting". Get to The Navigator, The National Fisherman, etc. Get positive press. Put the negative stuff out there to get all the key players and address their concerns. You need to know you've heard from user groups.
- Address the concerns you have heard from the user groups.
- Remember to include the socioeconomics.

BILLY CAUSEY (Florida Keys National Marine Sanctuary)

Key points

Causey expressed his excitement that so many young people were present at the workshop and that much attention is being focused on ocean planning and management issues around the globe.

Causey briefly reviewed and commented on several themes presented at the workshop. He noted that Hance Smith highlighted various uses that are occurring and that will continue to occur. He stated that human population and development are increasing, and there is increased pressure on ocean and coastal ecosystems. Causey emphasized the need for a balanced approach to deal with these pressures, and stated that zoning can be an effective method to deal with these issues.

Causey commented on Kenneth Sherman's statement that zoning is a confrontational term but noted that it will only be considered confrontational if originally described in that manner. John Duff said "Zoning is a misappropriation of property rights." Causey emphasized that this is only the case if you own the resource but oceans are a public trust, owned by everyone. The rights the public has to the ocean are for environmental protection and wise management.

Recommendations

- Be very clear when defining terms. Ocean zoning is a good term because it is a simple concept to identify with on land.
- The word 'ecosystem' is far more worth defining than 'zoning'.
- Recognize issues at local, regional, and global scales, and address these issues at different scales with different tools for different audiences.
- Use bigger spatial and temporal scales than we are accustomed to using.

RICHARD KENCHINGTON (University of Wollongong, Australia)

Key points

- Use and management of the Scotian Shelf is not uniform.
- Some uses are compatible and some are not. In Australia, Kenchington would do a zoning exercise to solve any conflicts.
- A zoning plan should achieve coordination of a mass of uncoordinated single sector zones.
- There is a need for Integrated Strategic Management to sustain the Scotian Shelf in the long term.
- There is a need to allocate sites in the context of conservation and sustainable use, with buffer zones, etc.
- The process of strategic planning is political. Participation in strategic planning can bring benefits but also risks. However, risk is reduced by trust and trust must be earned, especially for governments.
- In Australia, they had a fisherman who acted as a broker and went along the coast asking how to fix their problems. The fisherman built trust.

- Trust is built by working together. When you come to a boundary, you need to reach across that boundary. "It's about shaking hands across boundaries."
- "Those who can zone, won't regulate and those who can regulate, won't zone."
- Our generation has made its mistakes; a new generation can do better.

Recommendations

- Need a vision that captures the benefits of sustainable marine uses and builds trust. The vision should incorporate indicators of interest; does this reflect broader community acceptance?
- Consider social, economic, and environmental consequences of the process analytically.
- Explore partnerships with the industrial sector. Consider imaginative ways of engaging big industry (e.g., social dividends). For example, Shell and BP are trying to improve their public image through new policies that have them working with communities.
- Perhaps use 'multiple use planning' instead of 'zoning'.

QUESTIONS TO PANEL MEMBERS

Question

There is no one at the workshop representing oil and gas interests. Why is this?

COMMENT

Many attempts were made to have the oil and gas sector participate in the workshop. The steering committee invited a representative from the Canadian Association of Petroleum Producers to participate in the ocean sector perspectives panel, or to nominate someone. They declined to do both. We also invited someone from the Sable Offshore Energy Project to participate on the panel but they declined. News of the workshop was placed in an oil and gas industry newsletter. Contact was made with various individuals in the sector but not even one representative showed up. We did have participation from both the Canada Nova Scotia Offshore Petroleum Board and the Canada Newfoundland Offshore Petroleum Board but the lack of oil and gas industry representation was a big gap.

RICHARD KENCHINGTON

You should zone them out and see their response.

Comment

In terms of the media, we tried to get the media to attend and cover the event. It seems that the concept of this workshop was too abstract for them; perhaps they couldn't see the story.

BILLY CAUSEY

Education and outreach are not the same as media relations. You often only get media attention if there is a controversial issue. One of the lessons I have learned is that a dedicated person to do media is valuable to educating.

TONY IAROCCI

Lots of information came out of this workshop. Information will fill the void to get rid of the fear factor. Outreach is important. You need to educate the public about the outcomes of this meeting, whether in media or fisheries literature. It would be great to see zoning and ecosystem-based management on the front page. Let the public and fisheries managers know.

Question

There are benefits to planning in oceans and coastal zones but we need resources for science for rational discussion and an information base to make decisions. We haven't done a good job at educating politicians about this need. We need to challenge people to do it. We need to quantify monetary benefits, return on the economy, and tax dollar revenues from coastal and ocean planning. Maybe we need to quantify the economic importance of the oceans and show these numbers to politicians. Where does the research come from?

RICHARD KENCHINGTON

This is linked to the process of zoning as well. We need to move forward first and then get this information. Trust needs to be built, through the process. If you don't do this, we will lose the benefits of the Scotian Shelf. Then you go on to quantify those benefits. You don't need more information before moving further. We need targeted information to take the process further.

TONY IAROCCI

I heard about a voluntary lobster closure that is showing good results. Industry-driven lobster protection zones are a win-win situation. This should be out in the media. You already have lots of MPAs in Atlantic Canada, even if we don't call them this. There is conflict around terms like scallop closure, MPAs and zoning. These things can be supported by factions in industry but could be defused by getting information out there. You need to key in on funding at your next zoning meeting. Look at where do you go from here.

Question

What is the relationship between ocean zoning and MPAs? The terms MPA and zoning were sometimes used interchangeably at this conference. Do we need MPAs for zoning or zoning for MPAs?

BILLY CAUSEY AND RICHARD KENCHINGTON

Yes, we need both.

Question

Interpreted broadly, zoning addresses conflicts between gears. MPAs have more of a conservation purpose, whereas zoning has multiple purposes, including keeping sectors apart and resolving conflicts between industries.

BILLY CAUSEY

The Florida Keys National Marine Sanctuary is an MPA. We are using marine zoning to achieve conservation goals within the MPA, and to create jurisdictional boundaries within which you can zone. John Duff's presentation implied that the entire Exclusive Economic Zone is an MPA, in which we allow no discharge of pollutants, there are fishing regulations, etc. This dilutes the effect of the term for the public. It becomes looser when you don't have specific boundaries and this is when it can get misinterpreted. Five different zones are identified in our case: sanctuary, preserve, ecological reserve, etc. The two particular to us are sanctuary and preservation marine areas. Such terms exist in many areas of wildlife management. In our case, we didn't use the term 'zone' to describe what should be done in particular areas. The term 'zoning' spread fear. Use the term zoning but use it as a descriptor for what is being done.

JAN SCHRIJVERS

In Belgium, they will have little pockets of MPAs but still want zoning outside of MPAs, taking into account ecosystem-based management. In a New Zealand example, they are performing "effects-based management." You have sustainable use but within this you have rules about pollution, MPAs and effects-based management. It is important to think beyond MPAs. We need effects-based management in addition to ecosystem-based management.

TONY

Reserves have a whole other set of definitions. Don't get bogged down in definitions.

Steering Committee Workshop Synthesis

The steering committee faced many challenges as it planned the workshop Ocean Zoning: Can it Work in the Northwest Atlantic? These challenges included the following questions: What is to be the goal of the workshop? Who shall we invite? Who will sponsor the event? In the end, the process of organizing the workshop proved to be as much a learning experience as the workshop itself. This section is the steering committee's attempt to review key challenges faced while organizing the event and to synthesize workshop outcomes into recommendations for next steps of ocean planning and management on the Scotian Shelf.

ASSESSMENT OF THE WORKSHOP PLANNING PROCESS

The process of choosing a title and designing the workshop revealed important information about personal opinions on ocean zoning. Initially, the steering committee decided the workshop would be an active learning opportunity for participants with an engaging, hands-on format. Participants would actually develop a mock zoning scheme for an area on the Scotian Shelf by deciding on objectives for the planning area, the types of zones the area would have, the criteria to be used to divide the planning area into zones, and finally by drawing lines on a map and deciding which uses/activities would be permitted and prohibited in the area.

When the steering committee discussed this particular format with those outside the committee, however, it was met with a great deal of resistance. It was thought that if this format were used, people who did not attend the event would hear that certain individuals had gotten together and actually zoned an area of the Scotian Shelf, potentially resulting in fear and resentment. Following this, the committee contemplated using a hypothetical area, instead of a real one for the zoning exercise. However, this was thought to be too abstract for participants to grasp and there were some logistical obstacles. In the end, the committee decided on more of an academic synthesis format for the workshop.

What did we learn about ocean zoning in the process of organizing the workshop? One of the most obvious things was that the term "ocean zoning" caused fear and confusion and has many varied interpretations. Although we may have disagreed as a committee on the details, most committee members shared the view of ocean zoning as being spatial or area-based planning of the ocean. The committee soon discovered that the word "zoning" was an impediment throughout the process of organizing the workshop.

For example, when the committee approached Fisheries and Oceans Canada (DFO) to invite its sponsorship of the workshop, we were told that the federal government had reservations about the rather strong focus that the workshop placed on zoning as the recommended method for planning. The federal government felt that at this point in the development of ocean planning and management, it would prefer to keep its options open. It was also obvious that there was some resistance within DFO towards the use of the term "ocean zoning"; DFO prefers "spatial planning". An immediate focus on zoning as the approach to use was thought to be somewhat prescriptive, potentially closing out other options. Fisheries and Oceans Canada offered its support of the workshop if certain conditions were met: 1) the term "ocean zoning" was not used in the title of the workshop, and 2) preparatory materials and the format of the workshop were designed to indicate that zoning was one of several methods that could be used in ocean planning and management. In the end, the steering committee decided to proceed with the workshop without the support of DFO.

While trying to promote media coverage of the workshop, initial discussions with reporters were optimistic. However, the concept of ocean zoning seemed too abstract for the media to grasp, and in the end, no media coverage occurred.

Although many attempts were made to elicit broad representation at the workshop, there were some obvious gaps in participation. A notable example was the absence of oil and gas industry participation at the event. The steering committee made several attempts to elicit participation from the industry. The committee wonders if this industry would have participated in the workshop if the federal government, instead of a non-government environmental organization, had taken the lead in organizing the event. As well, the event took on a more academic format than originally envisioned and this may have made it more attractive to a university rather than an industry audience.

KEY OUTCOMES OF THE WORKSHOP

As members of the steering committee met to discuss this synthesis, the predominance of personal biases and expectations in the interpretation of workshop outcomes was obvious. In addition, clustering in breakout groups may have led to some degree of bias in discussion outcomes. For example, most of the participants in the "Role of Science" breakout group were natural scientists. Among their points of discussion was whether the role of science is to inform or to advocate. The group concluded that scientists should be objective suppliers of timely, relevant and focused information but that they also need to speak out when there is uncertainty. A group comprised mainly of policy makers and/or industry representatives may not have had a similar response to the same question. Thus breakout group composition and dynamics likely influenced discussion outcomes.

Despite potential biases and differences in opinion, the steering committee believes the following captures the key themes/outcomes of the workshop.

Zoning of ocean space is broadly recognized as a logical progression from the terrestrial management strategy of owning and zoning (e.g., regional land use planning). However, there exist fundamental differences between land and ocean that modify the transfer of zoning policy and practice from land to sea. To date, the majority of zoning in the ocean has occurred within MPAs, with the primary goal of environmental protection. In comparison, most zoning on land is done for the public regulation of land use activities.

Ocean zoning is being done in many parts of the world and is a proven strategy for ocean planning and management. It represents an appropriate spatial framework within which to control unrestricted ocean use; this is key to achieving ecosystem-based management and related ecosystem objectives. To protect the ecosystem, we need to consider eco-boundaries. For example, the DFO/Natural Resources Canada benthic habitat classification[1] exercise is one tool that could be used to draw ecosystem-based zones. Zoning, however, is not a total solution to ocean management problems and is best embedded in a comprehensive suite of strategies. Thus, there is a need to focus on zoning as a tool for ocean management, not an outcome. It is essential that Atlantic Canada gain knowledge from mistakes and lessons learned elsewhere, particularly regarding the process.

Throughout the workshop it became clear that there are no clearly defined criteria to use to optimize zoning. What criteria do you use to optimize zoning - protection of resources or the optimization of economics? Is zoning good for conservation, good for economic development (e.g., by providing tenure and property rights for ocean users), or simply a way of compromising?

Discussion at the workshop illustrated that there is a lot of confusion about what is meant by zoning and what is included in discussions of zoning. The differences in interpretations among stakeholders were evident at the workshop. Even those who were in agreement in opposing or in supporting zoning had varied responses and opinions about what zoning meant. Clarity of definition is important; there is a need to sort out the terminology issues (e.g., ocean zoning vs. spatial planning vs. multiple use management vs. ocean planning and management, etc.). What do these terms mean? What do they not mean? For what purposes should they be applied?

Since zoning will involve multiple-use and cross-sectoral management and will affect stakeholders, the process must directly involve all affected stakeholders, sectors and managers from the initial stages. Other jurisdictions, through trial and error, appear to have developed processes for effectively engaging all stakeholders and the public at the earliest possible juncture. We should learn from jurisdictions such as Florida or Australia. Developing ocean zoning/planning schemes directly with stakeholders is essential to achieve support and buy-in. Getting stakeholder support will also depend largely on how the vision of zoning is introduced.

Although ocean users in eastern Canada have unresolved questions about the concept of zoning, there is wide recognition that the current patchwork of sector-based management zones is inadequate for planning and management in Atlantic Canada. It was evident from the breakdown of workshop participants (41% government, 22% NGO, 19% academic, 8% students, 5% industry, 5% consultants), more than one fifth of whom (22%) were from DFO from several regions, that ocean zoning is recognized as an important management issue. Despite concerns about zoning that were voiced at the workshop, there was relatively widespread acceptance that zoning could, and likely should, play a role in ecosystem-based management on the Scotian Shelf. There was recognition that we need to seriously consider zoning as a management tool.

[1] *Arbour, J. 2004. Proceedings of a Benthic Habitat Classification Workshop. Meeting of the Maritimes Regional Advisory Process. Maintenance of the Diversity of Ecosystem Types: Benthic Classification and Usage Guidelines for the Scotia-Fundy Area of the Maritimes Region, CSAS Proceedings Series 2004/004. Accessible at http://www.mar.dfo-mpo.gc.ca/science/rap/internet/meetings2004.htm.*

NEEDS/NEXT STEPS

With the exception of MPAs, the Oceans Act approach to spatial planning does not allow DFO to establish regulatory zones within a Large Ocean Management Area (LOMA). Thus any proposal for spatial planning will be of a non-regulatory nature, carried out in the context of integrated management (IM), in accordance with the principles of the Oceans Act. Other jurisdictional authorities, however, can establish regulatory zones, as the result of the IM planning process. Given the constraints of the Oceans Act, there is a need for discussion on the merits of voluntary, non-regulatory-based zoning within Oceans Act LOMAs vs. regulatory-based zoning under existing sectoral legislation but through a DFO-led IM process.

Ocean zoning is complicated by complex and often overlapping federal and provincial legal/jurisdictional issues. It is unclear what this means in reality, in terms of limitations and constraints to zoning. First Nations' offshore land claims and potential future impacts on zoning schemes and the ability to zone are uncertain. Thus further research on the legal and jurisdictional implications of ocean zoning should be undertaken.

There is a need to look at scale issues. For example, what are the similarities and differences between zoning on the Great Barrier Reef, Australia and in Soufrière, St. Lucia or Eastport, Newfoundland? Which approaches work for all scales and which are particular to specific scales (e.g., community-based management approaches)? Models for successful zoning elsewhere are not necessarily transferable.

There is an overwhelming need to consider why some people are reluctant to even engage in a discussion of zoning, and why, in particular, would the federal government, which is responsible for ocean use management and conservation, not support a workshop exploring the zoning concept. In order to move forward, DFO needs to clarify its position on zoning/spatial planning.

The steering committee recommends the following next steps:

- Identify costs and benefits of zoning in a Canadian context.
- Design and conduct research on ocean zoning effectiveness, for example:
  - Identify a suite of indicators to evaluate zoning. This includes a suite of indicators for regulatory zones within MPAs and 'generic indicators' for larger scale, non-regulatory zones.
- Map ecosystem components, existing sectoral zones and intensity of human uses on the Scotian Shelf.
- Undertake spatial planning analysis and modelling of zoning options as part of a coordinated geomatic evaluation. Identification of data and information requirements, and their subsequent collection (if not already available) and access are essential pre-requisites to undertake the analysis and modelling.
- Learn from other jurisdictions, such as Florida or Australia, that have developed processes for effectively engaging all stakeholders.

RECOMMENDATIONS

- Assign levels of risk associated with ocean use activities based on robustness/vulnerabilities of impacted areas before developing a zoning scheme.
- Understand the ecology of the region before zoning (i.e., identify ecoboundaries at various scales so that any subsequent damage can be evaluated in an objective manner).
- Consider socioeconomic, not just biophysical, factors as part of an evaluation process prior to zoning. Many organizations, including The Ocean Management Research Network, have a role in this process in identifying and evaluating important socioeconomic factors.
- Coordinate data acquisition to ensure that data only need be collected once and can be used for multiple purposes. All data should be managed within a national infrastructure (i.e., the Canada Geospatial Data Infrastructure) to ensure standards, accessibility, storage, etc.
- Promote zoning as a management tool in decision support systems for protecting biodiversity and conservation, and for avoiding user conflicts.

- Choose a pilot area, smaller than the Eastern Scotian Shelf, and zone it, either as a charette or as part of an established process.
- DFO should clearly state its position on zoning/spatial planning.

The Eastern Scotian Shelf Integrated Management (ESSIM) Initiative can be used for future work on ocean zoning. Although spatial planning is already identified in ESSIM's Strategic Planning Framework as one of the tools that could be used in integrated ocean management of a LOMA, the steering committee proposes that zoning/spatial planning be integrated more directly into ESSIM's planning framework. Zoning should be tested via the ESSIM process in the context of adaptive management. Thus the committee makes the following recommendations:

- choose a short, understandable long-term vision statement for ESSIM;
- form a spatial planning subcommittee of ESSIM;
- provide different zoning options to ESSIM stakeholders for discussion; and,
- integrate DFO/Natural Resources Canada's benthic habitat classification work into ESSIM.

Appendix I: Workshop program

OCEAN ZONING: Can it Work in the Northwest Atlantic?

Sobey Conference Theatre, Saint Mary's University

Program

DAY 1
Monday, May 10, 2004

Session 1: Concepts of Zoning

8:00 Registration and Coffee

9:00 Welcome and Introduction

9:15 Keynote Presentation
Hance Smith, Cardiff University
Experiences in Sea Use Planning and the Context for Zoning

10:00 Sue Nichols, University of New Brunswick
Ocean Zoning: Is it so Different?

10:30 BREAK

11:00 Kenneth Sherman, NOAA Fisheries and Ecosystems
The Large Marine Ecosystem Approach to the Assessment and Management of Ocean Resources and Environment

11:30 Discussion

12:00 LUNCH

Session 2: Exploring the Concepts of Zoning

12:30 Concurrent Interactive Discussions

2:45 BREAK

Session 3: Practices of Zoning

3:15 Keynote Presentation
Richard Kenchington, University of Wollongong
Practical Aspects of Zoning and Their Application to the Great Barrier Reef Marine Park

4:00 Bill Causey, Florida Keys National Marine Sanctuary
Zoning the Florida Keys National Marine Sanctuary

4:30 Discussion

4:45 Reception and Poster Session

Program

DAY 2
Tuesday, May 11, 2004

Session 4: Zoning Perspectives

9:00 John Duff, University of Massachusetts
The Promise and Pitfalls of Ocean Planning and Management

9:35 Panel and Plenary: Ocean Sector Perspectives on Zoning

10:30 BREAK

11:00 Ocean Sector Perspectives on Zoning Discussion

12:00 LUNCH

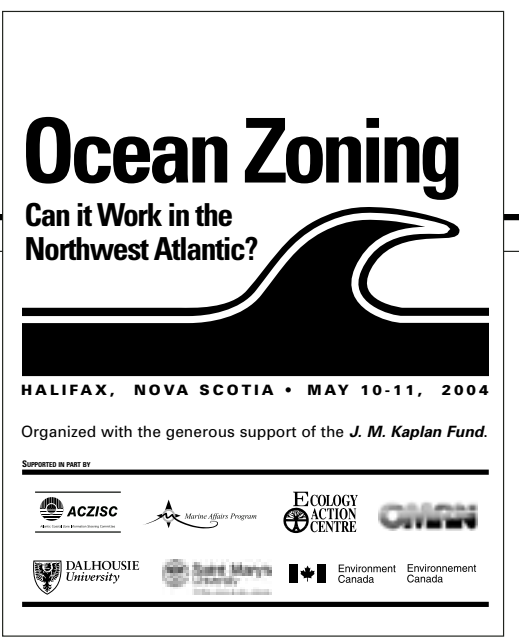
Session 5: Exploring the Concepts of Zoning (cont'd)

12:30 Concurrent Interactive Discussions

2:30 BREAK

3:00 Workshop Synthesis and Assessment
- Reports from concurrent interactive discussions
- Workshop assessments from panel
- Open discussion

5:00 Closing remarks



Appendix II: Poster abstracts

MARINE AND COASTAL PROTECTED AREAS IN THE U.S. GULF OF MAINE REGION

Dr. Cheri Recchia and Susan Farady[1], Esq.

The Ocean Conservancy mapped and evaluated the marine and coastal protected areas in the U.S. Gulf of Maine region. Over 300 sites in the U.S. portion of the Gulf, its coastal drainage area, and Georges Bank were analyzed. The full-color poster and accompanying report illustrates the results and recommends several actions.

The protected areas were analyzed in three ways to indirectly evaluate how effectively the sites conserve marine species, habitats and ecological processes. First, protected areas with marine components were evaluated against the Protected Area Management Categories developed by IUCN - The World Conservation Union. Second, the areas were assessed for measures implemented within to limit or prohibit specific activities (such as alteration of shorelines and coastal habitats, non-renewable resource development and disturbance of benthic habitats). Finally, sites were rated for their value in long-term conservation of marine biodiversity using a scoring system based on permanence of designation, size, and type, level and seasonality of protections provided.

All three analyses demonstrated that existing marine and coastal protected areas provide some important protections for endangered species and reduce the impacts of human activities on species and habitats. However, very few sites are designed or managed to provide comprehensive, lasting protection to the full range of marine species and habitats. The strongest protections are concentrated in small, scattered coastal sites, and the vast majority of Gulf of Maine waters lack protected areas of any kind.

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PROGRESS IN COMMUNITY-BASED MARINE ZONING – CASE STUDY: FOLKESTONE PARK AND MARINE RESERVE, BARBADOS

Rosaline R. Canessa[1], Travis Sinckler[2] and Jeff Green[3]

Folkestone Park and Marine Reserve, Barbados was established in 1980 as a sanctuary for marine life, and to provide economic growth in the community, educational opportunities and recreational facilities. To meet this aim, a zoning scheme was established in 1981 comprising a scientific zone, two water sports zones and a recreational zone. Although the establishment of the reserve in 1980 was a major accomplishment, management and protection of the reserve in the intervening years have failed to meet its objective relative to marine conservation, and have instead favoured the promotion of recreational enterprises.

To address the shortcomings of the Folkestone Marine Reserve and to attain some benefits of marine protected areas, a proactive and participatory management approach was embarked upon to evaluate and, if necessary, re-define the boundaries and zoning of the marine reserve within the broadened concept of a Folkestone Marine Management Area. The multi-stakeholder Round Table made interim recommendations to extend the boundaries, increase the area protected from harvesting activities and resource extraction, and include multiple use areas and a broader range of zones. Although the Round Table is not complete, progress to date points to the strengths of community involvement in evaluating and re-designing a marine zoning plan.

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A FRAMEWORK FOR REGIONAL MARINE PROTECTED AREAS PLANNING IN THE GREATER GULF OF MAINE AND SCOTIAN SHELF

Robert Rangeley, John Crawford, John Roff, Jennifer Smith[1], Hussein Alidina, Marty King, Ken Larade, Josh Laughren, Sarah Clark Stuart, Tracy Horsman, Anthony Chatwin

The pace of industrial development has exceeded the implementation of conservation measures in the greater Gulf of Maine and Scotian Shelf region and has resulted in a highly disturbed ecosystem. There is a clear need to implement more effective conservation measures before options for conservation are foreclosed. World Wildlife Fund Canada and the US-based Conservation Law Foundation are responding to this need by proposing a systematic approach to marine protected area (MPA) network planning and an initial set of Priority Areas for Conservation in this region. MPAs are an important tool for integrated management and should be a key component of any ocean zoning strategy.

Our contribution includes charting a framework for regional MPA network planning based on best practices from around the world; facilitating a discussion about places and values that deserve protection; identifying Priority Areas for Conservation where the ecological values, opportunities for conservation, and urgency of protection are greatest; and showing what a network of MPAs built on these Priority Areas might look like, all at a broad regional scale.

Our work thus far represents a step towards defining Priority Areas and an eventual network of MPAs. The draft maps presented here are based on a set of conservation values, targets, data and other sources of information that are subject to revision based on continued consultation with experts and stakeholders.

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Appendix III: Papers

EXPERIENCES IN SEA USE PLANNING AND THE CONTEXT FOR ZONING

Hance D. Smith
Marine and Coastal Environment Group
Cardiff University

Introduction

It is no exaggeration to say that, from historical and geographical points of view, the human use of the world ocean and its adjacent seas are at a critical juncture in several respects, measurable on a number of time scales. In terms of economic development, the most significant time scale is that of the 'long wave' or stage of 50-60 years which has been a marked factor in the industrialization of the global economy since the substantially British-based 'industrial revolution' between 1780 and 1830. At the present time the global economy is arguably experiencing a transition between two major stages involving, among other things, the decline of older production systems and investment in new technology and production systems.

Further than this, the North Atlantic/North American core region of the global economy, together with smaller scale isolated enclaves such as parts of the Pacific Rim, altogether encompassing approximately one-third of world population, may be regarded as fully developed industrially, a process which has taken some 250 years. The rest of the world remains at various stages of industrialization, a process which may well be complete in considerably less than the next 250 years, bearing in mind the substantial degree of integration within the global economy as a whole.

More profoundly, it is likely that the world is now moving out of the modern period defined in European historical terms as extending over the past half-millennium. In the present context the significance of this includes changes in the mindsets governing knowledge, culture and management pertaining to the marine environment. Of special importance is the emergence of multidisciplinary natural and social sciences applied to ocean management; a regionally multi-polar economic and political world; and a number of essentially long-term philosophical ideas including sustainable development, the precautionary principle and best practice options - the ultimate form of this range of ideas is perhaps not yet fully clear, but altogether represents the dawning in industrial society of the paramount need for balance between human activities and the environment - a rediscovery of an eternal truth well known in pre-industrial societies.

It is against this backdrop of ocean development that sea use planning and zoning must be set - a world of long-term outlooks and decision-making, employing in part, ideas which have been developed and applied on the land only in response to, and in tandem with, industrialization and its environmental, economic and social ramifications, roughly since the middle of the nineteenth century, but becoming much more established with the emergence of the modern state after the Second World War. Sea use planning as a term emerges in the 1970s, at the same time as the negotiations of the Third UN Conference on the Law of the Sea (UNCLOS III). As such it is one of several manifestations of the geographical extension of state control over the oceans - 'enclosure' of the sea. Compared to urban, and even rural land use planning, however, it was and remains a pale reflection of what happens on land. It is also in considerable measure different, not least because of the three-dimensional nature of the marine environment. A detailed description of its emergence is beyond the scope of this discussion, although it does involve applying the conceptual approach inherent in land use planning to a wide variety of activities. In practice it is concerned above all with spatial allocation of sea uses, but in a greater number of spatial dimensions compared to the land.

Zoning, by contrast, has a much longer and clearer history in the marine environment. In the present context it is useful to consider its history as co-terminus with the modern era in European history commencing in the second half of the fifteenth century. A notable early manifestation was the division of the world ocean in the Treaty of Tordisellas. More mundanely, much zoning into the past half-century was based on the delimitation of individual state control in the form of limits, mainly for the regulation of fisheries, and famously (in the case of the three-mile limit) based on the range of a cannon shot. Zoning may be practically defined as delimitation of sea areas for any specific use or set of uses.

In considering experiences of sea use planning and the context for zoning, a further preliminary consideration concerns organization and decision-making. Both functions are inter-related and carried out mainly, though not exclusively, by state organizations of various kinds, still mainly sectorally based

in economic terms, and still mainly, though not entirely for economic reasons. Therefore, after preliminary consideration of the development of the world ocean, there follows discussion of institutions and decision-making, before detailed evaluation of the development of zoning.

The Geography of Ocean Management

THE DEVELOPMENT OF THE WORLD OCEAN

Understanding the development of the world ocean involves appreciation of the historical and geographical patterns of sea uses; the basis of regional patterns flowing from this upon which management and planning is to be established; and the present regional status of sea use planning. Detailed historical and geographical patterns have been discussed elsewhere. For present purposes it is important to define fundamental sea use sectors (Figure 1), each of which have a substantial number of sub-categories. The fundamental characteristics of these categories derive from basic human purposes in the use of the marine environment, and are thus of both academic and practical significance. These have become increasingly developed during the industrialization of the world ocean which has occurred largely over the past 250 years.

Several types of stages in development have also been identified. In this discussion it is argued that the economic and technologically based 'long waves' or stages of 50-60 years in length are most significant in a sea use planning context. In order to be effective, investment in marine environmental management is likely to parallel these stages.

The development of the world ocean also exhibits clear geographical concentrations of activity (Figure 2). As well as the conventional and increasingly blurred distinction between the developed and developing worlds, there are some thirty regional foci of development in which much ocean and coastal uses are concentrated.

			SEA AND LAND									LAND ONLY	
			Transport	Strategic	Minerals & Energy	Living resources	Waste disposal	Leisure & recreation	Education & research	Conservation	Coastal engineering	Settlement	Manufacturing & Services
TECHNICAL MANAGEMENT	INFORMATION MANAGEMENT	Environmental Monitoring											
		Surveilance of uses											
		Information technology											
	INFORMATION ASSESSMENT	Environment											
		Technology											
		Economic											
		Sicial											
		Risk											
	PROFESSIONAL PRACTICE	Natural/social sciences											
		Surveying											
		Engineering											
		Accountancy											
		Planning											
		Law											
GENERAL MANAGEMENT	**Technical management co-ordination**												
	Organization management												
	Policy												
	Strategic planning												

Figure 1. Sea use matrix

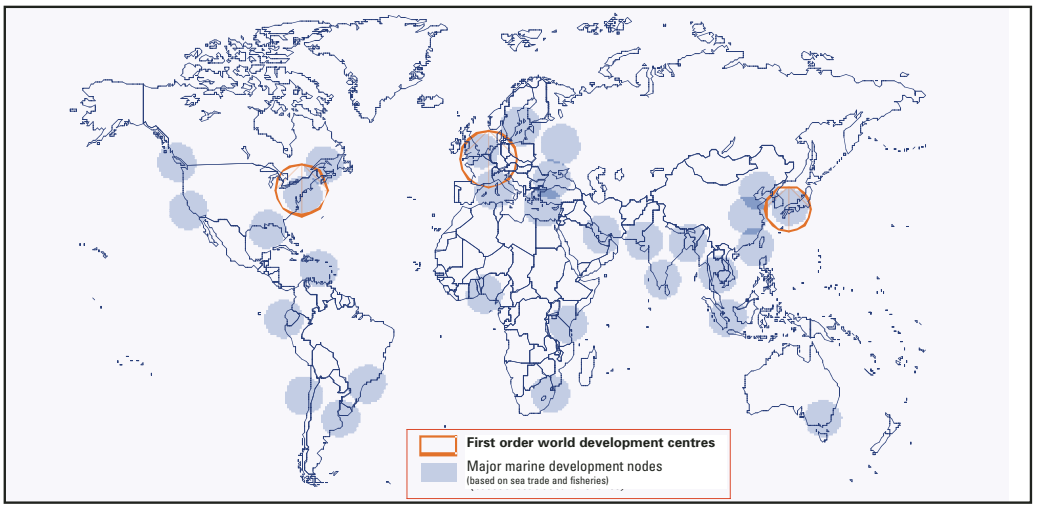

Figure 2. World development centres and nodes

The need for sea use planning is first of all a function of the intensity of multiple sea use patterns, largely within these regional concentrations of economic activity. Within each region there are three basic elements of use intensity. The first may be termed the 'urban sea' located predominantly in internal waters and the territorial sea adjacent to large urban settlements on land. The principal category of examples includes large port complexes and major inlets with multiple sea uses. These generally include navigation and port activity, waste disposal, coastal engineering, marine recreation and conservation. The second category of 'rural' seas includes most of the territorial sea and continental shelf waters adjacent to economically developed land areas. These regions are also intensively used, although the mix of uses is different, with emphasis on major shipping routes, naval exercise areas, offshore hydrocarbon and aggregate extraction, fisheries and aquaculture. Finally are the extensive 'wilderness' regions which are much less intensively used and cover nearly all of the ocean beyond the continental shelves as well as large expanses of coast and continental shelves. All of these regions have long-standing management arrangements in place, some of which are concerned with the spatial allocation function. A multiplicity of zoning arrangements are associated with these, especially - as already noted - with state jurisdictions generally, as well as shipping lanes, military exercise areas, offshore mineral extraction, fisheries and marine conservation.

A full-scale review of the regional status of sea use planning is beyond the scope of this paper. However, it should be noted that the status of sea use planning depends on the intensity of uses and related interactions with the environment; the overall technical and general management system already in place (Figure 1); and the stage of development of the management system, with particular reference to the human resources invested in it, reflected in the administration and data availability. Each of the regions highlighted in Figure 2 is unique in this respect.

INSTITUTIONS AND DECISION-MAKING

The cornerstone of ocean management remains the nation states, but management activities are widely spread, not only among governmental organizations at various scales, but also significantly - albeit to a limited degree - into the private and voluntary sectors. This section briefly considers the nature and geographical scale of operation of the organizations involved; their planning arrangements; and the fundamental nature of decision-making, all with particular reference to sea use planning.

The national state organizations commonly consist of several basic elements. One is central government. The majority of states have departments which are organized along a combination of economic sector basis and political tasks with respect to the sea. Only a few in which marine affairs are of high political priority have departments which are truly marine, with high level political representation within the government at cabinet level. A continuing discussion in sea use planning circles centres around the relative merits of the two approaches to maritime governance. A number of large states have a federal structure in which marine affairs organizations may be replicated to varying degrees at state level, which sometimes conflicts with federal level. Further, in the developed world at least, there also exists a large infrastructure of local government which plays a major role in land use planning, coastal engineering and coastal management generally.

Also to be noted is the substantial supra-national dimension, principally associated with the European Union, which has acquired considerable power and influence, notably in 'water column' affairs, including fisheries, waste management and pollution control, and conservation - the latter two principally in a coastal management context.

Finally are the international institutions. The principal groups are the global organizations of the United Nations system, notably the International Maritime Organization (IMO), the Fisheries Division of the Food and Agriculture Organization (FAO), the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the World Meteorological Organization (WMO) - all of which have full organization status; and the bodies and programmes of the UN Development Programme (UNDP) and the UN Environment Programme (UNEP) - notably the latter's Regional Seas Programme. A second group may be termed the regional organizations. These include development programmes associated with the UN system. There are also treaty organizations principally in the fields of fisheries and marine environmental protection, especially in the North Atlantic.

In a sea use management context, it is important to be aware of the geographical scale of operation of the organizations involved. Here there is a range of geographical scales, often primarily related to both organizational levels and legal jurisdictions. The three major categories are national, incorporating sub-national state and local levels already noted; supranational; and international. In the European example, local and national organizations are primarily responsible for seabed management; while international organizations are concerned with shipping and science; and the EU focuses upon fisheries, waste management and conservation.

A key element in sea use planning arrangements is the strategic plans which all these organizations may or may not possess. The scope of such plans relates primarily to the overall function of the organizations, and sea use planning considerations may or may not be important in this context. These plans are in turn based on sets of policy ideas.

A final dimension to consider is the nature of management functions. It is useful to distinguish between interactions between human activities and the environment on the one hand; and the purely human dimension of organizations, decision-making, policy and planning on the other. The nature of the first, technical management level; and the second, general management level, are summarised in Figure 1. Technical management is especially concerned with information acquisition and assessment and the professional practice which flows from this. General management is concerned above all with the co-ordination of technical management functions, organizations and decision-making, policy and planning.

Integration in sea use planning has several aspects. It includes first of all integration of the technical and general management levels in a functional sense; it is also concerned with notions of harmonisation of rules; co-ordination of decision-making; and organizational integration. All of these aspects have regional integration dimensions.

The Development of Zoning

INTRODUCTION

The development of zoning may be considered first in terms of overall state jurisdiction; followed by discussion of sea use sector zoning arrangements which are mainly, though not entirely public sector in nature, albeit for management of mainly private sector activities. There follows consideration of the contexts for zoning including factors which influence zoning decisions; the role of integration; and consideration of overall progress in regional terms.

STATE JURISDICTION

The nature and scope of state jurisdiction is of course well-known, and largely codified in the Law of the Sea Convention. The divisions of Internal Waters, the Territorial Sea, Contiguous Zones; Exclusive Economic and Exclusive Fisheries Zones; the High Seas and the International Seabed Area may be noted. In a sea use planning context it is worth noting a range of issues pertaining respectively to inshore waters, shelf seas, and the open ocean. It is also worth noting that at present perhaps only around one-quarter of the maritime boundaries between and among states have been formally delineated.

In inshore waters - roughly defined as coastal waters landward of the seaward limits of the Territorial Sea - a number of considerations are worth noting. These include identification and survey of the baselines from which the Territorial Sea boundaries are drawn, which has generally been done in the developed world at least. Defining the baseline identifies Internal Waters, which

often include substantial stretches of sea in estuaries and more open bights and gulfs, as well as archipelagic waters. These tend to be related to coastal configurations rather than sea use intensity. Where sea use is intensive there may be a case for either extending land use planning arrangements to cover Internal Waters, or developing similar sea use planning arrangements. There may even be cases where the baseline itself may require review and adjustment to reflect sea use intensity patterns and related planning arrangements.

In the shelf seas, national state jurisdiction is the norm for the seabed, particularly as regards Exclusive Economic Zone and Exclusive Fishery Zone arrangements and their extension beyond 200 miles. This particularly applies to licensing of mineral exploration and exploitation, and fixed installations on the seabed such as navigation aids and renewable energy installations. However, for water column uses such as fisheries, waste disposal and some conservation management, derogations from national state responsibility may be considerable. This is most notable in the European Union case. International arrangements as legally defined are also especially important in fields such as navigation, marine environmental protection and fisheries, especially in the developed world of the North Atlantic. It is in the shelf seas that true sea use planning systems are about to emerge - the Great Barrier Reef arrangements may be regarded as pioneering in this respect but further developments are in train, notably in Canada, Europe and Australia, and in parts at least of the United States.

In the open ocean beyond national state jurisdiction the arrangements enshrined in the Law of the Sea Convention and the Antarctic Treaty are well-known. What is important is assessment of the status of the fledgling international institutions charged with responsibilities in this area. Of special interest is the emerging and perhaps changing balance between institutions which form part of the United Nations system on the one hand, and regional indigenous organizations on the other, notably in the Pacific, Caribbean and South East Asia.

SEA USE SECTORS

The zoning arrangements for individual sea use sectors are considerably more extensive and complex than is often realised. The management circumstances which lie behind these are similarly diverse. A number of important aspects are outlined in the discussion immediately following, which is organized on the basis of the classification of uses in Figure 1.

In the field of shipping and port operations, zoning systems are of three kinds. First are arrangements operated by port authorities within defined port limits. Although not constituting formal sea use planning arrangements, these have de facto planning aspects in terms of shipping lanes, dredging and conservation areas, arrangements for maritime leisure activities and the like. Seaward of port limits are defined shipping lanes, mainly falling within the IMO ship routing provisions. Thirdly are marine environmental protection arrangements typified by IMO Special Areas, Particularly Sensitive Sea Areas, and UK proposals for Marine Environmental High Risk Areas, all of which acknowledge the need for conservation management allied to shipping activities.

In the military domain, of note are operational zoning arrangements for military patrols and wartime operations. Those formerly operated by NATO and the Warsaw Pact countries were of long standing; some may be classified. A second, more immediate category is the defined military exercise areas, including submarine exercise areas, and torpedo, rocket and firing ranges.

Mineral and energy exploration and development have arguably been the driving force behind parts of the Law of the Sea Convention itself, as well as providing the strongest incentive for many states to enclose their continental shelves. Continental shelf designations provide the framework for licensing of activities; a further dimension is the safety zones around offshore installations.

In the field of fisheries and aquaculture exist the oldest of zoning arrangements. In fisheries limits were almost universally defined in terms of distances from the shore - later formal Territorial Sea baselines - and these have been progressively extended seawards in the past half-century; the story need not be repeated here. Conventional limits have been supplemented by an increasing number of special boundaries, such as the offshore boxes defined in the European Union Common Fisheries Policy, generally brought into being for specific fisheries management arrangements. In aquaculture, where fixed installations inshore are the norm, quasi-planning arrangements have been brought in, for example, in the Highlands and Islands of Scotland.

Similarly in the field of marine leisure activities, inshore planning arrangements frequently exist, and are being expanded in response to often extreme pressures and conflicts of multiple use. These tend to be operated at the local government level within Internal Waters and Territorial Seas, especially in the vicinity of holiday beaches.

In the field of marine scientific research and related information acquisition, certain boundary arrangements are worth noting. These are primarily international within the UN system, related to fisheries data acquisition and the UNEP Regional Seas Programme, while the grids used by the International Council for the Exploration of the Sea (ICES) and the treaty fisheries organizations are also worthy of note.

In the field of waste disposal and related marine environmental protection, dumping grounds are often designated, although these are being phased out in some areas, such as North West European waters. More widely treaty marine environmental protection organizations in areas such as the North Atlantic and its adjacent seas operate within defined maritime boundaries.

Finally are boundaries in the marine conservation field. The best example remains the zoning system on the Great Barrier Reef, with its system of use priorities and related zones. It is worth noting that conservation is increasingly the main driver for large-scale sea use/marine spatial planning initiatives. This involves establishment of use priorities and categories of zoning superimposed on the palimpsest of zones outlined above, a process which has been scarcely begun, but which focuses attention on the need for integration, discussed further below. Meanwhile, many countries have a range of conservation designations with a considerable degree of complexity, notably within Europe, where the European Union is adding layers to these designations.

Context for Zoning

EXTERNAL FACTORS

Before moving on to explicit consideration of integration it is worth briefly considering the role of external factors which influence the processes of sea use planning. These include environmental, technological, economic, and social (including legal and political) factors. Also important are temporal and geographical combinations of these factors. These influences lie very largely outwith the influence of any planning system but sea use planning will have to cope with the consequences.

At the present time environmental factors summarised by the concept of global change have a high profile. Of particular concern are human modification of the ocean-atmosphere system and its likely deleterious consequences in the form of global warming, with its multifarious knock-on effects. Sea use planning considerations include the impacts of sea level change. Also important are short-term violent events such as earthquakes and volcanic eruptions and related tsunami.

In a technological context, sea use planning is emerging at a time of unprecedented development in information technology, just in time to provide the information acquisition and data base management which must underpin the whole operation. Beyond this we are passing through a key period of large-scale technological advance in all sea use sectors which have substantial implications. These changes are entwined with large scale global and regional economic developments which further complicate the processes of planning, and are undoubtedly related to long-term change patterns noted earlier in this paper.

In a broad social context, including legal and political aspects, the past thirty years have been historic, in the framing and implementation of the Law of the Sea Convention. However, the circumstances underlying the Convention are not static, and the Law of the Sea will continue to develop. Beyond this there is keen awareness of the role of the oceans in sustaining the human communities along the world's coasts. Sea use planning and management arrangements will have to take account of the sustainability or otherwise of these communities.

Finally to be noted are the temporal and spatial combinations of these factors. Of special note is the management of risk (Figure 1) allied to the concept of sustainability. In a sea use planning context neither means much unless the course of events is calibrated in time. In general, planning horizons have to be long - at least a human lifetime, or perhaps a 'long wave' stage may be realistically manageable in human terms. However, time scales involved for particular parts of the planning system may be either longer or shorter. Similarly it is the combinations of these factors which give shape to the real world of development regions highlighted in Figure 2; each is substantially unique in planning terms.

INTEGRATION

Sea use planning requires concepts and application which may be summed up by the term 'integration'. Aspects of this have already been noted above. Further themes in this context include appreciation of the basic aim of sea use planning; the practical basis involved; the use-environment system concept; technical measures and general measures respectively.

In applying zoning in sea use management and planning, the fundamental aim is to manage sea use/environment interactions. This requires understanding of the considerable complexity which is usually involved. The practical basis of this may be termed marine spatial or sea use planning. The planning and related zoning processes are primarily applied to the uses as classified in Figure 1. However, these processes also exist in relation to the marine environment itself, and further work is ongoing which will better define this relationship. Of note, for example, is the concept of marine landscapes (essentially ecological) which apply especially to shelf sea beds, as typified in the recent Irish Sea Pilot Study. Inshore ecosystems of estuaries and semi-enclosed waters are already well defined for the most part. Offshore, the Large Marine Ecosystem concept and its practical application are particularly significant.

In the management and planning of the use/environment system, zoning is an essential tool in conflict resolution, both among uses and in relation to the environment. Boundary conflicts among states (not least the Canada -U.S. dispute on the Atlantic coast) have a long history and probably a long-term future, but similar purely use-based conflicts are even more common. A second priority in which zoning is essential concerns conservation and related maintenance of biodiversity - the Great Barrier Reef already mentioned is a notable model, especially for the ecologically sensitive tropical world. Thirdly, zoning is an important tool for determination of spatial priorities necessary for a system which properly integrates human and environment interests.

In the area of technical management measures, there now exist sophisticated methodologies for practical boundary delimitation, spanning disciplines ranging from surveying to law. These can be allied to environmental monitoring, use surveillance and data management on a large scale. However, a major practical issue is often the cost involved, which lies beyond most countries outwith the developed world, broadly defined. Sea use planning systems are not cheap, and may be expected to spread slowly.

At the level of general management, a number of issues arise. These include assessment of the presence or absence of marine policy and strategic management plans by the major stakeholders; the role and practicability of enforcement measures; and financing of sea use planning and related zoning which need not fall entirely on government - indeed the private sector has to bear the costs of at least some of the arrangements involved, while the voluntary sector not infrequently supply the ideas.

AN ANALYSIS OF REGIONAL PROGRESS

As already noted, a detailed analysis of regional progress in sea u se planning and zoning lies beyond the scope of this paper. Nonetheless a few preliminary observations may be made with the assistance of the information contained in Figure 2. A very approximate analysis can distinguish between three groups of regions in terms of the degree of investment and sophistication in sea use management and related zoning activities.

The first of these may be termed the developed regions surrounding the North Atlantic and the Pacific Rim, including Western Europe, North America, Japan/South Korea and Australia/New Zealand. Here most countries have substantial maritime policies, often recently reviewed, and showing explicit awareness of sea use management and planning arrangements, sometimes at least matching the generally complex zoning arrangements already in place.

The second category of intermediate regions includes parts of the tropics - notably the Caribbean, parts of South East Asia, China and South Asia and the South West Pacific. In all of these, considerable progress is in train, often driven by initiatives originating in and actively supported by the developed regions above-mentioned.

In the rest of the world (i.e., the developing regions), there are minimal or non-existent arrangements, supported, if at all, through the UN system. This includes large swathes of the Latin American, African and South West Asian regional areas.

Conclusion

In conclusion, in this preliminary analysis, three themes may be highlighted.

First, is the necessity to be keenly aware of the processes of development of the world ocean and their regional implications. Of particular importance is assessment of the time scales of change in sea uses and environmental change, and estimation of the management resources needed to cope with these in the long-term, particularly at the level of the national state, which remains the cornerstone of the system, both economically and politically. Related to this is the development of a keen awareness of the supreme importance of overall sea use intensity as a basis for planning - it is this which helps to determine geographical priorities with the limited resources inevitably available. In this the Canadian approach of having an Oceans Act but concentrating initially on the eastern Scotian Shelf is a good example.

The second theme concerns organizations and decision-making. Here, although state institutions at local, national and international levels bear primary responsibility for sea use planning and zoning arrangements, there are likely to be some changes in the sectoral balance between public, private and voluntary sectors. In particular, the private sector has to bear some of the costs, perhaps directly on occasion, while the growth of participatory and partnership arrangements already evident in the coastal management field may be a good model for practical integration of public, private and voluntary sector decision-making. Allied to this is the need for strategic planning in large organizations in all three sectors, and the realisation of the importance of technical and general management approaches and co-ordination of these.

Finally, in the field of zoning itself, the continued importance of use sectoral zoning must be recognised as a practical tool in sea use planning, despite the need for integration. Meanwhile, this very need for integration can contribute towards awareness of common aims and objectives, and methods of implementation in the sea use management and planning process.

OCEAN ZONING - IS IT REALLY DIFFERENT?

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This paper looks at ocean zoning by reviewing some concepts of land use zoning. It examines these concepts in terms of ocean space and highlights some of the issues that may be involved.

Zoning Concepts from a Land Use Perspective

Zoning is a method of grouping classes of land uses together to achieve defined goals. It may be done after land use has occurred to direct future development or it may be done before land use occurs to ensure land uses meet land use planning objectives. Zoning has two major functions. Firstly, it helps to implement decisions about the spatial location of land use classes. Secondly, it helps to resolve conflicts about existing land uses. Zoning is based on spatial knowledge of:

a) resource potential,

b) current and projected uses, and

c) related attributes (e.g., transportation routes, property rights and values).

Do we know enough about the resource potential or potential uses of marine space to adequately define appropriate zones? It is an information intensive process and as new knowledge is acquired, any zoning scheme needs to be revisited. Zoning is not a static set of boundaries and rules.

Zoning may also be a formal process (e.g., municipal zoning under a Planning Bylaw) or it may be informal. Formal zoning can be

a) prescriptive (outlining what you can do), or

b) proscriptive (what you cannot do).

An example of informal zoning is the way in which economic principles lead to spatial distribution of land uses (see Figure 1).

Figure 1. Grouping of land uses by decreasing economic benefits

So, for instance, urban centres (even without formal zoning) attract high density commercial use while one family residential use occurs in the suburbs. Few households can afford the high land costs in the urban centre where land prices are usually dictated by the concept of highest and best use of the land. Such informal zoning can be seen in marine spaces where uses, such as recreation, focus on areas that are accessible and have specific features (e.g., beaches or marinas).

Some of the benefits of zoning include (Larsson 1997)[2]:

a) protection of the public good;

b) co-ordination and rationalization of activities;

c) protection of weaker interests;

d) prevention and resolution of conflicts; and

e) facilitation of long term planning and management.

Regulation through zoning is not the only 'constitutional' power that the state holds to achieve these objectives. The state can also acquire the property rights to land (e.g., expropriation or through gift). This, in effect, is what may happen in many marine protected areas (MPAs). Transactions also help to determine the relative value of the space and resources - for example, are citizens willing to buy out oil and gas rights to prevent development? Another constitutional power that states have to effect land management objectives is to provide incentives (e.g., reduced taxation) or disincentives (e.g., penalties for adverse uses).

Some of the recent issues surrounding zoning on land include the following:

a) zoning affects property rights and values: while most property holders seem to accept zoning as a regulatory power of the state, increasingly in the U.S. the negative effect that some zoning has on properties is being challenged in the courts. A major area of contention is designation of historical properties that prevent new (and more profitable) uses of the land parcel or building. In marine space a similar issue may arise in aquaculture siting or coastal MPAs;

b) zoning can be biased to 'first-comers': those who are in the initial decision making phases of a zoning process will most likely take care of their own interests but not necessarily the interests of future resource users;

c) incentive-based zoning is increasingly important: this falls out from the first issue, where it is always less contentious to offer carrots than wave a big stick.

Are the Oceans Different With Respect to Zoning?

This paper argues four major points: a) there are some differences; b) we do not want to repeat any poor land management practices at sea; c) property rights in a broad sense are still an issue and should not be ignored; and d) we need to build any ocean zoning scheme on the basis of well managed knowledge of the oceans and well-defined objectives. Let's look at the first and second issues.

There are some major differences in the oceans. Zoning tends to view the world as a 2-dimensional space with relatively fixed (in time and place) activities. The oceans are much more complex; they involve many more activities that move over time and place and one activity is not always unique to a particular space. Thus an ocean use, such as fishing, can to some degree coexist with recreational boating. Traditional zoning techniques minimize coexisting land uses and rights.

This reflects on the second issue – we should be learning from our mistakes on land, not duplicating them. Land resources and activities are also 4-dimensional yet zoning does not usually recognize this. Simply because on land we simplify the process by drawing lines defining discrete zones on a map, does not mean we have to repeat this experiment at sea. If we are to manage ocean resources effectively then we need to be looking at multiple coexisting uses and we need to be visualizing these zones in three and even four dimensions.

Property Rights, Jurisdiction and Information

Another lesson from land use zoning that we need not repeat in the oceans is that those who zone (typically planners) do not usually understand how their regulations will affect the rights of a large number of stakeholders. Again, because of the 3- and 4-D aspects of ocean activities, there will usually be more diverse stakeholders than are found on land. In addition, the 'rights' of these stakeholders are usually less precisely defined in law and in space.

[2]*Larsson, G. 1997. Land Management: Public Policy, Control, and Participation. The Swedish Council for Building Research, Stockholm.*

Some of these rights might include (see Figure 2):

a) public rights (under the common law) of navigation and fishing;

b) private 'riparian' rights of the adjacent upland property holders to access and use the tidelands and waters;

c) private rights, such as leases and licenses, for oil and gas development or for building a wharf;

d) community rights that may determine priority activities; and

e) underlying aboriginal title.

In addition to property rights, there are 'interests', such as jurisdiction, administration and sovereignty, some of which are held by different levels of government. Our research has shown that these interests can create a complex 4-D mosaic of 'authority' in the offshore with different spatial limits depending on specific resources or specific resource uses. Capturing these powers in marine space would be a challenge.

A fourth issue is information and information management. If any zoning scheme is to be effective then policy makers, legal enforcement authorities and other stakeholders (in a democratic process) need to be able to access and use the available information sets efficiently, effectively and equitably. We have a lot of data and many isolated data sets – what is needed, however, is information and knowledge, including local knowledge.

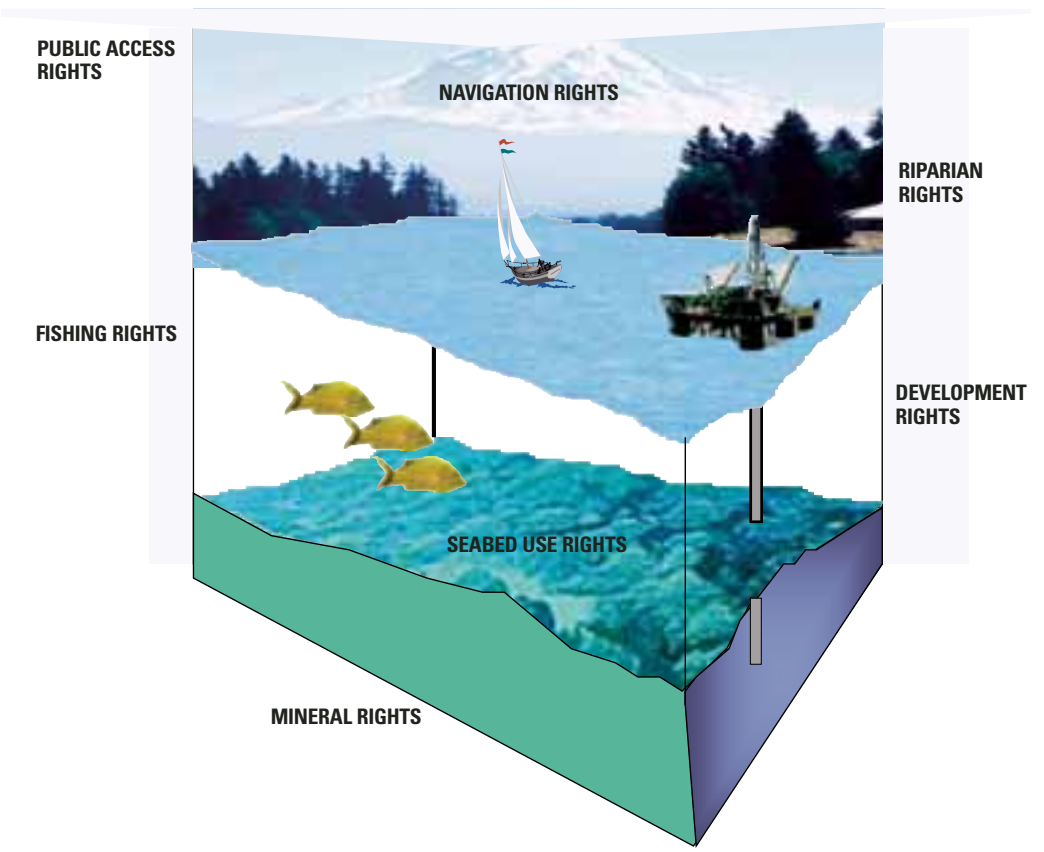

Figure 2. Complex rights in marine space (from Sutherland, M. 2002. Marine boundary delimitation for ocean governance. Proceedings of XXII FIG International Congress, Washington, D.C., 19-26 April).

Concluding Remarks

Ocean zoning may have merits but we should not underestimate the challenges if we want to do a better job in managing the oceans than we have on land. There needs to be a master plan that:

a) represents some degree of consensus of all stakeholders;

b) has some flexibility over time; and

c) has real and measurable objectives.

Until we know clearly what the objectives are, drawing lines on the oceans may be short-sighted and counterproductive. One of the largest challenges will be gaining recognition of the various interests and rights affected. Another will be combining ecosystem approaches to management with our tendency to try to isolate resources, processes and activities.

THE LARGE MARINE ECOSYSTEM APPROACH TO THE ASSESSMENT AND MANAGEMENT OF OCEAN RESOURCES AND ENVIRONMENT

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Abstract

Since 1984, the NOAA-Fisheries Large Marine Ecosystems (LMEs) Program has been engaged in the development and implementation of an ecosystem-based approach to support the assessment and management of marine resources and their habitats. A five theme modular approach has been developed for monitoring and assessing changes in productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance of LMEs in relation to recovery, sustainability and management of marine resources and their habitats. The natural boundaries of LMEs are based on four ecological criteria-bathymetry, hydrography, productivity and trophic relationships. A global effort is underway by NOAA in partnership with the Global Environment Facility, World Conservation Union, the Intergovernmental Oceanographic Commission of UNESCO, and other UN agencies to improve the long-term sustainability of resources and environments of the world's 64 LMEs and linked watersheds. Scientific and technical assistance is provided to developing countries committed to advancing new policies and actions for eliminating causes of transboundary environmental and resource-use practices leading to serious degradation of coastal environments, linked watersheds and losses in biodiversity and food security from overexploitation in LMEs located around the margins of the Pacific, Indian and Atlantic Oceans.

Introduction

Large marine ecosystems (LMEs) are natural regions of ocean space encompassing coastal waters from river basins and estuaries to the seaward boundary of continental shelves and the outer margins of coastal currents. They are relatively large regions of 200,000 km^2 or greater, characterized by distinct bathymetry, hydrography, productivity and trophically related populations. The theory, measurement and modeling relevant to monitoring the changing states of LMEs are imbedded in reports on ecosystems with multiple steady states, and on the pattern formation and spatial diffusion within ecosystems (Holling 1973, 1986, 1993; Pimm 1984; Sherman and Alexander 1986, 1989, 1993; Sherman et al. 1990, 1991; Beddington 1986; Mangel 1991; Levin 1993). From the ecological perspective, the concept that critical processes controlling the structure and function of biological communities can best be addressed on a regional basis (Ricklefs 1987) has been applied to ocean space in the utilization of LMEs as distinct global units for marine resource assessment, monitoring and management. The concept of assessment and management of renewable resources from an LME perspective has been the topic of a series of national and international studies, symposia and workshops initiated in 1984 and continuing to the present, wherein the geographic extent of each LME is defined on the basis of ecological criteria. The spawning and feeding migrations of fish communities within the LMEs have evolved in response to the distinct bathymetry, hydrography, productivity and trophodynamics of the system. As the spatial dimension of biological and physical processes directly influencing the success of population renewals within the regions under consideration are large, the term 'large marine ecosystem' is used to characterize them.

Several LMEs are semi-enclosed, including the Black, Baltic, Mediterranean and Caribbean Seas. Within the extent of LMEs, domains or subsystems can be characterized. For example, the Adriatic Sea is a subsystem of the Mediterranean Sea LME. In other LMEs, geographic limits are defined by the scope of continental shelves. Among these are the U.S. Northeast Continental Shelf and its four subsystems-the Gulf of Maine, Georges Bank, Southern New England, and the Mid-Atlantic Bight (Sherman et al. 1988)-the Icelandic Shelf and the Yellow Sea, the East Bering Sea Shelf, the North Sea and the Barents Sea Shelves as examples. For LMEs with narrow shelf areas and well-defined currents, the LMEs are bounded by the outer margins of the major coastal currents, rather than relying on the 200 mile Exclusive Economic Zone (EEZ) limits. Among the coastal current LMEs are the Humboldt, California, Canary, Kuroshio and Benguela currents. It is the coastal ecosystems

adjacent to the landmasses that are being stressed from habitat degradation, pollution and overexploitation of marine resources. Ninety percent of the usable annual global biomass yield of fish and other living marine resources is produced in 64 LMEs identified within, and in some cases extending beyond, the boundaries of the EEZs of coastal nations located around the margins of the ocean basins (Sherman 1994; Garibaldi and Limongelli 2003) (Figure 1). Levels of primary production are persistently higher around the margins of the ocean basins than for the open-ocean pelagic areas of the globe (Figure 2). It is within these coastal ocean areas that pollution has its greatest impact on natural productivity cycles, including eutrophication from high nitrogen and phosphorus effluent from estuaries. The presence of toxins in poorly treated sewage discharge, harmful algal blooms, and loss of wetland nursery areas to coastal development are also ecosystem level problems that need to be addressed (GESAMP 1990).

Figure 1. Map showing 64 large marine ecosystems and linked watersheds

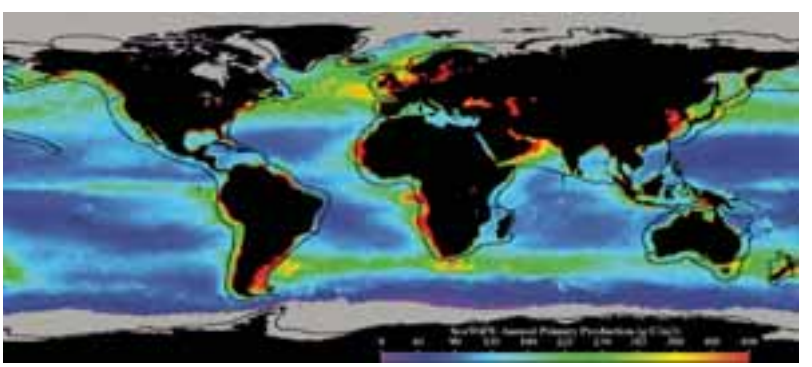

Figure 2. Global map of average primary productivity and the boundaries of the 64 LMEs of the world, available at www.lme.noaa.gov. The annual productivity estimates are based on SeaWIFS satellite data collected between September 1998 and August 1999, and the model developed by Behrenfeld and Falkowski (1997). The colour-enhanced image provided by Rutgers University depicts a shaded gradient of primary productivity from a high of 450 gCm2yr-1 in red to less than 45 gCm2yr-1 in purple.

A heuristic projection was produced by Steele (1988) to illustrate scales and ecosystem indicators of importance in monitoring pelagic components of the ecosystem, including phytoplankton, zooplankton, fish, frontal processes, and short-term but large-area episodic effects (Figure 3). Advances in technology allow for cost effective methods for measuring the changing states of LMEs using suites of indicators including those depicted in Figure 4, supplemented with other modular suites of indicators.

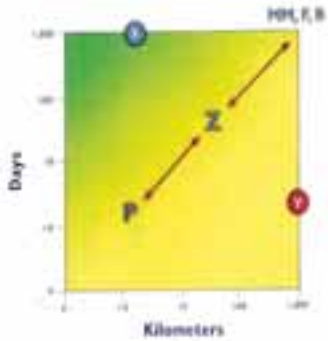

Figure 3. A simple set of scale relations for the pelagic food web. (P) Phytoplankton, (Z) zooplankton, (F) fish, (MM) marine mammals, (B) birds. Two physical processes are indicated by: (X) predictable fronts with small cross-front dimensions, and (Y) weather events occurring over relatively large scales. (Adapted from Steele 1988).

LME Indicators

A five-module indicator approach to the assessment and management of LMEs has been proven to be useful in ecosystem-based projects in the United States and elsewhere. The modules are customized to fit the situation within the context of a transboundary diagnostic analysis (TDA) process and a strategic action plan (SAP) development process for the groups of nations or states sharing an LME. These processes are critical for integrating science into management in a practical way and establishing appropriate governance regimes. The five modules consist of three science-based indicators focused on productivity, fish and fisheries, and pollution and ecosystem health, and two, namely socioeconomics and governance, that are focused on economic benefits to be derived from a more sustainable resource base and implementing governance mechanisms for providing stakeholders and stewardship interests with legal and administrative support for ecosystem-based management practices. The first four modules support the TDA process while the governance module is associated with periodic updating of the SAP. Adaptive management regimes are encouraged through periodic assessment processes (TDA updates) and updating of SAPs as gaps are filled (Wang 2004).

Figure 4. Large marine ecosystem management: planning and implementation schedule

PRODUCTIVITY MODULE

Productivity can be related to the carrying capacity of an ecosystem for supporting fish resources (Pauly and Christensen 1995). Recently, scientists have reported that the maximum global level of

primary productivity for supporting the average annual world catch of fisheries has been reached, and further large-scale "unmanaged" increases in fisheries yields from marine ecosystems are likely to be at trophic levels below fish in the marine food web (Beddington 1995). Measuring ecosystem productivity also can serve as a useful indication of the growing problem of coastal eutrophication. In several LMEs, excessive nutrient loadings of coastal waters have been related to algal blooms implicated in mass mortalities of living resources, emergence of pathogens (e.g., cholera, vibrios, red tides, paralytic shellfish toxins), and explosive growth of non-indigenous species (Epstein 1993).

The ecosystem parameters measured in the productivity module are zooplankton biodiversity and information on species composition, zooplankton biomass, water column structure, photosynthetically active radiation (PAR), transparency, chlorophyll-a, NO2, NO3, and primary production. Plankton of LMEs have been measured by deploying Continuous Plankton Recorder (CPR) systems monthly across ecosystems from commercial vessels of opportunity over decadal time scales. Advanced plankton recorders can be fitted with sensors for temperature, salinity, chlorophyll, nitrate/nitrite, petroleum, hydrocarbons, light, bioluminescence and primary productivity, providing the means for in situ monitoring and the calibration of satellite-derived oceanographic conditions relating to changes in phytoplankton, zooplankton, primary productivity, species composition and dominance, and long-term changes in the physical and nutrient characteristics of the LME and in the biofeedback of plankton to the stress of environmental change (Berman and Sherman 2001; Aiken et al. 1999).

FISH AND FISHERIES MODULE

Changes in biodiversity among the dominant species within fish communities of LMEs have resulted from excessive exploitation, naturally occurring environmental shifts in climate regime, or coastal pollution. Changes in the biodiversity of a fish community can generate cascading effects up the food web to apex predators and down the food web to plankton components of the ecosystem. The Fish and Fisheries module includes fisheries-independent bottom-trawl surveys and acoustic surveys for pelagic species to obtain time-series information on changes in fish biodiversity and abundance levels. Standardized sampling procedures, when deployed from small, calibrated trawlers, can provide important information on diverse changes in fish species (Sherman et al. 1998). Fish catch provides biological samples for stock assessments, stomach analyses, age, growth, fecundity and size comparisons; data for clarifying and quantifying multispecies trophic relationships; and the collection of samples for monitoring coastal pollution. Samples of trawl-caught fish can be used to monitor pathological conditions that may be associated with coastal pollution and can be used as platforms for obtaining water, sediment and benthic samples for monitoring harmful algal blooms, diseases, anoxia and changes in benthic communities.

POLLUTION AND ECOSYSTEM HEALTH MODULE

In several LMEs, pollution and eutrophication have been important driving forces of changes in biomass yields. Assessing the changing status of pollution and health of the entire LME is scientifically challenging. Ecosystem "health" is a concept of wide interest for which a single precise scientific definition is problematical. The health paradigm is based on multiple-state comparisons of ecosystem resilience and stability, and is an evolving concept that has been the subject of a number of meetings (NOAA 1993). To be healthy and sustainable, an ecosystem must maintain its metabolic activity level and its internal structure and organization, and must resist external stress over time and space scales relevant to the ecosystem (Costanza 1992). The ecosystem sampling strategies are focused on parameters related to overexploitation, species protected by legislative authority (marine mammals), and other key biological and physical components at the lower end of the food web (plankton, nutrients, hydrography) as noted by Sherman (1994).

Fish, benthic invertebrates and other biological indicator species are used in the Pollution and Ecosystem Health module to measure pollution effects on the ecosystem, including the bivalve monitoring strategy of "Mussel-Watch"; the pathobiological examination of fish; and the estuarine and nearshore monitoring of contaminants and contaminant effects in the water column, substrate and in selected groups of organisms. The U.S. Environmental Protection Agency (USEPA 2001), in collaboration with NOAA, has successfully applied a suite of seven coastal condition indicators to depict the status of coastal waters and LMEs of the United States (National Coastal Condition Report). The collaboration is ongoing and will provide reports of coastal conditions within the Northeast Shelf, Southeast Shelf and Gulf of Mexico LMEs in the U.S. Coastal Condition Report scheduled for release in August 2004 (USEPA 2004). In addition, where possible, bioaccumulation and trophic transfer of contaminants are assessed, and critical life history stages and selected food web organisms are examined

for parameters that indicate exposure to, and effects of, contaminants. Effects of impaired reproductive capacity, organ disease, and impaired growth from contaminants are measured. Assessments are made of contaminant impacts at the individual species and population levels. Implementation of protocols to assess the frequency and effect of harmful algal blooms, emergent diseases and multiple marine ecological disturbances (Sherman 2000) are included in the pollution module.

SOCIOECONOMIC MODULE

This module is characterized by its emphasis on practical applications of its scientific findings in managing an LME and on the explicit integration of economic analysis with science-based assessments to assure that prospective management measures are cost-effective. Economists and policy analysts work closely with ecologists and other scientists to identify and evaluate management options that are both scientifically credible and economically practical with regard to the use of ecosystem goods and services.

Designed to respond adaptively to enhanced scientific information, socioeconomic considerations must be closely integrated with science. This component of the LME approach to marine resources management has recently been described as the human dimensions of LMEs. A framework has been developed by the Department of Natural Resource Economics at the University of Rhode Island for monitoring and assessment of the human dimensions of an LME and the socioeconomic considerations important to the implementation of an adaptive management approach for an LME (Sutinen 2000). One of the more critical considerations, a methodology for considering economic valuations of LME goods and services has been developed around the use of interaction matrices for describing the relationships between ecological state and the economic consequences of change, and is included in the framework.

GOVERNANCE MODULE

The Governance module is evolving based on demonstrations now underway among ecosystems to be managed from a more holistic perspective than generally practiced in the past. In LME assessment and management projects underway in the Yellow Sea ecosystem, the Guinea Current LME and the Benguela LME, agreements have been reached among the environmental ministers of the countries bordering these LMEs to enter into joint resource assessment and management activities as part of building institutions. Among other LMEs, the Great Barrier Reef ecosystem is being managed from an ecosystem-based perspective, and the Antarctic marine ecosystem is also being managed from an ecosystem perspective under the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Governance profiles of LMEs are being explored to determine their utility (Juda and Hennessey 2001) in promoting long-term sustainability of ecosystem resources.

Application of Modules to LME Management

Indicator data, derived from spatial and temporal applications of the five modules, is being applied by a growing number of nations in the assessment and management of LMEs with the financial assistance of the Global Environment Facility (GEF). The GEF has been approached by developing countries for assistance in securing the futures of their shared LMEs. The GEF is supporting LME projects with $650 million in grants and other donor funding to assist developing countries in adopting an ecosystem-based approach to the management of human activities affecting coastal and marine ecosystems and linked freshwater basins. At risk are renewable goods and services valued at $10.6 trillion per year. A total of 10 LME projects involving 70 countries have been approved by the GEF Council, and another 7 LMEs involving 51 countries have GEF international waters projects under preparation. The 5-module assessment and management methodology is being tested by countries moving toward adopting practical joint governance institutions through place-based management. This LME approach engages stakeholders, fosters the participation of the science community, and leads to the development of adaptive management institutions. Actions are focused on the restoration of degraded habitats, including sea grass beds, coral reefs and mangroves; reduction of coastal pollution; and recovery of depleted fish, protected marine mammals, and sea turtle stocks.

Following a three-year pilot phase (1991-1994), the GEF was formally launched to forge cooperation and finance actions in the context of sustainable development that address critical threats to the global environment: biodiversity loss, climate change, degradation of international waters, ozone depletion and persistent organic pollutants. Activities concerning land degradation, primarily desertification and deforestation as they relate to these threats, are also addressed. GEF projects are implemented by the United Nations Development Programme, United Nations Environment Programme and the World Bank, and expanded opportunities exist for participation by other agencies.

The only new funding source to emerge from the 1992 Earth Summit, GEF today counts 171 countries as members. During its first decade, GEF allocated $US 3.2 billion in grant financing, supplemented by more than $US 8 billion in additional financing, for 800 projects in 156 developing countries and those in economic transition. All six thematic areas of GEF, including the land degradation cross-cutting theme, have implications for coastal and marine ecosystems. Priorities have been established by the GEF Council in its Operational Strategy adopted in 1995 (GEF 1995). The international waters focal area was designed to be consistent with both Chapter 17 and 18 of Agenda 21. In 1995, the GEF Council included the concept of LMEs in its GEF Operational Strategy as a vehicle for promoting ecosystem-based management of coastal and marine resources in the international waters focal area within a framework of sustainable development. The Report of the Second Meeting of the United Nations Informal, Open-ended Consultative Process on Ocean Affairs (UNGA 2001) related to UNCLOS recognized the contribution of the GEF in addressing LMEs through its science-based and ecosystem-based approach.

The geographic area of the LME, its coastal area and contributing basins constitute the place-based area for assisting countries to understand linkages among root causes of degradation and integrating needed changes in sectoral economic activities. The LME areas serve to initiate capacity building and for bringing science to pragmatic use in improving the management of coastal and marine ecosystems. The GEF Operational Strategy recommends that nations sharing an LME begin to address coastal and marine issues by jointly undertaking strategic processes for analyzing factual, scientific information on transboundary concerns and their root causes, and setting priorities for action on transboundary concerns. The TDA provides a useful mechanism to foster participation at all levels. Countries then determine the national and regional policy, legal and institutional reforms and investments needed to address the priorities in a country-driven SAP. Project goals and milestones of the SAP ensure vertical interpretation across the five modules on an annual basis to provide initial input information from the ecosystem indicators databases to the decision-making process identified in Figure 4 as adaptive management actions. The GEF-LME projects are generally funded for a 3 to 5 year initial phase, to be followed in the successful projects by a second 3 to 5 year grant that will have provided a 6 to 10 year time window for the participating countries bordering on the LME to have established a comprehensive ecosystem-based assessment and management system that will be transformed to a self-financed project during the second phase of implementation.

This allows sound science to become the basis for policy-making and fosters a geographic location upon which an ecosystem-based approach to assessment and management can be developed, and more importantly, can be used to engage stakeholders within the geographic area so that they contribute to the dialogue and in the end they support the ecosystem-based approach that can be pragmatically implemented by the communities and governments involved.

Without such participative processes to engage specific stakeholders in a place-based setting, marine science has often remained confined to the marine science community or has not been embraced in policy-making. Furthermore, the science-based approach encourages transparency through joint monitoring and assessment processes, including joint assessment cruises for countries sharing an LME, that build trust among nations over time and can overcome the barrier of false information being reported.

The GEF-supported processes in LME projects foster “learning by doing” and capacity building as “enabling activities” do in other GEF focal areas. They allow the science community to become engaged and provide interim outputs that serve as vehicles for stimulating stakeholder participation. These processes foster cross-sectoral integration so that an ecosystem-based approach to improving management institutions may be pursued. It provides a framework for those involved in integrated coastal management (ICM) and those addressing land-based activities and freshwater basin management to be integrated into priority setting processes. This process builds confidence among different sectoral interests in a country through establishing a national GEF inter-ministerial committee and then among participating countries sharing the LME by establishing a multi-sectoral, intergovernmental, GEF project Steering Committee. The process of producing the SAP facilitates development of country-driven, politically agreed ways ahead for commitments to action that address the priorities in a framework that encourages adaptive management. This shared commitment and vision for action has proven essential in GEF projects that have completed the processes in securing commitments for policy, legal and institutional reforms in different economic sectors. GEF may then fund an implementation project to assist countries in addressing the country-driven priorities for reform and investments.

Developing countries and those in economic transition have requested and received GEF support for LME projects through the International Waters focal area of the GEF. The approved GEF-LME

projects include developing nations and those in economic transition as well as other OECD countries since the living resources, the pollution loading and the critical habitats have transboundary implications across rich and poor nations alike. A total of $650 million in costs is currently being invested in the global network of LME projects as of May 2004, including funding from the GEF, other donors and national governments.

Currently, 121 different countries are engaged in the LME global network of projects (Table 1). With OECD countries involved that share the LMEs with the GEF recipient nations, expectations are that reforms will take place in both the North and the South in order to operationalize this ecosystem-based approach to managing human activities in the different economic sectors that contribute to place-specific degradation of the LME and adjacent waters. Additional information on NOAA's contribution to this global movement toward ecosystem-based management and resource sustainability is available from the LME Program Office, Northeast Fisheries Science Center, Narragansett Laboratory, Narragansett, Rhode Island and the LME Website http://www.lme.noaa.gov.

Table 1. Countries participating in GEF/large marine ecosystem projects

APPROVED GEF PROJECTS

LME	Countries
Gulf of Guinea (6)	Benin, Cameroon, Côte d'Ivoire, Ghana, Nigeria, Togo
Yellow Sea (2)	China, Korea
Patagonia Shelf/Maritime Front (2)	Argentina, Uruguay
Baltic (9)	Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, Sweden
Benguela Current (3)	Angola, Namibia, South Africa
South China Sea (7)	Cambodia, China*, Indonesia, Malaysia, Philippines, Thailand, Vietnam
Black Sea (6)	Bulgaria, Georgia, Romania, Russia*, Turkey, Ukraine
Mediterranean (19)	Albania, Algeria, Bosnia-Herzegovina, Croatia, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Morocco, Slovenia, Spain, Syria, Tunisia, Turkey*, Yugoslavia, Portugal
Red Sea (7)	Djibouti, Egypt*, Jordan, Saudi Arabia, Somalia, Sudan, Yemen
Western Pacific Warm Water Pool-SIDSa (13)	Cook Islands, Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu
	Total number of countries: 70*

GEF PROJECTS IN THE PREPARATION STAGE

Canary Current (7)	Cape Verde, Gambia, Guinea, Guinea-Bissau, Mauritania, Morocco*, Senegal
Bay of Bengal (8)	Bangladesh, India, Indonesia*, Malaysia*, Maldives, Myanmar, Sri Lanka, Thailand*
Humboldt Current (2)	Chile, Peru
Guinea Current (16)	Angola*, Benin*, Cameroon*, Congo, Democratic Republic of the Congo, Côte d'Ivoire*, Gabon, Ghana*, Equatorial Guinea, Guinea*, Guinea-Bissau*, Liberia, Nigeria*, São Tomé and Principe, Sierra Leone, Togo*
Gulf of Mexico (3)	Cuba, Mexico, United States
Agulhus/Somali Currents (8)	Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, South Africa*, Tanzania
Caribbean LME (23)	Antigua and Barbuda, The Bahamas, Barbados, Belize, Colombia, Costa Rica, Cuba*, Grenada, Dominica, Dominican Republic, Guatemala, Haiti, Honduras, Jamaica, Mexico*, Nicaragua, Panama, Puerto Ricob, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, Venezuela
	Total number of countries: 51*

*Adjusted for multiple listings
a Provisionally classified as Insular Pacific Provinces in the global hierarchy of LMEs and Pacific Biomes (Watson et al. 2003).
b A self-governing commonwealth in union with the United States

Extreme LME Stressors

Among the most extreme stressors affecting the sustainability of LMEs are the growing problems of coastal eutrophication and the depletion of fish and fishery resources and biomass yields.

NITROGEN OVER-ENRICHMENT OF LMES

Nitrogen over-enrichment has been reported as a coastal problem for two decades, from the southeast coast of the U.S. as described by Duda (1982) twenty years ago to the Baltic and other systems (Helsinki Commission 2001). More recent estimates of nitrogen export to LMEs from linked freshwater basins are summarized in Figure 5. These recent human-induced increases in nitrogen flux range from 4-8 in the U.S. from the Gulf of Mexico to the New England coast while no increase was documented in areas with little agricultural or population sources in Canada (Howarth et al. 2000).

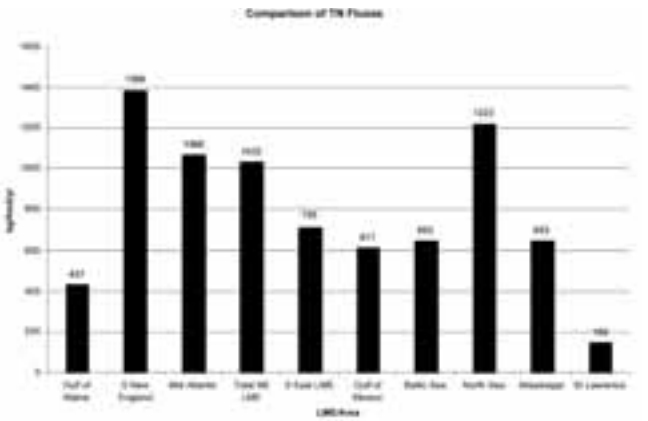

Figure 5. Comparison of total nitrogen fluxes from select LME watersheds. (Adapted from Jaworski 1999).

In European LMEs, recent nitrogen flux increases of from 3 fold in Spain to 4 fold in the Baltic and 11 fold in the Rhine basin draining to the North Sea LME have been recorded (Howarth et al. 2000). Duda and El-Ashry (2000) described the origin of this disruption of the nitrogen cycle from the "Green Revolution" of the 1970s as the world community converted wetlands to agriculture, utilized more chemical inputs, and expanded irrigation to feed the world. As noted by Duda (1982) for the Southeast estuaries of the U.S. and Rabalais et al. (1999) for the Gulf of Mexico, much of the large increase in nitrogen export to LMEs is from agricultural inputs, both from the increased delivery of fertilizer nitrogen as wetlands were converted to agriculture and from concentrations of livestock as shown by Duda and Finan (1983) for eastern North Carolina, where the increase in nitrogen export over the forested situation ranged from 20-500 fold in the late 1970s. Industrialized livestock production over the last two decades increases the flux, the eutrophication, and the oxygen depletion even more as reported by the NRC (2000). The latest GESAMP (2001) assessment also identified sewage as a significant contributor to the eutrophication in drainages from large cities, and atmospheric deposition from automobiles/agricultural activities may also contribute depending on proximity to sources.

The excessive levels of nitrogen contributing to coastal eutrophication constitute an extreme global environmental problem that is cross-media in nature. Excessive nitrogen loadings have been identified as problems in the following LMEs that are receiving GEF assistance: Baltic Sea, Black Sea, Adriatic portion of the Mediterranean, Yellow Sea, South China Sea, Bay of Bengal, Gulf of Mexico, and Plata Maritime Front/Patagonia Shelf. In fact, preliminary global estimates of nitrogen export from freshwater basins to coastal waters were assembled by Seitzinger and Kroeze (1998) as part of a contribution to better understanding LMEs. Included as Figure 6 and adapted from Kroeze and Seitzinger (1998), these preliminary estimates of global freshwater basin nitrogen export are alarming for the future sustainability of LMEs. Given the expected future increases in population and fertilizer use, LMEs may be, without significant nitrogen mitigation efforts, subjected to a future of increasing harmful algal bloom events, reduced fisheries, and hypoxia that further degrades marine biomass and biological diversity.

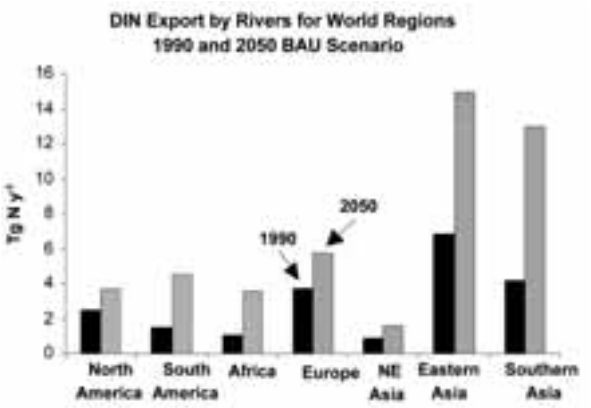

Figure 6. Model-predicted nitrogen (dissolved inorganic nitrogen) export by rivers to coastal systems in 1990 and in 2050, based on a business-as-usual (BAU) scenario. (Modified from Kroeze and Seitzinger 1998).

DRIVING FORCES OF BIOMASS YIELDS

The growing awareness that extreme declines in biomass yields are being influenced by multiple driving forces in marine ecosystems around the globe has accelerated efforts to broaden monitoring strategies to encompass food chain dynamics and the effects of environmental perturbations and pollution on living marine resources from an ecosystem perspective.

To assist stewardship agencies in the implementation of ecosystem-based assessment and management practices, diagnostic analyses are focused on the root causes of trends in LME biomass yields. In addition, information on principal driving forces of biomass yields imbedded in twenty-nine invited LME case studies conducted by a group of marine resource experts has been analyzed. A list of the principal investigators constituting an "expert systems analysis" appearing in twelve peer-reviewed and published LME volumes is given in Table 2. The biomass yields in Table 3 are based on the mid-point value in 1995 of a decadal trend in LME yields compiled by the Food and Agriculture Organization of the United Nations for the period 1990 through 1999 (Garibaldi and Limongelli 2003). Biomass yield data for four LMEs not included in the FAO report were taken from published LME case studies. Based on the "expert systems analyses," principal and secondary driving forces were assigned to each LME using four categories (climate, fisheries, eutrophication, inconclusive) as seen in Table 3.

Of the twenty-nine LME case studies, thirteen were assigned to climate forcing as the principal drivers of change in biomass yield, fourteen are listed as fisheries driven, one is principally driven by eutrophication, and the results of the analysis, as presented in another case study, are listed as inconclusive. In all but one case, where climate forcing was the principal driver of changing biomass yield, fisheries were secondary drivers in thirteen LMEs. In the case of the Mediterranean LME, the secondary driver is eutrophication according to Caddy (1993).

The contribution to the annual global biomass yields of the twenty-nine LMEs amounts to 54.4 mmt or 64% based on the average annual 5-year yield from 1995 to 1999 of 85 mmt (Garibaldi and Limongelli 2003). From a global management perspective, it would appear that nearly half of this LME yield (27.0 mmt) will require significant focus on improvements in forecasting of the climate signal, whereas an estimated 24.8 mmt of the biomass yield will need to be subjected to a principal management focus on catch-control combined with a secondary effort on forecasting the effects of climate forcing in an effort to recover depleted fish stocks and achieve maximum sustainable yield levels (Table 3).

The influence of climate forcing in biomass yields for the California Current LME has been expertly analyzed and illustrated by Lluch-Belda et al. (2003). Evidence of climate forcing for the Humboldt Current LME has been given by Wolff et al. (2003) and, for the Iceland Shelf LME, by Astthorsson and Vilhjálmsson (2002). In contrast, the argument for urgent reduction in fishing effort is supported by data presented by Sherman et al. (2003) for the U.S. Northeast Shelf LME and, for the Gulf of Thailand, based on the expert analysis of Pauly and Chuenpagdee (2003).

The observation that excessive fishing effort can alter the structure of the ecosystem, resulting in a shift from relatively high-priced, large, long-living demersal species, down the food chain toward

lesser-valued, smaller, short-lived pelagic species (Pauly and Christensen 1995) is supported by the LME data on species biomass yields. Evidence from the East China Sea, Yellow Sea and Gulf of Thailand, suggests that these three LMEs are approaching a critical state of change, wherein recovery to a previous ratio of demersal to pelagic species may become problematic. In all three cases, the fisheries are now being directed toward fish protein being provided by catches of smaller species of low value (Chen and Shen 1999; Pauly and Chuenpagdee 2003; Tang 2003).

The species change in biomass yields of the Yellow Sea, as shown in Tang (2003), represents an extreme case wherein the annual demersal species biomass yield was reduced from 200,000 mt in 1955 to less than 25,000 mt through 1980. The fisheries then targeted anchovy and, between 1990 and 1995, landings of anchovy reached an historic high of 500,000 mt.

Table 2. Published studies and volumes on LMEs

LME	Vol.	Author(s)	LME	Vol.	Author(s)
Somali Coastal Current	7	Okemwa	East China Sea	8	Chen & Shen
Bay of Bengal	5	Dwividi	Yellow Sea	2, 5, 12	Tang
	7	Hazizi	Kuroshio Current	2	Terazaki
East Bering Sea	1	Incze & Schumacher	Sea of Japan	8	Terazaki
	8	Livingston et al.	Oyashio Current	2	Minoda
West Greenland Shelf	3	Hovgård & Buch	Okhotsk Sea	5	Kusnetsov et al.
	5	Blindheim & Skjoldal	Gulf of Mexico	2	Richards & McGowan
	10	Rice		4	Brown et al.
Barents Sea	2	Skjoldal & Rey		9	Shipp
	4	Borisov		9	Gracia & Vasquez Baden
	5	Skjoldal	Southeast U.S. Shelf	4	Yoder
	10	Dalpadado et al.	Northeast U.S. Shelf	1	Sissenwine
	12	Matishov		4	Falkowski
Norwegian Shelf	3	Ellertsen et al.		6	Anthony
	5	Blindheim & Skjoldal		10, 12	Sherman
North Sea	1	Daan	Scotian Shelf	8	Zwanenburg et al.
	9	Reid	Caribbean Sea	3	Richards & Bohnsack
	10	McGlade	Patagonian Shelf	5	Bakun
	12	Hempel	South Brazil Shelf	12	Ekau & Knoppers
Iceland Shelf	10	Astthorsson, Vilhjálmsson	East Brazil Shelf	12	Ekau & Knoppers
Faroe Plateau	10	Gaard et al.	North Brazil Shelf	12	Ekau & Knoppers
Antarctic	1	Scully et al.	Baltic Sea	1	Kullenberg
	3	Hempel		12	Jansson
	5	Scully et al.	Celtic-Biscay Shelf	10	Lavin
California Current	1	MacCall	Iberian Coastal	2	Perez-Gandaras
	4	Mullin		10	Wyatt & Porteiro
	5	Bottom	Mediterranean Sea	5	Caddy
	12	Lluch-Belda et al.	Canary Current	5	Bas
Pacific American Coastal	8	Bakun et al.		12	Roy & Cury
Humboldt Current	5	Bernal	Guinea Current	5	Binet & Marchal
	12	Wolff et al.		11	Koranteng & McGlade
Gulf of Thailand	5	Piyakarnchana		11	Mensah & Quaatey
	11	Pauly & Chuenpagdee		11	Lovell & McGlade
South China Sea	5	Christensen		11	Cury & Roy
Indonesian Sea	3	Zijlstra, Baars		11	Koranteng
Northeast Australian Shelf	2	Bradbury & Mundy			
Benguela Current	2	Crawford et al.		5	Kelleher
	12	Shannon & O'Toole		8, 12	Brodie
Black Sea	5	Caddy		12	Daskalov

Volume No.	Volume description
1	1986. Variability and Management of Large Marine Ecosystems. Sherman and Alexander, eds. AAAS Symposium 99. Westview Press, Boulder, CO. 319p
2	1989. Biomass Yields and Geography of Large Marine Ecosystems. Sherman and Alexander, eds. AAAS Symposium 111. Westview Press, Boulder, CO. 493p
3	1990. Large Marine Ecosystems: Patterns, Processes, and Yields. Sherman, Alexander and Gold, eds. AAAS Symposium. AAAS, Washington, DC. 242p
4	1991. Food Chains, Yields, Models, and Management of Large Marine Ecosystems. Sherman, Alexander and Gold, eds. AAAS Symposium. Westview Press, Boulder, CO..320p
5	1992. Large Marine Ecosystems: Stress, Mitigation and Sustainability. Sherman, Alexander and Gold, eds. AAAS Press, Washington, DC. 376 p.
6	1996. The Northeast Shelf Ecosystem: Assessment, Sustainability and Management. Sherman, Jaworski and Smayda, eds. Blackwell Science, Cambridge, MA. 564p
7	1998. Large Marine Ecosystems of the Indian Ocean: Assessment, Sustainability and Management. Sherman, Okemwa and Ntiba, eds. Blackwell Science, Malden, MA. 394p
8	1999. Large Marie Ecosystems of the Pacific Rim: Assessment, Sustainability and Management. Sherman and Tang, eds. Blackwell Science, Malden, MA. 455p
9	1999. The Gulf of Mexico Large Marine Ecosystem: Assessment, Sustainability and Management. Kumpf, Steidinger and Sherman, eds. Blackwell Science, Malden, MA. 736p
10	2002. Large Marine Ecosystems of the North Atlantic: Changing States and Sustainability. Skjoldal and Sherman, eds. Elsevier Science, New York. and Amsterdam.449p
11	2002. Gulf of Guinea Large Marine Ecosystem: Environmental Forcing and Sustainable Development of Marine Resources. McGlade, Cury, Koranteng, Hardman-Mountford, eds. Elsevier Science, Amsterdam and New York. 392p
12	2003. Large Marine Ecosystems of the World: Trends in Exploitation, Protection and Research. Hempel and Sherman, eds. Elsevier Science, New York and Amsterdam. 423p

Table 3. Primary and secondary driving forces of LME biomass[3]. Based on published expert assessments in LME volumes listed in Table 2.

LME	PRIMARY	SECONDARY	LEVEL MMT	Expert Assessments	VOL REF
Humboldt Current	climate	fishing	16.0	Alheit and Bernal	5
				Wolff et al.	12
South China Sea	fishing	climate	10.0	Pauly and Christensen	5
East China Sea	fishing	climate	3.8	Chen and Shen	8
North Sea	fishing	climate	3.5	McGlade	11
Eastern Bering Sea	-	-	2.1	Schumacher et al.	12
Bay of Bengal	fishing	climate	2.0	Dwividi	5
				Hazizi	7
Okhotsk Sea[4]	climate	fishing	2.0	Kusnetsov et al.	5
Canary Current	climate	fishing	1.8	Roy and Cury	12
				Bas	5
Norwegian Shelf	climate	fishing	1.5	Ellertsen et al.	3
				Blindheim and Skjoldal	5
Iceland Shelf	climate	fishing	1.3	Astthorsson and Vilhjálmsson	11
Benguela Current	climate	fishing	1.2	Crawford et al.	2
				Shannon and O'Toole	12
Gulf of Thailand	fishing	climate	1.1	Pauly and Chuenpagdee	12
Mediterranean	fishing	eutrophication	1.1	Caddy	5
Sea of Japan[5]	climate	fishing	1.0	Terazaki	
Gulf of Mexico	fishing	climate	0.9	Richards and McGowan	2
				Brown et al.	4
				Shipp	9
Guinea Current	climate	fishing	0.9	Binet and Marchal	5
				Koranteng and McGlade	11
Baltic Sea	fishing	eutrophication	0.8	Kullenberg	1
				Jansson	12
California Current	climate	fishing	0.7	MacCall	1
				Lluch-Belda et al.	12
U.S. Northeast Shelf	fishing	climate	0.7	Sissenwine	1
				Murawski	6
				Sherman et al.	11
Scotian Shelf	fishing	climate	0.7	Zwanenburg et al.	11
				Zwanenburg	12
Black Sea	eutrophication	fishing	0.5	Caddy	5
				Daskalov	12
Barents Sea	climate	fishing	0.5	Skjoldal and Rey	2
				Borisov	4
				Blindheim and Skjoldal	5
				Matishov et al.	12
Caribbean Sea	fishing	climate	0.4	Richards and Bohnsack	3
Iberian Coastal	climate	fishing	0.3	Wyatt and Perez-Gandaras	2
Newfoundland-Labrador	fishing	climate	0.2	Rice et al.	11
Yellow Sea[6]	fishing	climate	0.2	Tang	2
				Tang	12
Great Barrier Reef	fishing	climate	0.1	Brodie	12
West Greenland Shelf	climate	fishing	0.1	Hovgård and Buch	3
				Pederson and Rice	11
Faroe Plateau	climate	fishing	0.1	Gaard et al.	11

[3]*Annual biomass yield levels based on 1990-1999 mid-decadal data (1995) from Garibaldi and Limongelli 2003*

[4]*Okhotsk Sea LME data from Kusnetsov et al. 1993 based on mid-decadal (1972) data on fishing yields from 1962 to 1982*

[5]*Biomass yield data from Terazaki (1999) based on mid-decadal data (1985) from Sea of Japan 1980-1990.*

[6]*Biomass yield data from Tang (2003) based on mid-decadal data for demersal species for the Yellow Sea, 1952 to 1992.*

Recovering Fisheries Biomass

The GEF-LME projects presently funded or in the pipeline for funding in Africa, Asia, Latin America and eastern Europe, represent a growing network of marine scientists, marine managers and ministerial leaders who are engaged in pursuing ecosystem and fishery recovery goals. The significant annual global biomass yields of marine fisheries from ecosystems in the GEF-LME Network of 44.8% provides a firm basis for moving toward the 2004 Johannesburg World Summit on Sustainable Development (WSSD) goal for introducing an ecosystem-based assessment and management approach to global fisheries by 2010, and fishing maximum sustainable yield (MSY) levels by 2015 (Table 3).

Evidence for species recovery following a significant reduction in fishing effort through mandated actions is encouraging. Following management actions to reduce fishing effort, the robust condition of the U.S. Northeast Shelf ecosystem with regard to the average annual level of primary productivity (350 gCm2 (yr), stable annual average levels of zooplankton (33 cc/100m3), and a relatively stable oceanographic regime (Sherman et al. 2002), contributed to: (1) a relatively rapid recovery of depleted herring and mackerel stocks, with the cessation of foreign fisheries in the mid-1970s; and, 2) initiation of the recovery of depleted yellowtail flounder and haddock stocks following a mandated 1994 reduction in fishing effort (Figure 7).

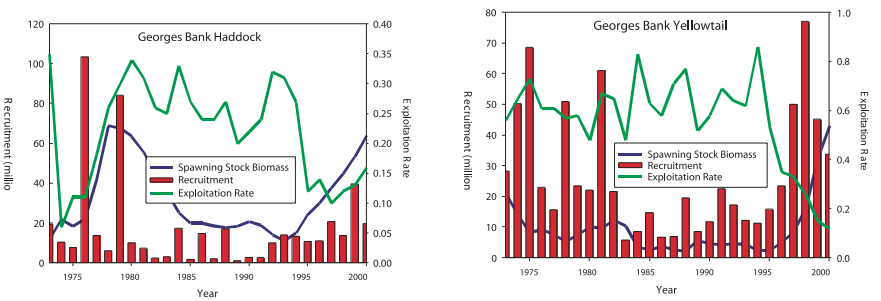

Figure 7. Increase in biomass of Georges Bank yellowtail flounder and haddock following reduction in fishing effort (exploitation rate) (NEFSC 2002).

LMEs and World Summit Targets

An increasing number of both developed and developing countries around the world are concerned enough with the degraded condition of their coastal and marine ecosystems to collaborate on GEF-LME projects. Ministerial level commitments to ecosystem-based approaches for assessment and management may ultimately lead to establishing joint adaptive management regimes in support of the global objectives of Chapter 17 of Agenda 21, the Jakarta Mandate emphasis on coastal biological diversity (CBD), UN Conference on the Law of the Sea (UNCLOS), the global plan of action (GPA), and the regional seas agreements countries have signed. Since the 1992 UN Conference on Environment and Development in Brazil, considerable movement has been made by international organizations engaged in ocean affairs to move nations towards adapting ecosystem-based assessment and management practices. A decade later, at the WSSD, another significant milestone was reached with support of over 100 countries to a Plan of Implementation (POI) that agreed on several specific marine ecosystem related targets, including achievement of "substantial" reductions in land-based sources of pollution by 2006, introduction of the ecosystems approach to marine resource assessment and management by 2010, designation of a network of marine protected areas (MPAs) by 2012, and the maintenance and restoration of fish stocks to MSY levels by 2015. It appears that an important corner has already been turned by 121 countries toward a focused global effort to restore biomass and biological diversity to coastal oceans as concerned governments understand the poverty reduction and security enhancement that accompanies more sustainable management regimes. The GEF international waters focal area has played a catalytic role through its emphasis on joint management of LMEs, their coastal assets, and linked river basins in an integrated manner. Through tests of these approaches, countries are starting to establish practical, science-based management regimes that address in collective and ecosystem-oriented ways the themes and programs under existing United Nations Sustainable Development Agenda 21 and other global instruments.

While many of the multi-country-driven LME initiatives supported with GEF grant funding have just started, and in others, the national and regional reforms in progress will take a number of years

to achieve, several lessons are becoming evident for the world community to consider in reversing the decline of its coastal oceans. A geographic approach, based on the LMEs of the world, their adjacent coastal areas and linked freshwater contributing basins, is likely to overcome the limits of more thematically directed activities to address global environmental problems (e.g., fisheries, sewage, sediment, contaminants). In this manner, the different stresses that are important to each specific area can be addressed jointly through processes that result in collective national actions in different economic sectors where needed. Processes such as the TDA and SAP foster multi-stakeholder dialogue, inter-ministerial dialogue, and a discourse with the science community in unraveling complex situations so they can be divided into priority components for more effective management than is now in general practice. Fragmented, thematic, single purpose programs are just not able to harness stakeholder involvement sufficiently to drive needed reforms compared to geographically-based initiatives.

Assessment and management based on the five modules in the TDA and SAP processes, foster an adaptive management approach through establishment of monitoring and evaluation indicators that are systematically measured by the nations and tracked over time for reporting to stakeholders and the GEF. GEF agencies have fostered participation of multiple levels of institutions (multi-country, national-interministerial, and local government/communities) for buy-in and adoption of reforms. The geographic nature of LME areas is conducive for achieving stakeholder participation and gaining political commitments to change.

The WSSD target for introducing ecosystem-based assessment and management practices by 2010 is likely to be met by most of the 121 countries constituting the existing LME network. It is unlikely that the Summit target for maintaining and restoring fishery resources to MSY levels by 2015 will be met. However, progress is being made in recovery of depleted fish stocks through mandated reductions in fishing effort (Sherman et al. 2002). With regard to the target for control and reduction of land-based sources of pollution, considerable additional effort will be required to achieve “substantial reductions in land-based sources of pollution by 2006”, whereas good progress has been made in designating MPAs within the GEF-LME Project Network.

References

Aiken, J., R. Pollard, R. Williams, G. Griffiths and I. Bellan. 1999. Measurements of the upper ocean structure using towed profiling systems. Pages 346-362 in K. Sherman and Q. Tang, eds. Large Marine Ecosystems of the Pacific Rim: Assessment, Sustainability and Management. Blackwell Science, Inc., Malden, MA.

Astthorsson, O.S. and H. Vilhjálmsson. 2002. Iceland Shelf large marine ecosystem. Pages 219-244 in K. Sherman and H. R. Skjoldal, eds. Large Marine Ecosystems of the North Atlantic: Changing States and Sustainability. Elsevier Science, Netherlands, London, New York, Tokyo.

Beddington, J.R. 1986. Shifts in resource populations in large marine ecosystems. Pages 9-18 in K. Sherman and L.M. Alexander, eds. Variability and Management of Large Marine Ecosystems. AAAS Selected Symposium 99. Westview Press, Boulder, Colorado.

Beddington, J.R. 1995. The primary requirements. Nature 374: 213-14.

Behrenfeld, M. and P.G. Falkowski. 1997. Photosynthetic rates derived from satellite-based chlorophyll concentration. Limnol. Oceangr. 42(1): 1-20.

Berman, M.S. and K. Sherman. 2001. A towed body sampler for monitoring marine ecosystems. Sea Technology 42(9): 48-52.

Caddy, J.F. 1993. Contrast between recent fishery trends and evidence for nutrient enrichment in two large marine ecosystems: the Mediterranean and the Black Seas. In K. Sherman, L.M. Alexander and B.D. Gold, eds. Large Marine Ecosystems: Stress, Mitigation and Sustainability. AAAS Press, Washington, D.C. 376 p.

Chen, Y.Q. and X.Q. Shen. 1999. Changes in the biomass of the East China Sea ecosystem. Pages 221-239 in K. Sherman and Q. Tang, eds. Large Marine Ecosystems of the Pacific Rim: Assessment, Sustainability and Management. Blackwell Science, Malden, MA.

Costanza, R. 1992. Toward an operational definition of ecosystem health. Pages 239-256 in R. Costanza, B.G. Norton and B.D. Haskell, eds. Ecosystem Health: New Goals for Environmental Management. Island Press, Washington, D.C.

Duda, A.M. 1982. Municipal point sources and agricultural nonpoint source contributions to coastal eutrophication. Water Resources Bulletin 18(3): 397-407.

Duda, A.M. and M.T. El-Ashry. 2000. Addressing the global water and environmental crises through integrated approaches to the management of land, water, and ecological resources. Water International 25: 115-26.

Duda, A.M. and D.S. Finan. 1983. Influence of livestock on nonpoint source nutrient levels of streams. Transactions of American Society of Agricultural Engineers 26(6): 1710-1726.

Epstein, P.R. 1993. Algal blooms and public health. World Resource Review 5(2): 190-206.

Garibaldi, L. and L. Limongelli. 2003. Trends in Oceanic Captures and Clustering of Large Marine Ecosystems: Two Studies Based on the FAO Capture Database, as reported to the FAO by official national sources. FAO Fisheries Technical paper 435. Food and Agriculture Organization of the United Nations, Rome. 71 p.

GEF (Global Environment Facility). 1995. GEF Operational Strategy. Global Environment Facility, Washington, D.C.

GESAMP (Group of Experts on the Scientific Aspects of Marine Pollution). 1990. The State of the Marine Environment. UNEP Regional Seas Reports and Studies No. 115. Nairobi.

GESAMP (Group of Experts on the Scientific Aspects of Marine Pollution). 2001. Protecting the Oceans from Land-based Activities: Land-based Sources and Activities Affecting the Quality and Uses of the Marine, Coastal and Associated Freshwater Environment. Rep. Stud. GESAMP No. 71. 162 p.

Helsinki Commission. 2001. Environment of the Baltic Sea Area 1994-1998. Baltic Sea Environment Proceedings No. 82A. Helsinki. 23 p.

Hempel, G. and K. Sherman, eds. 2003. Large Marine Ecosystems of the World: Trends in Exploitation, Protection, and Research. Elsevier B.V., Amsterdam. 423 p.

Holling, C.S. 1973. Resilience and Stability of Ecological Systems. Institute of Resource Ecology, University of British Columbia, Vancouver.

Holling, C.S. 1986. The resilience of terrestrial ecosystems, local surprise and global change. Pages 292-317 in W.C. Clark and R.E. Munn, eds. Sustainable Development of the Biosphere. Cambridge University Press, London.

Holling, C.S. 1993. Investing in research for sustainability. Ecological Applications 3: 552-555.

Howarth, R., D. Anderson, J. Cloern, C. Elfring, C. Hopkinson, B. Lapointe, T. Malone, N. Marcus, K. McGlathery, A. Sharpley and D. Walker. 2000. Nutrient pollution of coastal rivers, bays, and seas. ESA Issues in Ecology 7: 1-15.

Jaworski, N.A. 1999. Comparison of nutrient loadings and fluxes into the US Northeast Shelf LME with the Gulf of Mexico and other LMEs. Pages 360-371 in H. Kumpf, K. Steidinger and K. Sherman, eds. The Gulf of Mexico Large Marine Ecosystem: Assessment, Sustainability, and Management. Blackwell Science, Malden, MA. 704 p.

Juda, L. and T. Hennessey. 2001.Governance profiles and the management of the uses of large marine ecosystems. Ocean Development and International Law 32: 41-67.

Kroeze, C. and S.P. Seitzinger. 1998. Nitrogen inputs to rivers, estuaries and continental shelves and related nitrous oxide emissions in 1990 and 2050: a global model. Nutrient Cycling in Agroecosystems 52: 195-212.

Kumpf, H., K. Steidinger and K. Sherman, eds. 1999. The Gulf of Mexico Large Marine Ecosystem: Assessment, Sustainability, and Management. Blackwell Science, Malden, MA. 704 p.

Kuznetsov, V.V., V.P. Shuntov and L.A. Borets. 1993. Food chains, physical dynamics, perturbations, and biomass yields of the Sea of Okhotsk. In K. Sherman, L.M. Alexander and B.D. Gold, eds. Large Marine Ecosystems: Stress, Mitigation and Sustainability. AAAS Press, Washington, D.C. 376 p.

Levin, S.A. 1993. Approaches to forecasting biomass yields in large marine ecosystems. Pages 36-39 in K. Sherman, L.M. Alexander and B.D. Gold, eds. Large Marine Ecosystems: Stress, Mitigation, and Sustainability. AAAS Press, Washington, D.C.

Lluch-Belda, D., D.B. Lluch-Cota and S.E. Lluch-Cota. 2003. Interannual variability impacts on the California Current large marine ecosystem. Figure 9, p. 212 in G. Hempel and K. Sherman, eds. Large Marine Ecosystems of the World: Trends in Exploitation, Protection and Research. Elsevier Science, Netherlands, London, New York, Tokyo. 423 p.

Mangel, M. 1991. Empirical and theoretical aspects of fisheries yield models for large marine ecosystems. Pages 243-261 in K. Sherman, L.M. Alexander and B.D. Gold, eds. Food Chains, Yields, Models, and Management of Large Marine Ecosystems. Westview Press, Boulder.

McGlade, J.M., P.Cury, K.A. Koranteng and N.J. Hardman-Mountford, eds. 2002. The Gulf of Guinea Large Marine Ecosystem: Environmental Forcing and Sustainable Development of Marine Resources. Elsevier B.V., Amsterdam. 392 p.

NEFSC (Northeast Fisheries Science Center). 2002. Assessment of 20 Northeast Groundfish Stocks through 2001: A Report of the Groundfish Assessment Review Meeting (GARM), Northeast Fisheries Science Center, Woods Hole, Massachusetts, October 8-11, 2002. Available at http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0216/.

NOAA (National Oceanic and Atmospheric Administration). 1993. Emerging Theoretical Basis for Monitoring the Changing States (Health) of Large Marine Ecosystems. Summary report of two workshops: 23 April 1992, National Marine Fisheries Service, Narragansett, Rhode Island and 11-12 July 1992, Cornell University, Ithaca, New York. NOAA Technical Memorandum NMFS-F/NEC-100.

NRC (National Research Council). 2000. Clean Coastal Waters: Understanding and Reducing the Effects of Nutrient Pollution. National Academy Press, Washington, D.C.

Pauly, D. and V. Christensen. 1995. Primary production required to sustain global fisheries. Nature 374: 255-7.

Pauly, D. and R. Chuenpagdee. 2003. Development of fisheries in the Gulf of Thailand large marine ecosystem: Analysis of an unplanned experiment. Pages 337-354 in G. Hempel and K. Sherman, eds. Large Marine Ecosystems of the World: Trends in Exploitation, Protection and Research. Elsevier Science, Netherlands, London, New York, Tokyo. 423 p.

Pimm, S.L. 1984. The complexity and stability of ecosystems. Nature 307: 321-326.

Rabalais, N.N., R.E. Turner and W.J. Wiseman Jr. 1999. Hypoxia in the Northern Gulf of Mexico: Linkages with the Mississippi River. Pages 297-322 in H. Kumpf, K. Steidinger and K. Sherman, eds. The Gulf of Mexico Large Marine Ecosystem: Assessment, Sustainability, and Management. Blackwell Science, Inc., Malden, MA. 704 p.

Ricklefs, R.E. 1987. Community diversity: relative roles of local and regional processes. Science 235(4785): 161-171.

Seitzinger, S.P. and C. Kroeze. 1998. Global distribution of nitrous oxide production and N inputs to freshwater and coastal marine ecosystems. Global Biogeochemical Cycles 12: 93-113.

Sherman, B. 2000. Marine ecosystem health as an expression of morbidity, mortality, and disease events. Marine Pollution Bulletin 41(1-6): 232-54.

Sherman, K. 1994. Sustainability, biomass yields, and health of coastal ecosystems: an ecological perspective. Marine Ecology Progress Series 112: 277-301.

Sherman, K., J. O'Reilly and J. Kane. 2003. Assessment and sustainability of the U.S. Northeast Shelf Ecosystem. In G. Hempel and K. Sherman, eds. Large Marine Ecosystems of the World: Trends in Exploitation, Protection, and Research. Elsevier B.V., Amsterdam. 423 p.

Sherman, K., J. Kane, S. Murawski, W. Overholtz and A. Solow. 2002. The U.S. northeast shelf large marine ecosystem: zooplankton trends in fish biomass recovery. Pages 195-215 in K. Sherman and H.R. Skjoldal, eds. Large Marine Ecosystems of the North Atlantic: Changing States and Sustainability. Elsevier B.V., Amsterdam. 449 p.

Sherman, K. and L.M. Alexander, eds. 1986. Variability and Management of Large Marine Ecosystems. AAAS Selected Symposium 99. Westview Press, Boulder, Colorado. 319 p.

Sherman, K. and L.M. Alexander, eds. 1989. Biomass Yields and Geography of Large Marine Ecosystems. AAAS Selected Symposium 111. Westview Press, Inc., Boulder, Colorado.

Sherman, K., L.M. Alexander and B.D. Gold, eds. 1990. Large Marine Ecosystems: Patterns, Processes and Yields. American Association for the Advancement of Science, Washington, D.C. 242 p. (second printing in 1992).

Sherman, K., L.M. Alexander and B.D. Gold, eds. 1991. Food Chains, Yields, Models, and Management of Large Marine Ecosystems. AAAS Symposium Westview Press, Boulder, CO. 320 p.

Sherman, K. and L.M. Alexander, eds. 1993. Large Marine Ecosystems: Stress, Mitigation, and Sustainability. AAAS Press, Washington. 376 p.

Sherman, K., N.A. Jaworski and T.J. Smayda, eds. 1996. The Northeast Shelf Ecosystem: Assessment, Sustainability, and Management. Blackwell Science, Cambridge, MA. 564 p.

Sherman, K., E.N. Okemwa and M.J. Ntiba, eds. 1998. Large Marine Ecosystems of the Indian Ocean: Assessment, Sustainability, and Management. Blackwell Science, Cambridge, MA. 394 p.

Sherman, K. and Q. Tang, eds. 1999. Large Marine Ecosystems of the Pacific Rim: Assessment, Sustainability and Management. Blackwell Science, Malden, MA. 465 p.

Sherman, K. and H.R. Skjoldal, eds. 2002. Large Marine Ecosystems of the North Atlantic: Changing States and Sustainability. Elsevier B.V., Amsterdam. 449 p.

Sherman, K., M. Grosslein, D. Mountain, D. Busch, J. O'Reilly and R. Theroux. 1988. The continental shelf ecosystem off the northeast coast of the United States. Pages 279-337 in H. Postma and J.J. Zilstra, eds. Ecosystems of the World 27: Continental Shelves. Elsevier, Amsterdam.

Steele, J.H. 1988. Scale selection for biodynamic theories. Pages 513-526 in B.J. Rothschild, ed. Toward a Theory on Biological-physical Interactions in the World Ocean. NATO ASI Series C: Mathematical and Physical Sciences, Vol. 239. Kluwer Academic Publishers, Dordrecht.

Sutinen, J., ed. 2000. A Framework for Monitoring and Assessing Socioeconomics and Governance of Large Marine Ecosystems. NOAA Technical Memorandum NMFS-NE-158. 32 p.

Tang, Q. 2003. The Yellow Sea and mitigation action. In G. Hempel and K. Sherman, eds. Large Marine Ecosystems of the World: Trends in Exploitation, Protection and Research. Elsevier Science, Netherlands, London, New York, Tokyo. 423 p.

USEPA (U.S. Environmental Protection Agency). 2001. National Coastal Condition Report. EPA-620/R-01/005. Washington, D.C. 204 p.

USEPA (U.S. Environmental Protection Agency). 2004. Draft National Coastal Condition Report II. USEPA, National Oceanic and Atmospheric Administration, U.S. Department of the Interior and US Department of Agriculture, Office of Research and Development/Office of Water, Washington, D.C. 20460.

UNGA (United Nations General Assembly). 2001. Report on the work of the United Nations Open-ended Informal Consultative Process established by the General Assembly in its resolution 54/33 in order to facilitate the annual review by the Assembly of developments in ocean affairs at its second meeting. Report A/56/121, 22 June, New York. 62 p.

Wang, H. 2004. An evaluation of the modular approach to the assessment and management of large marine ecosystems. Ocean Development and International Law 35: 267-286.

Wolff, M., C. Wosnitza-Mendo and J. Mendo. 2003. The Humboldt Current LME. Figure 6, p. 287 in G. Hempel and K. Sherman, eds. Large Marine Ecosystems of the World: Trends in Exploitation, Protection and Research. Elsevier Science, Netherlands, London, New York, Tokyo. 423 p.

PRACTICAL ASPECTS OF ZONING AND ITS APPLICATION TO THE GREAT BARRIER REEF MARINE PARK

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Abstract

The Great Barrier Reef is an iconic ecosystem. The Great Barrier Reef Marine Park Act (GBRMPA) 1975 reflects the social and political context of the national recognition and pride of stewardship. It appears to be the first piece of legislation that specifically linked the concepts of conservation and reasonable or sustainable use. This paper provides a brief account of how the task of creating the Great Barrier Reef Marine Park (GBRMP) was approached, a discussion of the issues based approach of the GBRMPA, and the recent revision of the GBRMP Zoning Plan. It will discuss the GBRMP in the context of recent discussions of zoning and management for reasonable use and conservation of marine ecosystems and resources.

Introduction

The Great Barrier Reef Marine Park (GBRMP) provides a multiple use management regime for an area of 350,000 km^2. Zoning has been, and will remain, one of the cornerstones of management for the Great Barrier Reef (GBR). However, other management tools are also important and are used in conjunction with zoning (Day 2002).

The GBR is an iconic environment. It is a matter of national identity and pride for Australians. In the 1960s there was a protracted public debate about the threats, desirability and possible impacts of mineral recovery, and oil exploration and production in the GBR Region. The debate created awareness of the vulnerability and values of the GBR and the need to manage a broad range of contemporary and potential human uses and impacts that were likely to damage it. Lawrence et al. (2002) provide an account of the first 25 years of the GBRMP.

The issue of oil drilling was considered by a joint Royal Commission of the Commonwealth of Australia and the State of Queensland (Commonwealth of Australia 1974). The Commissioners were not unanimous in their conclusions but their report was followed by the passage of the Great Barrier Reef Marine Park Act (GBRMPA) 1975.

The GBRMPA 1975 was probably the first piece of legislation anywhere in the world that specifically addressed the management of a large marine ecosystem. Although the words "Marine Park" appear in the title, the Act provides for protection and sustainable multiple use using the words "conservation and reasonable use of the Great Barrier Reef Region". It anticipated many of the discussions of the 1980s on sustainable development.

What is Zoning?

The preparatory materials and even the title of this workshop reflect that Canadian practice is dominated by sectoral zoning. "Oceans and coastal management in Atlantic Canada comprises a patchwork of sector-oriented management zones that fulfill various functions and purposes."

The Macquarie Concise Dictionary defines zoning as "the marking out of an area of land with respect to its use". In that narrow sense it is a planning tool. But recent usage relating to marine management areas appears to conflate specific measures for biodiversity conservation and ecosystem resilience, including Protected Areas or Marine Parks, with the underlying and much broader issues of comprehensive multiple use management.

The spatial control framework of zoning is a small part of the management toolkit. Its effectiveness depends in part on the extent to which sub-components can be managed as independent subsets of the whole.

On land this is captured by the agricultural aphorism "Good fences make good neighbours". Terrestrial zoning and management relate to allocating single uses or clusters of very similar uses to precisely defined geographic areas in the context that multiple use is relatively limited. Thus areas may be zoned for residential, commercial or industrial development, transport or services infrastructure, agriculture, forestry, recreation or nature conservation. Typically the allocation of an area for one use class alienates or alters all or most of it from previous uses and some ecosystem processes. For developed zones allocation is often the first stage of a major change to suit an area to a single purpose or small cluster of compatible uses, through clearance of vegetation, movement of surface soils, and alteration of drainage patterns. Once the allocation decision has been implemented, the single use class activities can for most purposes be managed sectorally within their fences protected by common law rights without significant damage from activities outside the fence and without causing significant damage to activities outside the fence.

Fences don't work in the sea and multiple use is widespread. In a given period of time the same geographic location may be used sequentially or simultaneously for very different and otherwise unrelated uses. The surface may be used for commercial, recreational or military shipping and the water column for several pelagic fisheries. However, the largest difference for management is that seawater is a powerful and long-range linking medium. It is a solvent and coastal waters are sinks for wastes and consequences of land use. There are massive linkages across boundaries and the impacts of most activities cannot be confined. New technologies are bringing an increasing range of activities and impacts to marine areas that were previously remote, hazardous and little used.

Area-based controls are relevant for the seabed to manage the activity and impacts of fishing techniques within sustainable and reasonable levels or to allocate areas for infrastructure such as cables and pipelines or aquaculture sites. Such allocation will often not alienate or alter the area or make it unsuitable for continuation of many previous uses by other groups or sectors. Activities may be allocated to sites or zones but the consequences of independent sectoral activities are not contained within boundaries. As the intensity and range of uses increase cross-sectoral management is generally necessary.

Even though it is contrary to most terrestrially derived title, planning and management concepts, it seems we have to approach management and sustainability at the ecosystem scale and we have to address multiple uses and impacts.

What is the Basis of Management of the Great Barrier Reef Marine Park?

The GBRMPA requires the Authority to prepare zoning plans that define the purposes for which areas of the Marine Park can be used or entered. Zoning in the narrow sense, or spatial separation of sub-components with different management objectives, is thus clearly indicated. But as Day (2002) pointed out, it is only part of the suite of measures that are used.

The management of the GBR is achieved through regulations that implement the multiple use management controls specified in zoning plans. Those regulations must be consistent with Zoning Plans. In the context of this workshop it is not possible to separate zoning from the total suite of tools for planning and managing the GBRMP.

The broad objectives of zoning in the GBRMP are set out in the legislation:

- the conservation of the GBR;
- the regulation of the use of the Marine Park so as to protect the GBR while allowing reasonable human use;
- the regulation of activities that exploit the resources of the GBR Region so as to minimise the effect of those activities on the GBR;
- the reservation of some areas of the GBR for its appreciation and enjoyment by the public; and
- the preservation of some areas of the GBR in its natural state undisturbed by man except for the purposes of scientific research.

(s. 32(7), Great Barrier Reef Marine Park Act 1975)

These objectives provide a broad scope but the Act provides little guidance on a planning process apart from requirements for two phases of public participation, providing opportunities for the public to make representations prior to the preparation of a plan and to comment on a published draft plan. The initial phase of planning from 1977-1983 involved development and application of the goal, aims and planning approach for multiple use management of a large marine ecosystem in circumstances where there were no precedents. The process that was developed drew on elements of

management practice of terrestrial land use and protected areas, fisheries and navigation. The result was a framework with a clear goal and aims that guided the preparation of zoning plans and supporting regulations.

Zoning in the Great Barrier Reef Marine Park

The provisions of the GBRMPA require the specification of purposes of use and entry for each zone as:

- As of right - no permit required
- Only with a permit
- Conditions set out in regulations
- Case specific conditions

Activities that are not specified can be allowed by permit provided they are consistent with the provisions of the zone.

The system is clear and it reflects the common property nature of the marine realms. An activity that is not specified cannot be undertaken unless specifically permitted. This is the reverse of the onus of proof in the typical terrestrial situation where an activity that is not specified can be undertaken unless specifically prohibited.

The provisions of the zoning plans are implemented through regulations.

The Goal and Aims of the Great Barrier Reef Marine Park Authority

The 1983-84 Annual Report of the GBRMP Authority provided a statement of its goal and aims for management that had been developed through an iterative process in the preceding years. These provide clear guidance on the scope and basis of multiple use management (or zoning) to provide for conservation and reasonable use consistent with the GBRMPA 1975.

The goal is:

"To provide for the protection, wise use, understanding and enjoyment of the Great Barrier Reef in perpetuity through the development and care of the Great Barrier Reef Marine Park."

The aims which are subordinate to the goal identify the elements of conservation and reasonable use and are as follows:

Social

- To involve the community meaningfully in the establishment and management of the Marine Park;
- To minimise regulation of and interference in, human activities consistent with meeting the goal and other aims of the Authority;
- To achieve management of the Marine Park primarily through the community's understanding and acceptance of the provisions of zoning, regulations and management practices; and
- To achieve competence and fairness in the development and care of the Marine Park through the deliberate acquisition and use of relevant scientific and non-scientific information and techniques in decision-making and other activities.

Environmental

- To provide for the protection of the natural features of the Reef, whilst providing for multiple use of the Reef's resources.

Economic

- To minimise costs of developing and caring for the Marine Park consistent with meeting the goal and other aims of the Authority;
- To provide for development compatible with the conservation of the Reef's natural resources; and
- To minimise inhibitions on economic activities consistent with meeting the goals and other aims of the Authority.

General

- To adapt the Marine Park and the operations of the Authority to changing circumstances.

Developing the Planning Process

The planning process for initial declaration and zoning of the Marine Park was developed in close association with the goal and aims. An early step was a review by a senior town and land-use planner of the Queensland State Government Co-Ordinator General's Office to assess the extent to which the principles and practices of town and land use planning could be adapted for planning the GBRMP. He noted a number of issues that were not directly addressed in terrestrial planning approaches and recommended a case study (Kenchington 1990).

The case study addressed the Capricorn and Bunker group of reefs, an isolated chain of reefs and coral cays in the southern part of the GBR lagoon. The background study identified three major clusters of interest or user groups: Fisheries, Conservation and Tourism/Recreation. Drawing on the best available environmental, economic and social information, a mapping study identified biological regions, resources, and the constraints and opportunities for contemporary and potential uses. The resulting information base was used to prepare three draft zoning plans, each conforming to the requirements of the Act but deliberately and unreasonably biased to give precedence to the views of one of the three major clusters. Comparison of the three drafts revealed substantial areas where there were no conflicts and highlighted the areas where there were strong differences of view. Not surprisingly, each of the user clusters preferred the draft that maximized its opportunities but the exercise enabled each cluster to understand better the detail of issues important to the others. It also clarified the context of reasonableness in the sense that, while no group was likely to get all the outcomes it desired, most participants saw that it was possible to develop a multiple use solution that could be seen as reasonable in the light of contemporary values.

The study showed that multiple use planning was feasible but the consultative and co-ordinated approach implied major changes to the ways in which public participation was conducted for most terrestrial planning. There, it was common practice for a draft plan prepared by experts to be made available for inspection with an opportunity for affected parties or the general public to submit a formal objection. Typically the opportunity to comment was given minimal statutory notice and the period for comment was short. The planning agency was typically defensive and the public had a very low expectation of meaningful outcomes from the participatory process.

A more open process implied change for sectors, their Ministers and the public servants who managed their activities. There was now an expectation that they would justify the reasonableness of their use, management or impact in the broader context of the privilege of access to resources of the commons. While sectoral management arrangements were to continue, sectoral managers would not have the right to make decisions inconsistent with the conditions of use or entry established in the zoning plans and regulations for the Marine Park. This was supported by the precedence of the Act over most other legislation.

The Importance of Clear Guidelines

From the early stages of planning the Authority recognised that it was creating a multiple use management regime that had to address social and economic as well as environmental fundamentals. This requires a transparent framework of guidelines, operational principles or decision rules for developing and testing management plans that achieve conservation and reasonable use. As the program moved from the case study to the development of the Zoning Plan for the Capricorn Bunker Section of the Marine Park in 1980, the Authority published its first set of guidelines for zoning in an explanatory paper for participants in the zoning process (Kenchington 1990).

GUIDELINES FOR PREPARATION OF THE MACKAY/CAPRICORN ZONING PLAN 1980

GENERAL, LEGISLATIVE AND MANAGEMENT REQUIREMENTS

1. *The Zoning Plan should be as simple as possible.*
2. *As far as practicable the plan should minimise the regulation of, and interference in, human activities, consistent with meeting the goal of providing for protection, wise use, appreciation and enjoyment of the Great Barrier Reef in perpetuity.*
3. *As far as practicable the plan should maintain consistency with existing zoning plans in terms of zone types and provisions.*
4. *As far as practicable the plan should maintain consistency with plans drawn up under Queensland Marine Parks legislation.*
5. *As far as practicable the pattern of zones within Sections should avoid any sudden transition from highly protected areas to areas of relatively little protection. The concept of buffering should be applied.*
6. *As far as practicable, unless levels of localised activity suggest otherwise, single zonings should surround areas with a discrete geographic description (e.g., an island or reef).*
7. *Zone boundary widths should be consistent around reefs and islands and, where possible, should be described by geographical features (based on line of sight to aid identification in the field).*

SPECIFIC REQUIREMENTS

Shipping

1. *The plan should provide for the movement of shipping along recognised or proposed routes.*
2. *The plan must not impede the access of international, interstate or intrastate shipping to shipping routes or routes into existing ports on the coast of Queensland.*

Defence Areas

1. *The plan must recognise the requirements of the Department of Defence, particularly with regard to gazetted defence areas.*

Conservation of Significant Habitat

1. *As far as practicable areas of world, regional or local significance for wildlife conservation (involving for example, dugong, whales, turtles, crocodiles) should be given appropriate protective zoning.*
2. *As far as practicable where significant breeding or nursery sites can be identified, particularly for species subjected to harvesting, these should be provided with appropriate Seasonal Closure, Marine National Park or Preservation zoning.*
3. *As far as practicable representative samples of characteristic habitat types should be included in either Marine National Park 'B' or Preservation zones.*
4. *As far as practicable in reefal areas protective zoning should be applied to reef/shoal complexes (i.e., to incorporate a wide range of habitat types within one unit).*
5. *Reefs and other areas adjacent to coastal settlements and/or popular departure points are often the focus of fishing and related activities. As far as possible a group of Replenishment Areas (areas closed for set periods to enable fish and other exploited resources to regenerate) should be declared within the same general area.*

National Parks, Reserves and Historic Shipwrecks

1. *As far as practicable zoning of reefs and waters adjacent to existing National Parks, Fisheries Reserves and Historic Shipwrecks should complement the objectives of those reserves.*

Anchorages

1. *As far as practicable major anchorage sites should be in General Use zones so as to allow most of the activities associated with overnight or longer anchoring of vessels to continue. Where an anchorage is zoned in a manner that restricts those activities as far as practicable the opportunity to carry out those activities should be provided at an adjacent anchorage.*

2. *As far as practicable the zoning for anchorages should not result in the multiple zoning of a single island/reef unit simply because an anchorage is present.*

3. *As far as practicable the Plan should retain access for small boats to important all-weather anchorages. However, access to all zones during emergency conditions must be allowed for.*

Scientific Research

1. *Provision should be made for the conduct of scientific research throughout the Section. However, areas should only be zoned exclusively for scientific research where existing and probable future research programs indicate that those areas are likely to be used for that purpose on a frequent and regular basis. In other cases declaration of areas for special management for scientific purposes should meet the needs of the scientific community.*

1. *As far as practicable zoning should complement current spearfishing restrictions as set out in the Queensland Fisheries Regulations.*

Commercial and Recreational Activities

1. *As a general rule:*

   - *areas of significance for non-extractive activities should as far as practicable be given Marine National Park zoning; and*

   - *areas of significance for reasonable extractive activities should as far as practicable be given General Use zoning.*

2. *When a reef or area is zoned in a way which excludes a particular activity, provisions should be made, in as many cases as possible, for access to alternative areas.*

As the Authority and the community gained experience of the planning and processes, and the program addressed larger areas with new issues, the range of guidelines or operational principles has evolved retaining and refining most of the original ones and adding others to reflect new information. The operational principles for the most recent planning program can be viewed on: http:// www.gbrmpa.gov.au/corp_site/key_issues/conservation/rep_areas/info_sheets.html.

New Information and Changed Understanding

The Reef has always been accepted as a natural wonder and an Australian icon. There has been continuous change of values and attitudes to concepts of reasonable use. The change over 25 years means that activities that were once seen as reasonable are no longer factors for management. Management solutions that were seen as daring or aggressive are now seen as conservative. Activities that occurred at low levels that were seen to have no significant implications for conservation or the use and amenity of others are now seen to need management to demonstrate sustainability. We may think that we are planning for perpetuity but we must recognise that each generation will face changed situations and respond to their situation in the light of different information, values and attitudes.

The creation and initial zoning of the GBRMP was conducted in response to strongly held public and bipartisan political views that the natural values of the Reef should be systematically protected to secure its long term future. There was a sense of urgency and an acceptance of the need to complete the task within a reasonable period. This was strengthened with the inscription of the GBR Region on the World Heritage List in 1981.

By 1982 less than 20% of the 345,000 km^2 area had been declared and zoned. A new government elected in 1983 established the target of completing the task by 1988, the Bicentennial year of Australia's European settlement. Scientific, economic and sociological understanding of the GBR and the dynamics of contemporary or potential human uses and impacts were patchy and limited. It was clear that the creation and management of the GBRMP could not wait for major research but would have to be done on the best available information and revisited in the light of subsequent research and information.

There are still those who deeply resent the concept that they cannot fish when and where they choose. But the Marine Park is not alone in that because it is also an issue for sectoral fisheries managers. The majority works within the zoning and recognises that it brings responsibilities and benefits. The areas surrounding no-take zones are increasingly prized as good fishing spots - even by people who object to the closures. Indeed some of the success of the regime is reflected in the evidence of people prosecuted for fishing illegally in the no-take zones "because that's where the big fish are."

Now, a generation of experience of the GBRMP drawing on an increasing body of research, has consolidated the processes of planning and management and applied the benefits of new technologies for spatial planning, decision support and community consultation. A component of management has been a program of information and education targeted at the community generally, at interest and user groups and at schools. This has helped to create an informed, generally supportive, coastal community with a sophisticated knowledge of the issues and processes.

Changes in Technologies and Impacts of Use and Access

The technologies of use and access and the economic dynamics of the GBR have changed fundamentally since the start of the Marine Park. In 1979 the Reef was remote, pristine, navigationally hazardous and rarely visited. For most Australians it needed protection to maintain its existence and bequest values - "because it was there." It is now accessible thanks to satellite navigation and high-speed vessel technologies. Some of the existence values have become realised as an economic resource for recreation and tourism.

In 1979 the largest economic use was clearly fishing. The Reef Region was largely valued in local communities as a significant economic production system for natural resources. There was a generally held view that it was reasonable for amateur fishers to expect to recover all costs and make a profit by selling fish. By 1990 the largest economic use was clearly tourism by a factor of 4:1 but fishing continues as a significant economic activity with most of the Marine Park still available for fishing.

Changes in Values and Attitudes to Zoning and Management

Changes in values are illustrated in attitudes to controls on recreational fishing. In 1979 discussion of bag limit proposals on recreational fishers at sites accessible for recreational fishing caused controversy and outrage. Recreational fishing groups sent 30 cm telexes of protest to State and Commonwealth politicians. By 1989 the same groups were calling for bag limits. Now bag limits are accepted and light gear sport fishing with no retention is increasingly popular.

In 1979 collection of shells and coral was seen as a reasonable activity for which provision should be made, even though some of the collection methods included use of crow bars at low spring tides in order to break into crevices and cavities where shells may hide. This is now seen as inappropriate.

In 1979 scientific research was regarded as an automatically beneficial activity. But concerns developed over impacts of techniques, including use of explosives or poisons to collect fish, the scale of impacts on habitats and populations of rare species, and over adequacy of experimental design to justify environmental impacts. This led to a workshop by the Australian Academy of Sciences and the development of ethical guidelines for environmental research to complement the ethical guidelines on animal welfare (Kenchington and Lawrence 1998). These are now an integral component of the research permitting process for the Marine Park.

The biggest change in values and attitudes is reflected in the outcome of the recent process of review and re-planning of the GBRMP to focus systematically on all habitats and on the maintenance of biodiversity and ecosystem processes of the GBR World Heritage Area.

In the first zoning cycle there was robust debate with credible threats of collapse of the planning process and 4.5% of the GBRMP was included in no-take zones. The need to protect coral reefs was accepted but the concept that the full range of habitats was inter-linked and areas other than coral reef needed protection was not broadly accepted. So the no-take zones were very largely concerned with coral reef habitats. Still, creating them involved unprecedented restrictions and there was staunch opposition but the initial round of planning was accepted by the Commonwealth Parliament. The clear view of those involved in the process was that 4.7% no-take, 15.9% habitat protection and the rest general use was as good a balance of conservation and reasonable use as could be achieved at the time.

An important element of the initial round of planning was a commitment to review the plans. In light of the limits of available information for initial planning, there was a recognised need for research and monitoring to increase understanding essential to the concepts of conservation,

demonstrable sustainability, and reasonableness of use and impacts. A key element of that was the need for better understanding of the biological diversity of the GBR, and scales of space and time of the processes that drive the ecosystems of the GBR region.

Longer Term Strategic Planning

The initial phase of the GBRMP was followed by a phase of strategic planning that built on the network of stakeholders and understanding of the process and potential of the GBRMP developed in the initial round of zoning. The objective of the strategic planning was to address directly Australia's responsibilities and commitments for the GBR under the World Heritage Convention. The outcome was a 25-year vision for the future of the GBR World Heritage Area (GBRMPA 1994):

"A healthy environment: an Area which maintains its diversity of species and habitats, and its ecological integrity and resilience, parts of which are in pristine condition.

Sustainable multiple use: non-destructive activities which can continue forever, that is, in such a way that maintains the widest range of opportunities for appropriate sustainable use, and does not adversely affect the ecological integrity of its natural systems.

Maintenance and enhancement of values: the continuation and enhancement of diverse aesthetic, ecological, economic, cultural and social values, providing for the aspirations of residents, users, Aboriginals and Torres Strait Islanders and the global community.

Integrated management: management of activities which takes into account the ecological relationship between the Area and other adjacent areas, particularly the mainland.

Knowledge-based but cautious decision-making in the absence of information: decisions based on a commitment to research, monitoring and review using data and experience from all sources and erring on the side of caution in the absence of information.

An informed, involved, committed community."

The recent rezoning involved a well-informed public and was based on the improved understanding generated by the strategic planning process and 25 years of experience of the Marine Park, of information and education programs, and the results of targeted research.

The planning program was focussed largely on changes needed in order to meet national commitments under the World Heritage Convention for protection of the biological values of the GBR Region. It resulted in a substantial increase in areas protected by no-take zoning, and despite staunch opposition, achieved a new balance of conservation and reasonable use. There is now 33% no-take zoning, 33% habitat protection and 34% general use.

Developing an Issues-focussed Performance-related Approach

The initial phase of planning for the GBRMPA was driven by the objectives of declaration and zoning in accordance with the GBRMP Act. The staffing of the office of the Authority was organized on a basis of sequential functional process with sections for Research and Information, Planning, Park Management.

The 25-year strategic planning program generated a change to a focus on the critical issues, the means to address those issues through the GBRMP mechanisms and the means to evaluate the degree of success in addressing the issues. That process led to an issues based reorganization of the staffing of the office of the Authority to form 4 critical issues groups:

- Fisheries
- Water Quality and Coastal Development
- Conservation and World Heritage
- Tourism and Recreation

The organisational transition from a process to issues focus coincided with a broader program requiring Australian government departments and agencies to become overtly client focussed and to define outcomes and performance criteria for assessing effectiveness in implementation.

The critical issues focus has established the critical issue groups as participating clients in a cyclical process of review and adaptive management. They apply a responsive contemporary approach to issues

consistent with the broad objectives defined through legislation, commitments and strategic planning. In the context of conservation and reasonable, sustainable use there is a clear appreciation of the need to move to a situation of demonstrable sustainability. The objective is to be able to demonstrate with robust evidence that there are reasonable grounds to believe that the levels of uses and impacts upon the resources and ecological systems of the GBRWHA are sustainable individually and collectively.

The objective of demonstrable sustainability involves consideration of scales of time, space and socio-economic context that have thus far received little attention.

What are the Lessons of the Great Barrier Reef Marine Park Management Experience?

In an overview of the experience of the first 25 years of the GBRMP, Lawrence et al. (2002) concluded that there was much to learn. They reflected that there was much to be proud of in the way that the Marine Park could be held up as a world-class example of ecosystem management. They commented, "It is not a model for the rest of the world but it may be adapted to other situations."

Lesson 1: Zoning is a good starting point for multiple use management.

Zoning provides the geographic and regulatory management framework and is therefore hard to separate from component management measures. Day (2002) identified aspects of zoning the have worked well and those that have proved difficult.

Aspects of zoning that have worked well - (after Day 2002) include:

1. *The Multiple use approach*
2. *The specific written objectives for each zone*
3. *Complementarity between Commonwealth and State provisions*
4. *Clear zoning provisions specify activities that can be conducted:*
5. *Clear zoning maps*
6. *Effective well prepared and well informed public involvement in development of zoning plans*
7. *Good explanatory materials and information on provisions of plans and regulations*
8. *Designated areas within zones for special management provisions including:*
   - *Public safety*
   - *Vessel mooring sites*
   - *Recovery after impacts*
   - *Shipping areas for ships over 1500 tonnes*
   - *Temporary experimental areas for fisheries or scientific research*
   - *Seasonal closure (e.g., during breeding or spawning sites)*

Lesson 2: Boundary definitions and appeal provisions can generate difficult demands for management.

Zoning plans and regulations that meet the requirements of legislative drafting can still be hard to implement.

Aspects of zoning that have proved difficult - (after Day 2002) include:

1. *Definition of zone boundaries for purposes of prosecution of infringements.*
   - *originally specified as 500 or 1,000 meters from features such as the reef edge but hard to identify at sea*
   - *hard to mark physically*
   - *now defined as geographic co-ordinates reflecting widespread use of GPS and acceptance of GPS positioning as evidence of location.*

2. Split zoning

- *Used in complex, high use areas but very difficult to enforce*

3. Site allocation and management within zones

- *The rapid development of tourism generated demand for accessible sites with sheltered anchorages and the need for mooring and anchoring plans as finer scale controls within some zoned areas.*

4. Permit system demands

5. Deployment of limited management crews and resources within a very large area

Most of these speak for themselves.

An overall lesson of experience was that while provisions and objectives in plans were clear they were quite frequently impossible to enforce or particularly to pursue infringements to the courts because of practical difficulties, mostly relating to demonstrating the location of an offence in relation to complex boundaries.

Permits are a valuable tool for dealing with unanticipated demands and for setting appropriate conditions for specific activities but the issue of permit demands was substantial and largely unanticipated.

The requirement to respond to permit requests in a timely manner generated unpredictable but urgent demands for expert staff time to respond to requests for information and to process applications.

Provision for permits to operate exclusively to specific sites generated a speculative market for such permits and inefficient use of sites with many not being used because of attempts by speculators to achieve high prices.

The provisions for review and appeal of permit decisions also generated unpredictable urgent demands for expert staff time. Developing case experience led to requirements for tighter and tighter specification of permit conditions and the reasons for their imposition and, again, increased demands for expert staff time.

Lesson 3: A clear legislative mandate with precedence for conservation AND reasonable use at the ecosystem scale is a good basis for dealing with existing and new sectoral interests.

In the absence of such a requirement there is no incentive to move from sectoral hard lines and the implied primacy of sectors with pre-existing use of the marine commons.

The logical implication is that unreasonable uses or unreasonable levels of use will be excluded or phased out. Reasonableness implies demonstration of the basis for sustainability of each use, and of the acceptability of the direct and indirect impacts of that use on natural resources, biological diversity, ecosystem processes and on the access and amenity of other users.

In practice at the start of the process there is not an adequate research basis for most activities to demonstrate reasonableness or verifiable sustainability. In the absence of such demonstration the precautionary principle will indicate constraint.

Lesson 4: The requirement to provide for conservation and multiple use means that clear guidelines or operational principles are needed for the planning process.

A clear framework established early in the process guides the various interest groups and sectors to address the full context of multiple, sequential and cumulative activities and impacts. In the absence of such a framework there is a tendency to unresolvable ambit claims and the planning agency and its political masters are obliged to arbitrate. In practice in an open political environment two sectors or groups faced with the task of developing a reasonable outcome consistent with guidelines are likely to do so in preference to receiving an imposed solution and more likely to abide by that outcome.

Lesson 5: The situation is dynamic. Community values, attitudes and understanding in relation to conservation and reasonable use change with experience and new information.

A plan is developed in response to contemporary knowledge, technology and values. A solution developed at a particular point in time for a particular area is likely to require revision to accommodate knowledge, technology and values at a later time. It may have lessons appropriate for other locations but it is rarely possible simply to transfer a specific solution to another location.

At the time the Act was passed, fishing - the harvest of renewable biological resources from the ecosystem - was the largest economic activity occurring in the GBR Region. The tourism industry was effectively restricted to a few islands and day trips to the few reefs which could be reached within 2 hours on a vessel capable of 8 to 10 knots. It was possible to charter vessels longer expeditions but in the days before widespread SCUBA such charters were usually undertaken for the purposes of fishing.

There is an increasingly sophisticated understanding of the linkages between land and sea activities. There is also a growing understanding of the combined effects of natural episodic events, such as El Nino/La Nina weather events, and human impacts on the resilience or self-repair capacity of marine environments.

Tourism has now grown to be the largest economic activity in the GBRMP. There are occasional tensions but there is substantial agreement in purpose between environment management and the tourism industry. The object of the industry is to generate economic advantage by showing clients high quality examples of the healthy GBR ecosystem. The management of harvesting or extractive activities of fishing are the most important and difficult to address and are discussed in this paper.

Education and community involvement in planning and management and strategic planning have profoundly changed understanding of the dynamics of the GBRWHA and concepts of reasonable use and impact upon it.

Lesson 6: An issues based approach is important for setting management objectives and determining effectiveness in achieving them.

A successful plan reflects the best understanding of the constraints and opportunities for the area and resources in question at the time it is prepared. The dynamics of the system usually means that there is a combination of increased knowledge of the system and of human impacts, new or potential additional or increased uses and changing attitudes to the reasonableness of use. The quest for a perfect plan based on robust statistical analysis of perfect information is open ended and unlikely to reach closure. Acceptance that a planning solution is based on best available information, a commitment to performance evaluation and plan review is more likely to lead to plan closure. Parties then have the opportunity on review to bring new information to the table in the next iteration.

Clear well considered objectives are usually developed through close understanding of the issues. Demonstrating effectiveness of management for conservation and reasonable use involves the ability to measure management performance against objectives and overall to achieve demonstrable sustainability.

References

Commonwealth of Australia. 1974. Report of the Royal Commissions into Exploratory and Production Drilling for Petroleum in the Area of the Great Barrier Reef. Australian Government Publishing Service, Canberra, Australia. 1,052 pp.

Commonwealth of Australia. 1984. Great Barrier Reef Marine Park Authority Annual Report 1983-1984. Canberra, Australia. 101 pp.

Day, J.C. 2002. Zoning - lessons from the Great Barrier Reef Marine Park. Ocean and Coastal Management 45: 139 - 156.

Great Barrier Reef Marine Park Authority. 1994. The Great Barrier Reef, Keeping it Great. Great Barrier Reef Marine Park Authority, Townsville. 64 pp.

Kenchington, R.A. 1990. Managing Marine Environments. Taylor and Francis, New York. 247 pp.

Kenchington, R.A. and D. Lawrence (eds.). 1998. The Ethics of Environmental Research: Proceedings of the 1997 Fenner Conference. Australian Journal of Environmental Management 5 (Suppl): 1-84.

Lawrence, D.R., R.A. Kenchington and S.J. Woodley. 2002. The Great Barrier Reef: Finding the Right Balance. Melbourne University Press, Carlton, Australia. 26 pp.

Appendix A:

The 25-Year Strategic Plan for the Great Barrier Reef World Heritage Area. 25 year objectives for broad areas of activity.

1 Conservation

- *To ensure the persistence of the GBR WHA as a diverse, resilient, and productive ecological system, while retaining opportunity for a diverse range of experiences and uses consistent with Australia's obligations under the World Heritage Convention*

2 Resource management

- *To facilitate sustainable multiple use of the resources of the GBR WHA, through integrated management systems which are complementary with the management of the adjacent regions.*

3 Education, Communication, Consultation and Commitment

- *To have a community of responsible, informed individuals who have a broadly-based and widely-accepted understanding of the diverse values, natural attributes, and ecologically sustainable use of the GBR WHA, who:*
- *Show commitment to the maintenance of a healthy natural ecosystem*
- *Recognise the importance of having the opportunity for input into the way the GBR WHA is managed*
- *Act consistently to conserve and use in an ecologically sustainable way the GBR WHA.*

4 Research and Monitoring

- *To obtain and disseminate accurate and timely information which will help decision makers and maximize community confidence in decisions made regarding the GBR WHA*

5 Integrated Planning

- *To ensure that planning standards and guidelines for development, use, water quality and conservation aim to achieve a healthy, properly functioning GBR WHA*

6 Recognition of Aboriginal and Torres Strait Islander Interests

- *To have a community which recognises the interests of Aboriginals and Torres Strait Islanders so that they can pursue their own lifestyle and culture, and exercise responsibility for issues, areas of land and sea, and resources relevant to their heritage within bounds of ecologically sustainable use and consistent with our obligations under the World Heritage Convention and other Commonwealth and State laws.*

7 Management Processes

- *To have simple, pro-active and coordinated management processes which lead to appropriate, collaborative and timely decisions by governments, groups and individuals*

8 Legislation

- *To provide complementary, simple and effective legislation at all levels of government that facilitates effective implementation of the strategic plan and integrated management of the GBRWHA in accord with World Heritage obligations.*

ZONING THE FLORIDA KEYS NATIONAL MARINE SANCTUARY

Billy D. Causey
Superintendent, Florida Keys National Marine Sanctuary
The National Marine Sanctuary Program

The National Marine Sanctuary Program in the United States, managed by the National Oceanic and Atmospheric Administration (NOAA) in the United States (U.S.) Department of Commerce, comprises a network of 13 aquatic protected areas that encompass marine and freshwater resources from Washington State to the Florida Keys, and from Lake Huron to the Gulf of Mexico. The tropical Pacific Ocean has two designated Sanctuaries, one in American Samoa and another in the Hawaiian Islands. A second Hawaiian Sanctuary, encompassing the Northwest Hawaiian Islands will be the fourteenth Sanctuary when it completes the designation process. NOAA's National Ocean Service has managed marine sanctuaries since passage of the Marine Protection, Research and Sanctuaries Act of 1972. Title III of that Act is now called the National Marine Sanctuaries Act.

The National Marine Sanctuaries provide protection to a variety of aquatic areas, including deep ocean gardens, nearshore coral reefs, whale migration corridors, deep-sea canyons, and underwater archeological sites. They range in size from 0.7 km^2 in Fagatele Bay, American Samoa, to more than 13,730 km^2 off Monterey Bay, California - one of the largest marine protected areas in the world. Together, these sanctuaries protect nearly 46,600 km^2 of coastal and open ocean waters and habitats. While some activities are managed to protect resources, certain uses, such as recreation, commercial fishing, and shipping are allowed to the extent that they are consistent with a sanctuary's resource protection mandates. Research, education, outreach, and enforcement activities are other major components in each sanctuary's program of resource protection.

Florida Keys

The only emergent coral reefs found off the continental U.S. are located in the Florida Keys, from south of Miami to the Dry Tortugas. The coral reef community is an almost continuous reef tract and parallels the emergent Keys for 356 km, arcing in a southwesterly direction before terminating west of the Dry Tortugas. An outer reef tract lies east and south of the Keys at a distance of 4.8 to 11.3 km. Because the Upper and Lower Keys are protected from the direct flow of water from the Gulf of Mexico, they are considered to have greater reef development than the Middle Keys.

The National Marine Sanctuary Program has managed sanctuaries along the coral reef tract in the Florida Keys since 1975. The Key Largo National Marine Sanctuary was established in 1975 to protect 353 km^2 of coral reef habitat stretching along the reef tract from just north of Carysfort Lighthouse to south of Molasses Reef, offshore of the Upper Keys. In 1981, the 18 km^2 Looe Key National Marine Sanctuary was established to protect the very popular Looe Key Reef located off Big Pine Key in the Lower Keys. These two offshore National Marine Sanctuaries were, and continue to be, managed very intensively. The installation of mooring buoys to protect the reefs from anchor damage, educational programs, research and monitoring programs, and various resource protection programs, including interpretive law enforcement, were concentrated in these two marine protected areas. Both sites were located in federal waters. Since these two sanctuaries are located between 5-7 km offshore, the health of these coral reef resources has been affected by land-based sources of pollution and nutrients. Managing these two sites was like attempting to manage islands in the middle of the ecosystem. Obviously, the major threats came from outside the boundaries of the sanctuaries. In order to be successful at management, an ecosystem approach had to be implemented.

By the late 1980s, it became evident that a broader, more holistic approach to protecting and conserving the health of the coral reef resources had to be implemented. Regardless of the intensity used in managing small portions of the coral reef tract, sanctuary managers were witnessing declines in water quality and the health of corals from a wide range of causes. The more obvious causes of decline were point source discharges, habitat degradation due to development and over-use, and changes in reef fish populations due to overfishing. Clearly, less obvious sources of decline were affecting the health of the coral reefs and these had to be identified. These impacts were occurring at the local, regional and global scales.

Global and Regional Challenges

Ten percent of the world's coral reefs are considered to be lost beyond recovery and the remaining coral reefs, especially those near population centers, are in a state of decline. However, coral reefs are not the only marine ecosystem or marine resource that is in a state of alarming decline. For decades we have taken our bounties from the oceans; tapped into their vast reservoir of resources; used their

surfaces to move our commerce from port to port, coast to coast and continent to continent; and replaced vital coastal and marine habitats with facilities and development designed to attract ocean-loving people to our shores. Now we are witnessing the results of past actions by way of polluted waters, collapsing fisheries, loss of critical coastal and marine habitats, harmful algal blooms, coral bleaching, hazardous stormwater runoff, introduction of exotic marine species and global climate change. As a result, the economies that depend on a healthy ocean environment are being affected on local, regional and global scales.

Among our mistakes has been not to treat our oceans as a finite resource. For generations, we have honestly assumed our oceans would always be capable of supplying our needs, whether they are economic or spiritual in nature. We have always taken the quality of life given to us by our oceans for granted. However, in a few brief decades we have witnessed advancing technology collide with the ability of marine life to sustain itself.

Social and Economic Significance

In the U.S. we have witnessed a huge increase in the migration of our population to our shoreline. Today, more than 50% of the U.S. population lives within 130 km of a coast, and 3,600 people join them daily as coastal residents. On a global scale, two-thirds of the world's more than 5.5 billion people live within 130 km of the coast.

We are only beginning to realize the economic importance of our oceans as we watch our coral reefs suffer from coral bleaching, lose critical commercial fisheries, witness the decline of water quality, puzzle over mysterious fish die-offs, cope with coral diseases, monitor toxic algal blooms, and assess the impacts of exotic marine species. Today, one out of every six jobs in the U.S. is related to the oceans. In 1995, the U.S. fishing industry added more than $20 billion to the economy, while coastal tourism generated more than $54 billion. For example, 3 million tourists visit the Florida Keys on an annual basis and stay an average of 13.3 million visitor days. While in the Keys, the tourists spend $1.2 billion each year. Their favorite activities are snorkeling and diving on the living coral reefs, fishing and simply enjoying the environment.

The U.S. coastal tourism and recreation industries are the largest and fastest-growing economic segments of the U.S. service industry. Travel and tourism contribute tax revenues in excess of $58 billion a year, with $7.5 billion of that generated by foreign visitors. Beaches are the leading tourism destination in the country, followed by national parks and historic sites. In 1997, the U.S. Environmental Protection Agency (EPA) reported that coastal and marine waters support 28.3 million jobs, generate $54 billion in goods and services, contribute $30 billion to the U.S. economy through recreational fishing and provide a recreation destination for 180 million Americans each year. Miami Beach is an excellent example of just how much good beaches mean. There was no beach left by the mid-1970s as a result of erosion. Beginning in the late 1970s, a beach renourishment program was initiated, and beach attendance increased from 8 million in 1978 to 21 million visitors just five years later.

Sanctuary Designation

The U.S. Congress designated the Florida Keys National Marine Sanctuary (FKNMS), which is 9,600 km 2 in size, in 1990. The Sanctuary encompasses all of the waters surrounding the islands of the Florida Keys up to mean high tide. Some of the marine communities included in the Sanctuary are mangrove islands, lush seagrass beds, productive hard bottom, a variety of patch reef habitats, offshore spur and groove coral reef formations and deep coral reefs. The Sanctuary encompasses an estimated total 325 km^2 of coral reef, 143 km^2 in State of Florida territorial waters (< 3 nm from shore) and the remaining 182 km^2 in federal waters (>3 nm from shore).

With the designation of the Sanctuary, the entire coral reef tract of the Florida Keys was afforded certain levels of protection. Oil and hydrocarbon exploration, mining and large shipping traffic are excluded from the Sanctuary. Anchoring on corals in shallow water is prohibited, as is touching coral, collecting living or dead coral, and harvesting "live rock", a product of the aquarium trade. The Sanctuary has the authority to address discharges within its boundary, as well as potential pollutants that originate from outside the Sanctuary, offering protection of water quality that is critical for coral reef health.

The purpose of the Sanctuary is to protect the unique marine resources found within the Florida Keys and to manage human use of these resources. The management plan for the FKNMS contains a variety of management tools to protect and sustain the marine environment of the Florida Keys.

Sanctuary Management Tools

The Sanctuary's management plan was implemented in 1997. That plan was developed in an integrated process using various stakeholder groups, including a Sanctuary Advisory Council and all of the local, state and federal agencies that have a management role in the Florida Keys. General categories for the management programs are:

- Research and Monitoring,
- Education and Outreach,
- Volunteerism,
- Enforcement,
- Threat Reduction Measures, and
- Marine Zoning.

The individual components of these programs are far too comprehensive to cover fully in this paper, but a brief description follows.

RESEARCH AND MONITORING

To monitor changes occurring in the marine environment of the Florida Keys, the Sanctuary has implemented a comprehensive research and monitoring program. The goal of this program is to establish baseline information on the various components of the ecosystem and ascertain cause and effect relationships. In this way, research and monitoring can ensure the effective implementation of management strategies using the best available scientific information.

Many groups, including local, state and federal agencies, public and private universities, private research foundations, environmental organizations and independent researchers, conduct research on the coral reef environment. The Sanctuary facilitates and coordinates research occurring within its boundaries by registering researchers through a regional permitting system, recruiting institutions to carry out priority research activities, overseeing data management, and disseminating relevant findings to the scientific community and to the public.

Monitoring within the Sanctuary occurs at a number of levels. The objectives of the monitoring program are to establish a reference condition for biological communities and water quality conditions within the Sanctuary so that the effectiveness of management actions, specifically the non-consumptive zones, can be evaluated over time.

The most comprehensive, long-term monitoring program underway in the Florida Keys is conducted through the Water Quality Protection Program (WQPP), funded by the U.S. EPA through the authority of the Sanctuary Act. The WQPP and its associated monitoring program began in 1994 and consist of three components: water quality, corals and hard bottom communities, and seagrasses. The status of reef fishes, spiny lobster, queen conch, benthic cover and algal blooms are monitored Sanctuary-wide as well through NOAA funding.

In addition to fixed-station monitoring occurring under the WQPP, the effects of no-take management, which began in 1997 through the implementation of 23 discrete marine reserves, are specifically being monitored through a Zone Monitoring Program (ZMP). The goal of the ZMP is to determine whether the no-take zones are effective in protecting marine biodiversity and enhancing human values related to the Sanctuary. The ZMP is a three-level program that monitors changes in ecosystem structure (size and number of invertebrates, fish, corals and other organisms) and function (such as coral recruitment, herbivory, predation). Measures of effectiveness will include the abundance and size of fish, invertebrates and algae, as well as economic and aesthetic values of Sanctuary users and their compliance with regulations. Human uses of zoned areas are also being tracked.

EDUCATION AND OUTREACH

The primary management tool used in the thirteen National Marine Sanctuaries is education and outreach. Increasing public awareness and understanding through education is critical to achieving resource protection and stemming many of the ocean problems described above. Aquatic protected areas such as National Marine Sanctuaries provide excellent settings in some of the most significant and fascinating marine and coastal environments in the U.S.

By reaching the recreational visitors to the coastal or marine environments with educational and outreach messages, we are able to spread our messages across the nation, and indeed the world. However, it is also important that we reach our coastal residents with the same educational and outreach messages. For that purpose, the FKNMS has developed an informal education program that comprehensively targets both

visitors and residents. Our audience is the more than 80,000 year-round residents in the Keys, the 50,000 winter residents, and the 3 million visitors who spend 13.3 million visitor-days snorkeling, scuba diving, fishing or relaxing in the tropical environment of the Florida Keys.

Impacts to the resources of the Florida Keys are numerous, including water quality degradation, habitat destruction, overfishing and increasing human pressures on a finite, fragile ecosystem whose balance began to topple in the 1950s. Each one of these threats to the marine ecosystem of the Florida Keys requires education and outreach programs that target specific audiences. For example, many of the impacts to the shallow water resources of the Keys come from boating activities. Whether it is prop-scaring in the seagrass beds or running aground on fragile coral reefs, much of the habitat destruction we are witnessing is the result of poor or inexperienced boat operation. In the last ten years alone, boater registration has increased 60% in the Florida Keys. There is one boat for every two households in the Keys. This does not include the tens of thousands of boats that are trailered into the Keys by visitors each year.

Some of the challenges we face in educating residents, visitors and the wider public are:

- there is no single point of entry to the Sanctuary,
- there are large numbers of users,
- there are diverse, multilingual residents and tourists, and
- resource damage occurs from both direct and indirect impacts.

These challenges are not unlike many of those facing other aquatic protected areas around the nation or the world, for that matter. The goal of our education and outreach program is to meet and overcome these challenges with innovative and creative educational tools that increase the public's understanding of the marine environment. This will develop a more informed public who appreciate and use the marine environment for recreational, commercial or aesthetic purposes, recognizing their full impact on those resources.

The management plan for the Sanctuary contains an Education and Outreach Action Plan that uses a variety of tools to convey critical information to the various audiences. These tools are:

- community-based,
- school-based,
- partnership-based,
- technology-based,
- product-based, and
- media-based.

A description of these various programs can be found in the Sanctuary's final management plan.

VOLUNTEERS

The Sanctuary's volunteer program was established through a partnership with a non-governmental organization, The Nature Conservancy. Partnerships with the State of Florida, academic institutions and other non-governmental organizations have dramatically expanded the work begun by Sanctuary staff. With limited staffing and financial resources, the Sanctuary has been far more effective in carrying out some management programs because of the commitment of residents and visitors in seeing conservation work get done. For example, more than 120,000 volunteer hours were donated to the Sanctuary between 1996 and 2000. This is equal to $1.8 million dollars in contributions, based on a national figure that calculates the value of volunteer hours.

ENFORCEMENT

While National Marine Sanctuaries rely largely on compliance with Sanctuary regulations, the history of the Sanctuary program in the Florida Keys has required a major commitment to enforcement activities by NOAA. When Congress expanded the Sanctuary boundary in 1990, it became abundantly clear to Sanctuary managers that a major enforcement presence would have to be maintained in order to protect and conserve Sanctuary resources. Sanctuary enforcement in the Florida Keys has traditionally been accomplished through a cooperative agreement between NOAA and the State of Florida. The state continues to be the primary enforcement arm for the Sanctuary. NOAA provides 100% of the funding for enforcement activities in the Sanctuary to the Florida Fish and Wildlife Conservation Commission. There are 17 state-certified law enforcement officers assigned to the Sanctuary enforcement team. In addition, NOAA's Office of Law Enforcement and the U.S. Coast Guard (USCG) also provide enforcement support to the Sanctuary.

THREAT REDUCTION MEASURES

The Florida Keys National Marine Sanctuary and Protection Act contains very specific prohibition of certain uses such as the operation of vessels greater than 50 m in length within an Area to be Avoided (ATBA) established around Sanctuary waters and a prohibition on oil and hydrocarbon exploration and mining within the Sanctuary. The Act also contains very precise directions from Congress on the development of a WQPP by EPA and a comprehensive management plan by NOAA.

There have been significantly positive results since Congress restricted vessel operation within ATBA surrounding Sanctuary waters. The ATBA has been very effective at decreasing the number of major ship groundings on the coral reefs of the Florida Keys. Prior to 1990, there was a major ship grounding (>50 m in length) nearly every year. After the ATBA took effect in 1990, six years lapsed before there was a major ship grounding and only two have occurred since 1990.

In addition, the Sanctuary and adjacent waters have been approved as a designated Particularly Sensitive Sea Area (PSSA). This designation has to be approved by the International Maritime Organization and only exists for two other areas around the world. PSSA designation, while not accompanied by any additional rules or regulations, serves to elevate international recognition of the sensitivity of the marine environment of the Florida Keys to any catastrophic events, such as oil spills or release of hazardous materials.

Congress recognized the decline in the nearshore water quality of the Florida Keys when it designated the Sanctuary. Legislators authorized the EPA to work with the State and NOAA to develop a WQPP. Even before the implementation of the final plan in 1997, EPA and its partners had completed the WQPP. EPA incorporated the components of the WQPP into the Water Quality Action Plan contained in the Final Management Plan (1996). The EPA and its partners have continued to implement critical projects identified in the plan. The purpose and active role of the WQPP has been to recommend priority corrective actions and compliance schedules addressing point and non-point sources of pollution to restore and maintain the living coral reefs and other critical marine life in the Sanctuary. The WQPP consists of four interrelated components: 1) corrective actions that reduce water pollution directly by using engineering methods, prohibiting or restricting certain activities, tightening existing regulations, and increasing enforcement; 2) monitoring that includes a comprehensive, long-term water quality monitoring program designed to provide information about the status and trends of water quality and biological resources in the Sanctuary; 3) research/special studies that are designed to identify and understand cause and effect relationships involving pollutants, transport pathways and biological communities of the Sanctuary; and 4) public education and outreach programs designed to increase public awareness of the Sanctuary, the WQPP, and pollution sources and impacts on Sanctuary resources.

Other threat reduction measures include the implementation of Sanctuary regulations under the authority of the National Marine Sanctuary Act to protect and conserve Sanctuary resources. The regulations are divided into Sanctuary-wide regulations and regulations that apply to specific marine zones in the Sanctuary. The Sanctuary-wide regulations are focused on decreasing the level of habitat destruction in the Keys and addressing water quality issues. Anchoring on corals in shallow water is prohibited, as is touching coral, collecting living or dead coral, and taking “live rock”. Operating vessels in such a manner as to strike or otherwise injure coral, seagrass or other attached marine life is prohibited.

In addition to Sanctuary-wide regulations that address direct and indirect impacts to coral reef resources, regulations specific to five different types of marine zones were implemented in July 1997. At that time, the FKNMS implemented the first network of marine zoning for a National Marine Sanctuary in the U.S. Five types of zones were implemented, each with different objectives and regulations. Three of the zone types, Ecological Reserves, Sanctuary Preservation Areas, and Special Use/Research-only Areas include a total of 24 individual “no-take” or “fully-protected” areas that have been established within the Sanctuary to protect critical habitat, preserve a diversity of species, and relieve pressure in heavily used coral reef areas. These areas comprise 6% of the total area of the Sanctuary, or 10% of the coral reef community. Stringent restrictions on taking, removing, etc. marine life and harming natural resources are in place in these zones to ensure their long-term health. Lobstering, fishing, spearfishing, shell collecting, and other consumptive activities are prohibited in these areas. A more detailed discussion of the marine zoning within the Sanctuary appears later.

Other threat reduction measures have included the implementation of a Sanctuary-wide mooring buoy program. Sanctuary biologist John Halas first implemented the mooring buoy system now used in the FKNMS in 1981 in the Key Largo National Marine Sanctuary. This simple, yet effective

tool for reducing anchor damage to coral reefs and seagrass beds was later implemented in the Looe Key National Marine Sanctuary (1984) and eventually spread to other parts of the Keys. Sanctuary staff worked with Reef Relief, a grassroots conservation group in Key West, and two other grassroots groups in the Keys to install mooring buoys at many popular dive sites along the reef tract. While mooring buoys are excellent management tools, it is important to realize that other management programs must accompany a mooring buoy program, such as education, outreach, research and monitoring. When the FKNMS was designated, the Sanctuary incorporated mooring buoys previously installed by other organizations in Key West, Marathon and Islamorada, expanding the number of buoys managed by the Sanctuary from 175 to more than 400. Besides mooring buoys, the Sanctuary staff have installed and maintain 109 yellow boundary buoys and 120 Wildlife Management Area boundary buoys to mark the marine zones.

In addition to mooring buoys, the Sanctuary staff work closely with other agencies in implementing a Waterway Management Action Plan. Channel marking in the Sanctuary falls primarily under the jurisdiction of the USCG and the State of Florida. However, Monroe County, in which the Sanctuary is located, manages a large number of navigation aids that it has installed in Keys waters. The county uses boating improvement funds that come from the registration of vessels in Monroe County to install navigation aids in areas identified in their Channel Marking Master Plan. All channel markers and navigation aids have been inventoried; 600 (+/-) aids to navigation in the Florida Keys are maintained and referenced in a GIS database. A boat access survey of all Monroe County marinas, boat ramps and docking facilities has been completed and entered into a marine facilities GIS database.

The Sanctuary worked with the USCG, the owners of the M/V Contship Houston, and the Key West Propeller Club to place eight Racon beacons on navigational aids along the reef tract from Loggerhead Key in Dry Tortugas National Park to Fowey Rocks in the northern end of Biscayne National Park. These beacons send a signal that is picked up on the radar screens of passing ships, warning them of the coral reef tract. The Sanctuary used its authority to negotiate with the ship owners to have them purchase ten of these highly effective beacons.

MARINE ZONING

Australia has led the world in the application of marine zoning to protect and conserve marine resources, while those resources are being used by various groups. Following Australia's example, Sanctuary managers have attempted to balance protection of Sanctuary resources with their continued use through the implementation of a comprehensive network of marine zones. Marine zoning is the setting aside of areas for specific activities, which allows the balancing of commercial and recreational interests with agency mandates to protect marine resources. Comprehensive marine zoning is a fairly recent concept in the management of marine protected areas within the U.S., but has been successfully implemented internationally for decades.

The coral reefs of the Florida Keys have been the focus of consumptive or extractive activities since before the invention of SCUBA in the 1940s. Naturally, these activities have increased in intensity over the past few decades and today many Keys residents simply talk about what it used to be like in the "old days." Stories of beds of queen conch, rafts of sea turtles, huge schools of tropical fish, grouper, snapper and so many lobster all you had to do was wade out from shore for them, are common. The final plan for the Sanctuary includes a marine zoning plan that will make it possible for the coral reef to be like that again.

The marine zoning plan was one of the most controversial elements of the planning process, yet it provides the opportunity for marine resources in some areas to be like they were when they were undisturbed, decades ago. Setting aside portions of the coral reef community as ecological reserves will allow these areas to return to what they were before man started disturbing them. Compared to the overall size of the Sanctuary, which is 9,600 km^2, the areas in the final plan are small, but they are necessary to accomplish the overall goals of the Sanctuary.

While there was large support for marine zoning from some groups during the development of the Sanctuary's management plan, it was the most controversial management tool considered. The topics of greatest concern in establishing the marine zoning plan were the proposed locations, sizes and allowable uses.

In the early days of public consultation on the draft marine zoning plan, Sanctuary officials were hung in effigy by concerned commercial fishermen and other groups who opposed what NOAA was proposing. A large opposition movement was massed between 1992 and the implementation of the final management plan in 1997.

Between the release of the draft management plan in 1995 and the final plan, NOAA reduced the amount of area set aside as "no take" or "fully protected" in the marine zoning plan from less than 6% to less than 1%. However, Sanctuary managers did make it clear in the final plan that a process would be developed to establish an ecological reserve in the western extent of the Sanctuary.

In July 1997, the FKNMS implemented the first network of marine zoning for a National Marine Sanctuary in the U.S. Five types of zones were implemented at that time, with different objectives and regulations. A brief description of the zones follows:

Sanctuary Preservation Areas

All activities that do not result in removal of marine life or damage to the resources are allowed in these areas. Activities that are prohibited in the Sanctuary Preservation Areas (SPAs) include spearfishing, shell collecting, tropical fish collecting, fishing and other activities that result in the taking of marine life by divers, snorkelers and fishermen. In addition, direct physical impact to corals in these areas is prohibited. In an effort to reduce socioeconomic costs from the SPAs, regulations allow catch and release fishing by trolling in four of the SPAs: Conch Reef, Alligator Reef, Sombrero Key and Sand Key.

Special-Use Research Only Areas

There are only four special use areas in the Final Management Plan: Conch Reef, Tennessee Reef, Looe Key (patch reef) and Eastern Sambo Reef. These are all designated as research-only areas. No person may enter these areas except as specifically authorized by a valid permit.

Ecological Reserves

All activities that do not result in removal of marine life or damage to the resources are allowed in Ecological Reserves (ERs). Spearfishing, shell collecting, tropical fish collecting, and other activities that result in the harvest of marine life by divers, snorkelers, and fishing activities will be prohibited in this zone type. In addition, direct physical impact to corals and vessel discharges are restricted.

Wildlife Management Areas

There are 27 Wildlife Management Areas (WMAs) established in the Final Plan. The majority of these areas (20) fall under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS), and Sanctuary regulations have been established to complement the USFWS criminal sanctions with Sanctuary civil penalties. Public access restrictions in these areas include idle speed only/no wake, no access buffer, no motor, and closed.

Existing Management Areas

Out of the total 19 Existing Management Areas (EMAs), 13 are administered by the State of Florida Department of Environmental Protection, four by the USFWS, and two by NOAA. Managing these areas within the Sanctuary may require additional regulations or restrictions to provide complete resource protection. These additional management needs will be developed and implemented in cooperation with the relevant agency.

The marine zoning plan provides a very common sense approach to focusing protection in small critical portions of sensitive habitats, while not restricting activities any more than necessary. For example, the 18 SPAs that are in the final plan protect over 65% of the shallow spur and groove reef habitat, while capturing approximately 80% of the year-round diving activity. These areas displace very few commercial and recreational fishermen and their "no take or consumptive activity" status will lead to resource enhancement of the coral reefs. By making these areas "no take or consumptive activity" areas, the visiting divers are directed to reef habitat where their activity will have less impact. Approximately 6% of the Sanctuary is designated as "no take or extraction."

Three of the zone types, ERs, SPAs, and Special Use/Research-only Areas include a total of 24 individual "no-take" or "fully-protected" areas that have been established within the Sanctuary to protect critical habitat, preserve a diversity of species, and relieve pressure in heavily used coral reef areas. Stringent restrictions on harvesting marine life and harming natural resources are in place in these zones to ensure their long-term conservation. The 27 WMAs restrict vessel operation and provide resource protection to shallow-water habitats, including seagrass flats. These areas also serve to enhance the experience of catch and release fishermen. The EMAs are necessary to recognize the continued authority of the agencies overseeing these protected areas. Most of the smaller zones (SPAs) are located along the offshore reef tract and encompass the 65% of the most heavily used spur and groove coral formations.

Ecological Reserves are the most significant type of marine zone in the Sanctuary. They comprise the largest "fully protected" areas. These encompass large, contiguous diverse habitats and are designed to preserve biodiversity; provide spawning, nursery, and residence areas for marine life; protect habitats and species not covered by existing fishery management regulations; and allow areas to remain in or return to a natural state. The Sanctuary has two ecological reserves. The 30.8 km^2 Western Sambo Ecological Reserve protects offshore coral reefs, as well as all other habitats, including mangrove fringe, seagrasses, productive hard-bottom reefs.

In July 2001, after a three-year collaborative design and planning process, the Tortugas Ecological Reserve (518 km^2) was established to increase the Sanctuary's network of marine zones outlined in the management plan. This concluded a 10 year management planning process during which many lessons were learned. This new reserve, located in the westernmost portion of the Florida Reef Tract, conserves important deepwater reef resources and fish communities unique to this region. The Tortugas Ecological Reserve preserves the richness of species and health of fish stocks in the Tortugas and throughout the Florida Keys, ensuring the stability of commercial and recreational fisheries. Restrictions on vessel discharge and anchoring were implemented in this zone to protect water quality and habitat complexity. It is expected that the reserve's geographical isolation will aid scientists in distinguishing between natural and human caused changes to the coral reef environment.

The Tortugas Ecological Reserve is also significant because it adjoins a proposed 157.8 km^2 Research Natural Area in the Dry Tortugas National Park, a zone where shallow seagrass, coral, sand and mangrove communities will be conserved. Together, the Sanctuary's Tortugas Ecological Reserve and the National Park's Research Natural Area fully protect nearshore to deep reef habitats of the Tortugas region and form the largest, permanent marine reserve in the U.S.

Lessons Learned

There were many "Lessons Learned" during the process to develop and implement a marine zoning plan for the Sanctuary, including:

- Establish goals and objectives for the "reserve" at the beginning.
- Agree on the ground rules.
- Don't predetermine the location or size of a "no take" area.
- Do not begin the process with a specific percent area to be set aside.
- Include representatives of all stakeholder groups.
- Don't assume one commercial fisher represents all aspects of commercial fishing.
- Don't assume one conservation member speaks for all conservation interests.
- Don't leave out representatives from the general public.
- Include all affected fishery managers and agency representatives.
- Involve scientists, but not just fisheries biologists. Ecologists and oceanographers must also be included.
- Make sure the process is open and flexible.
- Make sure the public has opportunities to engage in the process.
- Strive for unanimous support or the highest level of consensus.
- Allow the stakeholders to help guide the process.

Planning a no-take reserve must be a bottoms-up procedure that includes a well-balanced group of stakeholders from the local community. Models or textbook approaches can use the most recent science or theory available but will not work if you exclude the local experts. The group must include those who make their living on the water, as well as those who have local conservation experience. For example, accord commercial fishers the same status as Ph.D. scientists; after all, commercial fishermen have "Ph.D.s in commercial fishing." Stacking a working group with outsiders raises suspicion and can lead to failure.

Furthermore, the procedure for selecting participants is important. The planning process must include those who will be respected by their peers as spokespersons for the stakeholder group. I cannot overemphasize the importance of this step. The selection process for the participants and the make-up of the working group must be viewed as balanced and representative if the process is to have any chance of gaining public confidence. The process is doomed to failure if individuals with extreme, uncompromising viewpoints are included.

Striving for balance does not mean achieving equal numbers of constituent groups, for example, one commercial fisher and one conservationist. However, make sure all aspects of the fishing and conservation community have representation in the group. Do not try to stack the membership of

a working group in favor of a particular viewpoint. Both the participants and general public will see through the façade and the process will lose credibility. Don't hesitate to include individuals with differing viewpoints. Let the science and the balanced, integrated approach to establishing a reserve stand on their own merit. Know that reasonable, knowledgeable, and experienced people will make good decisions when provided with good science.

Establish a high level of trust among the group as soon as possible. Participants must be willing to respect differing opinions. The idea is to empower those who know the resources best, and who have some vested interest in the reserve's success. However, you must be willing to seriously consider their advice and demonstrate how the experience and opinions of your local experts has influenced the reserve design.

Avoid allowing the group to begin discussions by proposing boundaries or arguing about the percentage of an area that should be designated no-take. Such discussions will polarize the group from the start. Instead, begin by providing the group with the best available scientific and socioeconomic data about the area.

Oceanographers can explain the current patterns so the participants can see for themselves the mechanisms for larval distribution. Geologists can explain the long-term perspective of natural forces affecting the area. Ecologists can discuss special natural features, and fisheries biologists can explain reproductive patterns in marine organisms.

Try to establish long-term trends, which invariably show declines in many regions. Present all of this information as if you were building a geographical information system, layer by layer.

The most important layer is the various "uses" of the region. Find out from the experts where the fish spawning aggregations are. Learn about the seasonal and annual movement of fish and other marine life. Learn where the fishers work, and ask them what areas do they think are important and worthy of reserve protection.

Ask scientists, conservation groups, and non-extractive users of the area these same questions. The idea is to start developing a joint vision of the special areas that should be considered for protection.

It is important to conduct a thorough socioeconomic assessment. Fisheries economists must collect data at the most detailed scale possible. Incomplete or inaccurate information will fuel opposition from user groups. Thorough consideration of socioeconomic factors can build support for the reserve and boost the confidence of user groups in the process.

Success of Marine Zoning Implementation

The success of implementation of a marine zoning plan depends on the effectiveness of several other management programs. Those are:

- marking boundaries on charts, with buoys and through inclusion in Differential Geographical Positioning System (DGPS) units,
- education and outreach,
- monitoring and research on zone effectiveness, and
- enforcement.

MARKING BOUNDARIES

Successful implementation will be best achieved if the public can voluntarily comply with regulations. This requires clearly marking the protected areas on navigation charts or marking the boundaries with buoys. Use of both of these tools lead to even higher compliance rates. Additionally, when possible, facilitate the inclusion of marine zoning boundaries in the DGPSs.

EDUCATION AND OUTREACH

The majority of the general public will comply with marine zone regulations if they are aware of them. It is critical for a marine zoning implementation plan to include education and outreach programs designed to reach the general public before they have a chance to harm or damage the resources.

MARINE ZONE MONITORING AND RESEARCH

Results from the Sanctuary's zone monitoring program indicate that three years after zone implementation, some heavily exploited species exhibit increases in abundance and size. Specifically, legal-sized spiny lobsters continue to be more abundant in SPAs than in reference sites of comparable habitat. The average size of lobsters is larger and remains above the legal minimum size limit in the no-take areas, whereas lobsters found at reference sites have remained below legal size. The mean size of lobsters within the Western Sambo Ecological Reserve has been significantly larger than in reference areas in both the open and closed fishing seasons. Additionally, catch rates (number of lobsters per research trap) are higher within the ER than within two adjacent fished areas at all times of the year.

Overall, a high degree of variability has been documented with regard to reef fish abundance and size between no-take areas and reference sites. However, as would be expected with the added protection of no-take management, some species have shown increased abundance over time.

ENFORCEMENT

One of the major site selection criteria identified in the design of the Tortugas Ecological Reserve was "enforceability." All groups, ranging from commercial fishermen to conservation organizations ranked enforceability as a major criteria in selecting sites, as well as leading to their long-term success. This includes actions such as selecting boundary lines along latitude and longitude lines and committing to acquiring enforcement staff and resources necessary for them to do their job. While the majority of the public will comply with regulations, a small percentage of chronic violators will lead to lower levels of compliance and a loss of confidence by the general public, if enforcement is inadequate.

CONCLUSIONS

Marine zoning is critical to achieving the Sanctuary's primary goal of resource protection. Its purpose is to protect and preserve sensitive components of the ecosystem by regulating within the zoned areas, while facilitating activities compatible with resource protection. Marine zoning ensures that areas of high ecological importance evolve in a natural state, with minimal human influence, while allowing sustainable use of Sanctuary resources. Marine zoning can be effective at protecting diverse habitats, and preserves important natural resources and ecosystem functions.

Success in stemming the decline of our oceans depends on our collective understanding of the concept of sustainability. We must remind ourselves that our generation cannot use up the resources that are important to support the economy and environment that will be inherited by future generations. The use of marine zoning takes the guesswork out of managing and maintaining natural systems in the marine environment. We hardly understand the biology and ecology of many species of marine life that we allow to be taken; yet the quantity and quality of marine resources continue to plummet around the world.

"It is important to scientific study and to the health and sanity of man, that there be preserved some unique areas ..... to observe nature's continuing evolution; ..... the grandeur and peace of nature."

– Samuel H. Ordway, Jr.

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THE PROMISE AND PITFALLS OF OCEAN PLANNING AND MANAGEMENT

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'Ocean zoning' is becoming a catchphrase that is catching fire. Both the Pew Commission and the U.S. Ocean Commission have issued comprehensive ocean policy reports in recent months and each of those reports is peppered with dozens of references to 'zones' and 'zoning.' So here's the question of the moment (in multiple choice format):

Is it time to zone the ocean?

- ❑ A. Yes, we need to zone the ocean.
- ❑ B. No, we don't need to zone the ocean.
- ❑ C. Too late.
- ❑ D. All of the above.

Take a few seconds to think it over. Have you thought about it? OK, time's up. The answer of course is D. And here's why. Each of the first three options is a valid response, and your instincts probably told you that.

Yes, we need to zone the ocean

Even if you don't see eye to eye with the Pew and/or the U.S. Ocean Commissions, you're likely to agree with some of their basic findings, in particular that ocean spaces are increasingly subject to a host of users and activities giving rise to conflicts over the best use for a given area. Simply stated: we can't accommodate all uses in all places at all times; we prefer to use some areas for certain activities/development; we'd like to maintain some areas for low-impact/no impact use; we have an opportunity to increase economic productivity and efficiency; and, we would like to sustain many traditional uses. What is being touted as 'ocean zoning' (which I would argue would be better characterized as ocean planning and management) can help us do all of that.

No, we don't need to zone the ocean

Even if we substitute the terms planning and management for zoning, an argument can be made that we don't need to zone the ocean just yet. The fact is, we still don't understand vast expanses of the ocean. So how can we plan and manage what we don't understand?

And even if some of our ocean spaces are subject to conflicting uses and users, let's face it, the ocean is a big place. The ocean areas of the U.S. are roughly equivalent in size to the land mass of the country. Zoning a nation's entire ocean could be a waste of time, energy and money. Another reason we don't need to zone the ocean is that it's not private property. On land, when we talk about zoning, we usually are talking about land use restrictions on private property owners. If the ocean is public space, why zone it at all, some would argue. And finally, one reason that some state and federal ocean resource managers are concerned about the 'Z word' is that it ticks people off. Mention 'ocean zoning' within ear shot of fishers or others whose livelihoods depend on access to the sea and you're likely to hear the lament 'don't fence me in' (or even worse, 'don't zone me out.')

Too late

Option C indicates that the query posed is a trick question to a great degree, since we are not dealing with a blank slate when it comes to 'ocean zoning.' As the U.S. Ocean Commission report notes,

> "Although invisible to the naked eye, governments have carved the world's oceans into many zones, based on both international and domestic laws. These zones are often complex, with overlapping legal authorities and agency responsibilities."

In the waters of the U.S., Canada and many other maritime nations, a random walk through national, state/provincial and municipal laws highlights the fact that the oceans and coasts are already buried under multiple monikers. In some cases, boundaries are set to distinguish the

relevant legal jurisdictions. As a result, we have lines separating federal waters from state waters. Under international laws, ocean zones specify the types of laws that might apply in an ocean area. For example, a coastal nation can apply virtually all of its laws in internal waters but finds its jurisdictional reach diluted as it reaches out to sea. Less authority is allowed in a country's Territorial Sea which can reach out to twelve nautical miles, still less in the Contiguous Zone that can stretch another twelve miles out and less still in the Exclusive Economic Zone that can reach out as far as two hundred nautical miles into the sea.

Talk to scientists and others who study the seas and you'll hear them mention the 'zones' that define the ecology of an area and/or what types of activity may take place. There are coastal zones, riparian zones, buffer zones, productivity zones, retention zones, and last but not least, dead zones. In addition to all of that zoning are the multitude of designations that effectively tell you what's allowed or prohibited in an ocean area. Look at a variety of nautical charts and you'll find shipping channels, marine sanctuaries, recreational diving spots, oil and gas platforms, and security zones.

All of the above

While some may have been tempted to answer A, B, or C, you can see why 'All of the above' is an answer that reflects reality as well as varying perspectives.

A possible starting point

Given that there are sound reasons to zone some ocean areas and refrain from zoning others and in light of the fact that ocean zoning has been going on in an ad hoc fashion for centuries, we might do well to look to the land as we consider managing our great public offshore spaces. Let's consider some of the principles that have been applied when it comes to managing public lands:

- Don't sell public lands, do inventory them;
- Plan for present and future use;
- Establish rules and regulations after considering views of general public;
- Establish goals & objectives as guidelines for public land use planning;
- Manage on basis of multiple use and sustained yield;
- Manage to protect scientific/scenic/historical/ecological/environmental air & atmospheric/water resource/archeological values;
- Preserve and protect certain public lands in their natural condition; and,
- Obtain fair market value of the use of the public lands and resources.

(see Federal Land Policy and Management Act 43 USC §1701)

The application of those principles could serve as a framework for an ocean space designation process that will better serve the beneficiaries of our public ocean resources.

Appendix IV: Workshop participants

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