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Marine Protected Areas in Canada with a particular Emphasis on Newfoundland

Science, Policy, and Implementation at Multiple Institutional Levels

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A Report to:

The Leslie Harris Centre of Regional Policy and Development

at Memorial University

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Introduction

The International Union for the Conservation of Nature (IUCN) defines a Marine Protected Area (MPA) as "Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment." While the particular objectives for marine protected areas are diverse, the overarching goal is to conserve and protect part or all of a marine environment through legal or other effective means. MPAs range in size from less than 1 km^2 to more than 1000 km^2, and the degree of protection provided by the MPA may vary from concentration on a single species to protection of a unique habitat and its living and/or non-living components (e.g. National Research Council 2001). Regulations may range from limitations on types of fishing gear to complete protection from any fishing, recreational, and even most scientific activity.

MPAs have become part of national level ocean policy in such nations as Australia, Canada, and the US (Kelleher and Kenchington 1992; Sobel 1993; Willison 2002). They have become, in a few cases, policy at the regional level (e.g., state of California). They depend, for their success, on community involvement (Kenchington and Kelleher 1991, Gubbay 1995) and hence they depend on becoming part of the mindset and policy of local organizations. Policy development is likely to differ among these organizational levels. The policy process includes the identification of different alternatives; the range of such alternatives will differ among national, provincial, and local levels. Choice among alternatives will be shaped by differences among levels in financial capacity, political diversity, management arrangements, administrative structures, and objectives for the MPA. The means by which marine protected areas in Canada may be implemented are complex and varied. Several federal departments have the authority to establish different types of areas under different legislation. Protected areas may overlap one another and jurisdiction among Federal and Provincial departments may be unclear. In addition, designation is politically complex because of the diverse stakeholders who foresee loss of access and may have different priorities (e.g. fisheries enhancement versus biodiversity conservation). Collaboration among federal and provincial governments and community groups is critical to the success of marine protected areas. While the legislative process for designation is often explicit

at any one organizational level, the relationship of process at one level to that at another level is usually tacit, or at best buried in unpublished documents.

Regional policy must take place at the intersection of national policies and local (municipal or community) interests. Thus with respect to MPAs, our ***first objective*** is to compare the policy contexts of MPAs at national, provincial, and local levels, with special attention to our own province of Newfoundland. This first component of the research will assemble information on MPAs as policy alternatives. It will place regional policy in the context of national and local policy. It will thus serve as a case study of regional policy in regard to marine resource policy and rural community development.

While the conservation goals for marine protected areas may be clearly defined and the scientific endpoints recognized, the science basis for selecting a specific area is often sparse. From a policy perspective, this sparse science basis is problematic because it may preclude clear success, leading to little ongoing public support and therefore less effective management for conservation and stock enhancement (e.g. Horwood 2000). Much of the science related to marine protected areas to date has been conducted in tropical or subtropical systems, with few studies in mid-latitude ecosystems such as those in Newfoundland. The problem of assuming that findings from tropical areas are relevant to Newfoundland extends far beyond the fact that species composition is much different. Cold-temperate oceans are much more seasonal in terms of temperature and production, and many of the major processes (e.g. growth, maturation, dispersal) are dependent on season and occur over much longer time and spatial scales (e.g. Bradbury et al. 2001).

Within this context, our ***second objective*** was to identify internationally significant science questions that can be addressed within the province of Newfoundland and Labrador, given the national political momentum of the Oceans Act, given the unique features of MPAs in Newfoundland, and given the working relation of Memorial University with communities. Two marine protected areas were recently announced for the province of Newfoundland and Labrador (Eastport and Gilbert Bay) and a third (Leading Tickles) is in the development stage. The policy context for these MPAs has been a combination of federal policy (through the Oceans Act) and local policy (support within the local community). All three areas are adjacent to rural communities and all three have seen substantial science participation from Memorial University

(e.g. Collins and Lien, 2002). Thus the history of MPAs in Newfoundland has been one of active involvement in rural communities by Memorial in an area of one of its principal research strengths, the marine sciences. Given the political momentum for MPAs at the local and national level, the next step is to identify those areas where Memorial scientists can advance knowledge of the scientific basis for MPAs. The scientific basis for MPAs is usually very complex, and combines issues of biology, marine chemistry, geology, and ocean circulation; it is the convergence of these diverse disciplines within Memorial that provide an excellent opportunity for collaboration between the university, local communities and organizations, province, and federal government.

The second objective, to identify leading edge science on MPAs in mid-latitude marine ecosystems, will form the launching point for a proposal currently in development for significant national level funding (NSERC Strategic Research Network Grant) to address key science questions related to MPAs. The preproposal to NSERC (submitted June 2006) has successfully moved through a screening phase and has now been approved to move to a full proposal that will be submitted in May 2007. A successful proposal will fund graduate and undergraduate students at the University, and the purchase of state-of-the-art field sampling instruments. It will also involve a substantial field component and hence inject funds into the communities adjacent to MPAs through field teams who will reside and work in these communities for extended periods as they interact with local stakeholders. Most importantly, this project will provide strong scientific advice that will support defensible policy decisions and maximize MPA potential (e.g. Roberts et al. 2003). We strongly believe that MPAs that are successful in attaining conservation and sustainability goals will be the most persuasive and effective mechanism for attaining ongoing local support and providing a model for new, locally-generated initiatives elsewhere.

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Methods

Objective 1: Compare the policy contexts of MPAs at national, provincial and local levels with special attention to Newfoundland and Labrador.

An extensive literature search was completed to assemble information on MPAs as policy alternatives. Information was collected on policy at three levels of organization: federal, regional, and local. The literature was analyzed in order clarify the role of regional policy in the

context of national and local policy. Enumeration of the frequency of multi-level policy analyses in the literature was completed.

Interview questions were developed to elicit supplementary information from local community members and federal and provincial policy officials regarding MPA policy development in Newfoundland and Labrador (Appendix A). In keeping with the requirements of the University regarding ethics in research, we applied for and obtained permission from the Interdisciplinary Committee on Ethics in Human Research (ICEHR) to carry out this research. From June through August 2006, MUN maintained a field research team in the community of Leading Tickles, NL. This team collaborated with the Department of Fisheries and Oceans (DFO) Oceans Branch to collect baseline scientific data to support MPA development in the area. During the time spent in Leading Tickles, we conducted a series of interviews with three community members, each of whom contributed to the development of local MPA policy and priorities. Additional interviews were conducted with policy officials from the Department of Fisheries and Oceans MPA Program (3 individuals) and from the Department of Fisheries and Aquaculture (Provincial Government of Newfoundland and Labrador, three individuals). These interviews helped to provide clarification regarding the interaction between local and regional policy in the context of MPA development.

Objective 2: Identify internationally significant science questions that can be addressed within this province.

A focused literature review on MPA science as it relates to American lobster ecology was conducted in order to provide scientific background to the development of internationally significant science questions (see Appendix B, prepared by Dan Ings). In addition, a preliminary application for an NSERC Strategic Network Program on "Scientific Criteria for Conservation and Sustainable Usage of Marine Biodiversity in Canada's Oceans" was submitted in June, 2006 (Appendix C). The original objective of developing internationally significant science questions that can be addressed within this province was expanded to the development of a national Strategic Network that will facilitate the collaboration of researchers across Canada to address key issues for the health of Canadian marine resources and our environment. Importantly, this network would expand the scientific expertise working in coastal Newfoundland to include not

only experts from Memorial University but also experts from universities and other organizations across Canada. After review of the preproposal, NSERC invited Snelgrove, Schneider, and the four other PIs plan to submit a full proposal by May 2007.

Ocean policy development in Canada

Resource management policy has evolved greatly over the past century, from the belief in the inexhaustible nature of the ocean's resources in the 1800s (Smith 1988), to the self-assured fisheries management regimes based on stock-recruit relationships and Maximum Sustainable Yield (Gordon 1954), to recent strategies including Integrated Management and Ecosystem-based Management. Ocean management priorities in the international arena began to change in the late 1980s, which fueled shifting perspectives in Canada as well. A consensus developed in the international arena, based on all major international agreements including the WCED Brundtland Report (1987), Agenda 21 (1992), the Convention on Biological Diversity (1992), and the UN Commission on Sustainable Development (1992), that integration of management and sustainable development of coastal and marine areas was necessary and that a sense of stewardship was required to protect the ecological structure and to preserve biological diversity (ICAM Dossier 1, UNESCO 2003).

Markey et al. (2000) reviews the development of Canadian oceans policy (emphasizing fisheries resources) in the recent past and describes the evolution to a more multi-faceted, decentralised strategy. Canadian fisheries management has emphasized economic objectives while taking a centralized approach to management. "Modernization and expansion became a policy objective in the 1940s and 1950s" (p 441). Excessive pressure on the resource has been fueled by over-capitalization and improved technology. The federal and provincial governments made the decision to subsidise fishers and financial support continued into the 1980s. Policies encouraged the concentration of licenses into the hands of fewer owners; this more centralized fishery, along with cost cutting, lead to a centralization of fisheries management. Fisheries management strategies based on economic objectives (efficiency, employment, and income) inadvertently resulted in resource depletion and "massive unemployment" (p 442). In the 1990s, the federal and provincial governments were forced to respond to the fisheries crisis in Canada by addressing the need for conservation strategies and reducing fishing capacity. Policy

priorities were forced to shift from economic to ecological objectives. Steps were taken toward diversification and decentralization of the fishery. At the same time, fishermen, communities, and other local stakeholders continued to call for, and became increasingly involved in, a variety of management tactics, from sentinel fisheries to Marine Protected Areas.

Changing perspectives on oceans management in the international arena, as well as national problems with fisheries management, contribute to an evolving perspective on oceans management in Canada and provide some background to the development of *Canada's Oceans Act*. The *Oceans Act* provides a framework for modern ocean management. This strategy outlines an "integrated approach to ocean management, coordination of policies and programs across governments, and an ecosystem approach" (Canada's Oceans Strategy p. v). One of the management tools presented in the *Oceans Act* is the authority to establish Marine Protected Areas.

Policy framework of marine protected areas in Canada and reading between the lines

Policy context for establishment of protected areas

The first protected areas in Canada were designated in the late 1800s and were primarily terrestrial (Jamieson and Levings 2001). Since the early 1900s, many marine protected areas, in some form or another, have been established by both the Federal and Provincial governments (see table 1 from Jamieson and Levings 2001). Currently, five types of federally legislated protected areas, with at least a partial marine component, exist in Canada: National Parks (Reserves), National Marine Conservation Areas, Migratory Bird Sanctuaries (MBS), Marine Wildlife Areas, and Marine Protected Areas (Jamieson and Lessard 2000). The type of protection offered by each designation varies based on the mandates of the agency under which the area was designated and based on the goals specifically described for the area in question. For example an area might be deemed a "no-take" area, where removal of resources is prohibited; or it could be a multi-use area, where resource use is permitted, but strictly controlled based on conservation goals (Thurston 1997). An area can also be divided into smaller zones with different levels of protection. A particular area may fall under protection based on multiple pieces of legislation. The following paragraphs briefly describe each type of federally legislated

protected area, including the agency responsible for designation, and what is actually protected. See Table 1 for a list of various types of protected areas.

Marine Protected Areas (MPAs) are created under *Canada's Oceans Act*. Established in 1997, this legislation describes Canada's strategy for oceans management in terms of resource development, protection, and conservation. *The Act* names the Minister of Fisheries and Oceans Canada the leader responsible for the development and implementation of a national strategy for the management of estuarine, coastal and marine ecosystems (section 29). *The Act* outlines a plan for Integrated Management, which requires the Minister of Fisheries and Oceans to coordinate with other Ministers, boards, and agencies in the implementation of policies or programs. One specific mandate of the Act charges the Minister with the responsibility to "…lead and coordinate the development and implementation of a national system of marine protected areas on behalf of the Government of Canada" (section 35.2). In this report the term Marine Protected Area (note capitalization) will refer to those established specifically under the Federal Oceans Act because this usage is consistent with the convention used in the majority of the literature on the subject. Other types of protected areas with a marine component may be referred to as marine protected areas (not capitalized). Following the establishment of the *Oceans Act*, a series of government documents has been written to further detail the process of MPA development and implementation. More detail on these documents will be provided in subsequent sections.

Canada's Wildlife Act (1985) allows the Governor in Council to "establish protected marine areas in any area of the sea that forms part of the internal waters of Canada, the territorial sea of Canada or the exclusive economic zone of Canada" (section 4.1(1)). In addition, the Minister may "provide advice relating to any wildlife research, conservation and interpretation carried out in protected marine areas and may carry out measures for the conservation of wildlife in those areas" (section 4.1(2)). Marine Wildlife Areas must contain "nationally significant" habitat for migratory birds, support wildlife or ecosystems at risk, or represent rare or unusual wildlife habitat or a biogeographic region. Marine Wildlife Areas are regulated by Environment Canada.

The *Migratory Birds Convention Act* allows the Governor in Council to make regulations prescribing protection areas for migratory birds and nests, and for the control and management of

those areas (section 12.1*i*). The resulting Migratory Bird Sanctuaries (MBS) prohibit disturbance of migratory birds, their eggs and nests, and protect habitat. Management is the responsibility of Environment Canada and often includes monitoring wildlife, maintaining habitat, and enforcement of hunting prohibitions and regulations.

The *National Marine Conservation Areas Act* establishes National Marine Conservation Areas (NMCAs) for the protection of natural, self-regulating marine ecosystems in order to maintain biological diversity. Protected areas are established for the benefit, education and enjoyment of the people of Canada and the world (4**.**1). The Act calls for NMCAs to be divided into zones, one of which must foster sustainable use of marine resources and one that must fully protect special features or sensitive elements of ecosystems (4.4). Management of NMCAs is the responsibility of Parks Canada and may include prohibition of ocean dumping, undersea mining, and oil and gas exploration and development. Fishing activities may be permitted, but conservation of the ecosystem should drive management in these protected areas.

In Canada, it is the responsibility of the federal government to protect and conserve all marine species, most anadromous species, and habitat below high tide, such as recognized fish habitat or habitat in national parks, NMCAs, and national wildlife areas (Jamieson and Levings 2001 p. 142). The provinces have jurisdiction over the land resources in Canada, including watersheds adjacent to marine waters.

Role of Provincial Government and Community-level Organizations as described in Federal Policy Documents

In addition to the federal legislation documents described above, several supporting federal documents detail strategies for collaboration among levels of government and community groups in implementing marine protected areas. We have narrowed the scope of our analysis to focus on documents related specifically to Marine Protected Areas under the *Oceans Act* because this designation is currently a "hot topic" in ocean policy and has recently been applied to three areas in Newfoundland and Labrador. We have analyzed these supporting documents for their description of multi-organizational-level responsibility and participation in MPA development and implementation. Specifically, our objective was to describe how federal policy documents address the roles of the provincial governments and community-level groups (if, in fact these

documents discuss the roles of these other organizational levels at all). While each of these policy documents stresses the importance of coordination or involvement of other levels of organization, most do not comprehensively describe how this coordination or involvement is possible.

Table 2 lists the documents that were reviewed and categorizes the type of treatment each document gives to the responsibility of provincial government and community groups. One document was classified as giving no treatment, meaning there was virtually no mention of how other institutional levels should interact with federal level. Two documents give cursory treatment to the description of collaboration with provincial and community groups. We define cursory treatment as mention of the importance of provincial and community involvement in the implementation of MPAs, yet only brief mention of how this collaboration should be pursued. Three documents provide detailed treatment, meaning that a method for executing collaboration is described.

Canada's Ocean Action Plan highlights the range of legislative and policy tools available to establish and manage marine protected areas, and articulates how three federal departments and agencies— Fisheries and Oceans Canada, Parks Canada Agency and Environment Canada— will work together to establish and manage a network of marine protected areas. However, no specific mention of provincial or community involvement is evident. *Canada's Federal Marine Protected Areas Strategy* describes the legislative tools available to the Federal government for implementing marine protected areas. The document goes on to say that cooperation among Federal Departments is necessary and that provinces, territories, Aboriginal Peoples and others will have an important role to play. Nonetheless, it does not specifically address how their involvement can be achieved.

Marine Protected Areas Policy (1999) reiterates that MPAs will be used as a means to "proactively conserve and protect marine ecosystem functions, species, and habitats for future generations" (p. 4). While not a particularly long document, the description of the responsibility of the DFO regional level and local resource users is quite specific. DFO regional levels are charged with developing and implementing specific MPA program details concerning the conservation, protection and use of the marine environment and its resources. The involvement of local resource users and other affected parties with regards to partnering responsibilities,

funding arrangements, jurisdictional coordination, zoning, protection standards, regulations, permissible activities, enforcement, monitoring and research, and public awareness will be detailed in MPA management plans. Based of the description of responsibilities of regional-level DFO and local resource users, we classify this document as giving detailed treatment to the role of other institutional levels of organization.

Canada's Ocean Strategy describes an integrated approach to ocean management and coordination of policies and programs across governments. *The Strategy* states that oceans governance is not only a federal government responsibility, but a responsibility shared by all. Subsequently, the federal government will develop activities to establish "institutional governance mechanisms" to improve coordinated oceans management within the federal government and among other levels of government. *The Strategy* calls for the on-going participation of federal, provincial, territorial, and municipal governments as well as Aboriginal organizations and communities, businesses, academia, non-governmental organizations and Canadians in general. "Integrated Management" is one of the primary approaches to actively involve coastal communities in the development, promotion, and implementation of oceans activities. Detailed plans for implementing Integrated Management can be found in *Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada.* This document outlines an operational framework that includes governance, management by areas, design for management bodies and types of planning processes. It describes integrated management bodies as comprised of governmental and non-governmental representatives that promote consultation with local interests. "Coastal communities, and other persons and interests affected by marine resource or activity management, should have an opportunity to participate in the formulation and implementation of Integrated Management decisions because the objective is achievement of common goals" (p. 10). An Integrated Management body's function "may evolve from an initial focus on information and consultation through to providing advice on the development of the management plan…[eventually, the] role may shift to an 'overseer' function" (p.11). This document describes the roles of each institutional level of organization in Integrated Management. Federal authorities have formal management and regulatory responsibilities. Participation by provincial and territorial departments, agencies and management boards, is critical to the process because of

the impact of land-based activities on the marine environment. Land use planning boards, regional development authorities, provincial, and regional and municipal authorities are responsible for pollution control. Local community groups will play essential roles in Integrated Management by sharing traditional ecological knowledge and information on local social and economic issues, ensuring that the planning process and resulting actions are relevant to the area, and providing "on-the-ground" expertise and capacity for management plan implementation, monitoring and enforcement.

The *National Framework for establishing and Managing Marine Protected Areas* is the document that is most informative when it comes to the roles of provincial governments and community groups. It states that the program will be implemented at the DFO Regional level. Subsequently, regions may implement the National Framework based on local marine conservation and protection needs. Local organizations, communities, and/or harvesters are specifically mentioned as having a prominent role to play in nomination of an area, consultation activities, public awareness programs, or co-management of sites. This document provides a detailed framework with six steps to establish and manage MPAs (see *National Framework for establishing and Managing Marine Protected Areas* figure 1).

Two Marine Protected Areas (Eastport and Gilbert Bay) were designated in Newfoundland and Labrador in 2005 under the Oceans Act, and a third is in the development stage (Leading Tickles). The process of establishing MPAs in Newfoundland and Labrador illustrates the translation of federal policy framework into on-the-ground (functional) collaboration between the Federal government and local communities. The following section describes how MPA development has materialized in Newfoundland based on interviews with government officials and community members.

MPAs in Newfoundland and Labrador: the intersection of federal, provincial, and community efforts

A variety of areas in Newfoundland and Labrador currently have, or have had (in the past) some level of special protection. Anderson et al. (2000) published a comprehensive listing of the type and purpose of closures, applicable legislation, restrictions on the resource, and other pertinent information. In the case of two MPAs and the third that is the development stages,

federal and provincial governments as well as communities collaborated under the guidance of the *Oceans Act* and supporting documents, but they had to read between the lines in order to make policies come to life on the ground. Under the official policy framework laid out in the Oceans Act, regional DFO Oceans, provincial officials, and community members developed their own unofficial policy for implementing MPAs. Based on interviews (for questions and selected responses see Appendix A) with three Department of Fisheries and Oceans (DFO) MPA program personnel, three Department of Fisheries and Agriculture (DFA) provincial officials, and three community members from Leading Tickles, as well as pertinent literature, we describe the interaction among levels of institutional organization in the development of the three MPAs in Newfoundland and Labrador.

Following the release of the *Oceans Act* the regional DFO in Newfoundland and Labrador created the MPA program under the Oceans Branch of DFO. Communities throughout the province were informed about the mandate for developing MPAs through regional economic development board meetings and other comparable venues. Three communities, Eastport, Gilbert Bay, and Leading Tickles sent proposals to DFO Oceans expressing interest in developing MPAs in their respective areas. The fisherperson's committee in Leading Tickles was interested in setting up an MPA to protect commercially-valuable species including lobster and capelin. They had seen fisheries diminish in their area in the past and wanted to try a new approach to protect remaining fisheries (all three community respondents concur). Some community members were hesitant to endorse an MPA, but outspoken members of the community convinced others that this was a good opportunity to have a say in how their local area is managed. DFO Oceans worked with communities to ensure proposals conformed to *Oceans Act* objectives. Virtually no scientific basis for the design of MPAs existed for the region. There were research programs in place on lobsters (Eastport) and 'golden cod' (Gilbert Bay), but none at Leading Tickles. DFO Oceans therefore began to collect data, notably by hiring hydrographers to conduct bathymetric surveys and divers to map vegetation. Fishermen were consulted to verify the maps based on their personal knowledge. The MPA designation process proceeded despite the sparse science basis. It was hoped, however, that an adaptive management approach would allow results from continued scientific research to be incorporated into management even after designation of an area. DFO Oceans Branch worked closely with

community members to develop research priorities, carry out research projects, and develop management plans for each MPA. The provincial government was involved as *ex officio* members of the MPA steering committees, in case issues involving provincial jurisdiction arose. To enable communication and to maintain a presence in outport communities, DFO Oceans employs a community liaison for each MPA (currently Eastport and Leading Tickles share a liaison).

The success of these three initiatives—two MPAs and one AOI with considerable momentum—stands in contrast to a prior initiative to establish a protected area in waters running seaward from Terra Nova Park. This initiative differed in that the proposed area was much larger and that the initiative did not spring from local communities. A comparison of the Newfoundland initiatives with initiatives in other provinces (notably British Columbia and Quebec) would be interesting and useful, but beyond the scope of the current report.

Provincial Conservation Efforts

The Government of Newfoundland and Labrador also manages six types of protected areas each of which is based on different conservation and recreation objectives (Parks and Natural Areas Division, Government of Newfoundland and Labrador). While most of these protected areas are land-based and do not have a specific marine component, they may border on marine areas and as such, the provincial government would have an interest. For example, because the provinces have jurisdiction over the land resources in Canada, they control sources of pollution that may affect marine areas. Ecological Reserves (established by the Department of Environment and Conservation) are one type of provincial protected area with a marine component, which allows for the protection of seabirds. Although the federal government has primary responsibility for administering the development and implementation of most marine protected areas, federal policy recognizes the importance of effective collaboration with provincial governments and other stakeholders including local communities and Aboriginal groups.

The Scientific Basis for Marine Protected Areas in Newfoundland

Based on the political momentum for Marine Protected Areas, the second objective of this project was to identify internationally significant science questions that can be addressed within Newfoundland and Labrador. Recent research conducted by Memorial University at the Gilbert Bay and Eastport MPAs and the Leading Tickles Area of Interest (AOI) has been a mixture of descriptive and causal science directed at local issues arising within each of the three locations (two MPAs and one AOI). Past research helped to define the scope of some of the science problems in an informal way. This report takes the next step, which is to identify questions significant both to local issues and the understanding of coastal ecosystems by the national and international science community.

Protection of American lobster populations in Newfoundland and effective management of the fishery are issues of concern that may be effectively addressed by using Marine Protected Areas. Lobster has been considered a good candidate for protection using MPAs because it is a relatively sedentary species. However, issues such as larval dispersal and adult migration complicate MPA design. We reviewed literature pertinent to American lobster ecology and MPA design (see Appendix B) to create a foundation on which to base future lobster research.

A series of workshops, culminating in a workshop in Ottawa co-sponsored by the Census of Marine Life, DFO and NSERC Special Research Opportunities, led to the development of a proposal to the Natural Sciences and Engineering Research Council (NSERC) to create a national network to investigate three Research Themes that encompass the scientific criteria for conserving biodiversity in marine ecosystems. Theme I explores the relationship between biodiversity, ecosystem health and functioning, and disturbance. Are productivity/biomass relationships related to biodiversity? What is the relationship between large-scale physical processes and functional diversity, and what is the relationship between physical structure in habitats and biodiversity? How do disturbances such as trawling, climate change, acoustic pollution, eutrophication, and overexploitation affect biodiversity? Theme II seeks to increase our capacity to quantify biodiversity. What is the nature of cryptic diversity, the spatial distribution of biodiversity, and temporal changes in biodiversity, and what are the driving processes that determine biodiversity? Key questions are: How can we utilize studies of spatial and temporal variability within and among habitats to model and predict broader biodiversity

patterns for other geographical areas, habitats, and times? How do the main processes that structure marine biodiversity vary with spatial scale? Can we extrapolate from smaller areas to larger areas? Do our models accurately portray mechanisms? Theme III addresses the question of how, given the dynamic nature of marine ecosystems and the dispersal potential of marine organisms, we foster a network of closed areas, MPAs, and similar strategies that will achieve the goals of conservation and sustainable use of adjacent areas. What are the major sources and sinks for reproductive propagules? Why do some habitats and geographic areas contribute disproportionately in terms of larval and juvenile survival and abundance? What features of the environment (geology, biology, physics, chemistry) affect that pattern?

These research themes form the basis for an NSERC Strategic Network proposal involving researchers across Canada (Appendix C). A preproposal has been approved through a screening process that has significantly increased the odds of proposal funding. NSERC has also approved $24,800 in funding to support travel to planning meetings for Snelgrove, Schneider, and others as they develop the full proposal to be submitted in May 2007. Memorial University has contributed ~$18,000 of in-kind support to develop this proposal (personnel, meeting space) and University of Victoria and Department of Fisheries and Oceans, who are partners in this initiative, have contributed $4500 and $5000 respectively. While this research initiative will be implemented in various nodes throughout Canada, a portion of the research will occur in Newfoundland and Labrador and will ultimately provide scientific evidence critical to the successful development and management of MPAs, including those in our province. One of the primary objectives will be to generate management tools and science input for decision-making at the local level, a central consideration given the leading role of communities in the development of MPAs in Newfoundland.

Conclusions

MPAs are a global phenomenon that have become part of national level ocean policy and practice in such nations as Australia, Canada, and the US. In some cases they have become policy at the regional level (e.g. California) although this is necessarily limited by the assignment of jurisdiction over marine waters to the national level.

They depend, for their success, on the development of an informal network of local policy and practice, which varies among communities. They succeed in circumstances where local policy and practice are not dissolved by national level policy or legal precedent and where national policy facilitates and can accommodate local arrangements. The collapse of fisheries in the late 20th century in Canada provided the political impetus and policy framework that increased the capacity of the federal government to accommodate local arrangements in marine waters.

Sound scientific evidence is needed to identify whether intended effects are being achieved and to document concomitant effects. However, there will never be sufficient scientific capacity to undertake focused research in each MPA. The emerging practice is initial science input followed by devolution of monitoring activities to local communities, with guidance from academic scientists. The effectiveness of these scientists would be increased by national initiatives to develop the capacity to guide locally based monitoring efforts. One potential model for science guidance is that used for environmental impact assessment, where monitoring activities are designed as tests of hypotheses concerning effects stated in an impact assessment.

References

Anderson, T.C., S.D. Lambert, J.M. Simms, and T. Taylor-Walsh. 2000. Marine areas with special protection, Newfoundland and Labrador. Canadian Manuscripts Fisheries and Aquatic Sciences #2507.

Bradbury I.R., P.V.R. Snelgrove, and S. Fraser. 2001. The influence of temperature on the loss of Atlantic cod (*Gadus morhua*) eggs and larvae from the inshore environment: a combined modelling and observational approach. Fisheries Oceanography 10: 342-352.

Canada's Oceans Act (1996, c. 31) http://198.103.98.49/en/O-2.4/ Accessed December 2006

Canada's Oceans Lecture. Delivered by John Fraser, 26 October 2006, St. John's, NL.

Canada's Wildlife Act (R.S., 1985, c. W-9, s. 1; 1994, c. 23, s. 2(F) http://198.103.98.49/en/ShowFullDoc/cs/W-9///en Accessed December 2006

Collins, R. and J. Lien. 2002. In our own hands: Community-based lobster conservation in Newfoundland (Canada). Biodiversity 3:11-14

Fisheries and Oceans Canada. Marine Protected Areas Policy (March 1999) http://www.dfo-mpo.gc.ca/canwaters-eauxcan/infocentre/legislation-lois/policies/mpa-policy/pdf/policy.pdf

Gordon, H. S. 1954. The economic theory of a common-property resource: The fishery. The Journal of Political Economy, 62: 124-142.

Government of Canada. 2005. Canada's Ocean Strategy http://www.cos-soc.gc.ca/doc/pdf/COS_e.pdf

Government of Canada. 2002. Policy and Operational Framework for Integrated Management of Estuarine, Coastal, and Marine Environments in Canada. http://www.cos-soc.gc.ca/doc/pdf/IM_e.pdf

Government Canada. 2005. Ocean Action Plan http://www.dfo-mpo.gc.ca/canwaters-eauxcan/oap-pao/index_e.asp Accessed December 2006

Government Canada. 2005. Canada's Federal Marine Protected Area Strategy http://www.dfo-mpo.gc.ca/canwaters-eauxcan/infocentre/publications/docs/fedmpa-zpmfed/pdf/mpa_e.pdf

Government Canada. 1999. National Framework for Establishing and Managing Marine Protected Areas http://www.dfo-mpo.gc.ca/canwaters-eauxcan/infocentre/publications/docs/newmpa/index_e.asp Accessed December 2006.

Gubbay, S. (Ed), 1995 Marine Protected Areas. Principles & Techniques for Management. P. 227. Chapman & Hall. Conservation Biology Series.

Horwood, J.W. 2000. No-take zones: a management context. *In:* Effects of Fishing on Nontarget Species and Habitats (Kaiser, M. J. and de Groot, S. J., eds), pp. 302-311. Oxford: Blackwell Science.

ICAM 2003. A reference guide on the use of indicators for integrated coastal management. Dossier 1, *IOC Manuals and Guides No. 45.* UNESCO.

Jamieson, G.S. and J. Lessard. 2000. Marine protected areas and fishery closures in British Columbia. Special Publication Canadian Journal of Fisheries and Aquatic Science 131: 1-414.

Jamieson, G.S. and C.D. Levings. 2001. Marine protected areas in Canada – implications for both conservation and management. Canadian Journal of Fisheries and Aquatic Science 58:138-156.

Kelleher, G. and R. Kenchington. 1992. Guidelines for establishing marine protected areas. IUCN, Switzerland. p.77.

Markey, S., J. Pierce and K. Vodden. 2000. Resources, people and the environment: A regional analysis of the evolution of resource policy in Canada. Canadian Journal of Regional Science 23: 427-454

Migratory Birds Convention Act (1994, c.22) http://198.103.98.49/en/ShowFullDoc/cs/M-7.01///en Accessed December, 2006.

National Marine Conservation Areas Act (2002, c.18) http://www.canlii.org/ca/sta/c-7.3/whole.html Accessed December, 2006.

National Research Council. 2001. Marine Protected Areas: Tools for Sustaining Ocean Ecosystems. National Academy Press, Washington, D.C.

Parks and Natural Areas Division, Government of Newfoundland and Labrador http://www.env.gov.nl.ca/parks/apa/panl/index.html Accessed December, 2006.

Roberts, C.M. and 11 others. 2003. Application of ecological criteria in selecting marine reserves and developing reserve networks. Ecological Applications 13: S512-S228.

Sobel, J. 1993. Conserving biological diversity through marine protected areas - a global challenge. Oceanus 36: 19-26.

Smith, T.D. 1988. Stock assessment methods: the first fifty years. In: Fish Population Dynamics 2nd edition. Ed. J. A. Gulland. John Wiley, New York.

Thurston, H. 1997. A Wilderness of Sea: Safeguarding Canada's Protected Oceans and Great Lakes with Protected Areas. World Wide Fund for Nature.

Willison, M. 2002. Science and policy for marine sanctuaries. Biodiversity 3: 15-20.

Table 1. Types of protected areas with a marine component in Newfoundland and Labrador.

Jurisdiction	Type of Protected Area (with a marine component)	Legislation	Regulating Agency	Number in Newfoundland and Labrador
Provincial	Ecological Reserves	Wilderness and Ecological Reserves Act	Department of Environment and Conservation, Government of Newfoundland and Labrador	16*
Federal	Migratory Bird Sanctuaries	Migratory Birds Conservation Act	Canada Wildlife Service, Environment Canada	3*
	Marine Protected Areas	Oceans Act	Department of Fisheries and Oceans	2(1)
	National Marine Conservation Areas	Canada National Marine Conservation Areas Act	Parks Canada	0
	Marine Wildlife Areas	Canada Wildlife Act	Canada Wildlife Service, Environment Canada	0

*From the Parks and Natural Areas Division, Government of Newfoundland and Labrador (http://www.env.gov.nl.ca/parks/apa/panl/index.html)

Table 2. List of the Canadian federal documents that were analysed for their description of provincial and community roles in MPA development and implementation. Each document is classified as giving no treatment, cursory treatment, or detailed treatment to the responsibility of other institutional levels of organization. Levels of treatment were defined as no treatment (virtually no mention of how other institutional levels should interact with federal level), cursory treatment (brief description of how to involve other institutional levels of organization), or detailed treatment (detailed plan to involve other levels of organization).

Federal Document	**Provincial Role**	**Community Role**
Canada's Oceans Strategy	Cursory treatment	Cursory treatment
Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada	Detailed treatment	Detailed treatment
Canada's Oceans Action Plan	No treatment	No treatment
Canada's Federal Marine Protected Areas Strategy	Cursory treatment	Cursory treatment
National Framework for Establishing and Managing Marine Protected Areas	Detailed treatment	Detailed treatment
Marine Protected Areas Policy	Detailed treatment*	Detailed treatment

*describes regional DFO responsibility, not province-level role

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