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A Policy and Planning Framework for Marine Protected Area Networks in Canada's Oceans



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WWF-Canada

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Jennifer L. Smith, Kaaren Lewis, and Joshua Laughren

ABOUT THIS DOCUMENT

WWF-Canada's vision for Canada's oceans is one of healthy ecosystems, communities, and economies founded on conservation and sustainable use. This vision is consistent with Canada's Oceans Strategy, which lays out a long-term plan to better understand and protect the marine environment, support sustainable economic opportunities, and establish Canada as an international leader in oceans management. Networks of marine protected areas (MPAs) will be integral to any strategy for achieving this vision. Planning and implementing effective MPA networks will require all levels of government to work with communities and stakeholders under a common policy and planning framework. This document is offered as a resource to help make this a reality. It is aimed at planners, partners, decision makers, and stakeholders who will play a role in shaping Canada's approach to planning MPA networks.

This framework draws on best practices from experiences around the world and extensive consultation with experts from Canada and other jurisdictions. It also builds on an earlier WWF-Canada report, *Planning for Representative Marine Protected Areas: A Framework for Canada's Oceans* (Day and Roff 2000). As well, the framework reflects guidance from the World Summit on Sustainable Development, the United Nations Convention on Biological Diversity, and the World Parks Congress.

Section 1.0 of this document outlines the role that networks of MPAs can play in the protection, management, and recovery of marine biodiversity and ecosystems in the Canadian context. Section 2.0 brings together best practices and international consensus to provide guidance on planning for *regional* MPA networks. It describes a systematic approach to conservation and lays out principles that will help in initiating, designing, and implementing effective networks of MPAs. Section 3.0 suggests a set of actions for *national* leadership that will help ensure Canada is successful in conserving marine biodiversity, supporting sustainable development, and meeting its marine conservation commitments. Section 5.0 points to key resources that are especially relevant to MPA network policy and planning.

ABBREVIATIONS

CBD	Convention on Biological Diversity
CEC	Commission on Environmental Cooperation
CMA	Coastal Management Area
DEFRA	Department of Environment, Food and Rural Affairs
DFO	Fisheries and Oceans Canada
EBSA	Ecologically and Biologically Distinctive Area
EEZ	exclusive economic zone
ESSIM	Eastern Scotian Shelf Integrated Management
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GBRWHA	Great Barrier Reef World Heritage Area
GIS	geographic information system
IM	integrated management
IUCN	International Union for the Conservation of Nature and Natural Resources (World Conservation Union)
LME	Large Marine Ecosystem
LOMA	Large Ocean Management Area
MCPA	Marine and Coastal Protected Area
MPA	marine protected area
NAFTA	North American Free Trade Agreement
NGO	nongovernmental organization
NMCA	National Marine Conservation Area
NOAA	National Oceanic and Atmospheric Administration
NRSMPA	National Representative System of Marine Protected Areas
OMRN	Oceans Management Research Network
PacMARA	Pacific Marine Analysis and Research Association
RAP	Representative Areas Program (of the GBRMPA)
SARSMPA	South Australian Representative System of Marine Protected Areas
SSME	Sulu-Sulawesi Marine Ecoregion
TNC	The Nature Conservancy
TUMRA	Traditional Use of Marine Resource Agreement
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Program
WCMC	World Conservation Monitoring Centre
WCPA	World Commission on Protected Areas
WWF	World Wildlife Fund
WWF-Canada	World Wildlife Fund Canada

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protected area networks
in Canada's oceans

TABLE OF CONTENTS

Executive Summary	7
1.0 The role of marine protected area (MPA) networks in ecosystem-based management and recovery of Canada's oceans	11
1.1 Introduction	13
1.2 Establishing definitions	13
1.2.1 MPAs	14
1.2.2 MPA networks	14
1.2.3 Types of MPAs	16
1.3 The role and benefits of MPA networks	18
1.3.1 Protection of physical habitat	20
1.3.2 Recovery and protection for species and populations	21
1.3.3 Rebuilding ecosystem resilience	22
1.3.4 Safeguarding against management uncertainty and benchmarking sustainability	23
1.3.5 Reducing conflicts over the use of ocean space	23
1.3.6 Economic and cultural benefits	24
1.3.7 Public education and enjoyment	26
1.3.8 MPAs in context	26
1.4 Canada's international and national commitments to MPAs and MPA networks	27
1.4.1 International commitments	27
1.4.2 National commitments	29
1.5 Conservation first: the need for action on MPA networks	30
2.0 Approach and guiding principles for planning regional MPA networks	31
2.1 A systematic approach	33
2.2 Principles for the planning process	39
2.2.1 Plan at an ecologically meaningful scale	39
2.2.2 Articulate a common purpose	40
2.2.3 Coordinate for consistency	41
2.2.4 Ensure inclusive decision-making	43
2.2.5 Promote First Nations engagement	44
2.2.6 Undertake public outreach	44
2.2.7 Develop common, accessible information and analysis	45
2.3 Principles for network design	47
2.3.1 State clear conservation goals	47
2.3.2 Set measurable objectives	50
2.3.3 Set clear and effective protection standards	52
2.3.4 Set design criteria for a cohesive network	53
2.3.5 Set design criteria for practicality and socioeconomics	54
2.3.6 Use a transparent site-selection methodology	55
2.4 Principles for implementation and management	57
2.4.1 Designate for effective and lasting protection	57
2.4.2 Monitor and evaluate	57
2.4.3 Anticipate change and manage adaptively	57

3.0 National action plan for implementing MPA networks	59
3.1 Set the overarching, national direction for planning MPA networks	62
3.2 Commit to the mechanisms that will deliver on MPA networks	64
3.3 Commit to a timetable for progress	64
3.4 Make timely decisions on long-standing MPA candidate sites	65
3.5 Provide interim protection for MPA candidate sites	65
3.6 Launch research programs to support information needs	66
3.7 Launch a national awareness campaign to engage the public	66
3.8 Conduct national-level monitoring and reporting on progress	67
4.0 Conclusion	69
5.0 Resources for guidance on MPA network planning	73
5.1 International agreements and recommendations	75
5.2 Canadian policy	76
5.3 Guidance and best practice	77
5.4 National frameworks	79
5.5 Prominent examples and case studies	80
Appendices and works cited	83
Appendix 1: Operating principles used in the GBRMP RAP	85
Appendix 2: Summary of goals proposed for identifying candidate MPA sites	92
Works cited	94
Acknowledgements	105

EXECUTIVE SUMMARY

Although we have traditionally viewed the oceans as vast and limitless, the collapse of Atlantic groundfish stocks is just one signal that many marine resources are in peril. Canada's marine ecosystems are threatened by habitat destruction and degradation, overexploitation, pollution, invasive species, and climate change. To protect and restore them, we need to turn to area-based management tools such as marine protected areas (MPAs).

MPAs are intertidal or subtidal areas – together with overlying water and associated flora, fauna, historical, and cultural features – that have been reserved by law or other effective means to protect the enclosed environment. They can be fully protected sites where fishing and other resource extraction are prohibited, or multiple-use sites where a certain level of sustainable resource use is allowed.

Fully protected areas can be nested within multiple-use MPAs to maximize conservation and socioeconomic outcomes, while a cohesive network of MPAs can achieve comprehensive regional conservation that single MPAs alone cannot.

Canada has committed to completing a national representative network of MPAs by 2012. While several sites have been designated in recent years, the total area under protection is just over 29,000 square kilometres, about 0.5% of Canada's ocean waters.

The roles and benefits of MPA networks

MPA networks can provide a foundation for sustainability by:

Protecting physical habitat from disturbances, such as destructive fishing practices or aggregate removal, in order to restore damaged sites or protect pristine ones.

Recovering and protecting species and populations by protecting sites that are particularly important to species resilience, for example, sites where fish spawn, juvenile fish are sheltered from predators, or concentrations of plankton attract many species.

Rebuilding ecosystem resilience to threats such as climate change by protecting habitat and species, giving ecosystems an opportunity to regain their health and biodiversity.

Safeguarding against management uncertainty by protecting a full range of habitats, thereby reducing the need to fully understand oceans to manage them properly, and providing benchmarks against which to measure human-induced ecological change.

Reducing conflicts over the use of ocean space by choosing the forms of protection best suited to the values of individual sites and by clarifying which areas cannot be developed.

Providing economic and cultural benefits by helping to recover and secure resource-based regional economies and by providing opportunities for new sources of income through tourism, education, and research, and **promoting public education and enjoyment**.

A new approach to planning regional MPA networks

Conservation plans worldwide are turning to a systematic approach and away from ad hoc, site-by-site protection. MPA networks should be selected and designed through a transparent process that meets regional conservation goals, while the size, shape, use zoning, and regulation of each site suits local needs and conditions.

Principles for the planning process

Plan at an ecologically meaningful scale – likely hundreds of thousands of square kilometres – to accommodate processes like migration, large-scale ocean transport, and the movement of species to different habitats during different life stages.

Articulate a common purpose that will help all parties involved – government agencies, First Nations, and other stakeholders – work toward a single, comprehensive MPA network and avoid duplicating effort and resources.

Coordinate for consistency among agencies, governments, and others, perhaps through a regional multi-party secretariat that ensures coordination on MPA program components and mechanisms.

Ensure inclusive decision-making by encouraging stakeholders to contribute knowledge and ideas, leading to better solutions and greater buy-in.

Promote First Nations engagement. First Nations are key partners in MPA network planning and will need to be involved in a government-to-government capacity. Network planning must recognize First Nations interests.

Undertake public outreach on the benefits and costs of MPA networks to improve public understanding and to take into account the values of the wider public in network design.

Develop common, accessible information and analysis that all parties agree to work with. Information is rarely complete, so planners and stakeholders should err on the side of protecting biodiversity and be prepared to adjust MPA management if new data emerge.

Principles for network design

State clear conservation goals. Setting goals at the outset will guide design of the network. One key goal is to protect the region's full range of communities and habitats in *representative areas*. Another is to protect *distinctive areas* – areas where important oceanographic processes occur, where many species aggregate, or that are important for growth, reproduction, or survival of particular species.

Set measurable, goals-based objectives that specify area, numbers, percentages, or presence/absence and that are tailored to the feature, species, or population in question.

Set clear and effective protection standards to give resource users certainty and help identify appropriate lead agencies and protection tools. The level of protection selected for each site will depend on its goals and objectives while ensuring that region-wide goals are supported.

Set design criteria for a cohesive network that embodies *viability* (ensuring sites are self-sustaining), *replication* (protecting more than one example of each habitat or distinctive value to guard against catastrophes), and *connectivity* (protecting the flow of nutrients and species between sites).

Set design criteria for practicality and socioeconomics, not just conservation objectives. Consider existing tenure, cost-effectiveness and manageability of MPA configurations, proximity to uncontrollable threats, and impact on resource users and communities.

Use a transparent site-selection methodology that includes identifying current conservation gaps, then drafting and refining plans to address those gaps. Specially designed computer programs can make it easier to explore a wider range of options.

Principles for implementation and management

Designate for effective and lasting protection to maximize benefits. Base MPA design and management on long time scales, permanently protect the network, and make the protection standards for core areas moveable only with strong scientific evidence and proper consultation.

Monitor and evaluate MPA design and current management strategies regularly to improve the success of individual sites and MPA networks.

Anticipate change and manage adaptively as new data become available or environmental conditions shift.

A national action plan for implementing MPA networks

Provide overarching, national-level guidance for planning MPA networks.

Commit to the mechanisms for MPA network delivery by charging regional institutions or partnerships with planning and implementation.

Commit to a timetable and milestones to ensure we meet our 2012 commitments.

Make timely decisions on long-standing MPA candidate sites that need urgent action.

Provide interim protection for MPA candidate sites to provide time for assessment and consultation and to prevent overexploitation before sites are formally designated.

Launch research programs to support information needs for MPA network design.

Launch a national public awareness campaign to build support for marine conservation.

Conduct national-level monitoring and progress reporting to share knowledge between regions, highlight regions requiring more capacity, and enhance accountability.

1.0

The role of marine protected area (MPA) networks in ecosystem-based management and recovery of Canada's oceans



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- 1.1 Introduction
- 1.2 Establishing definitions
- 1.3 The role and benefits of MPA networks
- 1.4 Canada's international and national commitments to MPAs and MPA networks
- 1.5 Conservation first: the need for action on MPA networks

1.0 THE ROLE OF MARINE PROTECTED AREA (MPA) NETWORKS IN ECOSYSTEM-BASED MANAGEMENT AND RECOVERY OF CANADA'S OCEANS

1.1 Introduction

Our traditional view of the oceans as vast and limitless is increasingly out of keeping with the reality that many marine resources are in peril, as evidenced by calamities such as the collapse of Atlantic groundfish stocks and the extinction or dramatic decline of cetacean species. Impacts that alter the structure and resilience of foodwebs and the ability of species to perform ecosystem functions, such as recycling nutrients or helping to regulate climate, affect the ability of the seas to sustain us. Many current and potential pressures, including habitat destruction and degradation, overexploitation, pollution, invasive species, and climate change, threaten Canada's marine environment. Mismanagement has left ecosystems and the human communities that rely on them vulnerable, and rapidly expanding industrial development in many of Canada's marine regions is outpacing efforts to help these ecosystems recover. Clearly we need an agenda of conservation action and sustainable use that will secure healthy, functioning ecosystems and human communities, lasting social and economic benefits, and certainty for ocean users and decision makers regarding use and management of natural resources.

Realizing this agenda will require a new approach to managing our oceans, carried out using innovative management tools. This new approach should entail a move away from past paradigms based on a single species, sector, activity, or issue and toward an ecosystem-based, integrated perspective that considers entire ecosystems as functioning systems and aims to maintain them in a healthy, productive, and resilient state (McLeod et al. 2005). Canada has begun to implement such an approach through the Oceans Act, the Federal Oceans Strategy, the Oceans Action Plan, and an MPA strategy, and has initiated integrated management (IM) planning in some areas of our oceans.

Managing the many current threats to the integrity of our ocean ecosystems, such as loss or damage of habitat, will require managing the way we use ocean space. MPAs are one category of a range of area-based management tools that will be necessary in addressing these threats to our oceans. MPAs and especially networks of MPAs can be uniquely effective at addressing the most significant area-based threats to marine biodiversity, and well-planned networks of MPAs can support the implementation of an ecosystem-based approach by protecting all of the major elements of a functioning ecosystem. This first section describes the role of MPA networks in a new, ecosystem-based approach and sets out Canada's commitments to marine conservation and MPA networks.

1.2 Establishing definitions

Although the idea of protecting places in the ocean is well known in some cultures, doing so through government-led planning is a relatively recent approach. For this reason, it is important to define clearly what is meant by the terms *MPA* and *MPA network* at the outset. This section presents a discussion of the use of these terms for the purposes of this document.

1.2.1 MPAs

The most widely accepted definition of an MPA is that developed by the International Union for the Conservation of Nature and Natural Resources (IUCN):

An 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 (IUCN 1994)

This definition also appears in Canada's Federal Marine Protected Areas Strategy. In this document we use the term *MPA* in the broad sense of the IUCN definition, not only to reference the formal designation under Canada's Oceans Act.

1.2.2 MPA networks

Defining what constitutes a *network* of MPAs is also helpful; however, no widely accepted definition exists. The following definition has been proposed by WWF globally:

An array of component MPA units that effectively scales up the management effects of individual parks and which provides for effective management of large-scale processes and patterns

In British Columbia, WWF-Canada and a number of other stakeholders are working to achieve consensus on a definition for MPA networks. The present definition is as follows:

MPA networks are composed of individual MPAs that are physically discrete and have separate management structures and regimes. The solution to providing effective biodiversity conservation at the scale of the Pacific coast of Canada is to create an array or network of component MPA units that taken together effectively enhance the management effects/benefits of individual MPAs and provide for the conservation of ecosystem function and effective management of large-scale processes and patterns. In other words, together they meet objectives (e.g. representing the full range of ecosystems and habitat types in a biogeographic region) that single MPAs cannot achieve on their own (WWF-Canada et al. 2006).

The United States National Oceanic and Atmospheric Administration (NOAA) is collaborating with the World Commission on Protected Areas (WCPA)/IUCN to develop a document that will provide guidance on building MPA networks. The draft document contains the following definition of an MPA network:

A system of individual marine protected areas operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels, in order to fulfill ecological aims more effectively and comprehensively than individual sites could alone. The system will also display social and economic benefits, although these may only become fully developed over long time frames as ecosystems recover. (WCPA/IUCN 2006)

Roff (2005) fully specifies the characteristics a network should embody:

A proper national or regional network of MPAs must consist of multiple sites with replicates of all habitat types that are oceanographically connected; individually or in aggregate they are of sufficient size to sustain minimum viable populations of the largest species in a region (including those of seasonal migrants to the region) and their resident species can sustain their populations by recruitment from one MPA to another.

The definition of MPA networks is a topic of active discussion; however, while definitions are helpful, the lack of a perfect definition need not be an impediment to moving ahead, as all definitions presented here express a similar intent and common themes of collective impact, connectivity, and comprehensiveness. For the purposes of this document, the following simple, inclusive definition, adapted from Roberts and Hawkins (2000), will provide a basis from which to specify more fully the characteristics of an effective network:

A group of MPAs that functions as a cohesive network and is designed to meet objectives and achieve comprehensive regional conservation that single MPAs cannot achieve on their own.

What does a protected area network look like in practice?

This report presents examples of functioning or proposed MPA networks from around the world, and more information can be found throughout the document and in the case studies in section 5.0. MPA networks are, however, a relatively new tool and progress has been swifter in the tropics, so examples are limited and those that do exist may look different from the networks that will emerge in Canadian waters.

Canada does, however, have significant experience in protected area network planning already: we can look to several of our terrestrial parks systems to help us envision what a regional protected area network looks like and how it might be planned. British Columbia is seen as a world leader in protected area network planning, and has a comprehensive network of parks, protected areas, and ecological reserves. The province's protected area system was doubled in size over a 10-year period following the release of a strategy aimed at protecting 12 percent of the provincial land base. This growth of the system was based on systematic, scientific assessments to achieve goals of representing British Columbia's diversity of ecosystems and protecting its special ecological, heritage, and recreation features. The strategy was implemented through a land-use planning process conducted at regional and subregional scales that facilitated the design of a network that was responsive to local circumstances, minimized social and economic impacts, and resulted in a comprehensive matrix of protected, special management, and intensive land-use zones. Interactive maps of the BC protected areas network can be accessed at the BC Market Outreach website www.bcforestinformation.com/maps/frames.htm and at the Integrated Land Management Bureau website ilmbwww.gov.bc.ca/ilmb/lup/lrmp/slupmap.html. Ontario, Manitoba, Nova Scotia and others have undertaken similar approaches to building protected area networks based on science and careful planning.

1.2.3 Types of MPAs

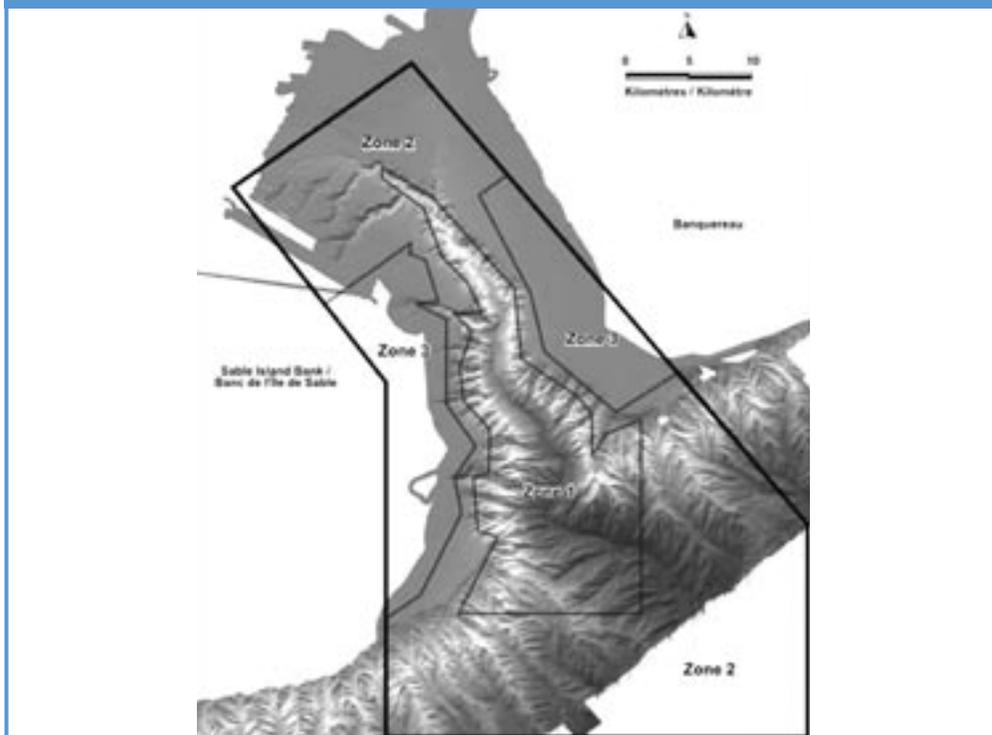
A distinction is usually drawn between highly protected, “no-take” areas – often referred to as fully protected MPAs – and multiple-use MPAs. Both have value and are effective in achieving a range of management objectives.

A *fully protected MPA* (or full-protection zone within a multiple-use MPA) is usually an area where (a) any removal of marine species and modification or extraction of marine resources (through fishing, dredging, mining, drilling, etc.) is prohibited and (b) other forms of human disturbance are minimized. More simply put, fully protected MPAs are “areas that are fully protected against all preventable threats” (Norse 2002, Day and Roff 2000). A strong body of literature exists on the effectiveness of fully protected MPAs for recovery and management of specific populations (see section 1.3).

Multiple-use MPAs are MPAs in which the use and removal of resources may be permitted, but such use is controlled to ensure that long-term conservation goals are not compromised. These are generally large areas, often with multiple objectives, that contain a spectrum of zones, some of which allow greater use and removal of resources than others (Day and Roff 2000). Multiple-use, multiple-zone MPAs are an effective way to accommodate the needs of multiple users, resolve conflicts among them, and ensure long-term conservation on a large, ecosystem-based scale.

A policy and planning framework for marine protected area networks in Canada's oceans

Figure 1. The Gully MPA



The MPA contains three management zones with varying levels of protection based on the conservation objectives and ecological vulnerability of each zone. Zone 1 comprising the deepest parts of the canyon is preserved in a near-natural state with full ecosystem protection. Zone 2 imposes strict protection for the canyon head and sides, feeder canyons, and the continental slope. The adjacent sand banks, which are prone to regular natural disturbance, comprise Zone 3.

Source: Fisheries and Oceans Canada, The Gully regulations: www.mar.dfo-mpo.gc.ca/oceans/e/essim/gully/gully-regs-e.html

Integrating *fully protected areas within larger multiple-use MPAs* is probably the most effective design for yielding conservation and socioeconomic outcomes. The Great Barrier Reef Marine Park (GBRMP) in Australia and The Gully MPA on the Scotian Shelf (figure 1) are examples of multiple-zone, multiple-use MPAs with fully protected core areas, albeit at very different scales. Objectives will dictate the type of MPA, its design, and the activities that will or will not be permitted within its boundaries. An MPA chosen for one purpose, for example, to protect an endangered species from a specific threat, will require a different management regime than an MPA chosen for protection of other values, such as fisheries, broad biodiversity conservation, or tourism and recreation objectives.

The IUCN protected area management categories, shown in table 1, provide a useful framework within which to think about MPAs and a standardized way to differentiate between them. The IUCN categories also allow for international comparison and reporting across jurisdictions that may use different nomenclature for their MPAs.

Table 1. IUCN protected area management categories (IUCN 1994)	
Category	Definition
Ia	Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.
Ib	Large area of unmodified or slightly modified land and/or sea retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.
II	Natural area of land and/or sea designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.
III	Area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.
IV	Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.
V	Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.
VI	Area containing predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

The IUCN categories were designed for both terrestrial and marine areas and are based on management objectives, not on the regulatory tools and rules used to manage the use of a protected area. These categories provide for a spectrum of objectives and management regimes, with Category Ia sites receiving the highest level of protection and Category VI sites generally having fewer restrictions on activities to provide for “a sustainable flow of natural products and services to meet community needs.” Fully protected MPAs are generally considered to be Category Ia sites, though some no-take areas have a range of objectives more characteristic of Category II and Category III sites. Multiple-use MPAs, on the other hand, are best conceived of as areas containing separate zones, each in a different IUCN protected area category.

The need to differentiate between MPAs for different purposes should in no way restrict the identification and design of MPAs to meet dual or even multiple objectives. For instance, when agreement is reached on joint objectives and integrated policy, design, and implementation, MPAs can achieve benefits for both fisheries and conservation (Ward and Hegerl 2003).

What kind of MPAs should make up Canada's networks? WWF-Canada's view

When planning a network of MPAs, a clear statement will be needed on what baseline level of protection, including range of uses, constitutes an effective individual MPA that meaningfully contributes to the goals and objectives of an MPA network. Such a statement can also be used to assess progress toward Canada's international MPA network commitments. WWF-Canada has advocated that individual MPAs meet minimum management requirements to ensure sustainable use and protect biodiversity.

Certain activities cause long-term or large-scale disruption to ecosystem structure and function and should be prohibited in MPAs. These activities include mining, seismic surveys for hydrocarbon reserves, exploratory drilling, oil and gas development, dumping, use of bottom impacting fishing gear, and open-cage finfish aquaculture.

Other activities should be considered on a case-by-case basis, depending on the ecological sensitivity of the area and the specific conservation objectives of the MPA. For example, fishing practices that do not cause large-scale or long-term habitat disturbance or do not result in the widespread or significant extraction of marine resources may be permissible. A precautionary approach should be taken in situations where uncertainty surrounds the effects of an activity on MPA objectives.

This approach is generally consistent with IUCN MPA Categories I to IV and can be used as a standard to measure the degree to which MPAs contribute to Canada's national and global conservation commitments.

1.3 The role and benefits of MPA networks

A well-planned network of MPAs that is designed to achieve large-scale, region-wide¹ goals for protection and restoration of marine life can provide ecological and social benefits that could not be attained by a single MPA or a collection of isolated protected sites surrounded by industrial activity. The following are some of the recognized benefits of well-designed MPA networks, set in the context of the role such networks can play in a broader plan for achieving ecosystem-based management. The benefits discussed here include benefits to targeted habitats and species, broader contributions to sustainability, utility for effective oceans management, and benefits to human communities.

¹ The use of the term *region* and the appropriate scale for MPA network planning is discussed in 2.2.1.

“Bottom line” benefits of MPA networks

Practitioners and stakeholders often look to MPAs to provide direct economic benefits in the form of ecotourism or increased fisheries landings. While case studies have shown that such direct benefits to fisheries and other sectors from MPAs are possible, as described in the following sections, there are difficulties associated with predicting and promising such benefits.

A distinction must be made between the benefits that can be expected from MPAs chosen, designed, and managed specifically to achieve direct fisheries goals, and the broader value of MPAs and networks for long-term economic sustainability. Even when explicit fisheries goals, objectives, and design criteria are set, and sound design, management, and monitoring are in place, there is still much to learn about how quickly these benefits might be realized and what factors might complicate delivery of predicted benefits (Russ and Alcala 2004, Kaiser 2005). Sale et al. (2005) outline some crucial research gaps that, if filled, would enhance our ability to use MPAs as an effective fisheries management tool. These include gaps in our understanding of, for example, patterns of larval dispersal or the “trophic cascade” impacts of fishing.

Sites chosen as a contribution to broad MPA goals such as representation or noncommercial species protection, however, may still have economic (if not short-term commercial) benefits. While such benefits are often difficult to quantify, these sites, both individually and through their contribution to the network as a whole, play a role in protecting and rebuilding – that is, “banking” – the natural capital and ecosystem services on which human economies are based, such as recycling nutrients into the marine food chain or helping to regulate climate (D. Laffoley, personal communication). Insuring a venture against risk is part of any sound business plan; securing natural capital also provides a form of insurance against faulty management decisions and overfishing (Sale et al. 2005). The distinction is that such benefits are likely to emerge on a longer time scale – the costs of implementing them will be borne by present generations while the benefits may serve future generations.

Our present baseline is often of a risk-prone, heavily degraded ecosystem in which natural capital has been run down. The costs to society of maintaining precarious coastal communities that rely on these uncertain resources is great, as evidenced by the costs of the outmigration and economic downturn that resulted from the collapse of Atlantic groundfish fisheries or some west coast salmon stocks. In comparison, conservation is a sound risk-averse strategy that, while sometimes costly at the outset, stands to offset the need for subsidy and reliance on government support in the longer term.

The expectation of benefits raises issues of equity. While MPA networks are expected to provide benefits to resource users and society, some level of cost and displacement is always associated with their implementation, just as any new business requires an initial investment of capital. Whether the benefits in question are long- or short-term, and whether they are fisheries-specific or supportive of broad ecosystem health, protection decisions should include provisions to ensure that the resulting benefits flow to the individuals and communities most affected and those who bear the initial cost of conservation measures.

If designed and managed on the basis of clear, shared goals and reasonable expectations, MPA networks should bring economic benefits now and in the future, making a positive contribution to community and regional development, as well as helping to ensure a more sustainable long-term footing.

1.3.1 Protection of physical habitat

Habitat loss in the ocean is not easily visible and so has continued for generations. But destructive fishing practices and activities such as the removal of aggregate can have cumulative and devastating effects on biodiversity, destroying or damaging what was once complex benthic habitat (figure 2) (Auster and Langton 1999, Morgan and Chuenpagdee 2003, Norse 1993, Agardy 1999). Some types of habitat, such as the structures formed by corals, tunicates, hydroids, and sponges, are especially sensitive to disturbance. If the species that build these habitats are slow growing, as in the case of Canada's cold-water corals and hexactinellid sponges, the damage can be long-term or even irreversible (ICES 2000). For species at risk, loss of habitat can be a deciding factor in the success or failure of recovery efforts. Since the most severe impacts of fishing gear are often wrought with the first trawl, forward planning for spatial protection is an important tool to "freeze the footprint" of present industrial activity.

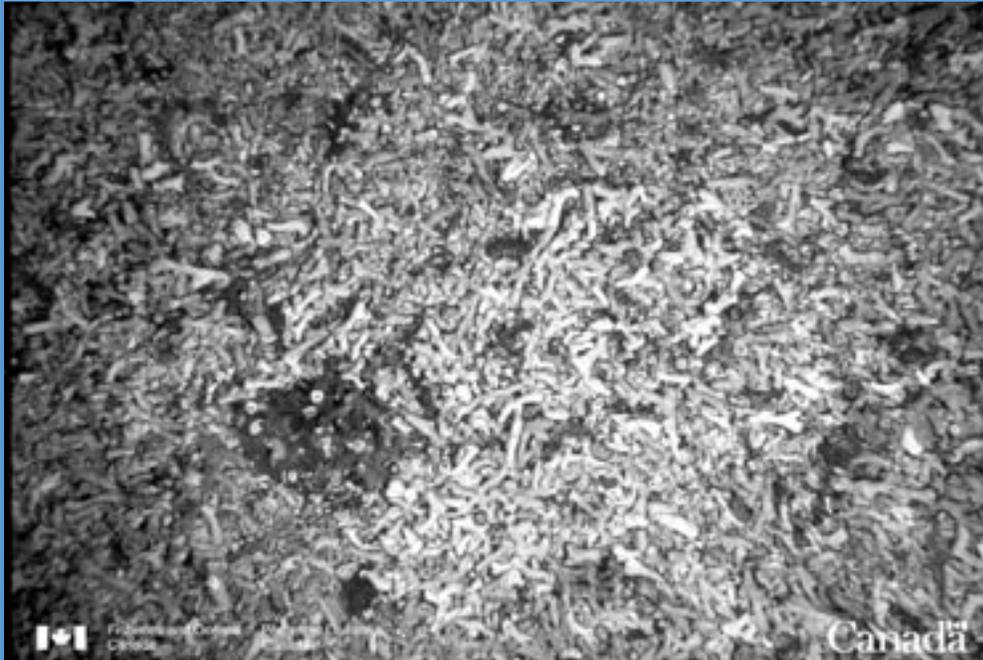
While changes in industrial practices are part of the overall solution, the safeguarding of sensitive and critical habitat calls for effective protection from physical disturbance that only area-based management measures such as MPAs that restrict habitat damage can provide. Establishing networks of MPAs that comprehensively protect the full range of habitats in a region would represent a substantial step toward recovering Canada's altered marine ecosystems by restoring habitat in heavily altered regions, preserving what's left in moderately affected ones, and, in more pristine areas, ensuring that samples of these habitats are set aside before options are lost or we are forced to undertake expensive restoration.

A policy and planning framework for marine protected area networks in Canada's oceans

Figure 2. a) Intact *Lophelia pertusa* reef or mound with a redfish (*Sebastes* sp.) peering out



Figure 2. b) *Lophelia pertusa* reef reduced to rubble – the impact of trawling



Source: Images courtesy of Fisheries and Oceans Canada/Pêches et Océans Canada

1.3.2 Recovery and protection for species and populations

Certain places in the ocean are of particular importance to the resilience of species and populations. These may be sites where fish aggregate to spawn, where dense vegetation provides a haven for juvenile fish to grow safe from predators, or where a high concentration of plankton draws whales and other species in large numbers. Overfishing, habitat destruction, pollution, and other threats can have a particularly serious negative effect on a population when effort is concentrated on these especially important places (Worm et al. 2005). Even nontarget species (such as at-risk wolffish, right whales, or sea turtles) and age classes (such as juveniles) may be at risk of being entangled in fishing gear or caught as bycatch (Rosenberg, Mooney-Seus, and Ninnes 2005). Area-based management that includes MPAs managed for species protection can address this issue by ensuring that both nontarget and commercially harvested species at key life stages can produce, feed, and grow in the habitats they require to maintain the health and structure of the wider population. Evidence clearly indicates that the reduction in fishing mortality afforded by highly protected (otherwise known as “no-take”) MPAs leads to what is termed a “reserve effect”; researchers and fishers have observed an increased abundance and diversity of species and expanded age and size structures within MPAs and on the fringes of these sites (NFCC 2004). These benefits are particularly robust for overfished species, both in theory (Beverton and Holt 1957, Polacheck 1990, Sladek Nowlis and Roberts 1999) and in practice (Russ and Alcala 1999, Roberts et al. 2001, Fisher and Frank 2002, Murawski et al. 2000).

Furthermore, increasing evidence from both tropical and temperate ecosystems shows that highly protected areas, once restored, can serve as source or seed-bank locations, enhancing the populations of species that humans use both commercially and recreationally by supplying recruits to adjacent areas (NFCC 2004) and other MPAs in a network.

In some cases, topographically complex habitats and less accessible areas such as canyons, irregular or rocky terrain, and very deep areas have acted as natural refugia, where some proportion of an exploited population can survive out of reach of fishing gear (Walters 1998, Caddy 1999). Although advances in fishing technology and seafloor mapping allow us to identify valuable areas and improve management, they also provide the means for natural refugia and the species they harbour to be exposed to damaging gear and intense fishing pressure (Orensanz et al. 1998). The search for new marketable species also brings industrial fishing activity into places previously under “protection by default” because of a lack of commercial species, for example, shallow coastal areas now being exploited in experimental fisheries for species such as sea cucumbers and urchins (M.-I. Buzeta, personal communication). Highly protected MPAs can help reduce the impacts of overfishing by preserving or replacing these natural refugia (Roberts et al. 2001).

A policy and planning
framework for marine
protected area networks
in Canada's oceans

Protected areas chosen to conserve sites currently subject to overfishing may risk displacing fishing effort to other sites and increasing pressure on both target and non-target species in unprotected areas. This is a further reason why MPAs should be planned within an ecosystem-based management framework and a matrix of appropriate zoning that considers the “big picture” (Kaiser 2005). Spatial protection measures may need to be paired with an overall reduction in fishing effort (Australian Government 2004; see also section 2.3.5).

1.3.3 Rebuilding ecosystem resilience

By protecting habitat, allowing for the conservation of species and populations, and better managing extractive uses, MPA networks are a key tool for the “passive restoration” and maintenance of wider ecosystem structure, function, and processes. Resilience may be described as the ability to absorb shocks without changing in fundamental ways or, when change is inevitable, to adapt without compromising the provision of ecosystem services (WCPA/IUCN 2006). Healthy, diverse ecosystems are likely to have greater resilience than those with heavily altered structures and impaired functioning (Rappart 1989). This is especially important as we face the prospect of large-scale changes such as climate change and ocean surface acidification. Simplified, degraded ecosystems will be more vulnerable to collapse as a result of such threats, and may react earlier and with more dramatic results for ecosystems and economies. Ecosystems that are more resilient and function more naturally may fare better, respond more slowly, and allow greater time and opportunity for human economies to adapt to such changes (D. Laffoley, personal communication).

1.3.4 Safeguarding against management uncertainty and benchmarking sustainability

Our lack of knowledge about the natural dynamics of marine ecosystems has been a major factor in the failure of traditional management approaches (Sladek Nowlis 2004). Adding area-based approaches to the range of tools we can draw on reduces our need to know everything about all components of the ecosystem and our reliance on highly speculative models, as with traditional methods for assessing the populations and sustainable yields of fish stocks (Sladek Nowlis and Bollermann 2002, Walters 1998). Rather, “one needs only to protect enough of the sea to encompass viable, interacting populations that can meet their habitat needs, reproduce successfully, function in their communities, maintain ecosystem services and retain their evolutionary potential to deal with inevitable changes, as they did in the eons before we came upon the scene” (Norse 2002; see also Lauck et al. 1998). Networks that include highly protected MPAs chosen as representative examples of the range of habitats in a region have a special role to play in this regard (this is discussed further in section 2.3).

Canada’s new marine management initiatives call for the use of *adaptive management*. Adaptive management is an innovative approach to managing ecosystems that treats management actions as scientific experiments, allowing managers to gain objective information about the success or failure of their actions and to use this learning to improve future policy and management decisions (Halbert 1993). Adaptive management requires room for experimentation and “safe fails” when management mistakes are made, as well as control sites that can be compared with sites that have been altered by human actions and used to measure or verify the ecological results of our decisions. MPAs, particularly those with high standards of protection, can serve as a benchmark against which to measure human-induced ecological change (PDT 1990, Polvina 1994, Willis and Millar 2005), and comprehensive MPA networks can allow more scientifically valid conclusions through replication of results and the ability to show that results hold between and across different types of habitat (Ballantine 1991). The resulting learning about what “works” both inside and outside of protected areas can contribute to future management decisions and to our overall understanding of our success at achieving sustainability (D. Laffoley, personal communication).

1.3.5 Reducing conflicts over the use of ocean space

An area-based approach to oceans management can help address and minimize conflicts over the use of ocean space (Agardy 1999), reduce costs associated with such conflict, and even deliver economic benefits (GHK Consulting Ltd. 2004). A zoning plan can achieve this by separating incompatible uses, while protected zones such as MPAs play the particular role of providing a space designated for nonconsumptive uses such as education, research, and recreation. Setting aside a proportion of the ocean to meet conservation goals also provides the “social licence” for industries to operate by ensuring that protection is in place before new or significantly expanded industrial development occurs, or may be considered as a compensatory measure for destructive uses – a common practice on land (Secretariat of the Convention on Biological Diversity 2004). A well-planned network of MPAs, as opposed to an open-ended case-by-case approach, can provide certainty to industry and avoid stranding intellectual and capital assets by making clear what areas can and cannot be developed, now and in the future (Day 2002); this is especially true when a single joint planning process yields a full network of MPAs and includes provisions for lasting protection

and a commitment to network plan reviews at regular intervals. And while traditional tools such as regulation, inspection, observation, self-reporting, and voluntary action will still be needed, compliance and enforcement of area-based management, where appropriate, are potentially clearer for users and may be less costly (Davis and Moretti 2005). Networks in particular, as opposed to isolated, separately managed MPAs, can help avoid duplication of management resources (Barr 2000). Finally, an area-based approach, unlike one-size-fits-all regulation, allows for the heterogeneity of ocean landscapes by providing the flexibility to implement different forms of protection according to the values that characterize different places and to ensure that space is provided for all compatible uses to occur.

1.3.6 Economic and cultural benefits

Well-planned MPA networks can play a role in recovering and securing long-term viability of resource-based regional economies, such as those based on fisheries, while providing opportunities to develop new sources of income through tourism, education, and research, all at a regional scale. Increasingly, throughout the world, coastal nations and communities that rely on ocean resources are looking to MPAs as one tool for safeguarding livelihoods (Murray et al. 1999) and providing economic alternatives. For example, individual, community-initiated MPAs may be designed to protect productive habitat and provide a refuge for lobster (as in the Eastport MPA in Newfoundland and Labrador, described in the text box below) or to enhance the profile of a tourism site on the basis of ecological or cultural values, while networks may be designed to facilitate recovery of a commercially important stock or form a “coastal water trail” to attract boaters.

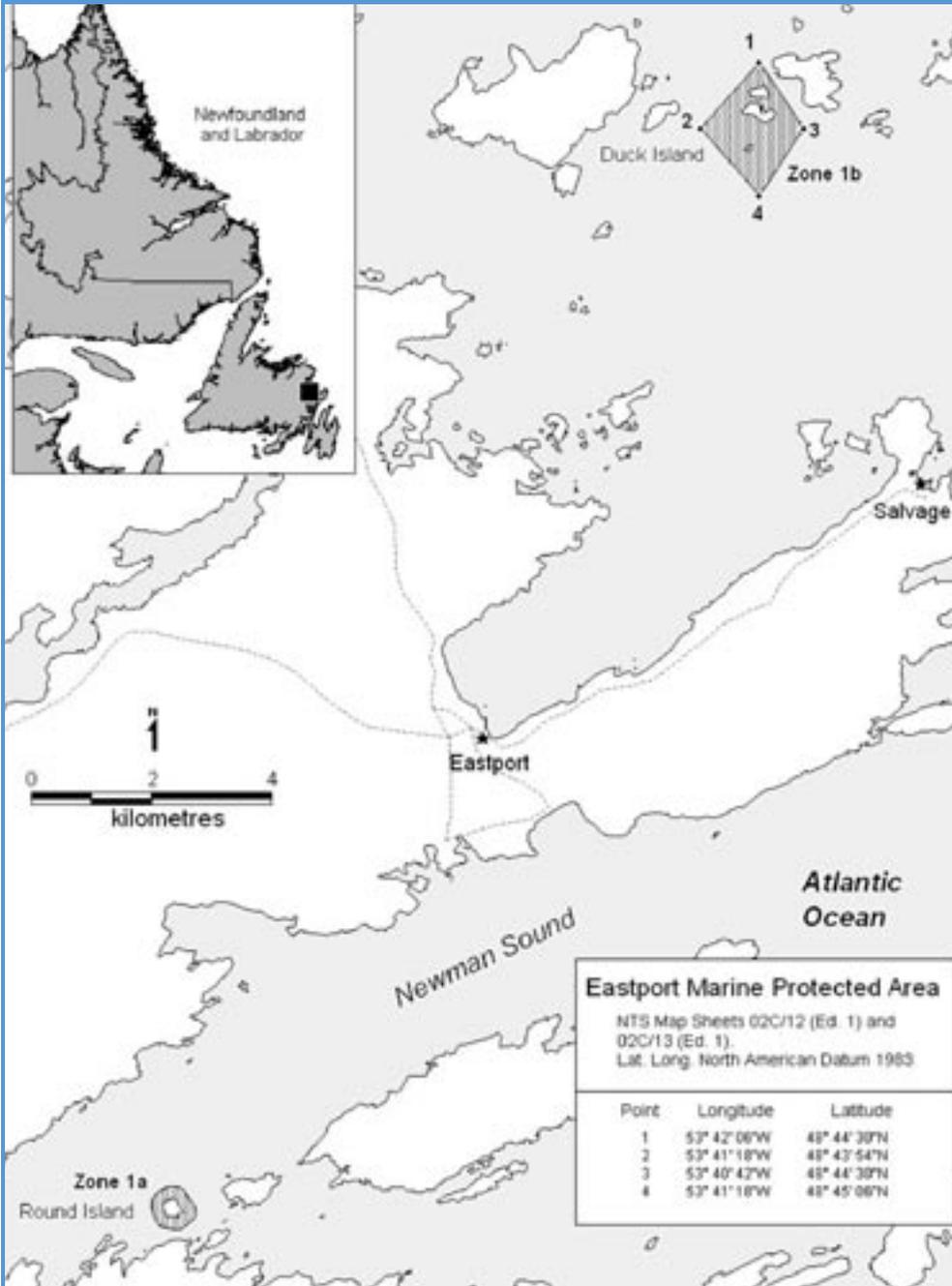
Eastport MPA: A stakeholder-driven protected area

Eastport, on the Eastport Peninsula in Bonavista Bay, Newfoundland and Labrador, was formally designated as an MPA under Canada's Oceans Act in 2005 (figure 3). The initiative was originally championed by a local stakeholders' association, the Eastport Peninsula Lobster Protection Committee, established to address declining catches. The subsequent MPA steering committee has identified the following benefits² that are expected to result from the establishment of the MPA:

- *Protecting the areas for future breeding of important species such as lobster. An MPA provides more permanence in protecting species in the area.*
- *Enhancing the sustainability of lobster and other species, thereby protecting the future income of fishers and others directly or indirectly affected by the fishing industry.*
- *Building on the success of the Eastport Peninsula Lobster Protection Committee.*
- *Providing greater recognition of the region by scientists, fishers, and tourists.*
- *Allowing increased access to sources of funding for other research. Additional fisheries and marine research can result in additional activity and new opportunities for other businesses in the region.*
- *Providing opportunities and benefits for other members of the communities in the region. MPAs can complement the economic activity in the region and can create potential economic spin-offs for local entrepreneurs or organizations that operate in the region.*

² From Eastport Marine Protected Areas: www.eastportmpa.com.

Figure 3. Eastport MPA, showing the closed areas surrounding Duck Island and Round Island



Source: Proposed Eastport Marine Protected Area Summary of Regulatory Intent: www.eastportmpa.com/regulatory_intent_1.htm

1.3.7 Public education and enjoyment

MPAs can play an important role in educating students and the public about Canada's marine wealth and heritage, marine ecology, and the threats to our marine environments. Promoting experience and enjoyment of these environments through recreational uses such as diving, ecotourism, and recreational fishing not only enhances awareness and concern, but also offers benefits to local economies (Ballantine 1997 in Secretariat of the Convention on Biological Diversity 2004).

1.3.8 MPAs in context

While MPAs offer unique benefits and will be a crucial tool for achieving conservation and sustainable use, other, complementary tools will continue to be necessary. This is because some threats to ecological integrity – for example, climate change – occur at a scale beyond that addressed by MPAs, while others, such as certain human activities (e.g., non-point-source pollution), are not spatially explicit in nature and are better addressed by implementing best practices through regulation and cooperation; reducing bycatch, for example, means changing how fishing is carried out, not just where it takes place. Within a matrix of appropriate zoning, effective management, and good industrial practices, MPAs can provide a foundation for conservation and sustainable use. The recommendation arising from the 2003 IUCN–World Conservation Union World Parks Congress makes clear that MPA networks are most effective when “embedded within wider integrated coastal and marine management frameworks that include collaboration among resource-management bodies and ensure linkages among marine, coastal and terrestrial protected areas to address potential threats beyond area boundaries” (IUCN 2003).

Just as MPAs are now accepted as an integral tool for achieving ecosystem-based management, so too is sustainable and sensible management of the surrounding ocean and terrestrial ecosystems crucial to the survival and success of MPAs (Secretariat of the Convention on Biological Diversity 2004). It has been said that “there can be no such thing as ecological integrity of a single MPA” (Roff 2005) because of the highly connected nature of the marine environment, but it is also true that even the best-designed network is influenced by activities in the surrounding ocean space and by global-scale impacts such as long-range transport of pollutants, flotsam, and climate change (Jameson, Tupper, and Ridley 2002).

The Jakarta Mandate of the Convention on Biological Diversity (CBD) included recommendations to integrate MPA network efforts with other ocean, coastal, and land governance policies “to achieve sustainable fisheries, biodiversity conservation, species protection and integrated watershed, coastal, ocean and High Seas and polar management objectives” and emphasized that MPA networks should be “embedded within wider integrated coastal and marine management frameworks that include collaboration among resource-management bodies and ensure linkages among marine, coastal and terrestrial protected areas to address potential threats beyond area boundaries” (CBD 1995).

Guidance from the Secretariat of the Convention on Biological Diversity (2004) indicates that MPA networks are likely to work best when implemented within a framework of integrated marine and coastal area management that addresses the wider planning area. Sustainable management and practices in the surrounding seas have a role to play by

- Providing direct benefits to biodiversity, for example, through reduced effort or best practices like bycatch-minimizing gear types
- Protecting wide-ranging values that are difficult to address through site-specific measures, such as chronic pollution caused by the dumping of oily bilge or the introduction of invasive alien species
- Reducing negative impacts on the connective processes between MPAs, as in the case of implementing systems to reduce the chances of marine mammals encountering fishing gear as they migrate from one critical site to another
- Reducing impacts on MPAs from outside their boundaries, such as transport of sediment or waste products from drilling activity (Secretariat of the Convention on Biological Diversity 2004)

Whether the processes for planning networks of MPAs and implementing ecosystem-based management throughout a region are one and the same or separate, the two must be functionally integrated, and MPA networks must be understood as embedded in and dependent on the surrounding ecosystem. Strong partnerships will need to be forged in which responsibility is shared.

1.4 Canada's international and national commitments to MPAs and MPA networks

1.4.1 International commitments

Canada was among the first countries to ratify the CBD, a key international agreement that requires countries to develop and implement strategies for the sustainable use and conservation of biodiversity. Canada has also agreed to the Jakarta Mandate on Marine and Coastal Biological Diversity, which was developed to direct the implementation of the CBD in marine ecosystems. At the World Summit on Sustainable Development in 2002, Canada committed to completing a national representative network of MPAs by 2012. Canada ratified the United Nations Convention on the Law of the Sea (UNCLOS) in 2003. UNCLOS gives nations the right to claim an exclusive economic zone (EEZ) and the marine resources within it. With that right comes the responsibility to conserve and manage these resources (Breide and Saunders 2005). Table 2 summarizes Canada's international commitments.

Table 2. Canada's major international commitments to MPAs and stewardship of marine ecosystems³

Agreement	Date	Commitment
World Summit on Sustainable Development	2002	The Johannesburg Plan of Action, in section IV, <i>Protecting and managing the natural resource base of economic and social development</i> , 32.c, recommends the establishment of MPAs consistent with international law and based on scientific information, including representative networks, by 2012.
United Nations Convention on the Law of the Sea	Ratified 2003	"The coastal State, taking into account the best scientific evidence available to it, shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation ... Such measures shall also be designed to maintain or restore populations of harvested species."
G8 Group of Nations Action Plan on the Marine Environment and Tanker Safety	2003	Clause 1.12 committed members to incorporate priorities from the 1995 Global Programme of Action for the Protection of the Marine Environment into national, regional, and international policies and initiatives; clause 1.13 committed members to establish, by 2012, ecosystem networks of MPAs, consistent with international law and based on scientific information, in their own waters and regions, and to work with others to achieve the same in theirs.
IUCN–World Conservation Union World Parks Congress	2003	Participants in the Marine Cross-Cutting Theme at the fifth World Parks Congress, in Durban, South Africa (8–17 September 2003), developed Recommendation 5.22, which called on the international community as a whole to establish, by 2012, a global system of effectively managed, representative networks of Marine and Coastal Protected Areas (MCPAs), consistent with international law and based on scientific information, that greatly increases the marine and coastal area managed in MPAs; these networks should be extensive and include strictly protected areas that amount to at least 20%–30% of each habitat.
Convention on Biological Diversity Conference of the Parties 7	2004	Decision VII/28, <i>Protected areas</i> (articles 8 a to e), which cites as the overall objective of the program of work (paragraph 18), annexed to the decision, the establishment and maintenance – by 2010 for terrestrial areas and by 2012 for marine areas – of comprehensive, effectively managed, and ecologically representative national and regional systems of protected areas. Also, Decision VII/5, <i>Marine and coastal biological diversity</i> , which, in paragraph 21, further specifies the need for integrated networks of MCPAs consisting of (a) MCPAs where threats are managed for the purpose of biodiversity conservation and/or sustainable use and where extractive uses may be allowed, and (b) representative MCPAs where extractive uses are excluded and other significant human pressures are removed or minimized to enable the integrity, structure, and functioning of ecosystems to be maintained or recovered.

³ Other relevant global conventions can be found on the Ad Hoc Open-Ended Working Group on Protected Areas website: www.biodiv.org/doc/meeting.aspx?mtg=PAWG-01&tab=1.

As caretaker of a vast continental shelf and EEZ encompassing highly productive and globally significant ecoregions within three of the world's oceans (Olson et al. 2001), including sensitive arctic waters that play a key role in regulating global ocean-climate systems, Canada is an important maritime nation with a special obligation to the rest of the world. We have an opportunity to assume a place among the world-leading jurisdictions like Australia, New Zealand, and the United States by upholding our commitments to stewardship of our ocean resources and increasing our efforts to establish MPA networks.

1.4.2 National commitments

At the national level, Canada has passed progressive marine conservation legislation – the Oceans Act – and developed a federal Oceans Strategy for its implementation. Canada's recently released Oceans Action Plan is based on four pillars: international leadership, sovereignty, and security; integrated oceans management for sustainable development; health of the oceans; and ocean science and technology. Canada's Oceans Act includes provisions for designating MPAs; to date, five MPAs have been established under the Oceans Act (The Gully, Endeavour Hydrothermal Vents, Basin Head, Eastport and Gilbert Bay), and several others are currently in the process of consultation and establishment.

The National Marine Conservation Areas Act, the National Marine Conservation Areas Policy, and *Sea to Sea to Sea* (Parks Canada 1995), the national system plan, lay out Parks Canada's approach to fulfilling its mandate of establishing a national system of MPAs to represent the 29 broad marine regions it has identified in Canada's Atlantic, Arctic, and Pacific oceans and the Great Lakes. Two NMCA's have been established to date (Fathom Five and Saguenay-St. Lawrence) and four more are under consideration.

Environment Canada sets out its policies and commitments to identify, designate, and manage MPAs in its *Habitat Conservation Program Strategy*, while greater detail on the application of the legislative tools under this policy can be found in *Migratory Bird Sanctuary Policy, Criteria and Procedures* and *Criteria for Selecting Candidate National Wildlife Areas*.⁴ There are presently 64 National Wildlife Areas with a marine component (C. Chute, personal communication).

Canada's Federal Marine Protected Areas Strategy (Government of Canada 2005), released in June 2005, elaborates on the roles and responsibilities of federal departments and agencies and expresses a commitment to take a more systematic approach to MPA planning and establishment. The strategy expounds on the additional role of Fisheries and Oceans Canada (DFO), outlined in Canada's Oceans Act, to lead and coordinate the development and implementation of a national system of MPAs. The strategy also highlights the need to undertake this work within an IM framework and to use the various federal MPA designation tools to create cohesive and complementary networks.

⁴ These policies can be found on Environment Canada's Habitat Conservation website: www.cws-scf.ec.gc.ca/habitat.

1.5 Conservation first: the need for action on MPA networks

Despite the evidence for the effectiveness of MPAs, the growing consensus about their unique and necessary contribution to ecosystem-based management, and the long-standing acceptance of the need for protected areas on land, few protected areas exist in marine waters: less than 0.5 percent of the world's oceans are protected (Roberts and Hawkins 2000). In Canada, the total area under protection is just over 29,000 square kilometres, about 0.5 percent of our EEZ.⁵ Much remains to be done if we are to implement the protection needed to restore our oceans and meet our international commitments.

WWF-Canada has proposed the principle of “Conservation First” – the tenet that conservation decisions should be made in advance of or concurrent with new or expanded large-scale industrial development. As Canada embarks on the process of implementing the Oceans Action Plan and developing IM plans that lay out a strategic course for development of our ocean resources, a unique opportunity exists to ensure that the Conservation First principle, a prerequisite for truly sustainable development, forms the basis of these plans.

A policy and planning
framework for marine
protected area networks
in Canada's oceans

⁵ L. Wood, personal communication. Calculations based on holdings in the MPA Global database as of May 2005: www.mpaglobal.org.

2.0

Approach and guiding principles for planning regional MPA networks



Polar bear: © WWF-Canon / Terry Domico

- 2.1 A systematic approach
- 2.2 Principles for the planning process
- 2.3 Principles for network design
- 2.4 Principles for implementation and management

2.0 APPROACH AND GUIDING PRINCIPLES FOR PLANNING REGIONAL MPA NETWORKS

This section describes an approach and principles for planning effective networks of MPAs, built on best practices and guidance from around the world and presented as a contribution to Canadian and regional frameworks for MPA network planning. These principles should be considered fundamental elements of a regional-scale MPA network planning process and have application in any of Canada's marine regions. They are, however, flexible enough to accommodate regional differences in their application based on such factors as differing levels of involvement of governmental and nongovernmental partners and of stakeholders, differing timelines and capacities, the role of First Nations and the status of land claims, availability of information, existing or past planning processes, the level of development, and so on. They offer guidance on science, policy, and social process and especially on the integration of these three components of MPA network planning. These principles are accompanied by more specific recommendations, examples, and resources that highlight ways to incorporate these principles effectively and collaboratively into MPA network planning in the Canadian context.

2.1 A systematic approach

World-leading regional-scale protected area network planning processes, both marine and terrestrial, are employing an approach known as *systematic protected areas planning* (Margules and Pressey 2000, Pressey 1999, Pressey et al. 1993, Noss 2003, Davey 1998, Noss and Cooperrider 1994, Groves 2003, Leslie 2005). Systematic protected areas planning is a departure from the more ad hoc, site-by-site approaches that have been used to select protected areas in the past. The site-by-site approach has yielded a set of protected areas that tend to be biased toward those places about which we know the most and those that are most scenic, least controversial, or under the greatest immediate threat. While these sites serve the important role of protecting outstanding ecosystems, a piecemeal approach is unlikely to be effective in achieving conservation of biodiversity at the regional scale and leaves a legacy of fragmented collections of sites “in which some elements of the native biota are overrepresented and others are not represented at all (Soulé and Terborgh 1999)” (Stewart, Noyce, and Possingham 2003). Furthermore, Canada's track record using such an approach in the marine environment indicates that sites take many years or even decades to establish and often are extremely small compared to the size of Canada's EEZ and the magnitude of the challenges.

In contrast to the site-by-site approach, systematic protected areas planning involves proceeding through a transparent process of selecting and designing a system of protected areas that function together to meet clear region-wide conservation goals, such as conserving the diversity of a region's biological communities or protecting the critical habitats used by a migratory species throughout its life cycle. Systematic protected areas planning is a means toward ensuring the integrity of the broader ecosystem by meeting big-picture, regional-scale goals while allowing local needs and conditions to influence the form of management and governance of each individual site in aspects such as size, shape, use zoning, and regulation, as appropriate.

The steps of systematic protected areas planning

Systematic protected areas planning is a process, and the following eight steps characterize the progression through groundwork, site selection, implementation, and ongoing management and monitoring. While the order of these steps is important, such a process will rarely be completely linear. Instead, course corrections and returns to refine earlier steps will be needed at times, progress may be made on later steps before early ones are complete, and the sequence may be adapted to reflect the circumstances and pre-existing processes in each region. Although flexible, the following steps provide a logical pathway through the complex process of protected area network planning.⁶

1. Coordinate among governments, agencies and partners; identify and involve stakeholders

All stakeholders who will be affected, and all those who will need to collaborate in the planning of the network (both inside and outside of government), should be involved from the initial stages to ensure that appropriate goals, objectives, information sources, and design options are chosen, and to build ownership and commitment.

2. Define the purpose of the network; identify conservation goals to be achieved and features to be protected

The overarching network purpose should clarify the problems we are collectively trying to solve by planning and implementing an MPA network, the broad values to be conserved, and the future state that everyone desires. Conservation goals that flow from the purpose should be visionary yet clear and unambiguous statements that direct conservation action and objective-setting (see point 4) while reflecting societal values and choices and political or institutional intent.

3. Identify and compile data and information to be used in setting quantitative objectives and the design of networks

This may require evaluating existing data, identifying gaps, and collecting new data in order to develop required information products. In addition to mapping the distribution of the features to be protected, we will need to understand the distribution of ocean use and tenure, and to inventory existing protected areas or areas already under special management where standards could be enhanced.

4. Set quantitative conservation objectives, management standards, and design criteria

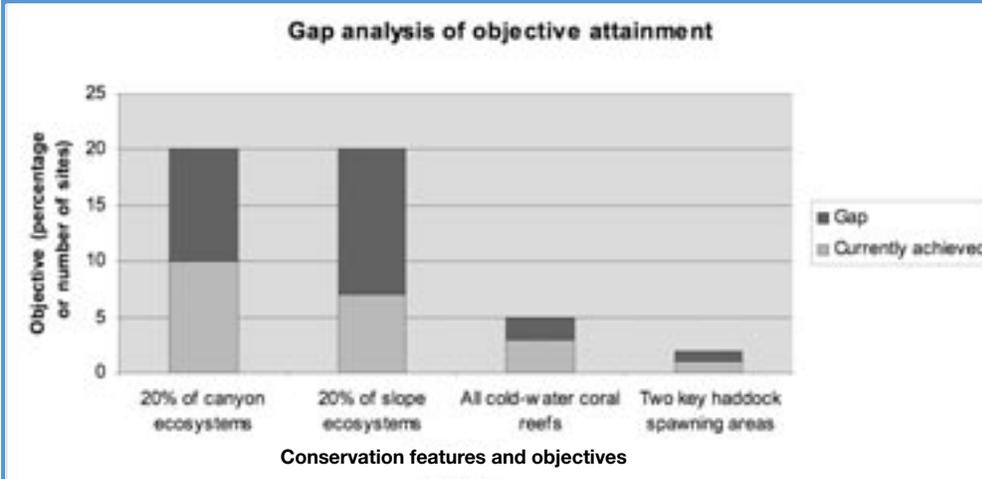
Quantitative, measurable conservation objectives provide specific direction for site selection and also allow evaluation of progress. Conservation objectives may be based directly on biological features, such as species and communities, or on surrogates, such as physical habitat types. Appropriate management standards should be defined that correspond to conservation objectives. Design criteria should reflect considerations for cohesive network design (such as replication and connectivity) and recognition of practical and socioeconomic factors (such as minimizing cost and displacement and recognizing existing tenure). Together, objectives and design criteria provide the “specifications” for network design.

⁶ This list, and the accompanying flow chart in figure 5, reflects generic characterizations of a systematic planning process, as widely accepted in the literature and in practice. It was adapted from several sources (Margules and Pressey 2000; Tear et al. 2005; Pressey 2005a; Department of Conservation and Ministry of Fisheries (New Zealand) 2005; T. Ward, personal communication, 23 January 2006).

5. Review existing objective attainment and identify network gaps

This step may involve not only measuring the extent to which objectives are already met by pre-existing protected areas, but also assessing how effectively these sites are managed to achieve the intended objectives. Figure 4 illustrates a hypothetical gap analysis.

Figure 4. Hypothetical example of a gap analysis



6. Select new sites to meet conservation objectives

Site selection is itself a multi-step process that should make use of transparent methodologies to apply the conservation objectives and design criteria to explore and propose possible network designs, consult on draft designs with affected stakeholders, and develop a refined design that is responsive to input.

7. Implement new protected areas

Implementation of new sites will include site-level decisions such as precise boundaries, zoning, management plans, and partnerships for management. This step may also involve upgrading the management standards of pre-existing sites.

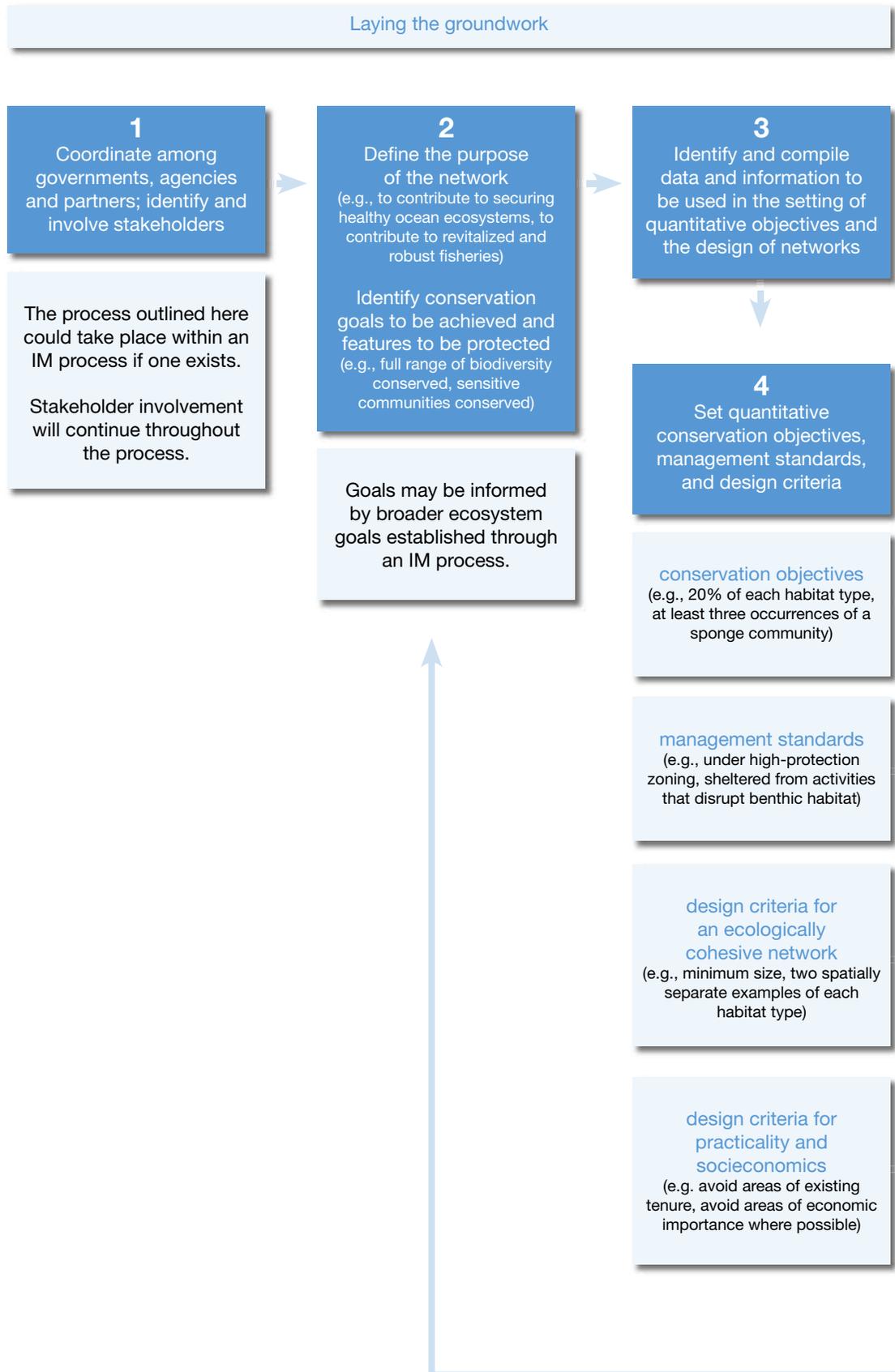
8. Maintain conservation values; monitor and manage adaptively

Standards and indicators for monitoring management effectiveness should be based on the region-wide goals and objectives for the network.

Margules and Pressey (2000), among others, describe systematic protected areas planning in greater detail.

Figure 5 provides a flow chart of a process for MPA network planning that adapts the systematic protected areas planning approach to the Canadian context, can be applied within IM or as a stand-alone planning process, and embodies the guiding principles presented in the next section.

Figure 5. A framework for systematic protected areas planning in Canada's oceans:



A policy and planning framework for marine protected area networks in Canada's oceans

process flow diagram

Site selection

Implementation

Management and monitoring

5

Review existing objective attainment and identify network gaps

7

Put in place interim protection for candidate sites

8

Maintain conservation values, and monitor and manage adaptively

6

Select new sites to meet conservation objectives

Implement new sites, set timelines, and monitor progress on implementation

Site selection may include steps such as:

- Generating and exploring a range of options
- Creating drafts
- Consultation
- Incorporating new information and qualitative factors
- Refining drafts

Decision-support software may be most useful in this step.

Implementation of new sites may include steps such as:

- Negotiating site-specific boundaries and zoning
- Identifying the designation tools most appropriate for the site and its values
- Developing partnerships for management between agencies, communities, industries, and First Nations
- Developing management plans and regulations that reflect network-wide objectives and standards as well as site-specific factors

Management and monitoring standards/indicators are informed by goals

Systematic protected areas planning can offer a way to avoid duplication and increase effectiveness, particularly when undertaken as part of IM, which facilitates collaborative, coordinated planning and a holistic context for MPA networks as part of a larger conservation strategy. A well-defined process with clear goals allows stakeholders to participate in the planning process knowing the criteria and “rules of the game” by which decisions will be made and conflicts resolved. This more systematic approach reduces uncertainty for all stakeholders and helps prevent loss of future options by linking decisions about the protection and use of ocean space and defining expectations for a complete network plan.

Systematic protected areas planning requires clear choices about the values and features we want to protect and the goals we set for their protection. Setting clear goals forces planners to be open and specific, which may be important for stakeholders who will be affected by conservation decisions. Once clear goals, objectives, and design criteria are established, sites can be selected in a fair and transparent way using explicit and consistently applied methods supplemented by pragmatic judgment and consultation.

A systematic approach lends itself to a comprehensive process that aims to meet conservation objectives while minimizing cost and displacement of ocean resource users and considering practical limitations such as existing tenure. Many different configurations of a protected areas network may meet conservation objectives: this concept is referred to as *flexibility*. Systematic protected areas planning allows planners and stakeholders to take advantage of flexibility by exploring the full range of alternatives for design of a network, providing choices and scope for resolving conflicts.

This approach to planning can rapidly become complex with the addition of multiple objectives and design criteria. To help address this challenge, specialized methodologies and tools, including computer programs, have been developed (Pattison, dosReis, and Smillie 2004; Evans et al. 2004; see also the text box in section 2.3.6 on the role of decision-support software). Although these tools may be extremely useful, communication about how they are used must be clear to ensure that the systematic approach remains transparent to all stakeholders. Software-based decision-support tools will not produce a final network configuration; rather, they can help ensure consistent, fair, and transparent decision-making based on explicit information and enable rapid, objective evaluation of how well different network scenarios achieve the conservation and design goals.

2.2 Principles for the planning process

2.2.1 Plan at an ecologically meaningful scale

Ecosystems are complex and interconnected through processes like migration, large-scale ocean transport, and the movement of species through a variety of habitats during different life stages. Small-scale, single-objective, area-based conservation – while effective for some purposes – may not be resilient to broader ecosystem changes, the negative effects of surrounding human activities, or threats to species at times when they are outside the protected site. The appropriate planning area for ecosystem-based management – and for MPA networks as a tool within ecosystem-based management – is likely to be on the scale of hundreds of thousands of square kilometres (Olson et al. 2001), reflecting the scale of the features (such as species distributions, habitats, and topographic features) and processes (such as water transport systems, primary production cycles, migration routes, and life history patterns) (Picard et al. 2005) that maintain the productivity and diversity of marine ecosystems. Such areas have been termed Large Marine Ecosystems (LMEs) (Sherman, Alexander, and Gold 1990) or ecoregions (Olson et al. 2001). In Canada, the federal government has identified Large Ocean Management Areas (LOMAs) that aim to balance an ecologically meaningful planning area and scale with management considerations (DFO 2002).

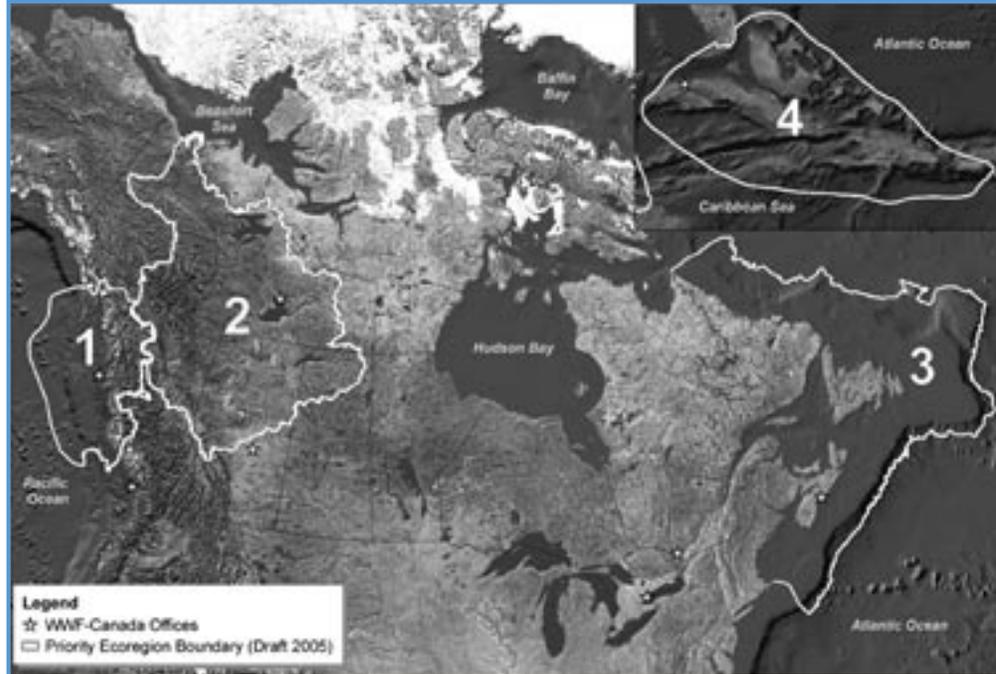
If ambitious goals for the recovery and protection of marine biodiversity are to be reached in a way that is effective and timely, MPA networks will need to be planned to achieve goals at this large scale and results should be assessed in an ecoregional context. Methods and tools for designing MPA networks are likely to be more robust if applied at the scale of ecologically defined units such as ecoregions, as the pattern of distribution of species and communities rarely coincides with political units (Olson et al. 2001).

The ecoregional action planning approach

The term *ecoregion* is used to describe a relatively large unit of land or water containing a distinct assemblage of natural communities and species, and environmental conditions. An ecoregion encompasses an area within which important ecological and evolutionary processes most strongly interact (Orians 1993).

WWF focuses its work on a set of ecoregions determined through a study called the Global 200. The Global 200 is a science-based global ranking of the Earth's most biologically outstanding terrestrial, freshwater, and marine habitats. It provides a critical blueprint for biodiversity conservation at a global scale. Developed by WWF scientists in collaboration with regional experts around the world, the Global 200 is the first comparative analysis of biodiversity to cover every major habitat type, spanning five continents and all the world's oceans. The aim of the Global 200 analysis is to ensure that the full range of ecosystems is represented within regional conservation and development strategies so that conservation efforts around the world contribute to a global biodiversity strategy. While the original Global 200 analysis dealt primarily with terrestrial, freshwater, and shelf ecoregions, WWF and The Nature Conservancy (TNC) are currently leading a global effort to produce a more complete inventory of the marine ecoregions of the world, which will provide a refined framework of relevant large-scale planning areas for marine ecosystems. Figure 6 shows WWF-Canada's priority ecoregions.

Figure 6. WWF-Canada's priority ecoregions: 1. Pacific, 2. Mackenzie Valley, 3. Northeast Atlantic, 4. Greater Antilles



A policy and planning framework for marine protected area networks in Canada's oceans

2.2.2 Articulate a common purpose

A common purpose for an MPA network can provide clear guidance and facilitate coordination and collaboration among stakeholders by clarifying the problems we are collectively trying to solve in planning and implementing an MPA network, the broad values to be conserved, and the future state that everyone desires. The importance of a common purpose, and the need to define that purpose with a maximum of cross-agency and stakeholder participation, is a common thread in the lessons emerging from jurisdictions that are leading in the creation of MPA networks (Living Oceans Society and WWF-Canada 2006).

At present, each agency with statutory powers to create MPAs (see table 3) has its own mandate, program, goals, and planning frameworks to guide candidate identification and selection. In addition, well over a dozen federal agencies, as well as many provincial and territorial agencies and First Nations, are involved in managing oceans use. A common purpose will help to move all parties toward thinking about a single, comprehensive network, to avoid duplication of effort and resources, and to inspire collaboration at ambitious spatial and thematic scales. Canada's Federal Marine Protected Areas Strategy acknowledges the need for coordination and identifies DFO as the lead agency. This approach recognizes the contribution of individual agencies not just to their mandate and program objectives, but also as part of a shared vision.

Example of a common purpose for an MPA network

A number of nongovernmental organizations (NGOs) in British Columbia have developed a shared marine conservation vision (which includes MPA networks) and goals, objectives, and guiding principles for the collaborative delivery of an MPA network in Canada's Pacific waters. In this document, the stated goal of the collaborative BC MPA network project is as follows:

A project to maintain marine life on the coast by establishing an MPA network of representative ecosystems and distinctive features as one cornerstone of an ecosystem-based approach to ocean management and sustainability that will secure

- Healthy, functioning marine ecosystems and human communities on the BC coast
- Lasting social and economic benefits
- Certainty for decision-making regarding sustainable use/management of coastal natural resources for tourism, recreation, aquaculture, fisheries, forestry, and energy purposes (WWF-Canada et al. 2006)

2.2.3 Coordinate for consistency

Because MPA network planning will likely proceed at different paces in different planning areas, a consistent and coordinated approach is needed across each region (e.g., between adjacent or nested Coastal Management Areas [CMAs] and LOMAs). Ensuring coordination and consistency will add efficiency and effectiveness in setting objectives, gathering information, and evaluating results. A coordinated effort by the various governments, departments, and agencies with a role in area-based protection of the marine environment, as conceived by the Oceans Strategy, will serve as a demonstration of commitment to collaboration on planning and implementation of MPA networks.

To be effective in building capacity and momentum toward Canada's commitment to complete representative networks of MPAs by 2012, this coordinated effort could include a regional multi-party secretariat or other institutional structure or facility with authority for implementing the MPA program and ensuring coordination and collaboration among agencies on all program components (e.g., policy integration, joint decision-making, information systems, analytical processes, decision support, public outreach) and mechanisms (e.g., institutional arrangements and partnerships). To be successful, this effort must be supported with adequate budget, staff, accountability, business plan, performance objectives, measures, and timelines. Such a structure would serve as a clear interface for stakeholders and the public.

An institutional arrangement for coordination should also leave the door open for collaboration with NGOs, First Nations, and other partners that may have expertise or information to contribute to the planning process.

Table 3 inventories the different federal agencies with a mandate that relates to MPA networks; more information on the roles of these different agencies can be found in Canada's Federal Marine Protected Areas Strategy (Government of Canada 2005). There are also many provincial and territorial governments and agencies with an interest in MPA planning and designation and, in some provinces, legislative or regulatory tools that allow for the creation of MPAs (see especially Governments of Canada and British Columbia [2006] and WWF-Canada et al. [2006]).

A policy and planning framework for marine protected area networks in Canada's oceans

Table 3. Federal statutory/regulatory powers to protect marine areas			
Government Agency	Legislation	Protected Area Designation or Regulatory Tool	Primary Conservation Objectives/Mandate
Fisheries and Oceans Canada	Canada's Oceans Act	Marine protected areas	<ul style="list-style-type: none"> commercial and non-commercial fishery resources, including marine mammals endangered and threatened species and their unique habitats areas of high biodiversity or biological productivity the conservation and protection of any other marine resource or habitat as is necessary to fulfil the mandate of the Minister
	Fisheries Act	Fisheries closures	<ul style="list-style-type: none"> commercial and non-commercial fishery resources
Environment Canada (Canadian Wildlife Service)	Canada Wildlife Act	National Wildlife Areas and Marine Wildlife Areas	<ul style="list-style-type: none"> marine wildlife and their habitats endangered and threatened species
	Migratory Birds Convention Act	Migratory Bird Sanctuaries	<ul style="list-style-type: none"> migratory birds and their habitat
Environment Canada (Parks Canada)	Species at Risk Act	Critical habitat provisions of the act	<ul style="list-style-type: none"> listed threatened and endangered species, their residences, and their critical habitat
	National Parks Act	National parks	<ul style="list-style-type: none"> representative ecosystems cultural heritage resources public understanding, appreciation, and enjoyment
	National Marine Conservation Areas Act	National Marine Conservation Areas	<ul style="list-style-type: none"> representative marine areas (oceanic and Great Lakes environments) ecological processes endangered and threatened species and their habitat cultural heritage resources public understanding, appreciation, and enjoyment

Scaling up to ecoregional networks

In Canada, DFO has a mandate to lead IM, one of the key delivery mechanisms for networks of MPAs and one that, by its nature, is intended to bring together governments, agencies, and stakeholders to plan using an ecosystem-based approach. The model for DFO-led, multi-agency-supported IM objectives has yet to be fully developed or implemented, and the geographic units at which IM will proceed may not always match ecoregional boundaries for valid jurisdictional reasons. In other cases, networks of MPAs will not be planned through IM but through stand-alone processes (i.e., processes the sole purpose of which is to plan an MPA or networks of MPAs) or a combination of both. In all cases, models for achieving coordination and consistency throughout the ecoregion will need to be created or models for collaboration on IM may need to be expanded.

Where ecoregions extend beyond Canada’s borders, we will need to plan cohesively with the United States or other nations, and pursue avenues for international cooperation and legal mechanisms for protection on the high seas. For example, parts of the Grand Banks extend beyond Canada’s EEZ to the high seas, and France has jurisdiction in a portion of the Atlantic continental shelf extending southward from the islands of Saint-Pierre and Miquelon. The Gulf of Maine straddles Canadian and U.S. waters, and the Gulf of Maine Council on the Marine Environment provides a forum for governments and stakeholders to cooperate on issues of environmental quality.⁷ In the Pacific Ocean, ecological linkages with Alaskan and Washington State waters make transboundary planning for resource use and protection important. The Commission on Environmental Cooperation (CEC), a body created under the North American Free Trade Agreement (NAFTA), has undertaken tri-national initiatives that can help to structure this coordination.⁸ In the Arctic Ocean, international interests and responsibilities will need to be addressed, as indicated in the international Arctic Marine Strategic Plan (Arctic Council 2004).

2.2.4 Ensure inclusive decision-making

Successful planning processes tend to maximize participation of stakeholders and effectively represent their concerns at all stages, and to emphasize true stakeholder input as opposed to consultation after the fact. Inclusive decision-making is important not only as a matter of principle, but also because effective communication and engagement will help secure buy-in and allow affected individuals to contribute their knowledge and ideas, leading to better solutions. Where MPA network planning will proceed as a component of DFO-led IM, stakeholder involvement in MPA network planning will follow from involvement in the broader initiative.

Engaging stakeholders in a meaningful way is complex. Challenges will arise in identifying who qualifies as a stakeholder, in determining when to accept an individual speaking on behalf of others, and in deciding what constitutes an appropriate outcome and when it has been reached. Stakeholders will expect clear terms and timelines for engagement and assurances that their participation will be reflected in the outcomes of the process. These challenges highlight the need for clarity, coordination, and consistency between government departments prior to engaging stakeholders.

Inclusive and effective involvement of interested parties is best achieved by carefully planning for early involvement; reaching beyond core audiences to extend an invitation to participate (D. Laffoley, personal communication); ensuring the right balance of multiple techniques (e.g., stakeholder workshops, community information sessions, public meetings, and websites [Fernandes et al. 2005]); tailoring communications messages, accessibility, and timing to meet the needs of individual communities with varying levels of literacy and access to technology; clear and centralized channels for acquiring information when needed; approachable and accessible staff dedicated to facilitating stakeholder involvement in the process; resources to assist with the participation of marginalized groups; and a general ethic of open, equitable dissemination of information, timelines, data, and results (Living Oceans Society and WWF-Canada 2006). Mechanisms for avoiding or navigating disagreement are also important to ensure that the process does not stall and that forward movement continues while conflicts are being resolved.

⁷ Gulf of Maine Council on the Marine Environment: www.gulfofmaine.org.

⁸ Commission for Environmental Cooperation: www.cec.org.

Flexible management relationships, such as shared management or co-management, may emerge as appropriate mechanisms for stakeholders to play a meaningful role in some regions and sites.

2.2.5 Promote First Nations engagement

Involvement and support of First Nations in marine planning and MPA establishment will be critical to success. First Nations are an additional level of government in Canada and therefore must be key partners in MPA network planning processes. Effective MPA network planning in the Canadian context must recognize constitutional obligations and be accessible to and inclusive of First Nations interests as a matter of good practice, while finding ways to move forward with conservation while ongoing claim processes are being resolved.

MPA networks can provide a mechanism to protect traditional cultural or subsistence use of marine resources. The cultural identity of many First Nations is closely linked with traditional uses of the marine environment, and Aboriginal rights and entitlement to fish are enshrined in law. MPAs and MPA networks in other countries have been designed to explicitly include zones designated for traditional use. Such zones protect the rights of Aboriginal people to cultural and subsistence use in portions of MPAs. Another approach being used in the Great Barrier Reef Marine Park Authority (GBRMPA) rezoning is the negotiation of Traditional Use of Marine Resource Agreements (TUMRAs) – formal agreements with Aboriginal and traditional owner groups that assert rights and interests in an area of the marine park. The GBRMPA also created a liaison unit to assist indigenous peoples through involvement in all tiers of management, and considered this level of involvement crucial for effective management (Living Oceans Society and WWF-Canada 2006).

In many cases, it will be appropriate for the federal or provincial government to negotiate directly with the affected First Nations to determine the nature of First Nations engagement and the process by which First Nations will be represented in MPA network planning. In most processes, First Nations will need to be involved in a government-to-government capacity rather than as participants or stakeholders. Aboriginal oceans users will also be holders of knowledge of importance to conservation planning, and specialized approaches to collect and apply this information are likely to require partnerships.

2.2.6 Undertake public outreach

Many people remain unaware or unconvinced that significant losses of marine biodiversity have occurred or that MPAs are an effective remedy or tool with multiple environmental, social, and economic benefits. Outreach to the wider public in a region will be important in improving understanding and facilitating discourse about the value of Canada's oceans. For example, reaching beyond the traditional set of stakeholders can help ensure that the interests of the broader public, such as long-term "existence" and "bequest" values – the knowledge that the biodiversity of our oceans thrives and will continue to do so unimpaired for future generations – are considered in planning decisions.

Outreach to the wider public should include a planned, strategic approach to communicating messages appropriately tailored to different groups and anticipating the expectations of these groups for specific information, employ a variety of techniques and tools (i.e., a range of different media), and convey a balanced presentation of the benefits and costs of MPA networks.

2.2.7 Develop common, accessible information and analysis

Common and accessible information and analysis will facilitate the development of a shared vision, objectives, and selection criteria and will help in achieving credible outcomes. A joint approach to developing information and analysis products, such as maps of ecological values, can overcome the limitations of individual organizations, lead to better questions and more responsive research, and provide greater capacity to answer critical and relevant questions that may not otherwise be addressed. This approach also removes obstacles to broad acceptance of information.

Ensuring that all stakeholders have access to, and agree to work with, the same base of information will help establish trust, foster constructive participation, and enable participants to offer solutions that work for them, thus promoting conflict resolution. This could range from open sharing of data to providing support staff who can assist the participants with geographic information system (GIS) technology and mapping.

Establishment of a program for responsive, collaborative development and equitable, accessible distribution of information products should be an early priority for each MPA network planning process. Some important elements of a collaborative science and information program are

- Data sharing structures and agreements
- An overriding principle of public access to publicly funded data, as committed to in the Conservation Commons, an agreement spearheaded by Canada⁹
- Looking to and drawing on other agencies, provinces, and even other countries for world-class biophysical, socioeconomic, and MPA science and expertise
- Outsourcing to independent experts when appropriate
- A collaborative approach (involving government and First Nations, NGOs, and academics) to analysis, research, and science, including identification of key analysis and scientific or research questions
- A strategy for ensuring that the research program meets the information needs of the MPA network planning process in a timely way
- A strategic approach to information, including agreement on key data sets, and identification and filling of gaps in information (including establishing baseline information)
- Agreements for accessing information collected by industry and information, such as fishers' knowledge, held by user communities
- Agreement on the levels of surrogacy (see text box, next page) and forms of modelling to be used, and on the rules and standards for accepting data sets to the process
- Agreements for sharing the costs of data collection among agencies and external partners
- User-friendly mapping technology to facilitate data sharing and equal access

Engaging the wider scientific community, whether by including government and nongovernmental scientists directly in planning processes or establishing scientific advisory committees and partnerships, could increase the likelihood of broad acceptance of a common information base. While consensus is rare in scientific research, agreement by both government and nongovernmental or independent experts that an information base is sufficiently sound for planning to proceed can enhance the confidence level of stakeholders and promote commitment to the MPA network planning process.

⁹ Conservation Commons: www.conservationcommons.org.

Moving forward in the face of uncertainty

Uncertainty in the science of planning MPAs stems from two sources: shortcomings in our understanding of the particular system at hand, especially in the distributions of marine life and habitats and the ecological and oceanographic processes that maintain this diversity, and uncertainty about the broad design criteria that will lead to effective network design in any system. Experts and practitioners are almost universally agreed that it is important not to wait for perfect science, but rather to move forward on the basis of our present understanding and the best available data, and to be prepared to manage adaptively as new information becomes available (NFCC 2004, Day 2002).

Furthermore, the *precautionary approach*, a key tenet of ecosystem-based management, states that “where there is uncertainty ... [it is preferable to] ... err ... on the side of biodiversity protection” (Secretariat of the Convention on Biological Diversity 2004).¹⁰ Protected areas network authorities, such as the Nova Scotia government and the GBRMPA, have interpreted the precautionary approach to provide direction for protected area planning: “Lack of scientific certainty about issues such as exactly where marine protected areas should be located, how large they should be, or how many are needed should not be used as a reason for not establishing a marine representative areas network” (Wachenfeld, Oliver, and Morrissey 1998).

Surrogates or indicators are frequently used when data directly depicting communities, productivity, or habitat types are not available; for example, primary productivity can be readily estimated using satellite images of ocean colour (Platt, Sathyendranath and Longhurst 1995) and models of physical habitat can be used to predict assemblages and community types (Kostylev et al. 2001). Strategically chosen surrogate data can often be collected more quickly and cost effectively than direct measurements and may serve multiple purposes, and the resulting indicators and models can trigger more detailed surveying in promising areas.

Management decision-making needs to progress on the basis of the best available science, judgment, and weight of evidence (J.C. Day, personal communication) and allow for adaptive management as better information becomes available.

¹⁰ Canada is a signatory to the CBD. In a discussion document, Canada also defines the precautionary approach within science-based risk management as a distinctive approach that “recognizes that the absence of full scientific certainty shall not be used as a reason to postpone decisions where there is a threat of serious or irreversible harm” and sets out guiding principles for its application (Government of Canada 2001).

Priority information and analysis needs

The following are information needs that are usually considered foundational for systematic conservation planning:

- A habitat classification system, map, or approach to assessing representation geared at the right level to serve as the basis for identifying representative sites at a regional scale (Day and Roff 2000, Day 2002). This product can also provide an ecologically significant benchmark against which to assess the contribution of existing sites to the overall MPA network goal of representation.
- Analyses and maps that describe those places in the ocean that merit protection because of their distinctive or unique values (Roff and Evans 2002).
- Maps and databases depicting stakeholders' values, perhaps expressed through indices and maps of cultural and socioeconomic importance. These products can help create better initial designs and provide an objective way to assess alternatives and minimize economic costs. This can also improve understanding of user groups' activities in an area that may affect an MPA and how an MPA may in turn affect those activities. Ardron 2005 is a highly relevant study of the development of a GIS tool that integrates this type of information.¹¹

Other useful data products include the following:

- A tool for analyzing habitat sensitivity to such pressures as physical disturbance or climate change impacts
- Information about the location and intensity of threats to marine ecosystems

2.3 Principles for network design

2.3.1 State clear conservation goals

Clearly stated conservation goals are central to a systematic approach to conservation planning, as the process of establishing goals is really about translating stakeholders' values and the mandates of government into decisions that will shape the configuration of a network plan (Pressey 2005b, Tear et al. 2005).

As described in section 2.1, goals for a network of MPAs should be conceptual and visionary yet unambiguous and brief, facilitating the development of more specific, quantifiable objectives (Tear et al. 2005). For example, goals may refer to "biodiversity conservation" or "viable populations," while objectives (addressed in section 2.3.2) set out numbers, areas, or percentages.

Two main types of goals have been identified as fundamental to designing an MPA network that is likely to achieve a vision of restoring, managing, and protecting biodiversity and ecosystem function: protection of sites representative of the full range of communities and habitat types, and protection of sites that stand out as especially distinctive or important (WCPA/IUCN 2006, Secretariat of the Convention on Biological Diversity 2004, Day and Roff 2000, Roff and Evans 2002, and others). Dearden and Topelko (2005, in Den Heyer et al. 2006) summarized the types of goals proposed by a sampling of researchers and initiatives (Appendix 2).

¹¹ Available on the Living Oceans Society website: www.livingoceans.org/library/index.shtml#local.

Representative areas

A systematic effort to conserve high-quality and enduring examples of the full range of habitats, environmental gradients, and ecological processes in a region – not just those areas about which we know the most – is a substantial step toward protecting the majority of diversity of marine plants and animals in the places where they live, as well as the natural processes that sustain them. By setting aside a network of representative areas, we aim to achieve long-term, holistic conservation above the species level, ensuring the continuity of communities and the ecological processes and interactions by which they are linked at large scales (Anderson et al. 1999). This is something that no other approach to protected areas network design can ensure (Day and Roff 2000). It is also our best hope to provide marine ecosystems with options that allow them to adapt to climate change. Conserving a range of environmental gradients and potential temperature refugia enhances resilience in the face of projected climate change impacts.

This approach, which is now well accepted in terrestrial protected areas network planning (Noss 1987, Franklin 1993, Pressey et al. 1993, Noss and Cooperrider 1994, Maybury 1999), is especially important in the marine environment because we know very little about the oceans and often cannot predict the long-term effects our actions will have on marine ecosystems. A representative approach is one way to be cautious when our scientific knowledge is incomplete because such an approach confers insurance against human error in management and an absence of comprehensive scientific data, by providing a precautionary means of sampling relevant ecological processes and critical life history sites, thus ensuring that management failures in the wider planning area are less likely to result in irreversible biodiversity loss (Hunter 1991, Secretariat of the Convention on Biological Diversity 2004). A representative network of MPAs can also contribute to the overall resilience of the ecosystem. An ecosystem that includes a representative network of MPAs may be better able to absorb shocks without changing in fundamental ways – to cope, adapt, or reorganize without sacrificing the provision of ecosystem services – because the components needed to rebuild persist (WCPA/IUCN 2006). Representation-based goals – conserving examples of each of a range of community and habitat types at various scales – should be foremost in driving the design of an MPA network.

A policy and planning
framework for marine
protected area networks
in Canada's oceans

Practical guidance on achieving representation

As described in the review of international agreements in section 1.4.1, the overwhelming majority of countries (including Canada) have accepted the concept of representation as part of their MPA network commitments. Some have put in place a legislative framework that explicitly directs responsible agencies to take a representative approach in designing networks; others have established broader mandates that encompass representation. Both international commitments and growing scientific consensus, however, support the idea that representation is an effective tool for achieving several of the directives of Canada's oceans policy framework, including health of the oceans, sustainable development, and the precautionary approach through the Conservation First principle, as well as for a range of objectives that may be adopted through IM.

The Secretariat of the Convention on Biological Diversity (2004) offers the broad guidance that all biogeographic regions and all major habitat types should be represented, providing a hierarchical, multi-scale approach to protected area network planning. Many initiatives have addressed this need with science-based frameworks for developing habitat or bioregional classification systems. Hierarchical frameworks for classification have been outlined by Department for Environment, Food and Rural Affairs (DEFRA) and the Irish Sea Pilot (DEFRA 2005), Day and Roff (2000), Commonwealth of Australia (2005), the GBRMPA (Fernandes et al. 2005), and NatureServe (Madden and Grossman 2004), among others.

Classifications are typically based on ecological theory paired with practical understanding. They may make use of data on species and community distribution, physical habitat type, or a combination of the two, and they usually draw on a combination of expert knowledge, systematic surveys, and remotely sensed data, combined with the help of a GIS.

In Canada, Parks Canada has established a program to achieve representation at a very general scale by locating an NMCA in each of 29 Natural Regions (Parks Canada 1995). This may be seen as the broadest level in a hierarchical approach, but the proposed NMCA system does not in itself complete the representation agenda. Classifications that depict the full range of major habitat types have been developed for some of Canada's marine regions (Zacharias et al. 1998 for British Columbia, Conservation Law Foundation and WWF-Canada et al. 2006 for the Scotian Shelf and Gulf of Maine), and the goal of representing communities and habitats is emerging in some regional initiatives (DFO 2006, WWF-Canada et al. 2006; Governments of Canada and British Columbia 1998, 2006).

Distinctive or important areas

A representative approach forms a sound foundation for a science-based and precautionary MPA network design; however, conserving representative habitats may not necessarily capture those places that are particularly distinctive or important. In this way, representative and distinctive areas are complementary components of a comprehensive conservation strategy: this pairing is also sometimes referred to as the coarse filter–fine filter approach (Anderson et al. 1999).

Distinctive areas may be places where important oceanographic processes or unique geomorphic features occur (physically distinctive areas), or they may be areas known to be important for growth, reproduction, or survival of focal species, groups of species, or species at risk (biologically distinctive areas) (Roff and Evans 2002). Goals and objectives for conservation of distinctive areas will be specific to the planning area in question, but may address the following:

- Rare, endangered, or threatened species and their critical habitats
- Migratory birds and their habitats, and sites of importance to other migratory species
- Important areas for fishery and aquatic resources and their habitat, such as spawning sites or rare habitat
- Other focal species that may be chosen for protection
- Areas of high biological diversity or productivity
- Particularly sensitive habitats needing protection from physical disturbance
- Unusual or distinctive geomorphic features that may also provide unique habitat types

The Ecologically and Biologically Significant Areas (EBSAs) concept described by DFO may be one potential approach to defining distinctive areas (DFO 2004).

We almost certainly do not know all the distinctive and important features or places that exist in Canada's marine ecoregions – the recent mapping of cold-water coral reefs in the Northwest Atlantic and the hexactinellid sponge reefs in the Northeast Pacific is a case in point (Breeze et al. 1997, Krautter et al. 2001). This speaks not only to the need to adapt network designs as new information comes to light, but also to the importance of a representative approach, which protects examples of habitats that probably include species that have not been discovered yet.

Complementary goals

While the goals of protecting both representative habitats and distinctive or unique natural features should be fundamental to the design of an MPA network, other types of goals may also contribute to achieving conservation of biodiversity and ecosystem function or other societal aspirations for an MPA network. These may include the following:

- Helping ensure the sustainable use of resources
- Protecting traditional use, cultural heritage, and archaeological resources
- Providing opportunities for scientific research and increasing education and awareness
- Providing and maintaining opportunities for recreation and recreation-based tourism

2.3.2 Set measurable objectives

General yet unambiguous goals that reflect stakeholder and societal intent must be used to derive objectives that are measurable and allow for both site selection and evaluation of progress. We need explicitly quantitative objectives to plan a network using a systematic approach; explicit objectives also make it possible to measure success. For example, the *goal* of conserving the range of biodiversity of the planning area will be achieved through the *objective* of capturing, at the least, a specific proportion of each habitat type within a highly protected zone. To be useful in guiding network design and assessing progress, objectives must be measurable in terms of area, numbers, percentages, or presence/absence.

Objectives should be tailored to the particular feature, species, or community of concern (Tear et al. 2005, Poiani et al. 2000). In attempting to develop and test hypotheses about the appropriate design of MPA networks and answer larger questions about what it will take to reverse the decline of the world’s ocean resources, some researchers have tried to estimate how much of the ocean should be protected. This has sometimes led to misconceptions and the setting of across-the-board targets that apply, somewhat arbitrarily, to all conservation features (see Agardy et al. 2003). In order to counter this confusion, objectives should be directly related to what is needed to achieve the relevant goal. This usually means that separate quantitative objectives will be necessary for each goal. In the recent rezoning of the GBRMP, for example, some of the objectives included no-take protection for, *at a minimum*, 20 percent of each unit of representation (referred to as a *bioregion*), 10 percent of each type of known seagrass habitat, and all major turtle nesting sites (GBRMPA Scientific Steering Committee 2002).

Objectives should also be designed with outcome in mind, that is, be selected to achieve a desired state (Tear et al. 2005). If the goal is to protect sufficient critical habitat of a stock to promote recovery, then our best science-based estimates of what is necessary to achieve this, paired with a precautionary approach, should guide the objective; a too-modest objective that leads to a token, isolated protected area will be unlikely to achieve the desired outcome.

Underlying the setting of objectives must be recognition that change, either in the ecosystem of concern or in our understanding of status and threats, will point to adjustments that may need to be made to objectives and implemented through future revisions of a network design.

Determining how much is enough – models for establishing goals and objectives

In the GBRMP rezoning, ecological and socioeconomic goals and objectives (termed “operating principles” in this process) were determined by two independent steering committees created to provide advice to the GBRMPA on scientific issues, programming, and priorities, and were underpinned by an expert technical analysis group of in-house staff with strategic leadership from independent experts. This approach, paired with consultation and consensus-building, is one effective way to establish goals and objectives.

In Canada, planners could look to analyses already conducted by the Conservation Law Foundation and WWF-Canada et al. (2006) and the Living Oceans Society (Ardron 2003) as a starting point for determining goals and objectives, in addition to the international guidance documents and consensus statements cited in this report. A review of the scientific evidence and management lessons from other jurisdictions can also yield suggestions (see Roberts and Hawkins 2000, Norse et al. 1998, Secretariat of the Convention on Biological Diversity 2004, Royal Commission on Environmental Pollution 2004, and others). In some areas, overarching regional goals for the desired future state of our oceans will be developed through IM, and some of these goals will be best addressed or addressed in part by spatial measures such as MPA networks. For example, a representative network would be a foundational strategy we could employ to achieve the draft Eastern Scotian Shelf Integrated Management Plan (ESSIM) conservation goal of conserving the range of biological communities (DFO 2006).

2.3.3 Set clear and effective protection standards

To provide certainty to resource users who engage in an MPA network planning process, it is important to define clearly what level of protection and range of uses constitute an effective MPA that meaningfully contributes to the objectives of the network and the site in terms of values to be conserved and threats or impacts to be managed. Clear protection standards should be established early in the planning process to provide certainty for resource users, and should start from a basic standard for inclusion in a network; as suggested earlier in this document, IUCN Categories I to IV are generally considered appropriate as a contribution to a global network of MPAs. WWF-Canada has proposed minimum protection standards (in section 1.2.3) that reflect this range of categories. Beyond that baseline, however, protection standards should be outcome oriented and directly related to goals and objectives. Identifying management standards in relation to conservation objectives establishes the general expectations up front, before a site is selected. For example, the GBRMP Representative Areas Program included an operating principle that called for at least 20 percent of each bioregion to be set aside under full, no-take protection.

A policy and planning
framework for marine
protected area networks
in Canada's oceans

To achieve the benefits of a representative approach, such as “to enable the integrity, structure, functioning and exchange processes of and between ecosystems to be maintained or recovered” and to ensure that the benefits of these areas as baselines and “insurance policies” are fully realized, some proportion of each site selected on the basis of representation should receive the status of a highly protected (i.e., no-take) MPA or highly protected zone within an MPA (Secretariat of the Convention on Biological Diversity 2004).

Sites selected on the basis of distinctive or unique values will merit a diversity of protection types, as the primary intent will likely be to ensure that threats specific to that value are managed. For example, a multiple-use MPA that is managed to reduce shipping traffic and the chances of whales becoming entangled in fishing gear may be appropriate to a site chosen on the basis of its importance to endangered whales, while places selected because of their outstanding importance to fish populations may necessitate highly protected, no-take zoning.

Clearly defining needed protection standards in this way may also make it easier to identify which government agency is best suited to take the lead on a particular site and which protection tools are most appropriate. For example, DFO's mandate for aquatic and fisheries resources may mean that designation under Canada's Oceans Act is the most appropriate tool for a site chosen on the basis of its fish species or habitat.

Network-wide, objectives-based initial protection standards are important; without such standards or guidance for consistent application, it is likely that highly protected MPAs will tend to occur where and when there is little opposition, and lower standards will prevail where there is conflict, regardless of the ecological conditions and conservation needs in each case. By combining general protection standards with local, site-based refinements and zoning plans, the approaches described here can help achieve a balance between ensuring that MPAs contribute to network-wide goals and considering site-specific needs and circumstances. The minimum protection standards proposed by WWF-Canada (see section 1.2.3) were created to inform such a network-wide baseline.

Experience in other parts of the world has produced various models for establishing and refining protection standards in individual MPAs. In Australia, “the issue was resolved by negotiating a process with industry where the Australian IUCN Reserve Management Principles were used as a basis for an objective based, case by case assessment of the impacts of proposed activities on the conservation values to be protected” (Stolten et al. 2003). Another, similar approach that has been applied in The Gully, Canada’s second MPA under the Oceans Act, would be to start by instituting general prohibitions against “disturbance, damage, destruction or removal of any living marine organism or any part of its habitat” and then considering exceptions for uses or activities that can be shown to be undertaken in a manner that does not compromise the conservation objectives and ecological characteristics of the protected area or exceed the natural range of disturbance and variation (Government of Canada 2004). This approach treats all users and activities equally, is based on limiting the potential negative effects the user or activity will have on the marine ecosystem rather than targeting specific industries and activities, and shifts the onus onto users to show that their activities will have no significant negative effects.

2.3.4 Set design criteria for a cohesive network

A set of sites selected on the basis of conservation goals and objectives will be comprehensive, but will not automatically function as a cohesive network. Marine ecosystems are inherently fluid and continuous, and scientific understanding of the processes of connectivity and resilience within marine ecosystems is usually incomplete. Some fundamental design criteria, however, can pair what biological and physical information we do have at present with ecological theory and precautionary choices to link a set of sites into a cohesive MPA network that embodies viability, replication, and connectivity and confers ecological integrity and ecosystem-wide benefits that individually established sites cannot.

Viability

Viability is the capacity of individual sites to self-sustain as far as possible, given the conditions that surround them. A viable MPA will be of sufficient size and shape to avoid or minimize edge effects, cross-boundary impacts, and genetic isolation. In the GBRMP rezoning, a design criterion was established to guide planners to select sites of no less than 20 kilometres along the smallest dimension, as this was deemed to be a sufficient size to contribute to viability. A network of sites with inherent viability will be collectively more resilient (WCPA/IUCN 2006).

Replication

Networks can be designed to hedge against uncertainty, whether related to unpredictable natural events (such as hurricanes or current oscillations) or accidental human impacts (such as oil spills or introduction of invasive alien species) by ensuring that more than one example of each habitat type or distinctive value is protected, and ensuring that these sites are spatially separate. This is referred to as *replication*, a design criterion that is recommended as a precautionary strategy for resilient networks. Where replication is not possible, for example, because only one example of a habitat type exists, other design criteria such as size, shape, and level of protection may need to be reconsidered to guard against catastrophe (WCPA/IUCN 2006).

Connectivity

Ecological processes that rely on movement, whether by passive transport or by active migration, are of great importance in the fluid medium that characterizes the marine environment. Networks can be designed with the goal of maintaining the flow of individuals and genes, ensuring that protected areas whose value lies in their role as sinks (i.e., areas of high abundance or diversity) are not negatively affected by human activities in the source areas that supply them with larvae, forage species, or nutrients (Bode, Bode, and Armsworth 2006). In the case of species that actively move within or through a region, networks can be designed to ensure that these species are not exposed to threats at points in their migration and life cycle where they may be most vulnerable, such as nursery grounds (Roberts and Hawkins 2000).

Roberts et al. (2003) suggested general rules for MPA network design that are likely to lead to a network in which linkages are maximized, even in the absence of detailed data on the connectivity processes of the planning region (see also Rachor and Guenther 2001). According to these general rules, which Roberts et al. suggest are likely to lead to what they term “emergent connectivity,” the safest network design will include a range of MPA sizes (which will tend to balance larval export and population viability); a range of distances between sites (which will foster connectivity at differing scales); and defining biogeographic regions within the planning area and designing connected, comprehensive “subnetworks” within each (because ecosystem connectivity is likely to be higher within biogeographic regions that across them). Designing networks to foster emergent connectivity makes use of what we know about linkages in marine ecosystems, leaves open the option to incorporate what we do not yet know, and hedges against future conditions, such as changes in prevailing currents, that might be brought about by global climate change.

A policy and planning framework for marine protected area networks in Canada's oceans

2.3.5 Set design criteria for practicality and socioeconomic

Successful processes have emphasized the practical and socioeconomic considerations, not just the conservation objectives, of decision-making surrounding candidate MPA sites and MPA network design options (Living Oceans Society and WWF-Canada 2006).

Practical considerations may include existing tenure (such as oil and gas leases, already established MPAs, title and treaty claims, and EEZ boundaries); network and site configurations that are cost-effective and practical to communicate, manage, and enforce (such as choosing some large versus many small sites, with easily charted boundaries); and the proximity of sites to uncontrollable threats, for example, major shipping lanes or urban areas, when more sheltered options exist. Socioeconomic considerations may include minimizing displacement of resource users and taking into account equity issues between affected communities. The GBRMPA developed a set of socioeconomic “operating principles” (Appendix 1) that could serve as a starting point for practical and socioeconomic design criteria.

It is at this stage that the concept of flexibility is important. Clear design criteria that reflect the reality of the situation and what matters to resource users and local people will make it possible to create acceptable network options, assess the potential value of a proposed site for resource use, and weigh this value against the significance of the site to network objectives. Investing in data and information products, meaningful stakeholder participation,

and effective consultation strategies can facilitate this. The result should be a network design that maximizes beneficial and minimizes detrimental impacts, providing fair and equitable consideration of the effects on livelihoods and easing implementation while still achieving the ecological objectives.

To make this complex task simpler and more transparent, some decision-support tools and site-selection methodologies offer the opportunity to consider socioeconomic and practical design criteria, such as minimizing cost or “locking” certain areas in or out of potential network designs (see section 2.3.6).

While *avoiding* negative impacts to oceans users whenever possible must be the predominant method used to minimize costs and secure community and political support, there may be cases where users are affected. In addition to avoidance of areas of economic importance, governments in Australia have chosen to provide *assistance* to some fisheries with a history of use in the area designated for no-take protection. Assistance schemes have been designed to help with costs incurred from having to travel farther or restructure, or for loss of catch as fisheries adjust to a new plan. In the small number of cases where adjustment is not deemed feasible and concerns about the viability of a fishery remain, or where displaced effort raises economic or ecological concerns, *acquisition* of licences or catch quotas has been used along with other forms of exit assistance to reduce the overall capacity and effort in a fishery (Phillips 2005, Oxley 2006). The Australian government policy on MPAs and displaced fishing sets out this “A3” strategy and describes a comprehensive approach to addressing these issues (Australian Government 2004).

2.3.6 Use a transparent site-selection methodology

The method of moving from objectives and design principles to examining network design options and selecting sites should be repeatable and transparent (Pressey 1999). In a systematic conservation planning approach, the procedure generally includes a gap analysis to determine to what extent objectives have been achieved by existing MPAs, followed by a process of creating and choosing among design scenarios to fill identified gaps. This usually requires the development of one or more draft plans, and refinement of the draft plan(s) by incorporating stakeholder input and any new data that may become available. There are likely to be many possible network design options that achieve the design principles (Cook and Auster 2006; Possingham, Ball, and Andelman 2000); building in time to explore these options will help ensure the best final design.

It is important that this process be carried out in such a way that stakeholders can see how their input is reflected in the plan, and that scenarios have been developed on the basis of the information at hand and not by individuals with biases (Day 2002). Decision-support software may be useful at the site-selection stage. Software developed for use in systematic conservation planning can help integrate large amounts of data, help address design principles systematically, help stakeholders understand how their input was used, and allow rapid evaluation of alternatives.

The role of decision-support software

When the design of a network includes many objectives and design principles and large data sets about the geographic distribution of features and uses, determining what configurations are possible can be complicated and time-consuming.

To address this challenge, several computer programs have been developed that provide support for protected area network design. As these programs become more advanced, they are better able to fill the decision-support needs of large-scale network design and to incorporate social and economic criteria. One tool in particular – a computer program called MARXAN – is of special relevance to marine ecosystems. Researchers at the University of Queensland, in conjunction with officers of the GBRMPA, developed this program for use in the recent rezoning of the GBRMP (Lewis et al. 2003). MARXAN makes use of an optimizing algorithm to put forward a range of efficient network options that meet user-defined objectives and design principles, both ecological and socioeconomic (Ball and Possingham 2000; Possingham, Ball, and Andelman 2000). A number of reviews (e.g., Evans et al. 2004, Ardron 2003, Conservation Law Foundation and WWF-Canada 2006) have determined that MARXAN is likely the most appropriate decision-support tool for MPA network planning in Canada.

The upcoming version of MARXAN, now called MARZONE, has important new capabilities including the ability to consider different types of cost from different map layers and the ability to create designs that include multiple types of zones, making it even more applicable to protected areas planning in the context of broader marine use planning and zoning.

MARXAN and other computer-based decision-support tools are just that – tools that can assist the planning process by permitting rapid evaluation of the range of different design options that may be available. Such tools can also be used to highlight those places that are “irreplaceable,” that is, places that must be included in the final network design if it is to conform to the agreed-on design principles, which can be useful in setting priorities or as a starting point for negotiating boundaries (irreplaceability is also sometimes referred to as “conservation utility” [Ardron 2003]). If applied and communicated appropriately, these tools can also make the process of site selection more transparent by ensuring that the same decision rules and data are applied to each design, and by making it easier to objectively measure and compare how well different designs meet the conservation objectives. Using a decision-support tool should not change significantly the overall approach to planning; however, use of such a tool can make it easier to explore a wider range of options and potentially allow planners to examine configurations that would not otherwise have been considered. Decision-support software can provide an invaluable first draft for a plan, but a computer-generated network design will inevitably be fine-tuned to yield a final plan that considers the full range of political and practical factors.

2.4 Principles for implementation and management

2.4.1 Designate for effective and lasting protection

Rates of change in ecosystems in response to management measures are highly variable: while some changes can be measured in relatively short periods of time, others may take decades to become apparent. Experience and research into the effectiveness of MPAs and MPA networks show that the benefits of protection to ecosystem recovery tend to be greater the longer areas are closed to extractive uses (WCPA/IUCN 2006).

Furthermore, the utility of a protected area as a “control” site for adaptive management is dependent on the maintenance of its status as a benchmark relatively free from human impact. Given the aforementioned variability in the response of ecosystems to protection, adaptive management is the only means by which we can gain experience of the effectiveness of different management regimes.

It is important, therefore, that the governance framework for MPA networks and MPA management plans be based on time scales that extend beyond shorter-term changes in political priorities, that the network be considered permanently protected, and that high protection standards for core areas be difficult to remove (Secretariat of the Convention on Biological Diversity 2004).

2.4.2 Monitor and evaluate

Monitoring and evaluation are paired practices that should be addressed even in the planning stages of MPA network design. Goals, objectives, and design criteria should be translated directly into measurable or verifiable indicators for evaluating both progress in implementing MPA networks and success of a network in achieving the intended outcomes. Monitoring should be planned both at the regional level, to facilitate understanding about trends in ecological characteristics and management issues that are important region-wide and the success of the network in achieving high-level regional objectives, and at the site level, to improve understanding of the system and to assess progress on site-specific management objectives (Pomeroy, Parks, and Watson 2004).

The findings of an effective monitoring and evaluation strategy can improve our understanding of what management actions have worked or not worked in the past and why, and inform the design of improved management strategies in the future; this process, when undertaken systematically, is called *adaptive management* (see also sections 1.3.4 and 2.4.3).

As Canada takes action on meeting its international commitments to establish a representative network of MPAs by 2012, there is also a need for an overarching monitoring strategy focused on tracking and reporting on progress toward completion of the entire national system; this is discussed further in section 3.0.

2.4.3 Anticipate change and manage adaptively

Any network design will be based on incomplete data and understanding of the system, and new data, monitoring results, “in-the-field” experience, or shifting environmental conditions may affect biogeographic boundaries, species distributions, and, in turn, the efficacy of designs and management practices. Reviews of the adequacy of the network and site design and improvements based on updated or newly acquired data should be planned at regular intervals; National Marine Conservation Area (NMCA) management plans, for example, are subject to review every five years. This type of adaptive management enables managers to be flexible and to anticipate and address the unexpected – for example, climate change was not even considered an important marine issue a decade ago (J. Day, personal communication. See also Pomeroy et al. 2004, Secretariat of the Convention on Biological Diversity 2004).

3.0

National action plan for implementing MPA networks



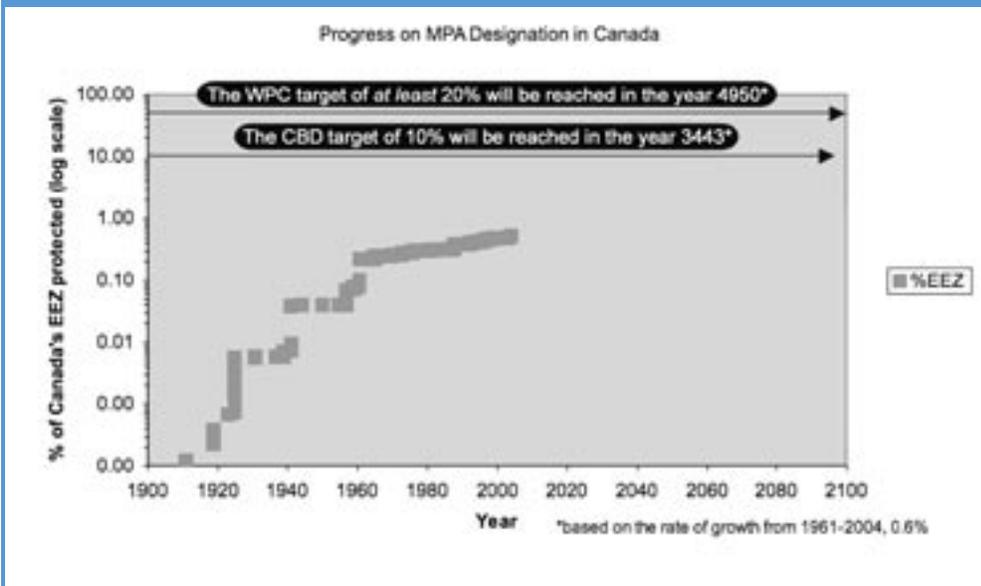
Finger sponges. © Mike Strong and Maria-Inez Buzeta

- 3.1 Set the overarching, national direction for planning MPA networks
- 3.2 Commit to the mechanisms that will deliver on MPA networks
 - 3.3 Commit to a timetable for progress
- 3.4 Make timely decisions on long-standing MPA candidate sites
 - 3.5 Provide interim protection for MPA candidate sites
 - 3.6 Launch research programs to support information needs
- 3.7 Launch a national awareness campaign to engage the public
- 3.8 Conduct national-level monitoring and reporting on progress

3.0 NATIONAL ACTION PLAN FOR IMPLEMENTING MPA NETWORKS

MPA network development must be rooted in collaborative regional processes, with strong stakeholder involvement and a range of partners. High-level direction and support, however, will also be needed to improve the momentum of MPA network planning and its chances of success. At the federal level, government can demonstrate commitment and leadership by championing overarching direction for the planning of MPA networks, developing a concrete action plan and timetable, and providing adequate resources aimed at achieving the key conditions required for an effective, collaborative MPA network planning framework. Without these critical elements in place, Canada is unlikely to meet its international commitments and, more importantly, may fail to halt the decline in the health of Canada’s oceans. Progress thus far has been slow and the shift from a site-by-site approach to a systematic one is in its initial stages; at the present pace of MPA establishment, Canada will not meet its international commitments (figure 7).

Figure 7. Progress on MPA designation in Canada, showing the years in which international targets will be met based on the present rate of increase



Source: L. Wood, figure based on data from MPA Global (see acknowledgements)

This section sets out actions that, taken collectively and with strong federal leadership, will help Canada reach its goal of establishing a national “network of networks” by 2012.

3.1 Set the overarching, national direction for planning MPA networks

The international goals to which Canada has committed and the national ones that government has set for itself are clear. The government needs, however, to elaborate on the scale, scope, and broad conservation objectives that will lead to a truly cohesive and comprehensive national network of networks, and to align the direction of all relevant federal and provincial departments with the World Summit on Sustainable Development vision for representative networks and the target date of 2012.

A clear national direction based on the principles for MPA network planning, as outlined in section 2.0, will be crucial to help set the agenda for establishing a common purpose, goals, objectives, and design criteria, thereby facilitating timely decision-making on networks of MPAs in each region.

A policy and planning framework for marine protected area networks in Canada's oceans

Models for articulating national-level direction for MPA networks

In 1998 the Australian government released a document titled *Guidelines for Establishing the National Representative System of Marine Protected Areas* (ANZECC TFMPA 1999), which outlined the principles that would guide MPA network planning initiatives throughout the country. This document, which was intended to assist government agencies in developing the national system of MPAs and to help stakeholders understand the process, has been informative in recent large-scale regional MPA network planning initiatives such as the GBRMP rezoning and the South Australian Representative System of Marine Protected Areas (SARSMPA). The document

- Sets out the goals, principles, and outcomes of the National Representative System of Marine Protected Areas, including a discussion of which MPAs are included in the system
- Outlines a process for the collaborative development of the national system, including the roles of jurisdictions
- Includes criteria for identifying and selecting MPAs
- Proposes a process for evaluating the national system

The 2005 New Zealand Marine Protected Areas Policy and Implementation Plan sets out guidance for a systematic MPA network planning process that includes developing information products, coordinating a range of management tools, protection standards, gap analysis, site selection, and an intention to provide greater detail on achieving representation.

Section 5.0 of this document provides references to several international sources of guidance that could inform Canada's direction. Chief among these are *Technical Advice on the Establishment and Management of a National System of Marine and Coastal Protected Areas*, a document produced by the Secretariat of the Convention on Biological Diversity; CBD Decision VII/28, which lays out the recommended steps to be taken in developing a protected area system; and an upcoming report from WCPA/IUCN (2006) titled *Establishing Networks of Marine Protected Areas: A Guide for Developing Capacity for Building MPA Networks*.

In Canada, the Federal Marine Protected Areas Strategy (Government of Canada 2005) and the principles described in section 2.0 form a starting point for joint discussion between governments, consultation with stakeholders, and formulation of a national plan, like those described above, to deliver on the commitment of representative MPA networks by 2012.

The following are key elements that should be included in the overarching national direction:

- A commitment to systematic conservation planning as the approach to identifying and selecting MPA network design options.
- A collaborative approach to developing a common purpose and clear goals for MPA networks. The objectives-based framework currently being developed and advanced through DFO-led IM initiatives (Jamieson and O’Boyle 2001) may be a good starting point for such an approach (see the text box below).
- Broad, national-level starting goals, which may be adapted within each region but should include the objectives of conservation of representative habitats and unique or distinctive natural features.
- Examples and/or templates that set out expectations regarding the formulation of goals, objectives, and criteria in each region.
- General guidance, adapted to each region, on an approach to marine habitat classification and a methodology to assess representation as the basis for spatially describing the biodiversity of each region and to serve as a gap analysis tool. This will ensure that progress toward the objective of representation can be measured and compared across Canada and between regional networks.

MPA network goals within the IM objectives-based framework

The objectives-based framework developed by DFO (Jamieson and O’Boyle 2001) and being tested in Canada’s first IM initiatives holds promise; the concept of a hierarchical objectives-based framework captures the principles of ecosystem-based management by looking at the broadest, most holistic elements of the ecosystem, including its human elements, and links them to specific components that can be managed and measured.

Where MPA networks will be planned through an IM process, it will be logical to develop MPA network goals, objectives, and design criteria that relate to or are directly derived from the goals of the larger IM process. Approaches to doing so effectively will need to be explored and adapted to each region. For example, IM objectives such as reversing the decline of species at risk will have clear area-based solutions that can be translated into MPA network design principles; objectives for conserving the range of community types and setting thresholds for exploitation or damage by all uses can be best secured by implementing the goal of representation. Linking MPA network and IM objectives will also provide a mechanism for linking monitoring at the site and network levels to the broader regional level.

3.2 Commit to the mechanisms that will deliver on MPA networks

Lead agencies can set the MPA network planning process in motion in each region by charging existing or new institutional mechanisms with the task of planning and implementing networks of MPAs, or by lending weight to provincial, First Nations, or nongovernmental initiatives that have already begun. Some of these (such as IM at the LOMA or CMA scale, provincial MPA planning, First Nations marine use plans, and collaborative NGO- or community-led initiatives) may function at units smaller than an ecoregion. As a result, joint programs for delivery and oversight of the kind described in section 2.2.3 will be needed to effectively “scale up” planning processes by making it possible to assess needs and progress toward the vision at an ecoregional scale.

These institutional mechanisms should include the following:

- Central and more streamlined interagency and intergovernmental coordination and oversight for all program components, such as integrated policy, information, analysis, decision-making, and outreach
- Infrastructure to carry out this coordination and oversight, in the form of an implementation office and program with
 - Adequate resources, dedicated human capacity, and leadership
 - An adequate time horizon for completion of the program
 - The ability and mandate to enter into partnerships, agreements, and negotiations (e.g., co-management, cost-sharing)
 - Staff seconded from key agencies and levels of government
 - A mandate for regular public monitoring and progress reporting
- Increased capacity for analysis and science
- Effective integration of conservation and socioeconomic interests
- First Nations involvement in site identification, assessment, and decision-making

The capacity and sophistication of many partners, including academia, NGOs, and industry, in planning processes and in particular in the use of technical tools for analysis and mapping is increasing. An emerging opportunity exists for government to enter into partnerships with such organizations in the development of these institutional mechanisms.

3.3 Commit to a timetable for progress

In each network planning process, a timetable and milestones will be needed to measure progress and ensure that these processes collectively deliver on our commitments by 2012.

In the Northwest Atlantic Ecoregion, where the ESSIM initiative is underway and other IM projects are becoming established, there should be a timetable and plan to complete the ESSIM process and to extend IM throughout the ecoregion, including a commitment to complete MPA networks as part of this process. In the Pacific Ecoregion, the draft federal/provincial agreement (called the Subsidiary Memorandum of Understanding Respecting a Marine Protected Areas Framework for the Pacific Coast of Canada Between Canada and British Columbia) should include similar timetables and milestones as outlined in WWF-Canada et al. 2006.

Discrepancies in the pace of progress between regions will be inevitable; in the Arctic, in particular, lack of data, high costs of public and stakeholder consultation given a small but wide-spread population, and untested decision-making criteria under land claims agreements will present a challenge for meeting the 2012 goal. Special institutional arrangements or task forces may be helpful in developing recommendations on how to move ahead in the Arctic. For example, a Nunavut Marine Council has been proposed under the Nunavut Land Claims Agreement, but has not yet taken form.

The renewal of the Oceans Action Plan in 2007 presents an opportunity to set businesslike milestones and timetables and to put in place the necessary resources for a program of action.

3.4 Make timely decisions on long-standing MPA candidate sites

In the past, the process of establishing MPAs has been extremely lengthy, even in ecologically outstanding areas with a high level of local support. For example, Iqalituq (also called Isabella Bay), critical habitat for bowhead whales off the east coast of Baffin Island, has been a candidate protected area for over 25 years, with strong local community support. Other long-standing candidates in various stages of completion include Bowie Seamount, a globally significant seamount chain off the coast of British Columbia, and Western Lake Superior, which would become the largest freshwater reserve in the world; other examples include the proposed Scott Islands Marine Wildlife Area and Gwaii Haanas National Marine Conservation Area Reserve. A key measure of success of any national plan and strategy on MPA networks must be to expedite decision-making in such cases.

Scarce resources are likely to dictate the pace and staging of full regional MPA network planning processes; we cannot complete planning for all of Canada's oceans at once but will have to proceed in stages over several years. As a consequence of this, important sites needing urgent action (due to a combination of value, threat, and opportunity) will and should be exceptions to the staged process of systematic planning.

3.5 Provide interim protection for MPA candidate sites

The process for establishing MPAs, even once candidates have been identified, can be lengthy. Interim protection of candidate sites will be critical to provide adequate time for assessment and consultation while ensuring that the values for which the candidate has been identified are not lost due to existing threats or in a rush to exploit resources before protections are put in place. These interim protection measures should, at a minimum, meet the following requirements:

- Apply to all candidate MPA sites selected for further public review and consultation
- Reflect pre-established network-wide minimum protection standards like those proposed in section 1.2.3
- Prohibit the expansion of new activities into a site, and require the completion of a rapid review and assessment of existing activities to ensure that important values are not lost
- Allow for the application of additional interim measures, which will be determined for any given site on the basis of an assessment of the extent of threat those activities and uses pose to the ecological values of that site
- Remain in place until MPA establishment decisions have been made

3.6 Launch research programs to support information needs

In any region or planning area, inevitably gaps will exist in the data needed to inform MPA network design. Science to inform and support the setting of objectives and design criteria requires a commitment of funding, capacity, infrastructure, and mechanisms to facilitate collaboration. While data availability, information needs, and capacity will vary from region to region, a national-level program could use scarce resources cost-effectively by

- Identifying priorities
- Developing “architectures” – conceptual approaches or standards for information and data products with applicability or adaptability for all of Canada’s marine ecoregions (for example, general common principles for developing region-specific approaches to habitat classification or to assessing representation; verification of indicators and surrogates with national applicability, such as those derived from remotely sensed data)
- Leveraging existing data liberation and development programs such as GeoConnections¹² to create economic spinoffs and a basis for partnerships
- Developing centres of expertise in decision-support tools such as MARXAN to help ensure that these tools are applied consistently across the country
- Providing support for data management and data sharing

Collaborative models are emerging that may be extremely helpful in filling key data gaps by pooling information, providing strategic direction for new research, and building consensus by encouraging broad participation and input at the outset of a national MPA network initiative. The Pacific Marine Analysis and Research Association (PacMARA),¹³ for example, is an impartial and independent network of researchers working to fill critical gaps in knowledge of the marine ecosystems of British Columbia and support an ecosystem-based approach to coastal and marine planning, conservation, and resource use in that province. The Oceans Management Research Network (OMRN),¹⁴ an interdisciplinary network with an initial focus on social sciences, provides a forum for researchers, managers, and policy-makers to “evaluate timely and innovative linkages, integrate lessons learned, transfer and share knowledge, and help create an expert core of ocean researchers.” An important element of the program will be supporting and collaborating with existing research networks, particularly those with national reach.

3.7 Launch a national awareness campaign to engage the public

All Canadians, not just those living in coastal areas, have a stake and interest in the health of our oceans and coastal resources. Most people, however, will not have a practical opportunity to express their values and opinions by participating in a regional MPA network planning process. A public awareness campaign can help build a broader constituency to support marine conservation commitments and goals, by informing Canadians that our marine environments are under pressure and that MPAs are one needed tool for mitigating this pressure. In addition, outreach can improve public understanding of the economic, social, and spiritual value Canadians derive from the ocean, and the benefits of an MPA network in preserving these values. A public awareness campaign should be seen as a long-term investment, presenting opportunities for governments and stakeholder groups to partner broadly to increase reach and effectiveness.

¹² GeoConnections: www.geoconnections.org/CGDI.cfm.

¹³ Pacific Marine Analysis and Research Association: www.pacmara.org.

¹⁴ Oceans Management Research Network: www.omrn.ca.

3.8 Conduct national-level monitoring and reporting on progress

A national-level monitoring strategy focused on tracking and reporting on progress toward completing each regional network and reaching the 2012 target can serve to facilitate sharing of knowledge and experience between regions, highlight regions requiring increased capacity or commitment, and enhance accountability of both government and partners. If a timeline and intermediate milestones have been developed (as suggested in section 3.3), reporting can provide an early assessment of whether we are on track to meeting our commitments. The MPA Global project,¹⁵ a partnership between the University of British Columbia Fisheries Centre, WWF-Canada, and others, provides tracking of progress thus far, and existing auditing and reporting mechanisms, such as the Commissioner of the Environment and Sustainable Development and the Auditor General, could provide an independent, “watchdog” element to this monitoring (Minister of Public Works and Government Services Canada 2005). In Australia, a Scientific Peer Review Panel has been struck to evaluate the extent to which regional network designs reflect national guidance and contribute to the National Representative System of Marine Protected Areas. Such a panel could provide increased independent advice and evaluation for the inevitably wide-ranging regional plans developing across Canada.

¹⁵ MPA Global: www.mpaglobal.org.

4.0

Conclusion



4.0 CONCLUSION

Current sectoral approaches to managing marine resources have not been effective for conservation, for industry, or for communities. Consensus is growing that an ecosystem-based approach is needed to address the complex, multi-sectoral realities of achieving conservation, recovery, and sustainable use of Canada's oceans. Networks of MPAs provide a foundation for this approach.

The benefits of MPA networks are now well known, and maritime nations around the world are taking steps toward establishing national and regional networks. Canada has committed to completing MPA networks in international agreements and national policy, and Canada's new approach to oceans management presents an opportunity to create a sound foundation for future sustainability.

Canada has yet to effectively chart a course for meeting these commitments. While progress thus far has been slow, many of the barriers to action have now been overcome: Canada has strong legislation, including the Oceans Act and the National Marine Conservation Areas Act, emerging government-wide policy, ongoing IM processes, and several long-standing and broadly supported candidate sites. Global examples of MPA planning now provide guidance, case studies, and best practices to help us implement well-planned networks of MPAs in each of Canada's marine regions.

Lessons from other countries show that, to be successful, leadership is needed at the national level to set direction, milestones, and timelines for moving forward. Furthermore, other levels of government and all industry sectors, communities, First Nations, and stakeholders must work collaboratively to share in this leadership and achieve implementation. The more that people are involved, the more successful it will be.

This report is intended as a contribution to the development of MPA networks in Canada. We hope it spurs debate, refinement, and improvement of Canada's approach.

The goal is not to create a network of MPAs for its own sake; rather, the goal is to put in place an essential building block for sustainably managing our oceans, to ensure – and in some cases rebuild – healthy marine ecosystems and healthy coastal communities.

5.0

Resources for guidance on MPA network planning



Juvenile pollock: © Mike Strong and Maria-Inez Buzeta

5.1 International agreements and recommendations

5.2 Canadian policy

5.3 Guidance and best practice

5.4 National frameworks

5.5 Prominent examples and case studies

5.0 RESOURCES FOR GUIDANCE ON MPA NETWORK PLANNING

The following selected resources are highly relevant to the development of policy and process for MPA network planning.¹⁶ These resources have been selected because they are key policies or agreements that should inform MPA network planning in Canada, because they provide guidance and represent international consensus, or because they describe successful case studies and examples indicative of that consensus. Paired with each reference is a brief description abstracted from the document or accompanying materials.

5.1 International agreements and recommendations

World Summit on Sustainable Development (Johannesburg) (2002)

- The Johannesburg Plan of Action, in section IV, *Protecting and managing the natural resource base of economic and social development*, 32.c, recommends the establishment of MPAs consistent with international law and based on scientific information, including representative networks, by 2012. The plan can be accessed at www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIToc.htm.

IUCN–World Conservation Union (2003)

- Participants in the Marine Cross-Cutting Theme at the fifth World Parks Congress, in Durban, South Africa (8–17 September 2003), developed Recommendation 5.22, which called on the international community as a whole to establish, by 2012, a global system of effectively managed, representative networks of MCPAs, consistent with international law and based on scientific information, that greatly increases the marine and coastal area managed in MPAs; these networks should be extensive and include strictly protected areas that amount to at least 20 percent to 30 percent of each habitat. Recommendation 5.22 can be downloaded at iucn.org/themes/wcpa/wpc2003/pdfs/outputs/recommendations/approved/english/pdf/r22.pdf.

G8 Group of Nations (2003)

- At its summit in Evian, France, in 2003, the G8 Group of Nations adopted an action plan, documented in *Action Plan on the Marine Environment and Tanker Safety*. Clause 1.12 of the action plan committed members to incorporate priorities from the 1995 Global Programme of Action for the Protection of the Marine Environment into national, regional, and international policies and initiatives; clause 1.13 committed members to establish, by 2012, ecosystem networks of MPAs, consistent with international law and based on scientific information, in their own waters and regions, and to work with others to achieve the same in theirs. The action plan can be accessed at www.g8.fr/evian/english/navigation/2003_g8_summit/summit_documents/marine_environment_and_tanker_safety_-_a_g8_action_plan.html.

¹⁶ This list of resources focuses specifically on networks; resources covering individual MPAs and more general issues can be found in CBD Ad Hoc Open-ended Working Group on Protected Areas 2005. See also the United States Marine Protected Areas Center Virtual Library: www3.mpa.gov/mpa_lib/publications.aspx.

Convention on Biological Diversity (2004)

- At the Conference of the Parties 7 in Kuala Lumpur, Malaysia (9–20 February 2004), participants adopted Decision VII/28, *Protected areas* (articles 8 a to e), which cites as the overall objective of the program of work (paragraph 18), annexed to the decision, the establishment and maintenance – by 2010 for terrestrial areas and by 2012 for marine areas – of comprehensive, effectively managed, and ecologically representative national and regional systems of protected areas. The decision can be accessed at www.biodiv.org/decisions/?dec=VII/28.
- Also adopted at the Conference of the Parties 7 was Decision VII/5, *Marine and coastal biological diversity*, which, in paragraph 21, further specifies the need for integrated networks of MCPAs consisting of (a) MCPAs where threats are managed for the purpose of biodiversity conservation and/or sustainable use and where extractive uses may be allowed, and (b) representative MCPAs where extractive uses are excluded and other significant human pressures are removed or minimized to enable the integrity, structure, and functioning of ecosystems to be maintained or recovered. The decision can be accessed at www.biodiv.org/decisions/?dec=VII/5.

5.2 Canadian policy

Canada's Oceans Act, 1997

- The Oceans Act outlines Canada's duties and responsibilities in its oceans territory and introduces a new oceans management model that promotes sustainable development of Canada's oceans and their resources. It also gives the Minister of Fisheries and Oceans power to designate MPAs and to lead and coordinate the development of IM plans. The Oceans Act can be accessed at www.pac.dfo-mpo.gc.ca/oceans/OceansAct/oceansact_e.htm.

Government of Canada. 2005. *Canada's Federal Marine Protected Areas Strategy*

- The intent of this strategy is to clarify the roles and responsibilities of federal departments and agencies that have MPA mandates and to describe how federal MPA programs can collectively be used to create a cohesive and complementary network of MPAs. This document is available at dsp-psd.pwgsc.gc.ca/Collection/Fs23-478-2005E.pdf.

Government of Canada. 2002. *Canada National Marine Conservation Areas Act*

- This act establishes the role of Parks Canada in creating MPAs for the purpose of protecting and conserving representative marine areas for the benefit, education, and enjoyment of the people of Canada and the world, and sets out provisions and direction for management and zoning. This act is available at laws.justice.gc.ca/en/C-7.3/233437.html.

Parks Canada. 1995. *Sea to Sea to Sea: Canada's National Marine Conservation Areas System Plan*

- This plan guides the establishment of NMCAs. It provides a description of the 29 marine regions and the status of system planning for each region.

Governments of Canada and British Columbia. 1998. *Marine Protected Areas: A Strategy for Canada's Pacific Coast. Discussion Paper*

- The draft joint federal/provincial MPA strategy proposes three important elements:
 1. *A joint federal-provincial approach:* All relevant federal and provincial agencies will work collaboratively to exercise their authorities to protect marine areas.
 2. *Shared decision-making with the public:* Commits government agencies to employ an inclusive, shared decision-making process with marine stakeholders, First Nations, coastal communities, and the public.
 3. *Building a comprehensive system:* Seeks to build an extensive system of protected areas by the year 2010 through a series of coastal planning processes.

The strategy is available at www.pac.dfo-mpo.gc.ca/oceans/mpa/dispa_e.htm.

Governments of Canada and British Columbia. 2006. *Subsidiary Memorandum of Understanding Respecting a Marine Protected Areas Framework for the Pacific Coast of Canada Between Canada and British Columbia*

- Currently under development as a subsidiary agreement to the 2004 *Memorandum of Understanding Respecting the Implementation of Canada's Oceans Strategy on the Pacific Coast*, the draft of this document outlines principles, mechanisms, processes, and structures to coordinate the joint review and establishment of a Pacific coast MPA system. The draft subagreement identifies elements of a two-phased implementation plan, with highlights including a federal/provincial MPA implementation team, public and First Nations consultation process, possible formation of an external technical advisory committee, interim protection measures, and clear implementation priority to the Bowie Seamount and Scott Islands proposals and the Southern Strait of Georgia and Gwaii Haanas NMCA candidates.

5.3 Guidance and best practice

Davey, A.G. 1998. *National System Planning for Protected Areas*. Gland, Switzerland: IUCN–World Conservation Union

- This first publication in the WCPA Best Practice Protected Area Guidelines Series provides guidelines that identify links between system planning (i.e., the design of a total reserve system covering the full range of ecosystems and communities found in a particular country) and the CBD and are intended for governments and others to use in the implementation of article 8 of the CBD, which addresses in situ (i.e., site-based) conservation.

Day, J.C., and J.C. Roff. 2000. *Planning for Representative Marine Protected Areas: A Framework for Canada's Oceans*. Report prepared for WWF–Canada, Toronto

- This report outlines a hierarchical classification framework for use in MPA network planning based on ecological principles and on the enduring and recurrent geophysical and oceanographic features of the marine environment.

Living Oceans Society and WWF-Canada 2006. *An Overview and Assessment of Marine Planning Processes*. Case Studies in Canada, USA and Australia

- This report, commissioned by WWF-Canada and Living Oceans Society, and researched by Dovetail Consulting, provides an overview and assessment of marine planning processes that have included the establishment of MPAs, with the aim of identifying the principles that should be used in collaborative processes that will make them meaningful and lead to lasting outcomes. The report is available at www.wwf.ca/Documents/Marine/MarinePlanningSummaryTNR.pdf.

Evans, S.M.J., G.S. Jamieson, J. Ardron, M. Patterson, and S. Jessen. 2004. *Evaluation of Site Selection Methodologies for Use in Marine Protected Area Network Design*.

- This report, prepared for the Pacific Scientific Advice Review Committee, Fisheries and Oceans Canada, identifies and compares different methodologies used for the selection of (candidate) MPAs. It is hoped that this will provide DFO with the information necessary to evaluate which selection methodology would be most effective in furthering its MPA objectives within the IM framework. The report is available at www.dfo-mpo.gc.ca/csas/csas/publications/resdocs-docrech/2004/2004_082_E.htm.

Secretariat of the Convention of Biological Diversity. 2004. *Technical Advice on the Establishment and Management of a National System of Marine and Coastal Protected Areas*. SCBD (CBD Technical Series No. 13). 40pp

- The output of a forum of researchers from around the world, this document provides technical advice on the establishment and management of MCPAs and networks of MCPAs. The report summarizes current scientific understanding and best practice approaches, together with references to key literature that can provide further details. The report is designed to provide advice to decision makers – policy-makers within government, MCPA and other marine and coastal managers, users, and communities. It is available at www.biodiv.org/doc/publications/cbd-ts-13.pdf.

WCPA/IUCN. 2006. *Establishing Networks of Marine Protected Areas: A Guide for Developing Capacity for Building MPA Networks*. In press

- Compiled as the result of a global two-year iterative process with agencies and managers involved in MPA network initiatives and ecosystem-based management, this report provides a framework to support the development and implementation of MPA networks, emphasizing the ecological principles that underlie network design, the best practices that designers can follow to establish networks, and important considerations throughout the development process. The report intends to serve those who play a fundamental role in making MPA networks happen, but who may not have a wealth of experience in marine conservation issues.

5.4 National frameworks

Australia

In the early 1990s, Australian governments identified a need to protect representative examples of the full range of marine ecosystems and habitats in MPAs. They agreed to establish a comprehensive, adequate, and representative system of protected areas covering Australia's EEZ – a National Representative System of Marine Protected Areas (NRSMPA). It aims to contribute to the long-term ecological viability of marine and estuarine systems, to maintain ecological processes and systems, and to protect Australia's biological diversity at all levels. The following are key documents that provide direction and guidance on the implementation of the NRSMPA.

Australia's Oceans Policy (1999)

Released in 1999, Australia's Oceans Policy outlines commitments and actions needed for the ongoing establishment of the NRSMPA for conservation purposes and to give regional security for industry access to ocean resources and their sustainable use. The policy can be accessed at www.oceans.gov.au/the_oceans_policy_overview.jsp.

Guidelines for Establishing the National Representative System of Marine Protected Areas (1998)

- These guidelines were prepared to assist government agencies in developing the NRSMPA and to help stakeholders understand this process. The guidelines deal with key aspects of the establishment of MPAs, including the functions of the NRSMPA and criteria for identifying and selecting MPAs. The guidelines continue to be used by each jurisdiction to reinforce the national commitment to establishing the NRSMPA. The guidelines can be accessed at www.deh.gov.au/coasts/mpa/nrsmpa/pubs/guidelines.pdf.

Strategic Plan of Action for the National Representative System of Marine Protected Areas: A Guide for Action by Australian Governments (1999)

- The plan of action for the NRSMPA integrates the policy and planning framework and outlines a set of actions to achieve the goals of the NRSMPA. The strategic plan can be accessed at www.deh.gov.au/coasts/mpa/nrsmpa/spa.html.

Cuba

Estrada Estrada et al. 2003. National System of Marine Protected Areas

- The Protected Areas Law (1999) created a framework for creation of a representative MPA network, and the first phase of a network has been implemented. WWF-Canada has been working with the Cuban government to carry out a comprehensive planning exercise to update its MPA system plan for 2008. The document can be accessed at www.environmentaldefence.org/documents/3692_mpasCubaIngles.pdf.

New Zealand

Department of Conservation. 2000. *The New Zealand Biodiversity Strategy*

- This strategy includes an objective to protect a full range of natural marine habitats and ecosystems to effectively conserve marine biodiversity, using a range of appropriate mechanisms, including legal protection. The strategy can be accessed at www.biodiversity.govt.nz/picture/doing/nzbs/index.html.

Department of Conservation and Ministry of Fisheries. 2005. *Marine Protected Areas: Policy and Implementation Plan*

- The objective of New Zealand's policy and plan for MPAs is to protect marine biodiversity by establishing a network of MPAs that is comprehensive and representative of New Zealand's marine habitats and ecosystems. Key components of the policy are as follows: a consistent approach to classification of the marine habitats and ecosystems; mechanisms to coordinate a range of management tools; an inventory to identify areas where MPAs are required; and a nationally consistent basis for planning and establishing new MPAs. The plan can be accessed at www.biodiversity.govt.nz/seas/biodiversity/protected/mpa_policy.html.

United Kingdom

DEFRA (Department for Environment, Food and Rural Affairs). 2004. *Review of Marine Nature Conservation: Working Group Report to Government*

- This review was established by DEFRA in 1999 to examine the effectiveness of the system for protecting nature conservation in the marine environment and develop practical proposals for its improvement. The report recommends a framework and actions for identifying and establishing an ecologically coherent and representative network for MPAs, within a broader set of recommendations for setting and achieving strategic goals for the marine environment. The report, and the U.K. government's response, can be accessed at www.defra.gov.uk/wildlife-countryside/ewd/rmnc.

5.5 Prominent examples and case studies

Representative Areas Program of the Great Barrier Reef Marine Park, Australia

- In the late 1990s, it was recognized that the existing zoning of the GBRMP did not adequately protect the range of biodiversity now known to exist within the park. A systematic program was therefore commenced (the Representative Areas Program), which was specifically designed to determine the major habitat types of the Great Barrier Reef region and develop a new zoning plan based on protecting representative examples of each habitat type within a network of no-take areas. The new zoning plan came into effect in July 2004. Publications describing various aspects of the planning process can be accessed at www.gbrmpa.gov.au/corp_site/management/zoning/zoning_publications.html.

Proposed Marine Protected Area Network for South-east Region, Australia

- On 14 December 2005, the Australian government released proposals for an extensive network of MPAs covering 171,000 square kilometres of Commonwealth waters in the South-east Marine Region off Tasmania, Victoria, eastern South Australia, and New South Wales. Information on the scientific, mapping, consultation, and designation processes can be accessed at www.deh.gov.au/coasts/mpa/southeast/index.html.

Ardron, J. 2003. *BC Coast Information Team Marine Ecosystem Spatial Analysis, v. 1.2*. Excerpted and revised from An Ecosystem Analysis for Haida Gwaii, Central Coast, and North Coast British Columbia, C. Rumsey, J. Ardron, K. Ciruna, T. Curtis, F. Doyle, Z. Ferdana, T. Hamilton, K. Heinemyer, P. Iachetti, R. Jeo, G. Kaiser, D. Narver, R. Noss, D. Sizemore, A. Tautz, R. Tingey, and K. Vance-Borland. Draft, September 22, 2003. 184pp

- The Living Oceans Society launched the Marine Protected Area Design Project in 1999 to develop a science-based methodology for identifying candidate MPAs in British Columbia as an important step toward establishing a system of MPAs. Volume 1.2 of this spatial analysis was released in 2003. The Living Oceans Society continues to work on related projects designed to incorporate the needs and concerns of First Nations, local residents, and fishers into the design, designation, and ongoing management of a network of MPAs, and is involved in a comprehensive, multi-stakeholder peer review that will lead to a refined version of the spatial analysis. The report and other information on this project can be accessed at www.livingoceans.org/library/index.shtml.

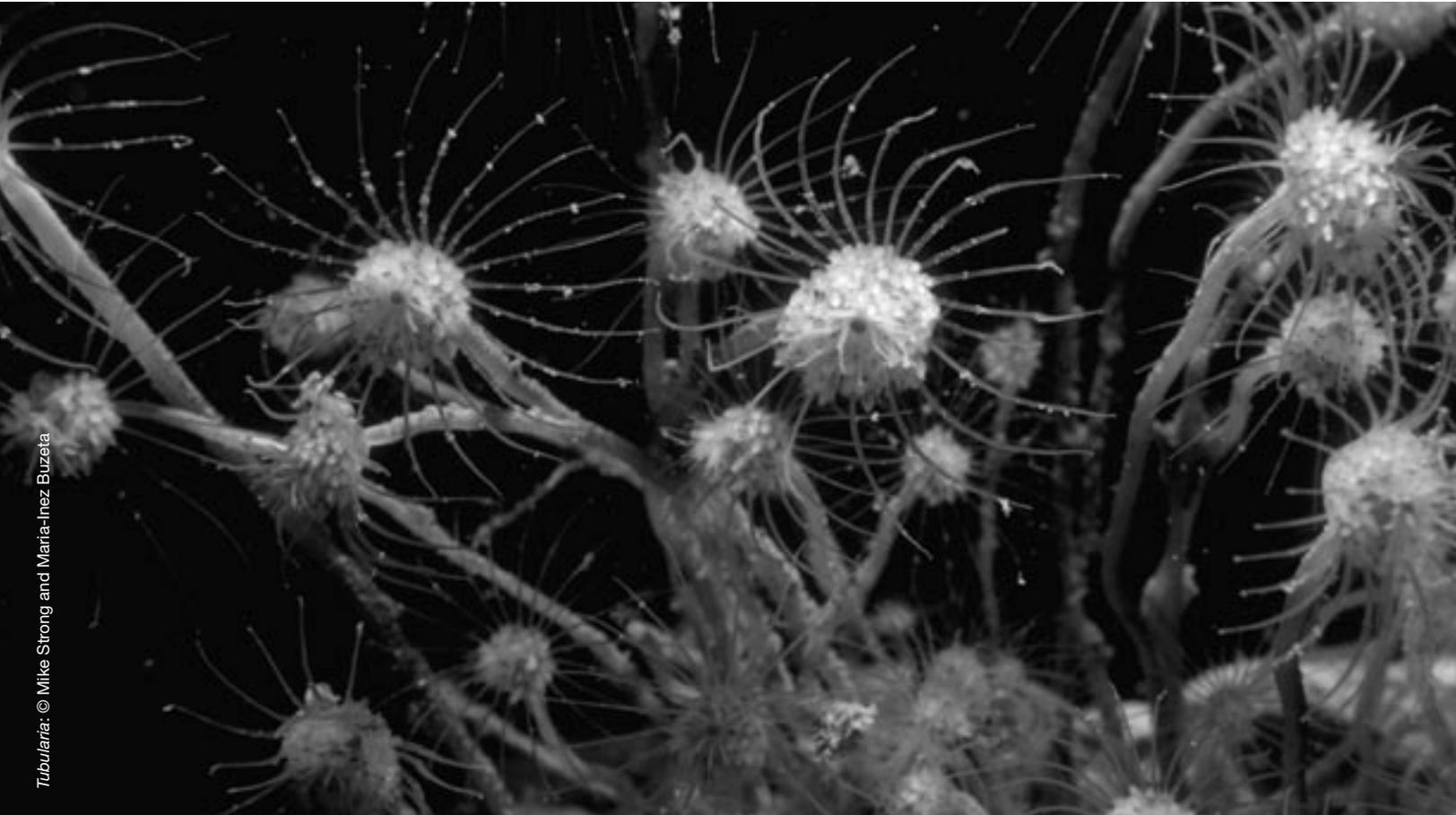
WWF-Canada, CPAWS BC (Canadian Parks and Wilderness Society British Columbia Chapter), David Suzuki Foundation, Living Oceans Society, Sierra Club of Canada BC Chapter. 2006. *Vision, Goal, Objectives and Guiding Principles for the Collaborative Delivery of a BC MPA Network: Input to the Development of an Implementation Plan for the “Subsidiary MOU Respecting a Marine Protection Areas Framework for the Pacific Coast of Canada.”* Vancouver: WWF-Canada

- This document, produced as a collaborative effort of several BC NGOs, describes an overarching vision for marine conservation, an MPA network goal, and a set of objectives and principles that, if adopted and implemented, would form the basis of a successful, collaborative MPA network delivery model. It also identifies the key deliverables and timelines required to achieve the establishment of an MPA network of representative ecosystems and distinctive features on the entire Pacific coast by 2012.

WWF–Sulu-Sulawesi Marine Ecoregion Program. 2004. *Framework for a Network of Marine Protected Areas in the Sulu-Sulawesi Marine Ecoregion*. Quezon City, Philippines: WWF Sulu-Sulawesi Marine Ecoregion Conservation Program. 48pp

- WWF and its partners in Sabah, Malaysia, convened a workshop of experts on MPAs in Kota Kinabalu to develop a technical framework for the selection of sites and successful implementation of a network of MPAs in the Sulu-Sulawesi Marine Ecoregion (SSME). This document presents the workshop processes and the outputs that are organized into a draft framework for the network of MPAs in the SSME.

Appendices and works cited



Tubularia: © Mike Strong and Maria-Inez Buzeta

Appendix 1: Operating principles used in the GBRMP RAP
Appendix 2: Summary of goals proposed for identifying candidate MPA sites
Works cited

APPENDIX 1: OPERATING PRINCIPLES USED IN THE GBRMP RAP

The following text is excerpted directly from documents developed for the rezoning of the GBRMP. The original, as well as supplementary documents referred to in this appendix, can be found in a dedicated section of the GBRMPA website: www.gbrmpa.gov.au/corp_site/management/zoning/zoning_publications.html.

Background & history

The Great Barrier Reef Marine Park Authority is implementing the Representative Areas Program to help ensure better protection of the Marine Park's biodiversity. This will involve a review of the existing zoning throughout the Marine Park. This information sheet is part of a package of materials that help explain various technical elements of the Representative Areas Program and the zoning review.

Biophysical operational principles as recommended by the Scientific Steering Committee for the Representative Areas Program

The Scientific Steering Committee

The independent Scientific Steering Committee (SSC) to the Representative Areas Program (RAP) provides advice on scientific issues, programming and priorities to assist the Great Barrier Reef Marine Park Authority (GBRMPA) to achieve the best possible outcomes. The membership of RAP's SSC was decided by the GBRMPA after consultation with over 70 of Australia's top scientists with expertise in the GBR region.

Background and context for these recommendations

The SSC believes that the existing network of Green Zones (no-take areas)¹ in the Great Barrier Reef Marine Park (GBRMP) is insufficient to maintain the biological diversity and ecological integrity of the Great Barrier Reef (GBR) into the future. The reasons are that:

- less than 5% of the Marine Park is currently in no-take areas;
- the existing areas are largely confined to coral reefs or the remote far north of the Marine Park; and
- the coverage of no-take areas in many of the 70 bioregions in the Great Barrier Reef World Heritage Area (GBRWHA) is minimal or non-existent.

The GBRMPA shares this concern and is rezoning the entire Marine Park through RAP. This rezoning will result in more no-take areas that will help:

- maintain biological diversity at the levels of ecosystem, habitat, species, population and genes;
- allow species to evolve and function undisturbed;
- provide an ecological safety margin against human-induced disasters;
- provide a solid ecological base from which threatened species or habitats can recover or repair themselves; and
- maintain ecological processes and systems.

¹ Green Zones (no-take areas) within the GBR Marine Park are equivalent to the existing "National Park Zones" (Cairns & Far North Sections) and "Marine National Park B Zones" (Central & Mackay-Capricorn Sections) in which activities such as boating, diving and snorkelling are permitted, but the taking of plants, animals and marine products is prohibited.

As part of the RAP, new no-take areas or Green Zones will be created and existing Green Zones may be expanded to achieve greater protection of biodiversity. The existing range of multiple-use zones will remain (ranging from 'General Use Zones' where most reasonable activities are allowed, through the new 'National Park Zones' [aka Green Zones or 'no-take' areas], to small areas of 'Preservation Zone' which are 'no-go' areas).

The Representative Areas Program has several phases:

- classification – map the marine diversity in the Great Barrier Reef World Heritage Area into bioregions;
- review – determine the extent to which the existing zoning protects the biodiversity shown by the bioregions;
- identification – identify networks of candidate areas which will achieve the biological objectives of RAP; and
- selection – select from amongst the options of candidate areas to maximise beneficial and minimise detrimental impacts whilst considering social, economic, cultural and management implications (Day et al, in press).

A policy and planning framework for marine protected area networks in Canada's oceans

Origin and justification of the biophysical operational principles

The following biophysical operational principles are recommended by the SSC to guide the establishment of a new network of no-take areas that could achieve the objectives of RAP. These principles will guide reserve design processes in RAP. The SSC recognises that other processes in RAP will address the cultural, social and economic dimensions of the program and that these may influence the degree to which the GBRMPA is able to achieve, in full, its recommendations. An independent Social, Economic and Cultural Steering Committee has developed operational principles for assessing social, economic, cultural impacts and management feasibility that complement the biophysical operational principles defined here (http://umparra.gbrmpa.gov.au/testweb/corp_site/key_issues/conservation/rep_areas/documents/tech_sheet_07.pdf).

The biophysical operational principles outlined below were established by the SSC by taking into account:

- the level of uncertainty about the biodiversity of the GBR World Heritage Area;
- the fact there is already a basic level of protection across the GBR Marine Park; and
- other efforts to ensure protection of the GBR Marine Park by improvements in, for example, water quality and sustainable fishing.

Amount of protection required

The extent of protection required to ensure the ongoing conservation and protection of marine biodiversity is a subject of debate in the scientific literature. Amounts recommended in the literature generally fall in the range of 20 - 40% of the sea in no-take areas. The scientific arguments for setting aside substantial amounts of the marine environment as no-take areas include:

- Risk minimisation – protecting a large proportion and replicate examples of a marine area – in total 20% or more – will reduce risks of over-exploitation of harvested resources and consequent effects on the ecosystem, whilst leaving reasonable opportunity for existing activities to continue in the remaining areas;

- Connectivity – the life cycles of most marine organisms mean that offspring from one area often replenish populations in other areas (referred to as ‘connectivity’). As more areas are closed to extractive activities, the benefits to the whole system through such connectivity (both among reserves and between reserves and non-reserves) is expected to increase, thereby offering greater security for conservation;
- Resilience against human and natural catastrophes – for any one disturbance, much of the network of protected areas should remain intact so that affected areas can recover more quickly and completely through replenishment from other non-impacted no-take areas;
- Harvested species – the protection of 20 - 40% of any fished grounds in no-take areas offers some fisheries the opportunity for better management, and permits no-take areas to maintain more natural population levels of harvested species and, consequently, more natural communities as a whole; and
- Maintenance of ecological services and goods – in no-take areas, ecosystems can function in a more natural manner which contributes to maintenance of ecological processes. This leads to more sustainable delivery of ecological goods and services to both the environment and humans.

The SSC is aware of the literature on theoretical and empirical evidence for levels of protection. Their considerations have been supported by independent advice from other experts in coral reef and non-reef ecosystems, and experts with technical knowledge about the design of protected area networks. The SSC recognises:

- national and international expectations associated with managing the world’s largest coral reef ecosystem and the world’s largest World Heritage Area in a developed country; and
- international experience and opinion advocating greater protection of the world’s oceans.

The percentages presented in these recommendations have been developed using best available knowledge of the GBR World Heritage Area system and general principles of reserve design. Despite this, detailed knowledge about the distribution of many plants and animals in the area is limited and the SSC recognises that many species are yet to be discovered. The SSC considers that species-specific information is insufficient to determine exact amounts of protection required for the whole ecosystem and that all knowledge gathered to date indicates that the protection of biodiversity requires much more than protection of particular species and a much greater extent of protection than currently exists in the GBRMP.

The percentage figures presented in the biophysical operational principles were developed using all available information and local knowledge/experience of the GBR World Heritage Area and recognition that requirements vary with areas and habitats. The final percentage protection recommended per bioregion is the outcome of implementing all the principles below including principles 5 and 6 (which refer to each bioregion) and principles referring to specific levels of protection for different habitats, communities and special and unique areas. The SSC also was mindful of the need for a precautionary approach to the protection of the unique biophysical properties of the GBRMP when recommending minimum amounts for no-take areas.

Biophysical operational principles recommended by the SSC	
Principle	Explanation
1. Have no-take areas the minimum size of which is 20km along the smallest dimension (except for coastal bioregions, refer to Principle 6)	While no-take areas may be of various shapes and sizes, 20km should be the minimum distance across any no-take area in order to ensure that the size of each area is adequate to provide for the maintenance of populations of plants and animals within Green Zones and to insure against edge effects resulting from use of the surrounding areas.
2. Have larger (versus smaller) notake areas	For the same amount of area to be protected, protect fewer, larger areas rather than more smaller areas, particularly to minimise 'edge effects' resulting from use of the surrounding areas. This principle must be implemented in conjunction with principle 3.
3. Have sufficient no-take areas to insure against negative impacts on some part of a bioregion	"Sufficient" refers to the amount and configuration of notake areas and may be different for each bioregion depending on its characteristics. For most bioregions, 3-4 no-take areas are recommended to spread the risk against negative human impacts affecting all Green Zones within a bioregion. For some very small bioregions fewer areas are recommended, whilst for some very large or long bioregions, more no-take areas are recommended.
4. Where a reef is incorporated into no-take zones, the whole reef should be included	Reefs are relatively integral biological units with a high level of connectivity among habitats within them. Accordingly, reefs should not be subject to 'split zoning' so that parts of a reef are 'no-take' and other parts are not.
5. Represent a minimum amount of each reef bioregion in notake areas	In each reef bioregion, protect at least 3 reefs with at least 20% of reef area and reef perimeter ² included in no-take areas. The number and distribution of no-take areas is described in principle 3.
6. Represent a minimum amount of each non-reef bioregion in no-take areas	In each non-reef bioregion, protect at least 20% of area. Two coastal bioregions ³ , which contain finer scale patterns of diversity due to bays, adjacent terrestrial habitat and rivers require special provisions. The number and distribution of no-take areas is described in principle 3.
7. Represent cross-shelf and latitudinal diversity in the network of no-take areas	Many processes create latitudinal and longitudinal (crossshelf) differences in habitats and communities within the GBR World Heritage Area. This diversity is reflected partly in the distribution of the bioregions, but care should be taken to choose no-take areas that include differences in community types and habitats that cover wide latitudinal or cross-shelf ranges (see principle 8).

² These bioregions are excepted:

- Capricorn-Bunker Mid-Shelf Reefs (RCB2) – include one of the inner 2 and one of the outer 2 reefs. This exception exists because RCB2 has only 4 reefs;
- Deltaic Reefs (RA1) – minimum 25% and minimum 15 reefs in one continuous area. This exception exists because the bioregion is too small for multiple notake areas;
- High Continental Island Reefs (RHC) – 20% of reef perimeter only. This exception exists because reef perimeter makes more biological sense for fringing reefs; and
- Central Open Lagoon Reefs (RF2) – 3 reefs. There are very few reefs in this bioregion.

³ For coastal bioregions:

- Coastal Strip-Sand (NA1) – protect at least six no-take areas, each at least 10km in length, spaced approximately every 70-100km apart. (This bioregion is approx. 800 km long); and
- High Nutrient Coastal Strip (NA3) – at least eight no-take areas, each at least 10km in length, spaced approximately every 70-100 km apart. (This bioregion is approx. 1400 km long).

Biophysical operational principles recommended by the SSC	
Principle	Explanation
8. Represent a minimum amount of each community type and physical environment type in the overall network taking into account principle 7 ⁴	This principle is to ensure that all known communities and habitats that exist within bioregions are included in the network of no-take areas. Communities and habitats were identified for protection in no-take areas based upon the reliability and comprehensiveness of available data. The requirements listed in Footnote 5 help implement this principle, which is intended to ensure that particularly important habitats are adequately represented in the network of no-take areas.
9. Maximise use of environmental information to determine the configuration of no-take areas to form viable networks	The network of areas should accommodate what is known about migration patterns, currents and connectivity among habitats. The spatial configurations required to accommodate these processes are not well known and expert review of candidate networks of areas will be required to implement this principle.
10. Include biophysically special/ unique places	These places might not otherwise be included in the network but will help ensure the network is comprehensive and adequate to protect biodiversity and the known special or unique areas in the GBRMP. Aim to capture as many biophysically special or unique places as possible.
11. Include consideration of sea and adjacent land uses in determining no-take areas	Past and present uses may have influenced the integrity of the biological communities and the GBRMPA should consider these effects, where known, when choosing the location of no-take areas. For example, existing no-take areas and areas adjacent to terrestrial National Parks are likely to have greater biological integrity than areas that have been used heavily for resource exploitation.

⁴ Data and objectives to implement principle 8:

- Halimeda beds – ensure no-take areas represent 10% of known Halimeda beds;
- shallow water seagrass – ensure no-take areas represent 10% of shallow water seagrass habitat;
- deepwater seagrass – ensure no-take areas represent 10% of known deepwater seagrass habitat;
- algae – ensure no-take areas represent 10% of known algal habitat;
- epibenthos – ensure no-take areas represent different faunal classes (5% each of echinodermata, sponges, bryozoans, solitary corals, soft corals, foraminifera, brachyura);
- dugong – ensure no-take areas represent identified dugong habitat areas summing to about 50% of all high priority dugong habitat;
- cays – where cays exist within a bioregion, try to include at least two examples of them in potential no-take areas;
- reefs size – capture 5% of reef area in each of five reef-size classes;
- inter-reef channels – capture at least one inter-reef channel in bioregions where they exist;
- exposure – ensure the entire network captures 5% of reef and non-reef area in each of five wave exposure classes;
- islands – where islands exist within a bioregion try to include one example of them in no-take areas;
- oceanographic diversity in water quality – ensure representation of reefs within the “natural” diversity of water quality (5% of reef and non-reef area in each of nine oceanographic “bioregions”; 5% of reef and non-reef area in each of four flood frequency classes);
- adjacent coastal and estuarine habitats (including islands) – locate no-take areas adjacent to mangroves, wetlands and protected areas rather than adjacent to suburbs; and
- major turtle sites – ensure no-take areas include known major turtle nesting and foraging sites (100% of about 30 sites of the 115 identified – these include both nesting sites and foraging sites).

The biophysical operational principles should be treated as a package to underpin the choice of what number, size and location of no-take areas to implement. If these principles are implemented in full, the SSC expects that around 25-30% of the GBRMP will be protected in Green Zones or notake areas – in some locations more and others less so.⁵ These biophysical operational principles refer to minimum amounts of protection. The SSC considers that to achieve the objectives of RAP the GBRMPA should protect at least these amounts in each bioregion and each habitat – none of these recommendations are for “ideal” or “desired” amounts. Ideal or desired amounts required for full protection are likely to be greater than indicated by the biophysical operational principles.

The SSC realizes that there are many different spatial configurations of no-take areas that would fulfill these biophysical operational principles and that the final location of no-take areas will be decided in consultation with Traditional Owners, users and other stakeholders.

The SSC considers that the biophysical operational principles are best estimates of the requirements to provide minimum protection through declaration of no-take areas (Green Zones), available literature and expert knowledge, and are based upon current knowledge of the system but may require review as new information becomes available.

References for further reading can be supplied upon request.

Social, economic, cultural and management feasibility operational principles

As part of the zoning review to implement the Representative Areas Program, two independent steering committees were formed to provide expert advice to the GBRMPA about the:

- biological and physical aspects of the Great Barrier Reef Region; and
- social, economic, cultural and management feasibility aspects of human use and values of the Marine Park.

The selection of new no-take areas will be guided by the operational principles developed by both these committees. These principles will help protect biodiversity whilst maximising beneficial and minimising detrimental impacts to local communities and stakeholders. A summary of the social, economic, cultural and management feasibility operational principles developed by the Social, Economic and Cultural Steering Committee is given below. These will apply, as far as possible, to the Representative Areas Program. Another technical information sheet is available detailing the biophysical operational principles.

⁵ More new no-take zones will be located over non-reef areas than reef areas because 21% of reef area is already in no-take zones.

Summary of the social, economic, cultural and management feasibility operational principles developed by the Social, Economic and Cultural Steering Committee

Operational Principle	Explanation
<p>1. Maximise complementarity of no-take areas with human values, activities and opportunities</p>	<p>This is achieved by placing Green Zones (or no-take areas) in locations that:</p> <ul style="list-style-type: none"> • have been identified through a consultative process that is participatory, balanced, open and transparent; • Traditional Owners have identified as important and in need of high levels of protection; • minimise conflict with Indigenous people’s aspirations for their sea country; • protect areas that the community identifies as special or unique, e.g. places of biological, cultural, aesthetic, historic, physical, social or scientific value; • minimise conflict with non-commercial extractive users such as recreational fishers; • minimise conflict with commercial extractive users; and • minimise conflict with all non-extractive users.
<p>2. Ensure that final selection of no-take areas recognises social costs and benefits</p>	<p>This will include recognition of the following:</p> <ul style="list-style-type: none"> • relative social costs and benefits, including community resilience; • spatial equity of opportunity within and between communities, including clan estates; • planned and approved future activities; and • consider requirements for monitoring the effectiveness of the zoning plans.
<p>3. Maximise placement of no-take areas in locations which complement and include present and future management and tenure arrangements</p>	<p>These arrangements include the following:</p> <ul style="list-style-type: none"> • existing or proposed zoning plans, management plans or other related management strategies for marine areas by federal, state or local government authorities; • existing or proposed tenure and management strategies for coastal areas (mainland and islands) in the region; and • Native Title claim areas and issues.
<p>4. Maximise public understanding and acceptance of no-take areas, and facilitate enforcement of no-take areas</p>	<p>This is achieved by:</p> <ul style="list-style-type: none"> • having Green Zones that are simple shapes; • having Green Zones with boundaries that are easily identified; and • having fewer and larger Green Zones rather than more and smaller Green Zones.

APPENDIX 2: SUMMARY OF GOALS PROPOSED FOR IDENTIFYING CANDIDATE MPA SITES

This table, after Dearden and Tolpeko 2005, in Den Heyer et al. 2006, summarizes the types of goals proposed by a sampling of MPA network planning initiatives.

Summary of criteria developed for identifying candidate sites for MPAs												
Source	Biogeographic representation	Habitat representation/heterogeneity	High diversity (habitat, species)	Genetic diversity	Degree/nature of threats	Productivity	Spawning/breeding grounds	Size/shape/connectivity	Export functions	Viability	Disturbance	Management/feasibility
Gubbay, 2003		✓	✓		✓				✓		✓	✓
IMO, 2001	✓	✓	✓			✓	✓					
IUCN, 1996	✓	✓	✓					✓				✓
Kelleher, 1999	✓	✓		✓			✓					
Salm & Clark, 2000	✓	✓	✓			✓						
Roberts, et al., 2003a	✓	✓			✓			✓	✓	✓	✓	✓
Hockey & Branch, 1997	✓		✓						✓			
Gladstone et al., 2003	✓	✓					✓					
Mills & Carleton, 1998	✓				✓							
OSPAR Commission, 2003	✓	✓	✓		✓		✓	✓				✓
Conner et al., 200			✓		✓			✓				
McLeod et al., 2005; Johnston et al., 2000		✓										
UNEP, 1994		✓					✓					
DFO, 2005												
Levings & Jamieson, 1999		✓	✓			✓	✓		✓	✓		✓
Parks Canada, 2003	✓	✓										
ANZECC, 1998	✓	✓		✓		✓						
Environment Australia, 2003	✓	✓	✓		✓		✓	✓				
NSW, 2000	✓	✓		✓		✓	✓					
Brody, 1998	✓	✓	✓		✓	✓		✓				
Total	14	16	10	3	7	6	8	6	4	2	2	5

A policy and planning framework for marine protected area networks in Canada's oceans

Aggregations	Vulnerable habitats	Vulnerable life stages	Species or populations of special concern	Exploitable species	Ecosystem linkages	Ecological services for humans	Naturalness	Uniqueness/rare habitats	Rare/endemic species	Scientific value	Critical habitat	Comprehensiveness	Site integrity	Int'l/nat'l importance
	✓				✓		✓	✓	✓	✓			✓	
✓			✓		✓	✓	✓	✓	✓		✓		✓	✓
	✓		✓		✓		✓	✓	✓				✓	
✓	✓	✓	✓	✓	✓	✓								
	✓	✓	✓	✓									✓	
		✓												
	✓	✓	✓				✓							
		✓	✓				✓	✓	✓					✓
			✓					✓				✓		✓
		✓	✓		✓		✓	✓	✓	✓				
✓			✓				✓	✓	✓		✓			
	✓	✓			✓		✓	✓	✓			✓		✓
				✓			✓							
	✓	✓	✓			✓	✓	✓	✓			✓		✓
			✓				✓	✓	✓		✓		✓	
3	8	8	11	3	7	3	12	13	9	3	5	4	7	5

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WWF-Canada
245 Eglinton Avenue East, Suite 410
Toronto, Ontario M4P 3J1
Tel. 416-489-8800
1-800-26-PANDA (72632)
wwf.ca

WWF-Canada
Atlantic Region Office
5251 Duke Street, Suite 1202
Halifax, Nova Scotia B3J 1P3
Tel. 902-482-1105

WWF-Canada
Pacific Region Office
409 Granville Street, Suite 512B
Vancouver, British Columbia V6C 1T2
Tel. 604-678-5152



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