

## CHAPTER 1 INTRODUCTION

*Fikret Berkes* (University of Manitoba)  
and *Helen Fast* (Department of Fisheries and Oceans)

### INTEGRATED MANAGEMENT, COMPLEXITY, DIVERSITY, CHANGE

This volume is the output of the project, “Integrated management, complexity and diversity of use: responding and adapting to change.” The project focused on the Canadian North, defined to include the Beaufort Sea, the Arctic Ocean coast and islands, Hudson Bay, and Hudson Strait. The use of the idea of integrated management (Cicin-Sain and Knecht 1998), complexity, and the diversity of resource use was intended to capture the issue of competing demands on the environment and the interrelationships among them. There was also a practical reason relevant to policy: integrated management is one of the three principles on which the 1997 *Oceans Act* is based (s. 30). Canada’s Oceans Strategy (2002) is constructed as a framework for integrated management.

The subtitle of the project, responding and adapting to change, captures the second major theme in the project and in this volume. We defined change broadly to include social and cultural change, economic and technological change, development pressures, globalization, and larger-scale issues such as climate change and Arctic ecosystem contamination. One notable fact about the Canadian North is the rate at which change has been occurring. We refer not only to visible technological change, such as TV, internet, and GPS units now used by indigenous hunters in daily life, but also to fundamental changes in both the social and the biophysical environment in the North.

The pace of change is striking, for example, in the area of contaminants, as evident from the contents of the Canadian Arctic Contaminants Assessment reports of 1997 and 2003 (Jensen *et al.* 1997; INAC 2003). The urgency of the contaminants issue can be deduced from the negotiations leading up to the international agreement designed to address the problem, the 2001 *Stockholm Convention on Persistent Organic Pollutants* (Downie and Fenge 2003). Also fundamentally important is the issue of climate change, judging by the work

of the multinational Arctic Climate Impact Assessment carried out under the Arctic Council (ACIA 2004) and the urgency of local and indigenous observations (Krupnik and Jolly 2002).

The title of the Krupnik and Jolly (2002) book is telling: “The earth is faster now” is a quotation from an Alaska elder, Mabel Toolie, referring to rapid change and the declining ability of her people to read the weather. British polar scientists Clarke and Harris (2003, 1) echo the same sentiment in scientific language: “The capacity of marine ecosystems to withstand the cumulative impact of a number of pressures, including climate change, pollution and overexploitation, acting synergistically is of greatest concern.” Change and the unpredictability and vulnerability created by change have been common themes in public meetings as well, such as the Beaufort Sea 2000 Conference (Ayles *et al.* 2002).

However, our understanding of change and its impact on social and environmental systems has been rather incomplete. Particularly in Canada, both marine research and northern research have suffered in recent decades. According to the findings of the Task Force on Northern Research (NSERC and SSHRC 2000, 1), the North has been facing “unprecedented social, physical and environmental challenges.” Yet, the Canadian research capability and the level of research activity in the North have declined over the years, requiring a rebuilding of research programs and training opportunities for a new generation of northern researchers. Taken together, these are some of the main considerations that shaped the objectives of the project.

This volume carries out the overall goal of the project and the parent body, the Ocean Management Research Network (OMRN 2004) through three specific objectives: (1) to research and learn from the experience in the area of integrated management, complexity and diversity of resource use; (2) to apply critical thinking to the phenomena of change and the way in which societies respond and adapt to new challenges; and (3) to understand the dynamics of change and explore policy options to build capacity to adapt to new challenges.

#### CONCEPTS AND DEFINITIONS

##### *Sustainability, the Ecosystem Approach and Integrated Management*

This book is interdisciplinary, using various concepts that cut across social and natural sciences; some definitions are therefore needed to establish a common vocabulary. The book contributes to the overall goal of *sustainability* in the Canadian North, whereby “the needs of the present and local population can be met without compromising the ability of future generations or populations in other locations to meet their needs” (MEA 2003, 215). Sustainability, as used here, is a process (and not an end point) that includes ecological, social, cultural, and economic dimensions. The question of “what is to be sustained” is not self-evident and has to be addressed on a case-by-case and area-by-area basis. The term *ecological system* (ecosystem) is used in the conventional ecological sense to refer to “a dynamic complex of plant, animal and microorganism communities and their nonliving environment, interacting

as a functional unit” (MEA 2003, 210). Ecosystems are not biological constructs untouched by human influences but have humans as integral component. To emphasize that social and ecological systems are in fact linked, and that the delineation between social and natural systems is artificial and arbitrary, we use the terms *social-ecological system* and *social-ecological linkages* (Berkes and Folke 1998, 4).

*Ecosystem approach* is a “strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way” (MEA 2003, 52) or “an approach to management that recognizes the complexity of ecosystems and the interconnections among component parts” (Canada’s Oceans Strategy 2002, 36). The related concept of *ecosystem-based management* is “the management of human activities so that ecosystems, their structure, function and composition are maintained at appropriate temporal and spatial scales” (Canada’s Oceans Strategy 2002, 36). The ecosystem-based management idea overlaps with the notion of *integrated management*, defined by Canada’s Oceans Strategy (2002, 36) as

a continuous process through which decisions are made for the sustainable use, development and protection of areas and resources. IM acknowledges the interrelationships that exist among different uses and the environments they potentially affect. It is designed to overcome the fragmentation inherent in a sectoral management approach, analyzes the implications of development, conflicting uses and promotes linkages and harmonization among various activities.

We use the term *cross-scale interactions* to refer to two kinds of linkages: *horizontal* (across geographic space or across sectors) and *vertical* (across levels of organization) (Young 2002). Harmonization refers to the horizontal linkages that are necessary to coordinate activities (*e.g.*, protected areas, transportation, oil and gas exploration, fishery management) to overcome fragmentation of decision making by sector. We make a distinction between *level* (“the discrete levels of social organization, such as individuals, households and communities and nations”) and *scale* (“the physical dimensions, in either space or time, of phenomena or observations”) (MEA 2003, 212, 214).

Many of the linkages in the Canadian North involve *Aboriginal peoples* (defined to include First Nations people, the Inuit and the Metis) and working with their knowledge of the environment. The term *indigenous knowledge* (IK) is used to mean local knowledge held by indigenous peoples, or local knowledge unique to a given culture or society. We use *traditional ecological knowledge* (TEK) more specifically to refer to “a cumulative body of knowledge and beliefs, evolving by adaptive processes and handed down through generations by cultural transmission” (Berkes 1999, 8). The word traditional is used to refer to historical and cultural continuity, recognizing that societies are constantly redefining what is considered “traditional.” Inuit Qaujimaqatuqangit (IQ) is the preferred

term for TEK as used by some Inuit groups. We use the terms Western resource management science, scientific resource management, and conventional resource management interchangeably. We recognize that all societies have their own knowledge systems, but we identify Western science and scientific method as representing a particular kind of knowledge which is used as the basis of resource management by centralized bureaucracies everywhere in the world.

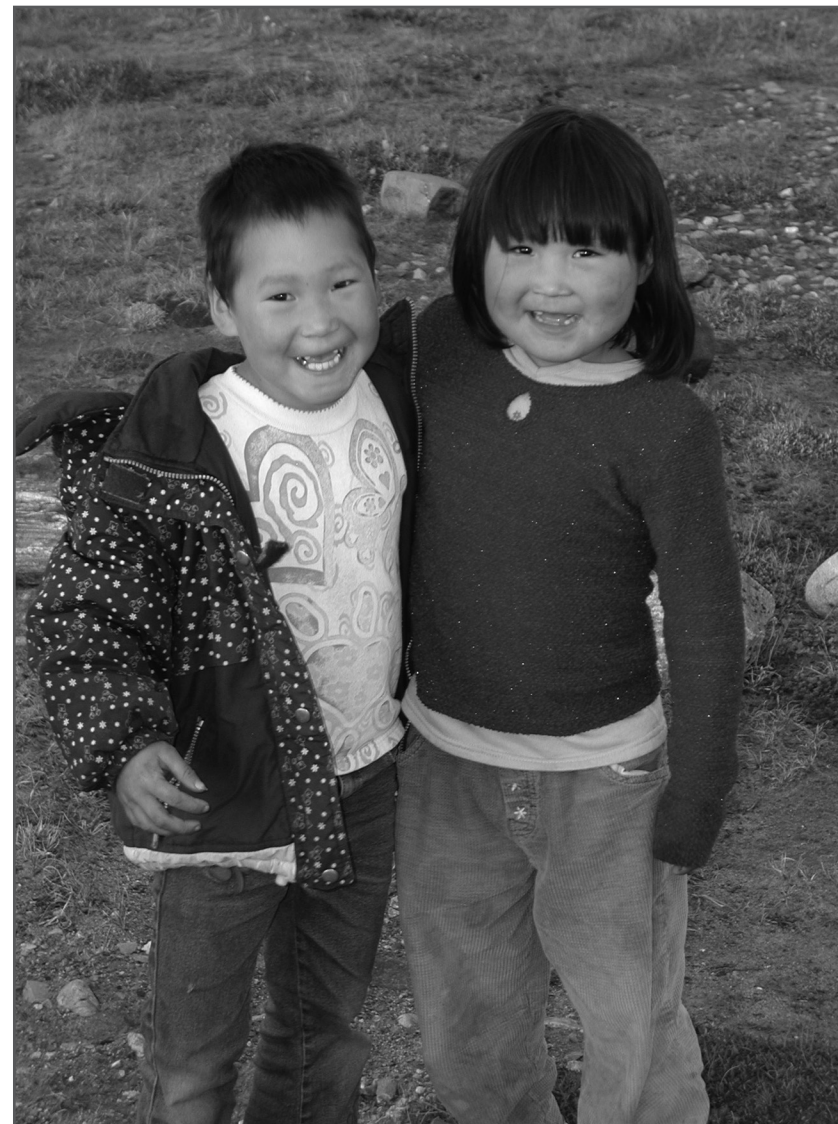
#### *Governance, Institutions, and Co-Management*

We use *governance* in the broader sense of coordination of social systems, and *institutions* in the broader sense of working rules and norms (Ostrom 1990). Processes of governance may or may not include the state; hence governance is possible even without the government, and institutions can exist without the presence of government agencies. The conventional governance involves top-down or state-centric governance in which *command-and-control* management is the norm, a “the policy framework in which environmental and resource management rules are prescribed by the regulator, leaving little flexibility for actors in the implementation” (MEA 2003, 209). But evolving notions of governance also includes an alternative: “In this second approach, which is more society-centered, the focus is on coordination and self-governance as such, manifested in different types of networks and partnerships” (Pierre and Peters 2000, 3).

There have been lively debates over governance, involving mixtures of self-governing, co-governing and hierarchical forms of governing, and incorporating state, private and civil society actors. In many countries, changes in patterns of governance have involved shifts in the balance and relation between government and society, and between public and private sectors. There is a trend toward more complementary patterns of interaction between formal governance and civil society, and a sharing of responsibility and accountability by public and private actors (Kooiman 1993).

Some authors have been using the term “good governance” to refer to these changes and trends (Rhodes 1997). Elements of good governance include participation (the involvement of resource users in the decisions that affect their livelihoods), accountability (the ability of the parties affected by a decision to demand and receive an explanation), transparency (openness of decision making), and legitimacy (the acceptance by users of the authority of rule-makers) (Jentoft 1999). In the area of resource management, participation is often seen as the basic element of good governance (McCay and Jentoft 1996; Wiber *et al.* 2004). The *subsidiarity principle* articulates the objective that decisions affecting peoples’ lives should be made by the lowest capable social organization, and emphasizes the importance of local-level institutions in governance (McCay and Jentoft 1996).

Institutions are “the rules that guide how people within societies live, work, and interact with each other” (MEA 2003, 21). North (1994) defines institutions as “humanly devised constraints that structure human interaction ... made up of formal constraints (rules, laws, constitutions), informal constraints (norms of



Rankin Inlet youth at the Meliadine Territorial Park, Rankin Inlet, Nunavut. The two young girls are Beatrice Pissuk (on the left) and Roseanne Shimout (on the right). Photo by Steve Newton, 2003.

behaviour, conventions and self-imposed codes of conduct), and their enforcement characteristics.” Institutions are not merely rule sets but have normative and cognitive dimensions as well (Jentoft *et al.* 1998), a consideration that is important in view of the differences between northern indigenous peoples and the dominant Canadian society in terms of social values, perceptions and knowledge.

Co-management systems in the Canadian North may be understood in this broader sense of governance and institutions. Co-management involves the sharing of responsibilities among the expanded set of players in governance; it involves networks and partnerships of a diversity of actors and their institutions. *Co-management* may be defined as “the sharing of power and responsibility between the government and local resource users” (Berkes *et al.* 1991, 12) or “a system that enables a sharing of decision-making power, responsibility and risk between government and stakeholders” (NRTEE 1998, 14). Co-management, as defined by the NRTEE, implies a formal agreement between at least one government and another group, and specifies government as a partner. Community-based management is sometimes considered an aspect of co-management, “but when community-based management does not include government as a partner in the decision making process, it is not co-management” (NRTEE 1998, p.13).

Even though co-management is often examined in terms of the formal arrangement under northern land claims and other agreements, the functional side of co-management is about joint problem-solving. Working partnerships develop over a period of time through learning and building of mutual respect and trust, as in the co-management of the Beverly-Qamanirjuaq caribou herd (Kendrick 2000). Thus, the actual power-sharing is the result, rather than the starting point, of the process of co-management.

Learning through networks and partnerships is important, and co-management oriented to problem-solving shows two characteristics. The first is the dynamic learning characteristic of *adaptive management*, or learning-by-doing in an iterative way (Holling 1978; Lee 1993). The second is the linkage characteristic of participatory or co-operative management (Pinkerton 1989; NRTEE 1998). Folke *et al.* (2002, 20) have used the term *adaptive co-management* to refer to this “process by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organized process of trial and error.” It is an inclusive and collaborative process in which stakeholders share management power and responsibility, as in Pierre and Peters’ (2000) “second approach” to governance.

Adaptive management is a key concept because it was designed to address issues of *uncertainty*, “an expression of the degree to which a future condition (e.g., of an ecosystem) is unknown” (MEA 2003, 215). Resource management operates in an environment of uncertainty in northern ecosystems, perhaps more so than elsewhere. This is because scientific information is sketchy, the normal range of environmental variation is large, and the rate of change is fast and getting faster, due to such major perturbations such as environmental contamination and climate change. Hence, it is difficult to address many of the issues of northern Canada with an approach that starts with the assumptions that research can provide the necessary data and that the future can be predicted and controlled. The lessons of a half-century of fisheries management suggest that such abilities to predict and control are an illusion (Charles 2001).

### *Ocean Management under Conditions of Uncertainty: Resilience*

If the future is inherently unpredictable, what are the management options? Adaptive management, with its emphasis on feedback learning from an intervention and the use of that information in the design and implementation of the next intervention (Lee 1993), is one tool to deal with uncertainty. A second tool is the *precautionary principle*, “the management concept stating that in cases where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation” (MEA 2003, 213). There are a number of alternative statements of the precautionary principle; the *Oceans Act* (s. 30) defines it simply as “erring on the side of caution.”

The study of change is one of the objectives of this volume. The approach used in the volume does not deal either with social change (Kulchyski *et al.* 1999) or with environmental change alone (Clarke and Harris 2003); it deals with social-ecological system change. The concept of resilience is a promising tool for dealing with change because it provides a way of analyzing the dynamics of how systems persist, transform themselves, or collapse. *Resilience* is the capacity of a system to tolerate disturbance without collapsing into a qualitatively different state. Hence resilience thinking pays special attention to *thresholds*, the points where systems flip from one equilibrium state to another; and *surprises* that are said to occur when perceived reality departs qualitatively from expectation (Holling 1986). According to the Resilience Alliance (2004):

A resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in social systems has the added capacity of humans to anticipate and plan for the future.... Resilience as applied to ecosystems, or to integrated systems of people and the natural environment, has three defining characteristics:

- The amount of change the system can undergo and still retain the same controls on function and structure;
- The degree to which the system is capable of self-organization; and
- The ability to build and increase the capacity for learning and adaptation.

In brief, resilience is “the capacity of a system to tolerate impacts of drivers without irreversible change in its outputs and structure” (MEA 2003, 214). A *driver* is “any natural or human-induced factor that directly or indirectly causes a change in an ecosystem” (MEA 2003, 210). More generally, drivers or external drivers, such as climate change, are those key factors that cause change. The identification of such drivers in a complex system is an important step in resilience thinking. It can then lead to an exploration of policy options to build capacity to adapt to change (Folke *et al.* 2002; Berkes *et al.* 2003).

Uncertainty, resilience, and a number of other concepts used in this volume have something in common: they are all related to complex systems. A *complex system* is one that has a number of attributes not observed in simple systems, including non-linearity, uncertainty, scale, and self-organization (Levin 1999). In complex systems, an *emergent property* is a “phenomenon that is not evident in the constituent parts of the system but that appears when they interact in the system as a whole” (MEA 2003, 211). It is a property that cannot be predicted or understood simply by examining the system’s parts. For example, consciousness cannot be understood by examining neurons and their connections, but emerges as a property of the whole organism. Similarly, resilience is an emergent property of integrated social-ecological systems; it cannot be understood by examining the parts of the system but emerges out of the consideration of how a system tolerates the impacts of drivers, shocks, and change (Gunderson and Holling 2002).

## BACKGROUND AND CONTEXT

### *International Context*

Historically, marine and coastal waters have supported two major activities: harvesting of marine products and transportation. But as the use of coastal areas has intensified, a number of additional activities have become important, including aquaculture, oil and gas exploration, and tourism and recreation. Through stock depletion, habitat degradation and pollution, coastal resources have declined in Canada and throughout the world, while potentially competing uses have intensified, producing a major crisis in oceans management. By the late 1980s, it had become clear that ocean and coastal resources were not sustainable under the conventional approaches of managing single activities and species. New management approaches, embracing environmental considerations, were urgently needed to replace this sectoral approach.

National and international organizations have been looking for alternatives to conventional management. One of the alternative approaches is embodied in the Code of Conduct for Responsible Fisheries, initiated by the United Nations Food and Agriculture Organization (FAO). Although focusing on only one sector, the Code provides a comprehensive set of guidelines that includes the Precautionary Principle, ecosystem stewardship, dispute resolution, international law, and international trade in fish products. Taking another cut at the issue, the Lisbon Principles for sustainable ocean governance use a multi-sector, multi-species governance approach (Table 1.1). They provide a more comprehensive but a smaller set of guidelines than the Code, and include the principles of responsibility, scale-matching, precaution, adaptive management, full-cost allocation, and participatory decision making (Costanza *et al.* 1999).

The international trends are toward ecosystem approaches and integrated management, and the consideration of uses and impacts from a variety of activities at the ecosystem level. These trends are not confined to the area of oceans management. Similar trends are also apparent in international efforts for the sustainable management of forest ecosystems and agro-ecosystems. Several

**Table 1.1**  
THE LISBON PRINCIPLES FOR THE SUSTAINABLE GOVERNANCE OF  
THE OCEANS AND COASTAL AREAS

<i>Responsibility principle</i>	The responsibility of individuals or corporations to use environmental resources in an ecologically sustainable, economically efficient and socially just manner.
<i>Scale-matching principle</i>	The importance of assigning decision making to the scale of governance which has the most relevant ecological information, which considers ownership and actors, and which internalizes costs and benefits.
<i>Precautionary principle</i>	The need to take uncertainty about potentially irreversible environmental impacts into account.
<i>Adaptive management principle</i>	The requirement to continuously monitor social, economic, and ecological systems because they are dynamic and have some level of uncertainty.
<i>Full cost allocation principle</i>	The need to identify and allocate all internal and external costs and benefits (social and ecological) of alternative uses of environmental resources.
<i>Participation principle</i>	The importance of full stakeholder participation in the formulation and implementation of decisions about environmental resources.

international initiatives have been examining alternative management options for ecosystems, including the Millennium Ecosystem Assessment (MEA 2003), the projects carried out under the Resilience Alliance (Gunderson and Holling 2002; Berkes *et al.* 2003; Resilience Alliance 2004), and the projects under the banner of Sustainability Science (Kates *et al.* 2001).

Many of these international efforts are participatory in nature, engaging the knowledge of resource users, their livelihoods and well-being, adaptive learning, and institutions of self-governance. This is consistent with the shift from a narrow concern with “government” to a broader concern with “governance” that involves state, private, and civil society actors. Participatory approaches have become increasingly important in resource management in part because of our understanding of ecosystem complexity and uncertainty. The complex nature of larger environmental problems means that the “objective, disinterested technical expert” no longer has a central role. The age of expert management is over, replaced by participatory problem solving in which the risks of decision making are shared among users and managers (Ludwig 2001).

These international trends are consistent with those in Canada. A report of the Royal Society of Canada examined aquatic research in the Canadian North and suggested a pluralistic strategy incorporating all critical perspectives. To meet the broader range of societal expectations, research should not only address the perspectives of scientists, policy makers, and managers, but also the perspectives of civil society actors, including northern Aboriginal groups (RSC 1995). Such pluralistic science extends the range of scientific inquiry beyond the

conventional positivist, expert-knows-best science (Ludwig 2001) and creates space for the incorporation of locally generated knowledge. There has been local input into the research questions being asked, and the use of local knowledge, for example, in the areas of Arctic contaminants and climate change, in the Canadian North, and specifically in areas under Aboriginal land claims.

### *Context of Aboriginal Land Claims*

A number of treaties were signed in the late nineteenth through the early twentieth century, covering parts of the Canadian North but excluding much of the Northwest Territories, Yukon, Quebec, Labrador, and British Columbia. When the Supreme Court of Canada recognized the existence of Aboriginal title in the early 1970s, Canada's ownership of nearly half of the country's land mass came under question. A new era of Aboriginal claims through comprehensive land claims agreements was born, removing the uncertainty and opening the way for development.

The *James Bay and Northern Quebec Agreement* of 1975 was the first one to be signed. A number of agreements have been signed since, including the *Inuvialuit Final Agreement* of 1984, the *Gwich'in Comprehensive Land Claim Agreement* of 1992, the *Sahtu Dene and Metis Comprehensive Land Claim Agreement* of 1993, the *Yukon First Nations Umbrella Final Agreement* of 1993, and the *Nunavut Land Claims Agreement* of 1993. The last-mentioned agreement is the largest in terms of geographical area, and it resulted in the creation of the new Nunavut Territory amid much fanfare.

The new generation of treaties are referred to as comprehensive agreements because they spell out the nature of the arrangement between the Government of Canada and Aboriginal groups, under a large number of headings, including self-government powers, control over social services such as education and health, compensation payments, environmental assessment, land use regulations, and the management of land and resources.

For the purposes of this volume, the provisions for land and resource management are crucially important. Aboriginal control over the environment in the land claims areas is mostly in the form of joint jurisdiction, legally specifying Aboriginal rights and responsibilities. The formalization of power-sharing between the central and local/regional governments is deemed important, for example, by the Report of the Royal Commission on Aboriginal Peoples (RCAP 1996) because it means that indigenous hunting and other resource use rights are recognized by law and are (at least in theory) enforceable. Each of the comprehensive claims agreements has a section or sections that specify the sharing of jurisdiction for fisheries and wildlife management, creating co-management boards as the main instruments of resource management.

The various agreements establish institutional structures in the form of management boards and joint committees. For example, Article 5, Part 11 of the *Nunavut Land Claims Agreement* specifies the membership of the Nunavut Wildlife Management Board (a co-management body), the board's bylaws,

powers, duties, and responsibilities. Section 14 of the *Inuvialuit Final Agreement* establishes four co-management institutions, including one for fisheries and marine mammal management, the Fisheries Joint Management Committee (FJMC) (Fast *et al.* 2001). Some of the agreements specify the use of Aboriginal knowledge in the process of co-management. For example, the *Nunavut Land Claims Agreement* provides for an Inuit traditional knowledge study of the bowhead whale that has since been carried out (Hay *et al.* 2000).

Strong provisions for resource and environmental co-management, and some thirty years of experience in joint problem solving, set the North apart from other coastal regions of Canada. In striving toward ocean and coastal co-management under the *Oceans Act*, many of the key lessons are not from the east and west coasts but from the Arctic (NRTEE 1998). Formal co-management is probably not essential for successful joint problem solving (Kendrick 2000). However, the experience in the North shows that joint management strongly parallels the emergence of Aboriginal land claims (Berkes *et al.* 2001). Participatory management, not only in fisheries and wildlife, but in a range of areas including integrated management, protected areas, ecosystem and human health, contaminants research, environmental assessment, climate change, has followed increasing political power in the North.

### *Context of the Oceans Act and Canada's Oceans Strategy*

The context of the *Oceans Act* is of central significance for this volume, as it addresses the problems of the conventional sectoral management of coastal and ocean resources, and it directs the Department of Fisheries and Oceans to build partnerships with Aboriginal land claims agencies, coastal communities, and other stakeholders in the marine environment.

Canada is a maritime nation, with a coastline of 244,000 kilometres, and a continental shelf covering 3.7 million square kilometres. Canada's Exclusive Economic Zone extends 200 nautical miles from shore and is equivalent to over 30 per cent of Canada's total land mass (Canada's Oceans Strategy 2002). About seven million Canadians live in coastal communities, and many coastal communities depend on the ocean and its resources for their livelihoods. Canada's ocean-based industries generate over \$22 billion annually in direct economic activity and contribute over \$83 billion to international trade. The growth of coastal and oceans-related activities has resulted in imbalances and degradation of the marine environment. These changes are increasingly evident in biodiversity loss, water quality issues, habitat loss, and the introduction of invasive species.

The *Oceans Act* (Canada 1997) came into force in 1997. With this Act, Canada became the first country in the world with comprehensive oceans management legislation. The Act is an important model, not only to meet Canada's needs but also as an example for other countries (Hanson 1998). It describes oceans management as a collective responsibility that requires collaboration among all levels of government and stakeholders. The list of stakeholders identified

includes the private sector, Aboriginal organizations, and local communities. The strategy for implementing this responsibility was subsequently described in Canada's Oceans Strategy (2002). The three policy objectives of this strategy are: a) understanding and protecting the marine environment; b) supporting sustainable economic opportunities; and c) international leadership (Canada's Oceans Strategy 2002).

Understanding the marine environment is predicated on scientific understanding to delineate ecosystem boundaries, identify key ecosystem functions, develop risk assessment techniques, develop performance indicators, and assess the health of the ecosystem. With this information, governments and other stakeholders will be able to make informed decisions on steps that need to be taken to protect the marine environment.

Supporting sustainable economic opportunities also depends on a sound understanding of the marine environment. Some of the major industrial activities in the marine environment include fisheries, offshore energy and mineral resource development, and shipping. Sustainable management of Canada's oceans requires that the benefits of development and economic activity be balanced with the costs of lost economic opportunities and continued environmental degradation.

Finally, Canada has a responsibility to influence international priorities, decisions and processes, particularly as they pertain to sovereignty and security, and the provision of support for sustainable ocean resources. Canada's Oceans Strategy will continue to evolve as new knowledge is gathered, and as DFO, other agencies and stakeholders gain experience in oceans management (Canada's Oceans Strategy 2002). Over a period of time, the process of integrated management is expected to facilitate sound decision making at the level of large-scale ecosystems, multiple users and issues of marine environmental quality.

#### THE RESEARCH AGENDA LEADING TO THIS VOLUME

The subject of integrated management, complexity, and diversity of use is relevant to all three coastal areas of Canada, and so is the theme of responding and adapting to change. The North is a particularly suitable setting for studying integrated management with respect to change and complexity of coastal areas. Resource use activities in the North are less intensive than those in the Atlantic and Pacific, and resource use rights are relatively more clearly defined, due to Aboriginal land claims agreements. The coastal areas in the North, from the Inuvialuit Region to northern Quebec and more recently to Labrador, are covered by comprehensive land claims agreements. Wide-ranging participatory decision-making processes, spearheaded by the co-management provisions of these agreements evolving since the 1970s, offer lessons in the solution of Aboriginal rights and resource conflicts elsewhere.

To meet the objectives of learning from experience, analyzing change, and exploring policy options to build capacity to adapt to change, the Integrated Management Node of the Oceans Management Research Network organized



Lake Hazen, Quttinirpaaq National Park. Photo by Micheline Manseau, 2002.

itself into five working groups: Ecotourism and Development, Security and Sovereignty, Community-Based Monitoring, Community and Marine Ecosystem Health, and Resilience and Adaptation.

The Ecotourism and Development Working Group examined a diversity of activities in the coastal zone. For example, in the Mackenzie River estuary and the Beaufort Sea, activities include tourism (Notzke 1999), Inuvialuit beluga hunting (Dressler *et al.* 2001), and protected area planning (Mathias and Fast 1998). These potentially conflicting activities are occurring while the area is facing increasing pressures for oil and gas development, marine food web contamination (O'Neil *et al.* 1997; Jensen *et al.* 1997), and climate change (Krupnik and Jolly 2002). The Working Group examined potentially sustainable and non-extractive industries, such as ecotourism (Fennell 1998), and studied selected geographic areas, such as West Hudson Bay and the Beaufort Sea, building on previous work.

The Security and Sovereignty Working Group started with an agenda that included the exploration of the nature of security in the post-Soviet circumpolar north. A new understanding of security is concerned with international co-operation through such new institutions as the Arctic Council (Huebert 1999). An expanded notion of security may extend to environmental security and change. For example, climate change is related to the thinning of ice, reduction in the extent of ice cover, and the extension of navigation season in the Arctic. This, in turn, is related to resource development, environmental security and, given possible change of the international status of the Northwest Passage, sovereignty (CARC 2002).

The Community-Based Monitoring Working Group started with the premise that involving local and regional organizations to monitor the environment would help implement Canada's Oceans Strategy and foster good environmental stewardship in general. Such monitoring would be sensitive to local concerns; it would be based on local and traditional knowledge of the environment and local priorities in defining what is to be monitored and how (see the DVD). Indigenous approaches to monitoring (O'Neil *et al.* 1997) could enrich the set of tools used by Western science, and traditional environmental knowledge could complement scientific knowledge, as in the example of climate change (Riedlinger and Berkes 2001).

The Community and Marine Ecosystem Health Working Group brought together researchers and practitioners around issues of community health, vulnerability and food security, nutrition and local economies, contaminants, and marine environmental quality (MEQ). It explored the connection between environmental health and community health, the issue of marine environmental quality from an indigenous point of view, and food security in the Arctic in the face of environmental change. Persistent organic pollutants (POPs) in the food chain have had a major impact on the harvest of wild foods, especially Arctic marine mammals (Downie and Fenge 2003). What is at stake is Arctic self-reliance and a way of life based on the potentially sustainable use of local renewable resources (Doubleday 1996).

The Resilience and Adaptation Working Group started with a research agenda using the notion of complexity, drawing attention to the importance of uncertainty, scale, self-organization, and resilience (Levin 1999; Gunderson and Holling 2002). It discussed the basic issue of how to cope with and recover from the shocks and stresses of rapid change. Folke *et al.* (2002) have suggested that policies for resilience may involve building adaptive capacity through the creation of flexible multi-level governance systems that can learn from experience and generate knowledge to cope with change. As applied to the Arctic, this may mean strengthening local institutions, fostering international institutions, such as the Arctic Council, and building cross-scale linkages from the local level to the international.

Working groups included university academics, graduate students, government researchers and resource managers, and practitioners. A major strength of the project was its integration with the work of the Department of Fisheries and Oceans (DFO) Central and Arctic Region, and the development of a rich array of interlinking partnerships through the Oceans Management Research Network. Northern partners included Aurora College, the Canadian Arctic Resources Committee, Fisheries Joint Management Committee of the Inuvialuit Region, the Land Administration of the Kivalliq Association, the Nunavut Research Institute, and the Tuktu and Nogak Project. As the project progressed, there were additional linkages with the Gwich'in Renewable Resources Board, Lutsel K'e Dene First Nation, eastern Hudson Bay Inuit communities, and a number of additional groups that contributed to the DVD.

## PLAN OF THIS VOLUME

The plan follows the three objectives of the volume: (1) to research and learn from the experience in the area of integrated management, complexity, and diversity of resource use, (2) to apply critical thinking to the phenomena of change and the way in which societies respond and adapt to new challenges, and (3) to understand the dynamics of change and to explore policy options to build capacity to adapt to new challenges.

The first section, which contains Chapters 2 through 6, is about learning from the continuous process of sustainable use, development, and environmental protection. The chapters challenge the fragmentation inherent in the sectoral management approach and offer alternative ways of understanding issues. The first three chapters are broadly on the themes of food, human health, and environmental health. Chapters 2 (Myers *et al.*) and 3 (Thompson) focus on a key issue for northern Aboriginal people: the land-based economy, wild foods, and contamination. Chapter 2 discusses the importance of subsistence activities in the context of changing social, economic, and environmental conditions. Chapter 3 applies vulnerability analysis to northern communities that are at risk from rapid and sweeping changes. Chapter 4 (Cobb *et al.*) examines marine environmental quality and the way science and traditional knowledge looks at environmental quality indicators. The next two chapters turn to the integrated management experience in Canada's western Arctic. Chapter 5 (Fast *et al.*) examines one detailed case of public participation of integrated management in the Inuvialuit Region. Chapter 6 (Schlag and Fast) is about communication and education regarding marine stewardship, a key concept in Canada's Oceans Strategy. It examines stewardship and sustainability issues through the lens of a younger person.

Chapters 7 to 10, which make up the second section, seek to apply critical thinking to respond and adapt to new challenges. The first two chapters of the section examine the links between traditional ecological knowledge (or Inuit knowledge, IQ), scientific knowledge, indicators, and monitoring. Chapter 7 (Manseau *et al.*) examines the role and place of traditional knowledge in resource management. Chapter 8 (Parlee *et al.*) illustrates this theme by explaining indigenous concepts of ecosystem health indicators among the *Denesoline* of the Northwest Territories. Chapters 9 and 10 explore new ways of doing things in the area of northern economic development, focusing on eastern Hudson Bay. Chapter 9 (Lemelin) is about ecotourism and its development in the Churchill area. It focuses on wildlife tourism relating to polar bears and uses a chaos and complexity approach. Chapter 10 (Junkin) examines the experience with local economic development based on local wildlife resources, with a focus on caribou harvesting. It is a discussion of commercial (rather than subsistence) use of wildlife and its links to development.

The third section, encompassing Chapters 11 to 14, addresses the questions of strengthening local institutions and building linkages from the local level to the international, and the creation of flexible multi-level governance systems



that can learn from experience. Chapter 11 (Berkes *et al.*) sets the scene, and illustrates the idea, of building institutional linkages across levels of social and political organization, using examples from the Inuvialuit Region's Fisheries Joint Management Committee, narwhal and polar management, and persistent organic pollutants. The next three chapters deal with renewable resource and ocean management in innovative ways, building conceptual frameworks based, respectively, on ideas of adaptive co-management (Chapter 12, Kristofferson and Berkes), social learning (Chapter 13, Diduck *et al.*) and law, hierarchy, and resilience (Chapter 14, Bankes). Chapter 12 considers an Arctic char example from the Central Arctic, treating it as a case of adaptive management (learning-by-doing) and co-management under the *Nunavut Land Claims Agreement*. Chapter 13 turns to the experience of polar bear and narwhal management in the Nunavut Territory. The case is analyzed in terms of social learning from management successes and failures, getting at the dynamics of change. The notion of resilience is examined further in Chapter 14 and applied to law and the regulation of resource use in the Nunavut Territory.

The fourth and last section explores governance, policy, and future directions. Chapter 15 (Huebert) uses a current case of international dispute (the dispute over a small island between Canada and Greenland in the High Arctic) to explore new challenges in Arctic governance. Chapter 16 (Armitage and Clark) surveys a wide variety of material from the North and the South regarding northern research priorities. It synthesizes a great deal of thought regarding issues, priorities, and research directions for renewable resources and oceans management, and looks for common themes and areas of convergence. The chapter should be examined in concert with the DVD in the back pocket of the book, the DVD that provides northern perspectives from the people themselves. Finally, Chapter 17 (Huebert *et al.*) provides a conclusion for the volume.

The book provides a unique approach that links the health of people, communities, and ecosystems; it draws heavily on theories related to adaptive management and resilience; and it explores the recent experience of new institutions established under northern land claims agreements. The overall message is that Canada and the people of the North have crafted new and potentially workable approaches to resource management and sharing, co-management institutions, and ways of sharing knowledge and learning from local and traditional knowledge. Some of these lessons (for example, regarding co-management) are relevant for addressing renewable resource and ocean management issues elsewhere in Canada and internationally. As one of the referees pointed out, however, the message of the book is tempered by the apparent shortcomings of the overall governance system in dealing with the tremendous changes of the last five decades, but also with emerging problems such as climate change and youth who lack the connection to the land of elders.

Throughout the book, we integrate knowledge from social and management-oriented research that supports the health and sustainability of Canada's oceans and coastal communities. Although our theme is the North, we use the Oceans

Management Research Network as our wider forum to bring critical thinking and new perspectives from all three coasts and the international experience. Linking research to management and policy applications breaks the ice, connecting academics, government managers, policy-makers, Aboriginal groups, and industry – groups that have been operating as solitudes for a long time. The new policy environment under the *Oceans Act* has the potential to facilitate a sharing of knowledge and understanding among the solitudes, leading to a shared vision to address new challenges.

#### REFERENCES

- ACIA. 2004. Arctic Climate Impact Assessment. Arctic Council. <http://www.acia.uaf.edu/>
- Ayles, B.G., R. Bell and H. Fast. 2002. The Beaufort Sea Conference 2000 on renewable marine resources of the Canadian Beaufort Sea. *Arctic* 55 (suppl.): iii–v.
- Berkes, F. 1999. *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. Philadelphia and London: Taylor & Francis.
- Berkes, F., J. Colding and C. Folke, eds. 2003. *Navigating social-ecological systems: Building resilience for complexity and change*. Cambridge: Cambridge University Press.
- Berkes, F., and C. Folke, eds. 1998. *Linking social and ecological systems. Management practices and social mechanisms for building resilience*. Cambridge: Cambridge University Press.
- Berkes, F., P.J. George, and R.J. Preston. 1991. "Co-management." *Alternatives* 18(2): 12–18.
- Berkes, F., J. Mathias, M. Kislalioglu, and H. Fast. 2001. "The Canadian Arctic and the *Oceans Act*: The development of participatory environmental research and management." *Ocean & Coastal Management* 44: 451–69.
- CARC. 2002. "On thinning ice." *Northern Perspectives* 27(2). <http://www.carc.org/>
- Canada. 1997. *Oceans Act*. S.C. 1996, c. 31. In force 31 January 1997.
- Canada's Oceans Strategy. 2002. Our oceans, our future. Policy and operational framework for integrated management of estuarine, coastal and marine environments of Canada. Ottawa: Fisheries and Oceans Canada.
- Charles, A. 2001. *Sustainable fishery systems*. Fish and Aquatic Resources Series 5. Oxford: Blackwell Science.
- Cicin-Sain, B., and R.W. Knecht. 1998. *Integrated coastal and ocean management*. Washington, DC: Island Press.
- Clarke, A. and C.M. Harris. 2003. "Polar marine ecosystems: Major threats and future change." *Environmental Conservation* 30: 1–25.
- Costanza, R., F. Andrade, P. Antunes *et al.* 1999. "Ecological economics and sustainable governance of the oceans." *Ecological Economics* 31(2): 171–87.
- Doubleday, N.C. 1996. "Commons' concerns in search of uncommon solutions: Arctic contaminants, catalyst of change?" *The Science of the Total Environment* 186: 169–79.
- Downie, D., and T. Fenge, eds. 2003. *Northern lights against POPs: Combatting toxic threats in the Arctic*. Montreal: McGill-Queen's University Press.

- Dressler, W., F. Berkes, and J. Mathias. 2001. "Beluga hunters in a mixed economy: Managing the impacts of nature-based tourism in the Canadian Western Arctic." *Polar Record* 37: 35–48.
- Eddy, S., H. Fast, and T. Henley. 2002. "Integrated management planning in Canada's northern marine environment: Engaging coastal communities." *Arctic* 55: 291–301.
- Fast, H., and F. Berkes. 1998. "Climate change, northern subsistence and land based economies." In *Canada country study: National cross-cutting issues*, vol. 8, edited by N. Mayer and W. Avis. Downsview: Environment Canada, 205–26.
- Fast, H., J. Mathias, and O. Baniyas. 2001. "Directions toward marine conservation in Canada's Western Arctic." *Ocean & Coastal Management* 44: 183–205.
- Fennell, D.A. 1998. "Ecotourism in Canada." *Annals of Tourism Research* 25: 231–235.
- Folke, C., S. Carpenter, T. Elmqvist et al. 2002. *Resilience for sustainable development: Building adaptive capacity in a world of transformations*. Paris: ICSU, Rainbow Series No. 3. <http://www.sou.gov.se/mvb/pdf/resiliens.pdf>
- Gunderson, L.H., and C.S. Holling, eds. 2002. *Panarchy. Understanding transformations in human and natural systems*. Washington, DC: Island Press.
- Hanson, A.J. 1998. "Sustainable development and the oceans." *Ocean & Coastal Management* 39: 167–77.
- Hay, K., D. Aglukark, D. Igutsaq, J. Ikkidluaq, and M. Mike. 2000. Final Report of the Inuit Bowhead Knowledge Study. Iqaluit: Nunavut Wildlife Management Board.
- Holling, C.S. 1986. "The resilience of terrestrial ecosystems: local surprise and global change." In *Sustainable development of the biosphere*, edited by W. C. Clark and R. E. Munn. London: Cambridge University Press, 292–317.
- , ed. 1978. *Adaptive environmental assessment and management*. New York: Wiley.
- Huebert, R. 1999. "Canadian Arctic security issues." *International Journal*, Spring: 203–29.
- INAC 2003. *Canadian Arctic contaminants assessment report II*. Ottawa: Indian and Northern Affairs Canada.
- Jensen, J., K. Adare, and R. Shearer, eds. 1997. *Canadian Arctic contaminants assessment report*. Ottawa: Indian and Northern Affairs Canada.
- Jentoft, S. 1999. "Legitimacy and disappointment in fisheries management." *Marine Policy* 24: 141–148.
- Jentoft, S., B.J. McCay, and D.C. Wilson. 1998. "Social theory and fisheries co-management." *Marine Policy* 22: 423–436.
- Kates, R.W., W.C. Clark, R. Corell et al. 2001. "Sustainability science." *Science* 292: 641–42.
- Kendrick, A. 2000. "Community perceptions of the Beverly-Qamanirjuaq Caribou Management Board." *Canadian Journal of Native Studies* 20: 1–33.
- Kooiman, J., ed. 1993. *Modern governance: New government – society interactions*. London: Sage.
- Krupnik, I., and D. Jolly, eds. 2002. *The earth is faster now: Indigenous observations of Arctic environmental change*. Fairbanks AK: Arctic Research Consortium of the United States.
- Kulchyski, P., D. McCaskill, and D. Newhouse, eds. 1999. *In the words of the elders: Aboriginal cultures in transition*. Toronto: University of Toronto Press.
- Lee, K.N. 1993. *Compass and gyroscope: Integrating science and politics for the environment*. Washington, DC: Island Press.
- Levin, S.A. 1999. *Fragile dominion: Complexity and the commons*. Reading, MA: Perseus Books.
- Ludwig, D. 2001. "The era of management is over." *Ecosystems* 4: 758–64.
- Mathias, J., and H. Fast. 1998. Options for a marine protected area in the Inuvialuit Settlement Region: Focus on beluga habitat. Inuvik: Report for the Inuvialuit Game Council on Behalf of the Fisheries Joint Management Committee.
- McCay, B.J., and S. Jentoft. 1996. "From the bottom up: Issues in fisheries management." *Society & Natural Resources* 9: 237–50.
- MEA. 2003. *Ecosystems and human well-being: A framework for assessment*. Millennium Ecosystem Assessment. Washington, DC: World Resources Institute/ Island Press.
- NSERC and SSHRC. 2000. *From crisis to opportunity: Rebuilding Canada's role in northern research*. Final Report to NSERC and SSHRC from the Task Force on Northern Research. Ottawa: Minister of Public Works and Government Services.
- NRTEE. 1998. *Sustainable strategies for oceans: A co-management guide*. Ottawa: National Round Table on the Environment and the Economy.
- Newton, S.T., H. Fast, and T. Henley. 2002. "Sustainable development for Canada's arctic and subarctic communities: A backcasting approach to Churchill, Manitoba." *Arctic* 55: 281–90.
- North, D. C. 1994. "Economic performance through time." *American Economic Review* 84: 359–68.
- Notzke, C. 1999. "Indigenous tourism development in the Arctic." *Annals of Tourism Research* 26: 55–76
- OMRN. 2004. Ocean management research network. <http://www.omrn.ca/>
- O'Neil, J., B. Elias, and A. Yassi. 1997. "Poisoned food: Cultural resistance to the contaminants discourse." *Arctic Anthropology* 34: 29–40.
- Ostrom, E. 1990. *Governing the commons. The evolution of institutions for collective action*. New York: Cambridge University Press.
- Pierre, J.B., and G. Peters, eds. 2000. *Governance, politics and the state*. Basingstoke: Macmillan.
- Pinkerton, E., ed. 1989. *Co-operative management of local fisheries*. Vancouver: UBC Press.
- RCAP. 1996. *Report of the Royal Commission on aboriginal peoples*. Vol. 2, Part 2. Ottawa: Supply and Services Canada.
- RSC. 1995. *Aquatic science in Canada. A case study of research in the Mackenzie Basin*. Vancouver: The Aquatic Science Committee of the Royal Society of Canada.
- Resilience Alliance. 2004. "What is resilience?" [http://www.resalliance.org/ev\\_en.php](http://www.resalliance.org/ev_en.php)
- Rhodes, R.A.W. 1997. *Understanding governance: policy networks, governance, reflexivity and accountability*. Buckingham, UK: Open University Press.
- Riedlinger, D., and F. Berkes. 2001. "Contributions of traditional knowledge to understanding climate change in the Canadian Arctic." *Polar Record* 37: 315–28.
- Wenzel, G.G. 1991. *Animal rights, human rights: Ecology, economy and ideology in the Canadian Arctic*. Toronto: University of Toronto Press.
- Wiber, M., F. Berkes, A. Charles, and J. Kearney. 2004. "Participatory research supporting community-based fishery management." *Marine Policy* (28):459–68).
- Young, O. 2002. *The institutional dimensions of environmental change: Fit, interplay and scale*. Cambridge, MA: MIT Press.