PART TWO

MARINE SPATIAL PLANNING IN THE ARCTIC:

A first step toward ecosystem-based management

A technical report of the Aspen Institute Dialogue and Commission on Arctic Climate Change

Prepared by Charles N. Ehler, Ocean Visions

Executive Summary

Driven by outside economic forces and the effects of climate change, the Arctic, its ecosystems, and its people are faced with substantial change ranging from the loss of ice-dependent species, more intense uses of the Arctic resources, including space, and the loss of natural services provides by Arctic ecosystems. International and national interests in mitigating and adapting to these changes has led to increased calls to manage human activities through an ecosystem-based approach. Marine spatial planning has emerged as an operational approach to translate this concept into management practice in many marine areas around the world.

Marine spatial planning is a public process of analyzing and allocating the spatial and temporal distribution of human activities to specific marine areas to achieve ecological, economic, and social goals and objectives that are specified through a political process. MSP is integrated, future-oriented, participatory, adaptive, ecosystem-based, and area-based. The process of MSP answers three simple questions: (1) where are we today?; (2) where do we want to be?; and (3) how do we get there?

Effective marine spatial planning is a continuous process, not a one-time "master plan", and can only be successful through a highly-participatory networked governance approach, i.e., all who have an interest in the governance of the Arctic are included in all stages throughout the process—from setting goals and specifying measurable objectives, through implementation, monitoring, and evaluation. Monitoring and evaluation of the performance of the MSP process is critical. The performance of management plans and their specific measures should be monitored, evaluated and reported to all stakeholders and rights-holders in a transparent manner.

MSP can provide a variety of environmental, economic and social benefits ranging from identifying biologically and ecologically important areas and identifying the cumulative effects of human activities on the environment, to creating certainty for business investment decisions and streamlining the process to creating new opportunities for local community and citizen participation, including indigenous peoples.

Marine spatial planning is already in place in one Arctic country—Norway has implemented an integrated management plan, including spatial and temporal management measures, for its part of the Barents Sea. The plan integrates previously separate management regimes for fisheries, shipping, oil and gas, and nature conservation. Canada has developed an integrated management plan for its part of the Beaufort Sea that will develop a marine spatial plan as one of its future actions. In the US, the federal government has developed a marine spatial planning framework for its entire exclusive economic zone, including its Arctic seas.

Alternatives for moving MSP forward in the Arctic are identified: (1) a "business as usual", incremental approach; (2) a "bilateral" approach between national governments; (3) a "hot spot" approach; (4) an Arctic-wide approach among national governments; and (5) an Arctic-wide approach beyond national governments.

Introduction

During the course of the deliberations of the Aspen Commission on Arctic Climate Change, marine spatial planning (MSP) assumed a prominent role as a potential tool for meeting natural resource management challenges in the Arctic in the face of growing pressure from various industries, notably energy, minerals and fisheries.

In some ways the Arctic is undoubtedly unique. Yet the changes taking place there will have significant implications for the global community, and the challenges of adaptation for communities and living resources in this remote region may provide important lessons for the future of other regions as well. It became clear to the Commission during their fact-finding missions and deliberations that the scale of change in the region, if not addressed in a suitably comprehensive manner as represented by the MSP approach, would so seriously degrade the Arctic's living systems and so transform the region as to make incremental efforts at adaptation futile.

In parallel with gathering information and views about the changes already underway in the Arctic, the Commission and its working group began a process of reviewing the current institutional framework for management of natural resources in the Arctic, and of exploring models of management approaches that have shown promise in other areas. In reviewing various approaches to the management of marine systems over the past half-century, the participants in the dialogue became convinced that sector-based regulation as traditionally practiced has not shown success in protecting the integrity of marine ecosystems, and would not likely prevent the degradation of the Arctic. With the able assistance of a number of experts, including Jane Lubchenco (now the Administrator of the U.S. National Oceanic and Atmospheric Administration (NOAA)) and Andy Rosenberg (Senior Vice-President for Science and Knowledge at Conservation International), the Commission explored models of integrated marine management that could be applied in the Arctic.

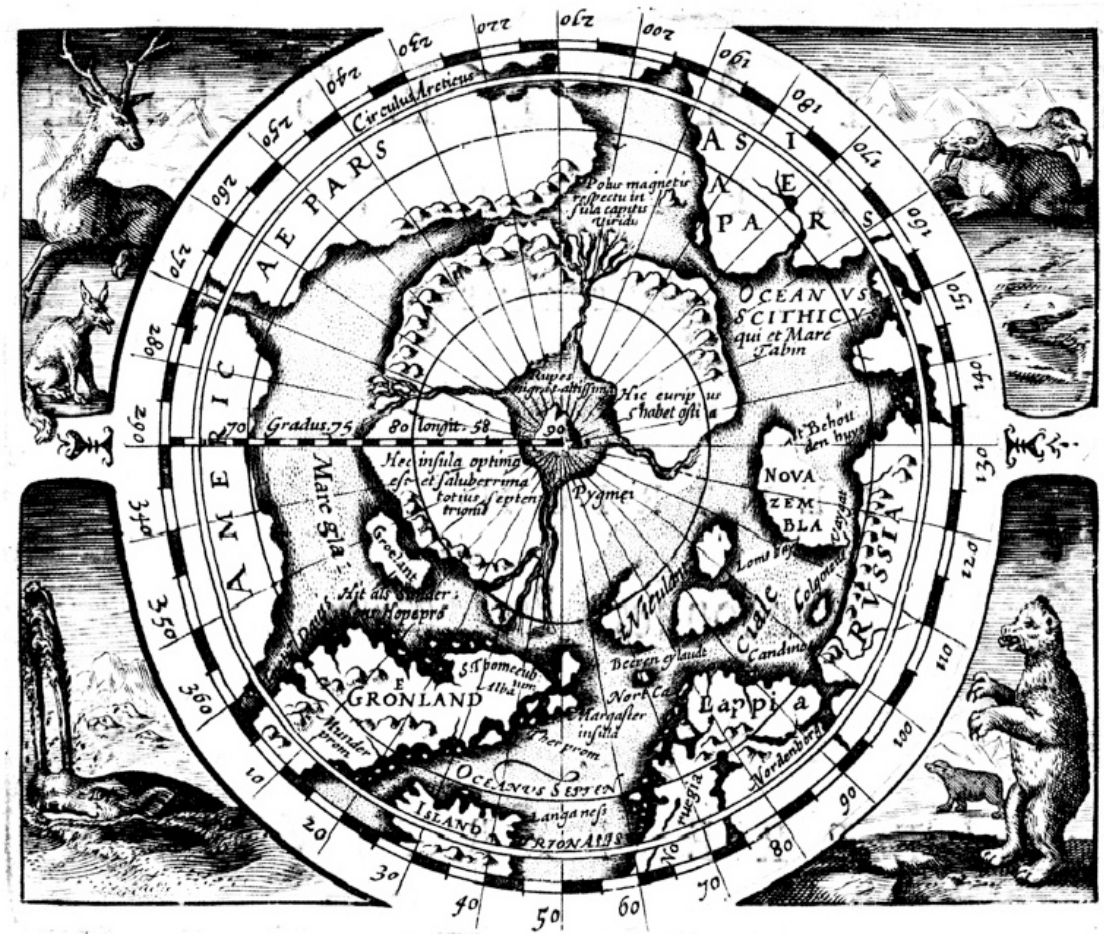
Dialogue participants recognized that most of the new economic activity projected in the Arctic maritime environment will take place in the coastal zones surrounding the high Arctic, and that the resources of these coastal areas are increasingly fragile and stressed by the direct impacts of climate change. They focused on the potential for ecosystem-based management, and integrated marine spatial planning, to ensure rational and sustainable use of this fragile resource base. A second feature of this planning approach further heightened its attractiveness—its accessibility to, and in fact, its reliance on the expert contribution of communities and local stakeholders. It is a premise of this report that the conservation and sustainable use of the resources of the Arctic marine environment should be conducted in a manner that benefits the local communities of the region, and most particularly the traditional communities that have co-existed in the Arctic environment for thousands of years. There is a clear need for traditional and indigenous communities to have a voice in decisions affecting their future, and it is hoped that an integrated planning approach such as the one outlined in this paper will contribute a useful framework for this participation in the future.

Context and Perspective

While parts of the Arctic have been inhabited for over 10,000 years, many parts have never been inhabited. If any of the early inhabitants drew maps, none have survived. Until 500 years ago, the Arctic was unknown to Western man—simply a white space on maps. Total open water, all land, land with rivers and magnetic mountains—all were conceptions of the Arctic. [1] A voyage by Sebastian Cabot to somewhere in the Davis Strait in 1508-09 was probably responsible for the first depiction of a Northwest Passage to the riches of China on a map. Cabot, in 1553 the Pilot Major of England, also recommended that the English search northeast for a passage to China. Over the next 450 years attempts in both directions by the English, Spanish, Portuguese, and Dutch failed. The Northwest Passage (Oslo, Norway, to Nome, Alaska) was finally achieved in 1905 by the Norwegian explorer Roald Amundsen in a refitted herring boat, the Gjoa. The first Northeast Passage (Vladivostok to Arkhangel'sk) was made by two Russian ice-breaking survey ships only in 1915.

Our knowledge of the Arctic has evolved rapidly in the last 100 years as technology has advanced. Theories of an ice-free open polar sea did not die until the 1870s, yet these were still as much guesswork as 16th century theories of an ice-free Arctic and a clear passage over the Pole. Now, because of climate change, the reality of an ice-free Arctic may not be so far away.

Figure 1. *Petrus Bertius, 1618. North Polar Regions (note that four rivers flow out from a polar mountain)*



The Need for an Ecosystem-based Approach to Marine Planning and Management in the Arctic

The Arctic—all 30 million square kilometers of it—is one of the most pristine, yet vulnerable, ecosystems in the world. [2] Protected by its historic inaccessibility, harsh environment, comparatively small human population, and slow rate of economic development, the Arctic has been relatively less affected by human activity than most other regions of the earth.

This is about to change. Driven by outside economic forces and the effects of climate change, the Arctic, its ecosystems, and its people are all faced with substantial change ranging from the loss of ice-dependent species, more intense human uses of the Arctic, and the loss of natural services provided by Arctic ecosystems. As the Arctic warms, its ice melts, and its ecosystems change, as technology improves, and as the demand for natural resources increases, opportunities open up for industry—shorter shipping routes, virgin fishing grounds, new areas of oil and gas exploration and development, and new places for commercial tourism. As well as business opportunities, these changes represent new risks to the Arctic's unique natural environment and to the people who now live and work in the Arctic. Once these activities begin in the Arctic, it will be difficult for policy makers and managers to put limits on them.

The failure of sectoral management in marine areas everywhere is long known and well documented. Before the last century, the oceans were used mainly for two purposes: navigation and fishing. Conflicts between uses were few and far between except around some ports. Traditionally marine management has been characterized as a sector-by-sector approach. Fisheries were managed separately from oil and gas development, which in turn was managed separately from marine navigation, despite real conflicts between uses. [3] Single-sector management has often failed to resolve these user-user conflicts, rarely dealing explicitly with trade-offs among uses, and even more rarely dealing with conflicts between the cumulative effects of multiple uses and the marine environment. New uses of marine areas including renewable energy, offshore aquaculture, and marine tourism, as well as the designation of new marine protected areas, have only exacerbated the situation. Single-sector management has also tended to reduce and dissipate the effect of enforcement at sea because of the scope and geographic coverage involved and the environmental conditions in which monitoring and enforcement have to operate. In sharp contrast to the land, little "public policing" of human activities takes place at sea.

As a consequence marine ecosystems around the world are in trouble. Both the severity and scale of impact on marine ecosystems—from climate change, biodiversity loss, pollution, development, habitat loss, and fragmentation—are increasing, with no corner of the world left untouched.[4,5] Awareness is growing that the ongoing degradation in marine ecosystems is in large part a failure of governance.[6,7] Many scientists and policy analysts have advo¬cated reforms centered on the idea of ecosystem-based management (EBM). [8] To date, however, a feasible method for translating this concept into an operational management practice has not emerged.

Many recommendations for an ecosystem-based approach to marine management in the Arctic already exist. In fact, in most Arctic countries are working to implement ecosystem-based management of their marine areas. The Arctic Council has repeatedly called for an ecosystem-based approach to marine management. For example, in its 2004 Arctic Marine Strategic Plan ecosystem-based management is defined as an approach that "...requires that development activities be coordinated in a way that minimizes their impact on the environment and integrates thinking across environmental, socio-economic, political

and sectoral realms." The key features of this approach includes a consideration of multiple scales, a long-term perspective, the recognition that humans are an integral part of ecosystems, an adaptive management perspective, and a concern for sustaining production and consumption potential for goods and services. [9]

The Best Practices in Ecosystem-based Oceans Management in the Arctic (BePOMAr) Project of the Arctic Council has summarized the practices that Arctic countries have used to apply an ecosystems-based management approach to marine management. [10] The conclusions of that project include:

- Flexible application of effective ecosystem-based oceans management;
- Decision-making must be integrated and science based;
- National commitment is required for effective management;
- Area-based approaches and trans-boundary perspectives are necessary;
- Stakeholder and Arctic resident participation is a key element; and
- Adaptive management is critical.

Successful ocean governance requires a capacity to deal with human and natural systems that are complex, heterogeneous, dynamic, and prone to nonlinear and often abrupt changes. This is not simply a matter of improving the management of fisheries, paying more attention to the effects of vessel routing, or managing the effects of increased tourism. What is needed is a "systems approach" that facilitates thinking about interactions among multiple natural and human drivers and directs attention to emergent and cumulative impacts from these interactions. To be successful under these conditions, governance systems must be able to monitor changes closely, adjust existing management action to changing circumstances, and cope with relatively high levels of uncertainty, i.e., they must engage in adaptive management. Feedback—in the form of monitoring information that informs management about the reactions of the managed systems to external influences and management measures—is critical to adaptation and success under these conditions. [11]

The thinking that underlies marine spatial planning is one that emphasizes spatially and temporally explicit activities and dynamic processes. It recognizes the heterogeneous distribution of marine species, habitats, and human activities in the sea; resources and resource uses occur in "places." Some are fixed in place, e.g., oil deposits; some are mobile, e.g., fish populations. Some places are more important than others. Relatively dense information about the direct effects of human actions upon the interacting elements of the system, whether measured or not, is likely to be found near the occurrence of those activities. Over time, the effect of any activity spreads and often dissipates and, consequently, becomes more difficult to isolate and measure. Management that operates at the scale where dense and direct information about the impact of a particular activity is available enhances the prospect of capturing useful and less costly feedback. If carried out at the same time the management agency is monitoring other elements of the system, such feedback becomes even more valuable. Such improvements can lead to more rapid adaptation and more effective learning about how to govern. [12]

Box 1. A Definition of Ecosystem-based Management

Offshore Oil and Gas Guidelines (2009 version; ANNEX A - Definition of the Arctic)

Ecosystem-based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors.

Specifically, ecosystem-based management:

- emphasizes the protection of ecosystem structure, functioning, and key processes;
- is place-based in focusing on a specific ecosystem and the range of activities affecting it;
- explicitly accounts for the interconnectedness within systems, recognizing the importance of interactions between many target species or key services and other non-target species;
- acknowledges interconnectedness among systems, such as between air, land and sea; and
- integrates ecological, social, economic, and institutional perspectives, recognizing their strong interdependences.

Scientific Consensus Statement on
Marine Ecosystem-Based Management, 2005 [13]

An integrated, ecosystem-based management approach has been identified in many marine places as an appropriate evolution to address problems caused by today's incremental, single-sector approach to marine management. However, examples of practical applications of an ecosystem-based approach are elusive. How to begin is the first challenge.

As mentioned, several Arctic nations have already begun to implement an ecosystem-based approach to their marine waters. [14] Both Norway in the Barents Sea and Canada in the Beaufort Sea have developed integrated management plans that employ an ecosystem-based approach (see later section of this report). A policy directive of the United States instructs appropriate federal departments to "pursue marine ecosystem-based management in the Arctic." [15] A more recent initiative by the U.S. to develop and implement an ocean policy and framework for marine spatial planning throughout its exclusive economic zone also supports adoption of "ecosystem-based management as a guiding principle, acknowledging regional differences, and practicing adaptive management." It also concludes that "human activities that may affect ocean, coastal, and Great Lakes ecosystems should be managed using ecosystem-based management and adaptive management, through an integrated framework that accounts for the interdependence of the land, air, water, ice, and the interconnectedness between human populations and these environments. Management should include monitoring and have the flexibility to adapt to evolving knowledge and understanding, changes in the global environment, and emerging uses." [16]

However, a large gap exists between the concepts of ecosystem-based management and its implementation. [17] Scientists characterize EBM differently than governmental agencies planning to manage coastal and marine ecosystems. In practice management objectives and measures tend to miss critical ecological and human factors emphasized in the academic

literature. While managers are beginning to put some EBM principles into practice, implementation needs to be much more thorough. The degree to which specific EBM criteria are translated from definitions to management actions is extremely variable in reality. In both science and management we lack a clear approach or toolkit for implementing EBM. Tools for traditional, single-species management are available and widely used, but explicit approaches are still needed to successfully conduct EBM. *Marine spatial planning is one important, practical approach to begin implementing EBM.*

What Is Marine Spatial Planning?

Marine spatial planning (MSP) is a practical way to create and establish a more rational approach to the human use of marine space and the interactions between its uses, to balance demands for development with the need to protect marine ecosystems, and to achieve social and economic objectives in an open and planned way.

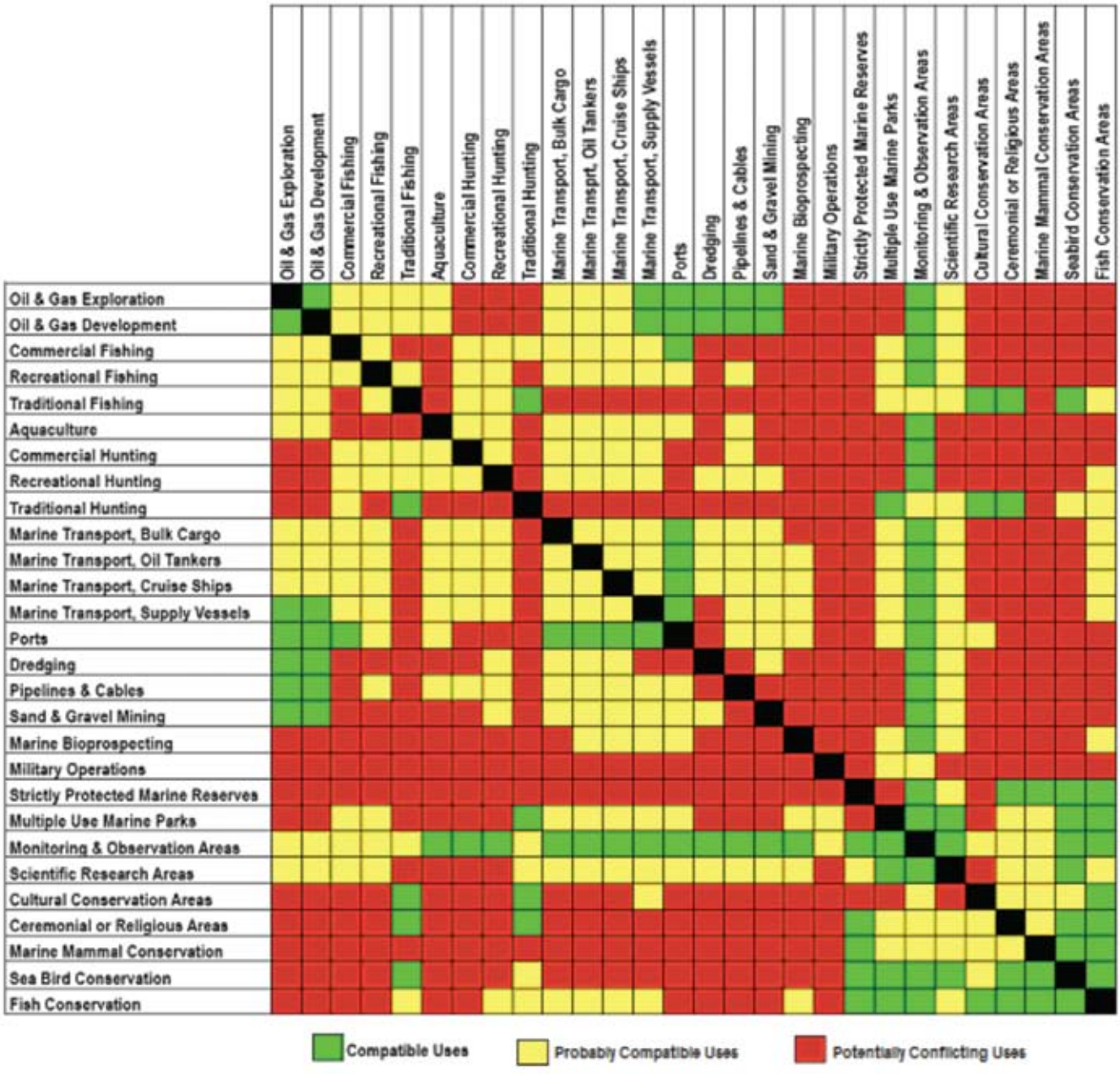
Recent research has estimated the cumulative impacts of human offshore activities on the marine environment at a global scale and concluded that almost half of the world's oceans are strongly affected by multiple stresses. Highly affected regions include the Eastern Caribbean, the North Sea, and Japanese waters. Only a few areas around the North and South poles remain relatively unaffected by human activities. Negative cumulative impacts of human activities on coastal and marine ecosystems would probably be higher if historical effects, unreported extraction, recreational use (including fishing), disease, and point-source pollution were incorporated in future measurements. [18]

Ocean resources are limited both in space and abundance and the pressure on the marine environment, resulting from an expansion of existing uses and the rise of new ones, has been detrimental to many places. Essentially, increased activity in the marine environment has led to two important types of conflict. First, not all uses are compatible with one another and are competing for ocean space or have adverse effects on each other (*user vs. user conflicts*). Numerous examples exist of conflicts between ocean users both globally and locally and include, for example, incompatibilities between the fast-growing, billion-dollar submarine cable industry and fisheries, causing damage to, or loss of, fishing gear or huge repair costs and lost revenues for cable disruptions. [19] Other user conflicts include wind farms located near shipping routes or traffic separation schemes, causing high risks of collisions and loss of cargo. In New Zealand, spatial conflicts have arisen from legislative obligations to uphold the historic and indigenous rights of fishers with more recent obligations toward nature conservation. [20]

Spatial use conflicts also occur within one particular use and refer, for example, to the use of different gear types for fisheries in certain areas, or the competition over use of space between commercial, recreational, and subsistence fisheries. Studies in California have illustrated that new commercial ocean activities will only exacerbate conflicts between users. [21]

Second, not all uses are compatible with the needs of a healthy and sustainable environment and cause conflicts between users and the environment (*user vs. environment conflicts*). Too often, ocean uses are located in sensitive biological and ecological areas with little or no consideration of their impact. Many scientific studies document the degradation of the world's oceans, the decline of marine ecosystems, and the collapse of important fish species, illustrating that this is increasingly impairing the ocean's ability to produce the goods and services essential for life on Earth. [22]

Figure 2. *A Preliminary Identification of Potential Use Compatibilities and Conflicts in the Arctic* [23]



Many of the conflicts described above can and have been avoided or reduced through marine spatial planning by influencing the location of human activities in space and time. During recent years, marine spatial planning has become increasingly important as a way to make ecosystem-based management[24] a reality in coastal and marine environments.[25] While concepts regarding ecosystem-based management are often considered too broad, too abstract and too complex to enable effective implementation,[26] MSP has proven to be a way to make this process more tangible.[27] Innovative and successful initiatives

Box 2. A Definition of Marine Spatial Planning

Marine spatial planning is a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social goals and objectives that are usually specified through a political process. Its characteristics include:

1. integrated across economic sectors and governmental agencies, and among levels of government;
2. strategic and future-oriented, focused on the long-term;
3. participatory, including stakeholders actively in the process;
4. adaptive, capable of learning by doing;
5. ecosystem-based, balancing ecological, economic, social, and cultural goals and objectives toward sustainable development and the maintenance of ecosystem services;
6. place-based or area-based, i.e., integrated management of all human activities within a spatially demarcated area identified through ecological, socio-economic, and jurisdictional considerations.

Ehler and Douvere, 2007. Visions for a Sea Change [28]

toward the development and implementation of ecosystem-based marine spatial planning have been taken in both highly-used marine areas such as the North Sea, the Baltic Sea, the coastal seas of China, and in large ocean areas such as the exclusive economic zones of Canada, Australia and New Zealand.

It is important to remember that we can only plan and manage human activities in marine areas, not marine ecosystems or components of ecosystems. We can allocate human activities to specific marine areas *by objective*, e.g., development areas or conservation areas, or *by specific uses*, e.g., oil and gas development, offshore aquaculture, or sand and gravel mining.

MSP does not produce a one-time plan. It is a continuing, iterative process that learns and adapts over time. It is comprised of three continuing processes:

1. **Plan-making**, or generating and adopting one or more integrated plans or policy frameworks that have strong spatial dimensions, for the protection, enhancement, and sustainable use of development of a marine area and its resources;
2. **Plan implementation**, including the execution of programmed works or investments, enabling change, encouraging improvement, and through regulation and enforcement of proposed changes and ongoing activities in, on, or over and under the sea, in accordance with the plans; and
3. **Monitoring and evaluation of plan performance**, or assessing the effectiveness of the plans, their time scales and implementation incentives, considering ways in which they need to be improved and establishing review and adaptation procedures.[29]

Box 3. Ten Steps of Marine Spatial Planning

The development and implementation of MSP involves a number of steps, including:

1. Identifying need and establishing authority;
2. Obtaining financial support;
3. Organizing the process through pre-planning;
4. Organizing stakeholder participation;
5. Defining and analyzing existing conditions;
6. Defining and analyzing future conditions;
7. Preparing and approving the spatial management plan;
8. Implementing and enforcing the spatial management plan;
9. Monitoring and evaluating performance; and
10. Adapting the marine spatial management process.

Ehler and Douvere, 2009 [30]

These 10 steps are not simply a linear process that moves sequentially from step to step. Many feedback loops should be built into the process. For example, goals and objectives identified early in the planning process are likely to be modified as costs and benefits of different management measures are identified later in the planning process. Analyses of existing and future conditions will change as new information is identified and incorporated in the planning process. Stakeholder participation will change the planning process as it develops over time. Planning is a dynamic process and planners (and stakeholders) have to be open to accommodating changes as the process evolves over time. Comprehensive MSP provides an integrated framework for management that provides a guide for, but does not replace, single-sector management. For example, MSP can provide important contextual information for guiding marine protected area management or for fisheries management, but does not replace it.

MSP answers three simple questions:

- **Where are we today?** What are the baseline conditions?
- **Where do we want to be?** What are the alternative spatial scenarios of the future? What is the desired vision?
- **How do we get there?** What spatial management measures move us toward the desired future?

MSP does not address all of the management measures that would be included in a comprehensive, integrated marine management plan—*only those management measures that specify where in space and when in time human activities should occur*. Other categories of management measures (Table 1) include:

- **Input measures**, or measures that specify the inputs to human activities in marine areas, such as limitation on the number of boats allowed to fish in a particular area;
- **Process measures**, or measures that specify the nature of the production process of human activities in marine areas, such as standards for "best environmental practices", the labeling or certification of the products and services of sustainable human activities, and codes of conduct; and
- **Output measures**, or measures that specify the outputs of human activities in marine areas, such as limitations on the amount to gravel extracted for the construction of artificial islands or causeways.

Table 1. Examples of Marine Management Measures

Input Measures	Output Measures
Management measures that specify the inputs to human activities in marine areas	Management measures that specify the outputs of human activities in marine areas
Limitation on fishing activity or capacity, e.g., number of vessels allowed to fish in the marine area	Limitation of the amount of pollutants discharged to a marine area from industrial sources, both onshore and offshore
Limitation on shipping vessel size or horsepower	Limitation on ballast water discharges, including alien species and pathogens, from marine transportation
Limitation on number of cruise ships operating in the marine area	Limitation on allowable catch within the marine area
Ship construction standards, e.g., special standards for vessels operating in Arctic waters	Limitation on allowable by-catch within a marine area
Other measures	Limitation on sand and gravel extraction within the marine area
	Other measures
Process Measures	**Spatial/Temporal Measures**
Management measures that specify the nature of the production process of human activities in marine areas	Management measures that specify where in space and when in time human activities can occur in marine areas or zones
Specification of fishing gear, mesh size, etc.	Specification of areas or zones for specific activities, e.g., commercial fishing, indigenous fishing and hunting, oil and gas development, sand extraction, marine transportation, cables and pipelines, military operations—all of the time
Specification of "best available technology" or "best environmental practice"	Specification of areas or zones closed to specific activities, e.g., commercial fishing, oil and gas development, sand extraction, cables and pipelines—all of the time
Standards for ice navigators and for safety and survival for seafarers in polar conditions	Specification of areas or zones open for specific activities, e.g., commercial fishing, oil and gas development, sand extraction, cruise ships, military operations—during specific times
Improved marine charts, aids to navigation, and other marine services	Specification of areas or zones closed to specific activities, e.g., commercial fishing, oil and gas development, sand and gravel extraction, cruise ships—during specific times, seasonal limitations on oil development operations
Increased search and rescue services	Specification of areas or zones closed to all development—all of the time, e.g., strictly protected areas, research areas, no-take, no impact areas
Improved spill response services, e.g., pre-positioning of equipment	Specification of areas or zones open to all development—all of the time, e.g., multiple use areas
Industry codes of practice or conduct	Designation of security zones, precautionary areas, safety zones
Other measures	Designation of critical habitat, environmentally or ecologically sensitive areas
	Designation of a Particularly Sensitive Sea Area (PSSA)
	Limiting activities in areas adjacent to cultural, spiritual, and archeological sites
	Special protection measures for areas of the high seas
	Other measures

Table 2. Benefits of Marine Spatial Planning

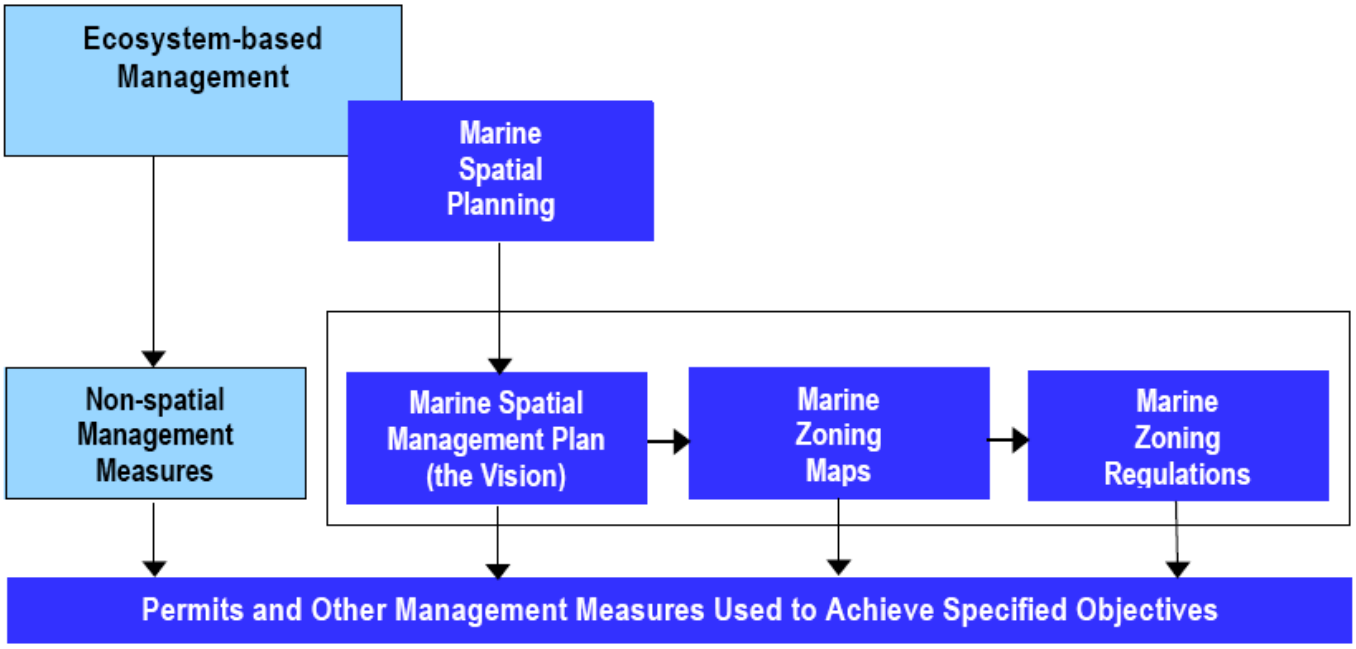
Ecological/environmental benefits	Identification of biological and ecological important areas as a basis for space allocation
	Incorporation of biodiversity objectives into planning and decision-making
	Identification and reduction of conflicts between human use and nature
	Ensures space for biodiversity and nature conservation
	Establish context for planning a network of marine protected areas
	Identification and reduction of the cumulative effects of human activities on marine ecosystems
Economic benefits	Greater certainty of access to desirable areas for new private sector investments, frequently amortized over 20-30 years
	Identification of compatible uses within the same area for development
	Identification and early resolution of conflicts between incompatible uses
	Improved capacity to plan for new and changing human activities, including emerging technologies and their associated effects
	Promotion of the efficient use of resources and space
	Streamlining and transparency in permit and licensing procedures
	Resolution of conflicts at planning level instead of individual project review
	Enables government, industry, and NGOs to work together to identify suitable locations for development and to identify areas where environmental values need to be protected and conservation should take precedence
Social benefits	Improved opportunities for local community and citizen participation
	Identification of effects of decisions on the allocation of ocean space (e.g., closure areas for certain uses, protected areas) on communities
	Identification and improved protection of cultural heritage
	Identification and preservation of social, cultural, and spiritual values related to ocean use
Administrative benefits	Improve consistency and compatibility of regulatory decisions
	Improve information collection, storage and retrieval, access, and sharing
	Improve integration and reduce duplication of effort and its associated waste of resources
	Improve speed, quality, accountability, and transparency of decision making, and reduction of regulatory costs

Modified from Ehler & Douvere (2009) and Tyldesley (2004)

What Are the Outputs of Marine Spatial Planning?

The principal output of MSP is a comprehensive spatial management plan (Figure 2) for a marine area or ecosystem. The plan moves the whole system toward a "vision for the future". It sets out priorities for the area and—more importantly—defines what these priorities mean in time and space. Typically, a comprehensive spatial management plan has a 10- to 20-year horizon and reflects political and social priorities for the area. The comprehensive marine spatial plan is usually implemented through a zoning map(s), zoning regulations, and/or a permit system similarly to a comprehensive regional plan on land. Individual permit decisions made within individual sectors (for example, the fisheries, or oil and gas, or tourism sectors) should be based on the zoning maps and regulations.

Figure 3. *The Outputs of Marine Spatial Planning*



Why Is Stakeholder Participation Critical to Marine Spatial Planning?

Involving key stakeholders in the development of MSP is essential for a number of reasons. Of these, the most important is because MSP aims to achieve multiple objectives (social, economic and ecological) and should therefore reflect as many expectations, opportunities or conflicts that are occurring in the MSP area. The scope and extent of stakeholder involvement differs greatly from country to country and is often culturally influenced. The level of stakeholder involvement will largely depend on the legal or cultural requirements for participation that often exist in each country.

Generally speaking, all individuals, groups or organizations that are in one way or another affected, involved or interested in MSP can be considered stakeholders. However, involving too many stakeholders at the wrong moment or in the wrong form can be very time consuming and can distract resources from the expected or anticipated result. To involve stakeholders effectively (e.g., leading toward expected results) and efficiently (e.g., producing expected results at least-cost), three questions should be asked:

- Who should be involved?
- When should stakeholders be involved?
- How should stakeholders be involved?

Where no legal obligations exist, it is important to define what type of stakeholder participation will be most suitable for a successful result. For instance, involving indigenous people in MSP efforts may not be a legal requirement, but they could however be greatly affected (positively or negatively) by MSP management measures, and should therefore participate.

Wide-ranging and innovative approaches to stakeholder participation and proactive empowerment should be used in the MSP process. Stakeholder participation and involvement in the process should be early, often, and sustained throughout the process. Stakeholder participation and involvement encourages "ownership" of the plan and can engender trust among the various stakeholders. Different types of stakeholder participation, including networked governance (Box 5), should be encouraged at various stages of the MSP process. The key stages at which stakeholders should be involved in the process include:

1. **The planning phase:** Stakeholders need to be involved and contribute to the setting of goals and objectives of MSP. They also need to be involved in the evaluation and choice of specific management measure options and the consequences of these choices on their areas of interest;
2. **The implementation phase:** Stakeholders should be involved in the actual implementation of MSP and its management measures. For example, an approach to enforcement may be identified that would involve local communities in the regulatory and enforcement process. When the local communities understand the problems and benefits of taking action—and agree upon the management measures to be taken—they will be part of the enforcement process, at least to the extent of encouraging compliance; and
3. **The monitoring and evaluation (post-implementation) phase:** Stakeholders should be involved in the evaluation of the overall effectiveness of MSP in achieving goals and objectives. The post-evaluation effort should involve all stakeholders in a discussion to identify plan results, evaluate results against objectives, and plan for the next phase of planning.

Box 5. MSP and Networked Governance

Networked governance is a strategy that recognizes and allows all rights-holders and stakeholders to be part of the decision-making process, in this case, the marine spatial planning process. As opposed to traditional "top-down", command-and-control systems, networked governance involves relevant stakeholders at all levels through less formal channels. The perspectives and positions of all stakeholders are included in defining the management goals and objectives and are used to develop a joint solution, i.e., a marine spatial management plan. The solution then calls for contributions from all stakeholders for its implementation. While ultimate responsibility for political decisions continues to lie with the executive authority (usually the government), it is also possible to construct incentives for ensuring compliance with the plan through heightened standards of accountability. Thorough stakeholder involvement increases each stakeholder's responsibility for their own contributions and makes each one more likely to hold government and other stakeholders accountable for their respective commitments.

Such a regime applied to the Arctic, and highly inclusive of indigenous peoples, would:

- Recognize that Arctic indigenous peoples are not merely stakeholders, but rights-holders to Arctic lands, waters, and resources, and thus have a clear right to participate at any planning or bargaining table;
- Build on the already formal role of Arctic indigenous peoples in regional planning and decision-making, e.g., through the Arctic Council;
- Ensure strong communication between indigenous communities and those making the management decisions affecting their environment;
- Encourage future Arctic developments to provide social equity and sustainable benefits for Arctic peoples;
- Insure that decisions made about the future of the Arctic include protection of the region's unique cultures and environment through recognition of the rights of its peoples;
- Preparing and approving the spatial management plan;
- Implementing and enforcing the spatial management plan;
- Monitoring and evaluating performance; and
- Adapting the marine spatial management process.

Excerpted and modified from a discussion draft paper prepared for the Aspen Institute's Dialogue and Commission on Arctic Climate Change by

Cochrane, Watt-Cloutier, et al.,

February 2010

The critical nature of stakeholder participation and involvement in MSP is discussed at length in Ehler and Douvere and Pomeroy and Douvere. [31,32]

Box 6. An Early Example of MSP and Networked Governance

In 2002 Coastal First Nations, an alliance of First Nation peoples on British Columbia's North and Central Coasts and Haida Gwali, signed an agreement with the Government of Canada to develop a marine use planning process under Canada's Ocean Strategy. Coastal First Nations began marine planning in 2005 along the British Columbia coast, an area now referred to as the Pacific North Coast Integrated Management Area (PNCIMA). Fisheries and Oceans Canada, the Coastal First Nations, and the North Coast-Skeena First Nations Stewardship Society officially agreed on the planning process in 2008. The agreement created a collaborative model for ocean governance that ensures the meaningful participation of First Nations in the development of management plans for marine use in the PNCIMA.

Ethics and values are the roots of traditional land and sea management systems. Although expressed in their own ways, First Nations ethics and values correspond to the scientific principles of ecosystem-based management and provide linkages between the two perspectives.

First Nations Ethics & Values	Scientific Principles
Balance & Interconnectedness	• Integrated Management • Long-term Sustainable Use
Respect & Responsibility	• Inclusive & Participatory • Precautionary Approach
Intergenerational Knowledge	• Adaptive Management • Best Information
Giving and Receiving	• Equitable Sharing

In 2004-05 the Coastal First Nations entered into an Aboriginal Aquatic Resource and Oceans Management agreement with DFO that supported Coastal First Nation consultations with other First Nations within PNCIMA on the collaboratively developed integrated management framework. The Coastal First Nations have built strong alliances with the North Coast - Skeena First Nation Stewardship Society and the Nuxalk First Nation, and all three organizations have agreed to work under the same operational framework. This alliance between all of the Central and North Coast and Haida First Nations on an initiative of this magnitude is unprecedented.

Community involvement and participation in the marine planning process is essential to its success. The primary role of First Nations in this process is to protect and conserve the marine environment on behalf of its community members. However, marine spatial planning is a process that brings together everyone that has an interest in the marine environment and integrates the wide variety of knowledge and interests into a common management plan that meets the needs of all participants. These interests could include not only First Nations peoples, but also federal and provincial governments, coastal communities, non-governmental groups including environmental groups and community groups, and other interests such as fishermen, shipping companies, forestry and fishing companies, recreational groups, mining and energy groups.

First Nations communities are developing MSP processes and products for their communities that are involved at all levels of the MSP process. Communities are the primary drivers in the development of local MSP plans. Marine planning committees/ work groups have been established in each community or area and work on behalf of the community to develop marine plans that reflect the values and interests of the community as a whole. Communication strategies have been developed to ensure transparency in the process and to ensure community members play an active role.

The DFO Aboriginal Aquatic Resources and Ocean Management Program, DFO Oceans, and the Gordon and Betty Moore Foundation provide funding for the MSP work of Coastal First Nations.

For more information go to: coastalfirstnations.ca/activities/marineuse.aspx

Important stakeholders in any Arctic MSP process would include representatives of Indigenous Peoples such as the Aleut International Association, the Arctic Athabaskan Council, the Gwich'in Council International, the Inuit Circumpolar Council, the Russian Association of Indigenous Peoples of the North (RAIPON), and the Saami Council. Representatives of non-governmental organizations such as the Natural Resources Defense Council (NRDC) and the World Wildlife Fund (WWF), representatives of Arctic industries including oil and gas (Royal Dutch Shell, ConocoPhillips, Statoil, GazProm, ExxonMobil), fishing, mining, marine transportation (Murmansk Shipping, Far Eastern Shipping) and tourism, and representatives of Arctic research institutions, such as the University of the Arctic, the University of Tromso, the University of Calgary, the University of Greenland, and the University of Alaska, would all have a stake in the outcomes of MSP. These specific stakeholder examples are illustrative, not exhaustive.

What Are Some Key Principles of Marine Spatial Planning?

MSP should be guided by a set of principles that: (a) determine the nature and characteristics of the MSP process; and (b) reflect the results desired through MSP. The Aspen Institute has identified some examples of specific principles for Arctic governance (p. 50 of this report). Many of these principles can be put into practice through MSP. For example,

- **Ecosystem resilience, integrity and productivity** can be optimized by maintaining food-web (trophic) structure and protecting and restoring biodiversity and available habitat—MSP can be used to identify biologically and ecologically important areas, including fish spawning areas, polar bear denning areas, and migration corridors;
- **A full suite of Arctic ecosystem services**, including the regulation of climate, the provision of food, habitat, and genetic resources, and spiritual and cultural development, to support human well-being on a continuing basis can be maintained through MSP by allocating human activities in time and space with the goal of sustaining those services;
- **Investment in Arctic scientific research and related infrastructure** to ensure sustainable development and environmental protection can be promoted through MSP by the identification of gaps in natural and social science information that is required to implement MSP in the Arctic;
- **Assessing, monitoring and managing multiple human activities using an integrated, adaptive, ecosystem-based management system** that takes into account risks and cumulative and interacting effects can be implemented through MSP, which carries out these activities to deliver an ecosystem-based approach to the management of human activities in marine areas of the Arctic;
- **Ecosystem management processes, based on science and traditional knowledge, can be applied through MSP**, which assesses new and expanded human activities routinely as part of the planning process. MSP identifies spatial and temporal management measures (Table 1) to reduce or eliminate impacts that would be hazards to human health, harm living resources and ecosystems, damage amenities, or interfere with other legitimate uses;
- **The rights, including human rights, of Arctic residents and Arctic indigenous peoples can be respected through a highly participatory and transparent MSP process** that includes all interested stakeholders;
- **Cooperation among Arctic states** to arrive at appropriate standards for managing human activities to meet the special conditions of the Arctic region, while promoting sustainable development, can be promoted through an Arctic-wide MSP process that would identify spatial and temporal management measure that would require international cooperation; and

Box 8. Ten Principles for Marine Spatial Planning

1. **Regulatory authority.** Whether it is an existing agency, an interagency coordinating committee or some newly created body, the department charged with implementing MSP must have clear legal authority to engage in integrated ecosystem management, including the authority to evaluate the efficacy of its decisions and adjust them over time.
2. **Dependable funding.** If MSP is to succeed, government needs to guarantee sufficient and dependable funding to the effort. This funding must be sufficient to cover necessary agency staff, as well as the cost of obtaining the requisite data, ensuring public participation obligations and needs, monitoring, enforcement, and evaluation.
3. **Public and stakeholder participation.** Early and regular consultation with the public and advisors (such as traditional leaders) is the norm, as is rapid dissemination of information, materials, public comments, etc.
4. **Transparency.** The MSP management system should provide for maximum transparency so that the basis for analysis and decision-making is unambiguous and the process by which decisions are made is obvious as the decisions are under consideration.
5. **Real accountability.** Entities charged with implementing MSP must be accountable to the country/state/community for effective implementation and achievement of the goals and objectives outlined in policy and legislation. Accountability can be achieved through several different tools, including setting clear milestone deadlines, linking funding with achievement or performance, issuing performance reports (score cards) for public consumption, or allowing citizen suits to compel agency compliance with substantive and procedural requirements.
6. **Clear objectives and directives.** Critically, any MSP management system should set forth overarching principles, clear tasks, deadlines for completing tasks, directives explaining the standards by which decisions will be measured and made, and the processes for making those decisions, as well as periodic review for determining progress.

7. **Evidence/Science-based decision making.** MSP decision-making should be based on the best readily available science and/or evidence. This standard combines a requirement for using the best science/evidence with the practicality of knowing that decision makers cope with uncertainty and less than perfect information every day. Because it is not always possible to wait for high levels of scientific certainty when resource and economic health are hanging in the balance, the use of best available science is the linchpin to effective policy. Where significant scientific uncertainty exists, the precautionary principle should guide decision-making.
8. **Independent decision-making.** To the greatest extent possible, an MSP management system should attempt to foster independent decision making and reduce the potential for agency capture (by the regulated industry or individuals), political gridlock, or legislative interference (avoid interference induced by favoritism, corruption, or undue influence).
9. **Clear decision-making rules.** Decision making rules should be established up front, leaving no ambiguity regarding how decision outcomes will be achieved.
10. **Adaptive to change.** The systems we develop and use to "manage" linked human-natural ecosystems must include effective feedback and be flexible enough to adjust management practices over time, if necessary. Therefore, an MSP management system should include a robust monitoring program that will allow managers to determine whether both management (e.g., compliance, efficiency, conflict reduction) and ecosystem goals and objectives are being met. In addition, the management system should facilitate the incorporation of new science and information as it becomes available. Similarly, the system should account for the variability of natural systems and the possibility of regime shifts, such as those we are likely to face in the wake of climate change.

Modified from Sivas and Caldwell, 2008 [33]

Why Are General Goals and Measurable Objectives for MSP Important?

Specifying MSP goals and objectives is essential to help focus and tailor MSP efforts toward achieving results in any marine area, including the Arctic. Typically, goals and objectives should be derived from the problems and conflicts identified in the early stages of the MSP process. Despite what is often assumed, goals and objectives are different from one another.

Goals provide the umbrella for development of all other objectives and reflect the principles upon which subsequent objectives are based. For example, the goals of the Arctic Council's Arctic Marine Strategic Plan included:

- Conserve Arctic marine biodiversity and ecosystem function;
- Promote the health and prosperity of all Arctic inhabitants;
- Reduce and prevent pollution in the Arctic marine environment; and
- Advance sustainable Arctic marine resource use. [34]

Examples of MSP-specific goals in the Arctic could include:

- Protect environmentally and ecologically valuable areas;
- Encourage the co-location of compatible human activities;
- Reduce and resolve conflicts among current and future human activities; and
- Reduce and resolve spatial conflicts between current and future human activities and nature.

Characteristics of good objectives are that they are specific, measurable, achievable, relevant, and time-bound, i.e., SMART. Monitoring and evaluating progress toward the achievement of desired outcomes can only be measured when objectives are well specified. Often objectives will be preliminary and indicative when you specify them for the first time, and firmer and better-specified when re-examined later in the MSP process. Examples of well-specified objectives would include:

- Protect 90% of essential habitat for diving birds by 2012;
- Ensure that adequate marine space is available to produce 25% of energy needs from offshore sources by the year 2020;
- Implement a representative network of marine protected areas by 2012; and
- Reduce the time required to make decisions on marine construction permits by 50% by 2015.

Why Are Performance Indicators Important?

The main purpose to establish indicators is to measure, monitor and report on progress toward meeting the goals and objectives of MSP. Indicators have numerous uses and the potential for improving management. They include the ability to monitor and assess conditions and trends, forecast changes and trends (such as providing early warning information), as well as help evaluate the effectiveness of spatial and temporal management measures.

The selection of relevant and practical (i.e., measurable) indicators is one of the most important components of a "results-based" approach to MSP. Table 3 below identifies some characteristics of good indicators. Indicators are needed to monitor progress with respect to inputs, activities, outputs, and outcomes. Progress needs to be monitored at all levels of the system to provide feedback on areas of success, as well as areas where improvements may be needed. Caution should be exercised in defining too many indicators. Choosing the correct indicators is often a trial-and-error process—and may take several iterations. Indicators can be changed—but not too often.

Extensive reviews and examples of ecological, socio-economic, and governance indicators for the performance evaluation of integrated marine management and its measures can be found in Ehler, Pomeroy *et al.*, and Belfiore *et al.*[35,36,37]

Table 3. Characteristics of Good Indicators for MSP

Readily measurable	On the time-scales needed to support spatial management of human activities, using existing instruments, monitoring programs, and available analytical tools
Cost-effective	Monitoring resources are usually limited
Concrete	Indicators that are directly observable and measurable in time and space (rather than those reflecting abstract properties) are desirable because they are more readily interpretable and accepted by diverse stakeholder groups
Interpretable	Indicators should reflect properties of concern to stakeholders; their meaning should be understood by as wide a range of stakeholders as possible
Grounded in theory	Indicators should be based on well-accepted scientific theory, rather than on inadequately defined or poorly validated theoretical links
Sensitive	Indicators should be sensitive to changes in the properties monitored (e.g., able to detect trends in time and space in the properties or effects)
Responsive	Indicators should be able to measure the effects of spatial management measures to provide rapid and reliable feedback on their performance and effects
Specific	Indicators should respond to the properties they are intended to measure rather than to other factors, i.e., it should be possible to distinguish the effects of other factors from the observed responses to spatial management measures

Why Are Monitoring and Evaluation Critical?

Monitoring is a critical and integral element of MSP in the Arctic. In a broader sense, a "monitoring system" includes a range of activities needed to provide information to MSP. These activities include modeling, laboratory and field research, time-series measurements in the field, quality assurance, data analysis, synthesis, and interpretation. What distinguishes a monitoring system from any of these activities taken alone is that a *monitoring system* is integrated and coordinated with the specific goal of producing pre-specified spatial planning information; it is the sensory component of management.

At least two types of monitoring are relevant to marine spatial planning: (1) *assessing* the *state of the system*, e.g., "What is the status of biodiversity in the marine area?"; and (2) measuring the *performance of management measures*, i.e., "Are the spatial and temporal management measures we have implemented producing the outcomes we desire?" These two types of monitoring are closely related.

Sound monitoring program design depends on the following factors:

- The objectives of the monitoring program need to be clearly articulated in terms that pose questions that are meaningful to the public and that provide the basis for the measurement of management performance;
- Not only must data be gathered, but attention must be paid to their management, analysis, synthesis, and interpretation;
- Adequate resources are needed not only for data collection, but for detailed analysis and evaluation over the long term;
- Monitoring programs should be sufficiently flexible to allow for their modification where changes in conditions or new information suggests the need; and
- Provision should be made to ensure that monitoring information should be reported to all stakeholders and rights-holders in a form that is useful to them.

Evaluation is the element of MSP in which the greatest learning occurs. Ideally, it should be a continuous process in which measures or indicators of management performance are defined and systematically compared with program goals and objectives. Evaluation should be undertaken periodically during the lifetime of a MSP program—at least every five years.

MSP initiatives often have goals and objectives that are very vague or general, and therefore are not easily measured. In these cases it is difficult, if not impossible, to determine the extent to which goals and objectives are being achieved. Evaluations, if undertaken at all, tend to fall back on indicators that measure effort (input) rather than results (outputs or outcomes). For example, the number of permits granted or denied might be used as an indicator of the performance of a MSP program rather than the number of use conflicts avoided or area of biologically important marine areas protected.

Meaningful evaluations can be conducted only if the objectives of the MSP program are stated in unambiguous (measurable) terms and if indicators for assessing progress are identified in the planning phase, and monitored afterward. Baseline data are essential. Many evaluations yield ambiguous results because these preconditions for assessing management performance do not exist.

Evaluation should be seen as a critical element of the process of MSP. Integrated and adaptive MSP is based on a circular or iterative—rather than a linear—management process that allows information concerning the past to feed back into and improve the way management is conducted in the future. Evaluation helps management to adapt and improve through a "learning process."

Where Is Marine Spatial Planning Currently Underway?

In many marine places, MSP has already proven to be an operational approach to implementing integrated, ecosystem-based management.[38] Twenty-four MSP programs in nine countries are identified in Table 4. Descriptions of these programs can be found on the UNESCO website on marine spatial planning: www.ioc3.unesco.org/marinesp. A key characteristic of these marine spatial management initiatives is their ability to provide integration across multiple uses and sectors, to minimize conflicts, to maximize sustainable economic development, and to protect important habitat and biodiversity areas.[39]

Table 4. International Examples of Marine Spatial Planning

Country	Plan	Area (km²)	Time Period
Australia	Great Barrier Reef Marine Park Original Zone Plan	344,400	1983-1988
	Great Barrier Reef Representative Areas Program	344,400	1988-2005
	Southeast Marine Bioregional Plan	1,600,000	2000-2004
	Southwest Marine Bioregional Plan	1,300,000	2005-date
	Northwest Marine Bioregional Plan	1,070,000	2005-date
	North Marine Bioregional Plan	715,000	2005-date
	East Marine Bioregional Plan	2,400,000	2005-date
USA	Florida Keys National Marine Sanctuary Management Plan	9,600	1991-date
	Channel Islands National Marine Sanctuary Marine Reserves	3,800	2002-2005
	California Marine Life Protection Act Plans (5 regions)	14,297	2007-date
	Massachusetts Integrated Ocean Plan	5,555	2008-2009
	Rhode Island Ocean Special Area Management Plan	3,800	2008-date
	Oregon Territorial Sea Plan	3,250	1991-1994
	Oregon Territorial Sea Plan Revision	3,250	2009-date
Canada	Coastal First Nations Marine Spatial Plans	88,000	2008-date
China	Territorial Sea Functional Zoning Plans (9 coastal provinces)	396,000*	2002-date
Belgium	Master Plan for Belgian Part of the North Sea	3,600	2003-2005
The Netherlands	Integrated Management Plan for the North Sea, 2015	57,000	2003-date
Germany	Marine Spatial Plan for the North Sea	28,600	2006-2009
	Marine Spatial Plan for the Baltic Sea	4,500	2006-2009
	Mecklenburg-Volporam Marine Spatial Plan	5,700	2005-2008
Norway	Integrated Management Plan for the Barents Sea	1,400,000	2003-2006
	Integrated Management Plan for the Norwegian Sea	1,170,000	2007-2009
Poland	Gulf of Gdansk Marine Spatial Plan Pilot Project	406	2007-2008

**estimated*

Current Marine Spatial Planning Activities in the Arctic

Marine spatial planning is already underway in several areas of the Arctic, including Norway, Canada, and to a limited extent, the United States.

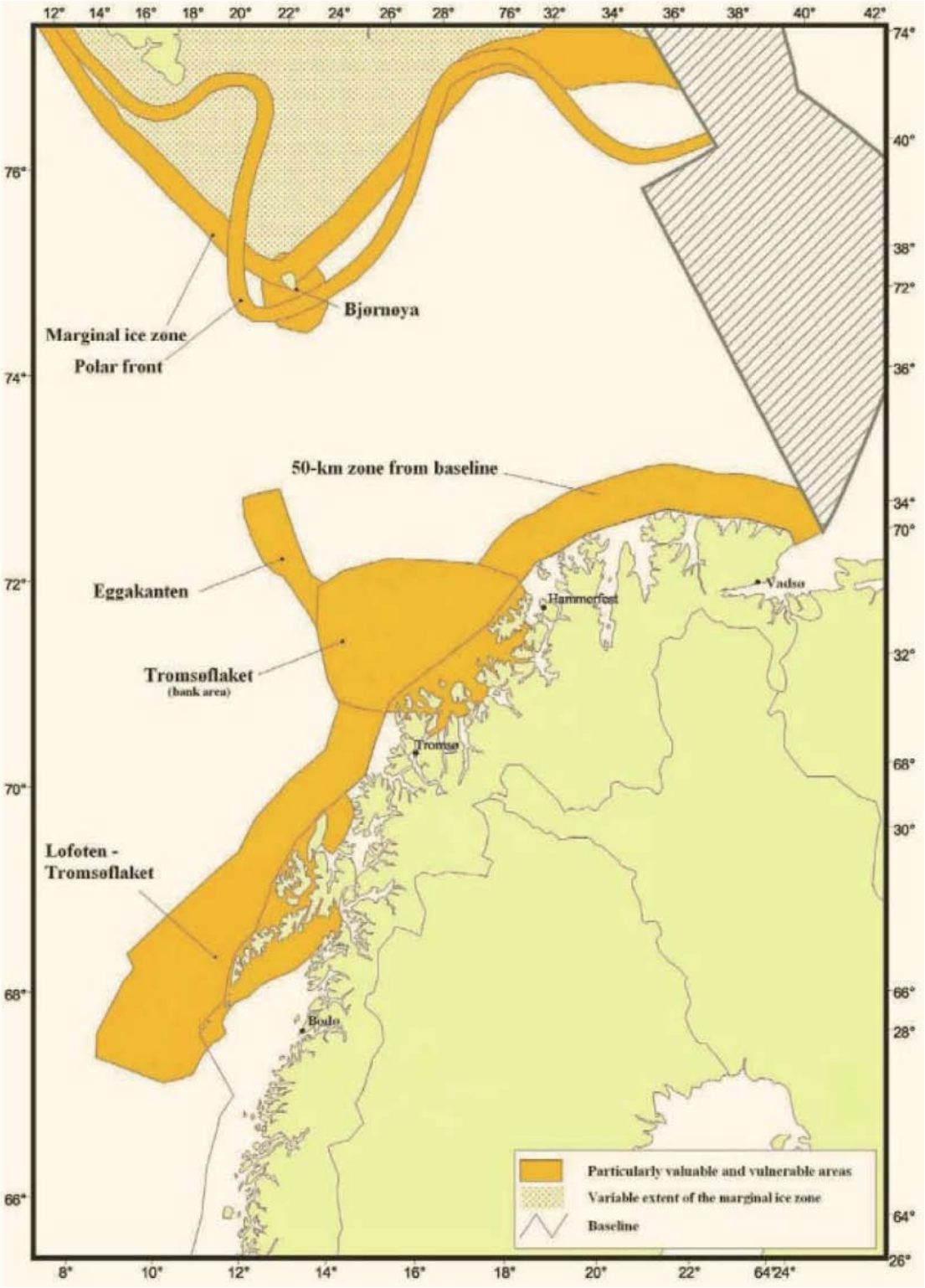
Norway: Marine spatial planning would be a new approach in most areas of the Arctic. However, in Norway, an ecosystem-based, integrated marine management plan, including a marine spatial plan, has been developed for the Barents Sea and the Sea Areas off the Lofoten Islands. It covers all areas offshore of one nautical mile of the coast within the Norwegian EEZ, as well as the fishery protection zone around the Svalbard archipelago—a marine area covering 1.4 million km2. Norway is one of the few countries that have successfully integrated all major economic activities—oil and gas development, fisheries, and marine transport—together with nature conservation in its marine spatial planning activities. The plan for the Barents Sea was initiated in 2002 and completed in 2006; the initial plan is now being revised. An integrated management plan for the Norwegian Sea (1.17 million km2) has also been developed recently. [40]

One of the major issues in the Barents Sea was the potential expansion of oil and gas activities into areas of the Barents Sea used by fisheries and living marine resources. MSP is at the core of the plan, identifying particularly valuable and vulnerable areas, either from ecological and/or human perspectives. Within the plan access to specific areas for human activities is carefully managed, for example, by moving shipping lanes outside Norwegian territorial waters (12 nautical miles), limiting trawling in sensitive areas, not opening most particularly valuable and vulnerable areas to petroleum activities, including the ice edge, and extending marine protected areas and fishery closure areas to protect spawning aggregations, fish eggs and larvae, and juvenile fish and shellfish. [41]

A government-appointed inter-ministry steering group chaired by the Ministry of the Environment and with representatives of relevant ministries led the work on the plan that included evaluation of the cumulative effects of development up to 2020. Development of the plan (2003-2006) followed a three-phase process. First, status reports were prepared by governmental management and research institutions or by consultants, covering the state of the marine environment, the coastal zone, fisheries, aquaculture, especially valuable areas, and shipping. The initial reports uncovered major gaps in current knowledge. Therefore, a key principle of the planning process was to use caution in the face of uncertainty. The plan also had to be adaptive to allow the evaluation of new knowledge as it became available. Determining the boundaries for the plan was another important issue, which included considerations of the ecosystem, economics, and politics, and discussions with the International Council for the Exploration of the Sea (ICES) and other organizations.

The second phase was an analytical one based on the first one. Four extensive government-funded environmental impact assessments (EIAs) were carried out, covering the impact of fisheries, shipping, hydrocarbon extraction, and external pressures (e.g. pollution) on the environment, resources, and local communities. To ensure compatibility among the EIAs, a set of common variables was used to compare impacts among sectors. Impacts were assessed relative to a base year (2003) and relative to expected future impacts up to 2020, with uncertainty obviously increasing over time.

Figure 4. *Particularly Valuable and Vulnerable in the Barents Sea*
(Royal Norwegian Ministry of the Environment)



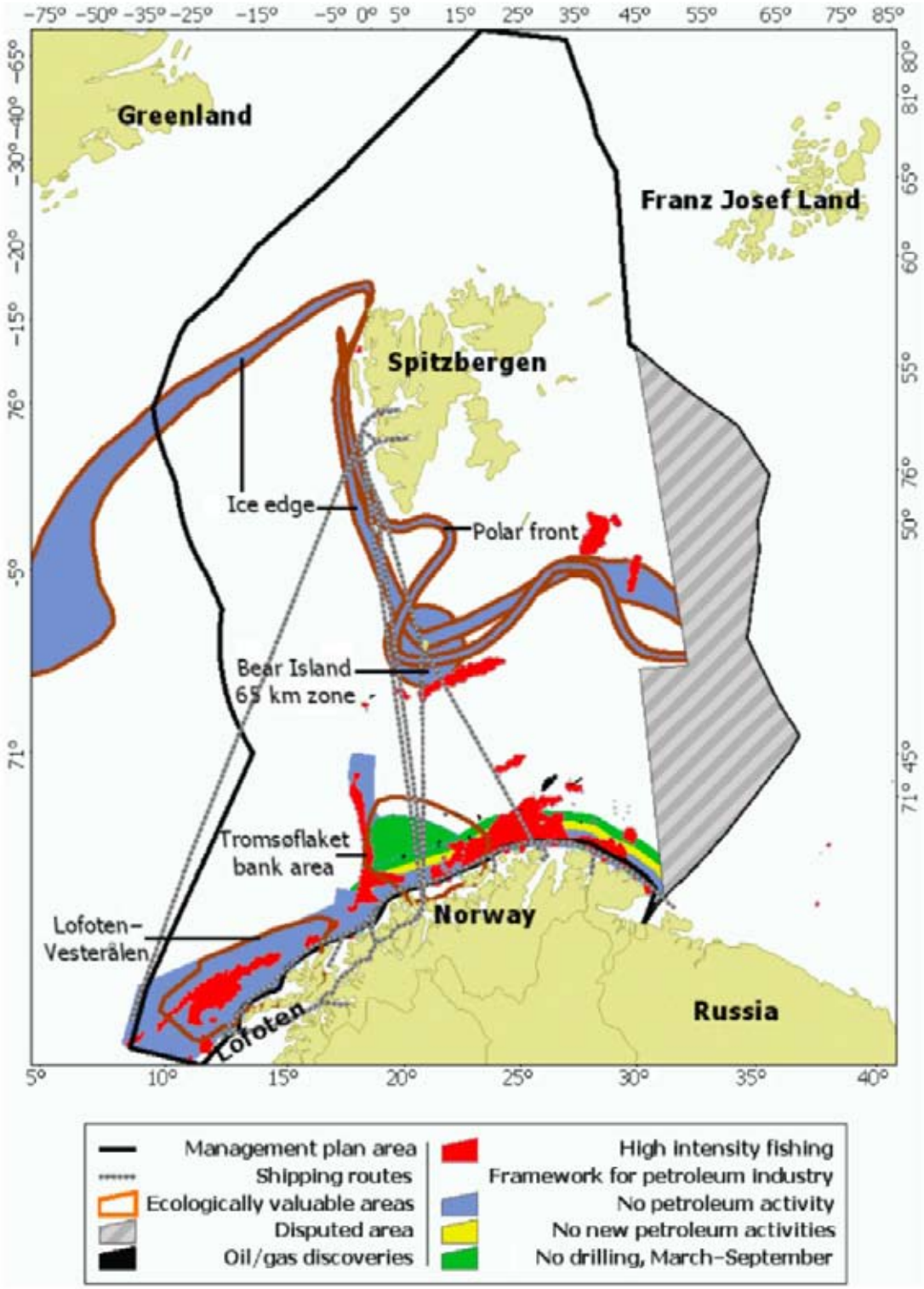
In the third phase, the EIA results were brought together and analyzed in more detail, focusing on: (1) the total impact of all human activities combined, both for the current situation and up to 2020; **(2)** area conflicts among human activities, and between human use and ecologically valuable areas; **(3)** the definition of management goals required for implementation; and **(4)** identification of gaps in current knowledge.

The analysis of total impact was difficult, because knowledge of the cumulative ecological impact of several interacting human effects was limited. Parallel to the second and third phases, a set of operational environmental quality objectives (EcoQOs) was developed, based on the management goals. These covered climate, ice edge, phytoplankton, zooplankton, commercial fish species, non-commercial fish species, benthic organisms, marine mammals, seabirds, alien species, threatened and vulnerable species, and pollutants. Progress toward the EcoQOs is monitored annually.

A central concept of the plan is that it is based on the best available scientific information and takes a precautionary approach, implying a need for revision as new knowledge becomes available. The plan represents a synergy of previously separate management regimes: management of fisheries, shipping, and the hydrocarbon industry are brought together under one umbrella to coordinate efforts and to achieve a healthy ecosystem (Figure 5). **In practice, achieving measurable improvements in all these sectors is the main challenge, and these are envisaged by implementing: (1)** marine spatial planning to resolve conflicts between activities and protecting the environment; **(2)** continuation of established management measures regulating the various activities; **(3)** implementation of EcoQOs; and **(4)** increased focus on international cooperation, especially with Russia, regionally and globally.

The plan identifies ecologically valuable areas and requires strict regulation of activities in these areas. To reduce conflict between fisheries and shipping, Norway has applied (through the International Maritime Organization) to move shipping lanes outside Norwegian territorial waters (its 12-nautical mile limit). To avoid future conflict, some areas will be closed to hydrocarbon exploration and exploitation (Lofoten, Bear Island, the polar front, and the ice edge). The framework for hydrocarbon extraction has been the focus of political debate around the plan, and will probably continue to be so. Several new sector-specific area-based measures are also considered, including plans for extension of marine protected areas and the use of seasonally closed areas to protect spawning aggregations, fish eggs and larvae, and juvenile fish and shellfish.

Figure 5. *The Barents Sea Management Area, Showing the Main Fishing Areas, Shipping Lanes, and the Area-based Framework for Hydrocarbon Extraction, and Valuable and Vulnerable Areas*

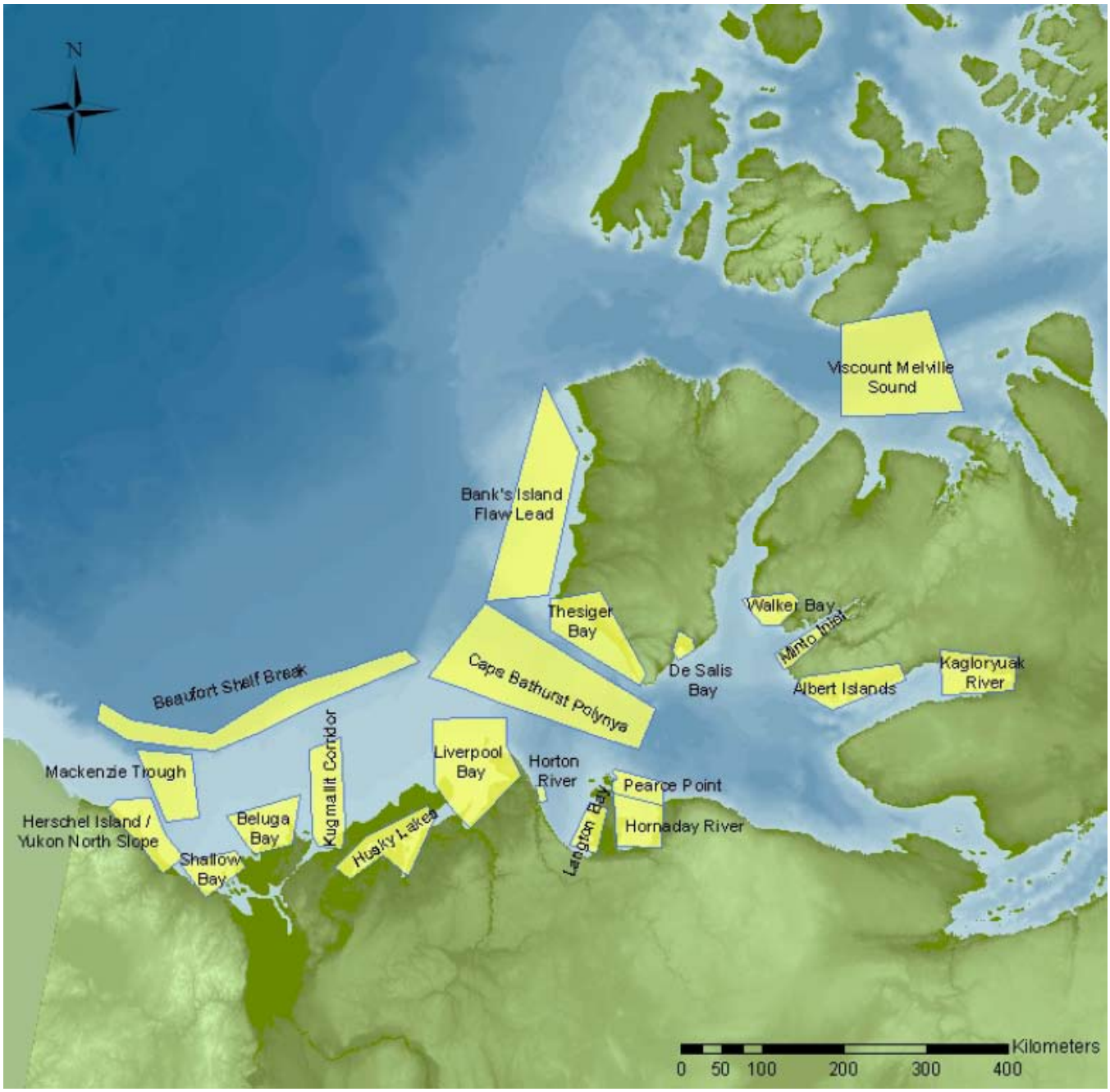


Cooperation among government institutions has been ensured by creating three new advisory groups, all reporting to the governmental steering group: a "monitoring group" responsible for coordinating monitoring activities and reporting annually on the state of the ecosystem, based on the EcoQOs; an operational "risk group" responsible for monitoring potential risks to the ecosystem and ensuring dissemination of information; and an "expert forum" responsible for advice on revisions to the plan. One of the shortcomings of the first Barents Sea planning process was its lack of consultation with the Saami Parliament. [42]

Canada: Canada's Department of Fisheries and Oceans has just completed an integrated management plan for the Canadian portion of the Beaufort Sea (1.75 million km2) as part of a large ecosystem-based management program for five large ocean management areas (LOMAs) in Canada.[43,44] The integrated management plan does not address marine spatial planning, but recommends marine spatial planning be conducted for the Beaufort Sea LOMA. Canada also completed in 2005 an overview of the Beaufort Sea marine ecosystem and more recently in 2009 an atlas of the Beaufort Sea.[45,46] The atlas contains a map of "ecologically and biologically significant areas", based on their biophysical structure and ecological function, created by the Department of Fisheries and Oceans Canada (Fig. 6). A "Beaufort Sea Partnership" is the primary forum for stakeholder engagement in integrated management of the Beaufort Sea LOMA. It is comprised of regional-level representatives and has an open membership, i.e., any organization with an interest in the management of the Beaufort Sea can become a member. The Partnership has about 40 member organizations, including Indigenous Peoples.

The Government of Canada brought its Oceans Act into force on January 31, 1997 making it the first country in the world to have comprehensive oceans management legislation. Canada's Oceans Strategy was finalized in 2002. This policy document defined the vision, principles, and objectives for the management of Canada's estuarine, coastal and marine ecosystems. Funding needed to apply Canada's oceans management legislation and policy became available in 2006 under a Federal initiative known as the Oceans Action Plan. The Beaufort Sea was subsequently named as one of five areas to receive funding. The area contains an estimated one-third of Canada's undeveloped conventional oil and gas potential.

Figure 6. *Ecologically and Biologically Significant Areas of the Beaufort Sea (Department of Fisheries and Oceans Canada, 2009)*



Aboriginal, federal and territorial governments and co-management interests, as well as industry, coastal communities and other interested parties agreed to work together on the implementation of a process that would lead to a plan for managing activities occurring in the Beaufort Sea. Development of the integrated management plan took three years to complete.

The plan is organized around six goals:

- **Governance:** To achieve effective governance for the sustainable use of the Beaufort Sea;
- **Economic:** To foster sustainable economic opportunities and options for Canadians, northerners and coastal communities;
- **Cultural:** To maintain and increase peoples' sense of place and preserve cultural identity and spiritual connections as they relate to oceans and coastal areas;
- **Social:** To improve human capacity, health, quality of life and opportunities as they connect to oceans and coastal areas;
- **Traditional and Local Knowledge:** To promote the value, credibility and use of traditional knowledge (TK) and local knowledge (LK) to current and future generations; and
- **Ecosystem:** To understand the Beaufort Sea ecosystem, to identify important areas and priority species and to maintain or enhance ecosystem integrity.

After securing general agreement on the need for a plan, stakeholders needed to know the current status and trends of the Beaufort Sea's ecosystem to determine what impacts human activities might have on that ecosystem. An ecological assessment was conducted to compile available science and traditional knowledge of the area. The Ecosystem Overview and Assessment Report (EOAR) describes areas and activities that need priority actions. A key part of the EOAR was the identification of Ecologically and Biologically Significant Areas (EBSAs) in the Beaufort Sea (Figure 6). Work leading to the EBSAs was a centerpiece of the planning process. It calls attention to areas that have particularly high ecological or biological significance and require specific management measures and standards to manage them responsibly.

A Social, Cultural and Economic Overview and Assessment Report similar to the EOAR was also completed for the Beaufort Sea LOMA. It is a valuable source of information on key social, cultural, and economic conditions, issues and objectives for the integrated management process. The report is an excellent reference for decision makers requiring information about current and historic ocean-based activities and stakeholder perspectives. Community profiles that outline the social, cultural and economic status of the communities are part of the report.

The Beaufort Sea Planning Office identified some of the benefits of working together on the implementation of the Beaufort Sea integrated management plan as:

- Increased cooperation across departments, governments and other organizations;
- Better integrated responses to cross-cutting issues;
- Better and more timely collection of information on key risks and their relationship to programs and values;

- Ongoing measurement of the actual effects of policies, programs and operations;
- Identification of areas of shared responsibility; and
- Greater accountability for management of shared responsibilities. [47]

USA: In 1988 the U.S. National Oceanic and Atmospheric Administration (NOAA) published the first comprehensive data atlas of the Bering, Chukchi, and Beaufort seas.[48] The NOAA atlas contained 112 maps of the Arctic region, including the Canadian Beaufort Sea and the Soviet Bering and Chukchi seas. Special maps developed for the Arctic atlas included sea-ice dynamics and sea-ice type, marine sediments, chlorophyll-a, and subsistence activities of Alaskan Natives, a particularly important human activity in the Arctic, developed from detailed anthropological field surveys conducted by the Alaska Department of Fish and Game. Unfortunately the NOAA atlas has not been updated, but other mapping activities are now underway in Alaska.[49] In August 2009 Audubon Alaska completed a draft Atlas of the Chukchi and Beaufort Seas. The project area includes the southern Beaufort, southern Chukchi, and northern Bering seas and includes 44 maps covering Alaska's Arctic marine environment. Thematic maps are presented in six categories: physical oceanography, water column and benthic life, fish, mammals, birds, and people. The Coastal Management Program of the North Slope Borough has also developed 31 detailed maps covering its jurisdiction, including subsistence use areas.[50]

Figure 7. *Polar Bear Map from the Audubon Arctic Atlas, 2009*

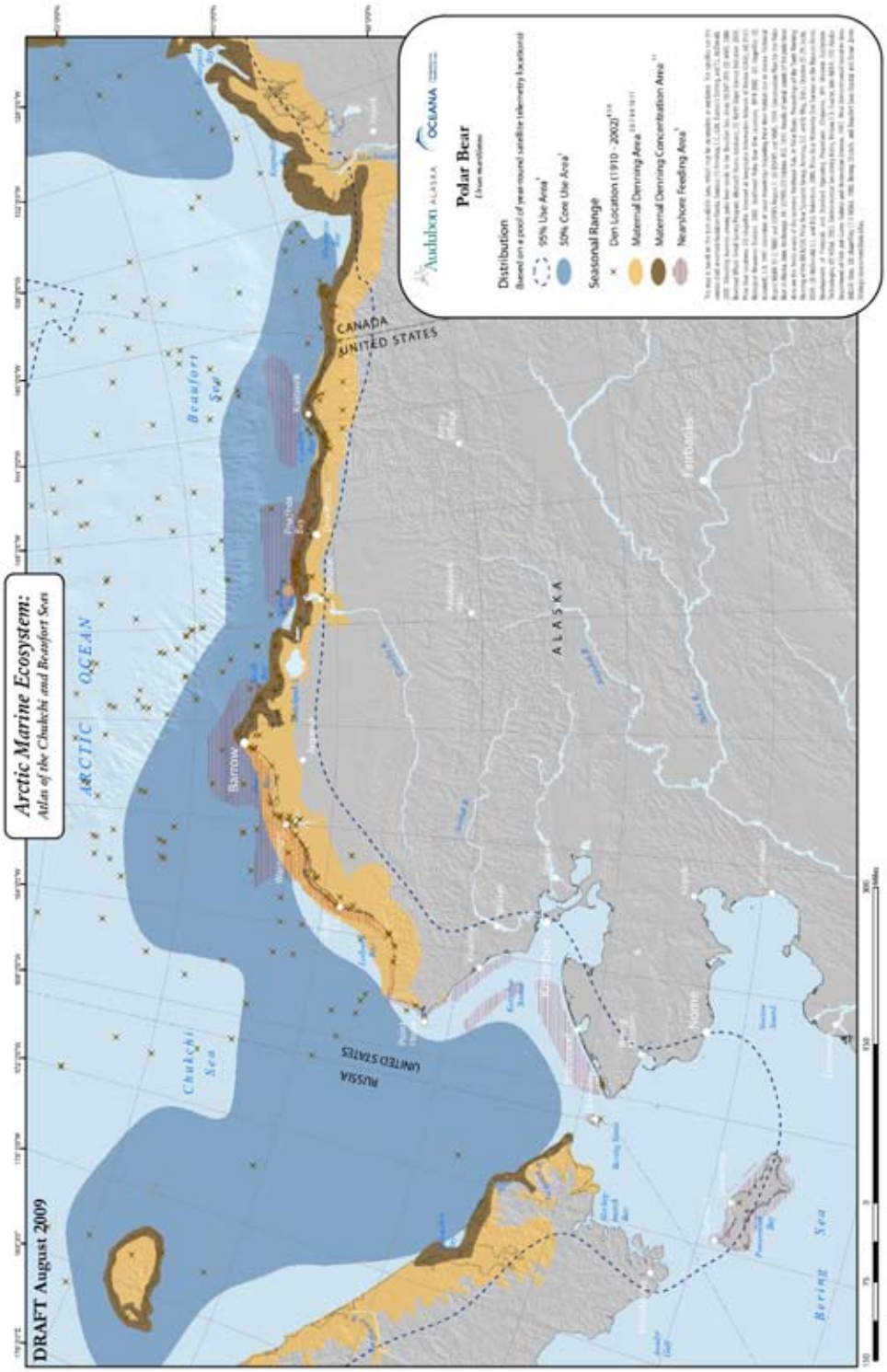
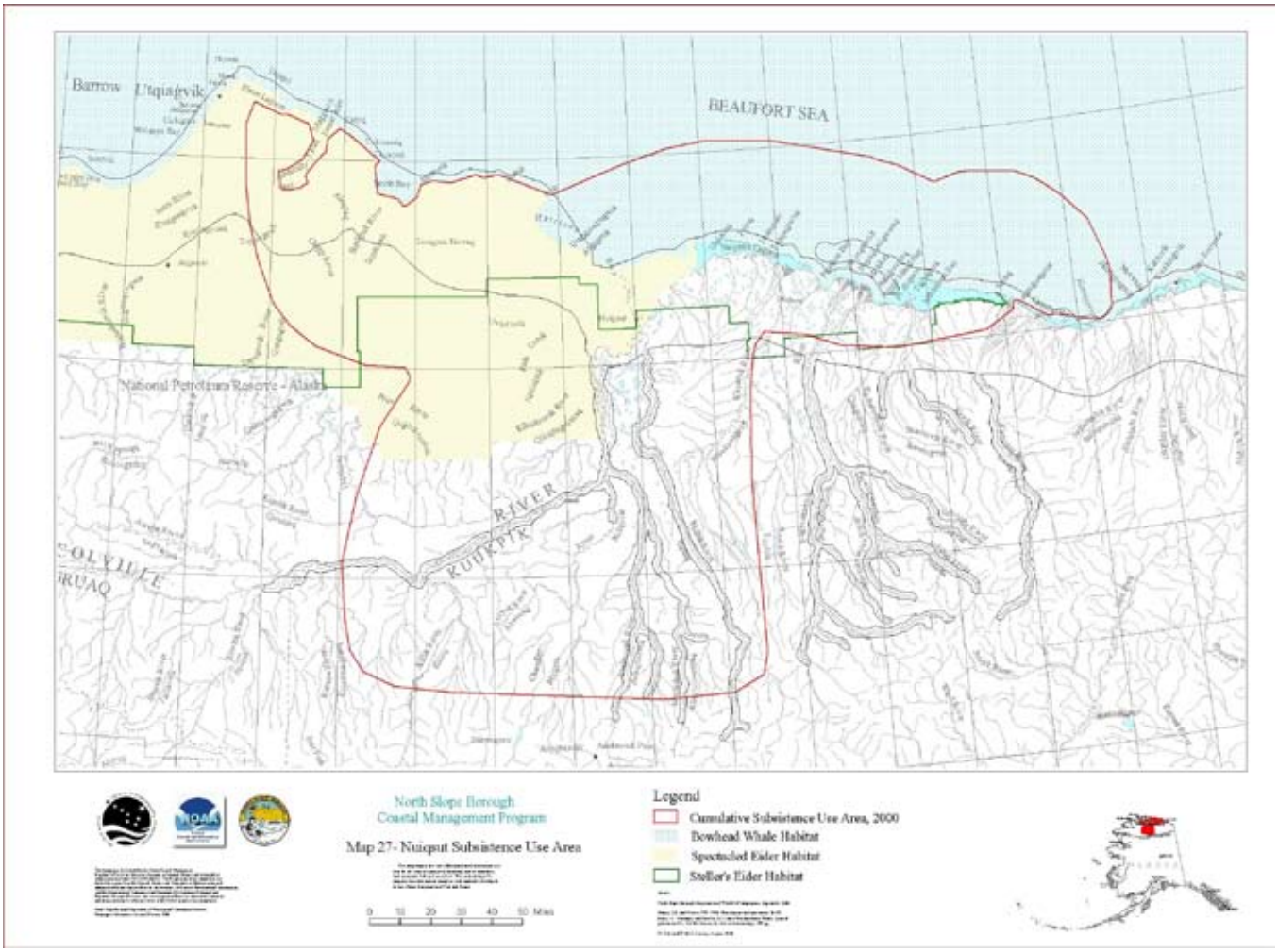


Figure 8. *Kaktovik Subsistence Use Area, Resource Atlas, North Slope Borough Coastal Management Program, 2009*

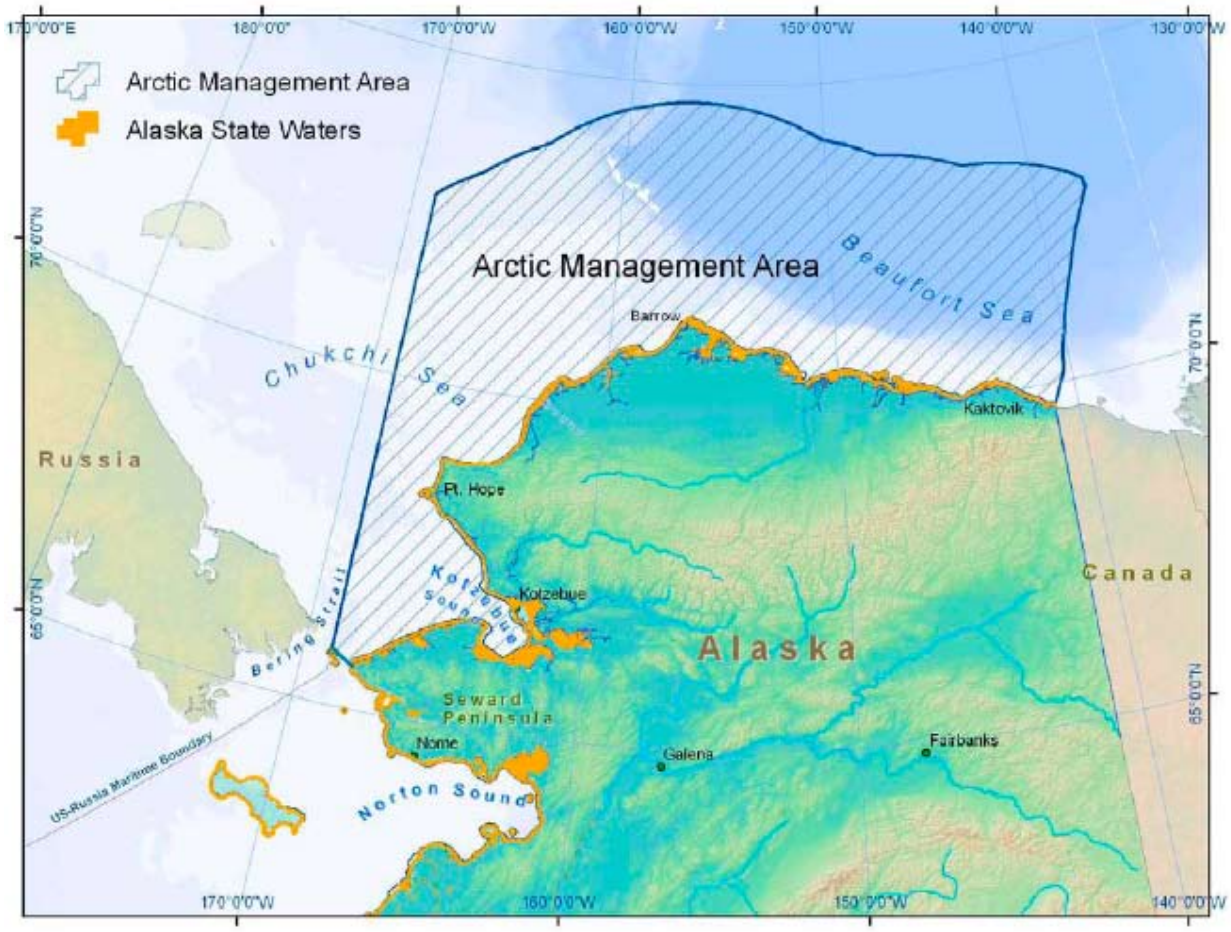


On June 12, 2009, President Obama sent a memorandum to the heads of executive departments and federal agencies establishing an Interagency Ocean Policy Task Force, led by the White House Council on Environmental Quality. The Task Force is charged with developing a recommendation for a national policy that ensures protection, maintenance, and restoration of oceans, coasts and the Great Lakes. It will also recommend a framework for improved stewardship, and effective marine spatial planning. On December 14, 2009, President Obama's Ocean Policy Task Force released its Interim Framework for Effective Coastal and Marine Spatial Planning for a 60-day public review and comment period. The Interim Framework suggests a comprehensive, integrated approach to planning and managing uses and activities. Under the framework, marine spatial planning would be regional in scope, developed cooperatively among Federal, state, tribal, local authorities, and regional governance structures, with substantial stakeholder and public comments. The framework proposes the establishment of nine regional planning bodies, including one for Alaskan waters. A final U.S. Framework for Marine Spatial Planning was issued in July 2010 and on 19 July President Obama signed an executive order that, among other instructions to federal agencies, provides for the development of coastal and marine spatial plans that build upon and improve existing Federal, State,

tribal, local, and regional decision-making and planning processes. The Obama Administration has proposed $20 million in the 2011 NOAA budget to support regional ocean partnerships and MSP.

In August 2009, the U.S. Secretary of Commerce approved a management plan for the fishery resources of the Arctic Management Area. The plan covers the Arctic waters of the United States in the Chukchi and Beaufort seas (Fig. 8). Warming ocean temperatures, migrating fish stocks and shifting sea ice conditions from a changing climate may potentially favor the future development of commercial fisheries. The plan establishes a framework for sustainably managing Arctic fish resources. Using a spatial management measure, the plan initially prohibits commercial fishing in the Arctic waters of the region until more information is available to support sustainable fisheries management.[51] The North Pacific Fishery Management Council approved the plan in February 2009. Final regulations protecting over 500,000 km2 of U.S. Arctic waters from industrial fishing went into effect December 3, 2009. The new regulations close all U.S. waters north of Alaska's Bering Strait to commercial fishing to allow time for more science to assess the health of Arctic Ocean ecosystems.

Figure 9. *Area of the US Arctic Fishery Management Area Closure*



Russia: No references to integrated management or marine spatial planning exist in Russian legislation or regulations. Governmental organizations of the Russian Federation that have responsibilities for marine management operate on a sector-by-sector basis. However, existing legislation does contain areas in which marine spatial planning could be an important instrument for solving the tasks and problems of marine management.

Marine planning is under discussion now only in the Russian academic community. The role of the academic community in this process is to formulate the basic principles of MSP, identify actions toward its implementation, and explain the need to incorporate this system into both national and international law.

Russia has identified biologically important areas. However, no marine areas have been designated as protected areas. Only coastal terrestrial have been designated; a few areas extend one kilometer into the territorial sea.

Pan-Arctic: While most MSP efforts have been focused at the national level, several initiatives have a Pan-Arctic perspective. For example, the Arctic Council has several different spatial data initiatives that are developing regional or circumpolar datasets or to provide a framework that would allow integration, access, and coordination of spatial data on the Arctic. It has discussed the possibility of developing a common interface for access to spatial data.[52] However, existing efforts of the Arctic Council to address cartography, geographic information systems, and spatial analysis have been conducted in isolation with no attempt at harmonization or integration. The Working Group on Emergency Prevention, Preparedness and Response, the Working Group on the Conservation of Arctic Flora and Fauna, and the Arctic Monitoring and Assessment Program have discussed the possibility of developing a common interface for access to spatial data, the first tentative steps toward providing a framework to allow for data standardization and integration within the Arctic Council.

The International Union for the Conservation of Nature (IUCN) and the Natural Resources Defense Council (NRDC) are about to undertake a cooperative Arctic Marine Ecosystem-Based Management Project to explore ways of advancing implementation of ecosystem-based management, and to begin the process of identifying specific ecologically significant and vulnerable marine areas that should be considered for enhanced protection in any new management arrangements. Partners in the project include the Ecologic Institute and the Center for Marine Biodiversity and Conservation (CMBC) at the Scripps Institution of Oceanography, University of California, San Diego. The main outcomes of the IUCN/NRDC Arctic Marine Ecosystem-Based Management Project will include: (1) policy recommendations on management arrangements needed to advance ecosystem-based marine management in the Arctic region; and (2) scientific findings (including maps and reports) on areas of ecological and biological significance or vulnerability that should be considered for enhanced protection in the Arctic. Shell International Exploration and Development and the Prince Albert of Monaco Foundation are co-funding the project.[53]

Another planned IUCN project, the first phase of which will be funded by Shell, will address the assessment of cross-sectoral, cumulative impacts in the Arctic. The project will assess the cumulative impacts of current and future developments on the Arctic environment, and will include a strategy to potentially develop an Arctic management plan or management plan(s) for Arctic regions. The project is divided into four phases and is expected to take at least four years to complete.

The first phase will build the required information network and organize a workshop to develop alternative scenarios for the Arctic. The second phase will identify regional developments and impacts, based on a limited and agreed set of scenarios. A larger group of stakeholders will then work in a third phase to make a strategic and integrated assessment of the potential impacts of the various sectors on the Arctic, their consequences, and advice regarding future choices. The final phase would involve additional stakeholders in assessing the political issues associated with such a forward-looking process.

How Can Marine Spatial Planning in the Arctic be Advanced?

Marine spatial planning is already occurring in the Arctic—at least in Norway (Barents Sea) and to a promising extent in the Canadian Beaufort Sea, and the USA. Only Russia and Greenland lag behind. Several options exist for moving forward:

1. A "Business as Usual", Incremental Approach

Under this option, the national government of Norway will continue to lead the way in the implementation of MSP. It is currently in the process of revising its integrated management plan for the Barents Sea and has just approved an integrated management plan for the Norwegian Sea. It is at least several years ahead of other Arctic countries in focusing on spatial and temporal management measures in its integrated approach to marine management. Canada will probably develop over the next several years a marine spatial management plan for its sector of the Beaufort Sea. However, no current plans exist for marine spatial planning in the remaining part of Canadian Arctic waters. The United States, depending on the outcome of nascent efforts of the Obama Administration to stimulate MSP in American marine areas through its executive order of July 19, 2010 and competitive grants to regional marine management organizations in 2011, could begin MSP in the Arctic seas of Alaska over the next several years. Progress on MSP in Greenland and Russia will continue to lag behind these other national efforts.

2. A Bilateral Approach between National Governments

Several areas have already been identified as potential bilateral projects for integrated marine planning: (1) the area of the USA-Canadian Beaufort Sea, known as the "Beaufort Sea Triangle",[54] and (2) the Norwegian-Russian Barents Sea. In 2005, a Norwegian-Russian working group on the marine environment was established as part of the bilateral marine protection cooperation between Norway and Russia. The working group was established to contribute to closer cooperation on ecosystem-based management of the Barents Sea.[55] In fact, Russian experts were involved in the preparation of parts of Norwegian plan for the Barents Sea, and Norway has discussed the possibility of producing a similar plan for the Russian side of the Barents Sea. Norway and Russia agreed in April 2010 to settle their dispute over the Barents Sea border that had dragged on for decades. However, immediate interests of the two countries appear to be focused on oil and gas development rather than any effort to develop an integrated management plan for the formerly disputed area.[56]

Preliminary work on MSP has begun through the Arctic Council's PAME (Protection of the Arctic Marine Environment) Work Plan for 2009-2011.[57] It is developing pilot projects to make the large marine ecosystem (LME) assessment approach operational (in the Canadian/US Beaufort Sea and the US/Russian Federation West Bering Sea).[58] These initiatives would move MSP in the Arctic forward, but without substantial new infusion of resources, progress is likely to be slow.

3. A "Hot Spot" Approach

Another way to develop a MSP initiative that could produce short-term results would be to identify a "hot spot" area in an Arctic nation that currently has no marine planning activities underway, but one that has the potential for new development. Hot spots of biodiversity and productivity in the Arctic would include flaw lead systems (waterways opening between pack ice and fast ice), polnyas (areas of open water surrounded by sea ice), areas of oceanographic fronts where mixing between cold polar and temperate waters occur, and marginal ice zones. A MSP initiative would be the appropriate approach through which to plan the future of multiple uses, identify areas for conservation, and help identify and rank baseline data gathering and applied research. It would demonstrate a commitment to an ecosystem-based management approach in the Arctic in a practical sense and could test new concepts of networked governance. This alternative could only be undertaken with the approval and cooperation of the host Arctic country.

4. An Arctic-wide, Systems Approach among National Governments

Planning for integrated, ecosystem-based management should be encouraged across Arctic countries—and a focus on MSP could be a first step in that direction. This approach would tackle the entire Arctic region, probably under the aegis of the intergovernmental Arctic Council. While the Arctic Council is not an operational body that can impose obligations on its participants, it could undertake marine spatial *planning* for the entire Arctic region with the understanding that *implementation* of any plan would be the responsibility of individual Arctic coastal nations.

Preliminary work on MSP has begun through the Arctic Council's PAME (Protection of the Arctic Marine Environment) Work Plan for 2009-2011.[59] The PAME continues to review the Arctic Marine Shipping Assessment and the Arctic Offshore Oil and Gas Guidelines. It is developing pilot projects to make the large marine ecosystem (LME) assessment approach operational (in the Canadian/US Beaufort Sea and the US/Russian Federation West Bering Sea).[60] However, *no current plan exists to develop a marine spatial plan for the entire Arctic region*. Given the working arrangement for PAME (two meetings a year) and the level of investment in its work plan (>$140,000 per year), little progress on an Arctic-wide approach to MSP can be expected over the next few years without a substantial infusion of new resources.

5. An Arctic-wide, Systems Approach beyond National Governments

Most current applications of MSP are carried out by national governments and can be characterized as "top down". For example, MSP initiatives in Western Europe, including Norway, have all been led by federal ministries, with varying levels of participation by non-governmental actors and stakeholders.

Another alternative to advancing MSP in the Arctic would explicitly recognize the importance of moving beyond sole reliance on the initiatives of national governments and toward a "networked governance" approach to guide the future of the Arctic development. Networks and partnerships of non-governmental actors including indigenous peoples, environmental non-governmental organizations, academia, and private industry, all of whom have substantial influence over governmental policies and actions, could be used to initiate MSP. Precedents exist. In Belgium, the University of Ghent laid the groundwork for MSP that was later implemented by the national government. In the United States, NGOs and the private sector,

particularly new private users of ocean space, e.g., wind farms and offshore aquaculture, have been particularly influential in the development of a national MSP framework. Local indigenous peoples (Coastal First Nations) have led by example the MSP process in British Columbia from the "bottom up" (See Box 6).

Similarly, Indigenous Peoples from the Arctic could take the initiative to develop an Arctic-wide approach to MSP through a network of their organizations including the Aleut International Association, the Arctic Athabaskan Council, the Gwich'in Council International, the Inuit Circumpolar Council, the Russian Association of Indigenous Peoples of the North (RAIPON), and the Saami Council. While capacity building to begin MSP might be needed, technical advice could be sought from the Coastal First Nations Planning Office in Vancouver, British Columbia, and the Beaufort Sea Planning Office in Inuvik, Northwest Territories, Canada. Initially the Arctic Council Indigenous Peoples Secretariat in Copenhagen, Denmark could provide coordination of this initiative. Alternatively, the initiative could be self-organizing, relying on the interests and initiative of a few indigenous organizations and their leadership. The important role of MSP "champions" within these organizations cannot be over-stated. Getting started and maintaining momentum of a MSP initiative requires early buy-in by leaders and their organizations. Listening to successful stories from the MSP initiative of the Coastal First Nations could build support for an Arctic-wide MSP initiative. New Internet-based, low-cost (or free) communications technology, e.g., face-to-face video calls, video conferencing, and webinars, could be used to supplement or substitute for long-distance Arctic travel.

An initial task would be to find adequate financial support for the initiative that could take 3-4 years to complete a first integrated, ecosystem-based marine spatial plan for the Arctic at the cost of about US$1.5-2 million per year.[61] Total funding required would be about US$ 6-8 million dollars. Funding should be sought from several foundations and the private sector, especially Arctic users.

If funding can be found, then a number of pre-planning tasks should be undertaken including the creation of a MSP team, the development of a work plan, and a definition of boundaries and a time frame for planning, e.g., 10 years, 20 years. Other early tasks would include defining MSP principles and goals (see pp. 25-29 of this report and the UNESCO Guide to MSP for additional details). These tasks should be completed during the first year of planning, if not earlier.

A key task of moving toward an ecosystem-based management approach is the identification of "ecologically or biologically important areas" based on the best available scientific information and local knowledge. Some places in the sea have much greater importance than others for particular species, ecosystems, or processes, as well as for humans, too. "Real estate values" in the sea vary enormously, just as they do on land. Knowing which places are most important to conserve and which places are compatible with development is central to the art of MSP. The output of this task, an Arctic-wide map of these areas, is a requisite for ecosystem-based MSP (additional information on identifying ecologically and biologically important areas can be found on pp. 50-55 of the UNESCO MSP guide. The Pan-Arctic initiatives of IUCN, NRDC, and Shell (an international organization, a NGO, and a business) described in the previous section could substantially contribute to the development of an Arctic-wide marine spatial plan.

Leadership through a MSP initiative by Indigenous Peoples could provide the basis for other stakeholders, e.g., the business and NGO communities, to collaborate in the planning process. Eventually the Arctic Council and national governments would participate, particularly in the implementation of many spatial and temporal management measures.

ENDNOTES

[1]Hayes, Derek, 2003. ***Historical Atlas of the Arctic***. Douglas & McIntyre Ltd: Vancouver, BC, Canada. 208 p.

[2]The Arctic Ocean, with a surface area of about 14 million km2, is the smallest of the oceans of the World.

[3]Cicin-Sain, B., and R.W. Knecht, 1998. ***Integrated Coastal and Ocean Management: concepts and practices***. Island Press: Washington, DC. 517 p.

[4]Millenium Assessment, 2005. ***Ecosystems and Human Well-being: current state and trends***. Island Press: Washington, DC.

[5]Halpern, B.S., et al., 2008. A global map of human impacts on marine ecosystems. ***Science***. 319: 948-952.

[6]Crowder, L.B., G. Osherenko, O.R. Young, S. Airame, E.A. Norse, N. Baron, J. Day, F. Douvere, C.N. Ehler, B.S. Halpern, S. J. Langdon, K.L. McCloud, J.C. Ogden, R.E. Peach, A.A. Rosenberg, and J.A. Wilson, 2006. Resolving mismatches in U.S. ocean governance. ***Science***. 313: 617-618

[7]Young, O., G. Osherenko, J. Ekstrom, L.B. Crowder, J. Ogden, J.A. Wilson, J.D. Day, F. Douvere, C.N. Ehler, K.L. McLeod, B.S. Halpern, and R. Peach, 2007. Solving the Crisis in Ocean Governance: place-based management of marine ecosystems. ***Environment***. 49/4: 20-32.

[8]McLeod, K., and H. Leslie (eds.), 2009. ***Ecosystem-based Management for the Oceans***. Island Press: Washington, DC. 368 p.

[9]Arctic Council, 2004. ***Arctic Marine Strategic Plan***. PAME International Secretariat: Akureyri, Iceland. 13 p.

[10]Hoel, A.F. (ed.), 2009. ***Best Practices in Ecosystem-based Oceans Management in the Arctic***. Norwegian Polar Institute/Polar Environmental Centre: Tromso, Norway. Report Series 129. 113 p.

[11]Young, Oran, Gail Osherenko, Julia Ekstrom, Larry B. Crowder, John Ogden, James A. Wilson, Jon C. Day, Fanny Douvere, Charles N. Ehler, Karen McLeod, and Robbin Peach, 2007. Solving the crisis in ocean governance: place-based management of ocean ecosystems. ***Environment***. Vol. 49, no. 4, May. pp. 20-32.

[12]Ehler, C., and F Douvere, 2007. ***Visions for a sea change: report of the first international workshop on marine spatial planning***. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides, 46: ICAM Dossier, 3. Paris: UNESCO. 83 p.

[13]***Scientific Consensus Statement on Marine Ecosystem-Based Management***, 2005. Prepared by scientists and policy experts to provide information about coasts and oceans to U.S. policy-makers. Available online: http://www.compassonline.org/pdf_files/EBM_Consensus_Statement_v12.pdf

[14]Yeager, B.B., 2009. Managing towards sustainability in the Arctic: some practical considerations. ***Zeitschrift für ausländisches öffentliches Recht und Völkerrecht*** (Heidelberg Journal of International Law, Sonderabdruck aus Band 69, Nr 3. Pp. 567-578.

[15]United States National Security Presidential Directive and Homeland Security Presidential Directive NSPD 66/HSPD 25, ***Arctic Region Policy***, 9 January 2009. Downloadable at: www.fas.org/irp/offdocs/nspd/nspd-66.htm

[16]White House Council on Environmental Quality, 2009. Interim Report of the Interagency Ocean Policy Task Force. Executive Office of the President: Washington, DC. September 10. 38 p. Downloadable at: www.whitehouse.gov/administration/eop/ceq/initiatives/oceans/interimreport.

[17]K. Arkema, S. Abramson and B. Dewsbury, 2006. "Marine ecosystem-based management: from characterization to implementation," ***Frontiers in Ecology and the Environment***. 4: 525–532.

[18]B. Halpern, S. Walbridge, K. Selkoe, C. Kappel, F. Micheli, C. Agrosa, J. Bruno, K. Casey, C. Ebert, H. Fox, R. Fujita, D. Heinemann, H. Lenihan, E. Madin, M. Perry, E. Selig, M. Spalding, R. Steneck, R. Watson, 2008. "A Global Map of Human Impact on Marine Ecosystems," ***Science*** 319: 948–952.

[19]S. Coffen-Smout and G. Herbert, 2000. "Submarine Cables: A Challenge for Ocean Management," ***Marine Policy*** 24: 441–448.

[20]R. Bess and R. Rallapudi, 2007. "Spatial Conflicts in New Zealand Fisheries: The Rights of Fishers and Protection of the Marine Environment," ***Marine Policy*** 31: 719–729.

[21]D. Sivas and M. Caldwell, 2008. "A New Vision for Californian Ocean Governance: Comprehensive Ecosystem-Based Marine Zoning," ***Stanford Environmental Law Journal*** 27: 209–270.

[22]This matrix is preliminary and should be refined for specific areas of the Arctic through a stakeholder participation process.

[23]B. Worm, E. Barbier, N. Beaumont, J. Duffy, C. Folke, B. Halpern, J. Jackson, H. Lotze, F. Micheli, S. Palumbi, E. Sala, K. Selkoe, J. Stachowicz, and R. Watson, 2006. "Impacts of Biodiversity Loss on Ocean Ecosystem Services," ***Science*** 314:787–790.

[24]The Convention on Biological Diversity describes *ecosystem-based management* as "a strategy for integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. The ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of ecosystems." (Convention on Biological Diversity. Decision V/6 of the Conference of the Parties to the Convention on Biological Diversity. Ecosystem Approach, available online: <http://www.biodiv.org>.

[25]L. Crowder, G. Osherenko, O. Young, S. Airame´, E. Norse, N. Baron, J. Day, F. Douvere, C. Ehler, B. Halpern, S. Langdon, K. McLeod, J. Ogden, R. Peach, A. Rosenberg, and J. Wilson, 2006. "Resolving Mismatches in U.S. Ocean Governance," ***Science*** 313: 617–618. See also C. Ehler and F. Douvere, 2007. ***Visions for a Sea Change. Report of the First International Workshop on Marine Spatial Planning***, Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides No. 48, IOCAM Dossier No. 4 (Paris: UNESCO); and F. Douvere, 2008 "The Importance of Marine Spatial Planning in Advancing Ecosystem-based Sea Use Management," ***Marine Policy*** 32, no. 5. September 2008.

[26]K. Arkema, S. Abramson and B. Dewsbury, 2006. 'Marine Ecosystem-Based Management: From Characterization to Implementation, ***Frontiers in Ecology and the Environment*** 4: 525–532.

[27]O. Young, G. Osherenko, J. Ekstrom, L. Crowder, J. Ogden, J. Wilson, J. Day, F. Douvere, C. Ehler, K. McLeod, B. Halpern, and R. Peach, 2007. 'Solving the Crisis in Ocean Governance: Place-Based Management of Marine Ecosystems," ***Environment*** 49: 21–30.

[28]Ehler, C., and F Douvere, 2007. ***Visions for a sea change: report of the first international workshop on marine spatial planning***. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides, 46: ICAM Dossier, 3. Paris: UNESCO. 83 p.

[29]Tyldesley, D., and B. Hunt, 2003. ***Review of how land use planning system could influence the development of a marine spatial planning system for England***. English Nature Research Report No. 566. English Nature: Peterborough, UK. 38 p.

[30]Ehler, Charles, and Fanny Douvere, 2009. ***Marine Spatial Planning: a step-by-step approach toward ecosystem-based management***. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides No. 53, ICAM Dossier No. 6. Paris: UNESCO. 2009 (English). Downloadable at: ioc3.unesco.org/marinesp

[31]Ehler & Douvere, 2009. *Ibid*.

[32]Pomeroy, R. and F. Douvere, 2008. The engagement of stakeholders in the marine spatial planning process. ***Marine Policy***. Vol. 32, no. 5. September. pp. 816-822.

[33]Sivas and Caldwell, 2008. A new vision for California ocean governance: comprehensive ecosystem-based marine zoning, ***Stanford Environmental Law Journal***.

[34]Arctic Council, 2004. ***Arctic Marine Strategic Plan***. PAME International Secretariat: Akureyri, Iceland.

[35]Ehler, Charles N., 2003 Indicators to measure governance performance in integrated coastal management. ***Ocean and Coastal Management Journal***. Vol.46, Issues 3-4, pp. 335-345.

[36]Pomeroy, R.S. et al., 2004. ***How Is Your MPA Doing? A guidebook of natural and social indicators for evaluating marine protected area management effectiveness***. IUCN Protected Area Program: Gland, Switzerland. 234 p.

[37]Belfiore, Stefano, Julian Barbiere, Robert Bowan, Biliana Cicin-Sain, Charles Ehler, Camille Mageau, Dan McDougall, and Robert Siron, 2006. ***A Handbook for Measuring the Progress and Outcomes of Integrated Coastal and Ocean Management***. IOC Manuals and Guides, 46; ICAM Dossier 2. Paris: UNESCO. 217 p.

[38]Ehler & Douvere, 2009. *Ibid*.

[39]Ehler and Douvere, n. 11 above.

[40]Royal Norwegian Ministry of the Environment, 2006. ***Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas off the Lofoten Islands***. 144 p.

[41]Royal Norwegian Ministry of the Environment, 2009. ***Integrated Management of the Marine Environment of the Norwegian Sea***. Report No. 37 to the Storting.

[42]Olsen, E., et al., 2007. The Norwegian ecosystem-based management plan for the Barents Sea. ***ICES Journal of Marine Science*** 64: 599-602.

[43]The Saami Parliament's supplementary report regarding the ILO Convention no. 169, Resolution 026/08.

[44]Beaufort Sea Planning Office, 2009. ***Integrated Ocean Management Plan for the Beaufort Sea: 2009 and beyond***. Inuvik, NT, Canada. 70 p.

[45]For more information, go to: www.dfo-mpo.gc.ca/oceans/marineareas-zonesmarines/loma-zego/index-eng.htm

[46]Fisheries and Oceans Canada (2005). ***Marine ecosystem overview of the Beaufort Sea large ocean management area (LOMA)***. Report prepared by North/South Consultants and the Inuvialuit Cultural Resource Centre. 118 p.

[47]Fisheries and Oceans Canada (2009). ***The Beaufort Sea Integrated Ocean Management Planning Atlas***. 30 p.

[48]Beaufort Sea Planning Office, 2009. ***Integrated Ocean Management Plan for the Beaufort Sea: 2009 and beyond***. Inuvik, NT, Canada. 70 p.

[49]Ehler, Charles N., Daniel J. Basta, et al., 1988. ***The Bering, Chukchi, and Beaufort Seas Strategic Assessment Data Atlas***. National Oceanic and Atmospheric Administration, National Ocean Service, Strategic Assessment Branch: Rockville, MD. 112 maps and text.

[50]For example, see: ak.audubon.org/files/Audubon%20Alaska/documents/Draft_Atlas_of_the_Chukchi_

and_Beaufort_Seas_Introduction.pdf

[51]See North Slope Borough Resource Atlas maps, available at: www.co.north-slope.ak.us/programs/coastal_management/resource_atlas.php

[52]Downloadable at: www.fakr.noaa.gov/sustainablefisheries/arctic/

[53]Barry, T., 2008. The Arctic Council—approach to spatial data. The Arctic Council (Conservation of Arctic Flora and Fauna): Tromso, Norway. 5 p.

[54]Robert Blaauw, Business Development Manager, Russia and Arctic, Shell International Exploration and Production B.V., personal communication, 11 March 2010,

[55]Baker, Betsy, 2009. Filling an Arctic gap: legal and regulatory possibilities for Canadian-US Cooperation in the Beaufort Sea. ***Vermont Law Journal***. Vol. 34:057. pp. 57-120.

[56]Royal Norwegian Ministry of the Environment, 2006. ***Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas off the Lofoten Islands***. 144 p.

[57]BBC News On-line. Norway agrees Barents Sea Arctic border with Russia. 27 April 2010. Available at: news.bbc.co.uk/2/hi/8646644.stm

[58]Arctic Council/PAME, 2008, ***Work Plan*** 2009-2011. PAME Secretariat: Akureyri, Iceland. 20 p.

[59]The "LME Approach to the Assessment and Management of Coastal Waters" is described at: www.lme.noaa.gov/index.php?option=com_content&view=article&id=47&Itemid=41

[60]Arctic Council/PAME, 2008, ***Work Plan*** 2009-2011. PAME Secretariat: Akureyri, Iceland. 20 p.

[61]The "LME Approach to the Assessment and Management of Coastal Waters" is described at: www.lme.noaa.gov/index.php?option=com_content&view=article&id=47&Itemid=41

[62]This very rough first estimate of MSP costs in the Arctic by the author is derived from a comparison to similar large-scale MSP efforts in other countries.


PRINCE ALBERT II OF MONACO
FOUNDATION


THE ASPEN INSTITUTE