

**ECOSYSTEM –BASED APPROACHES FOR CONSERVING
ARCTIC BIODIVERSITY¹**

**For the Arctic Council’s
Workshop for the Arctic Marine Strategic Plan**

By

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¹ The content of this paper is the responsibility of the author(s) and does not necessarily represent the views of the PAME Working Group as a whole, or it’s member countries.

Executive Summary

Introduction

This discussion paper is intended to provide background information and to precipitate discussion on ecosystem-based approaches for conserving arctic biodiversity at the Arctic Council (AC) Workshop for the Arctic Marine Strategic Plan in Reykjavik in October 2003. The paper also introduces preliminary recommendations for biodiversity conservation, which can be discussed at the October workshop.

The discussion paper is based on a variety of contributions and information, such as reports and programs of the Conservation of Arctic Flora and Fauna (CAFF), and the valuable scientific information for biodiversity and ecosystems included in the Arctic Climate Change Impact Assessment (ACIA) Scientific Report.

The paper begins with an executive summary that examines ecosystem approaches for conserving biodiversity, arctic biodiversity conservation, the international framework for biodiversity conservation, and preliminary recommendations as the next step forward. The remainder of the paper is divided into chapters that address threats to arctic biodiversity, the arctic framework for biodiversity conservation, case studies of regional and national ecosystem-based approaches, and preliminary recommendations, followed by an appendix that summarizes marine-oriented activities in the CAFF program.

Ecosystem approaches for conserving biodiversity

A consideration of ecosystem approaches for conserving biodiversity requires a shared understanding of the different components of an ecosystem approach. This executive summary begins by considering definitions for some of these components.

Biodiversity

Under the Convention on Biological Diversity, biodiversity is defined as “the variability among living organisms from all sources, including *inter alia*, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species, and of ecosystems” (CBD, 1994).

The least visible and studied level of biodiversity is genetic diversity within species. Most species consist of several distinct populations within their geographical range, which do not interbreed, and become genetically distinct. Species diversity varies greatly, with lower diversity in the Arctic than in warmer climates. Ecosystem diversity refers to combinations of species compositions and physical structures. A marine strategic plan need to consider all levels of biodiversity.

Conservation

Conservation can be defined in terms of a range of international, regional and national measures and approaches. Biodiversity and conservation are linked as one makes efforts to conserve biodiversity through conservation measures. These conservation measures may be local, regional, national, and international regulatory regimes, and a range of voluntary measures. Integrated management approaches and best management practices are also useful concepts for achieving conservation goals.

The marine ecosystem

Within the context of marine biodiversity, the marine ecosystem can be defined as estuarine areas that may be a mixture of fresh and brackish waters, coastal areas, and marine areas. The marine areas can be located within and external to state jurisdiction.

Ecosystem approach

The ecosystem approach was defined at the World Summit on Sustainable Development (WSSD) to incorporate biodiversity, conservation and sustainable development. At the WSSD, the ecosystem approach was defined as “the comprehensive integrated management of human activities based on best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of the ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity” (WSSD 2002). The AC Arctic Marine Strategic Plan will be based on principles adopted at WSSD.

Integrated management

Integrated management is the means by which managers can reconcile the protection of important marine areas, through a system of marine protection areas and other zoning regimes, and regulated renewable and non-renewable resource uses. This is consistent with the global trend which the IUCN’s World Commission on Protected Areas terms “mainstreaming” protected areas, meaning the gradual shift from treating them as conservation islands or preserves to treating them as integral parts of a broader terrestrial and marine sustainable development and use strategy.

Marine Protected Areas

Marine Protected Areas (MPAs) are tools developed to provide integrated area-based marine biodiversity conservation. Only an estimated 2% of the marine Arctic is under any kind of formal protection (CAFF/IUCN/PAME Circumpolar Marine Workshop 1999). Historically, nearly all MPAs have been established in coastal waters within national jurisdictions. In response to growing international concern, the WSSD highlighted the need to maintain the productivity and biodiversity of important and vulnerable marine areas beyond national jurisdiction—the “high seas”, which are comprised of the world’s oceans that lie beyond the territorial sea and Exclusive Economic Zones (EEZ) and above the continental shelf of coastal nations.

Renewable resource use

Renewable resource use can be defined as commercial and subsistence harvests of fish, marine mammals and water birds, and other marine life forms. Commercial and subsistence resource uses share similarities, but are also separated by important differences for biodiversity conservation. Subsistence uses of estuarine, coastal and marine species are characteristic of indigenous peoples and local communities in the Arctic region. These subsistence uses can be consistent with conservation and, under some regulatory regimes, may function to preserve arctic species and habitat. A consideration of commercial fishing and use of other marine organisms is required under a comprehensive arctic marine strategic plan, as well as an acknowledgement of their impact on marine ecosystems and species. Examples include bycatch of seabirds and marine mammals during fishing operations, and the effect of fishing on the availability of food for marine bird and mammal populations.

Conservation of Arctic Biodiversity

When considering the conservation of arctic flora and fauna, it is useful to consider different aspects of arctic biodiversity. Understanding relationships, and the ways in which they may change, is essential to understanding the long-term conservation needs of arctic biodiversity. Aspects of arctic biodiversity conservation listed below highlight some of the conservation issues that need to be addressed under any arctic marine strategic plan:

- *Species population ranges.* Plants and animals living at the extremes of their geographic and climatic ranges may be essential to the long-term survival of their species. They are also sensitive indicators of environmental change because their survival depends far more on external factors such as climate than on internal ones such as population cycles.
- *Species flexibility and vulnerability.* The presence of relatively few species in the Arctic may mean that certain key ecological functions depend on only one or two species, rather than several with overlapping roles as might be found in lower latitudes.
- *Genetic diversity within species.* The greater the range of conditions under which a species can survive, the more likely it is to do so as conditions change. In the Arctic, where there are relatively few species compared with other parts of the world, genetic diversity can be of great importance to the ability of plants and animals to continue to perform their ecological functions.
- *Habitat diversity.* The diversity of habitats across small and large distances offers a crucial buffer against change, as many species can move from one area to another as the highly variable conditions created by northern climates demand.
- *Habitat fragmentation.* Habitat fragmentation may act as a barrier to species' mobility under habitat diversity. For the marine environment, habitat fragmentation may occur due to disturbances to the seabed and benthic environments, from seabed fish trawling, or due to the deposit of sediments or pollutants. There may be less fragmentation in the water column.
- *Ecosystem structure and function.* Biodiversity is more than a listing of species in a given area. The relationships among species, and between species and their environment, are the basis of an ecosystem. Changes to ecosystems can have unexpected effects. For example, the removal of biomass through commercial fishing may cause secondary alterations in the food web, as in the case of killer whales apparently preying on seals and other mid-size mammals in the absence of larger whales removed from the North Pacific/Bering Sea ecosystem through commercial whaling.
- *Impact of climate change.* Estuarine, coastal and marine areas are inhabited by species that are influenced by changes in temperature and nutrients, that are ice edge dependent, or that may be affected if there are shifts in local and regional currents and circulation patterns. The concern over climate-related change to the North Atlantic Current (as a result of climate change), and potential changes for the marine and terrestrial ecosystems of the Faroe Islands, illustrates potential impacts of changes in currents. Climate change will modify species ranges and ecosystems, supporting the establishment of a more flexible MPA and conservation approaches, with less reliance on geographic delineation.

International framework for biodiversity conservation in estuarine, coastal and marine areas

This section summarizes the international framework for the Arctic estuarine, coastal and marine waters. To date, the most effective way to conserve marine biodiversity has been to regulate

human activities occurring in the marine environments (e.g., fishing and shipping), and to set aside areas in which human activity is prohibited or restricted. These efforts have intensified over the past 25 years, and there is now a wide array of legal and regulatory instruments at both the international and national levels. There is also an increased effort to set aside marine areas for conservation purposes. However, marine conservation efforts have lagged behind efforts focused on terrestrial environments.

The 1982 United Nations Convention on the Law of the Sea (UNCLOS) is the overall framework for the conservation and sustainable use of the world's oceans and seas. It establishes uses of the ocean and its resources, and presents a definitive legal classification system for marine waters that includes internal waters, the territorial sea, the contiguous zone, and the exclusive economic zone. UNCLOS also deals with rights and obligations of coastal States and other States over the continental shelf and on the high seas, and establishes rules governing the areas of the ocean beyond the limits of national jurisdictions. UNCLOS sets out coastal States' rights and jurisdiction and obligations within each maritime zone, including the right and obligation to take conservation measures within each zone. These conservation measures include but are not limited to the designation of conservation areas.

Chapter 17 of Agenda 21, which was adopted in 1992, remains the fundamental program of action for achieving sustainable development for oceans and seas. The Convention of Biological Diversity (CBD), also adopted in 1992, includes decisions in relation to the conservation and sustainable use of marine and coastal biological diversity, and the ecosystem approach is incorporated within those decisions. The CBD establishes the aims, principles, and operational guidance for an equitable and integrated approach to the conservation and sustainable use of the marine and coastal environment.

The World Summit on Sustainable Development (WSSD) highlighted marine issues for which action is most urgently needed, including those below.

- Apply the ecosystem approach for the sustainable development of the oceans by 2010,
- Set a target date of 2012 for the completion of an effectively managed, ecologically representative network of Marine and Coastal Protected Areas
- Maintain fish stocks at sustainable levels, and restoring depleted fish stocks,
- Prevent, deter and eliminate illegal, unreported and unregulated fishing,
- Establish marine protected areas,
- Establish global reporting and assess the state of the marine environment, and
- Eliminate subsidies that contribute to illegal, unreported and unregulated fishing and to excess fishing capacity.

In its December 2002 Resolution on Oceans and Law of the Sea, the United Nations General Assembly endorsed the WSSD ecosystem-based Plan of Action, including the establishment of representative networks of marine protected areas by 2012.

The Global Program of Action for the Protection of the Marine Environment from Land-Based Activities (GPA) builds on UNCLOS, and contains provisions for habitat conservation. Other important international Conventions for marine conservation are: Trade in Endangered Species (to control trade in endangered flora and fauna), Whaling (to conserve whale stocks and regulate the whale fishery), Wetlands of International Importance (to conserve important wetlands, including coastal), World Heritage (to protect natural areas and cultural sites of universal value), Migratory Species (to protect migratory species and their habitats) and the United Nations Fisheries Agreement (to conserve and sustain the use of migratory fish and those that straddle economic zones).

Two anti-pollution Conventions also contain important marine conservation provisions. They are the Convention for the Prevention of Pollution from Ships (MARPOL), which restricts vessel discharges and can be used to identify Special Areas, Areas to be Avoided (ATBAs) and Particularly Sensitive Sea Areas (PSSAs) for ships; and the Convention on the Protection of the Marine Environment of the North-east Atlantic (OSPAR) which contains provisions for conserving marine habitats and species.

At present within Europe, national legislation primarily ensures the conservation of marine species and the establishment of marine protected areas. European Community Directives, such as the EC ‘Habitats Directive’ and the EC ‘Birds Directive’, provide a broader framework for this national implementation, and can also assist in determining the necessary protection requirements. The European Community Council Directive on the Conservation of Wild Bird (79/409/EEC), or the Birds Directive, is discussed in order to illustrate the European biodiversity conservation approach. Article 4 of the Directive requires Member States to classify the most suitable territories, or Special Protection Areas (SPAs), for the protection and conservation of wild birds that are listed in an annex of the Directive, and for regularly occurring migratory bird species. The selection of SPAs should take into account the protection of these birds in the land and sea territories of the Member States, up to the 200-mile Exclusive Economic Zone, and are based on ornithological criteria in the Directive. The EC Fisheries Regulation compliments the Birds Directive by according protection to seabird feeding areas and, thus, also protect the seabirds.

Preliminary recommendations as the next step forward

Although much of the Arctic marine environment is undisturbed, threats to biodiversity conservation are intensifying and spreading. Achieving conservation of biodiversity while also allowing for sustainable forms of economic growth will be a significant challenge in future years. The discussion paper concludes with preliminary recommendations, that are intended to assist discussions at the workshop for the AC Arctic Marine Strategic Plan, and to be considered for inclusion in the Plan.

These recommendations arise from the information and trends identified in this discussion paper, the *Arctic Flora and Fauna Recommendations* accepted by the Arctic Council, and from issues and trends identified in several CAFF reports. The recommendations address five key conservation challenges and goals: conserving ecosystems and habitats, conserving species, assessing and monitoring biodiversity, addressing global issues, and engaging society in conservation.

While the recommendations stem from a variety of sources and this discussion paper, they have a broader application. Conserving Arctic biodiversity requires the active participation of all sectors of society within and external to the Arctic. These preliminary recommendations are presented in the hopes of encouraging greater cooperation and collaboration for Arctic biodiversity conservation. Conserving Arctic biodiversity ensures that Arctic ecosystems and their biodiversity remain viable and able to sustain future human socio-economic and cultural needs.

The remainder of the discussion paper is divided into chapters that address threats to Arctic biodiversity, the Arctic framework for biodiversity conservation, and cases studies of regional and national ecosystem-based approaches. The paper concludes with preliminary recommendations for biodiversity conservation.

Threats to Arctic Biodiversity

The Arctic is a unique ecosystem encompassing nearly 30 million km², including an ocean, multiple seas, and adjacent landmass of over 14 million km². The Arctic region comprises a

variety of biomes and habitats ranging from boreal forests to arctic desert to ocean and pack ice. Many of the region's habitats and ecological processes and adaptations are unique. In a global context, the Arctic is a distinct and significant component of the diversity of life on Earth.

The Arctic marine environment is important on a local and national scale, providing many essential opportunities and resources for humans. The marine environment is also important on a global level in sustaining biological resources such as fish, marine mammals, and birds that are valued by communities and economies far from the region, and by influencing global climatic patterns and functioning as sinks of carbon dioxide, the main greenhouse gas.

The extremes of climate and sunlight in the marine Arctic drive extreme seasonal variations in marine production, with nutrients that concentrate during the dark winters supporting the burst of primary production in the spring. A wide diversity of animal species is resident in the marine habitat. The Arctic also supports many migratory species of marine mammals and birds. During the short summer breeding season, the marine and terrestrial Arctic also supports tens of millions of migratory wildlife that range to many parts of the globe. Over 250 species of birds flock to the Arctic each spring to use the rich breeding grounds and abundant nutrient supplies. The Bering and Barents Seas in the Arctic contain some of the richest fisheries in the world.

In addition to its value as wildlife habitat, the marine environment has sustained Arctic peoples across historical time. In fact, many Arctic societies such as the Inuit and coastal Saami depended almost exclusively on marine resources. Europeans were and continue to be extensive users of the Arctic's marine resources; and past European exploitation of the Arctic species almost drove some species to extinction.

Why does biodiversity in the Arctic require protection? The region faces a broad spectrum of threats, from direct and indirect human-caused threats (e.g., seabird bycatch in fishing gear, and waterbird mortality from oil pollution) to broad-scale human-caused environmental changes (e.g., climate change and ozone depletion) combined with cyclic changes in ecosystems. To illustrate problems that may affect conservation of biodiversity in the Arctic, a brief overview is presented of threats to estuarine, coastal and marine biodiversity.

Climate change: Sea ice, ice edge and ice thickness affect arctic ecosystems and species. For example, reduction in sea ice affects polar bears and seal habitat and distribution. Climate change may disrupt air and water currents, thereby altering migratory and nomadic routes of marine mammals, fishes, and birds. It may also alter historically persistent sources of prey availability, impacting animal distributions and population dynamics. Clearly, climate change will impact current distributions and abundances of biodiversity in the Arctic.

Ozone depletion: Though ozone depletion may be diminishing, it must be considered in the context of climate changes, contaminants and other environmental threats. For example, the increased ultraviolet radiation allowed by ozone depletion may cause photochemical damage in the DNA of living organisms.

Environmental changes: A growing accumulation of evidence points toward the occurrence of a complex of significant and interrelated atmospheric, oceanic, and terrestrial changes in the Arctic in recent decades (SEARCH: Study of Environmental Arctic Change, Science Plan, 2001). There is evidence that these changes are connected with the rising trend in the Arctic Oscillation (AO), a mode of atmospheric variability that may act over a range of time scales. There is theoretical evidence that the positive trend observed in the AO index might be indicative of global warming. Recent declines in Arctic ice cover have been linked to lower trophic level effects (changed primary production and types of algae species present) and upper trophic level impacts (underweight walrus and abandoned ringed seal pups in the Beaufort and Bering Seas) (SEARCH 2001).

Threats to the High Seas: New techniques in commercial resource exploitation allow bottom trawlers to locate and harvest deep-sea fish stocks such as the orange roughy, damaging fragile benthic coral-based communities in the process. With some 75% of the world's major fisheries fully exploited, over-exploited, or depleted, pressures on unexploited deep-sea habitats are intensifying. Other growing high seas threats include bycatch mortality of seabirds, marine mammals, and sea turtles; increasing ocean shipping; and waste and pollution. Exploitation of deep seabed mineral resources and methane hydrates is also forecast to begin within the next decade (IUCN, WCPA, WWF Malaga Experts Workshop Proceedings, 2003).

Physical disturbance / Habitat fragmentation: Bottom trawling and dredging can severely alter the structure and complexity of benthic communities by removing slow-moving or attached organisms, smoothing the sea floor (e.g., altering habitat), and increasing suspended sediment loads. Deposition of sediments and pollutants can also influence the biodiversity of the sea floor.

Chemical disturbance: The acidification of land and waters and the accumulation of heavy metals in food webs extend over wide areas. PCBs, as well as other contaminants, are found in high levels in polar bears and other marine mammals and birds in many arctic regions, and are suspected to cause reproductive system abnormalities.

Invasive Alien Species: Invasive species may be purposely introduced for various reasons, or accidentally introduced by such means as aquaculture or ballast water. Foxes have been introduced for fur farming on many islands in the Bering Sea area, eliminating or severely reducing local seabird populations. Non-native Red King Crabs have been introduced into the Barents Sea and Atlantic Salmon into the Pacific, with unknown ecosystem effects. Invasive species accidentally introduced by ballast water are likely to be a growing threat as shipping traffic in the Arctic increases and as milder temperatures permit a greater number of species to survive.

Commercial use and risks of overexploitation: Overfishing has led to declines of some fish species, changes in marine food webs, and economic crises in many Arctic regions. For example, the starvation of many seals and the collapse of seabird colonies in the Barents Sea region in the 1980s have been associated with the overexploitation of capelin.

Incidental impacts of commercial use: Commercial fishing may have incidental impacts such as bycatch of seabirds and other non-target species that may be difficult to estimate, and complicated to mitigate. An example is the wide variety of bird species taken as bycatch in the longline groundfish fishery in the Bering Sea and Aleutian Islands.

Subsistence use and risk of overexploitation: Subsistence use can serve to protect biodiversity by supporting the maintenance of a healthy ecosystem for targeted species. However, under some conditions, subsistence uses can also work against conservation of biodiversity. For example, colonies of murre (guillemots) in Greenland have become vulnerable to the rapidly expanding range of subsistence hunters using powerboats, with harvest levels that may not be sustainable.

Aquaculture: Aquaculture is increasingly prevalent in coastal waters in the Arctic. Though the environmental impacts of aquaculture have lessened since the early days of the industry, aquaculture operations directly impact marine ecosystems through increases in nutrient and contaminant levels.

Commercial shipping and extractive resource activities: Shipping is likely to dramatically increase throughout the Arctic due to lessening ice cover and thickness, as well as due to overall global projected increases in shipping. Resource development activities for hydrocarbons and minerals are also forecast to increase. These activities can impact local biodiversity and conservation in their areas of extraction, and increase the risk of spills from pipelines and in shipping routes.

Tourism: An estimated 1.5 million tourists annually visit the Arctic area defined by CAFF. Currently, tourist activity in coastal and marine areas remains effectively unregulated. Without adequate oversight and monitoring, the increasing popularity of cruise ships has the potential to bring increasing impacts on biodiversity in previously remote coastal and marine areas.

Arctic Framework for Ecosystem-based Approaches

All Arctic countries use or plan to use protected areas as a mechanism for marine conservation, with generally similar rationales - habitat, species and ecosystem conservation- for setting aside areas. However, there has been a steady shift in the application of protected areas, and countries are increasingly considering cultural heritage, spiritual and recreation values as equally important criteria to designate protected areas.

In general, representatives of the Arctic countries have observed that there is sufficient national legislation available to protect the marine environment and conserve its biodiversity and habitats. However, there exists an implementation gap, as legislation is not always implemented or its provisions adequately enforced. There may be merit in examining how the circumpolar countries as a group could enhance implementation. Arctic countries may also consider developing an overall management framework for marine protection and conservation (e.g., along the lines of the arrangement being put in place under Canada's *Oceans Act*). Additionally, there is the issue of biodiversity conservation for those waters outside national boundaries.

The current international framework for marine conservation is introduced in the Executive Summary. In addition to the international regime, each Arctic coastal State has national legislation for marine protection and biodiversity conservation. Brief national summaries are presented, followed by an examination of selected national frameworks which illustrate different approaches to marine protection and biodiversity conservation.

- **Canada** has legislation at the federal, territorial and provincial levels - over twenty pieces in all. Historically, Canada's marine focus has been on fisheries and sovereignty but there is now more emphasis on broad-based conservation measures, that include integrated management approaches and setting aside marine protected or conservation areas. Canada's *Oceans Act* serves as an overarching framework for marine conservation. The Oceans Strategy under that Act provides an integrated ecosystem approach to coastal and oceans management, and for coordination of policies and programs across federal government departments and different levels of government.
- The **Faroe Islands** are a self-governing overseas administrative division of the Kingdom of Denmark. On 1 May 2003, an agreement was reached between the Faroese and Danish governments on the transfer of legislative and administrative competence concerning the marine environment to the Faroe Islands.
- **Greenland** shares jurisdiction for the marine environment with Denmark. Greenland has been strengthening its marine legislation and since 1994 has passed three important Acts on marine pollution and shipping, on fisheries and on hunting and is also reviewing its entire nature conservation regime.
- **Iceland** is a marine dependent country with a major focus on fisheries. It has comprehensive legislation and regulations for the marine environment, especially for fisheries and pollution and has recently enacted legislation to establish its first major marine conservation area, the Breidafjörður Marine Conservation Area. Iceland has eight pieces of legislation relevant for marine conservation.
- **Norway** has traditionally been dependent on its marine resources and has been steadily increasing its regulation of marine and coastal activity. It is now focusing more on multi-

species management plans, and has five main pieces of legislation relating to marine conservation.

- **Russia** shares responsibility for the marine environment between its territorial states and the federal government. It has been slowly establishing a legislative base to enhance Arctic marine conservation and to date has passed eight pieces of legislation, with the main one being the *Law on the Exclusive Economic Zone of the Russian Federation* (1998).
- The **United States (U.S.)** shares jurisdiction for Arctic marine conservation between the State of Alaska and the federal government.

National frameworks for marine protection and biodiversity conservation

Norwegian framework

Norway is developing a national Marine Conservation Plan to ensure improved protection of its valuable marine habitats. Norway is a leader in the protection of cold-water corals, and has taken specific action to protect at least five significant cold-water coral areas. The Norwegian Polar Institute has also completed an evaluation of the marine area protection around Svalbard.

Jurisdiction of Norway's marine environment is shared among national authorities, county officials, and Svalbard authorities. Protection of the marine environment includes increased regulation of fisheries activities and the use of protected areas. About 2% of the Norwegian mainland coast is under some form of legal protection as either wetlands or for landscape values.

Norway has several pieces of legislation that it uses to protect its marine environment. *The Svalbard Act* (1925) governs activities on Svalbard, including all islands and marine areas within four nautical miles from the shoreline, and authorizes fisheries regulations and protection of the marine environment through establishment of marine protected areas and regulation of shipping within this zone.

The Act relating to scientific exploration and exploitation of submarine natural resources other than petroleum resources (1963) establishes a sovereign right to scientific exploration and exploitation of submarine natural resources other than petroleum, (petroleum resources are regulated in a special act adopted in 1996), within the border of the Norwegian continental shelf.

The Nature Conservation Act (1970), administered by the Ministry of Environment, is a framework act, which declares nature as a national asset to be administered for its long-term preservation and utilized in accordance with a long-term comprehensive administration of resources. The act provides a legal basis for establishing protected areas, including protection of the marine environment.

The Act relating to the Norwegian Exclusive Economic Zone (1976) establishes a 200-nautical mile exclusive economic zone with respect to natural resources and certain economic activities. This act is the legal basis for exercising jurisdiction over marine science and environmental protection within the limits of international law.

The Wildlife Act (1981) provides for protection of all wild terrestrial mammals, birds, amphibians and reptiles outside protected areas on the Norwegian mainland, in the Norwegian internal waters, in the Norwegian territorial sea and in Norway's Exclusive Economic Zone.

The Salt Water Fisheries Act (1983) regulates fisheries (with the exception of anadromous salmonids) and exploitation of marine mammals. For protection of fishery interests, this act also authorizes regulation of other activities such as oil and gas exploration or extraction within Norway's territorial sea.

The Act relating to Salmonids and Fresh-Water Fish etc. (1992) provides for protection of anadromous salmonids on the Norwegian mainland and in Norwegian internal waters, the Norwegian territorial sea, and the Norwegian Exclusive Economic Zone. In areas of major value to fish resources, the government may prohibit activities or use of the area, when this is necessary to preserve or improve habitats.

Russian framework:

According to a status assessment by WWF Russia, at present only one mostly marine protected area—the Far Eastern Marine Reserve—has been created in Russia, while about 100 reserves and national parks have been created on land. Other marine areas are protected as components of land-based reserves. The total area of marine habitat defined as Marine Protected Area is about 9,100 km², covering some 1.8% of the continental shelf of the Russian Federation.

Responsibility for Russia's marine environment is shared between the territorial states and the federal government. The territorial state governments have jurisdiction over the coastal zone (to the 12 nautical mile limit) and the federal government has jurisdiction over the Exclusive Economic Zone. Russia is establishing a legislative base that will be used to enhance the conservation of the Arctic marine environment, including the *Law on the Exclusive Economic Zone of the Russian Federation*, 1998, protecting the marine ecosystems and protection and use of any resource in the zone of the Russian Federation. This law lays out the state jurisdiction over the zone, including the protection of marine ecosystems and the protection and sustainable use of living and non-living resources. It also contains clauses for co-operation with local authorities, for protection and conservation of rare and endangered species, for preventing habitat deterioration, and for organizing natural reserves and other protected areas.

The *Law on the Conservation of Nature in the Russian Federation* is used to regulate all aspects of nature conservation, excluding those affecting protected areas. Under this law, Russia develops its Red Data Book of endangered species, including marine species. Once entered in the Red Book, all endangered species, including marine mammals in territorial/state waters, come under federal jurisdiction. Migratory species moving between territorial/state waters are also under federal jurisdiction.

The Law on Special Protected Areas (1995) is used to establish and regulate national protected areas. A consultation process with government departments and local communities is required. The law regulates relations in the domain of organization, protection and use of specially protected natural areas in order to preserve the unique and characteristic natural complexes of the flora and fauna, to study the natural processes in the biosphere, to monitor changes in their condition, and to educate the public in matters of ecology.

Law on the Continental Shelf (1995) defines the status, sovereign rights and jurisdiction of the Russian Federation on its continental shelf. This law includes protection and conservation of the marine environment, mineral and living resources, and the development of measures aimed at preventing the destruction of living organisms in the presence of economic or other activity or navigation.

United States framework

The total area of the ocean under U.S. jurisdiction that is currently protected remains very small, especially compared to terrestrial protected areas. Ocean areas protected in marine reserves-- where all extractive and disruptive activities are prohibited-- is a fraction of one percent, compared to the 4.6 percent of the land area of the U.S. protected as wilderness. Most protected marine reserves in U.S. waters are small (one square kilometer or less). Large expanses protected

as marine sanctuaries may be misleading in terms of biodiversity conservation, as their protection is mostly limited to the exclusion of oil and gas development.

The U.S. has a relatively comprehensive suite of legislation to protect its marine and coastal environment, both at the federal and state (Alaska) level (CAFF Habitat Conservation Report No. 8, 2000). But specific authority for the creation of marine protected areas or reserves remains unclear for the vast majority of U.S. ocean waters, hampering implementation of marine protected areas as tools for ecosystem-based management. Four key laws and executive orders provide limited authority for the establishment of Marine Protected Areas and Reserves.

The *Magnuson-Stevens Fishery Conservation and Management Act* (1976) establishes the federal fishery management authority, mainly to stop fishing by foreign fleets in U.S. waters, protect habitat, and prevent bycatch and overfishing. In 1996, the *Sustainable Fisheries Act* was passed and integrated into the Magnuson-Stevens Act. Regional fishery management councils must plan to rebuild fisheries that are overfished. In addition, the councils must make regulations to reduce bycatch and minimize the mortality of bycatch. They are required to protect “essential fish habitat”, water and substrate for fish spawning, breeding, feeding, and growth to maturity.

The *National Marine Sanctuaries Act*, created by Title III of the *Marine Protection, Research, and Sanctuaries Act* of 1972, was renamed in 1992. The mission of the National Marine Sanctuary Program is to serve as the trustee for a national system of marine protected areas, or marine sanctuaries, in order to conserve, protect, and enhance their biodiversity, ecological integrity, and cultural legacy. Protection for natural resources varies, but generally, dredging, dumping, placing structures on the seabed, mining, and oil and gas exploration and production are restricted or prohibited in all sanctuaries. Each sanctuary also has site-specific regulations tailored to its individual needs and resources. Typically, sanctuaries do not prohibit fishing.

The *Coastal Zone Management Act* establishes the National Estuarine Research Reserve System was passed in 1972 and amended in 1996. Twenty-five sites have been designated for long-term research, conservation, and education. Restoration is a goal at many of these sites. The act provides a system that can be used for coordinated and comparative research of coastal waters around the US.

Executive Order No. 13158; Marine Protected Areas (2000) directs federal agencies to expand and strengthen the national system of marine protected areas by working with state, territorial, tribal, and other stakeholders. The designation and management of marine protected areas remains with existing authorities.

Case Studies: Regional and National Ecosystem-based Approaches for Biodiversity Conservation

CAFF Ecosystem-based Marine Conservation Projects:

The CAFF **Compendium of Ecologically Important Marine Areas** builds on initial efforts by the Circumpolar Protected Areas Network (CPAN) to identify major datasets on marine habitats, biota, chemical, geological, and physical parameters that will be used to identify important Arctic marine areas. The datasets will be compiled into a GIS database and electronic atlas. The database will assist countries seeking to identify Marine Reserves and Marine Protected Areas. Given the proximity of the CPAN workshop to the workshop for the Arctic Marine Strategic Plan, the results of the CPAN workshop will be presented at the workshop for the Arctic Marine Strategic Plan.

CAFF has developed the **Circumpolar Biodiversity Monitoring Program** for several years, and it is a key element in the CAFF Strategic Plan. The goals of the program are to provide an information basis for sound decision-making regarding conservation and sustainable development

of arctic flora and fauna, and to improve the detection of arctic biodiversity changes and their causes and effects. Some specific objectives of the program are to develop an infrastructure to coordinate and harmonize long-term monitoring of arctic biodiversity, establish a circumpolar database of summarized monitoring data, and to integrate CAFF's biodiversity monitoring program with other physical and chemical monitoring programs in the Arctic. Eight initial monitoring "networks" have been established: seabirds, shorebirds, reindeer/ caribou, polar bear, Arctic char, arctic vegetation, geese, and ringed seal. There is a strong marine focus to the Circumpolar Biodiversity Monitoring Program as a result of species that inhabit estuarine, coastal and marine areas.

CAFF and the **Circumpolar Seabird Group (CBIRD)** have ongoing projects concerning seabird harvest regimes (CAFF Technical Report No. 9), and seabird bycatch in commercial fisheries (CAFF Technical Report No. 1). Relevant projects for the Arctic Marine Strategic Plan include: the Circumpolar Murre Monitoring and Banding Plans, the Murre Colony Catalog, peer-reviewed publications on murre and climate change, Common Eider Colony Map, and co-management initiatives for migratory birds in the Arctic. A technical report, the Conservation of Arctic Breeding Birds Outside the Arctic, is in progress. This report will describe the international aspects and conservation issues of migratory birds, including waterbirds, which regularly breed in the Arctic and winter outside the Arctic or beyond the legal jurisdiction of the eight Arctic nations.

The *CAFF International Murre Conservation Strategy and Action Plan* is a representative example of an ecosystem approach. The two species of murre (guillemot) inhabit coastal and offshore marine regions of all northern circumpolar countries, and are among the most numerous and widespread of Arctic seabirds. Murres play important roles in the food webs of Arctic marine ecosystems and in the lives of people in coastal communities; and are particularly vulnerable to the direct or indirect effects of a range of human activities, such as hunting, tourism, oil pollution, competition with fisheries and entrapment in fishing gear. These threats are common through most of their range, and have resulted in significant population declines in several circumpolar countries in the present century. Many murre populations are shared by two or more circumpolar countries as a result of their migration and dispersal patterns, so exploitation and conservation actions in one country can have significant effects in others. Effective conservation of these economically and ecologically important species requires a coordinated international approach. In response, CAFF produced an *International Murre Conservation Strategy and Action Plan*, providing for the first time a strong, circumpolar effort to conserve Arctic murre populations. Considerable progress has been made since the plan's adoption, and most Arctic nations are now implementing national murre conservation plans.

Iceland: Breidafjordur Marine Conservation Area

Breidafjordur is a large, shallow bay 50 km wide by 125 km long in western Iceland, with an area of 2,874 km², of which about half is included in the conservation area. To the south, it is flanked by the Snaefellsnes peninsula, the Western Fjords peninsula to the north, and the Snaefellsjokull glacier. The region consists of shallow seas, small fjords and bays, and a rich intertidal area with 3000 islands, islets, and skerries. Breidafjordur contains half of Iceland's intertidal area and a third of its coastline. It offers valuable lessons on how protection of natural values can interact with established human uses, as this is an area inhabited since the settlement of Iceland 1100 years ago.

Breidafjordur is a multiple use marine conservation area established in 1995 by a special law. The primary goal of the area is conservation of the natural environment, including fisheries and the better management of commercial stocks. The area is classified as a Habitat/Species Management Conservation Area (IUCN Category IV), but within it are zones that are Strict

Nature Reserves (IUCN IB) and managed Resource Protected Areas (IUCN VI). The site allows traditional use of the areas resources and permits extraction activity and fisheries. There are management interventions to protect the common eider and certain areas to conserve important cultural features. Access to some parts is restricted to scientific purposes while others allow tourism and outdoor recreation.

Governance is by a multi-stakeholder committee comprising the local communities, the National Museum (responsible for cultural heritage) and the Institute of Natural History (responsible for ecological research). A conservation, or management, plan has been completed by the committee and has been signed by the Minister for the Environment. During the process, extensive consultation took place with the Nature Conservation Agency, which is responsible for protected area management and has the authority for planning. The conservation plan for the area takes into account research, monitoring, fisheries, recreation, sustainable tourism, and environmental education. The Breidafjordur Marine Conservation Area is a likely candidate for Ramsar designation, as well as for a mixed natural-cultural World Heritage Site.

Iceland: BIOCE Research Program

One of the fundamental challenges facing efforts to conserve marine biodiversity is the incomplete and patchy knowledge of regional biodiversity status. Inventory efforts are difficult and expensive, yet they form the building blocks for biodiversity conservation. The BIOICE Research Program is designed to find out more about biodiversity and the distribution patterns of the species that live in and on the seabed in the waters surrounding Iceland.

The program is a collaborative effort by several research institutes and government agencies, and forms an outstanding example of collaborative international work to measure biodiversity, enabling more effective conservation. Icelandic, Norwegian, and Faroese research vessels collect samples from 600 stations on the sea floor. After sampling, the specimens are sorted into taxa at the Sandgerdi Marine Center, which is run by the program's participants. When the program began, about 2,000 species were known to live in the area. The program now estimates that it will double this total, and has already discovered and described 20 species that are entirely new to science.

Norway: Sustainable kelp harvesting

Kelp harvesting is a global industry that can have strong ecosystem effects—kelp forests form the foundation for many coastal ecosystems, similar to terrestrial forests in an ecosystem management context. Norwegian authorities are taking a proactive, precautionary approach to management of kelp harvesting, with cooperation between scientists, policy makers, and industry. The Norwegian Ministry of Fisheries is responsible for the management of the kelp forest. The Directorate for Nature Management, Ministry of Environment has a role in opening new areas for harvesting, and is also responsible for protected areas. Many seabird reserves cover areas with kelp forests, and, in several of these areas, kelp harvesting is prohibited because of the importance of the kelp forest as feeding areas for seabirds.

A multi-year project is underway, in cooperation with government and industry, to examine whether kelp trawling impacts the spatial and temporal interactions between fish, seabirds, and kelp forests. There is also work for national plan for Marine Protected Areas (MPA); where several of these areas will contain kelp forest and restrictions on harvesting. The MPAs will *inter alia* serve as reference areas for kelp forests. Work has been going on for several years to establish knowledge of the ecological importance of the kelp forest. Based on this knowledge and the industry's experience a system of "harvesting fields" is established, with individual fields harvested every five years, based on the knowledge of reestablishment of the kelp and the associated flora and fauna. Opening or closing areas for harvesting is a cooperation between the

fisheries management, environmental management with a close cooperation with the scientists (in particular the Institute of Marine Research), and the industry.

Russia: Lena Delta

The Lena River is one of the longest rivers in the world. From a small mountain lake in southern Russia, the Lena flows north for 2,800 miles or 4,400 km. Just before pouring into the Laptev Sea, the Lena splits into several small rivers that flow through a flat plain to create the Lena River Delta. Swans, divers, geese, ducks, plovers, sandpipers, snipes, phalaropes, terns, skuas, birds of prey, songbirds, and gulls are only some of the migratory birds that breed in this productive wetland. The rich delta also supports abundant populations of fish and five marine mammals.

A protected area called the Lena Delta Reserve was expanded in 1995, making it the largest protected area in Russia (24,400 square miles, or 61,000 square kilometers). This large expanse offers protection to the abundant wildlife of the delta. However, overfishing is reportedly a concern. Outside of the reserve, mining, forestry, grazing, expanding agricultural activities, water diversion for irrigation, and pollution from fertilizers and pesticides may threaten the quality and quantity of water that reaches the delta. The shallow Laptev Sea gets much of its water from the Lena and is directly affected by changes in the Lena Delta Reserve.

United Kingdom: Carmarthen Bay Marine Protected Area, and SOTEAG Environmental Monitoring

The United Kingdom (UK) is the wintering home to Arctic migratory seabirds, with a variety of regulatory and voluntary approaches to the protection of seabirds. Two different approaches for seabird protection and conservation are discussed. Marine protected areas for seabirds are currently being established in the UK under multilateral agreements and the EC Birds Directive.

The Carmarthen Bay, adjacent to the coast of Wales, is the UK's first wholly marine Special Protection Area (SPA) under the Birds Directive, and is within the UK's territorial waters (within 12 miles of the coast). The black scoter count in Carmarthen Bay exceeded 16,000 birds between 1997 and 2002, thus qualifying the bay as an SPA under established guidelines. The definition of the seaward boundary was made data from arial surveys of seabirds conducted using a line transect sampling method, that took into account detection probabilities of seabirds and estimations of their abundance. The final boundary was defined by parallels and meridians, including interpolation points representing 95% of density values. This approach to determining the seaward boundary might function as a future criterion for boundary selection at other inshore sites.

The Shetland Oil Terminal Environmental Advisory Group (SOTEAG) is a government, industry, and academic group, with an independent Chair and Secretary. SOTEAG was established in 1976 for the Shetland Islands off the northeastern coast of Scotland, to examine and advise on the environmental implications of the hydrocarbon terminal at Sullom Voe. SOTEAG has a role during all stages of construction, site rehabilitation, commissioning and operation, including the activities of tankers bringing to and removing hydrocarbons from Sullom Voe.

Shetland is one of the great seabird regions of the world, and some of the breeding colonies are among the largest in Europe. Shetland's seabird populations include arctic species, and have been recognized as being of national and international importance. Seabird populations for all of the Shetlands are included in the SOTEAG's monitoring programme because of their national and international importance, and their vulnerabilities to oil spills. The programme has concentrated on selected cliff-nesting species and inshore waterfowl, and sample sites have been selected throughout the Shetlands. Internationally accepted counting methods used to count species, and a full time resident ornithologist is employed and works cooperatively with local officers, and

members of Scottish Natural Heritage, the Shetland Bird Club, and the Royal Society for the Protection of Birds. This seabird monitoring has produced one of the largest and best data sets in the UK, and was very valuable in understanding the environmental impacts of the Braer oil spill in January 1993 off the southwest coast of the Shetland.

Preliminary Recommendations for Inclusion in the Arctic Council's Arctic Marine Strategic Plan

Although much of the Arctic marine environment is undisturbed, threats are intensifying and spreading. Climate change, pollution, extractive resource development, commercial fishing, shipping, tourism, and invasive species are among the issues and activities with actual and potential impacts. Achieving conservation of marine biodiversity, while also allowing for sustainable forms of economic growth, will be a significant challenge.

The twelve preliminary recommendations are intended to guide discussions at the workshop for the Arctic Council's Arctic Marine Strategic Plan, and to be considered for potential inclusion in the resulting Plan. These preliminary recommendations arise from the information and trends identified in this discussion paper, the *Arctic Flora and Fauna Recommendations* accepted by the Arctic Council, and from issues and trends identified in several CAFF reports including *Arctic Flora and Fauna: Status and Conservation* (CAFF 2001). The recommendations address five key conservation challenges and goals in the Arctic: conserving ecosystems and habitats, conserving species, assessing and monitoring biodiversity, addressing global issues, and engaging society in conservation.

While the recommendations stem from a variety of sources and this discussion paper, they have a broader application. Conserving Arctic biodiversity requires the active participation of all sectors of society within and external to the Arctic. These recommendations are presented in the hopes of encouraging greater cooperation and collaboration in Arctic marine biodiversity and conservation. Conserving Arctic biodiversity will ensure that Arctic ecosystems and their biodiversity remain viable and vigorous for generations to come and, therefore, able to sustain human socio-economic and cultural needs.

Conserving Ecosystems and Habitats

It is important to maintain or enhance ecosystem integrity and avoid habitat fragmentation and degradation in the Arctic, and to take into account the impact of climate change and existing and future renewable and non-renewable resource uses. To this end, five recommendations are suggested.

1. Identify ecologically important marine areas and habitats in the Arctic and ensure their protection using integrated management approaches, including establishment of marine protected areas (MPAs) with a focus on a circumpolar system or network of MPAs, and through permanent or temporary restrictions on uses and developments in other marine areas.
2. Promote an ecosystem approach to Arctic marine and coastal resource use and management, and the use of accepted best management practices.
3. Manage Arctic marine activities consistent with the protection, maintenance, and restoration of Arctic marine biodiversity.
4. Incorporate into relevant decision-making processes the full range of marine biodiversity values, and build strategies to reduce impacts of development activities on estuarine, coastal and marine biodiversity.

5. Assess interactions between local, national and regional development activities affecting estuarine, coastal and marine environments, and understand their impact on biodiversity.

Conserving Species

In the Arctic environment, there are estuarine, coastal, and marine habitats, and many species of not found anywhere else in the world. These species may be flora or fauna, and include benthic organisms, reefs and corals, fish, seabirds, shorebirds, and waterfowl, and marine mammals. Many species transcend national boundaries, and are important to the lives and livelihoods of indigenous peoples and local communities. In order to maintain populations of Arctic plant and animal species, two recommendations are suggested.

6. Identify threats to arctic marine species, and implement conservation measures for species of concern.
7. Assess impacts of marine invasive species, climate change, increased commercial shipping, tourism, and other economic developments on Arctic biodiversity, and develop approaches and strategies to minimize their impacts.

Assess and Monitor Arctic Biodiversity

Baseline information and data is required to understand arctic estuarine, coastal and marine ecosystems, and to monitor the status and trends in their biodiversity. Such information is a prerequisite for effective conservation and economic development decisions, and for assessing the effectiveness of mitigation measures. The following recommendation is suggested to address this goal.

8. Develop and implement programs to monitor Arctic marine biodiversity at the circumpolar scale in estuarine, coastal, and marine environments, to allow for regional assessments and integration with other Arctic and global monitoring programs.

Circumpolar and Global Issues.

Effective conservation of marine biodiversity does not terminate at the legal or political boundaries in the Arctic. Many species that breed in the Arctic migrate beyond the Arctic and must be protected on their wintering grounds, or over their range, to effect their conservation. The following recommendation is suggested.

9. Arctic Council States, in cooperation with non-Arctic states, should assess Arctic migratory and nomadic marine species when they move outside the Arctic into non-Arctic habitats, and work cooperatively with these non-Arctic States to improve conservation strategies for those species and their habitats.

Engaging Society in Conservation.

Ultimately, the long-term effectiveness of the conservation of marine and coastal biodiversity depends on society's understanding of issues affecting the Arctic. One important mechanism is to provide outreach tools and improve access to information by Arctic residents and resource decision-makers. Active coordination and communication between researchers, managers, resource users, and residents is essential. Therefore, three recommendations are suggested.

10. Encourage the participation of Arctic indigenous peoples, other residents and local communities in the conservation of marine biodiversity, outreach and education, including traditional ecological knowledge.
11. Develop a circumpolar Arctic marine policy that recognizes the marine environment for all its values.

12. Consider the establishment of a circumpolar Arctic Marine Ecosystem Council to coordinate the implementation of an Arctic Marine Strategic Plan.