Arctic Biodiversity Assessment

Report for Policy Makers

CAFF
Conservation of Arctic Flora and Fauna

ARCTIC COUNCIL

Arctic Biodiversity Assessment: Report for Policy Makers

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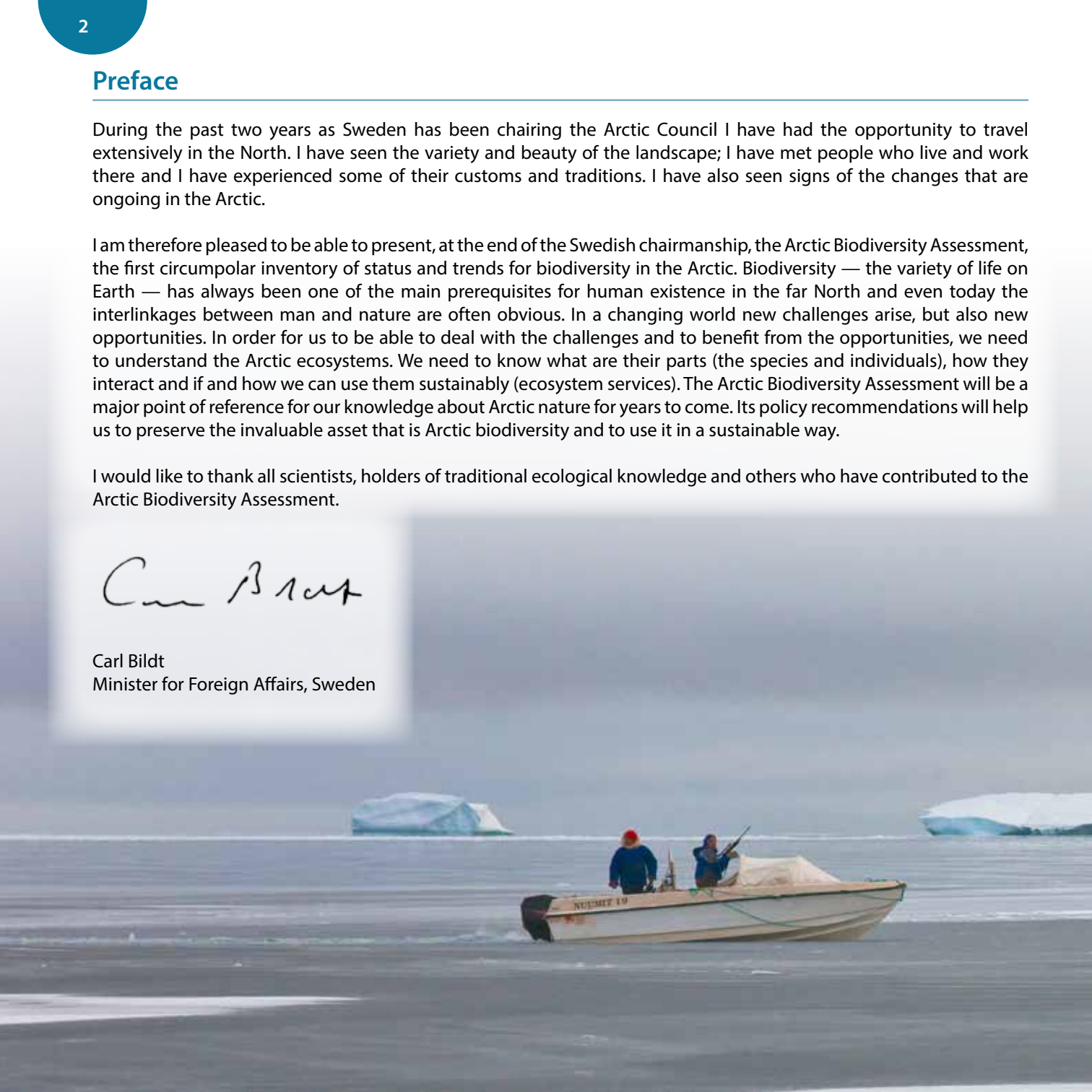
Arctic Biodiversity Assessment Report for Policy Makers

Preface

During the past two years as Sweden has been chairing the Arctic Council I have had the opportunity to travel extensively in the North. I have seen the variety and beauty of the landscape; I have met people who live and work there and I have experienced some of their customs and traditions. I have also seen signs of the changes that are ongoing in the Arctic.

I am therefore pleased to be able to present, at the end of the Swedish chairmanship, the Arctic Biodiversity Assessment, the first circumpolar inventory of status and trends for biodiversity in the Arctic. Biodiversity — the variety of life on Earth — has always been one of the main prerequisites for human existence in the far North and even today the interlinkages between man and nature are often obvious. In a changing world new challenges arise, but also new opportunities. In order for us to be able to deal with the challenges and to benefit from the opportunities, we need to understand the Arctic ecosystems. We need to know what are their parts (the species and individuals), how they interact and if and how we can use them sustainably (ecosystem services). The Arctic Biodiversity Assessment will be a major point of reference for our knowledge about Arctic nature for years to come. Its policy recommendations will help us to preserve the invaluable asset that is Arctic biodiversity and to use it in a sustainable way.

I would like to thank all scientists, holders of traditional ecological knowledge and others who have contributed to the Arctic Biodiversity Assessment.



Carl Bildt
Minister for Foreign Affairs, Sweden

The Arctic Biodiversity Assessment

The purpose of the Arctic Biodiversity Assessment (ABA) is to synthesize and assess the status and trends of biological diversity in the Arctic. It identifies the current status of and historical trends in population size and distribution of Arctic species and, where available, presents projections of future change. As data on this scale are only available for a few well-known species and ecosystems, it is not possible to provide a comprehensive accounting of status and trends of all Arctic biodiversity. It is possible, however, to discuss broad trends in habitat condition and extent, ecosystem function, and overall biodiversity.

The ABA provides a much-needed description of the state of biodiversity in the Arctic. It:

- creates a baseline for use in global and regional assessments of Arctic biodiversity which will inform and guide future Arctic Council work;
- provides up-to-date knowledge gathered from scientific publications supplemented with insights from traditional knowledge holders;
- identifies gaps in the data record;
- describes key mechanisms driving change; and
- presents science-based suggestions for action on addressing major pressures on Arctic biodiversity.

The ABA consists of four components: (1) *Arctic Biodiversity Trends 2010 – Selected Indicators of Change*, which provided a preliminary snapshot of status and trends of Arctic biodiversity; (2) the *Arctic Biodiversity Assessment, Status and Trends in Arctic Biodiversity*, a comprehensive, peer-reviewed scientific assessment of Arctic biodiversity, and scientific synthesis (3) a traditional ecological knowledge (TEK) compendium, and (4) this Report for Policy Makers aimed at making the science accessible for decision-makers and identifying actions to address key findings.

The unprecedented changes being experienced in the Arctic emphasize the importance and urgency of getting information to decision-makers in a timely manner. To do so requires easily accessible, comprehensive data, coordinated and consistent monitoring, up-to-date assessments of trends and informed responses. The synthesis of status and trends of Arctic biodiversity in the ABA will serve as a baseline against which further change can be measured. The Circumpolar Biodiversity Monitoring Program (CBMP) is the Conservation of Arctic Fauna and Flora's (CAFF's) primary effort to monitor biodiversity on an ongoing basis to provide relevant information to decision makers about the changes that are occurring, and their underlying causes. Specifically, the CBMP is developing and implementing ecosystem monitoring programs for freshwater, marine and terrestrial environments and is planning one for coastal environments. Resulting information is being made accessible by publishing indicators on the CBMP (and other) websites, via the Arctic Biodiversity Data Service, and through other publications such as the annual Arctic Report Card. These efforts are intended to help shorten the time between detection of changes, reporting and effective policy responses.

Inuit hunters on an Atlantic walrus hunt, Greenland.
Photo: Jenny E. Ross/Lifeonthinice.org

Introduction

Arctic biodiversity is an irreplaceable cultural, scientific, ecological, economic and spiritual asset.

In addition to its intrinsic worth, Arctic biodiversity provides innumerable services and values to people. Arctic habitats are home to species with remarkable adaptations to survive in extreme cold and highly variable climatic conditions. Millions of migratory birds breed in the Arctic and then fly to every continent on Earth, contributing to global biodiversity and ecological health. More than a tenth of the world's fish catches by weight come from Arctic and sub-Arctic seas. Tourists are travelling north in increasing numbers, and globally there is a growing appreciation of Arctic species and ecosystems as increasingly rare examples of largely pristine biodiversity.

The Arctic is home to more than 21,000 known species of highly cold-adapted mammals, birds, fish, invertebrates, plants and fungi including lichens, as well as tens of thousands of microbe species. These include iconic species such as polar bear, muskox, bowhead whale, narwhal, walrus, caribou, Arctic char, ivory gull, Arctic fox and snowy owl as well as thousands of lesser known species. In addition to species themselves, the Arctic also harbors a diversity of marine, freshwater and terrestrial habitats, such as vast expanses of lowland tundra, wetlands, mountains, extensive shallow ocean shelves, millennia-old ice shelves, pack ice and huge seabird coastal cliffs.

> *"Nature feeds me. It helps me. I can speak with the grass, bushes and water – I can speak with all things. I am connected to all things."*
>
> Dmitrii Nikolayevich Begunov, Cherskii, Russia

Among those who live in the Arctic are dozens of distinct indigenous peoples who call the Arctic home. Their ways of life demonstrate the vitality of language and traditional knowledge, key aspects of the human relationship with biodiversity. Arctic cultures have been more reliant on hunting and fishing than those in almost any other part of the world because of the limited availability of edible wild plants. Some species, such as bears and whales, have great spiritual importance in Arctic cultures, and harvest of wildlife is deeply rooted in the self-perception of Arctic peoples. Traditional foods currently account for a smaller portion of indigenous diets than in the past, but biodiversity and a healthy natural environment remain integral to the well-being of Arctic inhabitants. They provide not only food, but the everyday context and basis for social identity, cultural survival and spiritual life.

Geographically, the Arctic is made up of the world's smallest ocean and neighboring seas, surrounded by a relatively narrow fringe of island and continental tundra, much of it underlain by permafrost. Freshwater habitats range from shallow tundra ponds fed by small streams to large deep lakes and rivers. Arctic land and freshwater areas are generally low in productivity and species richness, though there are exceptions. For example, the number of plant and lichen species in some tundra areas is as high

What is biodiversity? The United Nations Convention on Biological Diversity defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems, as well as the ecological complexes, of which they are part; this includes diversity within species, between species, and of ecosystems". Biodiversity includes the multitude of poorly known species, of which there are many in the Arctic, that collectively provide the foundation for food webs and ecosystems. The interactions between humans and their surroundings are also part of the diversity, vitality and sustainability of life on Earth.

as in the richest grasslands of temperate and subtropical regions. For the ocean, sea ice is the defining feature of the Arctic. Unlike Arctic terrestrial and freshwater habitats, marine ecosystems on some Arctic shelves are among the most productive on Earth. The sea ice itself provides important habitat for many species and is vital to the Arctic marine food web. Arctic marine, freshwater and terrestrial ecosystems are interconnected physically and biologically.

Extremes of cold and seasonality and limited accessibility have kept human influence low, allowing ecological processes to function largely undisturbed. But climate change and an increasing demand for Arctic resources are driving a new era of human activity with subsequent likely consequences for Arctic biodiversity. Sustainable societies need a sustainable environment, but we can no longer take Arctic environmental well-being for granted.

"The 'master plan' is that our purpose is to hunt marine mammals, but that we should not take that for granted. This is why conservation is so important in our culture."

George Noongwook, Savoonga, U.S.A.

We have a unique and urgent opportunity in the Arctic to conserve large, undisturbed ecosystems and the species and cultures they support. Doing so will help protect the integrity of Arctic biodiversity and the sustainability of Arctic communities. The future of the Arctic and its biodiversity requires an active and decisive approach to conservation and sustainability.

The Convention on Biological Diversity and other international conventions

CAFF's efforts to conserve Arctic biodiversity and promote the sustainability of the Arctic's living resources are complementary to the conservation and sustainable use objectives of the United Nations Convention on Biological Diversity (CBD). The 2013 ABA will provide data and information on the status and trends of biological diversity in the Arctic to the Fourth Global Biodiversity Outlook. It will also form part of the Arctic Council's contribution to the CBD's Strategic Plan for Biodiversity 2011-2020.

Five other major international conventions focus on biodiversity issues: the Convention on Conservation of Migratory Species, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the International Treaty on Plant Genetic Resources for Food and Agriculture, the Ramsar Convention on Wetlands and the World Heritage Convention.

All Arctic Council countries are a Party to one or several of these Conventions and work with them to develop international policies for the conservation and sustainable use of biodiversity.

Polar bear, Svalbard, Norway. Photo: Ole J. Liodden

Traditional ecological knowledge

Arctic peoples have thrived in a harsh environment for millennia, in no small part because they have acquired a great depth of knowledge about the land and waters of their homelands and the species that live there, which provide food, clothing and meaning to Arctic cultures. This traditional ecological knowledge is increasingly recognized as an important source of information for, among other things, understanding Arctic biodiversity and developing effective strategies to conserve that biodiversity, including indigenous ways of life.

Documenting traditional knowledge and using it appropriately in scientific and management settings is not a simple task. Cross-cultural understanding is needed to "translate" concepts from one worldview to another. Reducing information to isolated facts removes important context in which the information was developed, and loses the rich associations that turn individual observations into a consistent and effective system of understanding. The long-term viability of Arctic societies is a reflection of the power of their knowledge.

The ABA has attempted to incorporate traditional ecological knowledge into its work. Relatively little such information is available in published form. Nonetheless, statements from holders of traditional knowledge have been highlighted in the chapters of the scientific report, to emphasize the significance that biodiversity has for Arctic peoples and the value their knowledge has for conservation.

Reindeer herding in the Polar Urals, Russia. Photo: Oksana Belikova/Shutterstock.com

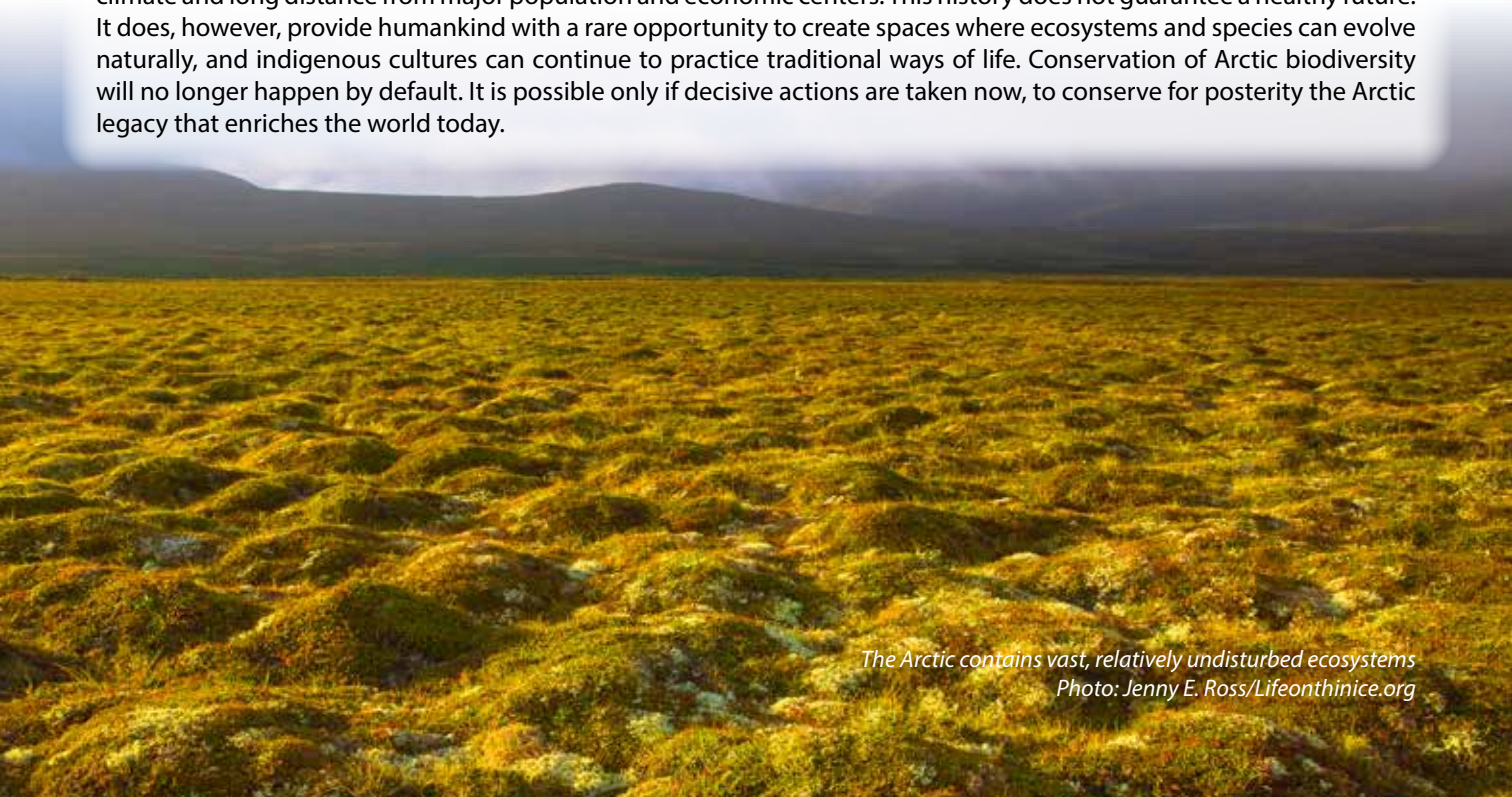
» To provide an ecologically meaningful account of Arctic biodiversity, the ABA used a scientific definition of the Arctic. On land, the treeline is the effective southern boundary of the Arctic. At sea, the boundary is approximately the maximum extent of sea ice. Where appropriate, information from adjacent sub-Arctic areas was included, but it was not possible to include a comprehensive assessment of sub-Arctic biodiversity.

Key Findings

Key Finding 1: Arctic biodiversity is being degraded, but decisive action taken now can help sustain vast, relatively undisturbed ecosystems of tundra, mountains, fresh water and seas and the valuable services they provide.

Arctic species today enjoy large areas of habitat that support a full range of ecological processes and interactions. But climate change, industrial development, pollution, local disturbances and invasive alien species are affecting the Arctic, and their impacts are increasing. The most visible changes in the Arctic are those to the physical environment, including warming temperatures, the loss of sea ice and an increasing collective footprint from industrial activities. The resulting ecological impacts are often much harder to see. Yet these changes are important to consider now, since impacts being felt today may take years or decades to show their full effect. Stressors do not act in isolation, and often exacerbate one another, leading to greater cumulative impacts than expected from individual activities or stressors. The world has seen many examples of long-term ecological damage due to increasing human activity. This assessment has demonstrated that, in the Arctic, we still have an opportunity to act before it is too late.

Globally, habitat loss and degradation pose the main threats to biodiversity. The relative well-being of many Arctic ecosystems today is largely the fortuitous result of a lack of intensive human encroachment, thanks to the extreme climate and long distance from major population and economic centers. This history does not guarantee a healthy future. It does, however, provide humankind with a rare opportunity to create spaces where ecosystems and species can evolve naturally, and indigenous cultures can continue to practice traditional ways of life. Conservation of Arctic biodiversity will no longer happen by default. It is possible only if decisive actions are taken now, to conserve for posterity the Arctic legacy that enriches the world today.

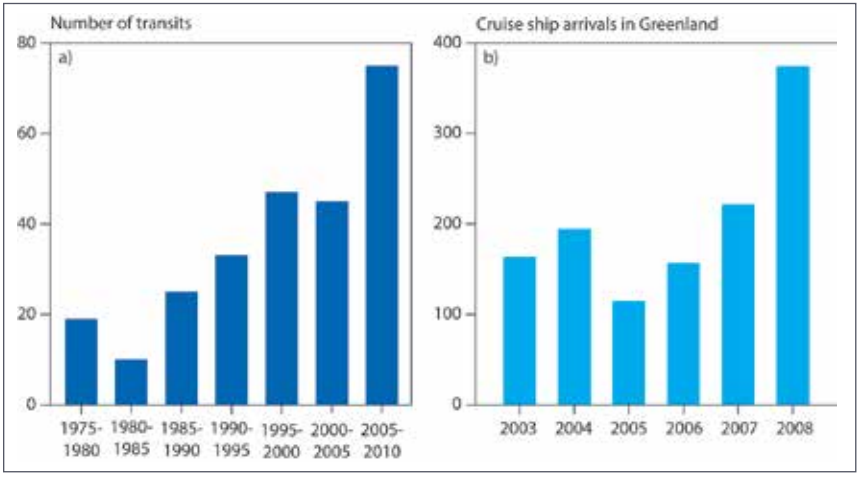


The Arctic contains vast, relatively undisturbed ecosystems
Photo: Jenny E. Ross/Lifeonthinice.org

Key Finding 2: Climate change is by far the most serious threat to Arctic biodiversity and exacerbates all other threats.

Summer temperatures in the Arctic during recent decades have been warmer than at any time in the past 2000 years, and the region is warming twice as fast as the rest of the planet. Within this century, temperatures in the Arctic are projected to increase by several degrees further from the 1980-2000 average. Changing combinations of high temperatures, winds and precipitation are likely to give rise to very different climates in the Arctic. Arctic summer sea ice cover – and particularly the amount of multi-year ice – is decreasing at an accelerating rate. The years since 2007 have seen less summer sea ice than any previous year in the satellite era, and 2012 set another record low. The ocean is expected to become ice free in summer within a few decades. The increased carbon dioxide concentrations in the atmosphere are also leading to acidification of ocean waters worldwide, especially in colder Arctic waters that can dissolve more carbon dioxide. Warming is also causing loss of permafrost and glaciers, affecting hydrology, vegetation, erosion patterns and other features of terrestrial ecosystems.

The distribution of flora and fauna is shifting northwards as the Arctic continues to warm. On land, shrubs are growing taller and spreading, boreal species and ecosystems are already moving into what is now the low Arctic, and the treeline is expected to move north. While low Arctic species are expected to move into the high Arctic, some high Arctic species and ecosystems are expected to disappear or remain only as isolated fragments in high mountain areas. In the ocean, loss of sea ice is already affecting the timing and patterns of primary production, altering food webs and reducing the availability of sea ice to walrus and ice seals for resting, molting, breeding and rearing young. The total loss of some key habitats such as multi-year pack ice is expected. In the process of rapid change and transitions, new combinations of species are altering Arctic ecosystems.



Number of ships a) transiting through the Northwest Passage (five year intervals, from 1975 to 2009), and b) landing in Greenland (cruise ships only, from 2003 to 2008. (AMSA 2009 and NORDREG 2009.)

By increasing the accessibility of the Arctic to humans, climate-induced changes will facilitate increased industrial activity such as oil and gas exploration and marine shipping. These changes will in turn bring other stressors to the region. For example, ships discharging ballast water into Arctic seas may introduce invasive species that may outcompete and displace resident species. The stress of climate change does not act in isolation, but works in conjunction with other stressors, yielding even greater risks to Arctic biodiversity.

Photo: Jan van de Kam

Key Finding 3: Many Arctic migratory species are threatened by overharvest and habitat alteration outside the Arctic, especially birds along the East Asian flyway.

Overharvest and habitat loss and degradation threaten some Arctic migratory species throughout their global ranges. The Eskimo curlew has likely gone extinct as a result of overharvest outside the Arctic, and the spoon-billed sandpiper faces extinction now due in part to overhunting in its wintering areas in southeast Asia. Loss of staging and wintering habitat for waterfowl and shorebirds, for example, is occurring at an alarming rate in many areas, especially in East Asia around the Yellow Sea. The loss of coastal and intertidal habitat is expected to increase considerably with sea level rise and increasing development. Some migratory marine mammals that occur in the Arctic during part of their migration are also experiencing habitat loss or degradation outside the Arctic as well, but these alterations are poorly documented at present.

Threatened migratory species require protection throughout the year, across their full migratory range and across multiple international boundaries. Effective management in one region can be undermined by harmful actions elsewhere. Arctic birds migrate far and wide, so Arctic migratory bird conservation is a truly global issue, of great importance to ecosystems and overall biodiversity in the Arctic and beyond.

Key Finding 4: Disturbance and habitat degradation can diminish Arctic biodiversity and the opportunities for Arctic residents and visitors to enjoy the benefits of ecosystem services.

Circumpolar distribution and probability of potential petroleum reserves (US Geological Survey, 2011)

Roads, noise, pipelines, dams, drilling and mine sites, destructive fishing practices and other forms of direct and indirect damage to habitats and species are putting increasing pressure on the Arctic environment in some areas. Some commercial fishing techniques such as bottom trawling have the potential to damage sensitive seafloor habitats and their ecological communities. Construction of roads and pipelines has led to fragmentation of landscapes, permafrost degradation and changes in vegetation and hydrology. Noise from offshore seismic exploration and drilling affects the behavior of bowhead whales and other species. Although reindeer grazing can benefit biodiversity in several ways and could be instrumental in counteracting some of the effects of climate change, grazing has caused degradation locally in the Arctic in particular in regions where their habitat has been fragmented.

The majority of these stressors currently result from oil, gas and mineral exploitation on land. Offshore oil and gas exploration and production are in their early stages in the Arctic region, but are expected to increase in the coming decades, producing impacts from noise and other habitat disturbance. These effects may persist long after the activity ceases. Where the causes of habitat degradation have been removed, recovery is typically slow in the Arctic. To date, most of the impacts have been relatively localized, although the activities are taking place in many regions of the Arctic and are expected to increase.

The extent of the effects that these human disturbances can have in displacing species from important habitats is often closely related to their spatial needs and specific behaviors. Species that require large areas of undisturbed habitat, such as caribou and reindeer, are sensitive to habitat loss and fragmentation from development activities such as road construction in and around calving grounds. Populations that are heavily hunted are often more easily displaced by human activity. Intensive land- and seascape planning could minimize harmful effects from localized disturbances and ensure that increases in human populations and industrial activity are managed in ways that sustain a rich biodiversity.

Migrating caribou. Photo: Susan Morse

Key Finding 5: Pollution from both long-range transport and local sources threatens the health of Arctic species and ecosystems.

Location of shipping accidents and incidents 1995-2004 (AMSA, 2009)

Pollution can affect the health of individual animals and, in severe cases, the productivity and functioning of an ecosystem. Relatively high levels of contaminants have been documented in several Arctic animals, including polar bears, beluga whales and some seabirds, but there is as yet little scientific evidence that these have had an effect at the population level. Climate change affects the pathways of contaminants in the environment, including the release of contaminants previously captured by ice and permafrost. Increasing industrial activity in the Arctic will also lead to more potential local sources of pollution as well.

Persistent organic pollutants and heavy metals such as mercury, lead and cadmium from sources far to the south reach the Arctic by air and water. Once there, they accumulate through the food web and affect the health of individual animals and humans. Some contaminants such as DDT and PCBs are decreasing following concerted international action such as the Stockholm Convention on Persistent Organic Pollutants, but other existing and newly developed contaminants are still widely used. In addition, ozone-depleting chemicals in the stratosphere can lead to increasing exposure to ultraviolet light, potentially harming living organisms.

Mining, oil and gas activities, Arctic settlements and legacy sites such as military bases are current and potential sources of pollution, litter, sewage and black carbon within the Arctic. The risk of major oil spills is a serious threat for marine ecosystems, particularly those associated with sea-ice, because response can be difficult and spilled oil is likely to persist for a long time. Oil spills are a lesser, but still very important, threat for terrestrial and freshwater systems. Legacy contaminants and radioactivity from past military and other human activity have impacted and will continue to impact biodiversity in the region. Arctic communities often have an impact in their local area, and reducing those impacts will benefit the local environment and contribute to global efforts to reduce pollution.

Thick-billed murre. Photo: Ole J. Liodden

Invasive Nootka lupin, Iceland. Photo: Sigurður H Magnússon

Key Finding 6: There are currently few invasive alien species in the Arctic, but more are expected with climate change and increased human activity.

Globally, invasive non-native species are considered the second most important threat to biodiversity after habitat loss. These are species introduced by human activity that may flourish and spread in their new environment, threatening native species and ecosystem functions. Although some known invasive non-native species are found in the Arctic, the problem has been less acute than in other regions of the world. To date, invasive alien plants have reached the low Arctic in Alaska. Over a dozen terrestrial invasive non-native plant species are known from the Canadian low and high Arctic. Even on the high Arctic archipelago of Svalbard, nine non-native plant species have been found to reproduce. The Nootka lupin, introduced to control erosion in Iceland, has invaded sub-Arctic heathland vegetation in almost all of Iceland. It has also been found in southwest Greenland, though it is not yet known to have spread into tundra vegetation there. The status of aquatic invasive non-native species in the Arctic and sub-Arctic is even less well known, but benthic communities in northern Norway and the Kola Peninsula are already facing disturbance from the introduced Pacific red king crab.

In the future, many non-native terrestrial species already present in sub-Arctic ecosystems may become invasive and move north, aided by climate change, human settlement and industrial activity. Similarly, Arctic shipping and increasing development may allow invasive non native marine organisms into the Arctic in unmanaged ballast water or on ship hulls and drilling rigs. Pathogens and disease vectors, too, may arrive with other invasive species. Combating invasive species is extremely difficult. Prevention is the best option if the Arctic is to be spared the severe impacts seen from this threat elsewhere in the world.

Key Finding 7: Overharvest was historically the primary human impact on many Arctic species, but sound management has successfully addressed this problem in most, but not all, cases.

Small-scale, traditional harvest of mammals, birds and fish has provided the foundation for Arctic societies since humans first arrived in the region, and continues to do so today for many people in the Arctic. During the last few hundred years, the arrival of newcomers to the Arctic and the introduction of modern hunting technologies resulted in some mammals experiencing severe population declines such as bowhead whales and walrus in large parts of the Arctic. The Steller's sea cow and great auk went extinct in the mid-18th and mid-19th century. At the same time, previously sustainable traditional harvest practices were often ignored or disrupted. In some cases local harvest has also resulted in population declines, as is the case with some seabirds in Greenland in the 20th century. Continued human immigration, population growth, technological advances and commercial markets for wildlife products resulted in increased harvest pressure on some wildlife populations. Populations of some depleted species, such as bowhead whales, muskox, some fish stocks and many migratory birds that declined sharply, have subsequently recovered or are showing signs of recovery.

Even though overharvest was the most significant recent historical pressure on many Arctic wildlife species, it is also the most manageable. In most areas, hunting and fishing activities that might threaten fish, mammal and bird populations are now regulated for species where there is conservation concern. As a result, the historical pressure from overharvest has been largely removed as a major threat for most species. Nevertheless, some areas where overharvest occurred still have the legacy of diminished wildlife populations and hunting opportunities, for example for walrus and thick-billed murres. Improved management and conservation actions are based on greater understanding of the potential for harm to species and ecosystems, better regulation and enforcement, and in many cases on greater engagement with Arctic peoples. The incorporation of traditional values, practices and knowledge can help improve both management and enforcement.

At the same time, new harvest ventures bring new risks of overharvest. There is increasing concern that the global demand for seafood outside the Arctic combined with increasing accessibility of Arctic seas as a result of sea-ice loss creates the potential for increased risks to poorly known fish and crustacean stocks. This risk can be reduced by effective regulation and enforcement that respect principles and practices for sustainable management.

Bowhead whale populations show signs of recovery from historical overhunting. Photo: Kristin Laidre/ARC-PIC.com

Key Finding 8: Current knowledge of many Arctic species, ecosystems and their stressors is fragmentary, making detection and assessment of trends and their implications difficult for many aspects of Arctic biodiversity.

Effective, targeted conservation actions require reliable, up-to-date, easily accessible information. For example, successes in addressing overharvest stem in large part from accurate data on population size, reproduction rates and other parameters. International negotiations to reduce some contaminant emissions succeeded in large part because of strong scientific evidence for the worldwide transport of these substances and their uptake and impacts in biological systems, including humans.

Sea butterfly, Limacina helicina. Photo: Kevin Lee

From the present assessment, the overall status of Arctic biodiversity is clear in general terms. It is equally evident, however, that important knowledge about the majority of Arctic biodiversity remains to be documented. While the distributions of many mammals, birds and vascular plants are known, large gaps exist in knowledge about even the distribution of most other species—not to mention the many species likely remaining to be discovered. When it comes to population densities, sizes and trends, the knowledge gaps grow significantly larger. Even some commonly harvested species of mammals, birds and fish are not monitored adequately to ensure accurate and early determination of population trends. Most species that are not harvested or of direct value to humans are not monitored at all. Even for the few species where adequate, ongoing monitoring exists, the mechanisms that drive these population trends are in most cases poorly understood at best.

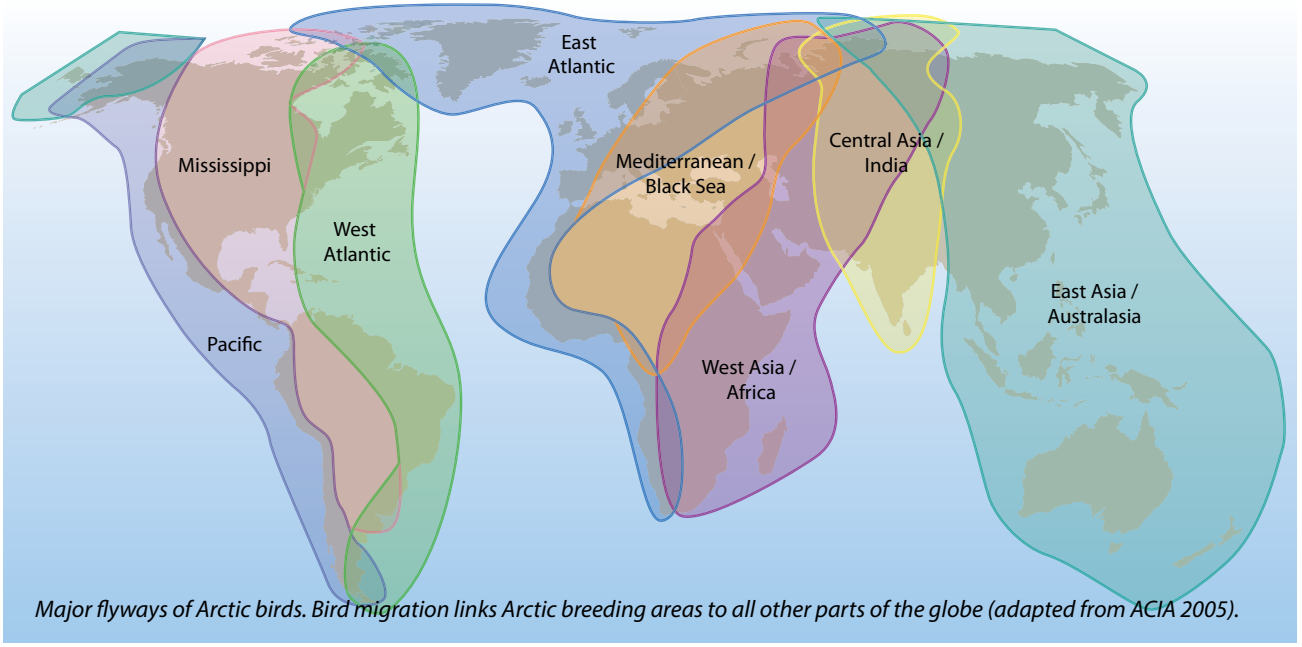
If decisions regarding human activity in the Arctic are to be supported with adequate, timely and up-to-date biodiversity information, there is a need for concerted efforts to collect, analyze and make readily available those data. Improved inventories, baselines, monitoring and research are needed, involving Arctic peoples and their knowledge. Key indicators of ecosystem structure and function should be identified to contribute to ecosystem-based approaches to monitoring and management, as in the case of CAFF's *Arctic Marine Biodiversity Monitoring Plan*. Filling gaps in our knowledge is particularly crucial for important aspects of invertebrates, microbes, parasites and pathogens. These organisms are vital for ecosystem functioning but are all too often overlooked in the documentation and assessment of biodiversity and ecosystem health.

Key Finding 9: The challenges facing Arctic biodiversity are interconnected, requiring comprehensive solutions and international cooperation.

Climate change affects the physical environment, with consequent impacts on ecosystems and species as well as the mobilization of contaminants. Human activity in the Arctic may increase due to improved access and rising global demand for resources. Risks from pollution such as oil spills will increase as Arctic development proceeds. Pathways for invasive species to reach the Arctic will become more numerous as more ships travel north and more roads are built. More activity also means a greater potential for habitat degradation. And more activity may mean more people, who may increase fishing and hunting pressures.

Individually, each of these challenges places stress on Arctic biodiversity, as outlined in previous key findings. Together, they create a web of stresses and impacts that cannot be successfully addressed in isolation from one another. Both in the Arctic and globally, biodiversity must be conserved in a holistic fashion, so that efforts to reduce one stressor do not unintentionally make the effects of another stressor worse.

The habitat needs of migratory species, long-range transport of persistent contaminants, global shipping lanes and the geography of ecosystems do not follow political boundaries. Thus, international cooperation is increasingly needed to fully address the conservation challenges that face Arctic biodiversity now and in the decades to come. The recommendations that follow recognize the interconnected and transboundary nature of the challenges to biodiversity conservation in the Arctic and beyond.



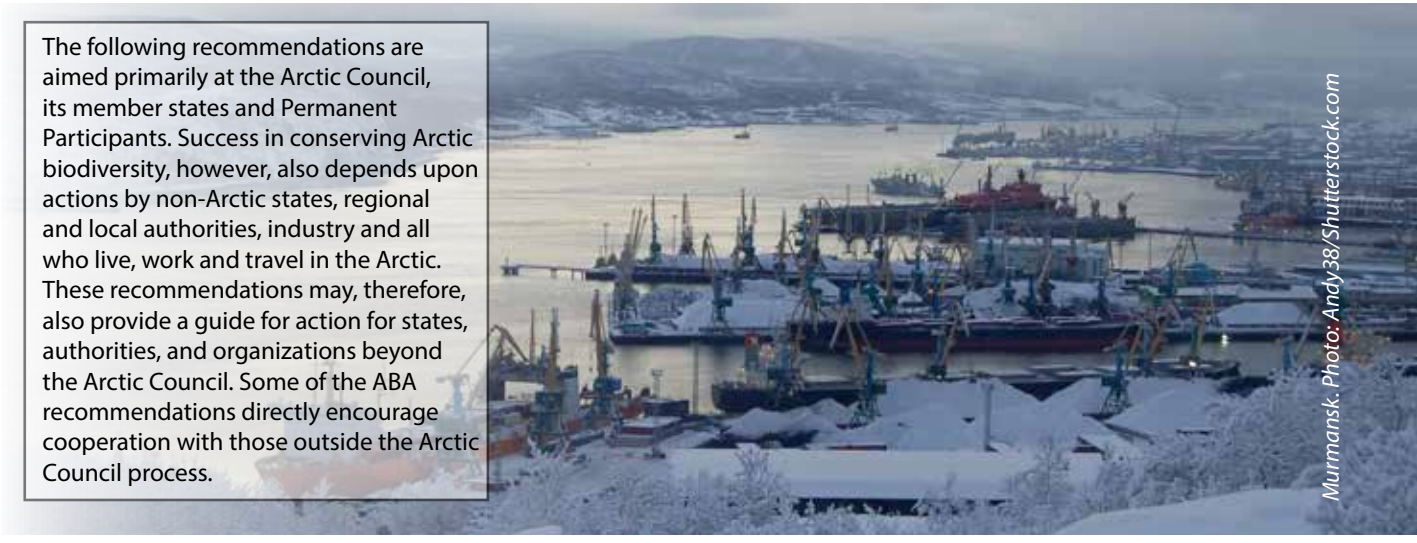
Major flyways of Arctic birds. Bird migration links Arctic breeding areas to all other parts of the globe (adapted from ACIA 2005).

Recommendations

Large tracts of the Arctic remain relatively undisturbed providing an opportunity for proactive action that can minimize or even prevent future problems that would be costly, or impossible, to reverse. The key findings of the ABA are interrelated and responding to them would benefit from a holistic approach. When taken together, three cross-cutting themes are evident:

- the significance of climate change as the most serious underlying driver of overall change in biodiversity;
- the necessity of taking an ecosystem-based approach to management; and
- the importance of mainstreaming biodiversity by making it integral to other policy fields, for instance by ensuring biodiversity objectives are considered in development standards, plans and operations.

The following recommendations are aimed primarily at the Arctic Council, its member states and Permanent Participants. Success in conserving Arctic biodiversity, however, also depends upon actions by non-Arctic states, regional and local authorities, industry and all who live, work and travel in the Arctic. These recommendations may, therefore, also provide a guide for action for states, authorities, and organizations beyond the Arctic Council. Some of the ABA recommendations directly encourage cooperation with those outside the Arctic Council process.



Murmansk. Photo: Andy38/Shutterstock.com

A comprehensive and integrated approach is needed to address the interconnected and complex challenges facing biodiversity and to ensure informed policy decisions in a changing Arctic. In addition to many Arctic Council initiatives underway, there are other conventions and processes addressing these cross-cutting themes and many of the individual stressors acting on biodiversity. This includes many regulatory and non-regulatory measures that are in place or under development to provide consistent standards and/or approaches to development in the Arctic. Many of these can, or do, provide safeguards for biodiversity.

Care was taken in the development of the ABA recommendations to review recommendations from other major Arctic Council initiatives. Many of the recommendations overlap and are mutually supportive, emphasizing the importance of considering all recommendations together. Some of the ABA recommendations reinforce the significance to biodiversity of recommendations or actions already underway, others build upon existing recommendations or processes, and others are more specifically focused on biodiversity issues. All are important to ensure the conservation of Arctic species, ecosystems and the services they provide.

Climate change

1. Actively support international efforts addressing climate change, both reducing stressors and implementing adaptation measures, as an urgent matter. Of specific importance are efforts to reduce greenhouse gas emissions and to reduce emissions of black carbon, methane and tropospheric ozone precursors.

2. Incorporate resilience and adaptation of biodiversity to climate change into plans for development in the Arctic.

Ecosystem-based management

3. Advance and advocate ecosystem-based management efforts in the Arctic as a framework for cooperation, planning and development. This includes an approach to development that proceeds cautiously, with sound short and long-term environmental risk assessment and management, using the best available scientific and traditional ecological knowledge, following the best environmental practices, considering cumulative effects and adhering to international standards.

Mainstreaming biodiversity

4. Require the incorporation of biodiversity objectives and provisions into all Arctic Council work and encourage the same for on-going and future international standards, agreements, plans, operations and/or other tools specific to development in the Arctic. This should include, but not be restricted to, oil and gas development, shipping, fishing, tourism and mining.

Identifying and safeguarding important areas for biodiversity

5. Advance the protection of large areas of ecologically important marine, terrestrial and freshwater habitats, taking into account ecological resilience in a changing climate.
    a. Build upon existing and on-going domestic and international processes to complete the identification of ecologically and biologically important marine areas and implement appropriate measures for their conservation.
    b. Build upon existing networks of terrestrial protected areas, filling geographic gaps, including under-represented areas, rare or unique habitats, particularly productive areas such as large river deltas, biodiversity hotspots, and areas with large aggregations of animals such as bird breeding colonies, seal whelping areas and caribou calving grounds.
    c. Promote the active involvement of indigenous peoples in the management and sustainable use of protected areas.

6. Develop guidelines and implement appropriate spatial and temporal measures where necessary to reduce human disturbance to areas critical for sensitive life stages of Arctic species that are outside protected areas, for example along transportation corridors. Such areas include calving grounds, den sites, feeding grounds, migration routes and moulting areas. This also means safeguarding important habitats such as wetlands and polynyas.

7. Develop and implement mechanisms that best safeguard Arctic biodiversity under changing environmental conditions, such as loss of sea ice, glaciers and permafrost.
    a. Safeguard areas in the northern parts of the Arctic where high Arctic species have a relatively greater chance to survive for climatic or geographical reasons, such as certain islands and mountainous areas, which can act as a refuge for unique biodiversity.
    b. Maintain functional connectivity within and between protected areas in order to protect ecosystem resilience and facilitate adaptation to climate change.

Muskox. Photo: Lars Holst Hansen/ARC-PIC.com

Red Knots (Calidris canutus) on migration rest on coastal rocks along the Snæfellsnes Peninsula, Iceland, as waves wash across the coastline. Photo: Erlend Haarberg/naturepl.com

Addressing individual stressors on biodiversity

8. Reduce stressors on migratory species range-wide, including habitat degradation and overharvesting on wintering and staging areas and along flyways and other migration routes.
    a. Pursue or strengthen formal migratory bird cooperation agreements and other specific actions on a flyway level between Arctic and non-Arctic states with first priority given to the East Asian flyway.
    b. Collaborate with relevant international commissions, conventions, networks and other organizations sharing an interest in the conservation of Arctic migratory species to identify and implement appropriate conservation actions.
    c. Develop and implement joint management and recovery plans for threatened species with relevant non-Arctic states and entities.
    d. Identify and advance the conservation of key wintering and staging habitats for migratory birds, particularly wetlands.

9. Reduce the threat of invasive alien/non-native species to the Arctic by developing and implementing common measures for early detection and reporting, identifying and blocking pathways of introduction, and sharing best practices and techniques for monitoring, eradication and control. This includes supporting international efforts currently underway, for example those of the International Maritime Organization to effectively treat ballast water to clean and treat ship hulls and drilling rigs.

10. Promote the sustainable management of the Arctic's living resources and their habitat.
    a. Improve circumpolar cooperation in data gathering and assessment of populations and harvest and in the development of improved harvest methods, planning, and management. This includes improving the use and integration of traditional ecological knowledge and science in managing harvests and in improving the development and use of community-based monitoring as an important information source.
    b. Develop pan-Arctic conservation and management plans for shared species that are, or will potentially be, harvested or commercially exploited that incorporate common monitoring objectives, population assessments, harvesting regimes, guidelines for best practices in harvest methodology and consider maintenance of genetic viability and adaptation to climate change as guiding principles.
    c. Support efforts to plan and manage commercial fisheries in international waters under common international objectives that ensure long-term sustainability of species and ecosystems.Encourage precautionary, science-based management of fisheries in areas beyond national jurisdiction in accordance with international law to ensure the long-term sustainability of species and ecosystems.
    d. Support efforts to develop, improve and employ fishing technologies and practices that reduce by-catch of marine mammals, seabirds and non-target fish and avoid significant adverse impact to the seabed.
    e. Develop and implement, in cooperation with reindeer herders, management plans that ensure the sustainability of reindeer herding and the quality of habitat for grazing and calving.

11. Reduce the threat of pollutants to Arctic biodiversity.
    a. Support and enhance international efforts and cooperation to identify, assess and reduce existing and emerging harmful contaminants.
    b. Support the development of appropriate prevention and clean up measures and technologies that are responsive to oil spills in the Arctic, especially in ice-filled waters, such that they are ready for implementation in advance of major oil and gas developments.
    c. Encourage local and national action to implement best practices for local wastes, enhance efforts to clean-up legacy contaminated sites and include contaminant reduction and reclamation plans in development projects.

Dolly Varden, northern subspecies, Salvelinus malma malma
Photo: Neil Mochnacz, Fisheries and Oceans Canada

Kayla Nuyaviak holding a whimbrel chick in the Mackenzie Delta 2010, Canada. Photo: Kim Jones

Improving knowledge and public awareness

12. Evaluate the range of services provided by Arctic biodiversity in order to determine the costs associated with biodiversity loss and the value of effective conservation in order to assess change and support improved decision making.

13. Increase and focus inventory, long-term monitoring and research efforts to address key gaps in scientific knowledge identified in this assessment to better facilitate the development and implementation of conservation and management strategies. Areas of particular concern identified through the ABA include components critical to ecosystem functions including important characteristics of invertebrates, microbes, parasites and pathogens.

14. Recognize the value of traditional ecological knowledge and work to further integrate it into the assessment, planning and management of Arctic biodiversity. This includes involving Arctic peoples and their knowledge in the survey, monitoring and analysis of Arctic biodiversity.

15. Promote public training, education and community-based monitoring, where appropriate, as integral elements in conservation and management.

16. Research and monitor individual and cumulative effects of stressors and drivers of relevance to biodiversity, with a focus on stressors that are expected to have rapid and significant impacts and issues where knowledge is lacking. This should include, but not be limited to, modeling potential future species range changes as a result of these stressors; developing knowledge of and identifying tipping points, thresholds and cumulative effects for Arctic biodiversity; and developing robust quantitative indicators for stressors through the Circumpolar Biodiversity Monitoring Program.

17. Develop communication and outreach tools and methodologies to better convey the importance and value of Arctic biodiversity and the changes it is undergoing.

Conclusion

Arctic biodiversity is a unique global asset, and it faces numerous serious threats. In a world where habitat degradation and species loss are increasingly prevalent, the scarcity and value of intact ecosystems and healthy species are increasing. The Arctic is one of the largest relatively undisturbed physical and ecological systems remaining on Earth, providing a rare opportunity to maintain the ecological integrity of an entire biome. Humans have a responsibility to make Arctic biodiversity conservation a priority and sustainable development in the Arctic a reality.

Many Arctic species and habitats exist nowhere else on Earth. Millions of migratory birds connect the Arctic with the entire globe and uniquely adapted marine mammal species swim in Arctic seas. Arctic peoples continue to live in this extreme environment, using innovations and knowledge to thrive far removed from humanity's tropical origins. Unlike in much of the rest of the world, which has been developed and settled by large numbers of people, biodiversity in the Arctic remains largely intact.

> *"This is what I want to pass on to my descendants: good food from the land, caribou and fish. The land makes you live well and be healthy."*
>
> Rosie Paulla,
> Gjoa Haven, Canada

Yet, as humans are increasingly drawn to and inspired by the beauty and potential of the Arctic, as we increasingly harvest its fish to feed ever-growing populations, as we increasingly exploit its minerals and petroleum, as we increasingly route our ships through its waters and especially as our actions alter its climate, Arctic biodiversity is no longer being left alone to take care of itself. As we recognize the unique values of the Arctic and its critical importance to the earth's oceanographic, atmospheric and biological systems, we must also take on the global responsibility to sustain the Arctic and its biodiversity for ourselves and our descendants. Without the Arctic's biodiversity and the services it provides, the world will be a far poorer place. With the Arctic's biodiversity, humans can demonstrate a commitment to the beauty, mystery and indispensable importance of biodiversity in our world.

Landmannalaugar, Iceland, sub-Arctic zone. Photo: corepix/shutterstock.com

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