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ARCTIC BIODIVERSITY

Contents

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COVER: Arctic tern, Svalbard, Norway.
Photo: Peter Prokosch

ABOVE: Fulmar, Svalbard, Norway.
Photo: Christopher Michel

EDITORIAL

Protecting biodiversity: Our obligation to future generations

THE ARCTIC is home to species whose ability to survive in extreme cold and variable climatic conditions is remarkable. Millions of migratory birds breed in the Arctic and then fly to other continents, contributing to global biodiversity. More than a tenth of the world's fish catch comes from Arctic and sub-Arctic seas. Tourists are travelling north in increasing numbers. Globally, there is a growing appreciation that Arctic ecosystems are increasingly rare examples of largely pristine biodiversity.

The Arctic Council's (AC's) member states and permanent participants representing the Arctic Indigenous peoples are committed to protecting the environment and enhancing sustainable development. In its Arctic Council chairmanship programme for 2017–2019, Finland identified the environment as one of its four priorities.

Protecting Arctic ecosystems and strengthening their resilience is a major challenge for AC member states. We must look for new, effective ways to protect the fragile, unique Arctic environment. The United Nations Aichi Biodiversity Targets (2011–2020) should guide the AC's work on biodiversity.

It is important that we continue to fight climate change while also adapting to its impacts.

During its AC chairmanship, Finland aims to ensure a clear line from science to policy and actions resulting in concrete impacts on the ground. The Paris Agreement on climate change and the UN Sustainable Development Goals (SDGs) are key tools to safeguard biodiversity in the Arctic.

The AC and its working groups have produced many top-quality assessments on the state of the Arctic environment along with recommendations for action. Multiple declarations and meetings of the Arctic ministers have expressed concern about Arctic biodiversity being degraded, and have identified climate change as the most serious threat. In response, the AC has developed an action plan (known as "Actions for Arctic Biodiversity 2013–2021") to implement the recommendations of the Arctic Biodiversity Assessment. Finland encourages member states to put these recommendations into practice and communicate the results through global forums. We need to intensify exchanges of best practices and emerging technologies to promote sustainable and responsible development in the Arctic.

Finland is hosting the 2018 Arctic Biodiversity Congress to enhance the conservation and sustainable use of Arctic biodiversity by promoting dialogue among scientists, Indigenous peoples, policy-makers, government officials, industry, students and civil society. Among other things, the Congress will discuss progress on implementing the Convention on Biological Diversity's Strategic Plan for Biodiversity 2011–2020 as well as the Aichi Targets and SDGs. Further reflecting the emphasis on the environment, Finland is also organizing a meeting of the Arctic environment ministers in conjunction with the Congress.

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Among the urgent actions needed, Finland encourages strengthening the Arctic Protected Area Network, especially in marine areas. Enhancing the worldwide work of the Arctic Migratory Birds Initiative will reduce multiple stressors along the flyways of the most threatened Arctic species.

The 2018 Congress is bringing participants together from across the Arctic in different fields to share knowledge in support of a common goal: finding ways to preserve the Arctic's biodiversity. We owe it to future generations to safeguard the Arctic's precious biodiversity. ○

Photo: Image bank of the Environmental Administration

KIMMO TIILIKAINEN
is Minister of the Environment, Energy and Housing in Finland.

2018 Arctic Biodiversity Congress:

Working together for a better future

ANYONE WHO lives or works in the Arctic is all too familiar with the myriad of challenges facing the region. Expanding shipping and development offer opportunities, but increase the risk of harmful oil spills and the likelihood that invasive alien species will be introduced. Higher levels and more frequent occurrences of underwater noise are affecting marine mammals and other species. Changes like these also have the potential to affect Arctic Indigenous peoples, including their food security and way of life. In addition, pollutants and contaminants from around the world, such as microplastics, can make their way to the Arctic, threatening millions of marine birds, fish and other organisms. The list goes on.

The 2018 Arctic Biodiversity Congress offers an important opportunity to discuss these issues—and take steps to come up with concrete solutions to them.

Hosted in Rovaniemi, Finland by the Arctic Council's (AC's) Conservation of Arctic Flora and Fauna Working Group (CAFF) and Finland's Ministry of the Environment, the Congress bring together 450 participants from 27 countries, including all the Arctic countries and Indigenous organizations represented in the AC. It provides a space for dialogue between those interested in making specific and significant contributions to conserving the region's biodiversity—from scientists to Indigenous peoples to government and industry officials to students.

The goals of this Congress are ambitious. But lofty goals are necessary if we are going to meet the significant challenges facing the region today. One aim is to "mainstream" biodiversity by making it integral to other disciplines, policies and practices. We will not succeed if we address the web of stresses and impacts facing the Arctic in isolation; the changes facing the region are inter-

connected and require comprehensive solutions and international co-operation. Both in the Arctic and globally, we must conserve biodiversity in a holistic and integrated fashion. The Congress invites a diversity of perspectives to do just that.

The Congress is also an opportunity to discuss one of the greatest challenges facing our world today: climate change. The Arctic is warming more quickly than any other region on Earth. In fact, some of the clearest evidence of the effects of climate change are in the changes we are seeing in the Arctic biome. It is time for nations across the Arctic and around the world to more effectively communicate and cooperate to address biodiversity loss. The AC's CAFF working group is uniquely positioned to explore and communicate how our changing climate is affecting Arctic biodiversity. This knowledge will be vital to managing the emerging risks that accompany development, such as invasive species, oil spills and underwater noise.

Participants in this year's Congress will also contribute their voices, ideas and expertise to inform how we address the 17 recommendations contained in the *Arctic Biodiversity Assessment: Report for Policy Makers* and the subsequent *Actions for Arctic Biodiversity 2013–2021* implementation plan. Work being implemented under these strategies is a key indication of how the Arctic has fared in relation to the Convention on Biological Diversity's *Strategic Plan for Biodiversity 2011–2020* and its Aichi Targets, the UN Sustainable Development Goals, and other key global processes and multilateral environmental agreements. The articles contained within the pages of this issue of *The Circle* are just a small sampling of what will be discussed in Rovaniemi. The online version of the magazine will also offer additional interviews and videos, so you can experience the Congress even if you can't attend.

Both in the Arctic and globally, we must conserve biodiversity in a holistic and integrated fashion. The Congress invites a diversity of perspectives to do just that.

Although global discussions about meeting the Paris commitments are vigorous and ongoing, we need to see similar attention to meeting the Aichi Biodiversity Targets—especially when it comes to the Arctic's future. From there, we can celebrate successes and identify areas that need improvement when it comes to the role that ecosystem-based management in the Arctic plays in achieving our global goals. The Congress is the perfect venue to draw attention to these commitments. It will allow us to work together to take concrete steps to meet them and to protect the Arctic's biodiversity in the years to come. ○

CYNTHIA JACOBSON works for the US Fish and Wildlife Service and is chair of the Arctic Council's Conservation of Arctic Flora and Fauna (CAFF).

LIISA ROHWEDER is secretary general of WWF-Finland and chair of WWF's Arctic Programme.

Male walrus, Prins Karls Forland, Svalbard, Norway.

Photo: Peter Prokosch

MONEY FOR CANADIAN ARCTIC BIODIVERSITY

Pilot program supports sustainability and knowledge transfer from Indigenous elders to youth

IN JULY, the Canadian government announced $900,000 to establish a pilot Guardian program for the Tallurutiup Imanga National Marine Conservation Area (NMCA) in Nunavut. Tallurutiup Imanga is the Inuit name for Lancaster Sound in Canada's High Arctic. Guardian programs are Indigenous-led initiatives that aim to empower communities to work as equal partners with government and industry to manage ancestral lands

POLAR OCEANS CONTAIN CRITICAL CLUES ABOUT ENVIRONMENTAL CHANGE

Further study of polar oceans is "urgent," says new report

STATE OF THE POLAR OCEANS 2018, a report published in July by British Atlantic Survey, notes that the polar oceans are the least understood bodies of water on Earth—and that studying them is essential to answering some of the biggest questions about the global environment. Unfortunately, the study's results offer little to celebrate when it comes to the Arctic oceans. Some key findings include:

- The Arctic Ocean is now 2 to 3 C degrees warmer than the 1982–2010 mean.
- Oxygen levels in the world's oceans have dropped by about 2 per cent in the last 50 years. The effect is more pronounced in the Arctic Ocean and will hurt fish stocks.
- Microplastics are a growing problem: a recent Norwegian study found up to 234 microplastic particles in a single litre of melted Arctic sea ice.

The report highlights that the polar oceans are part of a global feedback loop and not as isolated as they might seem. It concludes that there is an urgent need for continued research to develop the knowledge we will need to live with and adapt to environmental change.

Photo: Peter Prokosch

according to traditional values.

The funding will help implement the pilot program, which seeks to support the transfer of Indigenous knowledge from elders to youth. The funding also supports Inuit stewardship of the land, and will enable a local Inuit association to study how the program might best contribute to managing the entire conservation area.

Ultimately, the hope is that establishing Tallurutiup Imanga as a national marine conservation area will advance Canada's biodiversity targets and preserve key species while ensuring traditional Inuit activities can continue for future generations.

IS CLIMATE CHANGE MAKING WHALE COMMUNICATION MORE COMPLEX?

Bowhead whales in Spitsbergen have an extensive repertoire of songs

VIRTUALLY ALL MAMMALS use sound to communicate, but very few produce intricate songs. One of them is the bowhead whale (*Balaena mysticetus*), recently studied in the Fram Straight between Greenland and Svalbard.

Bowhead whale.

Illustration: David G. Stanton, Wikimedia Commons

Using recordings, researchers noticed that the Spitsbergen bowheads used distinct song types for relatively short periods of time—a few months at most—and then changed them. According to a recently released study, these bowhead whales produced more than 184 different song types over a three-year period, a level of diversity the study says is "rivalled only by a few species of songbirds."

Kit Kovacs, a researcher with the Norwegian Polar Institute and one of the study's co-authors, says there are several potential theories to explain this extraordinary diversity in song. It may have come about because of an expanding population. Or warmer temperatures could play a role, since whales may "immigrate" to the area from other populations as thick sea ice thaws. It could also be that there is strong pressure for novelty in a small population.

Bowheads sing underwater beneath heavy ice during the polar night, so arriving at a detailed understanding of their syntax is challenging.

EVOLUTION AT THE ENDS OF THE EARTH

Study finds new fish species emerge more quickly at the poles than in the tropics

NEW RESEARCH published in *Nature* suggests that species evolve more quickly in high-latitude oceans than in the species-rich tropics—a finding that surprised scientists.

The study found that fish species at the poles divided into new species twice as fast as those near the equator: every four million years versus every 10 to 20 million years.

According to the study's lead author, evolutionary biologist Daniel Rabosky, the reason for this is still unclear, but likely isn't related to the Arctic's physical environment or colder temperatures. He suggests climate instability may explain the change.

We already know that species diversity booms after a big extinction event—it's thought that the clearing-out may create the conditions for a fresh profusion of species—so climate instability at the poles could be causing a similar rebound effect. For example, researchers have observed that new species form rapidly among fish in northern Canadian lakes that were once ice sheets.

The next generation

Giving youth a voice in the Arctic's future

The Arctic is home to roughly 100 species of mammals, 200 species of birds, several thousand species of insects, and 125 different kinds of fish, reptiles and amphibians. It also has more than 2,000 plant species on land, not to mention the algae, krill, zooplankton and microorganisms that live beneath the water's surface. Each of these species plays a critical role in maintaining an ecological balance in the Arctic. The challenge is how to protect this delicate balance.


Julia Lynge Ezekiassen

IN OCTOBER, 35 young people aged 18 to 25 will gather in Norvajärvi, Finland to tackle this question. They're part of the first Arctic Youth Summit, which is coinciding with this year's Conservation of Arctic Flora and Fauna (CAFF) Arctic Biodiversity Congress. The youth represent the nine Arctic countries—Canada, the US (Alaska), Russia, Finland, Sweden, Norway, Iceland and Greenland—as well as the Arctic Council's observer states, Singapore, India and Germany.

Nineteen-year-old **TASHA ELIZARDE** from Juneau, Alaska and 24-year-old **JULIA LYNGE EZEKIASSEN** from Nuuk, Greenland are two of the young people taking part in the summit. They may live thousands of kilometres apart, but they share a common desire: ensuring youth have a voice in the Arctic's future. We spoke to them about their views on biodiversity and what it means for their communities.

When you hear the word biodiversity, what do you think about?

TASHA: From my understanding, biodiversity is the variety of life. It basically means just how different and diverse the world is. Not just the environmental aspect, but also how environmental diversity plays into our ways of life. For example, I live in Juneau, which is in a rainforest. That's a very different environment from that of the people I know who live in the actual Arctic circle, people up in Utqiaġvik. Because of the way the environment is set up, the way we grew up and live is very different.

JULIA: Biodiversity means the variety and variability of life from different sources on earth. For instance, it explains the diversity of living organisms on land and in the sea and also their connection to the ecosystem. Although biodiversity can be understood in different ways, I am interested in Arctic biodiversity because I live in Greenland. I am especially interested in

JULIA: I also think that the lack of knowledge of Arctic biodiversity among the people who live in the Arctic can be considered a threat. To preserve the biodiversity of my community, I would really like to see increased focus on the subject. Politicians can do better when it comes to disseminating that knowledge.

Tasha Elizarde

the known species of living organisms in the Arctic and how some conditions and tendencies influence the welfare and lives of these species and the ecosystem.

Why is protecting biodiversity important to you?

TASHA: When we think about climate change and other environmental problems, like ocean acidification, we see these impacting our environment and biodiversity. That affects the people who are living there. But people are not the only things being affected.

For instance, I live near the Mendenhall Glacier in Alaska, which has been receding over the past few decades. You can see some really extreme photos that compare what the glacier used to look like in the 1800s, the 1900s and now. Growing up, there was this hiking trail where we could see the glacier. When I was maybe 10 or 12 years old, I was able to see it really well. Nowadays, when I hike that same path, I can't see the glacier because it has receded so much.

JULIA: It is critical to protect Arctic biodiversity so the lives and ecosystems of Arctic species can be preserved.

TASHA: I feel young people are not given the platform to effect change. There is often an unwillingness or inability on the part of the people in leadership positions to take our opinions into account.

It's a known fact that hunting and fishing have always been a big part of Greenland's culture. It's important to preserve and protect Arctic biodiversity to sustain this way of life, but in my community, overhunting has also had a negative impact on biodiversity. Another threat—both locally and internationally—is pollution. For example, the lack of waste management here in Greenland is a real problem, as is the environmental impact of increased shipping from both cargo and cruise ships.

I also think that the lack of knowledge of Arctic biodiversity among the people who live in the Arctic can be considered a threat. To preserve the biodiversity of my community, I would really like to see increased focus on the subject. Politicians can do better when it comes to disseminating that knowledge. Communicating with the community about

the importance and value of Arctic biodiversity is, in my opinion, a very important tool. I believe that by doing this, and by making political decisions to preserve the biodiversity in my community, we can reduce the threats.

Why do you think it's important that young people take a leadership role in preserving biodiversity?

TASHA: I think it's important because, frankly, young people are the ones who are going to inherit the world. So not doing anything means we don't have a say in our future. There are a lot of problems arising—such as climate change—that we are going to have to take on. It isn't fair for us to not have control, because it is the world that we will be living in.

At the same time, I feel young people are not given the platform to effect change. There is often an unwillingness or inability on the part of the people in leadership positions to take our opinions into account. We need to see what solutions and collaborations we can engage in to solve a lot of the problems we're now discussing.

JULIA: My answer is very simple: It's important because our choices influence the lives of the next generations. ○

SESSION:
Inspiring Arctic voices through youth
Thursday October 11, 2018
13:30 to 15:00
Many of the youth will speak at this Congress session.

Arctic Ocean acidification

Winners, losers and

The ecological and socio-economic impacts of ocean acidification and warming will be considerable without large reductions in carbon emissions—and nowhere will the effects be more apparent than in the Arctic. This conclusion is based on the results of the 2018 Arctic Ocean Acidification Assessment, which will be presented at the 2018 Conservation of Arctic Flora and Fauna (CAFF) Arctic Biodiversity Congress in a session co-chaired by RICHARD BELLERBY, EMILY B. OSBORNE and CLAUDIA GELFOND ROCHE.

THE FASTEST RATES of ocean acidification in the world—and the largest net changes in pH that we can observe today—have been detected in the Arctic Ocean. These shifts in ocean chemistry have an impact on marine ecosystems, in turn affecting both ocean resources and northern economies. The 2018 Arctic Ocean Acidification Assessment, conducted by the Arctic Monitoring and Assessment Programme with an update to the 2013 assessment, presents the chemical, biological and socio-economic impacts of ocean acidification through a series of regionally focused case studies.

COMPLEX RESPONSES FROM MARINE ECOSYSTEMS

Increasingly acidifying ocean conditions can affect marine organisms in a variety of ways. Some may experience altered growth, development or behaviour if exposed to low pH at certain life stages. Others may experience indirect effects, such as changes in their food web structures or predator–prey relationships.

This mixed response tells us that some organisms will be winners and others will be losers—an outcome that ultimately means we can expect a more complex array of impacts on marine ecosystems. The 2018 Arctic Ocean Acidification Assessment highlights some of these intricate interactions and underscores the difficulty of predicting how ecosystems may respond to change. But case studies like those of the Barents Sea cod fishery, Norwegian urchin harvesting and Greenland shrimp fisheries may shed some light on the regional challenges and socio-economic effects of ocean acidification in distinct Arctic areas.

For example, the case study of Norwegian urchin harvesting identifies the synergistic impacts of ocean acidi-

Some organisms will be winners and others will be losers—an outcome that ultimately means we can expect a more complex array of impacts on marine ecosystems.

complex ecosystem impacts

Winner or loser? Sea urchin, Ytterstad, Nordland, Norway.

Photo: Ytterstad, Nordland, Norway.

fication and warming on the potential harvestable urchin population and kelp regrowth in northern Norway. Considered a delicacy in some cuisines, urchins have been explored as an emerging fishery that could benefit kelp forest regrowth. Projecting the impacts of an acidifying, warming ocean on the urchin population and kelp growth in a variety of future CO_2 emissions and ocean acidification scenarios can help us figure out the best harvesting strategies for both.

ANTICIPATING THE SOCIO-ECONOMIC IMPACTS

Many of the studies included in the assessment anticipate that ocean acidification will have negative socio-economic impacts on communities. This would be thanks to the drastic ecological changes that are expected as marine systems respond to acidification. But other Arctic regions may experience positive economic effects from environmental changes like rising temperatures and reduced sea ice. The assessment includes studies of several Arctic regions to better understand the variety of socio-economic impacts that ocean acidification may cause.

Overall, the assessment presents a synthesis of current research showing that ocean acidification is already affecting Arctic marine ecosystems, and that as it continues, it will ultimately have significant ecological and socio-economic effects that are difficult to predict accurately. Collectively, the studies indicate that while it's clear there will be significant changes in Arctic ocean services, our current knowledge does not allow for a high level of confidence that these projections are accurate.

Protecting and managing Arctic ecosystems and ecosystem services to the benefit of local and global societies will depend on an integrated socio-ecological understanding of the Arctic Ocean. ○

SESSION:

Arctic Ocean acidification: Pan-Arctic processes and regional ecosystem impacts

Wednesday October 10, 2018
8:30 to 10:00

RICHARD BELLERBY is a senior scientist and research coordinator at the Norwegian Institute for Water Research, Norway and director of the SKLEC-NIVA Centre for Marine and Coastal Research at East China Normal University, China.

EMILY B. OSBORNE is a program manager at the NOAA Arctic Research Program.

CLAUDIA GELFOND ROCHE is a researcher affiliated with the Ocean Acidification Research Center at the University of Alaska Fairbanks.

Grenadier fish among anemones and bristle worm tubes at 800 metres depth.

Photo: Chris Yesson

The impacts of trawling

Fragile life at the bottom of the sea

Greenland's deep seafloor is home to a diverse assembly of benthic fauna, including corals and sponges. Deep-sea fisheries are vital to Greenland's economy, but trawling can damage benthic species by dragging heavy gear across the seabed. In fact, a team of marine scientists from Nuuk, Greenland and London, England explored the seabed using underwater cameras and found that these habitats have undergone substantial change due to trawling. As MONA FUHRMANN discusses, these findings challenge the industry to reach conservation goals.

IMAGINE DIVING DOWN to 1,000 metres below the sea surface of West Greenland. You would find complete darkness, icy temperatures and pressures that no human would survive.

Yet the sea floor is home to a peculiar community of organisms that have adapted to this harsh environment. There are sea cucumbers burrowing in the mud, starfish and brittlestars crawling on the surface, and the delicate lattices of moss animals branching alongside sea squirts. Larger soft corals and sponges provide shelter and substrate for a community of smaller invertebrates as well as nursing and feeding grounds for fish and their offspring.

Meanwhile, Greenland's fisheries are an economic lifeline: seafood from ground fisheries constitutes over 80 per cent of the country's exports. This fact means the industry often finds itself at odds with the need to protect life on the sea floor. Fisheries for deep-water prawns, offshore halibut and cod use deep-sea trawls that weigh heavily on the seabed, often damaging or destroying fauna as the gear is dragged along. Trawling poses a particular threat to the immobile and long-lived seafloor organisms that are an integral part of the marine ecosystem.

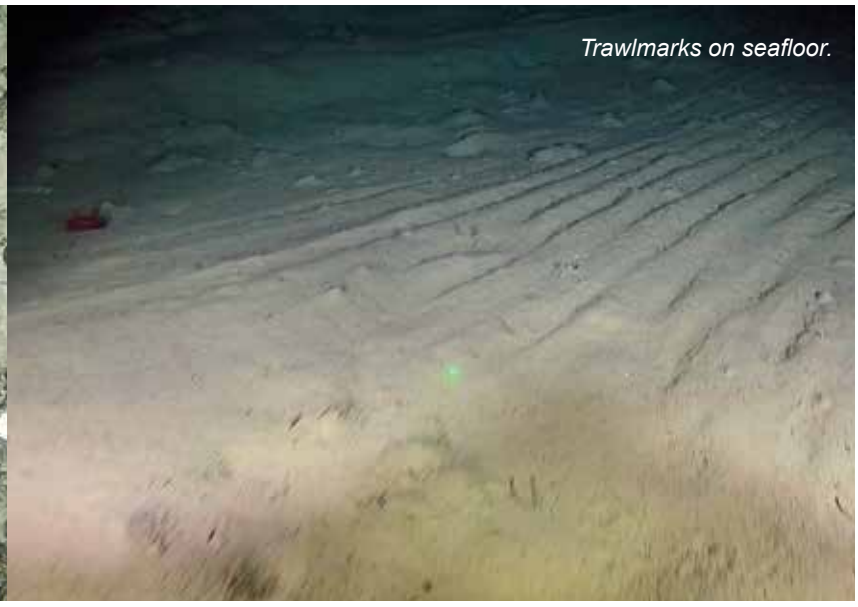
RISING TO THE CONSERVATION CHALLENGE

Greenland's trawl fisheries have been responding to conservation challenges by engaging with green-labelling organizations—such as the Marine Stewardship Council—to implement sustainable strategies to safeguard natural resources and environments. But the deep ocean of the Arctic is one of the least explored and understood places on Earth, and considerable knowledge gaps remain. I am part of a team of marine scientists from the Zoological Society of London (ZSL) and the Greenland Institute for Natural Resources that is trying to fill these gaps by investigating the distribution of seafloor species and how they are affected by trawling.

Underwater cameras allow us to survey the seabed, giving us a unique view of the life there. By examining data from trawl fisheries, we can compare habitats that have been fished in the past (or are being fished now) with non-fished habitats. We often see evidence from trawl fishing in the form of grooves and

Soft coral, anemone and sea star on rocky bottom at 300 metres depth.

Photo: Chris Yesson



Trawlmarks on seafloor.

Photo: ZSL

tracks on the seabed. The results of our research confirm what is widely known in the scientific community: trawled areas are considerably lower in biodiversity and in the abundance of larger organisms.

One of our research challenges is to find habitats in West Greenland that are entirely untouched by fisheries so we can understand what a pristine, untouched area should look like. For example, some areas on the shelf of West Greenland have been fished for cold-water prawns for more than 50 years. Most of the damage usually occurs the first time an area is trawled, and recovery rates are extremely slow. I have spoken with an old fisherman who could remember a time when metre-high corals (of the species *Paragorgia*) clogged entire nets. But despite our efforts over the past decade, we have not been able to capture on video a single specimen of this potentially tree-sized coral, which suggests they are long gone.

I have spoken with an old fisherman who could remember a time when metre-high corals (of the species *Paragorgia*) clogged entire nets. But despite our efforts over the past decade, we have not been able to capture on video a single specimen of this potentially tree-sized coral, which suggests they are long gone.

MORE RESEARCH NEEDED

As fisheries expand into unexplored areas, pristine habitats face new conservation challenges.

In fact, Chris Yesson, a research fellow at ZSL, says that with sea temperatures rising, prawn stocks appear to be migrating further north. Fisheries want to move with them, he notes, but this means moving into new areas and damaging potentially vulnerable seabed habitats.

SESSION:
Reducing the effects of commercial fishing on biodiversity
Tuesday October 9, 2018
15:00 to 16:30

Under the circumstances, there is a pressing need to conduct more research in these areas (or at least develop sound predictions regarding the presence of vulnerable habitats) to inform management before a fishery enters them.

The Greenlandic culture is strongly connected to the ocean and its resources. The most famous Greenlandic saga about the mother of the sea, Arnaqquassaaq, tells about the connection of people to the sea and the importance of preserving harmony between humans and nature. From her home at the bottom of the sea, Arnaqquassaaq would send up fish, mammals and birds for hunters to catch. If humans failed her, she would stop the supply of food.

I think this saga contains a lot of truth—and a potential warning. The ocean floor is a rich habitat, providing food and shelter for many commercial fish species and feeding grounds for mammals, such as the walrus. Taking care of the home of the mother of the sea is essential to taking care of ourselves. ○

MONA FUHRMANN is a post-doctoral researcher at the Institute of Zoology in London, UK with a keen interest in benthic ecology of Arctic ecosystems. She focuses on benthic deep-sea communities in West Greenland, particularly their distribution and diversity and the impacts of trawling.

New findings on polar bears

An updated look at polar bears in the Russian Arctic

Photo: Varvara Semenova

Researcher Andrei Boltunov (left) and veterinarian Snezhana Atanasova prepare to measure a bear's heart rate on Bolshevik Island in the Severnaya Zemlya archipelago.

Photo: Varvara Semenova

In the Russian Arctic, some 25,000 polar bears range over almost 4 million square kilometres of water, islands and mainland coast—all the way from Franz Josef Land in the west to the Bering Strait in the east. Historically, the study of polar bears in Russia was restricted to coastal areas accessible by helicopters from a few airports, resulting in a biased understanding of these animals. But as ANDREI BOLTUNOV tells us, a new approach has dramatically expanded research coverage of the polar bear range in Russia.

ACCORDING TO the International Union for the Conservation of Nature, the Russian Arctic is host to four polar bear subpopulations, each named after the seas they inhabit: Barents, Kara, Laptev and Chukchi. An interesting research question is: Does this subdivision reflect the natural structure of polar bear populations in the region?

From 2014 to 2016, polar bear studies were a part of four large-scale, complex expeditions organized by Rosneft, a Moscow-based oil company. The studies covered all four seas of the Rus-

Conserving these polar bears against the backdrop of a changing environment and increasing economic activity requires further studies aimed at helping us develop and apply measures to ensure their long-term survival.

sian Arctic and lasted a total of about six months. The aim was to provide up-to-date insights into the biological and environmental background of the species in its natural habitat—which is within an area of the Arctic shelf being considered for development—as well as a basis for monitoring bears in the area as an indicator of sustainable Arctic marine ecosystems.

To study the polar bears, researchers tranquillized 32 of them to obtain samples. They also tagged 20 using satellite transmitters. In addition, they set up 78 autonomous photo recorders on Wrangel Island, Novaya Zemlya and Novosibirskie Islands. Laboratory studies analyzed the bears' DNA, toxicology and microbiology.

Although some of the results of these field expeditions and lab studies are still being analyzed, we can draw some general preliminary conclusions about polar bear life in the Russian Arctic.

1. Everywhere the species ranges, there is a balance between local resident bears and large-scale nomads in the overall population. (A resident species is one that inhabits an area throughout the year.) This finding is suggested by a number of factors: the geographic features of various parts of

ANDREI BOLTUNOV is a member of the International Union for the Conservation of Nature/ Species Survival Commission Polar Bear Specialist Group. He works with the Marine Mammal Research and Expedition Center Ltd.

A polar bear wades into the Arctic Ocean near Wrangel Island.

Photo: Varvara Semenova

the Russian Arctic; regional patterns of sea ice cover; the distribution of the main polar bear prey species; and the results of recent polar bear studies. In this context, the Kara Sea likely has the biggest proportion of bears who are present year-round. This conclusion is supported by the considerably low variability of haplotypes (groups of genes inherited from a single parent) in the area compared with bears in the Chukchi Sea region. The Chukchi Sea is a rich feeding area, so it attracts a fair number of bears from nearby areas seasonally, leading to high variability in haplotypes. The vast marine area between the Kara Sea and Chukchi Sea habitats serves as a kind of buffer zone.

2. The levels of persistent organic pollutants (POPs) found in the polar bears reveal two major clusters of bears. The Kara Sea bears have a higher POPs burden. This sets them apart from the rest of the Russian Arctic bears.

3. There is evidence of exposure to antibiotics in some of the polar bears. We can infer that these bears live closer to coastal settlements, unlike their counterparts who inhabit more remote Arctic areas.

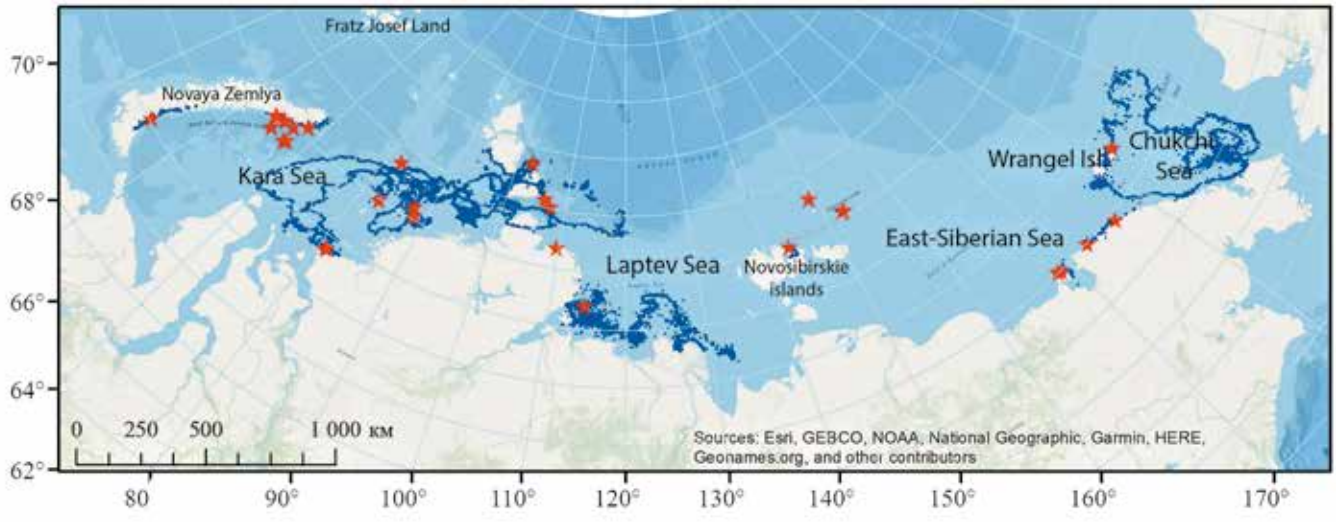
Overall, the polar bear population in the Russian Arctic has a complex, patchy structure where populations differ by haplotype diversity, pollution burden and habitat use features. Recent large-scale studies provide an extensive amount of new information on the species and raise new questions.

However, conserving these polar bears against the backdrop of a changing environment and increasing economic activity requires further studies aimed at helping us develop and apply measures to ensure their long-term survival. ○

SESSION:

Impact of reduced ice cover in the Arctic marine environment

Tuesday October 9, 2018
13:00 to 14:30



Stars represent places where the bears were immobilized; blue dots are the ARGOS locations of all tagged bears.

Rosa rugosa, a popular ornamental plant, is now becoming invasive in the Arctic.

Photos: Jamie K. Reaser

Shipping is a major pathway for marine invasive species in the Arctic.

Invasive alien species threaten biodiversity in the Arctic

Putting the freeze on invasive alien species

Invasive alien species are one of the top drivers of biodiversity loss—and changes in the Arctic make it particularly vulnerable to biological invasion. As JAMIE K. REASER observes, we've reached a crossroads where we must make a choice: stop the spread of invasive alien species or live with the adverse consequences indefinitely.

NO ONE TRAVELS ALONE. Throughout history, people have conveyed plants, animals, pathogens and parasites to other continents, sometimes intentionally, but often as hitchhikers. While some of these organisms have proven beneficial, a growing majority cause harm. According to the Convention on Biological Diversity, invasive alien species are alien (non-native) species whose introduction and/or spread (into a novel ecosystem) threatens biological diversity. Invasive alien species may also affect our food, water, infrastructure, health and safety, cultural identities, livelihoods, economies and even military readiness.

Although there are notable invasive alien species already present in the Arctic—for example, American mink, European green crab and Nootka lupine are all altering Scandinavian ecosystems—the region is less affected than others. However, as the Arctic warms—with the attendant increase in resource extraction, settlement and tourism—the risks posed by invasive alien species will grow substantially. These species will arrive in increasing numbers via shipping, horticulture, the escape or release of domestic animals, construction materials and equipment, recreational gear and numerous other pathways unless we take proactive action. We have a unique opportunity in the Arctic: there

Invasive alien species may affect our food, water, infrastructure, health and safety, cultural identities, livelihoods, economies and even military readiness.

JAMIE K. REASER is executive director of the US National Invasive Species Council.

is still time to put the freeze on invasive alien species.

In 2013, the Arctic Council's Arctic Biodiversity Assessment recognized the threat posed by invasive alien species to Arctic ecosystems, cultures and economies, and called for a strategy to address invasive alien species on a regional scale. In 2016, after more than a year of multinational negotiations, the Arctic Invasive Species (ARIAS) Strategy and Action Plan was adopted. Known simply as "ARIAS," the plan sets out three goals and 15 priority actions to be implemented by Arctic Council governments and their partners at regional, national and subnational scales. The goals are:

- To raise awareness of the unique opportunity that the Arctic Council and its partners have to inspire the urgent and effective action necessary to protect the Arctic from invasive alien species
- To improve the capacity of the Arctic Council and its partners to make well-informed decisions on the needs, priorities and options for preventing, eradicating and controlling invasive alien species in the Arctic by improving the knowledge base
- To protect Arctic ecosystems and human well-being by instituting prevention and early detection/rapid response programs for invasive species as a matter of priority.

An international team, the Arctic Council's ARIAS Implementation Coordinating Group is turning the plan into region-wide projects and, ultimately, region-wide success. The group will be seeking partnerships with NGOs, industries, academic institutions, Indigenous peoples and local communities.

The future of the Arctic is a matter of human choice. We can learn from mistakes made elsewhere and take responsibility for our actions. We can limit the impact of invasive alien species. The question is, will we? Will you? l

The ARIAS Strategy and Action Plan is available at www.caff.is/strategies-series/415-arctic-invasive-alien-species-strategy-and-action-plan. The views expressed in this publication are solely those of the author and do not necessarily reflect the views of the United States government.

SESSION:

Arctic Invasive Alien Species Action Plan: National implementation and empowering decision making by mobilizing, sharing, and analyzing Arctic invasive alien species data

Wednesday October 10, 2018
15:15 to 17:15

CASE STUDY:

Eradicating rats in the Aleutian Islands

Photo: Tocekas, Wikimwdia Commons

Brown rat (Rattus norvegicus).

Hawadax Island's story is one of recovery—the recovery of an Alaskan island ecosystem and a cultural identity. Spanning 2,704 hectares, Hawadax (pronounced "how AH thaa") is a rugged volcanic island located about 2,100 kilometres west of Anchorage in the Aleutian archipelago. Since 1827, Hawadax had been known as Rat Island, a name that reflected the abundance of invasive brown rats (Rattus norvegicus) and the havoc they had wrought on the island's ecosystem for some 200 years.

The rats had arrived on ships as "stowaways," established a large population, and proceeded to devour seabird eggs and young chicks as well as the vegetation that provided habitat for numerous native island species. In September 2008, the US Fish and Wildlife Service partnered with two NGOs to eradicate the invasive rats. Within five years, the detection of terrestrial birds, shorebirds, and seabirds had increased significantly. Nesting tufted puffins (*Fratercula cirrhata*) and Leach's storm petrel (*Oceanodroma leucorhoa*) re-colonized the island, and black oystercatchers (*Haematopus bachmani*) enjoyed substantially greater nesting success. The Aleutian endemic giant song sparrow (*Melospiza melodia maxima*), which had likely been extirpated from Hawadax, was confirmed to be breeding on the island.

In May 2012, the US Board on Geographic Names celebrated the island's recovery by approving a proposal to change the island's name from Rat Island back to Hawadax Island—Hawadax being the original Aleut name meaning "entry" and "welcome." The project partners continue to work together to prevent invasive rats from being reintroduced.

Song for the Reindeer

By Jamie K. Reaser

I owe you my life.

No man can become a man
without otherness.

You are other.
And, you are me.

We are of the same
hoof and bone.

When I consume your body,
you are the knife and the spoon
and the tongue of the ancestors.

How otherwise starved and naked I would be.

Cradle and sled,

You've born me
into this world
and across the miles
that no one else cared witness.

My stride is a learned migration
into my self.

Only here can I know flight.

I may be the breath,
But you are the sound of my soul:

This soft rhythm of the taiga.
These branches snapping in the wind.
The keepers drumming at the threshold
of the world
in which we are true brothers.

Blood lines. Life lines.

There is only one world.

And, this music.

Yes, this music ~

I've come to understand
is a Man's initiation.

How could I be without you?

How could I ever be without you?

As well as being executive director of the US National Invasive Species Council, Jamie K. Reaser is a fellow of the International League of Conservation Writers. She will be giving a poetry reading at the Arctic Biodiversity Congress. Her work is available through online retailers and Talking Waters on Facebook.

Reindeer, Svalbard, Norway.

Photo: Christopher Michel

Biodiversity versus development

Regulating oil and gas development in the Canadian Arctic

In 2012, the* Kulluk*, a Royal Dutch Shell offshore exploratory rig, ran aground in the Chukchi and Beaufort seas in the Arctic Circle.

Early in 2018, Husky Energy's* SeaRose *floating production storage and offloading operation was shuttered after a close call with an iceberg off Newfoundland and Labrador. It had 340,000 barrels of crude oil on board.

In summer 2018, the expedition cruise ship* Akademik Ioffe*, carrying tourists and scientists, struck land near Kugaruuk, Nunavut. Its hull was breached and water began to seep in.

Photo: Berardo62, Wikimedia Commons

There were no lives lost or oil spilled in these incidents. But that's not the point, says **MARK BROOKS**, an Arctic oil and gas specialist with WWF-Canada: the point is that any incident has the potential to cause extreme consequences, and better regulation is needed. We spoke with Brooks about the risks that increased traffic and exploration pose to biodiversity in the Arctic and what WWF is trying to do about it.

What are the risks of an oil spill in the Arctic on a day-to-day basis?
That depends how you define an oil spill. As the industry likes to point out, there's a very low risk of a major blowout along the lines of the *Exxon Valdez,* which released 11 million gallons of oil into waters near Alaska. But when you talk about risks, you have to talk about consequences. In the Canadian Arctic, there's almost no infrastructure, no response capacity. Communities are small and Coast Guard response vessels are few and far between. The consequences of an uncontrolled spill or major shipping accident would be catastrophic. That's why we feel strongly that the risk has to be minimized to the greatest extent possible—approaching zero.

As Arctic ice thaws, will the risk of an incident go up?
Yes. Right now there's really no oil and gas activity in the Canadian Arctic because the economics don't make sense. But that could change. The price of oil could go up again or the Canadian government could lift the moratorium on new licenses. And once you start getting more traffic—even just shipping and marine traffic—it will affect biodiversity in the Arctic by changing migration patterns, wildlife availability, hunting and fishing. Any single ship or oil well would run the same risk of a catastrophic accident, and the more of them you have in play, the greater the overall risk.


Mark Brooks

What technologies are available that could help prevent oil spills?
Industry likes to say technology is always improving, but oil and gas operations are also taking more chances. We're seeing deeper and deeper wells drilled in riskier environments. Companies are pushing technology to its limits. That's why government needs to step in: to

SeaRose FPSO and offshore support vessels.

We're seeing deeper and deeper wells drilled in riskier environments. Companies are pushing technology to its limits. That's why government needs to step in: to ensure regulators are forcing companies to improve their technologies and make their operations as safe as possible.

ensure regulators are forcing companies to improve their technologies and make their operations as safe as possible. But that's not the case right now in Canada's offshore environment. We don't have a world-class regulatory system in place to keep accidents from happening, so we continue to see accidents or near misses.

For example, same-season relief wells (SSRWs) are now an essential part of the safety regime. In the *Deepwater Horizon* incident, an explosion on a semi-submersible offshore drilling rig in the Gulf of Mexico caused a blowout that could not be plugged until a relief well was finally drilled. Yet Canada is now allowing alternatives to SSRWs. Having a capping stack on hand or nearby is also crucial in the Arctic, but not required under Canadian regulations.

What biodiversity impacts would you expect to see from an oil spill in the Arctic?

We would expect to see mortality ecosystem disruption and profound impacts on marine wildlife and migration patterns. Canada is totally unprepared to deal with a major shipping spill or a well blowout. We just don't have the capacity to respond to an accident of that magnitude in an extreme environment like the Arctic. We've seen what happened with the *Exxon Valdez* spill in Alaska, where most of the oil could not be cleaned up.

Canada says it is modernizing its regulatory framework. What would you like to see?

As it stands, they're only modernizing small pieces of the framework—just a few regulations under the *Canada Oil and Gas Operations Act*. We've been asking the government to take a much more holistic view, including Indigenous consultation and a carbon reduction strategy. Those are not being considered at all, so we've decided to try to do it ourselves. We're organizing a symposium this fall that will bring together a panel of experts from around the world to figure out what a truly world-class, gold-standard offshore regulatory regime would look like in the Arctic. We hope to come out with a series of recommendations for the Canadian government by the end of 2018 that will minimize risk to the greatest extent possible.

What's the bottom line when it comes to Arctic oil and gas development?

Even with the latest technology, and despite industry assurances, things do go wrong. And if it could happen once, it could happen again—and next time, in the Arctic, the environmental damage could be catastrophic. There is a clear threat to marine wildlife, biodiversity and ecosystems in the north if this activity goes ahead under existing regulations. ○

SESSION:
Oil spill prevention, preparedness and response in the Arctic
Wednesday October 10
15:15 to 17:15

Developments in Arctic

Will the Task F

The profound changes that have already come to the Arctic—and the prospect of even more significant changes in the future—have prompted Arctic nations and peoples to reassess the international arrangements they created to help them respond and adapt to such changes. In just a few short years, a number of initiatives to strengthen the governance of the Arctic region have emerged. But as DAVID BALTON writes, more needs to be done.

OVER THE PAST DECADE, the Arctic Council (AC) has evolved into the pre-eminent international forum for addressing Arctic issues. Among other things, it now boasts a permanent Secretariat and an Indigenous Peoples Secretariat. It has also helped establish a number of other entities, including the Arctic Economic Council, the Arctic Coast Guard Forum and the Arctic Offshore Regulators' Forum.

The AC has also served as the forum for negotiating and concluding three new binding agreements since 2011: the Arctic Search and Rescue Agreement, the Arctic Marine Oil Pollution Agreement, and the Arctic Science Cooperation Agreement. Two other agreements—the Polar (Shipping) Code and the Arctic Fisheries Agreement—involved additional states and were developed outside the Arctic Council process.

orce on Arctic Marine Cooperation deliver?

But another notable and potentially consequential effort to strengthen the governance of the Arctic—the Task Force on Arctic Marine Cooperation—appears to have become sidetracked.

In 2015, the Arctic Council created the task force with a mandate "to assess future needs for a regional seas program or other mechanism" for the Arctic. The task force worked actively for two years and delivered a well-crafted report with recommendations in 2017. Highlighting that the Arctic Ocean is experiencing unprecedented change, the task force concluded that Arctic nations would likely need "additional new institutional capacity" to tackle the challenges that would result.

TERMS OF REFERENCE NEEDED

In May 2017, the Arctic Council Ministers "recognize[d] the increasing need for regional cooperation to promote the conservation and sustainable use of the Arctic marine environment" and gave the task force a new mandate: to present "terms of reference for a possible new subsidiary body, and recommendations for complementary enhancements to existing Arctic Council mechanisms, for consideration by Ministers in 2019."

The task force has met twice during the Finnish chairmanship of the AC. At this point, it appears unlikely to fulfill the key part of its current mandate—namely, to present the requested terms of reference. Senior Arctic Officials (SAOs) have instead suggested that consideration of any new subsidiary body should await the completion of the AC's first-ever strategic plan, currently under development.

Looking ahead, those involved will need to consider further steps in improving Arctic governance to meet the region's needs, including conserving Arctic biodiversity. The Arctic Council has room to grow in this regard without losing its flexibility or inclusiveness. Its members should provide financial and other resources to the AC in a more transparent and predictable manner, a necessary predicate to any call for an increase in such resources. The AC should also streamline and consolidate its dispersed secretariat structures.

With respect to the five new binding agreements, the parties to each of them must ensure they are implemented effectively—a process that has already begun in the case of the Search and Rescue and the Marine Oil Pollution agreements. Another challenge will be to figure out how these instruments—along with the Arctic Council and the other international bodies that address Arctic issues—should interact with one another to form a well-integrated Arctic governance system.

A final thought: If the Task Force on Arctic Marine Cooperation does not present terms of reference for a new Arctic Council subsidiary body that would help Arctic states and peoples to cooperate on Arctic Ocean issues, a new initiative—such as a regional seas program—should be launched to create such a mechanism outside the Arctic Council framework. This mechanism could draw inspiration from similar mechanisms elsewhere, but should be tailored to meet the specific needs of the Arctic region and developed in a transparent manner with the involvement of Arctic stakeholders. ○

DAVID BALTON is a senior fellow working with the Polar Initiative of the Woodrow Wilson International Center for Scholars. The Wilson Center and WWF recently announced a partnership focused on strengthening Arctic governance.

If the Task Force on Arctic Marine Cooperation does not present terms of reference for a new Arctic Council subsidiary body that would help Arctic states and peoples to cooperate on Arctic Ocean issues, a new initiative—such as a regional seas program—should be launched to create such a mechanism outside the Arctic Council framework.

SESSION:
Biodiversity in the high seas of the Central Arctic Ocean: Advancements in scientific understanding and future management
Wednesday October 10
10:30 to 12:00

Return WWF Arctic Programme
275 Slater Street, Suite 810,
Ottawa ON, K1P 5H9, CANADA

View of Rovaniemi from Jätkänkynttilä (Lumberjack's Candle Bridge).

Photo: Tyvic, Wikimedia Commons

Where to find WWF at the CAFF

Tuesday, October 9

15:00–16:30	Session CC4: Early warnings: approaches to measuring, modelling and assessing change in biodiversity
	Session AS4: Reducing the effects of commercial fishing on biodiversity
	Session KNO8: The problem of the polar bear: Does the symbol of the Arctic prevent us from fixing the Arctic?

Wednesday, October 10

8:30–10:00	Session IAB2: Safeguarding habitats for Arctic species under changing environmental conditions
10:30–12:00	Session IAB7: Bowhead whale conservation and future research cooperation
15:15–17:15	Session AS2: Oil spill prevention, preparedness and response in the Arctic
	Session IAB3: Arctic marine protected areas: identification, effectiveness, co-management and cooperation

Thursday, October 11

8:30–10:00	Session IAB5: Transboundary management of Arctic biodiversity
10:30–12:00	Session MB3: Green financing, blue economy: Investments in Arctic biodiversity
13:30–15:00	Session AS3: Reducing the effects of shipping on biodiversity
	Session MB2: Inspiring Arctic voices through youth

Friday October 12

10:30–12:00	Session AS5: Conflict between people and polar bears in the Arctic: how to address an increasing issue?

WWF

Why we are here
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

www.panda.org/arctic