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THE CIRCLE

PROTECTING THE LAST ICE AREA

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PROTECTING THE LAST ICE AREA

Contents

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COVER:
Photo: Brad Benter/USFWS.

ABOVE: In Franklin Bay, Northwest Territories, a diving specialist positions an ultra-sensitive light meter beneath two metres of Arctic sea ice. A DFO-led initiative sampled and documented the under-side of the sea ice as part of the Canadian Arctic Shelf Exchange Study (CASES). For more information, see http://cases.quebec-ocean.ulaval.ca/network.asp

Where ice is life

FOR SOME, The Last Ice Area is a name that conjures the iconic, the adventurous, maybe even the nostalgic. For others it is a call to action to protect an area of summer sea ice above Arctic Canada and Greenlandland projected to persist the longest in a region undergoing unprecedented change. Still others have said it conveys a sense of gloom for something we are on the verge of losing.

All of these emotions and reactions could be apt. It depends on how you are experiencing The Last Ice Area – whether you are still learning about it, living in it or analysing what is happening there and attempting to formulate management and conservation options.

This edition of *The Circle* is your go-to guide about The Last Ice Area project, beginning with what it is, where it is and why WWF settled on that particular name.

We don't pretend to have all the data or all the answers. But we can present what the science and research tells us to date about how sea ice is receding, where and why. There are geographic and atmospheric reasons for summer sea ice congregating in the Canadian Arctic Archipelago and off the northernmost coast of Greenland as Bruno Tremblay at Canada's McGill University will explain in his article about the physical picture of high latitude climate change.

While critically important, this cannot only be a conversation about climate modelling, statistics and data. The Last Ice Area is also an emotional discussion, and rightly so. For some people ice is life. It is where they hunt and fish, and how they travel. Arctic peoples will tell you there is a positive psychological impact to getting out on the ice. And a negative effect when they can't. Okalik Eegeesiak, president of the Qikiqtani Inuit Association writes that recent changes in the high Arctic are overwhelming for the average Inuk.

There is a vast and intricate web of life in the Last Ice Area – marine, terrestrial and bird species that use sea ice to migrate, mate, den, nest and give birth. Others use it as a place to socialize, eat or rest. They will either adapt to receding sea ice, become prey of or displaced by new species moving north as temperatures rise, or they will be squeezed into smaller habitats. An update on biodiversity in the far north informed by traditional ecological knowledge is also presented in this edition by the Conservation of Arctic Flora and Fauna, the biodiversity working group of the Arctic Council.

THIS CANNOT ONLY BE A CONVERSATION ABOUT CLIMATE MODELLING, STATISTICS AND DATA. THE LAST ICE AREA IS ALSO AN EMOTIONAL DISCUSSION ...

WWF's role, as always, is to bring diverse communities, interest groups, stakeholders and experts together to initiate discussion and facilitate strategizing. We recently did this at a Last Ice Area workshop in Iqaluit. That workshop and our report on the discussions that ensued mark a milestone in what will be a lengthy, broad, but never boring dialogue on this critically important Arctic region, regardless of what you choose to call it. ○

ALEXANDER SHESTAKOV is the director of the WWF Global Arctic Programme.

Industrial road through proposed Russian park re-routed

A ROAD that would have bisected a planned national park in Russia's Arctic has been re-routed following intervention by WWF-Russia.

North-West Phosphoric Company (NWPC) had planned to build a road through Khibiny, a national park scheduled to be created in 2015.

"Thanks to the reasonable position of the regional government, a compromise was found and the process didn't come into open conflict," says WWF-Russia CEO, Igor Chestin,

NWPC planned to build the industrial road to unite two ore deposits. The company has now agreed to build an underground mine and ore processing facility in an area of young pine forest of lesser ecological value outside of the planned park.

"We had a very strict position at the beginning of the process, but after consultations with scientists, WWF and Kola Biodiversity Centre, experts decided to change the project concept," says Vladimir Kunitsky, director general of North-West Phosphoric Company.

"From the environmental point of view it's the best alternative," says Victor Petrov, director of the Kola Biodiversity Centre.

High Arctic research station saved

CANADA'S northernmost research lab will continue operating after receiving a new grant from the Canadian government.

The Polar Environment Atmospheric Research Laboratory (PEARL) in Eureka, Nunavut, will receive $5 million over five years.

"That's going to enable us to keep the station running in a good campaign mode for the whole period," Jim Drummond, principal investigator for PEARL told the Canadian Broadcasting Corporation.

The Canadian government had earlier announced it would stop funding the research station, creating alarm within the international scientific community. PEARL is one of the northernmost research stations in the world and one of very few that contribute Arctic data to networks of research stations that collect similar data around the world.

The High Arctic research station, located at latitude of 80 degrees north, was among seven projects that will receive as much as $5 million each under the new Climate Change and Atmospheric Research (CCAR) program.

PEARL has been tracking ozone depletion, air quality and climate change in the High Arctic since 2005. It contributes data to several international environmental monitoring projects through an informal network of university researchers called the Canadian Network for Detection of Atmospheric Change

The Polar Environment Atmospheric Research Laboratory on Ellesmere Island.

Photo: CANDAC/Mariele Wolfe

Canada names new Chair of Senior Arctic Officials

Patrick Borbey

PATRICK BORBEY will become Chair of the Arctic Council's Senior Arctic Officials for the Canadian Chairmanship from 2013-2015.

"Mr. Borbey's extensive experience working with Northerners will be a great asset in his role as the Chair of the Senior Arctic Officials," said the Canadian Minister for the Arctic Council, Leona Aglukkaq.

Borbey is currently president of the Canadian Northern Economic Development Agency. Before that, he served in several senior government positions including Senior Assistant Deputy Minister of Treaties and Aboriginal Government, and Assistant Deputy Minister of Northern Affairs at Indian and Northern Affairs Canada.

From whales to wakes

WWF HAS launched a new online mapping tool to help people visualize the different activities and values at play in the Arctic. ArkGIS was launched to coincide with the Arctic Council Ministerial meeting in April. "Everywhere in the world, good maps are preconditions for sound management and informed public debate about natural values and human activities," says Nina Jensen, CEO of WWF Norway. The ArkGIS is a web based mapping system, allowing anyone to produce their own maps showing natural resources and updated overviews of activities like shipping or oil drilling. It allows any user to download premade maps and videos, as well as developing customized maps on their own, using an interactive map service www.arkgis.org

Oil industry backs away from arctic waters

REUTERS News Agency reports that energy companies are no longer finding the high Arctic as financially alluring.

Once the irresistible frontier for oil and gas exploration, the news agency says the Arctic is quickly losing its appeal as energy firms grow fearful of the financial and public relations risk of working in the pristine icy wilderness.

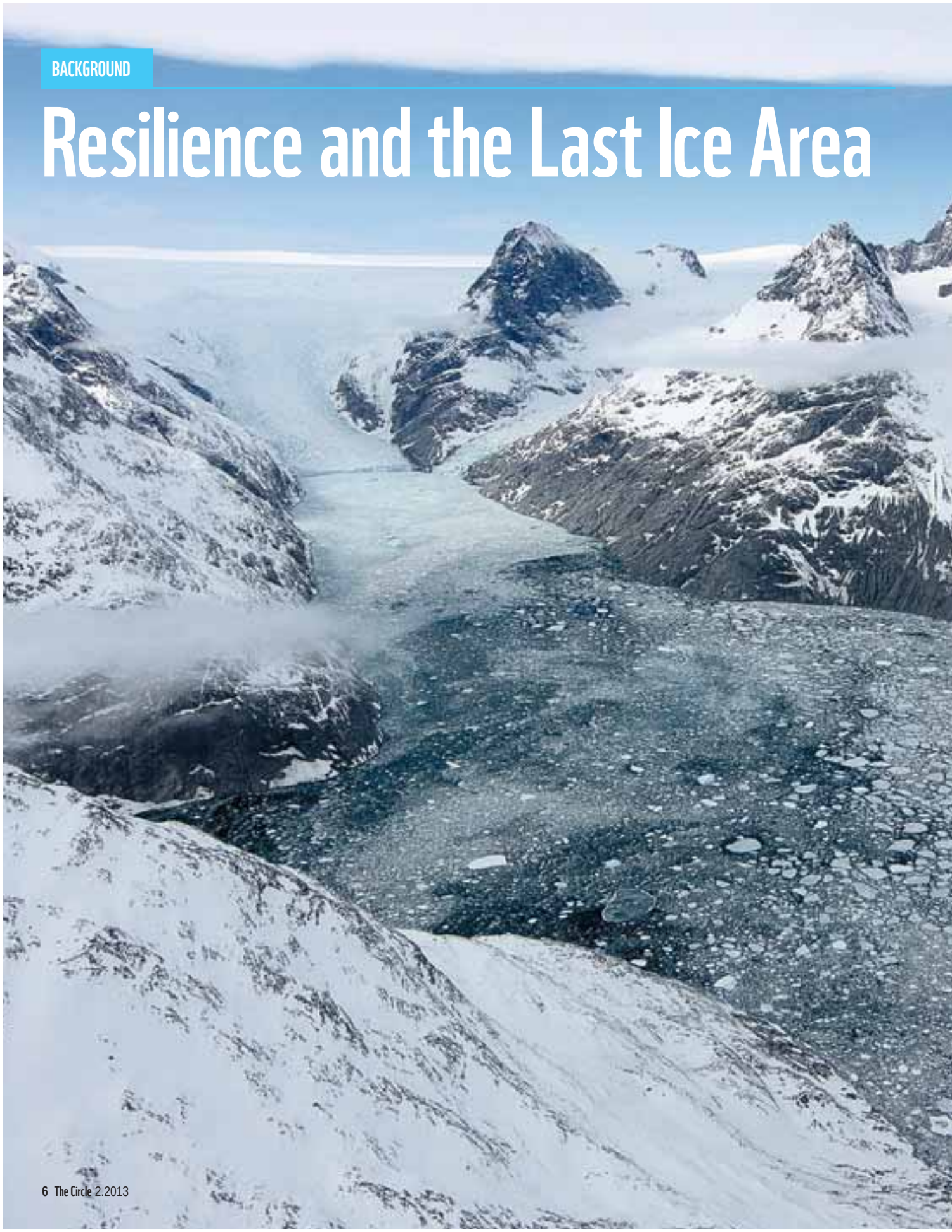
Reuters also reported that while the Arctic may hold 13 percent of the world's undiscovered oil and 30 percent of its gas, a series of blunders and failures there are making executives wary of such a sensitive area and are turning their attention back to more conventional resources and the shale revolution.

The turning point likely came last New Year's Eve, Reuters says, when Royal Dutch Shell's drillship ran aground in rough waters off Alaska, setting off a public relations storm that inflicted much pain on the firm, made more acute by how little it had to show for the $4.5 billion it has spent on the Arctic since 2005.

"The interest to develop oil and gas is very high, but nevertheless there is more and more concern about the environment and the risk part of it," said Harald Norvik, a board member at ConocoPhillips and a former CEO of Statoil, a pioneer in the Arctic.

"We have been focusing on areas in the Arctic. Now we put our priorities into other areas, like Tanzania, Argentina and Texas. That is the logical development," he said.

Resilience and the Last Ice Area



Clouds, ice and sea ice in a fjord in southern Greenland.
Photo: NASA/Maria-Jose Viñas

The Arctic is changing fast, and one of its fastest-changing components is its sea ice. Since satellite records began, sea ice has been shrinking at a rate of about 11 per cent a year. Last year set a new low in recorded history. That trend is predicted to continue.

By Clive Tesar

The effects of shrinking sea ice and the changes to come are particularly uncertain for Arctic ecosystems. Natural systems are very complex. Removing a major element of the system – summer sea ice – is likely to cause significant change. Some species are considered "ice obligate", meaning they need sea ice for hunting, mating, nesting or migrating. There is also "ice associated" life that may not absolutely need sea ice, but seems to make use of it.

This looming, largely climate-driven change and its impact on Arctic ecosystems convinced WWF to focus on the concept of resilience. If change continues, how can Arctic ecosystems best absorb that change? One of our first responses was a project called RACER (Rapid Assessment of Circumpolar Ecosystemic Resilience – see edition 01.12 of the Circle). RACER was designed in part to help identify resilient features across the Arctic landscape. Researchers modelling the future of Arctic sea ice have identified one such feature – a big chunk of summer sea ice in an area covering Canada's high arctic islands and northern Greenland that is projected to remain for decades after summer ice has mostly gone from the rest of the Arctic Ocean.

This led us to consider the area's potential importance to sustaining life associated with ice, and to the people who live around and on that ice. The people of northern Greenland and northern Canada talk about the importance of getting food from the sea, and not just to feed their families. Getting out on the ice provides cultural continuity. It's a way of expressing and affirming their identities as Inuit whose history and way of life is intimately connected to sea ice.

CLIVE TESAR is the Last Ice Area project lead for WWF's Global Arctic Programme and Head of Communications & External Relations.

Having established the likely importance of this Last Ice Area underscored the need for more research to better define the future of the ice, and ➤

Where is the Last Ice Area?

The Last Ice Area is defined by future summer sea ice, so it's not a fixed place like an island or a mountain or watershed. Most sea ice models agree there is a high probability that summer sea ice will remain in an area around Canada's high Arctic islands and northern Greenland. That likelihood is largely due to geography with lots of relatively small channels where ice can get stuck, and ocean currents that push ice away from Russia and swirl it around in the western part of the ocean above North America.

We have defined the study area as north of Lancaster Sound (including communities on the north of Baffin Island) and on the Greenland side, roughly north of the community of Qaanaaq. We also fund research outside this area since what is happening where the sea ice is disappearing will also help inform the importance of the Last Ice Area.

➤ the effects of this future on animals, people, and entire ecosystems. This would require more money than we had. Two years ago Coca-Cola joined us in a campaign called "Arctic Home". The company helped us raise money from individuals in Canada, the United States and several European countries, then made a direct contribution to help fund the project.

We engaged with local people to ask what they wanted to know about the Last Ice Area, the future of this area of resilient sea ice, and how they thought it should be managed. We have also been talking to governments to bring them into the discussion about the Last Ice Area since they have much of the required authority to make decisions on future management.

Photo: WilliamLarned

Winter flock of spectacled eiders.

As we approach the end of our first year of project funding, we have contributed to a variety of research, along with government and other partners. We have provided more detailed ice modelling, and have begun to match up how different species of animals might use that ice in the future. We have collected traditional Inuit knowledge about

Managing new interest in Canada's Last Ice Area

By Vicki Sahanatien

THE LAST ICE AREA of the Canadian high arctic is a vast region of islands and ocean channels called the Arctic Archipelago. On the east side are huge islands such as Ellesmere at 800 x 400 km with dramatic, towering mountains, fiords, ice caps and glaciers that spill into the sea. To the west, the archipelago islands are also relatively large but have topographies rolling with mesas, like the high plains and deserts of central North America. One of the defining characteristics of the entire archipelago is multi-year sea ice that survives the summer melt season, year after year. It has different physical characteristics than annual or seasonal sea ice – it is much thicker, harder as it contains less salt, and its surface is rough and hummocky. It is this sea ice that is being lost as climate warming continues. We are working to understand how this last reach of multi-year sea ice contributes to maintaining sea ice dependent species during the summer season.

I've travelled and worked throughout the western portion of the LIA – from Lancaster Sound to the northern tip of Ellesmere Island. It is an incredibly beautiful place and one of extremes, sometimes brimming with life and other times silent and devoid of all but lichens. My last trip to the LIA was in March 2013. I was in Grise Fiord, with a Department of Fisheries and Oceans biologist, meeting with the Iviq Hunter and Trapper Organization to discuss, obtain approval, and begin planning the Jones Sound narwhal movement study. March marks the return of long hours of daylight in the high arctic, a change from the 24 hours of darkness of winter. The sun energizes people and ecosystems. On the bottom of the sea ice a garden of algae was growing, powered by the sunlight penetrating through it. By March Inuit hunters were travelling out further on the sea ice, across Jones Sound to Devon Island for polar bears and to the floe edge for seals. While in Grise Fiord I learned that Jones Sound is now comprised of only annual sea ice and its thickness in March 2013 was between 1.3 and 1.4 metres.

There is much human interest and activity in the Canadian high arctic and the LIA region: mineral exploration, the Mars project on Devon Island, the many research scientists conducting studies on land and in the seas, tourists arriving in cruise ships, polar expeditions, and oil and gas seismic mapping. Many people come and go each year but only the people of the communities (Ausuittuq (Grise Fiord), Qausuittuq (Resolute Bay), Iqpiarjuk (Arctic Bay) and Mittimatalik (Pond Inlet)) remain year round, like their predecessors, the Thule, Dorset and Independence cultures. Inuit are concerned about how this burgeoning interest in the LIA will be managed and how wildlife will be protected from the impacts of new and future human activities. One of the primary tools for the future management of the LIA will be the Nunavut Land Use Plan, which is now under development by the Nunavut Planning Commission. The Nunavut Land Use Plan is being developed in consultation with communities, government and the public. One of my main efforts this coming year will be to develop the LIA submission and coordinate WWF's overall input into the land use planning process. ○

VICKI SAHANATIEN is the Senior Officer, Government & Community Relations, WWF Arctic Program

the area, and how people and animals have used sea ice in the past. We have also contributed to baseline studies of animal populations, including polar bears and narwhal. All of this will provide the information necessary to future management of those species, and the entire Last Ice Area.

As we continue to commission new research, this year will focus on polynyas, areas of ocean that stay open all year round, and which are important feeding areas for many of the species that use the Last Ice Area. We will also continue our discussions with governments and residents about potential management initiatives, as we gather more evidence about the importance of this unique area. ○

What's in a name?

■ The Last Ice Area conveys several concepts, and avoids others. It doesn't say "park" or "protected area" or even "refuge". If we're going to get northerners and governments talking about how best to manage the area, we can't start with a set idea of how it should be managed. We want to ensure people understand the uniqueness of the sea ice habitat. However, a number of people thought the name was gloomy. A colleague in Europe has suggested "Lasting Ice Area" might have been a better choice, and I have to agree. Lasting Ice Area better conveys the sense of hope and optimism of this project. It says while much of the Arctic is rapidly changing, there is one piece that is changing less. But we've been calling it the Last Ice Area for a couple of years, and I think changing the name now would just lead to confusion. If you find the name gloomy, please pencil "ing" onto the "last".

Greenland: Living the Last Ice Area

By Mette Frost

MADS-OLE KRISTIANSEN is one of 40 hunters in Qaanaaq, Greenland who live off the ice and the living resources harvested there. He made a lasting impression at the recent Last Ice Area workshop in Iqaluit, Nunavut, when he explained how climate change and loss of sea ice affects his everyday life. The ice forms later now, he says, making it impossible to travel safely with dogs and sledge in the spring and fall. For a community depending on the sea ice for hunting, fishing and travel between communities, climate change is dramatically influencing the livelihoods of people here.

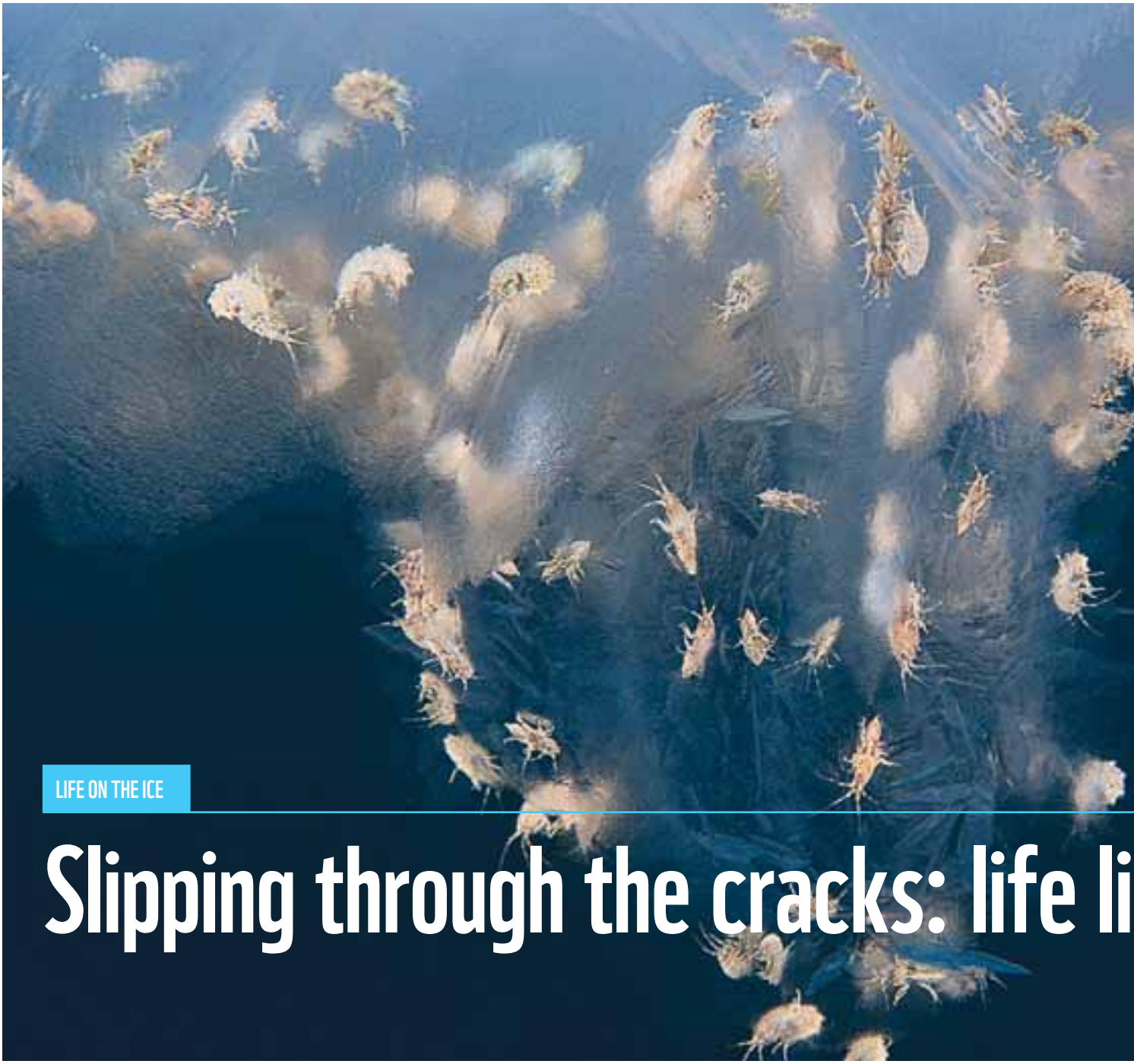
Many strong words and visions were exchanged between workshop participants from Nunavut, Canada and Greenland. Adaptation to climate change can be abstract and theoretical when studied from a distance. For the communities who depend on the sea and the sea ice, adaptation to change is very hands-on. Karl-Kristian Kruse, a hunter from the small community of Niaqornat and member of Inatsisartut/Greenland Parliament was succinct in his question directed at everyone in attendance: "how are we to adapt to these changes?"

There is much concern over the potential consequences of new industry on nature and the northern environment. Clearly we need more research and study into the effects of seismic activities on Arctic wildlife.

What do we mean when we talk about sustainable development for future generations? Naaja Nathanielsen, member of Inatsisartut/Greenland Parliament, says we need to make sure we are talking the same talk in what it means to create a sustainable future. "When WWF says it is committed to living in harmony with nature, I think most Inuit can relate to that idea and that aim," she said. "But there might be a difference in the way we understand 'living in harmony with nature'. Does that mean 'conserving' nature or does it mean 'adapting' to nature? And this will greatly affect our approach to managing the ice changes. It is my hope that both sides will be willing to listen to the other even though we might end up realizing that we will never agree completely."

Former speaker of the Greenland Parliament and minister Josef Tuusi Motzfeldt also weighed in on the importance of collaboration. "We may be a small society. But we are not too small to care about the environment to secure the biodiversity," he said. "And we are not too small to make an effort. These efforts as well as active work in international organizations are essential in order to maintain and strengthen the position of the Arctic in the world." ○

METTE FROST is the WWF Denmark Last Ice Area project leader.



LIFE ON THE ICE

Slipping through the cracks: life li

It is one of the defining features of the globe. From the dark waters of the Arctic Ocean, a vast white dome of ice emerges and caps the planet. It is a global regulator, a lifeline for local communities and an irreplaceable habitat for some of the most iconic and culturally significant species in the North.

Recent changes in Arctic sea ice cover – driven by rising air temperatures – have affected the timing of ice break-up in spring and freeze-up in autumn, as well as the extent and type of ice in different areas. JOAN EAMER and COURTNEY PRICE explain what that means to life on the ice.

Ice Amphipods attached to ice crystals in Arctic coastal fast ice.
Photo:Shawn Harper

nked to ice

OVERALL, MULTI-YEAR ICE is rapidly being replaced by first-year ice. The extent of ice is shrinking in all seasons, but especially in the summer. Predictions indicate the Arctic Ocean will be virtually ice-free in summer within 30 years, with multi-year ice persisting mainly between islands of the Canadian Arctic Archipelago and in the narrow straits between Canada and Greenland.

These changes affect the structure of the ice platform, the timing of biological events such as plankton blooms and bird nesting, the amount of primary production and the availability of open water at different times of the year. Such changes are expected to continue and probably accelerate during the 21st century, affecting the functioning of Arctic marine ecosystems.

Changes in ocean conditions also mean sub-Arctic species of algae, invertebrates, fish, mammals and birds are expanding northwards, while some Arctic-adapted species are losing habitat along the southern edges of their ranges. Of particular concern are ice-algae communities, copepods and amphipods, species that are vital to the healthy functioning of the Arctic marine food web. Relationships among species are changing too, with new predation pressures and shifts in diets recorded for some animals.

For human settlements adjacent to Arctic seas, negative impacts on health, culture and economies are expected to result from the impairment of harvesting ice-associated species. On the other hand, increases in marine productivity and range extensions by southern organisms, especially commercial fish species, should present new economic opportunities. However, new and expanded activities related to resource extraction, shipping, fisheries, and cruise-ship tourism carry substantive risks to Arctic marine flora and fauna. The speed and the way in which change will happen are both uncertain.

How Arctic species will adjust to these changes is also uncertain. Changes are too rapid for evolutionary adaptation, so species with the natural ability to adjust their physiology or behavior, such as some seabirds and the beluga whale, may fare better. Species with limited distributions (for example, the ivory gull), specialized feeding or breeding requirements (for example, the narwhal), and/or high reliance on sea ice for part of their life cycle (including polar bears and several seal species) are particularly vulnerable.

Given the dramatic changes seen in the Arctic, and the urgency to develop an adequate response, Conservation of Arctic Flora and Fauna (CAFF), the biodiversity working group of the Arctic Council, has published the Arctic Biodiversity Assessment. This report contains the best available science informed by traditional ecological knowledge on the status and trends of Arctic biodiversity, and developed recommendations for policy. The report is available in English, Russian and Inuktitut. CAFF is immediately following up on this landmark scientific report with the publication of a more in depth report on sea ice-associated biodiversity, the Life Linked to Ice report. This document, to be released in autumn 2013, will act as a reference for policy makers and present four recommendations for an informed and flexible policy response for Arctic ecosystem conservation and management. CAFF continues to work with the eight Arctic states, six permanent participant organizations, observers to the Arctic Council and many international partners to address the conservation of Arctic biodiversity. These findings will be communicated to the governments and residents of the Arctic, to promote practices that ensure the sustainability of the Arctic's living resources. ○

COURTNEY PRICE is the Communications Officer at the Conservation of Arctic Flora and Fauna (CAFF), the biodiversity working group of the Arctic Council.

JOAN EAMER is a science writer and biodiversity specialist in pollution prevention, environmental monitoring and assessment, co-management, and biodiversity conservation.

Photo: Michael Cameron, NOAA.

Ringed seal

By Shawn Dahle

RINGED SEALS are the smallest and most widely distributed of the six ice-associated seal species in the Arctic. These seals require ice habitat to perform their annual cycles of reproduction and molting, and rarely haul out on shore. Ringed seals are uniquely adapted to inhabiting areas of solid ice by maintaining breathing holes with strong claws on their foreflippers. They often excavate small caves, or lairs, in snowdrifts over their breathing holes in which they whelp and nurse their pups .

Ice loss is expected to be greatest in the summer and autumn months when ringed seals' use of ice – primarily for resting between foraging trips – is at a minimum. The greatest impact to this species from reduced ice cover will be diminished snow accumulation on ice. Winter precipitation is forecasted to increase in a warming Arctic; however, as the ice forms progressively later in autumn, much of the snow will fall into open water resulting in reduced accumulation by spring. Ringed seals require snowdrift depths of at least 50-65 cm for their birth lairs. Such depths typically occur where 20-30 cm or more of snow falls and is drifted along pressure ridges or ice hummocks. By the end of this century, snow cover is projected to be insufficient for the formation and occupation of birth lairs throughout most of the ringed seal's range. Without the protection of lairs, ringed seals – especially newborns – will be vulnerable to freezing and predators. Due to the link between ice cover and snow accumulation, the "last ice area" north of Greenland and the Canadian Archipelago is where snow cover suitable for ringed seals will likely persist the longest. ○

SHAWN DAHLE is a biologist at the NOAA Alaska Fisheries Science Center's National Marine Mammal Laboratory in Seattle, Washington. His research focuses on monitoring and assessing the status of seal populations in Alaska.

Protecting high

By Tony Gaston

ONE OF THE MOST OBVIOUS and well documented features of climate warming has been the northward movement of many animals and plants. Moose, grizzly bears, hummingbirds and robins have all been reported hundreds of kilometres north of their normal range in recent years, often to the surprise of northern residents who are unfamiliar with them. This is a natural reaction to climate change: various species are pushing into areas that were previously unsuitable for them and in some cases providing a welcome change of diet for locals. Less obvious, but critical from the conservation viewpoint is the impact these immigrants will likely have on the ecosystems they invade, where they compete with high Arctic residents for limited resources. Ultimately, competition from southern invaders will likely be as big a threat to Arctic animals as changes in the weather.

Canada's high Arctic islands support a very diverse mammal fauna including Arctic hare, muskox, Peary caribou, ermine, wolverine, wolf and two genera of lemmings. The dispersal of these animals among the islands has been aided – most of the year – by the presence of sea ice.

With the increasing length of the open water season, crossing between islands will become harder, especially during the important spring and fall dispersal seasons. Under most conditions, this reduction in connectivity might be seen as a problem for conservation, isolating local populations and leaving them more vulnerable to extinction through inbreeding and random climatic events. No doubt

Arctic terrestrial fauna

Photo: Paul Nicklen/National Geographic Stock / WWF-Canada

Young Peary caribou (Rangifer tarandus pearyi), Canada.

that will affect the smaller islands. However, in the case of Canada's high Arctic islands, increasing isolation could reduce the probability that southern mammals, such as voles, snowshoe hare and barren ground caribou will cross the Northwest Passage and penetrate to Bathurst Devon, Ellesmere and other islands which currently support a typically high Arctic assemblage of species. There is the potential for Canada's high Arctic islands to become a refuge for species likely to be eliminated elsewhere.

We can be proactive in this process by initiating policies to reduce the likelihood of southern mammals being introduced north of Parry Channel, using approaches currently in place for Antarctica and for many isolated islands such as the Galapagos. In the longer term, the Canadian high Arctic islands could become the primary refuge for Arctic mammals. This could be abetted by proximity to the Last Ice region, which will continue to confer a cool climate on most of the archipelago after many regions farther south have morphed towards sub-Arctic ecosystems. There is generally little that can be done on the ground to protect Arctic biodiversity against global warming, but creating a refuge for high Arctic mammals in Canada's north might just be one useful step. ○

TONY GASTON is a Research Scientist with Environment Canada, specializing in the ecology of Arctic vertebrates.

Sea ice as habitat for Arctic marine birds

Mark Mallory

SEA ICE FORMS a critical component of the habitat Arctic seabirds rely on annually for feeding and survival. Although they don't nest on ice – with the exception of some Ivory Gulls which nest on ice islands – they do rely on ice edges, ice leads, and polynyas or open stretches of water surrounded by ice as key foraging locations. This is especially true early in the season when they provide the only open water near breeding colonies.

These areas support higher productivity of marine foods and concentrate food around ice edges. As well, these openings in the ice allow birds (especially the guillemots) to dive and exploit the zooplankton and Arctic cod communities living on the underside of the ice. Seabirds also rely on the sea ice as a platform for pair-bonding and other social activities, to escape from marine predators, and for resting.

We are already seeing the effects of the loss of sea ice on seabirds in some regions. For example, thick-billed murres (Brunnich's guillemots) are foraging less on ice-associated Arctic cod and more on capelin, a species typical of subarctic waters that provides less energy per unit body mass. Ice is clearing out near some colonies almost three weeks earlier in the year, creating an earlier peak in food supplies, and murres cannot advance their date of hatching to keep pace. The consequence is that rates of chick growth are reduced, as is adult body mass (an index of physical condition). The effect of this will likely be reduced survival and ultimately declines in local populations. There may also be increased incursions of potential competitors, such as Razorbills into their breeding range.

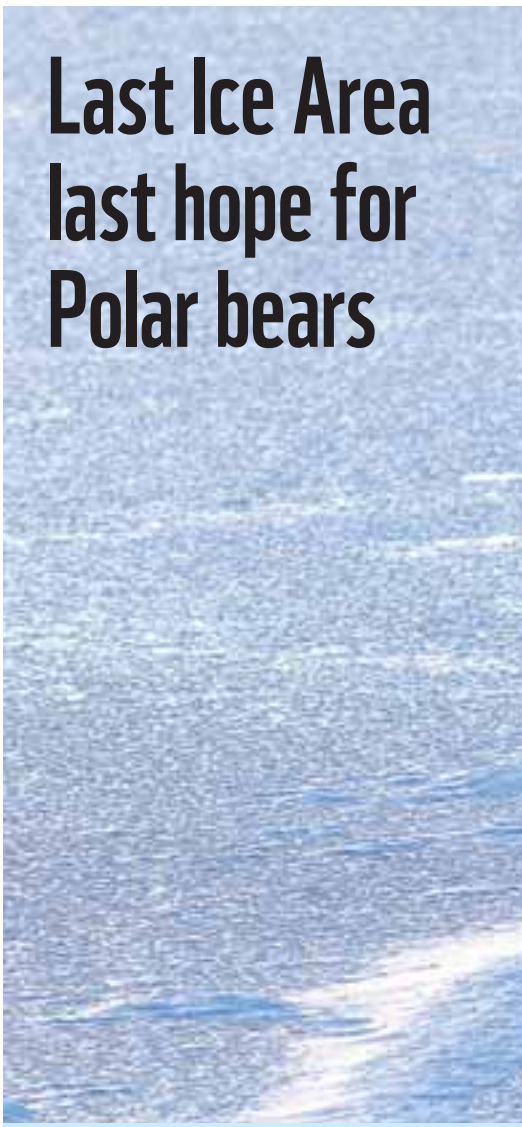
Photo: Mark Mallory

Thick-billed murre

Arctic seabirds are adapted to tolerate and exploit the opportunities provided by sea ice habitat. Consequently, if we lose that sea ice, we should expect populations of Arctic seabirds to be reduced, and perhaps replaced by more subarctic species. ○

DR. MARK MALLORY is a Canada Research Chair at Acadia University, Nova Scotia. He leads teams of researchers and students that assess the effects of anthropogenic activities on marine bird populations in Arctic Canada.

Last Ice Area last hope for Polar bears



Andrew Derocher

POLAR BEARS rely on the presence and characteristics of sea ice as the surface from which they hunt, travel, migrate, mate, and sometimes den. Polar bears and their primary prey – ringed seals and bearded seals – only exist where there is sufficient sea ice. The life history of polar bears is made possible by their diet dominated by energy-rich seal blubber. While polar bears are often found on

Photo: Andrew Derocher

land when their primary habitat melts in summer, the nutritional input from terrestrial areas is paltry. The bears rely on fat stored during the previous spring to survive the ice-free period. If the ice-free period is too long, the bears go locally extinct. We know this from an "experiment" some 10,000 years ago in the Baltic Sea at the end of the last ice age. Some sea ice forms there each winter, and ringed seals persist but the bears didn't make it. Today only fossilized polar bears remain. They didn't become more terrestrial like their grizzly bear ancestors and eat goose eggs or berries. Polar bears couldn't survive without enough sea ice. The chain of change for polar bears begins with loss of sea ice that reduces access to seals, may increase distances travelled to find food and lengthen the fasting period. The net result is less stored fat that results in both lowered reproduction and survival. Ultimately populations decline. The best analysis to date predicts a two-thirds reduction in global polar bear abundance by mid-century. For the other third, their best hope is the Last Ice Area. It is unclear how many bears may survive in the Last Ice Area but the bears may find enough ice and enough seals to survive. While little is known about the bears in this area, the first insights are coming to light as we explore the ice patterns in the area relative to the ecology of the bears. ○

ANDREW DEROCHER is a professor of biological sciences at the University of Alberta, Canada. His current research focuses on understanding the effects of climate change on polar bears.

The Last Ice Area – the physical

The Arctic has recently witnessed four record low, minimum sea ice extents at the end of the summer in the last decade. As BRUNO TREMBLAY tells us, the minimum sea ice extent has declined by approximately 40 per cent between 2003 and 2012, an area more than twice the surface area of Quebec, Canada's largest province.

THE SEA ICE VOLUME in the Arctic Ocean has also declined. Thick multi-year ice that is 5 years or older covered nearly 25 per cent of the September surface area in the early eighties. It has almost disappeared with a combination of model and observational data showing a loss of September sea ice of approximately 75 per cent.

A summer ice-free Arctic is expected to occur within a few decades in the northern part of the Canadian Arctic Archipelago. The region immediately to its north is expected to maintain a summer sea ice cover until well into the 21st century. Arctic sea ice cover does not have the same thickness everywhere. Along the Eurasian coastline, sea ice is moving offshore under the effect of dominant winds, keeping the ice in this region relatively thin at about 1 meter. Along the northern coast of the Canadian Arctic Archipelago and Greenland, sea ice originating from the Eurasian coastline is pushed against the continent by the same dominant winds and can circulate within the Arctic Ocean proper for several years – sometimes decades – as part of the Beaufort Gyre. The Gyre is a wind-driven ocean current located in the polar region of the Arctic Ocean and contains both ice and water. Here sea ice can grow to thicknesses of several meters or even tens of meters.

The dominant wind patterns responsible for this sea ice circulation are not expected to change in a warmer world. Therefore, global climate models indicate sea ice will persist in the region north of the Canadian Arctic Archi-

BRUNO TREMBLAY is a Professor in McGill University's Dept. of Atmospheric and Oceanic Sciences. His research focuses on high latitude climate change and the future of sea ice cover in a warming world. This article is based on his work with David Huard.

picture

A nascent iceberg breaks off Pine Island Glacier's calving front. Icebergs in this area of the Amundsen Sea most often rise between 150 and 200 feet above the water surface.

Photo: NASA/Maria-José Viñas

Ice extent and ocean circulation

Adapted from Polyak et al., 2010

pelago where the ice is thicker. Most of the Pacific sector of the Arctic has been ice-free at the end of the summer since 2007 – cutting the recirculation of thick multi-year ice north of the CAA within the Beaufort Gyre providing a new efficient mechanism for multi-year loss.

But global climate models tend to be conservative and underestimate the recent trend in sea ice decline. In the real world, thick sea ice north of the Canadian coastline transits through the archipelago and melts at lower latitude during the summer. Results from a higher resolution regional ice-ocean model show a more dynamic sea ice drift pattern, resulting in a complete disappearance of sea ice within the Last Ice Area and rapid decline even in the winter maximum extent by the end of the 21st century.

The length of the ice-free season however is short – from approximately August to October. Just a few months after the sea ice minimum, the sea ice returns rapidly but remains thinner than in the late 20th century climate. This leads to a seasonal cycle in ice extent with relatively smaller loss in the fall, winter and spring and a larger loss in the summer.

The models do show that the ice cover can come back, if greenhouse gas emissions are reduced and their levels in the atmosphere decline. For instance, if early and forceful actions on reducing carbon dioxide emission are put in place – stabilizing carbon dioxide levels somewhere close to those found in the 1980's (350 ppm) – the summer sea ice extent stabilizes at approximately 4.5 million square kilometers (the level of sea ice extent in 2007). ○

Up for grabs? Inuit and climate change

Rich resources are said to be lying beneath the ice-covered land and sea of the Arctic. With climate change and ice retreating at a record pace, those resources may be that much more within reach especially if an ice-free Northwest Passage becomes a new year-round shipping route. But whose reach? Inuit leader OKALIK EEGEESIAK says the world has been eyeing the Arctic's frozen treasure chest for some time now. She says these resources are not up for grabs for just anyone to take as they please.

OKALIK EEGEESIAK is President of Qikiqtani Inuit Association

THE UNCERTAIN consequences of climate change still need to be weighed and measured. For now, it is my job to say the Inuit deserve a strong presence and a loud voice at the decision table about what happens in the Arctic today and into the future. Inuit are not against development but we have to be involved in any decisions about developing the Arctic and our future in a changing climate.

FOR THE AVERAGE INUK, CLIMATE CHANGE IS AN OVERWHELMING CONCEPT.

Photo: QIA/Communications.

A fuel supply ship anchors off the coast of Igloolik.

Inuit have been in the Arctic since before planes, trains and automobiles. Our ancestors' resilience and ingenuity ensured our survival. But in the last 100-150 years, we have undergone a revolution, enduring vast social, economic and political change. Climate change is an added stress and is very much seen and felt in our daily life, especially by hunters. These hunters feed our families, teach our young the essence of sharing and strengthen our ancient tradition of a hunter-gatherer society in the modern world.

Long before scientists and environmentalists began talking about climate change, Inuit of the circumpolar regions were seeing and experiencing changes to their environment – thinning ice, shifting seasons, unpredictable weather patterns, new species of animals and significantly warmer temperatures.

For the average Inuk, climate change is an overwhelming concept. The subject is so complex and the solutions seem to be so out of reach. Climate change is mainly caused by the richest nations on earth with billions of people living in them. The Inuit of the world are a small population. We do not have the numbers to effectively influence the national policies of the countries we live in. Sometimes we feel like mosquitoes trying to get the attention of elephants.

We are concerned. We want to understand the consequences of climate

change and be part of the efforts to mitigate it. But we also have to deal with the realities of daily life in the Canadian Arctic. How can I feed my family this week? Will my children be able to keep a roof over their heads? How can we keep up with the cost of living that keeps growing by leaps and bounds?

Inuit have survived in the Arctic through millennia by adapting our lives to the environment and the wildlife on which we depend. We must, once again, adapt to the changing landscape, new weather patterns, new species, changing seasons, and conflicting or non-effective policies. This includes mitigating the efforts of animal rights movements, which play upon emotion rather than facts. Imagine the messaging if one of these movements used an Inuk or Inuit as its poster child instead of the cute seal pup and the majestic polar bear. If Inuit had a fraction of the budget of some of these animal rights organizations, we would be in a better position to work with our partners to advance our rights and interests.

Decades ago, Aboriginal leaders in Canada started telling southern governments and societies their way of life was not sustainable. We told them they were going to destroy the environment if they did not change the way things were done. We told you and you didn't listen. The consequences of climate change and how we learn to adapt can best be understood through a combination of Inuit traditional knowledge and modern science. So start listening. ○

SOMETIMES WE FEEL LIKE MOSQUITOES TRYING TO GET THE ATTENTION OF ELEPHANTS.

Managing offshore oil and gas resources in Canada's north

It is estimated that one third of Canada's remaining conventional natural gas and light crude oil reserves are in the North.

GENEVIÈVE CARR says under its Northern Strategy, the Government of Canada is working to improve regulatory systems and invest in infrastructure to attract industry to the North. It also wants to ensure development happens sustainably with Northerners directly benefitting from economic growth.

THE MANAGEMENT of oil and gas resources in the northern offshore is a federal responsibility carried out by Aboriginal Affairs and Northern Development Canada (AANDC), in collaboration with territorial and Aboriginal governments. AANDC manages matters related to land, royalty and benefits, whereas the National Energy Board takes the lead regulatory role in approving operations.

AANDC engages early and often with local communities, regional Aboriginal organizations, territorial and federal government departments, regulators and international organizations to support responsible development of oil and gas resources in the North. This contributes to ensuring preparedness among stakeholders for offshore oil and gas activities. It also facilitates participation in resource development and access to potential benefits, while creating efficiencies for industry and regulators.

AANDC's activities to prepare for oil and gas exploration and development correspond to the level of activity in any given region. For example, AANDC has been offering oil and gas rights in the Beaufort Sea for more than two decades. Private sector and government research programs, along with decades of oil and gas exploration in the region, have resulted in a well-developed understanding of the regional ecosystem, geology and physical operating environment of the Beaufort Sea. Full engagement with Inuvialuit in regional planning and decision-making has also tapped into traditional knowledge held by local hunters and trappers, and broadened our understanding of the region.

GENEVIÈVE CARR works with the Northern Petroleum Resources Directorate of Aboriginal Affairs and Northern Development Canada.

Photo: NASA / Michael Studinger

Ice covered fjord on Baffin Island with Davis Strait in the background. There is growing oil industry interest in the area

Federal research programs such as the Environmental Studies Research Funds and the Program of Energy Research and Development continue to generate new knowledge in exploration areas.

In response to renewed exploration interest and investment in the Beaufort Region, the Beaufort Regional Environmental Assessment was launched in 2011. This is a four-year partnership among Inuvialuit, industry, governments, regulators and academia to strengthen the environmental and socio-cultural knowledge base for oil and gas activity in the Beaufort Sea. For example, research is underway to better understand, quantify and predict sea ice dynamics, thickness and strength of deformed multi-year ice, and extreme ice features. Research findings will contribute to the improved design of offshore structures and better ice management practices to ultimately prevent oil spills.

There has been no rights issuance in Canada's Eastern Arctic offshore region of Baffin Bay/Davis Strait since the 1970s.However, exploration in neighbouring Greenlandic waters to the East and the Labrador Sea to the South, as well as an application to the National Energy Board to conduct a two-dimensional, seismic survey in Baffin Bay, indicate growing interest in the area. Oil and gas companies must first be granted exclusive exploration rights from AANDC in order to be able to secure a significant discovery licence following exploration drilling. However, these rights do not guarantee an operator's ability to drill; the operator must still seek approval for its proposed operations from the National Energy Board.

Initial planning is underway for a strategic environmental assessment (SEA) in Canada's Eastern Arctic offshore to inform government decisions around issuing oil and gas rights in the region. This assessment will also involve full stakeholder engagement to address the challenges and opportunities of oil and gas exploration. Lessons learned from resource development in other parts of Canada and abroad will be incorporated into this strategic environmental assessment. Scientific and traditional Inuit knowledge will also be used to examine risks of potential oil and gas activity to the region's natural and social environment. Ultimately, this will ensure exploration rights, if they are issued, are issued responsibly and with the best available information.

Exploration timelines for offshore oil and gas are long. It is not unreasonable to expect up to twenty years between when AANDC first issues exploration rights to possible development of a significant discovery. That time will be used to continue identifying and filling knowledge gaps to further contribute to overall readiness for resource development. ○

MICRO STUDY:

Human activit

The Last Ice Area is not the only place WWF is looking for evidence of resilience to climate change. As part of an Arctic-wide focus on resilience we have also looked at other sites, large and small, such as Vaigach Island off Russia's Arctic Coast. Analyzing the effects of climate change on one distinct piece of the Arctic is a unique challenge. ALEXEY KOKORIN reports it can also net surprising results, as discovered by research supported by the Russian Ministry of Education and Science, (project 14.U02.21.0677) and WWF Russia.

SINCE 1976, temperatures in European Russia have increased by 2°C, significantly higher than the global average increase of 0.6°C and central Russia's average increase of 1.5°C. The Voeikov Main Geophysical Observatory also estimates that the next 30-50 years will see temperatures in Russia rising nearly two times more than those in the rest of the

ALEXEY KOKORIN is a director with the Climate and Energy programme of WWF Russia and Nobel Prize winner for his research and report for the Intergovernmental Panel on Climate Change.

y greater threat than climate change

Vaigach Island.

world. Increases in the Russian Arctic could be 4-6°C higher.

To examine how climate change will affect the Arctic, researchers chose Vaigach Island off Russia's northern coast between the Kara and Barents Seas. This small island is just 105 kilometers long and 44 kilometers wide. The sole settlement, Varnek, is home to only 106 people, mostly Nenets, an Indigenous population of the Arctic tundra. A large part of the island is a nature reserve.

Since 2010, this project has explored the flora, fauna, impacts from people and cultural artifacts, as well as polar bear and Atlantic walrus populations on Vaigach. Remote probing data, cartographic materials, and scientific literature have also been analyzed.

The results indicate ecosystems substantially resistant to climate change.

Much of the island is hard limestone, so thermokarst (marsh caused by thawing permafrost) thermal erosion and solifluction (the gradual slide of wet soil down slopes) are only slowly wearing away the coastline. In the next 30 years the sea level will not rise higher than 0.5 meters, which is not critical for a rocky island with cliffy coastline. Permafrost melting will increase swampy areas and reduce lichen, spurring the growth of other types of vegetation.

Windstorms (40 m/sec or more) are a much more serious threat to ecosystems and are expected to nearly double in frequency in the next 30 years along with other dangerous climatic events. In March 2013, for example, more than 500 domestic reindeer starved to death on a nearby island because they couldn't break through ice to forage. A thick layer of snow crust usually indicates climate instability when a thaw period is followed by a frost. The consequences are even worse if precipitation accompanies thaw and frost. Herd death on this scale has not been seen since 1972 but a warmer, damper climate with more frequent temperature changes could result in increased animal mortality through-

HUMAN ACTIVITY ON VAIGACH ISLAND POSES A GREATER THREAT

out the Barents Sea region.

Polar bears were found to be quite resistant to the impacts of climate change on Vaigach because they don't den here and only pass through during migration. Reduced ice coverage of the Barents Sea and a longer ice-free season is much worse for polar bears, forcing them to swim greater distances, pushing them to exhaustion. Walruses use shingle beaches and littoral zones for rookeries and have naturally adapted to changing rookeries from one storm to another. Wild reindeer are rarely seen and only in the north of Vaigach Island, when they migrate from nearby Novaya Zemlya Island. Potential reduction of deeryard (lichen) caused by increasing swamp formation is not significant enough to endanger the reindeer population.

Vaigach Island is also home to more than one hundred bird species. Storms destroy bird nests on sea cliffs and can cause total nestling loss, but the natural sustainability of bird populations ensures their recovery in the absence of other threats.

Historically, the Nenets did not settle on Vaigach Island, but used it as a sanctuary for traditional sacramental rites. Settlement only occurred in the 1920s with the accompanying human activities that threaten ecosystems: hunting and fishing; domestic reindeer grazing; landfills; human disturbance and proposed oil production in the Pechora Sea.

The domestic reindeer herd on Vaigach is over 1,500 animals. Potential increase in swamp formation will reduce lichen, the basic winter forage so reindeer will have to graze on a larger territory, including the nature reserve. Restricting herd sizes would help prevent damage to the ecosystems in the protected area.

While the locals primarily harvest fish, marine mammals are also target species. Ringed seal are hunted to feed working dogs. Apart from hunting, the disturbance factor is dangerous for walruses because they panic and stampede for water when people approach. Given their number and overcrowding, the death of some animals is inevitable. Fortunately, the main rookeries are in the north-west of the island, where hunters and tourists are rare.

The demand for polar bear pelts is quite high and poaching – while risky – is very profitable. On Vaigach, potential poachers include locals, sailors on passing boats or tourist-hunters. In the absence of controls to detect and prevent pelt exports from the island, WWF and the Marine Mammals Council established bear patrols with local residents to protect and monitor the animals. More effective would be upgrading the Nature Reserve to a National Park to provide better protection and allow more research into rare species and ecosystems.

The residents of Vaigach are also vulnerable to climate change. If buildings are not damaged by storms wearing away sea coast, thawing permafrost, or thermokarst, gale force winds could destroy the settlement.

Climate change provides good prospects for oil and gas development in the Arctic. An ice-proof, stationary platform has already been established in the Barents Sea but a spill would see 8-10,000 tons of oil flow into the sea. Oil spill modeling shows Vaigach Island would be right in its path and all its coastal ecosystems seriously endangered.

These climate change impacts observed on Vaigach Island obviously contribute both favourably and unfavourably to the evolution of the local ecosystems. While natural sustainability of the populations is currently sufficient to preserve all objects of flora and fauna, human activity on Vaigach Island poses a greater threat to both animal and plant species and ecosystems in general, than the climate change observed or projected for the next 30 years. ○

WWF PERSPECTIVE

Building trust, moving forward

By Riannon John and Rune Langhoff

THEO IKUMMAQ says he and other residents of Igloolik – a small island off the coast of Baffin Island – have travelled the same routes over sea ice for decades to hunt, fish, and visit other communities. But in recent years that ice has become unstable, unsafe and unpredictable.

He told participants at the Last Ice Area workshop in June how the tightly-knit community has recently lost two lives as well as many snowmobiles to polynyas – areas of open water surrounded by sea ice – "because they didn't know they were there." It was a poignant testimonial to how the Arctic is changing and how those changes are affecting the way Inuit communities use sea ice, something that is core to their traditional way of life.

Others attending the workshop related similar changes and raised important questions. What happens as the Arctic sea ice melts? How do we take care of the resilient areas where this sea ice will last the longest?

Ikummaq was among those who gathered in Iqaluit to address those questions along with representatives from

Theo Ikummaq speaking at the Last Ice Area Workshop, Iqaluit, June 2013
Photo WWF/ Riannon John

Inuit associations, northern communities, government and non-governmental organizations, and Arctic scientists. The WWF-hosted workshop, building on meetings in Nuuk, Greenland in January 2012, was designed to share research and local perspectives to begin discussions on managing this critical region of resilient sea ice, the Last Ice Area.

Canadian and Greenlandic government representatives gave presentations on oil and gas exploration and mining development in and near the Last Ice Area, and how their governments intend to manage those ventures. Opportunities and risks were vigorously discussed with many workshop participants living in communities that could be directly affected by these projects asking for a more in-depth exploration of the subject. Other experts spoke to how specific countries are addressing change in the Arctic, raising questions about how governments and communities can better communicate and coordinate.

Caleb Sangoya of Pond Inlet, Nunavut, found discussions on shipping particularly relevant.

"It seems to me, before I came up here, that our future was foggy," he said. "We didn't know what was going to happen in shipping. Now I know there are more ships coming up in the future, which will have significant effect on our sea mammals and lifestyles. Now, we can talk about it and how we can keep our traditions and lifestyles. Now we can negotiate with those different companies."

"We need to build trust," said Pat Netser, Director of Regional Affairs for Health Canada. "We Inuit have lived here for thousands of years. We have a really strong connection to nature and changing weather patterns. We always have it in the back of our minds how things have changed, and we have to adapt to that." He liked how the workshop brought together delegates from Nunavut and Greenland. "We in Nunavut are very closely linked to Greenland. They're sharing some of the challenges we see with the ice melting. It's good to have a different perspective."

That resonated with Ane Hansen, a member of Greenland's committee on fisheries. "I'm very pleased this workshop showed that there is a common understanding between hunters and scientists," she said. "I'm happy that WWF spends some of its resources on bridging the gaps that exist and uniting different players of the Arctic."

Theo Ikummaq agrees the meetings were helpful, but he wants more Inuit involvement. "The climate is changing, but to what extent we don't really know. We're the ones having to live through it. We need to make suggestions about what research could happen, help design the research, and participate in it."

Data from the Iqaluit workshop will be used to determine those next steps.

"Our goal for the meeting was to begin the conversation about management options for the Last Ice Area," says project lead Clive Tesar. "Now we need to outline the possibilities and explore their advantages and disadvantages. It is critical that we work closely with stakeholders. We'll also connect with workshop participants and those who couldn't join us to get their input as we move forward." ○

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THE PICTURE

The first arctic oil tanker

Photo: United States Federal Government or Humble Oil & Refining Co/Wikimedia Commons

THE SS MANHATTAN was an oil tanker constructed at the Fore River Shipyard in Quincy, Massachusetts that became the first commercial ship to cross the Northwest Passage in 1969. Having been built as an ordinary tanker in 1962, she was refitted for this voyage with an icebreaker bow in 1968-69. Registered in the United States at the time, she was the largest U.S. merchant vessel as well as the biggest icebreaker in history. The Manhattan remained in service till 1987. After an accident in East Asia she was scrapped in China.