
Protect their future and save ours
POLAR BEARS
INTERNATIONAL

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Front and back cover photos

To receive timely email news and updates on polar bears and their Arctic habitat, please visit **bit.ly/pbinewsletter** and fill out the form on our website. This is the only signature print piece that we send each year. If you prefer not to receive a copy of our magazine, please email **info@pbears.org**.

Connecting over polar bears

This past summer, blue skies and snowy mountain slopes formed a backdrop to our new pop-up interpretive center in Longyearbyen, Norway. For five weeks during the Arctic summer, our temporary center—a joint effort with the Svalbard Museum—provided us with a chance to engage with visitors from around the world. As many as 450 people stopped by each day to learn from our scientist ambassadors about polar bears, sea ice, and climate change—and to ask questions:

How much sea ice has Svalbard lost?

Can polar bears switch to eating reindeer?

What can I, as a citizen, do to help move the needle on climate change?

Thanks to its role as a stopping-off point for Arctic cruises, Svalbard is a natural place for us to expand our educational efforts and spread our conservation message. More than 30,000 people visit Longyearbyen in July and August alone, spending time in the town before heading off on small cruises to see fjords, glaciers, and sea ice, along with wildlife from polar bears to walruses and Arctic foxes.

Education has long been one of the core pillars of Polar Bears International's conservation efforts, complementing our research, policy, and coexistence work. Early on, we were one of the first wildlife organizations to offer robust distance-learning through our Tundra Connections webcasts, and our live Polar Bear, Northern Lights, and Beluga Cams—in partnership with explore.org—reach over 4 million people around the world every year.

We build on this outreach through our website, which serves as polar bear central for a global audience, and through other communications including a strong social media presence, extensive press coverage, widely viewed videos, and lesson plans tailored to a range of audiences. Earlier this year, this outreach included a TED Talk by one of our staff scientists that currently has more than 1 million views, shining a spotlight on polar bears and the threats they face.

We're grateful for your commitment and support, which make these efforts possible. After all, motivating people to get involved in climate action will not only help polar bears—but will improve the future for all of us.

Sincerely,

Krista Wright

Krista Wright
Executive Director

Krista Wright.

Protect their future and save ours
POLAR BEARS INTERNATIONAL

Onto the sea ice we go

"Working on the sea ice of Hudson Bay was instantly on my list of must-do projects. I was mesmerized by the environment, its remoteness, and the sheer scale of where the bears lived."

By Dr. Andrew Derocher

I first started studying the polar bears of Western Hudson Bay in 1984. This past spring, it occurred to me that the bears I caught as part of our research could be the great-great-great-great-grandchildren of those first bears I caught. We know more about the population dynamics, genetics, movements, and diet of the Western Hudson Bay bears than anywhere else in the world. This population has been studied longer and more intensely than any of the 18 others across the Arctic, producing a body of data that has been the foundation for research conducted elsewhere. After all, a polar bear is a polar bear even if it lives in Norway or Alaska: The bears all do pretty much the same things but with some regional variation.

I've studied polar bears in many populations across the Arctic both on land and on the sea ice. Without a doubt, studying them on the sea ice is vastly more interesting. Yes, bears are harder to find there (white on white vs. white on green), but the sea ice is where everything happens.

Studies from afar

We can garner insights about the lives of polar bears from our satellite telemetry research. We've used those devices for over three decades to study the comings and goings of a sampling of bears. Despite the reams of data these devices

provide, dots on a map only tell part of the story. What's more, historically, all those dots came only from adult females. That's because male polar bears have necks wider than their heads and can't wear collars; they slip right off. We also can't place collars on subadults. They're growing too fast, and it's just too risky to rely on the automatic release mechanism of the collars.

My earliest experience with polar bear telemetry was in 1985 when I flew off over the sea ice in a small twin engine Cessna plane to locate polar bears that were wearing ear-tag or glue-on VHF transmitters. Those radios didn't link to satellites. In those days, we had to get close enough to an animal to hear the signal and get a location through an antenna mounted on the plane. Back then, working on the sea ice of Hudson Bay, rather than flying overhead in a plane, was instantly on my list of must-do projects. I was mesmerized by the environment, its remoteness, and the sheer scale of where the bears lived.

Onto the sea ice

Decades later, after many projects studying polar bears on the sea ice in various parts of the Arctic—from Norway to the Southern Beaufort Sea—the siren calls of the Hudson Bay sea ice were loud. The development of small, light satellite ear-tag transmitters was the spark I needed. While these tags only last up to six months, they would provide insights into the movements of adult males and subadults. Further, they would provide the critical metric we monitor: the date the bears come off the ice at break-up. The project in partnership with the San Diego Zoo Wildlife Alliance and Polar Bears International started in April 2017. We now have five years of data (we lost two years to covid interruptions) and have deployed over 50 satellite ear-tag radios.

The project involves a lot more than deploying the ear-tag radios. We're also studying the bear-fox-seal and sea-ice relationships. While out on the sea ice, we log every polar bear track, fox track, seal, and seal kill. We also take samples from seal kills when we can to assess prey species, sex, and age composition.

The frozen platform of ice is an incredibly dynamic system. It's worth noting that it's in almost constant motion and drifts at about eight kilometers per day—and some days more than twice that rate—while some areas along shore don't move at all. Sea ice movement is something the bears have to deal with: If they didn't, they'd eventually drift out of Hudson Bay to the northeast or be so far from home at break-up that they wouldn't be able to get back.

One consequence of climate change is that thinner ice or ice with lower concentration is prone to drifting more on winds and currents. For the bears, it's akin to turning up the

speed on a treadmill: The higher the speed, the more energy the bears will use, and energy used for movement can't be used for making cubs or for withstanding the summer fast. How different age and sex classes of bears are dealing with changing sea ice conditions is part of our study.

Polar bears are all different in their own ways. A subadult female has to focus on growing big enough by four or five years of age so she can reproduce. A subadult male has to grow big enough to fight successfully for access to breeding females, and most of that breeding won't happen until they hit their prime in their mid-teens. Contrast this with an adult female that must meet the huge energy drain of nursing her cubs on her fat-rich milk. On another trajectory, an adult male is usually far more interested in mating than eating. Our tracking program is providing novel insights on each of these groups and how they are responding to climate change.

Early insights

We're still collecting and analyzing data, but our early findings suggest that subadults and adult males behave much the same as adult females. There are some differences in movement rates and arrival dates on shore at break-up but they're not as big as one would expect. Grizzly bears, the terrestrial cousins of polar bears, show marked differences in movements and the area they traverse but it seems that all polar bears play by the same rules.

Our data on seal kills, seal distribution, and the interactions between Arctic foxes and polar bears has only just begun. The 20 ear-tag radios we deployed on polar bears this spring will add a lot of new information—and we'll continue to gain data as the sample size increases. While it's complex to analyze polar bears and sea ice, adding in other species takes things to a new level.

All in all, the sea ice project in Hudson Bay is an incredible challenge. There's a reason nobody else has attempted a study like this there. The bear density is lower, the ice is incredibly dynamic, and the weather is often unkind in the spring. This past spring, we had a frigid start in mid-April but temperatures spiked to unseasonably warm temperatures in the first week of May, thinning the sea ice and putting an abrupt end to our research for the year.

Overall, we're getting new insights into the bears. After all, if you want to know how a person makes a living, you'd need to visit them on a workday and not a holiday. The same applies to polar bears: The sea ice is where they work.

Dr. Andrew Derocher is a Professor of Biological Sciences at the University of Alberta and a long-time Scientific Advisor to Polar Bears International.

KEY FACTS
about polar bears

- The polar bear is the only bear classified as a marine mammal. They are the largest bears in the world and the largest four-legged predators. Their scientific name, *Ursus maritimus*, means “sea bear.”
- Polar bears have evolved for a life hunting seals on the sea ice. They depend on the ice for hunting, traveling, mating, and sometimes denning.
- They have two layers of fur that prevent almost all heat loss. In fact, their fur keeps them so warm that they can quickly overheat when they run.
- In addition to two layers of fur, a thick layer of fat helps keep the bears warm. A polar bear’s body fat can measure over 10 centimeters thick.
- Polar bears have paws the size of dinner plates. This helps spread their weight so they don’t break through the sea ice.
- Small bumps on the bottom of their paws, called “papillae,” grip the ice and keep the bear from slipping.
- Sea ice loss from climate change is the single biggest threat to the bears. When forced ashore by melting sea ice, the bears are largely food-deprived and lose about one kilogram per day.
- Scientists predict that, if we continue on our current carbon emissions path, we’ll lose most polar bear populations by the end of the century.

Celebrating 10 years of Krista Wright's leadership

By Barbara Nielsen

Krista Wright will never forget seeing her first polar bear. After working for more than two decades in environmental education, she took a year off to reexamine her life and recharge—riding her bike across northern Thailand and Laos, helping a friend launch a nonprofit, and volunteering to teach Nordic skiing and winter ecology to kids.

Polar bears weren't on her radar, but owls were. So she pressed Denver Holt, director of the Owl Research Institute, to take her on as a volunteer,

"Denver refused, saying I wasn't tough enough—though I was," Krista recalls. "So my friend Dan Cox, a wildlife photographer who volunteered with Polar Bears International, said, 'Well, if the owls won't take you, the polar bears will.'"

That was 2008. Within five years, Krista had progressed from volunteering with us during polar bear season in Churchill—where she saw her first bear—to being appointed executive director when Robert Buchanan, the previous president, retired.

This year marks 10 years since Krista took the helm. During that time, Polar Bears International has grown from a small nonprofit with a budget of less than $500,000 to one with projects across the Arctic, a global reputation as a leader in polar bear conservation, 31 staff members in four countries, and a budget of more than $6 million.

Krista Wright, second from right, on a polar bear den study project in Svalbard.

I talked with Krista about key accomplishments from the past 10 years and her vision for the future.

Your first volunteer experience with Polar Bears International was during polar bear season in Churchill, Canada, in 2008. What was that like?

It was actually pretty hard! Robert and his wife, Carolyn, had recruited a group of tough, passionate people who didn't mind roughing it for the opportunity to educate travelers to Churchill about polar bear science and conservation. It was inspiring to work alongside those trailblazers.

I spent nine weeks in Churchill, sleeping on a plywood bed and working long hours with no breaks. I'd get up at 6 and keep going until 11 or 12—just trying to keep everything moving, from working with visiting media to helping with education programs and getting scientists to the tundra.

I felt a passion for the work from the beginning. What drew me was not just the bears and the Arctic ecosystem, but the chance to work on a global issue like climate. I recognized it was important, for polar bears and all of us.

After that first season as a volunteer, you began working on a contract basis. Can you tell us about that?

That first season showed that I was organized and could take charge. I could communicate effectively and wasn't afraid to offer suggestions. From that point on, Robert provided me with an opportunity to work closely with him and learn from him.

I started attending board meetings, and the board saw that I was good at organizing and a strategic thinker, someone who had an ability to lead. I came in with the right experience and the right skill set at the right time. In the past, I'd worked for a variety of nonprofits and had worn a lot of hats. I'd also served on nonprofit boards and had a broad understanding of how nonprofits worked.

We didn't have an office then—the volunteers and contractors worked remotely—so the board chair, Dani Reiss, pressed me to open one in Bozeman, where I lived. So I did that and we centralized operations.

Establishing an office was a big first step. My second biggest accomplishment was setting up a donor management software system. I did that along with one of our board members, Val Beck. A lot of my work in those early days had to do with putting systems in place.

At what point did Polar Bears International start hiring staff?

By then, we'd come to a point where we had to decide whether to remain an all-volunteer organization, supported by some contract help, or start hiring staff. The board made the commitment to hire staff, with generous support from two board members, Dick and Val Beck, who agreed to pay several salaries until we could get on a sound financial footing.

We hired our first paid employees in 2010—four people, including me: Dr. Steven Amstrup, our chief scientist; BJ Kirschhoffer, our field projects manager; and Barbara Nielsen, our communications director. Then, the next year, we hired our first office administrator followed by a development specialist and some education employees. Having staff in place allowed us to grow, especially since most of us could wear a lot of hats.

Three years later, you were appointed executive director. What were some of your early decisions?

My first decision was to hire biologist Geoff York to bring more science and research capabilities to the organization. Polar Bears International had always helped fund research, and Steve Amstrup was on staff, and I thought it was important to expand on that. Geoff had been a polar bear researcher in Alaska and later led WWF's Arctic Program. Like Steve, he understands the need to link science to conservation.

The decision to strengthen the science team helped put us where we are today. It helped build our credibility and positioned us to serve as policy experts and leaders in polar

bear conservation. We currently have 10 scientists on staff. Through it all, we've retained our nimbleness and have earned a reputation for tech innovations that are helping to advance polar bear science.

Polar Bears International has a strong education and outreach arm as well. How has that grown?

Robert, our former president, laid a solid foundation by creating educational programs that have become real powerhouses. He started the Tundra Connections broadcasts, making us early adopters of online learning. He also created the Climate Alliance, which empowers zoo staff to communicate with the public about polar bears, sea ice, and climate change. Thanks to tech advances and partnerships, both programs have changed and grown and are making a real impact.

In 2011, we partnered with explore.org on the Polar Bear Cams from Churchill and later on the Beluga and Northern Lights Cams. Between the cams and the webcasts, we now reach more than 4 million people every year. We also have a top-ranked website and amazing media coverage, reaching 5 billion people around the world last year alone—sharing the science and highlighting the need to act on climate change.

In 2019, Polar Bears International opened an interpretive center in Churchill, followed by the MARS Arctic Research and Conservation Center, which provides staff housing. The organization now has projects across the Arctic. Could you have imagined that in the early days?

It's gratifying to see how far we've come, thanks to this incredible team. Polar Bears International House, our interpretive center in Churchill, has been hugely successful in terms of outreach and community relations. And the MARS Center has made our work in Churchill so much easier, both from a logistical standpoint and staff well-being. It makes a big difference to have your own room where you can rest and recharge during busy field seasons.

In the early days, we had research projects in Alaska and Canada. We've since expanded our fieldwork to Svalbard, Norway, and have a pop-up interpretive center there. Before the war in Ukraine, we were supporting research on Russia's Wrangel Island. Our scientists actively take part in international meetings, including those held by the Range States and the IUCN Polar Bear Specialist Group. The "International" is now there in Polar Bears International.

What strikes you most about the changes you've seen?

I feel privileged to have worked with Polar Bears International's trailblazers. It's gratifying that we're now a circumpolar organization with a global reach, focused on the overarching threat of climate change while also working to ensure healthy polar bear populations in the short term.

We've clearly made an impact on polar bear conservation. But we still have a lot of work to do. A recent paper co-authored by our chief scientist emeritus shows unless greenhouse gas emissions are greatly reduced, most polar bear populations are likely to disappear by 2100.

That said, we're seeing signs of momentum. The world's nations came together on the Paris climate agreement in 2015, and the current U.S. administration passed the first major climate bill. There's been a shift in public opinion on the need to act, and it's exciting to see technology advance and learn about new ideas and approaches. We're one of the many organizations sharing a vision of what's possible—which is essential to motivate change.

Looking back, what are you most proud of?

The team and all we've accomplished. I feel privileged to work with an outstanding group of people who are really committed to the cause. From the early days, our people have been one of our greatest strengths, along with the polar bears. They're magnificent animals that capture hearts all over the world, and they carry an important conservation message. They're iconic and unique, and we'll continue to do all we can to sustain their future—and by sustaining their future, we'll improve our own.

Barbara Nielsen is Senior Director of Communications at Polar Bears International.

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Many companies will double, or even triple, your donation to Polar Bears International. We utilize these gifts by making a lasting change in the Arctic, altering the lives of polar bears and humans alike.

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Got milk?

"During times of reduced food availability, polar bear mothers must rely on their body fat reserves to support themselves, while also producing milk to support their cubs."

Photos © Daniel J. Cox / NaturalExposures.com

By Dr. Louise Archer

All animals face the challenge of deciding how to spend their limited energetic resources. For polar bears—long-lived mammals that can reproduce several times over their lifetimes—females must balance their own energy needs for survival with the needs of their cubs. Seasonal changes in Arctic sea ice coverage mean that polar bears often face long periods without access to important habitat for hunting seals, making these energy allocation decisions particularly challenging for reproductive females. During times of reduced food availability, polar bear mothers must rely on their body fat reserves to support themselves, while also producing milk to support their cubs. Previous research shows that polar bear milk is generally extremely high in energy (up to ~33 percent fat), and cubs will typically stay with their mother for around 2.5 years, with females lactating for much of this time. As a researcher in polar bear energetics, I have been curious about the impact of changing sea ice dynamics and longer fasting periods on the ability of polar bear moms to nurse their cubs. This topic is growing all the more relevant as sea ice loss from climate warming is rapidly altering foraging opportunities for polar bears across the Arctic.

Some valuable data

A serendipitous meeting with wildlife scientist and veterinarian Dr. Stephen Atkinson provided a rare opportunity to tackle this question. Sea ice disappears entirely from Hudson Bay in the warmer summer months, forcing the polar bears here onshore. While on land, bears are fueled solely by their energy reserves until temperatures cool and the sea ice returns in the fall. As part of his graduate research on Western Hudson Bay polar bears in

the 1990s, Stephen collected milk samples from females with cubs while the bears were fasting on shore during the ice-free season. Along with measuring the composition of the mother's milk, Stephen and colleagues recorded other important metrics including the body mass, length, age, and fat reserves of each bear. In a recent study, Drs. Peter Molnar and Stephanie Penk of the University of Toronto Scarborough, Dr. Anthony Pagano of the U.S. Geological Survey, Stephen, and I recently revisited this data with some new modeling tools and new questions. For every polar bear family, we calculated how long they had been fasting on land based on that year's sea ice break-up date. We then estimated the energy content of the mother's milk and identified important factors that affected milk energy, aiming to understand whether the bears moderated their lactation investment—and if so, why.

"We found the energy content of polar bear milk decreased the longer bears had been off the sea ice and fasting on land."

We found the energy content of polar bear milk decreased the longer bears had been off the sea ice and fasting on land. Female body condition also influenced the energy in the milk: Not surprisingly, females with lower energy reserves produced milk that was the lowest in energy. Some of the females had already stopped producing milk entirely when they were sampled, even though they were still accompanied by cubs. Bears were more likely to have ceased lactation the longer they had been off the sea ice, and when they were in relatively poor body condition. This indicated that as females spent longer fasting and burned through their own fat reserves, they were increasingly forced to prioritize their own energetic needs, with less energy available to allocate to their cubs. However, the age of the cubs also affected milk production: Females with cubs-of-the-year (cubs born that winter, termed COYs) produced more energy-rich milk than females with yearlings (cubs from the previous year). Since COYs require lots of energy to support their fast growth rates but have yet to accumulate sufficient fat reserves to sustain themselves, they are more dependent on their mother's milk than yearlings. Our study suggested that mothers accompanied by vulnerable COYs continued lactating and produced more energy-rich milk (even when in lower body condition) than mothers of yearlings.

Consequences for moms and cubs

For a smaller subgroup of bears, Stephen had obtained milk samples twice within the same fasting season, allowing us to test whether bears that reduced their investment in lactation saved more energy overall. We discovered that for every 0.3 calorie drop in energy per gram of milk, moms burned through 1 kilogram less of their own body reserves between recaptures. Although producing milk with less energy benefited polar bear moms, their cubs didn't do as well: Cub growth decreased as milk energy declined, with some cubs not growing at all in the capture interval.

Impacts on polar bear populations

Dusting off these historical data provided valuable insight on how female polar bears balance their own energetic needs with those of their cubs. Almost three decades have passed since these samples were collected and a lot has changed for the polar bears in Western Hudson Bay. Earlier sea ice melt and later refreeze dates have extended the ice-free period by approximately nine days per decade from 1979 to 2011 (roughly 27 days, total), with corresponding declines in polar bear body condition. Such changes are likely challenging the ability of moms to continue to provide the high-energy milk required by their offspring. Declining lactation performance may have already played a role in increased cub mortality that has accompanied longer ice-free seasons, and the overall reduction in the size of the Western Hudson Bay population, which has dropped by about half since the early 1980s. If human-caused warming is not constrained and sea ice loss continues, female polars bears are likely to increasingly struggle to provide for both themselves and their cubs.

Dr. Louise Archer is a Mitacs Postdoctoral Fellow at the University of Toronto Scarborough, supported by Polar Bears International.

When in doubt, just ask the bears...

By Dr. Ian Stirling

How one "studies" a polar bear can vary greatly. To date, most of the information scientists collect for the conservation and management of polar bears involves a surprisingly brief amount of actual contact with the bears themselves. Typically, after a bear has been located, it is tranquilized by a dart fired from a helicopter. Once the bear can be safely approached, it is tagged, measured, has specimens such as a tooth, blood, and fat collected, and may have a satellite radio collar deployed to track its movements. Other more recent innovations include analyzing samples from hair traps, or from specialized darts that collect skin samples, that provide data on an individual's identity as well as other possible aspects of genetic diversity. But these methods, while critical, only tell part of the story.

Clifftop observations

Some insights are only possible to attain by actually watching wild undisturbed polar bears doing whatever they want to do, whenever they want to do it, at their own speed, 24 hours a day, in all kinds of weather, for protracted periods of time. In 1973, we first chose to try observing wild polar bears hunting on the sea ice at Radstock Bay on southwest Devon Island, Nunavut, because previous fieldwork in the area had shown us it was usually a good place to find bears and there were a couple of excellent clifftops from which we could safely make observations. Initially, we simply wanted to see what we might be able to learn about the ecology of polar bears by just watching them.

After a surprisingly successful initial trial observation period from a clifftop camp, we eventually completed a total of 17

"Some insights are only possible to attain by actually watching wild undisturbed polar bears doing whatever ***they*** want to do, whenever ***they*** want to do it, at ***their*** own speed."

spring and fall observation periods between 1973 and 1999. An observation period for an individual bear started when it was first spotted and continued non-stop, in a sequence of shifts with different observers as necessary, until it disappeared out of sight. Most observations were made with 15-60x zoom telescopes from inside the observation cabin. If the bears came too close to shore beneath the clifftop we were observing them from, we had to briefly watch from a vantage point outside the cabin (sometimes in very cold weather). Overall, I like to think of our approach as being one of asking the bears to tell us about themselves, rather than the other way around. Below, I outline a couple of examples of difficult problems that could not have been resolved in any other way other than by simply "asking the bears."

Dependence of yearling cubs

A couple of years after starting the long-term behavior study back in the 1970s, a significant difference of opinion developed in management circles about how old a cub would have to be before its mother could legally be harvested. At the time, in the Northwest Territories in

(*top*) © Daniel J. Cox / NaturalExposures.com (*bottom*) Cheryl and Wendy observing outside at Cape Liddon. © Ian Stirling

Cape Liddon, Radstock Bay, polar bear observation camp in spring.
© Ian Stirling

"We would not have learned about such relevant behavior if we hadn't 'asked the bears' to 'show us' the details."

Canada (now subdivided into NWT and Nunavut), family groups of bears were only protected if the adult female was accompanied by cubs of the year, which meant it was legal to shoot a female that was still accompanied by dependent yearlings. However, it was common knowledge that female polar bears in the wild did not wean their cubs until they were two and a half years of age. Thus, I argued, unsuccessfully, that all family groups should be protected until the cubs are two and a half years of age, because that is how long they need to be with their mothers before they have learned enough to be able to survive independently. If yearlings were not protected, a hunter who only had one tag could legally kill a female accompanied by yearling cubs. However, he would actually be killing them all because yearlings would not yet be mature enough to survive independently if their mother was killed.

The response from managers and hunters of the time was to disagree and, somewhat sarcastically, ask, "Where are your data to prove that yearlings cannot survive on their own?" Because of our ongoing study of the behavior of wild polar bears at Radstock Bay, we were able to analyze our direct observations of many individual females with dependent cubs of different ages to prove polar bear cubs of the year and yearlings did almost no hunting whatsoever. From that it was clear that they would not survive if they were orphaned before reaching two and a half years of age. The results of that study were published in 1978 and, to the credit of the Northwest Territories Wildlife Department of the time, they changed the regulations to protect adult females with yearling cubs, effective the following year. The only way we could actually obtain the information we needed to resolve the issue was "to ask the bears."

Insights on tranquilizing

Similarly, because much of the research done on polar bears for conservation and management purposes involved temporarily immobilizing them for tagging, collecting specimens, and deploying radio collars, there was a shared concern on the part of both scientists and Inuit hunters that such activities might have some kind of negative effect on the bears. In response, several independent studies compared factors such as survival, body condition, and reproductive success of individually marked bears at the time of their first capture and compared those results to the same data collected during subsequent recaptures of known individuals. None of those studies found any negative effects arising from having been previously immobilized. Then, more recently, analyses of movement data from bears that had satellite collars deployed on them at the time of being immobilized showed that they returned to normal movement patterns within two to three days.

Regardless, some of the hunter groups continued to question whether something important might still be happening that we could not see. So, we compared visual observations of the behavior of 35 polar bears immobilized at Radstock Bay as they recovered to observations of the behavior of non-immobilized bears of the same age and sex classes in the same seasons and years. Again the immobilized bears returned to normal behavior patterns in two days and showed no detectable adverse effects in the following 21 days. Furthermore, three adult bears were observed killing seals 0.4 to 2.1 days after being immobilized. This confirmed that some individuals recovered even more quickly than the satellite data had suggested and were able to hunt successfully with no negative side effects. We would not have learned about such relevant behavior if we hadn't "asked the bears" to "show us" the details of how immobilized bears behaved during their recovery—and how quickly they returned to successful hunting.

Breeding behavior

Relatively briefly, it is also worth emphasizing that when one undertakes a long-term observational study of any animal, such as this one of polar bears, observers are occasionally exposed to unique insights into their natural behavior that would not be possible any other way. For example, we have all known for years that female polar bears are "induced ovulators," which means that they don't ovulate automatically on some predetermined schedule, as do human females. If ovulation was spontaneous, and there was not a suitable male present at the time, the egg would simply die and be wasted. We also know though that adult males sometimes cannibalize cubs or drive them off. Similarly, they've also been known to cannibalize females in times when food may be scarce. Thus, it is no surprise that most females, whether with cubs or alone, avoid adult males. During a 13-day, 24-hour continuous observation that we were lucky enough to be able to document from start to finish, we learned how an adult female and male change their behavior sufficiently to allow them to trust each other enough to be able to mate—all within viewing range of our cabin.

We were watching an adult female with a two-and-a-half-year-old cub (the age at which cubs are weaned) when a very large adult male turned up and started following them. After about 18 hours, he ran between the pair but, instead of trying to defend her cub, the mother just watched. After two days, the cub stopped following them and was not seen again. For the next seven days, the male and female alternated running back and forth toward or away from each other, but not too far away, just far enough for the female to be able to safely flee if the male acted too threateningly. Sometimes they pretended to hunt for a few minutes at a time and, periodically, they rested or slept between active periods. Over a few days, these protracted interactions slowly, but steadily, caused the male and female to both change their behavior toward each other. They even began to nuzzle affectionately and walk slowly back and forth together before finally mating several times over the next five days. About five hours after they finished mating, they slowly parted and walked off in different directions, occasionally looking back at each other, but continuing to disappear out of sight. Obviously, the long period of nonviolent interaction between the adults had evolved to facilitate their mutual trust and then the stimulation of repeated copulations presumably caused the female to ovulate. This remains the only time the behavior associated with breeding behavior in a polar bear has been documented from start to finish.

In summary, the potential for gaining even more unique insights into the ecology of wild polar bears though visual observations of their behavior seems unlimited. I wonder what they might tell us about themselves next!

Dr. Ian Stirling, FRSC, is a member of the Scientific Advisory Council for Polar Bears International and the IUCN Polar Bear Specialist Group. He is also a Research Scientist Emeritus for Environment and Climate Change Canada and an Adjunct Professor of the Department of Biological Sciences, University of Alberta.

Barents Sea polar bears

By Kieran Mulvaney

Of the approximately 25,000 polar bears that scientists estimate roam the Arctic, roughly 10 percent are found in the Barents Sea, including the Norwegian archipelago of Svalbard, Franz Josef Land in the western Russian Arctic, and the sea ice between them and to their north.

As with polar bears elsewhere, the Barents Sea bears prey primarily on seals, particularly ringed seals. They also, like other polar bears, face threats from declining sea ice due to climate change. But there are some differences that make the Barents Sea bears an interesting and special case.

Of the 2,650 or so bears that are believed to live in this population, approximately 1,000 live on the Norwegian side of the sea, and they are uniquely divided into two groups that follow different strategies for survival.

Coastal and pelagic bears

Ocean currents in the Barents Sea continually carry ice offshore as it forms in winter. Then, as the weather warms, new ice stops forming and the remaining ice drifts north, leaving a gap of water between land and the polar ice pack. A minority of the Svalbard population, about 250 bears, chooses not to follow the pack ice, but instead stays year-round on the shores and coastal ice of the archipelago. These "coastal bears" have among the smallest home ranges of any polar bears—as little as 185 square kilometers (71 square miles)—and focus their feeding efforts primarily on ringed seals on landfast ice (ice that is "fastened" to the coast) and glacial ice in fjords. Most of their feeding takes place in spring, after ringed seals have pupped and when food is most abundant.

The larger group consists of bears that head out onto the ice pack, traveling out to sea with it and wandering large distances in search of food. They hunt over a wider area—in contrast to their coastal cousins, pelagic polar bears' ranges can encompass almost 400,000 square kilometers (150,000 square miles)—and for longer periods. This is because food is more dispersed on the sea ice than in coastal areas. They also hunt larger harp and bearded seals as well as ringed seals.

Whether a bear is a coastal or pelagic bear appears to depend on which path its mother took.

"If you're born locally in Svalbard, you do the same thing as your mother did," explains Jon Aars, senior scientist with the Norwegian Polar Institute. Further, he notes, the coastal bears are themselves often found in distinct areas. "So, if they're born and raised in south Svalbard, they stay in that area; if they're in north Svalbard, they stay in that area, generation after generation."

Additionally, he notes, "even when bears are pelagic, we call them Svalbard bears because that is where they go back every time they give birth."

History and threats

Barents Sea polar bears have faced threats from human activities for well over a century. From around 1870 to 1973, Norwegian hunters killed about 300 bears annually in the population, mostly on Svalbard. Winds and currents bring pollution in the form of chemicals such as brominated flame retardants and even radionuclides from atmospheric nuclear testing. But by far the biggest potential threat is posed by sea ice loss as a result of climate change.

Impacts of Hunting

Beginning in about 1870, Norwegian hunters killed or captured approximately 300 Barents Sea bears, mostly on Svalbard, every year for a century. In the 1960s, scientists expressed concern about plummeting polar bear numbers, and in 1973 Norway ceased hunting polar bears after signing the international Agreement on the Conservation of Polar Bears. (The Soviet Union banned commercial hunting in 1956.)

Given the number of bears killed, it has been estimated that the Barents Sea population numbered about 10,000 bears before hunting began. It is believed that the population rebounded rapidly in the first decade after hunting stopped and subsequently grew more slowly or stabilized.

It is unclear why numbers today are far short of the pre-hunting estimate. One factor may be that hunting figures include bears from other populations that migrated into the Barents Sea. It is also possible that the carrying capacity— the number of animals an ecosystem can support—has decreased, or that recovery is being limited by factors such as pollution or climate change.

The annual average temperature in the Barents region climbed by as much as 2.7 degrees Celsius (4.9 degrees Fahrenheit) each decade in the past 20 to 40 years, making it the fastest warming area on Earth. Unsurprisingly, this has impacted sea ice in the region: the extent of landfast ice around Svalbard has declined by 50 percent compared to the period 1973-2000, and polar bears in the Barents Sea are now confronted with a sea ice season that is two to three months shorter than it was three decades ago.

For coastal bears in the Barents, this means the ice on which they hunt ringed seals is sparser and more fractured, forcing them farther inland to feed on bird eggs or reindeer or requiring them to spend more time in the water, swimming from floe to floe and attempting to leap out of the water and onto ice to grab seals. Although polar bears are highly accomplished swimmers, spending too much time in the water depletes their energy reserves; besides, such hunting techniques are far less reliable than stalking seals on the ice.

One fascinating development on Svalbard has been coastal bears turning more to land-based prey, including birds' eggs and even reindeer.

Aars believes that any increase in this type of predation is due to bears having to spend more time on land in the absence of coastal ice but also because reindeer populations have increased rapidly in recent

years as the population recovers from over-hunting in the 20th century. That doesn't mean, he cautions, that bird eggs and reindeer will supplant ringed seals in the diet of Svalbard polar bears.

Geoff York, Polar Bears International's senior director of conservation, agrees. "Plenty of energetics studies dismiss the possibility that polar bears could survive on terrestrial foods alone," he says.

Another consequence of decreasing ice is that the ice edge is retreating farther and farther away from the Svalbard coast, and sometimes is not even returning in the fall when pregnant bears need to come ashore to give birth.

That means those bears must either swim long distances to shore, again depleting them of vital fat stores they need when going without food while they give birth and nurse their young, or den elsewhere; there are indications, says Aars, that at least some bears are giving up on even attempting to reach Svalbard and are instead walking long distances over the ice to den on Franz Josef Land.

What the future holds

Surprisingly and pleasingly, despite the huge changes in sea ice cover, polar bear population numbers in the region appear to be stable; and, unlike with Western Hudson Bay or Southern Beaufort Sea bears, scientists have not observed widespread deterioration in body condition of polar bears in the Barents Sea. This is likely due to the rich, productive waters of the Barents Sea.

But the warning signs are there.

Studies have shown, for example, that coastal and pelagic bears are increasingly becoming separated from each other, resulting in less mating between the two groups and causing a 10 percent loss in genetic diversity in Svalbard bears over the last 20 years.

"I think if you asked people 20, 30 years ago, if you lost three months of sea ice, how would the polar bears do, a lot of people would say they will do very badly," says Aars. "And we haven't seen that. But if they lose one, two more months, who knows? It could be that there is a threshold, that when something happens to the population, it happens very suddenly."

Kieran Mulvaney is a freelance writer who has written extensively about polar bears and the Arctic for publications including National Geographic, The Guardian, and The Washington Post.

Decoding polar bears

By Dr. Ruth Rivkin

It's no surprise that polar bears are being affected by climate change. Polar bears are adapted for life in cold environments, and they depend on sea ice for their survival. The bears use sea ice for hunting, migration, and denning. Any time spent on land typically means fasting. As temperatures continue to rise, sea ice forms later and melts earlier, making climate change a threat to polar bear survival. Understanding how the bears will respond to climate change can help guide strategies for their conservation and management.

Genetic blueprints

Researching the genetic diversity in polar bears can help us understand if and how the bears will adapt to climate change. Genetic diversity is a measure of the amount of variation in DNA sequences between individuals. It provides the foundation for all evolution to take place, including adaptation. Adaptation happens at the genetic level when species gain certain genetic combinations that improve their survival and reproduction in the environment they are exposed to. The capacity for species to adapt depends in part on the amount of genetic diversity contained in their genomes, which are the entire set of DNA sequences of an individual. Studying the genomic basis of adaptation can help paint a more complete picture of how vulnerable a species is to environmental impacts such as climate change.

"Researching the genetic diversity in polar bears can help us understand if and how the bears will adapt to climate change."

Polar bear genomics is a growing field, and one that has been able to offer important insights into how the bears are evolving in the face of climate change. Recent work has highlighted the influence of summer sea ice loss on genetic diversity in polar bears. For instance, in the Norwegian Arctic, genetic diversity decreased by 10 percent over the 22-year study period, a trend that was strongly associated with declines in sea ice coverage. The research also showed that polar bear populations—that is, the groups of bears that form ecologically and evolutionary unique units—have become more genetically distinct from one another, indicating that bears are traveling less often across the ice between populations.

Differences in diversity

Canada contains 13 of the world's 19 designated populations of polar bears, although evidence suggests that bears in the country form between four and six unique genetic groups. Research indicates that the Canadian High Arctic, particularly the Norwegian Bay population, likely forms a unique genetic group. My genomic research points to this population as one that is particularly vulnerable to climate change because of a mismatch between its genetic diversity and the projected declines in sea ice thickness with warming temperatures. My results suggest that this population is probably maladapted to future ice conditions. This trend may be happening because there is not enough genetic diversity in the small Norwegian Bay population to allow the bears to adapt to the changing environment, or because sea ice is predicted to be lost so rapidly in the High Arctic that the bears simply will not have enough time to adapt.

In contrast to the High Arctic populations, polar bears in the southern regions of the Arctic live in seasonal sea ice areas that have already experienced considerable ice loss. The number of bears in the Western Hudson Bay population has declined by about 50 percent since the 1980s. Interestingly, my research shows that these bears may be better able to adapt to further losses in sea ice than bears in the High Arctic. One explanation for this seeming contradiction is that Hudson Bay has already lost most of its summer sea ice cover, so bears are already experiencing the ice-free conditions that are predicted to occur later in the century for bears in the High Arctic. Also, it is possible that the bears that were included in my samples have already had some time to adapt to ice-free summers and are now more resilient to climate change. I plan to continue to investigate hypotheses that explain this pattern of genetic resilience across the Arctic.

Potential new population

Recently, one study used genomics to identify a potential new population of polar bears in southeast Greenland, which would bring the world's total to 20. Southeast Greenland has limited sea ice because the current off the coast runs too quickly to allow it to form. Because of the lack of sea ice, the bears there spend most of their time on landbound glacial ice. Multiple lines of DNA evidence, including genomics and transcriptomics (the study of how the genome is expressed as proteins and other molecules), suggest that this group is genetically distinct from other populations, including the other Greenland populations.

(*top*) Polar bears are adapted for life on the Arctic sea ice. Their curved claws help grip the ice and aid the bears in grabbing their seal prey.

(*bottom*) Can polar bears adapt to climate change? Researching their genetic diversity can help us understand if and how that is possible.

"The capacity for species to adapt depends in part on the amount of genetic diversity contained in their genomes."

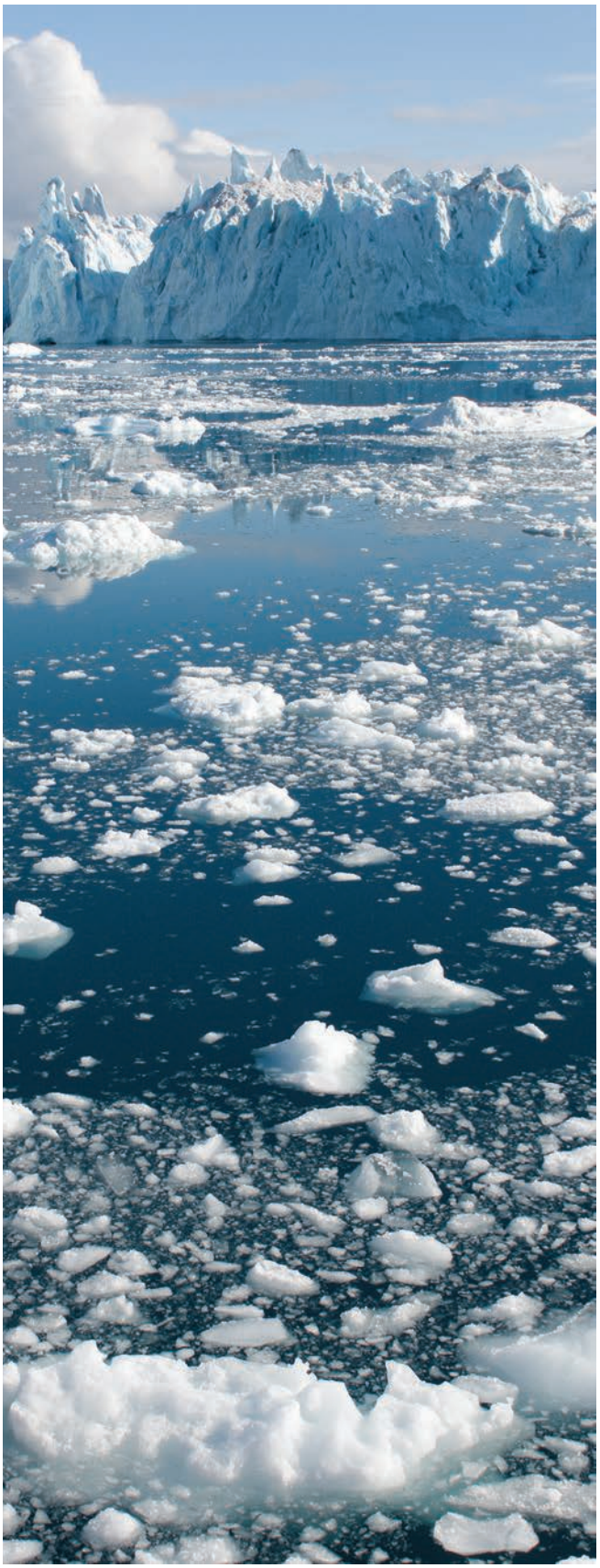
Polar bears in southeast Greenland have lower genetic diversity, and demographic analyses suggest that they recently became isolated from other bears in the area. This fact is supported by historical records that indicate that the bears were first observed in the area in the 1830s, despite observations from other parts of Greenland dating back to the 14th century. The sea ice conditions in southeast Greenland mimic those projected to occur across the Arctic by the end of the century, so this potential 20th population could serve as one example of how polar bears in the Arctic could adapt to ice-free summers by using glacial ice as an alternate habitat source—until the glaciers melt as well.

Mapping out genomes

Incorporating genetic information into existing conservation frameworks can help identify populations that may be at risk of extinction or ones equipped to adapt to climate change. This is one major goal of my research, which is a joint effort between Polar Bears International, Environment Canada and Climate Change, the San Diego Zoo Wildlife Alliance, and the University of Manitoba.

We are currently sequencing the genomes of 520 polar bears from the Canadian Arctic to investigate patterns of genomic evolution, looking back into the past and forward into future climates. Some questions that I hope this research will answer are: How have polar bears evolved under previous climate change events (e.g., the last Ice Age)? Do the bears have enough genetic diversity to adapt to the current climate change event? Are there regions of the genome that have already begun to evolve in response to climate change, and can we find specific genes that may particularly influence adaptation? And can we predict how the bears will adapt under different levels of warming, depending on different levels of carbon emissions? Answering these questions can provide valuable insight into the conservation strategies to ensure that polar bears continue to survive in the Arctic.

Dr. Ruth Rivkin is a NSERC Postdoctoral Fellow at the University of Manitoba, working with Polar Bears International and the San Diego Zoo Wildlife Alliance.



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For over 30 years, Polar Bears International has focused on the long-term survival of polar bears and their sea ice home. We fund research, education, coexistence, and advocacy efforts that support polar bear conservation and inspire action.

Climate change is the overarching threat to polar bears and a key focus of our efforts. Here's how you can get involved:

- ***Vote with the climate in mind,*** in each and every election, at every level of government. Also, reach out to your representatives and let them know you support climate action.
- Help make climate change a kitchen-table issue by ***talking about it with friends, family, and colleagues***. Why? Because when everyone is talking about something, it feels important. And when something feels important, people act.
- ***Support an energy shift that reduces or replaces fossil fuels*** with clean energy sources like solar and wind.
- Help build a better future in your community by ***supporting energy-efficient construction standards***.
- ***Promote clean transportation*** through community projects like bike lanes, electric buses (including school buses), and no-idle zones.
- Learn more and join our community by ***signing up for our e-news, joining our Tundra Connections webcasts, and watching our Polar Bear Cams***.
- Support our conservation efforts by ***making a donation, becoming a monthly donor, or checking out our gift shop***.

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February 27th

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July 15th

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