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# Ripple Marks

The Story Behind the Story **BY CHERYL LYN DYBAS**

## LAST OF THE ICE BEARS?

### CLIMATE CHANGE THREATENS ICONIC POLAR BEARS' FOOD SOURCES

In 1773, King George III of England appointed naval officer Constantine John Phipps to command an Arctic expedition. Phipps was dispatched to search for a passage to the Pacific Ocean. Instead, on the ice fields near Spitsbergen (now Svalbard), Norway, he found polar bears. The explorer was the first to describe the bears as a distinct species, *Ursus maritimus*.

Were he to undertake the journey today, Phipps would spot polar bears not on sea ice, but wandering along rocky shorelines, searching for frozen water.

#### IT BEGINS—AND ENDS—WITH SEA ICE

For polar bears—marine mammals and apex predators of Arctic realms in Norway, the United States (Alaska), Canada, Greenland, and Russia—everything begins and ends with ice. Or, more to the point,

with the ice edge. For the bears, it defines the thin line between life and death.

If sea ice continues to melt at its current rate, two-thirds of the world's 20,000 to 25,000 polar bears could be gone by 2050. Between 2001 and 2010, the southern Beaufort Sea subpopulation, one of 19 subpopulations of polar bears worldwide, declined by 40%.

Both the surface and the underside of annual—or yearly forming—sea ice are vital to polar bears, says biologist Ian Stirling of the Canadian Wildlife Service and the University of Alberta. “The surface provides the platform on which bears can travel and from which they’re able to hunt for their choice prey, ringed seals,” writes Stirling in his book *Polar Bears: The Natural History of a Threatened Species*. “Below is a thriving ‘under-ice’ community of algae and marine organisms.”

That unique community doesn’t exist under multiyear, or several-year-old, sea ice. Multiyear ice is thicker than annual sea ice; it lets less sunlight pass through and has a less biologically rich flora and fauna.

When annual sea ice forms in fall, ringed seals cut breathing holes in its surface. Ringed seals, also known as ice seals, are found in Arctic waters on ice floes and pack ice. The seals scratch away at the ice with sharp flippers, allowing them to live where seals without such ice choppers can’t.

As winter wanes, sunlight streams through the ice, and phytoplankton bloom on its underside; the plankton support invertebrates small and large, ultimately providing food for the seals.

Where ringed seals go, polar bears soon follow. The bears prefer a ringed seal dinner over any other seal species. On average, it takes 43 ringed seals per





year to feed one polar bear, according to Sterling. A population of 20,000 polar bears worldwide would need more than one million ringed seals (or ringed seal “equivalents,” as measured by the sizes of other seal species) to survive.

“There is simply no other marine mammal in the Arctic that’s sufficiently abundant, and small enough, to be relatively easily killed by bears of all sizes, that could replace ringed seals in sustaining the majority of the world’s polar bears,” states Stirling.

As winter approaches and ice closes in, a polar bear’s seal-hunting options dwindle. But along the coastline of the Arctic basin, polynyas—open areas—in annual sea ice remain ice-free. Polynyas that recur from year to year are critical to marine mammals like seals. Because of the importance of this circumpolar chain of open waters, it’s been dubbed “the Arctic ring of life.”

But the ring of life may have become a death trap.

#### SPECIES’ FUTURE IN ONE BEAR’S TALE?

One polar bear’s story may foretell the species’ future.

Three subpopulations of polar bears inhabit Canada’s Hudson Bay: the western Hudson Bay, southern Hudson Bay (including James Bay), and Foxe Basin bears.

The sea ice of Hudson and James Bays melts each year in early summer, forcing the bears ashore for several months. During that time, they live off stored fat reserves until the ice refreezes in late fall. But ice breakup is arriving sooner and ice freeze-up later.

“The bears have fewer weeks to hunt seals,” says Martyn Obbard, a biologist at the Ontario Ministry of Natural Resources. “Already, consequences have been documented in the western Hudson Bay subpopulation. The bears are declining in health and number.” A similar trend has been observed in the southern Hudson Bay subpopulation.

James Bay’s polar bears may be the most at risk. James Bay boasts the southernmost polar bears in the world. Because sea ice is melting so rapidly there, Obbard is concerned about the bears’ future.

In September 2012, he and colleagues placed GPS collars on several polar bears on Akimiski Island in James Bay and along the bay’s Ontario coast. One bear was an adult female the team collared on Akimiski on September 18, 2012.

The scientists monitored her signals throughout the fall. On December 5, 2012, the downloads ceased. The biologists assumed the bear had managed to give her collar the slip.

“When bears drop collars, it’s a major

disappointment,” says Obbard. GPS collars are expensive, so he asked biologists with the Ontario Ministry of Natural Resources goose research project on the island to recover the device during their nest searches the following May.

“Imagine their surprise, and ours,” Obbard says, “when they discovered the bear’s body.” She had lain in state on the island, frozen there all winter. “The bear was in very poor condition when she died,” says Obbard, “literally skin and bones.”

Based on data from her GPS collar, she remained near her capture location until late October. Then she ventured forth, walking the entire coast of Akimiski Island and back by late November. In early December, she made her way to a small islet off Akimiski and returned—then stopped. “Between September 18<sup>th</sup> and December 5<sup>th</sup>,” Obbard says, “she went an astounding 650 kilometers.”

Scientists think she was searching for the first ice that would allow her to go far enough onto James Bay to hunt seals. “Sadly,” Obbard says, “the ice formed near Akimiski Island only 10 days after she died. She had simply run out of fat reserves before the freeze-up.”

Her demise, the researchers say, is a harbinger of the consequences of changes in sea ice duration, especially delays in freeze-up.



What's to eat? Polar bears are finding out—the hard way—that the pickings are slim. Their ringed seal prey is becoming inaccessible due to lack of sea ice, so the bears are coming ashore to feed on geese (pictured here along the west coast of Svalbard in Norway) and other terrestrial, rather than marine, species. *Photo courtesy: Jouke Prop, University of Groningen*



## HOW MANY POLAR BEARS IN THE ARCTIC? COUNTING BEARS FROM SPACE

In the remote Arctic, it's a challenge to keep track of where polar bears are and where they might be going. What if scientists could use satellite imagery to count, and perhaps someday to follow, the bears?

Researchers have found that polar bear population estimates based on satellite images are similar to estimates from traditional wilderness counts from plane or helicopter fly-overs.

Seth Stapleton of the US Geological Survey's Alaska Science Center in Anchorage and colleagues at the University of Minnesota, the Government of Nunavut, Canada, and the Minnesota Department of Natural Resources looked at satellite photos of polar bears on Rowley Island, a small island in far northern Canada. Their estimate of 92 bears was similar to that of 102 bears from an aerial survey conducted a few days earlier.

The technique works only when the bears are onshore, however, as contrasting shades are needed to spot them. White polar bears are fairly easy to see against a dark land surface, say the scientists, who published their results in the July 2014 issue of the journal *PLOS ONE*.

After ice breaks up and before it forms again, polar bears must move to land. In August and September, the land is usually snow- and ice-free, so a white bear stands out against a dark background. If the researchers can go another step and figure out how to detect white polar bears against the white of ice, it will allow them to track the bears in more months of the year.

The Canadian government is especially interested in the discovery: its share of the world population of polar bears is 10,000 to 15,000, a large part of the globe's 20,000 to 25,000 bears.

## WITHOUT SEALS, WHAT'S LEFT TO EAT?

In Canada or anywhere in the Arctic, what's a polar bear to do when ringed seals disappear?

For polar bears to stay alive, say biologists Robert Rockwell of the American Museum of Natural History in New York and Linda Gormezano of the University of Montana, their food preferences need to change with the melting of the ice.

Some bears are already switching their prey to snow geese, caribou, and even starfish to survive in a rapidly warming environment. "Polar bears are opportunistic and eat what's available," says Gormezano. "They may glean some nutrients, such as calcium, from starfish, but it's doubtful that starfish could sustain a polar bear." Rockwell and Gormezano published their results in 2013, in papers in the journals *Polar Ecology*, *Ecology and Evolution*, and *BMC Ecology*.

If the polar bear is on the west coast of Svalbard in Norway, it's going after the eggs of birds called pink-footed geese. On Svalbard's coastal tundra, pink-footed goose nests are common. They perch on greenstone outcrops in numbers as high as 126 nests per square kilometer, at an average distance of 1.5 kilometers from the shoreline.

Close enough for the swipe of a polar bear paw, says biologist Jouke Prop of the University of Groningen in the Netherlands. "In 2011 and 2012, polar bears invaded the pink-footed goose nesting area to consume goose eggs," write Prop and colleagues in a paper published in 2013 in the journal *Ornis Norvegica*.

From 2010 to 2012, the researchers assessed the breeding success of pink-footed geese by checking the region on foot. The survey took place after pink-footed goose eggs had hatched in mid-July.

Until recently, polar bears were seldom seen along this stretch of coast. "Then in 2011 we observed that polar bears had conducted forays in the nests of pink-footed geese," state Prop and paper co-authors. The next year, polar bears repeated their visits.

No fools they, the bears selected locations with the largest number of nests.

"Polar bears have recently extended

their marine hunting habitat to land," says Prop. "In Svalbard, this has become very evident by a large number of bears spending the summer on shore."

The change in behavior has also dramatically affected the nesting success of other geese—known as barnacle geese—along the Svalbard coast. For successful hatching of their eggs, barnacle geese depend on coastal islands that Arctic foxes can't reach. "These islands are easy targets, however, for polar bears in search of food," says Prop, "leading to an almost complete breeding failure of barnacle geese."

Last summer, "barnacle goose egg predation by polar bears was more severe than we had witnessed before, with not one nest surviving along the 25 miles of coastline where we're conducting research," Prop says. "And nearby eider nests produced young only when they were well-hidden between rocks."

The polar bears also arrived onshore a month earlier. A decade ago, a few came in July. Last season, many more showed up in June, right in the middle of nesting season.

It's likely, says Prop, that the bears' interest in bird eggs "stems from the deteriorating conditions of their main hunting habitat—sea ice—which makes their ringed seal prey inaccessible."

Are polar bears a long-term threat to Svalbard's geese and seaducks? "The answer depends on changes in the bears' food availability," says Prop, "and to what extent bears are pushed to exploit resources other than seals."

The breeding success of Svalbard's birds may decline, the scientists believe, as more bears are forced to extend their hunting range inland, thereby finding goose and eider nests.

In a cascade of events, if ringed seals continue to go under, they may take waterbirds with them.

## THE LAST RINGED SEAL—AND POLAR BEAR?

Ringed seals raise their pups in "snow caves that form atop sea ice. But the caves are dwindling in size and number. Late ice formation in fall, rain-on-snow precipitation in late winter, and early ice breakup in spring are to blame. By the end of the century, snow depths may be too low for the caves to form.

Can anything be done for ringed seals and polar bears? We can help wildlife

**Cheryl Lyn Dybas** (cheryl.lynn.dybas@gmail.com), a Fellow of the International League of Conservation Writers, is a contributing writer for *Oceanography* and a marine ecologist and policy analyst by training. She also writes about science and the environment for *National Geographic*, *Natural History*, *World Wildlife*, *Africa Geographic*, *BioScience*, *National Wildlife*, *Scientific American*, and many other publications.



cope with the effects of global warming by ensuring that species have space to move along with a changing climate, scientists say, and by conserving and restoring connectivity between habitats.

In December 2014, the US National Marine Fisheries Service (NMFS) proposed to designate 900,000 square kilometers in the Bering, Chukchi, and Beaufort Seas off Alaska as critical habitat for ringed seals. It would be the largest-to-date such critical habitat.

NMFS also listed four ringed seal subspecies—including the Arctic subspecies, which lives in the proposed critical habitat area—as threatened under the US Endangered Species Act.

The critical habitat designation would add an extra layer of protection for ringed seals. That's especially important, researchers say, where the seals may be forced to move to find sea ice.

Projections are for patches of sea ice to remain frozen for some time, providing habitat for isolated ringed seals and polar bears. But, ultimately, there is no adaptation strategy for loss of sea ice.

The polar bear is among the species featured in the 2014 publication *Vanishing: Ten American Species Our Children May Never See*. According to the report, the only thing that can ensure that our grandchildren live in a world with wild polar bears is to dramatically reduce our emissions of carbon dioxide.

If we fail, Earth's last polar bear may not drift into the beyond on a last sliver of sea ice. Barely subsisting on goose eggs and starfish, she or he may be a skeleton lumbering across barren ground, the last in a procession to a polar bear graveyard.

