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 18th and December 5th,” 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
WHAT’S A POLAR BEAR TO DO WHEN RINGED
WITHOUT SEALS,

Some bears are already switching their
prey to snow geese, caribou, and even
starfish to survive in a rapidly warming
environment. “Polar bears are opportun-
tistic and eat what’s available,” says
Gormezano. “They may glean some nutri-
ents, 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 jour-
nals Polar Ecology, Ecology and Evolution,
and BMC Ecology.

From 2010 to 2012, the researchers
assessed the breeding success of pink-
footed goose 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 loca-
tions 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 spend-
ing the summer on shore.”

The change in behavior has also dramat-
ically affected the nesting success of other
goose—known as barnacle geese—along
the Svalbard coast. For successful hatch-
ing 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 pre-
dation 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
ests 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’ inter-
est in bird eggs “stems from the deter-
riorating conditions of their main hunt-
ing 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.
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.