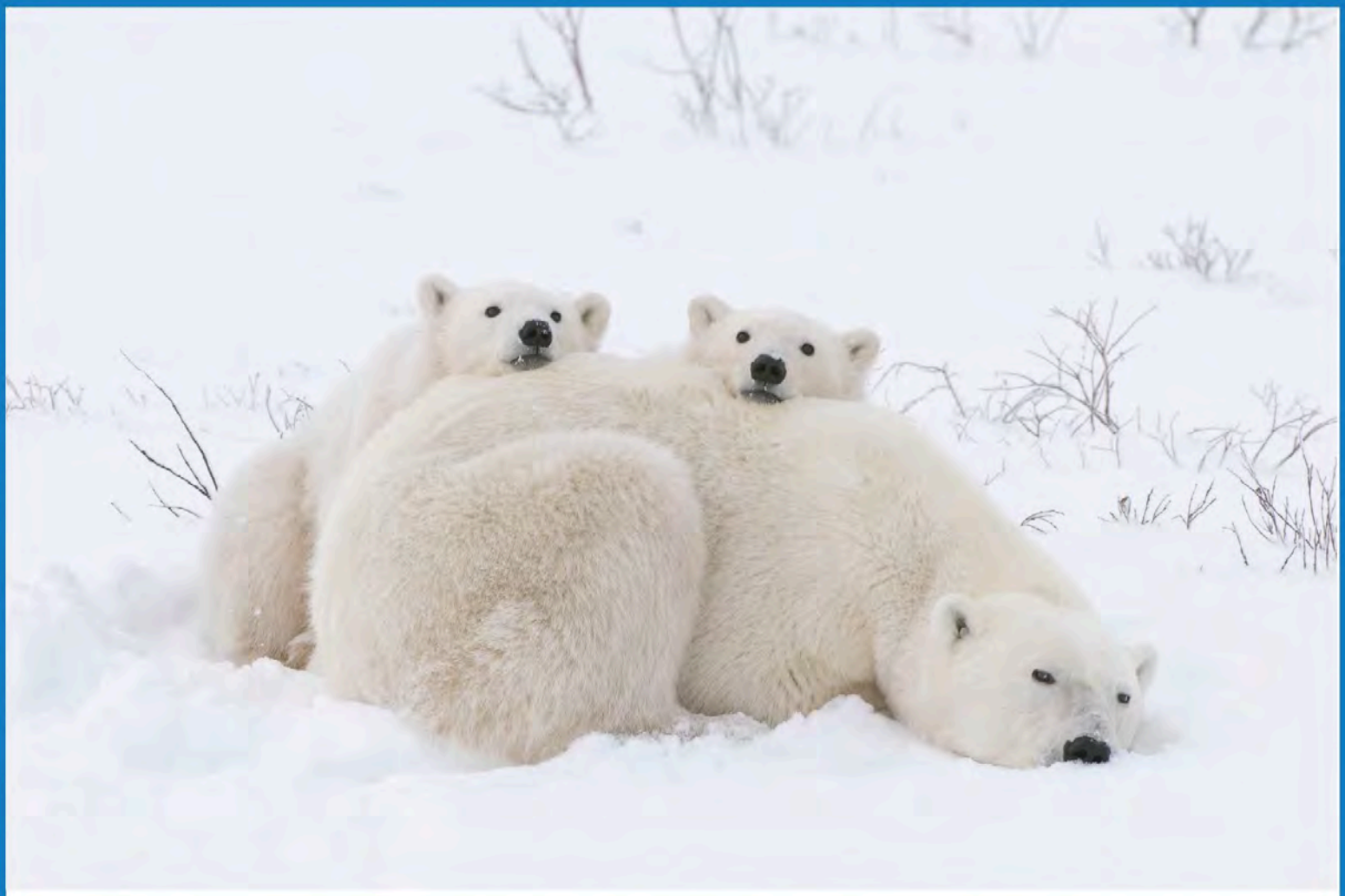

Polar Bear Handbook for Arctic Guides

2nd Edition

POLAR BEARS INTERNATIONAL

Polar Bear Handbook for Arctic Guides

Polar Bear Handbook for Arctic Guides
2nd Edition
Published by Polar Bears International

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Cover Image: Polar bear mom and cubs in the Western Hudson Bay
© Daniel J. Cox / NaturalExposures.com

Polar Bears International (PBI) is the only nonprofit organization in the world dedicated solely to protecting the future polar bears and the Arctic sea ice they depend on.

Recognized as a global leader in the field, PBI leverages a team of leading scientists and conservationists to advance crucial research and coexistence strategies. Registered in Canada and the United States – but working across the Arctic – the organization aims to inspire people worldwide by highlighting the urgent threats to the Arctic, and the direct connection between this remote region and our global climate.

polarbearsinternational.org

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Executive Summary

Professional tourism and adventure guides are at the forefront of polar bear conservation outreach. As trusted messengers, you introduce visitors from all over the world to the bears and their unique ecosystem. This handbook is intended to bring you — and your guests — the latest in polar bear science.

Polar bears are creatures of contrasts. The largest bears in the world, they begin their lives blind and helpless and weighing no more than a kilogram (2 lbs). Known for its white colouring, polar bear fur is in fact translucent and only appears white because of the way it refracts sunlight; not only that, but the skin beneath that fur is actually black. The combination of hollow, air-trapping hairs, black skin and a thick layer of fat helps keep polar bears warm in one of the planet's coldest environments.

Polar bears are the world's largest land carnivores, but in many jurisdictions, they are considered marine mammals. They are completely tied to the marine ecosystem because they primarily prey upon ice-dependent marine mammals such as ringed and bearded seals. Even though they are excellent swimmers, it is extremely rare that polar bears attempt to catch their prey in the water, where they would be at a disadvantage; instead, they access marine life from open leads and breathing holes in the water's frozen surface.

Polar bears are creatures of the sea ice. It is on sea ice that they spend the bulk of their time, wandering across hundreds or even thousands of miles each year. They seek out patches of open water where seals may surface; they may also simply wait by breathing holes that seals have carved into the ice. During springtime, they scour the ice for snow dens where seals are raising their pups, using their massive front paws to crash down through their roofs in search of the prize inside.

The Arctic is a harsh environment, and even animals as superbly adapted to it as polar bears need every available opportunity to feed in order to survive. However, as climate change has gripped the Arctic, sea ice has decreased in thickness and extent – and, most importantly, has been melting earlier in the spring and freezing later in fall.

One consequence of longer sea-ice-free periods is that bears start looking elsewhere for food, and that includes human camps and settlements. Hungry polar bears may be attracted to the smell of food and garbage, on occasion resulting in encounters with unsuspecting humans — which rarely end well for either.

Addressing climate change and reducing or reversing sea ice loss is vital for polar bears, but it is also important for the people who make the Arctic their home.

And as the ice melts, other ice-dependent Arctic species, including the seals on which polar bears feed, are also at risk. In a sense, polar bears are the "canaries in the coal mine" for climate change, their fate reflective of the fate of the Arctic as a whole, and beyond.

Polar Bear Facts and Figures

Here is a selection of facts and figures that shows how fascinating polar bears are:

Size

	Adult male	Adult female	Cub - 1 year	Cub - 3 months	Newborn
Weight	350-600 kg (770-1,320 lbs)	150-290 kg (330-639 lbs)	45 kg (99 lbs)	13 kg (28 lbs)	500-700 g (1.1-1.5 lbs)

Walkers and Swimmers

- Polar bears travel immense distances. They can travel more than 3,000 km (1,864 miles) over the course of a season and can have home ranges that exceed 500,000 km^2 (193,000 sq mi).
- The polar bear's scientific name *Ursus maritimus* means "sea bear". Unsurprisingly, polar bears are at home in the water.
    - In 2014, a polar bear off Svalbard was recorded diving for three minutes and 10 seconds while attempting to prey on some bearded seals on an ice floe.
    - In 2011, an adult female polar bear was recorded swimming in the southern Beaufort Sea north of Alaska for 232 continuous hours over a distance of 687 km.
- However, such extreme swims are rare and come at an immense energetic cost to the bears. Cubs are unable to make long swims due to their lack of body fat and strength.
- As sea ice retreats, bears are forced to swim longer and longer distances in open water.

From Brown to White

- Polar bears are very closely related to brown bears; a 2012 study concluded that they separated from a common ancestor 5 million years ago, although a more recent analysis suggests it was much more recent, perhaps as little as 500,000 years ago.
- Fossil evidence shows that polar bears as we know them have existed for at least 120,000 years.
- Brown and polar bears are so closely related that they can interbreed—and, in at least a couple of cases in the wild, have done so, though this is very rare.

A visitor at Polar Bears International House in Churchill, Manitoba takes a photo of a life-size paw replica display. © Madeline Grant / Frontiers North Adventure

Evolutionary Adaptations

Polar bears have several traits that distinguish them physically from brown bears and enable them to thrive in an Arctic environment:

- Their **necks and snouts** are significantly more elongated than those of brown bears. These serve multiple functions, including enabling them to sniff prey from possibly more than 1 km (.6 miles) away (depending on wind direction). Longer necks and snouts also help polar bears keep their heads above water when swimming and allow them to shove their heads into holes in the ice to seize and retrieve seals just below the surface.
- Their massive **paws** can reach up to 30 cm across—the size of a dinner plate. These paws act as snowshoes, allowing polar bears to walk efficiently and quietly across the snow and ice. They are also effective "paddles" for swimming, as well as very useful cudgels for subduing seals. Tufts of fur between their toes and foot pads help with warmth. Their footpads are covered by soft, small bumps known as papillae that grip the ice and keep the bear from slipping.
- Their **mouths** contain 42 razor-sharp teeth that are specially adapted for grabbing and holding prey animals and shearing fat and meat from their carcasses.
- Their **ears** are smaller than those of brown bears, to minimize heat loss.
- The **hairs** in a polar bear's pelt are hollow, allowing air to become trapped and warmed, providing an additional layer of protection against the cold. Polar bears are so well insulated that, even in their Arctic domain, their biggest challenge is generally keeping cool, not warm, and they can frequently be seen flattening their bodies against the ice to cool down.

More online:

- Polar Bear Biology and Genetics
- Adaptations & Characteristics (including 3-minute overview video)
- Classroom Resources - Units & Lessons

What—and How—Do Polar Bears Eat?

Polar bears are creatures of the sea ice, and almost all their prey also live on and around sea ice.

Hunting

- Polar bears hunt primarily by using a sense of smell so strong that they can smell prey from over 1 km (.6 mi) away.
- Even though polar bears are excellent predators, it is estimated that often only a small percentage of their hunts end in success.
- A polar bear can eat 45 kg (99 lbs) of food in one sitting.
- Although polar bears eat mostly ringed and bearded seals, they will also hunt smaller walrus, and other small pinnipeds where available. In some places, they may supplement their diet with carrion or reindeer, or in rare cases beluga whale, bird eggs, kelp, or whale carcasses.

A polar bear waiting by a seal hole | © Madison Stevens / Polar Bears International

Polar bears employ two principal methods of hunting:

- *Stalking*: The polar bear flattens itself on the icy ground and slowly creeps toward a seal that is on the ice. If the seal raises its head, the bear will freeze before slowly creeping forward again. Once it is within about 6m (20 ft) of the seal, the bear uses its explosive speed to pounce. A polar bear may also swim quietly up to a seal asleep on the floe, then leap out of the water to try and take its prey by surprise.
- *Still Hunting:* Seals use long claws to open and maintain breathing holes in the ice. Polar bears use this to their advantage. A bear patiently waits next to a hole until it senses a seal approaching from below and then grabs it as it pokes its head through. In a variation of this approach, bears sniff out the lairs that ringed seals build over those holes when they are giving birth and raising their young. They creep up to the lairs and, if they smell or hear movement inside, break through the roofs by punching down with all their weight on their front paws.

A ringed seal | © Dr. Steven C. Amstrup / Polar Bears International

Ringed seals

Most of the time, polar bears eat seals, particularly a species known as the ringed seal (*Pusa hispida*). Widespread throughout the Arctic, Ringed seals measure about 1.25 m (4 ft) in length and weigh approximately 50-65 kg (110-143 lbs). There are estimated to be more than 2 million in total.

A polar bear's favourite part of the seal to eat isn't the meat, but the seal's thick layers of blubber, which are full of calories and easier to break down. When a bear kills a ringed seal, it normally tears away chunks of fat and swallows them without chewing, as it tries to consume as much as possible before any other bears or

scavengers catch the scent. As the meal progresses, it will use its incisors to shear the last of the fat from the meat.

Unlike brown bears, polar bears do not normally cache their kills. Once a bear has finished eating, it will normally leave the carcass on the ice, where it will swiftly be eaten by other polar bears and scavengers like Arctic foxes. When hunting is good, polar bears might eat just the calorie-dense fat on a seal or marine mammal and leave the meat, optimizing their energy intake.

A bearded seal | © Kt Miller / Polar Bears International

Other prey

Although ringed seals are polar bear's principal prey, they also eat other species when the opportunity presents itself.

- *Bearded seals*: Less numerous than ringed seals, they generally rely on natural openings in the ice rather than carving their own breathing holes. This makes them less reliable prey than ringed seals, but because they are much larger—reaching almost 2.5 m (8 ft) in length and weighing up to 350 kg (770 lbs). They are prized prey, although only accessible to larger male bears.
- *Walruses*: With their thick hides and long incisors, walruses are dangerous prey. Only a very desperate and hungry bear would attempt to take on an adult walrus, not least because the huge animals congregate in large herds. However, bears will sometimes prowl along the edges of a herd, hoping to spark a panicked rush into the water, so they can quickly snatch a pup or the carcass of a walrus that has been trampled.
- *Belugas*: Polar bears sometimes are able to take belugas, which can weigh up to 1600 kg (3,500 lbs). Most often, they use their massive paws and long claws to snatch them out of the water while standing on the shore, particularly when the whales are trapped in a small pocket of open water known as a polynya. Very occasionally, they have even been seen leaping onto belugas' backs.

- *Other Prey and Food Items*: Polar bears that are unable to reach sea ice may turn their attention to other available food sources. Polar bears in Svalbard have been observed chasing down and killing reindeer, while other bears have been observed eating seabird eggs—even climbing cliffs to reach the nests. Bears in Western Hudson Bay frequently will eat birds or voles, or even munch on kelp, to tide them over while they wait for the bay to freeze. Polar bears may frequent subsistence whaling communities to feast on bowhead whale carcasses. All of these, however, are responses to specific opportunities, and none, aside from whale carcasses, provide the same caloric density as blubber from marine mammals, the high-fat diet that polar bears require.

Polar bear mother and cubs | © Erinn Hermsen / Polar Bears International

A Polar Bear Life: Season by Season

Spring

Spring is the season when the Arctic comes to life, and the time of year when polar bears have the most success hunting. In March and April, polar bear cubs and mothers emerge from their dens just as ringed seals are giving birth to their pups. Ringed seal mothers build dens on the sea ice in which to give birth and nurse their young; polar bears sniff out these dens and smash through their roofs to reach the pups inside.

Later in the spring, ringed seals haul out on the ice for extended periods when they shed and regrow their fur. As they molt, they experience increased blood flow to their skin to support the tissue regeneration. This limits heat loss, but makes them less protected from icy waters and more reluctant to swim, leaving them vulnerable to another wave of polar bear predation.

Meanwhile, female polar bears without cubs enter estrus during spring. Adult males follow their scent, which is secreted through their paws, sometimes for kilometers and kilometers, fighting each other off in an attempt to mate. See Mating for more information.

- What do polar bears do in spring?

Summer

Exactly how polar bears spend their summers depends largely on which part of the Arctic they live in. For example, in the most northerly parts of Canada and down the east coast of Greenland, sea ice persists year-round. Polar bears here traditionally have not had to change their behaviour much from season to season, though prey availability may shift seasonally.

In other areas, including Svalbard, currents pull sea ice away from the shore during summer. Svalbard bears therefore either choose to travel with the ice or to stay on land until the ice returns. On Wrangel Island in the Chukchi Sea, bears travel back and forth between land and ice.

In some parts of their range, such as Western Hudson Bay, where the sea ice melts completely each summer, the bears come ashore and rest and wait until the ice forms again. During this time, they can lose as much as 1 kg (2.2 lbs) of weight every day.

- What do polar bears do in summer?

Fall

Polar bears that have stayed on the sea ice as it has been pushed away from the land remain far out at sea, hunting seals. As the weather cools again, whether they stayed behind when the ice moved out or stayed ashore after the sea ice melted completely, all polar bears anticipate the ice's return.

The most famous example is in Western Hudson Bay, where each fall the bears pass through and around the town of Churchill on their way to the bay's shore, waiting for the water to freeze. As they wait, males sometimes engage in "sparring," or mock fighting, which exercises the muscles they need for hunting and may help the bears establish a hierarchy.

As soon as temperatures drop low enough the ice starts to freeze. As the ice solidifies, polar bears walk out to begin hunting. Meanwhile, pregnant females make or find dens and wait to give birth.

- What do polar bears do in fall?

Winter

Polar bears do not hibernate in winter. In fact, they are quite active during the coldest, darkest months of the Arctic year. But life in winter can be a challenge even for this hardy species.

Although there may be plenty of sea ice, in many parts of their range there are few fractures, fissures, and openings where polar bears can wait for seals to appear. Additionally, ringed seals spend far less time on the surface of the ice in winter than they do during the rest of the year, so they are harder to find and hunt. And, of course, the Arctic winter is dark and ferociously cold, and can be extremely windy. The wind can make it difficult for bears to use their sense of smell to hunt, so they may adjust their path based on wind direction. Polar bears have been documented walking cross-wind to pick up as many scents as possible, then turning upwind when they smell something interesting. But, when the wind is too harsh the bears may spend large periods of time sheltering from the wind and the cold, waiting for spring to return.

Meanwhile, deep in their warm dens, pregnant females give birth to their young cubs around late December. Sheltered from the elements outside, the cubs grow rapidly on their mother's fatty milk. When they're born, the milk is over 30 percent fat, the fattiest of any mammal on land. Over time the milk will decrease in fat and calories as cubs learn to eat seals, but they may still nurse until they're weaned at about 2-3 years old. Mom and cubs will stay in their dens for roughly 8-12 weeks, until it is time for them to emerge into the open so their mother can take advantage of the seal pupping season. The annual cycle begins again.

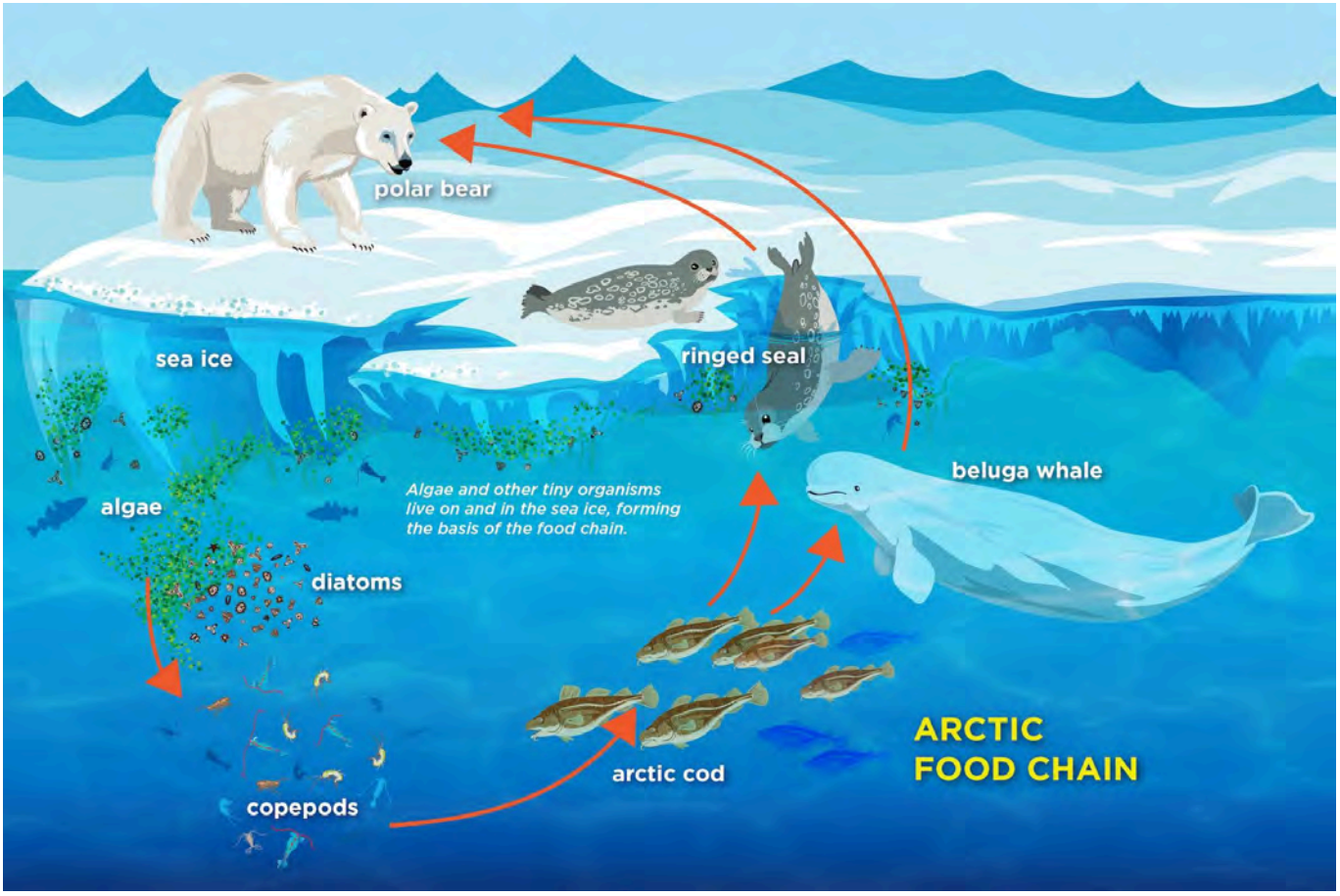
- What do polar bears do in winter?

Sea ice

All polar bears live in the Arctic or subarctic, spending most of their time on sea ice and primarily eating seals, especially ringed seals. However, conditions vary; in some parts of their range sea ice melts each summer, whereas elsewhere it may persist year-round. These differences mean that polar bears experience different challenges, depending on which part of the Arctic they call home.

Why is sea ice important to polar bears?

- One simple reason is that polar bears need sea ice **because their prey needs sea ice**.
  Polar bears feed primarily on ringed seals, which use their long claws to carve open breathing holes in the ice. One way polar bears hunt seals is by locating those breathing holes and waiting for seals to emerge.
- In addition to ringed seals, polar bears also prey on bearded seals, walruses, and sometimes belugas—all marine mammals. However, while polar bears are excellent swimmers, they **cannot compete with any of those species in the water**; being on the sea ice enables them to wander vast distances in search of their prey species, all of which must come to the surface to breathe. When they do, a nearby bear can take advantage.
- The sustenance that polar bears can gain from fatty seals and other marine mammals is **far greater than anything they can get from land-based prey** in the Arctic — blubber contains *many* more calories than carbohydrates or protein. Therefore, they need sea ice so they can travel far across the ocean's frozen surface to reach their prey. While polar bears could stay on land and eat only terrestrial species, they would not be able to obtain enough calories to maintain their body mass or reproduce.
- While thick ice, like multiyear ice, may provide a more stable platform for traveling, if the ice cover is *too* thick or extensive, hunting is difficult. Polar bears use **leads, or gaps in the ice**, to provide access to the ocean below, through which seals may surface to breathe, and the ice floes need to be thin enough to allow ringed seals to maintain their breathing holes.
- Sea ice is not just important for seals and polar bears: It is literally essential to life in the Arctic ecosystem. **Sea ice is to the ocean as soil is to a forest.** When the surface of the water freezes, it traps tiny algae inside, which spend the winter in little channels in ice floes. When the sun returns in spring and ice begins to melt, these algae are released into the ocean below, kick-starting an explosion in productivity. The algae are eaten by microscopic animals, which are eaten by small fish, which are eaten by larger fish, which are eaten by seals, which are eaten by polar bears. Without sea ice in the Arctic, entire food chains would be disrupted.



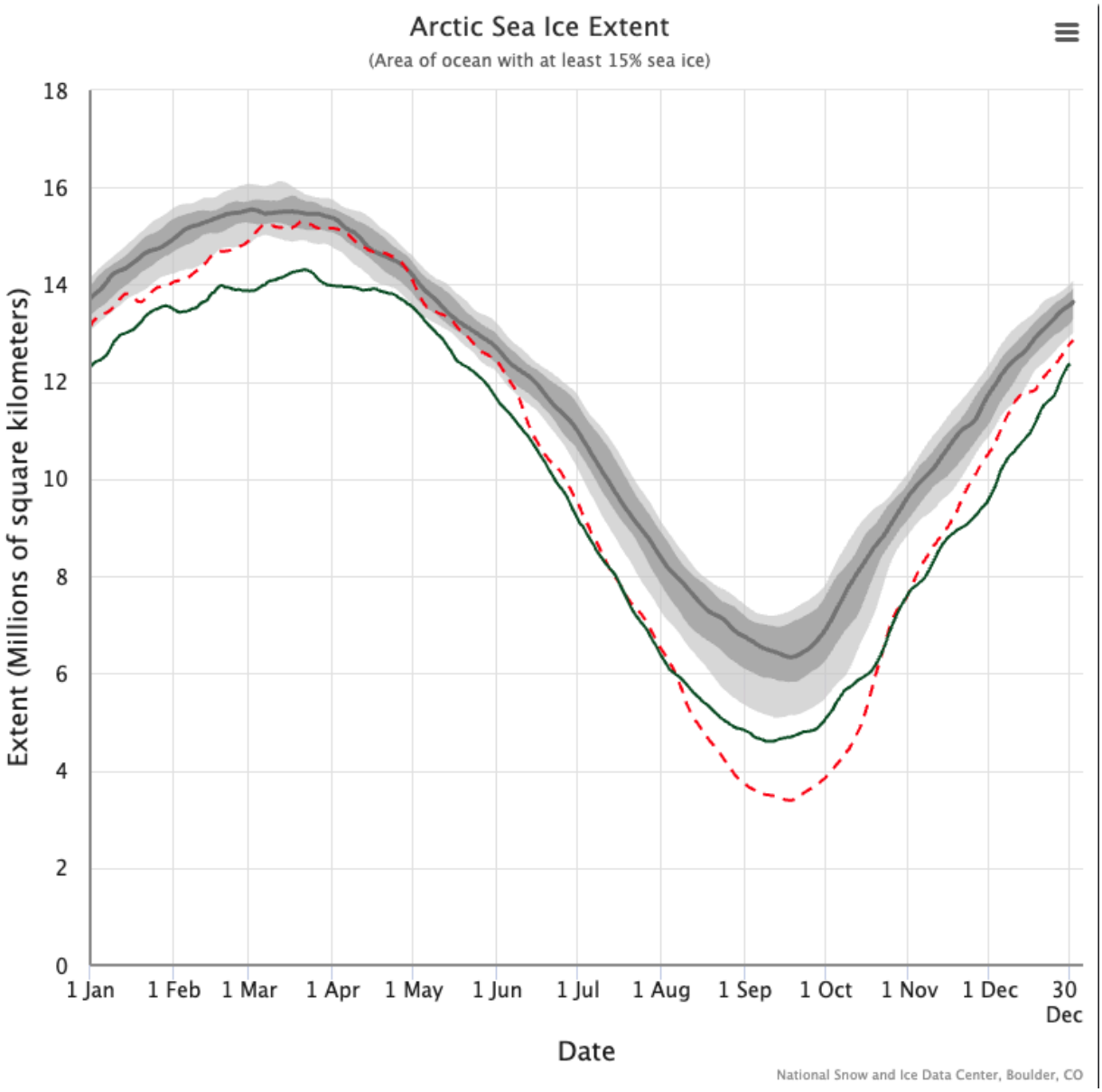
The Arctic food chain| Illustration by Peppermint Narwhal

What's happening with sea ice?

As the seasons change, Arctic sea ice cover expands and contracts. It generally reaches a maximum each March (although it can be as early as late February and as late as very early April) and decreases over the course of the summer until it reaches its minimum level for the year in September, before growing again over winter.

Declining extent

In recent decades, Arctic sea ice has been declining in extent. Overall, winter sea ice extent in the Arctic has been declining by approximately 2.6 percent per decade. In the summer, however, it has been diminishing more rapidly: by about 12 percent per decade.



This chart shows the declining extent of sea ice over the course of the year since 1981. Sea ice extent in 2025 (green) was below the 1981-2010 median extent (dark grey) at all times of year. Source: National Snow and Ice Data Center.

Arctic summer sea ice extent hit record lows in 2002, 2005, 2007, and 2012; that last year remains the record, but the past decade has seen a “new normal,” with sea ice extent so consistently reduced that the lows of 2002 and 2005 are no longer in the Top 10.

Declining thickness

A primary reason sea ice is diminishing much more rapidly in summer than in winter is because, year by year, it is declining in thickness. In the 1980s, older, thicker ice constituted roughly 30 percent of the Arctic ice pack; by the 2010s that had plummeted to five percent. That is because, over time, thicker ice has simply melted away; and although sea ice continues to reform each winter, because it is now thinner it is less resistant to melting away in the summer.

Feedback loop

In addition, as sea ice melts, it exposes more open water, which absorbs more heat and contributes to further warming and melting. This is why Arctic sea ice cover has been described as being in a “death spiral.”

Polar bear on sea ice.
Photo: Daniel J. Cox / Natural Exposures

Sea ice ecoregions

Researchers divide polar bear habitat based on similar sea ice conditions into four "*ecoregions*."

- Polar Bear Habitat
- Video: Sea Ice Ecoregions

Divergent Sea Ice Ecoregion

In this region, which includes the Southern Beaufort Sea, Chukchi Sea and the Barents Sea, ocean currents continually carry sea ice away from shore as it forms.

During winter, that ice is replaced by new ice as it forms; in summer, ice continues to move offshore but no new ice replaces it close to the coast. Historically, this left only a relatively small stretch of water between land and ice; now, however, ice is retreating farther offshore in the summer, forcing bears in this ecoregion to choose between traveling with it or staying on land for the summer. On Svalbard, the majority of the bears in this population — numbering nearly 1,000 — choose to stay with the ice ("pelagic" bears), but 200-300 or so choose to remain on the archipelago year-round ("coastal" bears). In the Southern Beaufort Sea, as the ice drifts away from shore, bears cover immense distances - on average, an area of more than 57,000 square miles - each year in search of suitable prey and habitat. Traditionally, Southern Beaufort bears made dens on the sea ice, the only population to do so, although they have reverted to denning on land now that sea ice in the region is thinner and less extensive.

Divergent sea ice ecoregion | © Polar Bears International

Coastal Alaska, Chukchi Sea Russian Arctic, Svalbard, and the Barents Sea

Convergent Sea Ice Ecoregion

The same currents that pull sea ice away from shore in the divergent sea ice ecosystem carry much of that ice across the polar basin to the waters and coasts of the Convergent Sea Ice Ecosystem. There, it collects along the shore, providing the bears of this ecoregion with access to sea ice, and to the shallow, productive waters beneath, all year, even in summer.

Historically, this area has seen some of the highest concentrations of "multiyear" ice—the thickest, oldest ice, that builds up over years and, because of its thickness, is the most resistant to melting. The region includes the Tuvaijuittuq Marine Protected Area, also known as the Last Ice Area, because models suggest that this is the region where year-round sea ice is likely to persist the longest in a warming world.

Convergent sea ice ecoregion | © Polar Bears International

Eastern Greenland, north of the Canadian Arctic Archipelago, and the northern Beaufort Sea

Archipelago Sea Ice Ecoregion

The narrow channels of the Canadian Arctic Archipelago have thwarted and crushed the ships of many generations of explorers seeking the Northwest Passage, and even in a time of diminishing sea ice as a result of climate warming, they have maintained much of their ice cover all year long.

This ecoregion includes an area that, along with the northern part of the Convergent Sea Ice Ecoregion, is likely to provide a refuge for polar bears found there, although the southern parts of the region have increasingly seen ice-free periods in summer.

Archipelago sea ice ecoregion | © Polar Bears International

The islands and channels of the Canadian Arctic Archipelago

Seasonal Sea Ice Ecoregion

In this ecoregion, which is largely in the southernmost extent of the polar bear's range, sea ice melts completely in the summer. As a result, bears must come ashore for the summer months and wait for the sea surface to begin freezing again in late fall.

The most famous example is the Western Hudson Bay polar bear population that passes through and around the town of Churchill, Manitoba, each fall as bears head to the bay in anticipation of the ocean freezing again. Because the amount of time they spend on the ice each year is already limited compared to bears elsewhere, the bears in this ecoregion are especially vulnerable to the impacts of a warming climate. Studies show that bears in Baffin Bay are skinnier and raise fewer cubs successfully, while the population of Western Hudson Bay had fallen from 1,200 in 1987 to 618 in 2021.

Seasonal sea ice ecoregion | © Polar Bears International

Central and eastern Arctic Canada, and western Greenland

Mating

Polar bears are polygynous: one male will mate with several females each mating season.
In polygynous species, the males are normally much larger than the females and compete aggressively with each other for the right to mate, and polar bears are no exception. In fact, polar bears are considered "dimorphic," meaning two sizes, since males are over twice as large as females.

Finding Each Other

Because polar bears cover huge distances on their travels, and because they range across the ice at low densities, simply finding each other to mate can be a challenge. For males, an additional difficulty is that mothers keep cubs with them for up to two and a half years, during which time they do not enter estrus and stay as far away as possible from large males; as a result, only about a third of adult females are available for mating at any given time.

Fortunately, female polar bears have evolved a means of signaling their availability to mate: They secrete pheromones through glands in their paws, leaving a scented trail that lets males know they are in estrus. Once a male picks up on this scent, he will follow it for long distances until he finds the female. But before he can hope to mate, he often must compete for her affection with other males—sometimes violently.

Competing for females

Female polar bears are sexually mature and start to mate at around 5 years old. Male polar bears are sexually mature at 3 years old, but genetic studies tell us that they don't have much mating success until they are larger. At age 6, the scars and cuts that are signs of fighting with other males for the right to mate with a female begin to appear. This suggests that males don't even attempt to compete for females until they are strong enough to hold their own with other mature males, which can take them into their early to mid-teens. Lending weight to this theory is the fact that males in mating pairs tend to be larger; they are possibly also more sexually attractive. Fighting-related injuries tend to become less frequent as a male ages, suggesting that older males reach an age where threats and displays of dominance are sufficient.

Courtship

There is limited direct observation of mating polar bears, but it has been observed and recorded in the wild. Here is what we know for now.

Females tend to be wary of large, adult males, which are much larger than them and have been known to kill and eat not just cubs but, in rare circumstances, also fully-grown females. So, when a male emerges victorious, or if a male reaches a female before any competition, he must first earn her trust. After herding her to a secluded spot away from any other potential competitors, he spends the next several days in close proximity to the female, until she finally allows him to make some physical contact.

Only after a week or so will she allow him to mate with her. And it is only now that she will ovulate, thus ensuring that her egg does not go wasted—this is called induced ovulation. Mating itself can last as much as two hours or more at a time, for several days in a row, after which the two go their separate ways and the male begins a search for another female.

Although the egg has now been fertilized, the full pregnancy is not yet ready to begin. The female must first spend several months building up her fat reserves, so after undergoing a few divisions, the zygote enters a state of dormancy known as delayed implantation. By around October, if her body has accumulated enough fat, the fertilized egg or eggs will implant and the cubs begin to grow until it is time for the female to give birth, generally in late December or January. If the female does not have enough body fat, the fertilized egg or eggs will either be shed or reabsorbed (scientists do not yet know which).

Interestingly, females often mate with more than one male. Genetic research has revealed that about 20 percent of cubs in litters larger than one cub do not share the same father.

Pregnancy

Several months after a female has mated, and if she's gained enough weight (sometimes hundreds of kg) and her body is in good condition (at least 200 kg, or 440 lbs), with plenty of fat from feeding on seals all spring and summer, the fertilized egg becomes implanted in her uterus. Late in the fall, as other polar bears take advantage of cooling temperatures and growing sea ice cover to start finding food, pregnant females prepare to spend the winter months in a den in the snow where they will give birth and nurse their young.

Mother polar bear and cubs | © Daniel J. Cox / Natural Exposures

Denning Period

In some locations, such as western Hudson Bay, a pregnant female may dig a den into the permafrost or use one that has already been dug. The females then wait for snow to fall and cover them up. Very few females make dens on the sea ice, and this has become less common, while most pregnant females dig directly into snowbanks. When they are comfortable and secure, they give birth—sometimes to one cub, sometimes to three, but most frequently two.

In the den, it is warm and comfortable. The mother's body heat elevates the temperature by as much as 25 degrees C (45 F) compared to the outside, and she constructs the den with a small opening and a narrow downward sloping tunnel to keep heat in.

- Top Mom and Cub Facts
- The Basics of Polar Bear Denning

A polar bear den | © Dr. Steven C. Amstrup / Polar Bears International

When the cubs are born, they weigh only around 500 g, about the size of a block of butter. The mother's milk is just over 30 percent fat and full of calories, so cubs grow rapidly and within three months can weigh about 12 kg (26 lbs). They can weigh well over 45 kg (99 lbs) by their first birthday, and can more than double that again by their second, with male cubs sometimes growing larger than their moms by the time they are weaned.

While she is in the den, for at least three months, a mother polar bear does not eat. In Western Hudson Bay, where the sea ice melts completely every summer, denning females have not eaten since coming ashore in June or July; by the time they emerge with their cubs from the den, they will have fasted for as much as eight months—what is believed to be the longest fast of any mammal.

The Timing Must Be Just Right

After many months in the den, roughly two to three of those months with needy cubs, the mother breaks through the snow and her cubs see the outside world for the first time. For the first several days, the family may not wander at all except to explore the immediate vicinity, stretch, and build strength in their legs; but within the week, the family will head to the sea ice to begin hunting seals.

Polar bear emergence is timed to coincide with when ringed and bearded seals are giving birth to their pups on the sea ice, providing the bears with a relatively easy feast of prey. If they emerge too early, there will not be enough seals to sustain them; too late, and they will miss the seals' peak availability, which could significantly impact the cubs' chances of survival.

Read more: Trophic mismatch

The first year of a cub's life is its most dangerous. On average, only 50 percent survive beyond one year of age. In parts of the Arctic where sea ice loss is greater, their survival rates are even lower. For those that do survive, the first two years of life are spent learning everything they can from their mothers. And then, in the spring of their third year, they become fully weaned. Their mothers enter estrus and begin mating again, and the young bears are on their own and considered subadults.

The next two and a half years are another difficult period for the young bears, as they leave their mothers and must compete with much larger, older bears. But if they make it to full adulthood at the age of about 5, their survival rates increase dramatically.

Living with Polar Bears

As climate change causes decreases in sea ice, polar bears are more likely to spend more time ashore and away from their seal prey. Inevitably, that will bring them closer to and into communities in the North, with the potential for tragic and possibly fatal interactions between bears and people, especially as the bears become hungrier. Here are some things to know about polar bear-human coexistence and how best to avoid bear attacks.

Polar Bear Attacks Are Very Rare, But Very Real: A 2017 study found records of just 73 documented attacks between 1879 and 2014, resulting in 20 human fatalities. But in small communities such as Arviat in Nunavut, or Wales in Alaska, which experienced fatal attacks in 2018 and 2023 respectively, such events are more than statistical outliers: they are devastating incidents that leave deep scars.

The Majority of Attacks Are from One Particular Subset of Polar Bears: The same study found that 61 percent of all attacks were by bears in below-average to poor body condition, with many of those being younger bears. Young bears, generally those between 2.5 and 5 years old, struggle to compete for food against larger, stronger bears, and are more likely to be hungry enough to take desperate measures due to their rapid growth, such as entering communities and even attacking people.

It Is Possible to Live Alongside Polar Bears: The town of Churchill, Manitoba, on the shores of Canada's Hudson Bay, is one example of a community that has adapted to living with polar bears. Every fall, several hundred bears pass near town in anticipation of the bay freezing. Although in the past that resulted in bears being shot, Churchill now thrives on polar bear tourism. Wildlife officers in the Polar Bear Alert program work with the community to keep bears and people apart, waste management is a high priority, and educational programs seek to inform residents and visitors alike on appropriate and safe behaviour.

Managing Attractants Is Key: The number of incidents in Churchill declined noticeably when the town closed its open-air dump. Removing food rewards for bears that enter communities is an important part of reducing the potential for negative bear-human interactions. Longyearbyen, Svalbard, is another example of a community that is managing waste well within town, notably with the construction of an indoor waste management facility and wildlife proof waste bins around the community. However, outside of town there have been more problems, as in the case of polar bears breaking into cabins to find food — a dangerous situation for both bears and people. More work needs to be done Arctic-wide to educate people about the importance of reducing attractants and eliminating food rewards.

A polar bear-safe garbage bin in Churchill | © Erinn Hermsen / Polar Bears International

Deterrents Are Important: Anybody living in polar bear country should have access to nonlethal deterrents. Handheld flares and bear spray are effective short range tools for deterring bears long enough for someone in a potentially dangerous situation to make an escape, while shotguns that fire blank cracker shells and longer range flares are also widely used. Polar bears are generally not interested in a fight, and many can be deterred by bright lights or loud noise.

Understanding Polar Bears: Anyone visiting, living in, or working in polar bear country should be aware of the basics of polar bear behaviour and how to respond should they encounter a bear. Technologies such as "Bear-dar"—a radar specially configured to recognize approaching polar bears may prove to be of use in specific situations. But the best long-term way to reduce the risk of polar bears entering areas where they may present a threat to people is to reduce the emissions of greenhouse gases so that bears can continue to find their preferred prey on healthy sea ice.

- Polar bear / human coexistence

Threats to Polar Bears

Despite living in a region where the human population is very low and thinly distributed, the bears face a number of conservation concerns that place their future at risk.

The IUCN Polar Bear Specialist Group lists the polar bear as a vulnerable species, citing sea ice loss from climate change as the single biggest threat to their survival.

Climate Change

Climate change is by far the most serious issue facing polar bears.

Polar bears need sea ice to reach their prey. Due to global climate change, sea ice is freezing later and breaking up earlier, and impacting their ability to hunt seals. We believe in being responsible with our natural resources and taking practical, common sense steps to address these problems before they get worse.

The atmosphere is like a blanket that surrounds the earth, making our planet habitable, and in just the right conditions for supporting life. When we burn fossil fuels like coal, oil, and methane gas for energy, we add more and more carbon dioxide into the atmosphere. This buildup thickens this "blanket," trapping in more heat around the earth, raising our average global temperature, and disrupting the climate.

The Arctic is warming much faster than the rest of the planet. In several regions, this is disrupting polar bear survival by reducing the amount of time polar bears have to hunt seals, increasing their fasting period, and forcing them to rely on their fat stores for longer. Already, in parts of the Arctic, this has led to a decline in polar bear populations. Research in the best-studied populations show that not only are the number of bears declining, but body mass is diminishing, and the number of cubs surviving to maturity is also decreasing in direct correlation with loss of sea ice. These impacts are expected to increase as the planet continues to warm.

Trophic mismatch

For polar bears, some parts of the year are tougher than others. For bears in many parts of the Arctic, especially those in which sea ice melts completely in the warmest months – for example, Western Hudson Bay - summer is effectively a time of fasting, as they wait for the ice to return.

Winter provides challenges of its own: while there is plenty of ice, conditions are often too harsh even for the comfort of polar bears, which are as likely to be curled up behind a ridge sheltering from a fierce winter gale as they are to be wandering in search of food. Ironically, winter poses an additional problem for polar bears in that sea ice may be so thick or uninterrupted by open-water leads that it makes hunting seals more challenging.

The sweet spot for polar bears and for all Arctic wildlife is springtime, when the return of sunlight prompts a surge in biological productivity. Key to that productivity is sea ice.

As sea ice forms, it traps multitudes of microscopic organisms within it, including unicellular algae and phytoplankton called diatoms.

Although sea ice is more saline than freshwater ice, it is fresher than the water from which it formed, as some salt is extruded during its formation. (The older the ice, the fresher it is.) With the return of spring, sunlight penetrates the ice and warms the water below, melting the floes from the bottom and creating a layer of relatively fresh water, complete with algae and diatoms, which – because freshwater is lighter than saltwater – floats at the surface. The sun's rays bathe it with warmth and light, these phytoplankton bloom, and the Arctic springs to life. These organisms are eaten by small zooplankton, small zooplankton are eaten by larger zooplankton, and so on, up to fish, seals and polar bears. The melting ice and the returning sun set in motion an explosion of life that is strong enough to sustain the Arctic marine ecosystem through much of the summer and into early fall.

Ringed seals time the birth of their pups to take advantage of this spring bounty, creating snow lairs on ice in which their pups are born and nursed. By that stage, newborn polar bear pups are three or four months old, but they have spent their short lives in dens that their mothers dug in the snow; their emergence from those dens is in turn timed to coincide with the availability of seal pups.

However, as a result of climate change, spring is now arriving earlier in the Arctic: according to a 2019 study by researchers from UC Davis, in parts of the Arctic as much as 16 days earlier than just a decade previously.

Such rapid change results in what is known as "trophic mismatches," defined as when the timing of events in the life cycles of interacting species (like predator and prey) falls out of sync.

In the maritime Arctic, an early influx of phytoplankton into the water raises the prospect of both polar bear cubs and their ringed seal pups no longer emerging in time to take maximum advantage of the spring bounty. That problem becomes especially acute with early spring melt of sea ice giving them less time in the latter part of the season as well.

The problem is further compounded in those parts of the polar bear's range in which sea ice all but disappears in the summer. In Western Hudson Bay, for example, pregnant females must endure an ice-free summer that is lengthening as a result of climate change, plus several months in the den without feeding – a seven-or-eight month fast that is the longest in the mammalian world. That leaves them severely depleted and in dire need of huge amounts of calories when they emerge in the spring. An inability fully to make up that caloric deficit because the seasons have effectively shifted can leave a polar bear mother, and hence her cubs, perpetually depleted, with potentially severe ramifications for the survival of both.

Pollution

Despite mostly living far from major population and industrial centers, polar bears can carry surprisingly high levels of toxic chemicals. This is because wind and ocean currents transport these pollutants into the Arctic, and they become increasingly concentrated in the food chain and are acquired in high doses by polar bears when they eat seals. Such pollutants can have impacts on bears' endocrine and reproductive systems, among other issues.

- Polar Bears and Toxic Pollution in Oceans

Disease

Like most bear species, polar bears are not very prone to disease—at least historically. Some viruses have been detected in polar bears in Alaska and Russia. In addition, some parasites, like Trichinella, are known to have infected the bears and incidence seems to be rising with warming temperatures.

The big concern for scientists is that more diseases will be introduced as the Arctic warms, due to increased human activity and the migration of lower-latitude species to the far north, with potentially fatal consequences.

Commercial Activities

Commercial activity in the Arctic has increased as the region becomes more accessible. These activities include oil and gas exploration and development, shipping, and mining—each with their own challenges.

Oil and gas activity, for example, not only brings the risk of spills, but could disturb polar bear moms and cubs hidden in dens under the snow—the most vulnerable time in their life cycle.

Increased shipping may disturb key prey species, disrupt sea ice and is another source of both air and water pollution.

Unregulated or Poorly Regulated Tourism

The growth in Arctic tourism has enabled people to see the region and polar bears more than ever before. That can only increase people's understanding of, and care for, bears, the Arctic, and conservation. However, it is important that such tourism be properly regulated and that visitors be fully educated to ensure that polar bears and people alike remain safe and that an increase in human visitors does not add to the pressures facing the bears.

Human-Polar Bear Conflicts

As sea ice retreats, polar bears are increasingly approaching and entering communities and camps out of naive curiosity or in search of food. As a result, sometimes bears and people come into conflict, which can end tragically for both. For that reason, organizations like Polar Bears International are working closely with Arctic communities to ensure they are supported and empowered in reducing or avoiding negative interactions with polar bears and that they have the necessary means to protect themselves by resolving such interactions as peacefully as possible when they do occur.

Polar Bears International is committed to building a network of polar bear smart communities, providing customized kids' safety colouring books, bear safety posters for visitors, technical support with installing electric fences, support for co-produced research to understand bear movements, deterrence equipment and front-line bear guard training to start up a polar bear patrol. We've also brought leaders from Canada's Hudson Bay coast to Svalbard, Norway to each others' communities to share their knowledge on living alongside polar bears.

- Safety video, downloads and more for Svalbard and Churchill

Overhunting

Hunting is important to some Indigenous peoples as part of both culture and subsistence. Vigilance is needed to ensure quota systems are sustainable, keeping hunting within the bounds that populations can support.

While climate change remains the overarching threat to polar bears, overhunting is a growing issue for some populations. This concern is being monitored closely by the IUCN Polar Bear Specialist Group, which is composed of scientists from the five polar bear nations — Canada, Russia, Denmark (Greenland), Norway and the United States.

The history of legal hunting

Historically, overhunting was the polar bears' greatest threat. From the 1800s up through the 1960s, commercial and later sport hunters greatly reduced polar bear numbers across their range. Populations rebounded in most places after the five polar bear nations signed the International Agreement on the Conservation of Polar Bears. The Agreement halted commercial hunting and significantly curtailed sport hunting.

The Agreement allowed legal, sustainable harvest to continue on a limited basis for Indigenous peoples in some countries, based on quota systems that allow populations to regenerate. These hunts have long been an important part of Indigenous cultural traditions and are part of subsistence lifestyles in some regions.

Current status

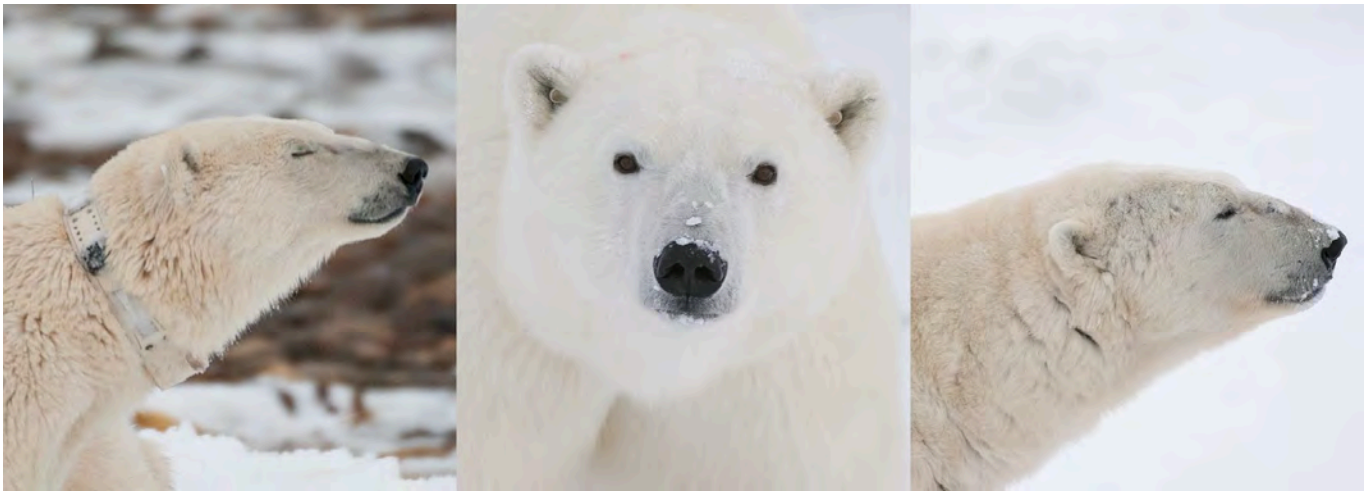
Partly due to other pressures, especially climate change, new research suggests that hunting could become unsustainable in some regions. This is a warning that these regions may require enhanced population monitoring.

A unilateral move by Nunavut, Canada in 2019 raises the long-term impact of hunting through the increased loss of reproductive females and the subsequent loss in reproduction. These changes affect roughly two-thirds of the global population of polar bears. It also impacts management in other countries and adjacent provinces/territories that share polar bear populations with Nunavut, which have had no direct say in the decision.

The IUCN Polar Bear Specialist Group has called out this threat and is in dialogue with members of the Polar Bear Range States — the global management body for polar bears—on the urgent need for Nunavut to address this.

Studying Polar Bears

Studying polar bears is extremely challenging. Polar bears wander vast distances through a habitat that is cold, remote, dangerous and dark for much of the year. So, scientists must find different ways to piece together as much information as they can.



A female bear with GPS collar (left), GPS ear tags (centre), and a male polar bear (right)
© BJ Kirschhoffer / Polar Bears International

Counting Bears and Gathering Data

Counting polar bears to determine the size and trends of populations is a critical conservation tool. One method is flying along predetermined transect lines with observers seated on either side of the aircraft counting the bears they see. This is much more difficult in the Arctic than it sounds, and has a wide margin of error. A more accurate variation is a “mark-recapture” study: Observers spot bears from the air and dart them with tranquilizer guns. They then land next to the bear, affix ear tags, and mark the bears with tattoos inside their lips. The idea is that over the course of a survey — which may last several years — a mathematical equation allows researchers to calculate how many bears there likely are in the population based on how many captured bears had been previously marked versus how many captured bears are unmarked. While the bears are tranquilized, they can also be measured and weighed, and samples can be taken (e.g., blood, fur). Researchers may also take fat biopsies that provide information about their health, genomics, and possible contaminants in their system.

Satellite Collars and Other Tools

To follow a polar bear year-round, scientists use satellite tags to track their movements and behaviours. Traditionally, these have been attached in the form of collars, which are designed to fall off after a preset period. Unfortunately, the necks of adult males are so large that collars slide off them and over their heads, and young bears can’t be safely collared as they are still growing. As a result, almost all the collar tracking data we have on polar bears is from adult females. Scientists are therefore continuing to explore other options, including satellite ear tags and other devices which can be attached to a bear’s fur and that fall off when the bear goes through its annual molt. In this way, any polar bear can be tracked.

- Population Studies

Watching on the Ground

Some behaviours can only be discerned from watching polar bears go about their daily business, but because of their extensive wanderings and wide ranges, such studies generally only take place where large numbers of bears congregate in relatively small areas. For example, in Western Hudson Bay each fall, bears gather along the coast waiting for the bay to freeze; it is here that young bears engage in mock-fighting, or "sparring." Also, Wrangel Island in the Chukchi Sea is a major polar bear denning area and has been the site of multiple years of ongoing polar bear studies. Researchers study known denning areas to watch mothers and cubs emerge in the spring. The pioneer of such in-the-field studies was the late Ian Stirling, who in the 1970s conducted a lengthy series of observations from atop a cliff on Devon Island, Canada; these studies provided much of what we know about some aspects of polar bear behaviour, including mating.

More recently, solar-powered remote cameras on Svalbard have allowed researchers to observe den emergence behaviour. This non-invasive study will help answer questions about the impacts of human disturbance on polar bears.

- Den emergence studies

Genetics Research

The fairly new field of genetics research with respect to polar bears can answer many questions, including how diverse the bears are, their genetic age—a robust marker for stress, and the role genes play in their survival. Studies can explore, for example, how adaptable a subpopulation is to environmental changes and can help answer questions on topics from hybridization to gene flow between populations. Such information may have increasing importance in conservation and policy decisions. Data for such studies can also be collected with biopsy darts that do not require the bear to be sedated or handled.

- Genetics Studies

Indigenous Knowledge

Inuit hunters and other Arctic Indigenous peoples who spend time on the land can see polar bears in the wild relatively often, and are familiar with aspects of their patterns and behaviours. Indigenous knowledge (IK) of polar bears is a valuable component of our understanding of these animals.

In addition to insights passed down from generation to generation, Indigenous Knowledge also encompasses current and more recent observations, including those related to polar bears in a warming Arctic. These

insights can deepen our understanding of the bears, and help guide management decisions. Other terms for this knowledge include Traditional Knowledge (TK), Traditional Ecological Knowledge (TEK), Local Ecological Knowledge (LEK), and, specific to parts of the Canadian Arctic, Inuit Qaujimajatuqangit (IQ). Many unique Indigenous cultures also have their own words for their knowledge in their own language.

- Indigenous Knowledge

Energetics research

A growing and vital field of polar bear studies is research into energetics: the study of how animals take in and expend calories. Like all animals, polar bears need to take in energy through feeding, and they use those calories to move, grow, produce offspring, and keep cells and tissues healthy.

Polar bears require vast amounts of energy, a trait that is common for large, predatory mammals, but their ability to hunt is being compromised by declines in the sea ice habitat where they catch seals. Reductions in hunting habitat mean fewer seals and fewer calories coming in, leaving polar bears with less energy available for reproduction and basic health functions, like repairing tissues and fighting off infections. The type of nutrients is also important: polar bear physiology is uniquely well-adapted for digesting and storing fat, limiting their ability to replace blubber with other types of food. Researchers have modeled how the availability of sea ice influences the balance of "calories in, calories out," and how dietary nutrients are stored (e.g., body fat content). These models can be used to predict events like mortality from starvation; such predictions were remarkably accurate at reconstructing recent changes in polar bear abundance in Western Hudson Bay, and are now being used to estimate how bears would respond to future sea ice scenarios.

This kind of granular research helps us gain a more detailed understanding of the way in which climate change and other pressures can affect specific populations under specific conditions.

Zoos

Polar bears in human care can provide insight that is impossible to obtain from bears in the wild. They fill knowledge gaps and answer basic questions, ultimately helping scientists better understand what polar bears need to survive in a rapidly changing Arctic.

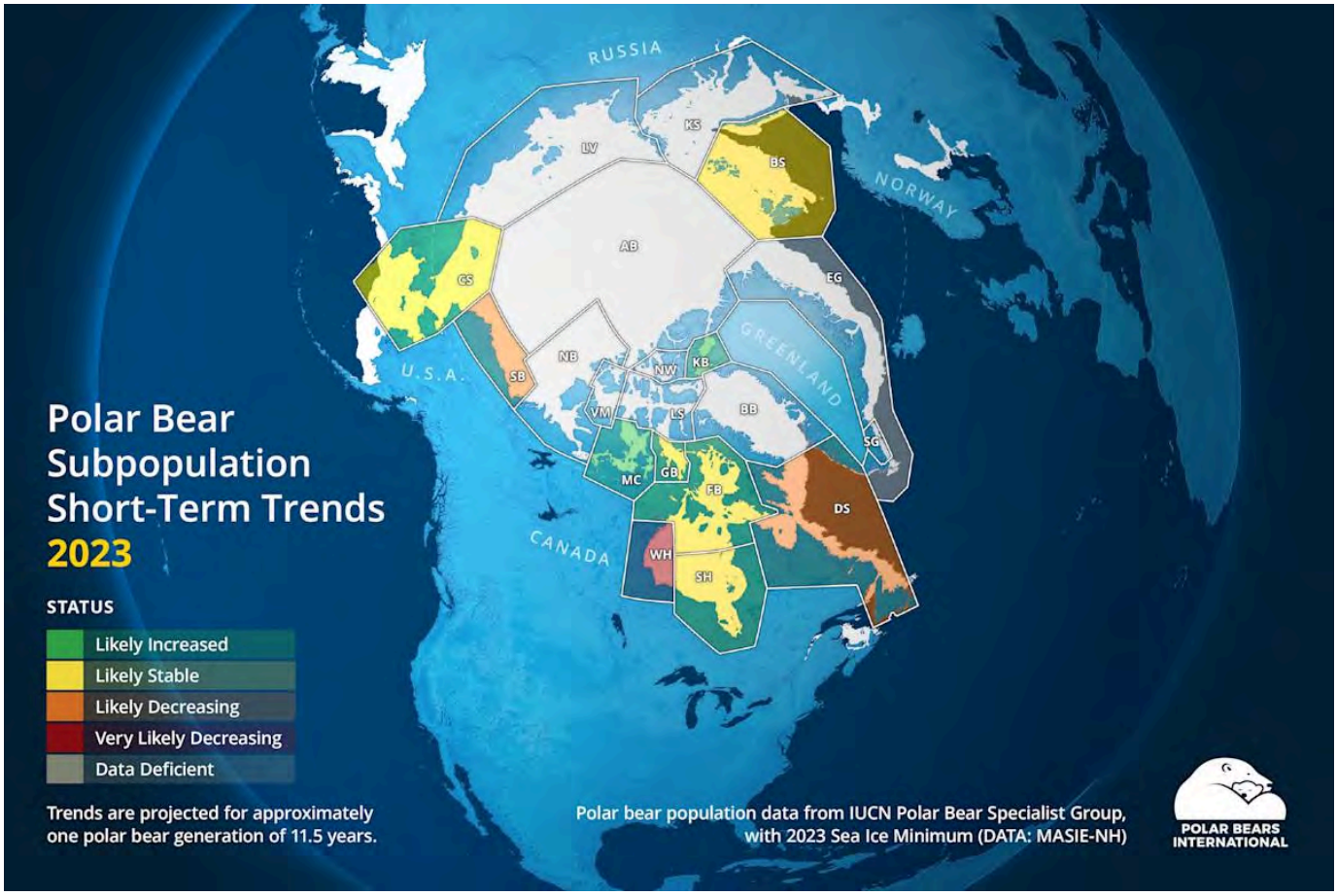
One common area of study is energetics: determining how much energy bears consume with different activities. Another includes research into their hearing range. Bears in zoos have also been extremely helpful in testing the efficacy of new tracking technology and calibrating physiological markers to make inferences about the diets of wild bears. Modern zoos train the bears to participate in their own health care, allowing close examinations, swabs and blood samples to enable longitudinal studies. They can also be trained to perform certain behaviours on cue, which has led to the testing of less invasive tracking methods and a better understanding of hearing sensitivity.

- Zoo-based research

Polar bear populations

- It is estimated that there are approximately 26,000 polar bears across the Arctic, divided into 20 subpopulations.
- Because polar bears are so difficult to study, accurate estimates are lacking for several populations.
- Two of the best-studied population — the Southern Beaufort Sea and Western Hudson Bay populations — are decreasing in number.
- Until recently, scientists classified the bears into 19 subpopulations. However, at the June 2024 meeting of the IUCN Polar Bear Specialist Group, scientists determined that a small number of bears in southeast Greenland, recently identified as the most isolated and genetically distinct in the world, should be recognized as belonging to their own subpopulation. What is especially notable about this is that the Southeast Greenland bears have responded to the loss of sea ice by hunting seals from freshwater glacial ice in fjords.

Status of polar bear populations



Population status (Polar Bear Specialists Group)

Population	Size (estimated)	Status (survey period)
Arctic Basin (AB)	Unknown	Data deficient
Baffin Bay (BB)	2284–3367	Data deficient
Barents Sea (BS)	1899–3592	Likely stable (2004 to 2015)
Chukchi Sea (CS)	1552–5944	Likely stable (2008 to 2016)
Davis Strait (DS)	1603–2588	Likely decreased (2007 - 2018)
East Greenland (EG)	Unknown	Data deficient
Foxe Basin (FB)	2096–3189	Likely stable (1994 to 2010)
Gulf of Boothia (GB)	949–2101	Likely stable (2000 to 2017)
Kane Basin (KB)	221–493	Likely increased (1997 to 2014)
Kara Sea (KS)	Unknown	Data deficient
Lancaster Sound (LS)	1759–3323	Data deficient
Laptev Sea (LV)	Unknown	Data deficient
M'Clintock Channel (MC)	545–955	Likely increased (2000 to 2016)
Northern Beaufort Sea (NB)	825–1135	Data deficient
Norwegian Bay (NW)	115–291	Data deficient
Southeast Greenland (SG)	Unknown	Data deficient
Southern Beaufort Sea (SB)	606–1212	Likely decreased (2001 to 2015)
Southern Hudson Bay (SH)	860-1454	Likely stable (2012 to 2021)
Viscount Melville Sound (VM)	93–229	Data deficient
Western Hudson Bay (WH)	425-899	Very likely decreased (2011 to 2021)

Learn about the 20 populations of polar bears and how they're faring: **Polar Bear Status**

Barents Sea (including Svalbard)

The polar bears in and around Svalbard are part of the Barents Sea subpopulation.
This population also includes a portion of the western Russian Arctic (Franz Josef Land), the sea ice between both archipelagos, and the sea ice to their north.

Population size: Around 2,650 bears (1,000 of in Norwegian territory, 250 of those local to Svalbard)

A century and a half ago, there may have been as many as 10,000 bears in the population, but beginning in 1870, hunters killed approximately 200 a year in Svalbard until Norway signed the International Agreement on the Conservation of Polar Bears in 1973, banning hunting.

What makes this population different:

Two different strategies: The Barents Sea is in the divergent sea ice ecosystem: currents pull sea ice away from shore as it forms. As a result, Barents Sea bears have adopted two different feeding strategies.
The majority (pelagic bears) head out onto the ice pack, traveling out to sea with it and covering as much as 500,000 km^2 (193,000 sq mi) in their search for food. About 250 remain ashore on Svalbard all year (coastal bears), hunting seals close to shore on "landfast" ice —ice anchored to the coast—and on glacial ice in fjords.

Whether a bear is a coastal bear or a pelagic bear seems to be influenced heavily by its mother's choice. Cubs born to coastal bears generally also become coastal bears. Indeed, a bear born in north Svalbard tends to remain in north Svalbard, while a bear born in the southern part of the archipelago is more likely to live most of its life there.

High density of dens: Svalbard, Franz Joseph Land and Novaya Zemlya have some of the highest concentrations of polar bear denning areas in the world. (Other high density denning areas include Western Hudson Bay and Wrangel Island in the Chukchi Sea.) Pregnant females build maternity dens in the snow all over Svalbard, but most commonly in the eastern part of the archipelago. As sea ice changes in the broader Barents Sea, more of these "Svalbard bears" are denning on Franz Joseph Islands or all the way over on Novaya Zemlya in Russia. Dens are generally within 10 km of the coast, close to areas of landfast ice where ringed seals give birth to their pups, giving mothers and cubs the best opportunity to find as much food as possible when they emerge.

Feeding: Like polar bears everywhere, polar bears in the Barents Sea feed primarily on ringed seals. However, coastal bears in Svalbard are also known to prey on reindeer, bird eggs, and vegetation, although to what extent is unclear. It seems likely that polar bear predation of reindeer has increased in recent years: partly because reindeer numbers on Svalbard have rebounded after they were protected from hunting; partly because terrestrial habitat has improved and expanded with warming on land; and partly because declining sea ice means bears are forced to spend more time on land. Though Svalbard reindeer can carry significant fat in the autumn, they have nowhere near the same amount of calories as a seal, and it usually takes a lot of energy for a polar bear to hunt a reindeer. Thus, while supplemental feeding clearly benefits individual bears in some circumstances, it is energetically challenging for any of these additional terrestrial food sources to come close to matching the sustenance provided by seal blubber at scale.

Challenges:

Despite the dramatic sea ice and other environmental changes around Svalbard, the relative hyper-productivity of this unique region seems to be buffering the worst effects of warming on polar bears—at least for now.

Climate change: This region is warming up to eight times faster than the rest of the world and the amount of landfast ice around Svalbard has declined by 50 percent compared to 1973-2000. The sea ice season is two months shorter than it was two decades ago, leaving the bears with fewer opportunities to hunt. The retreat of sea ice from Svalbard's shores means that some pregnant females are not even attempting to return to the archipelago to give birth and are instead turning to Frans Josef Land or Nova Zemlya in Russia.

Pollutants: Bears in this region contain higher levels of chemical pollutants than those in Greenland or Alaska.

Learn more: Barents Sea polar bear population

Western Hudson Bay (including Churchill)

Population size: 618 (2021 survey)

What makes this population different:

Of the 20 populations of polar bears, this is arguably the most comprehensively studied and best known. It is also the one that has been most extensively filmed, photographed, and marveled at, thanks to the tourism industry that has developed around the bears in Churchill, Manitoba. Because of its presence close to some small centers of human population, it is also among the populations that has the most frequent interactions with people; unfortunately, it is also being heavily impacted by climate change.

Feeding:

Like other polar bears, this population depends on access to fat-rich seals.

This area is known as the Seasonal Ice Ecoregion, which encompasses most of the bears of central and eastern Canada. In this area of the Arctic, sea ice melts completely in summer – generally sometime in July, although the precise timing varies from year to year – prompting the bears to come ashore. While they may remain sporadically active on land during the summer, this is largely a period of fasting until the ice returns in November.

When denning, female bears undergo one of the longest fasting periods of any mammal, roughly eight months. Their emergence from their den is timed to coincide with a veritable Arctic buffet, as spring is when seal pups are born, presenting the mother with an abundance of easy prey. She will not only need to feed her cubs but will be desperately hungry herself from the energetic effort of giving birth and producing rich milk.

Challenges:

Longer ice-free period: In the 1980s, the waters of Hudson Bay were ice-free for an average of 141 days each year; a 2024 study concluded that, under 2 degrees C of warming, that figure will increase to 165-170 days in Western Hudson Bay and 175-180 days in Southern Hudson Bay. Scientists have determined that 180 days is a critical fasting threshold for polar bears, beyond which up to 21% of adult males and 63% of subadults may starve to death. In the summer of 2024, Southern Hudson Bay bears were forced to spend a record 198 days ashore. There is evidence that the decrease in sea ice that has already taken place is affecting some polar bear populations: for example, the population estimate for Western Hudson Bay polar bears was 949 in 2011, but ten years later had fallen to 618.

Potential impacts of hunting: Partly due to other pressures, especially climate change, new research suggests that hunting could become unsustainable in some regions. This is a warning that these regions may require enhanced population monitoring.

Learn more: **Western Hudson Bay polar bear population**

Southern Beaufort Sea

Population size: 819 polar bears (as of 2021)

What makes this population different:

Long-term monitoring: The Southern Beaufort Sea sub-population has historically been one of the best-studied populations in the world. That long-term monitoring has allowed scientists to document that persistent sea ice loss is leading to fewer cubs and greater energy use for adult bears, prompting a 40 percent decline in the population. Today, this effort is threatened both by changing environmental conditions that make fieldwork challenging, and by lack of federal funding to maintain this priceless data set.

Enormous home ranges: As they travel across the retreating ice, bears frequently cover enormous distances. A 2001 study by PBI's senior scientist emeritus Steve Amstrup and colleagues found that the average home range of 75 radio-collared females was approximately 57,500 square miles, although there was considerable variation, with some restricting themselves to areas as small as 1,158 square miles and others expanding across more than 230,000 square miles – an area almost as large as France.

Shifting denning habits: Historically, up to half of maternity dens by the Southern Beaufort Sea polar bears were built on the sea ice. However, as the extent and quality of sea ice in the region has declined, so has this behaviour, to the extent that all denning now appears to take place on land. Females build dens in snowdrifts that settle along coastal, river and lake bluffs in the otherwise largely flat coastal plain. Conditions and topography appear to be more conducive to denning in the central and eastern part of the range.

Challenges:

Climate change: Population declines are driven by changes in sea ice cover as a result of climate warming. The ice-covered period each year has decreased by 17.5 days per decade since 1979, leaving largely open water for longer stretches, especially in coastal areas, and giving bears less time to feed. Additionally, thick multiyear ice has largely disappeared, replaced by first-year ice that is thinner and less stable. In addition to having less time to hunt, bears must spend more energy to travel greater distances to find suitable ice conditions.

Industrial activity: In addition to the obvious potential consequences for polar bears and the Arctic ecosystem more broadly of a catastrophic oil spill there is particular concern about denning polar bears being disturbed by the heavy equipment used in seismic exploration and drilling activities.

Given that denning on sea ice is seemingly no longer an option, dens are now being built almost exclusively on land, which brings them closer to this industrial activity. The purpose of building dens is to provide mother and cubs with a safe and comfortable environment in which the young bears can spend the first couple of months of their lives; any disturbance that forces the mother to abandon the den early essentially condemns the cubs to death. As cub loss has been a major factor in the estimated 40 percent decline in the population, any further impacts on cub survival would obviously be potentially highly deleterious. Such concern is only heightened by the prospect of oil exploration in the Coastal Plain of the Arctic National Wildlife Refuge (ANWR), which hosts the greatest concentration of den habitat in the area.

Federal regulations require oil companies to use FLIR (forward-looking infrared) radar to search for polar bear dens before beginning any activity, but a 2020 study by PBI and Brigham Young University found that these surveys failed to locate more than half the dens in a given area.

Coexistence: A very different consequence of human activity in the region is a growing reliance by bears on piles of bowhead whale remnants, the leftovers from subsistence hunting by Inupiat communities. In the town of Kaktovik, more than 120 bears – roughly 15 percent of the remaining population – have been observed feeding on carcasses at once. It is possible that the energy gained from such scavenging is preventing the Southern Beaufort population from declining more rapidly and severely, although the increased presence of bears in close proximity to humans raises risks for both.

Learn more: **Southern Beaufort Sea polar bear population**

Tools for talking about polar bears

What can your guests do?

To save sea ice, we need to move away from burning fossil fuels for energy. Without action to address heat-trapping gas emissions, a 2020 study shows that we could lose all but a few polar bear populations by the end of the century. The key to getting the climate back to functioning the way it should is to transition away from fossil fuels for energy altogether.

Changes in individual behaviour won't achieve the goal

While it's true that Arctic travel has an environmental impact, it's important to look at the big picture.

The "carbon footprint" idea was created by oil and gas companies to divert attention from their own actions and shift responsibility to consumers. Yet because of how our systems are set up, individual behaviour alone won't achieve the reductions we need.

Dr. Flavio Lehner, chief climate scientist at Polar Bears International and assistant professor in Earth and Atmospheric Science at Cornell University, says we've already run an experiment on this.

"During the pandemic, the whole world shut down and people stopped driving, flying, and made other changes in behavior," he said. "Yet total emissions dropped by only about five percent, showing how much emissions are baked into the systems that keep everything running: agriculture, factories, heating and cooling, transport of goods, etc.

"Individual action is not pointless, and collectively can help bring about shifts in social norms, but we need a systematic change towards producing energy and goods in carbon-neutral ways to reach our goal of stabilizing the climate."

Here are some meaningful actions you can share with your guests.

- **Talk about climate change** and why it matters to you with your friends, family, and colleagues. Social science tells us the majority of people agree that it's essential our governments do whatever it takes to limit the effects of climate change. By making climate change part of your conversations, you'll help make it an everyday issue and a policy priority.
- **Vote with the climate in mind**, in each and every election, at every level of government—because we need policy changes to create sustainable systems. You can also regularly contact your representatives in support of climate action. And you can encourage your friends, family, and neighbors to join you in getting involved.

- **Get involved with community projects** that will help make a difference on a scale beyond your own household (because individual actions alone won't get us where we need to be). This might mean advocating for electric buses, working with schools on no-idle zones, or supporting local bike lanes, farmers markets, and renewable-energy initiatives.

Given the outsized impact of fossil fuels and heat-trapping gases, we want to focus on carbon dioxide emissions—therefore programs and actions that will reduce or eliminate our emissions are key. Highlighting ways to shift our energy from fossil fuels to renewable energy, and make our current energy systems more efficient are a great starting point.

- Sharing hope
- Your Voice Matters—Now more than ever

Appendix: Key papers

Living with polar bears

Coexistence between people and polar bears supports Indigenous knowledge mobilization in wildlife management and research

Nature Communications Earth & Environment, 2025

Despite extensive research on polar bears in the Churchill region, few academic reports have been co-authored by Indigenous peoples or centered on local knowledge of polar bears. With knowledge holders representing Swampy Cree, Sayisi Dene, Métis, Sioux, and Inuit people living in Churchill, this report mixes methods from Indigenous ways of knowing and social sciences to advance wildlife conservation across the Arctic.

Anthropogenic food: an emerging threat to polar bears

Oryx, 2022

Polar bears attracted to human-created food sources, like garbage, are at increased risk of conflict with people. Climate-driven sea ice loss, growing human populations and increased tourism are adding to the threat, but better management of waste can help.

Feeding and energy

Variation in energetic balance among free-ranging polar bears during the spring mating and foraging season

Arctic Science, 2025

Polar bears on the sea ice show more variation in weight gain than previously thought, which may make them more vulnerable to loss of summer sea ice.

Energetic constraints drive the decline of a sentinel polar bear population

Science, 2025

A bioenergetic model based on four decades of analysis quantifies the link between declining sea ice and shrinking polar bear populations.

Polar bear energetic and behavioral strategies on land with implications for surviving the ice-free period

Nature Communications, 2024

Researchers followed 20 bears as they foraged for food on land over three years. Although they were flexible and creative in their feeding strategies, terrestrial food didn't make up for a lack of ice. Nearly all lost weight while on land.

Yes, they can: polar bears successfully hunt Svalbard reindeer

Polar Biology, 2021

An apparent increase in reindeer hunting may be linked to reduced ice cover, with bears spending more time on land, as well as a growing reindeer population.

Windscapes and olfactory foraging in a large carnivore

Nature, 2017

Polar bear hunting behaviour, migration and habitat selection are influenced by wind direction and speed.

Long-distance swimming by polar bears (*Ursus maritimus*) of the southern Beaufort Sea during years of extensive open water

Canadian Journal of Zoology, 2012

While polar bear females and their cubs can swim long distances, this requires more energy than moving across sea ice.

Habitat

Top-Down and Bottom-Up Processes Jointly Explain Mesopredator Movement and Foraging Ecology

Ecology Letters, 2026

The presence of polar bears restricts the time and locations where seals will forage. However, this study found that when prey diversity is high, seals will spend more time in areas with polar bear predation risk.

Polar bear energetic and behavioral strategies on land with implications for surviving the ice-free period

Nature Communications, 2024

This key paper finds that the risk of starvation for polar bears increases with the time spent onshore.

Distributional shifts of polar bears (Ursus maritimus) in Hudson Bay in relation to sea ice dynamics, 2017-2022 Final Report

Environment and Climate Change Canada, 2023

The boundary between the Western Hudson Bay and Southern Hudson Bay polar bear populations is less clear than previously thought, with documented exchanges of individual bears between the populations.

Habitat degradation affects the summer activity of polar bears

Oecologia, 2017

Loss of sea ice, and shallow water habitat with sea ice, is causing polar bears to alter their behaviour.

Populations

Glacial ice supports a distinct and undocumented polar bear subpopulation persisting in late 21st-century sea-ice conditions

Science, 2022

Researchers describe the discovery of an isolated population of polar bears from southeastern Greenland that is much less reliant on sea ice, instead existing at the terminal end of a glacier. See our interview with the lead author

Reproduction

Temporal dynamics of polar bear (Ursus maritimus) pregnancy rates in western Hudson Bay: influence of mass, age and timing of first breeding

Conservation Physiology, 2025

Researchers found a significantly lower percentage of potentially pregnant females in the Western Hudson Bay population compared to four decades ago.

Monitoring phenology and behavior of polar bears at den emergence using cameras and satellite telemetry

Journal of Wildlife Management, 2025

Satellite tracking collars and remote camera traps have been combined for the first time to answer questions about polar bear denning. The researchers present new insights into the timing of den emergence and post-emergence behaviours alongside new tools to monitor polar bear dens across the Arctic.

Research techniques

A deep dive into capture-mark-recapture studies
IUCN Polar Bear Specialists Group, accessed 2025
So much of what we know about polar bear populations — and how to best protect them — comes from hands-on measurements with wild bears. This explainer from the Polar Bear Specialists Group looks at what we've learned from these studies, how the technology has changed and what we might see in the future.

Designing epigenetic clocks for wildlife research
Molecular Ecology Resources, 2025
This study demonstrates how genetic clocks can be used to accurately and affordably assess the age of polar bears.

Threats

Assessing the combined influence of biotic and anthropogenic stressors on polar bears to inform conservation planning
Ecosphere, 2025
A team led by the U.S. Geological Survey modeled the impacts to polar bear populations of both environmental stressors and direct threats from human activity. For the species overall, sea ice conditions and access to marine prey are likely to have a greater negative impact on populations than any other threat. Across most of the Arctic, direct stressors like hunting and industrial activity were a lesser threat and varied by region. However, in regions with seasonal ice, including Western Hudson Bay, the models suggest that hunting could become the most significant anthropogenic threat.

Energetic constraints drive the decline of a sentinel polar bear population
Science, 2025
Researchers have analyzed the energy acquired and expended by polar bears, showing a clear link from environmental conditions to individuals and populations. Based on over four decades of data, the study demonstrates that sea ice loss was responsible for the halving of the Western Hudson Bay subpopulation of polar bears.

Polar bears and snowmobile traffic
Norwegian Polar Institute, 2026
Researchers found that snowmobile traffic had little effect on how much time adult female polar bears spent on the sea ice in spring, even though they may react strongly to the presence of the vehicles.