



Polar Bear Handbook for Arctic Guides



Polar Bear Handbook for Arctic Guides

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Cover Image: Polar bear in the Western Hudson Bay

© Erinn Kermesen / Polar Bears International

Polar Bears International's mission is to conserve polar bears and the sea ice they depend on.

We also work to inspire people to care about the Arctic, the threats to its future, and the connection of this fragile ecosystem to our global climate.

As a science-based organization with staff including leading polar bear scientists and partnerships that span the circumpolar Arctic, we focus on addressing both the long- and short-term challenges that polar bears face, with a goal of sustaining a future for the bears across the Arctic.



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Image 1: Polar bear mother and cubs | © Erinn Kermesen / Polar Bears International

Overview

Polar bears (*Ursus maritimus*) are the world's largest land carnivores, but they are also marine mammals that are specifically adapted to the frozen surface of Arctic oceans. They eat primarily ringed seals and larger bearded seals, but have also been known to hunt belugas and walruses and to scavenge whale carcasses when they can. Depending on their location, some polar bears will also opportunistically eat birds and their eggs and even mammals such as reindeer. But long-term, land-based food sources cannot provide them with the energy they need to survive. Polar bears survive by eating fat-rich marine mammals, like seals.

A mature male polar bear may reach more than 2.5 meters from tip to tail, measure 1.5 meters tall at the shoulder and reach almost four meters into the sky when it stands on its hind legs. It may also weigh almost 600 kilograms, although most are smaller. Females are significantly smaller than males, although with a weight of up to 350 kg, they are sizable animals themselves.

Evolutionary Adaptations

Polar bears are very closely related to brown bears, [evolving from a common ancestor](#) approximately 500,000 years ago. They 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 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 cms 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.
- Their mouths contain 42 razor-sharp teeth that are especially adapted for grabbing and holding prey animals and shearing meat from their carcasses.
- Their ears are smaller than those of brown bears, to minimize heat loss.
- Unlike brown bears, polar bears have a layer of fat roughly 10 cm thick that insulates them against the frigid Arctic and provides buoyancy when they swim. It is topped by a layer of skin that, perhaps surprisingly, is black.
- 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.

Fun Fact: Polar bear fur is not actually white, but colorless and translucent. It just appears white in most light.



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 lives on and around sea ice.



Image 2: A ringed seal | © BJ Kirschhoffer / Polar Bears International

Seals

Most of the time, polar bears eat seals, particularly a species known as the ringed seal (*Phoca hispida*). Widespread throughout the Arctic—there are estimated to be more than 2 million in total—ringed seals measure about 1.25 meters in length and weigh approximately 50 to 65 kg.

A polar bear's favorite 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.



Image 3: A polar bear waiting by a seal hole | © Madison Stevens / Polar Bears International

Polar bears employ two principal methods of hunting:

- *Stalking:* As its name suggests, this involves a bear flattening itself on the icy ground and slowly creeping toward a seal that is on the ice. It will creep forward until the seal raises its head, and then it will freeze before slowly creeping forward again. Once it is within about 6 meters of the seal, the bear uses its explosive speed to pounce. A variation of this technique sometimes sees bears swimming quietly up to a seal asleep on the floe and then leaping 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 by patiently waiting next to a hole until it senses a seal approaching from below and then grabbing 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.



Image 4: 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. Consequently, they are less reliable prey than ringed seals, but because they are much larger—reaching almost 2.5 meters in length and weighing up to 350 kg—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, at which time they can quickly snatch a pup or the carcass of a walrus that has been trampled.

- *Belugas*: Surprising as it may seem, polar bears sometimes are able to take belugas, which can weigh up to 1600 kg. 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. And 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.

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 to molt for extended periods when they shed and regrow their fur. During the molt, they experience increased blood flow to their skin to support the tissue regeneration which, in an attempt to limit heat loss, makes them less protected from icy waters and more reluctant to swim. This leaves 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 miles and miles, fighting each other off in an attempt to mate. See [Mating](#) for more information.

Summer

Exactly how polar bears spend their summers depends largely on where they are. For example, in the most northerly parts of Canada and down the east coast of Greenland, sea ice persists year-round, so bears here traditionally have not had to change their behavior a great deal 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 of weight every day.

See [“Where do Polar Bears Live”](#) for more on how sea ice patterns vary seasonally by region.

Autumn

For the bears that have stayed on the sea ice as it has been pushed away from the land, autumn finds them in much the same position as summer: on the ice, 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 autumn 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, young 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 fall turns to winter, as soon as temperatures drop low enough the ice starts to freeze up. As it solidifies, polar bears walk out onto the ice to begin hunting. Meanwhile, pregnant females make or find dens and wait to give birth.

Winter

Unlike other North American and European bears, 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 that ice can be largely solid, with few fractures, fissures, and openings by which 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% fat, the fattiest of any mammal we find 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.

Where Do Polar Bears Live?

All polar bears live in the Arctic, 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 their location.

Researchers divide polar bear habitat based on similar sea ice conditions into 4 “*ecoregions*.”



[Polar Bear Habitat](#) +  Sea Ice Ecoregions

It is estimated that there are about 26,000 polar bears across 20 subpopulations in the Arctic. However, accurate estimates are lacking for several populations, and two of the best-studied populations (Southern Beaufort Sea, Western Hudson Bay) are decreasing in number.

Until recently, scientists classified the bears into 19 subpopulations. In June 2024, the IUCN Polar Bear Specialist Group meeting 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 is that the Southeast Greenland bears have responded to the loss of sea ice by hunting seals from freshwater glacial ice in fjords.



Polar bear subpopulation map (2024) | Polar Bears International



Divergent Sea Ice Ecoregion

In this region, which includes Svalbard and the Barents Sea, ocean currents continually carry sea ice offshore 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, 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).

Image 5: 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 combines with locally formed ice and 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.

Image 6: 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 final refuge for polar bears, although the southern parts of the region have increasingly seen ice-free periods in summer.

Image 7: 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 raising fewer cubs successfully, while the population of Western Hudson has fallen from 1,200 in 1987 to 618 in 2022.

Image 8: 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 miles and miles until he finds the female. But before he can hope to mate, he often must compete for her affection with other males—sometimes violently.

Size Matters

Female polar bears are sexually mature and start to mate around 5 years old. Male polar bears are sexually mature at 3 years old, but generally don't begin mating 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—and that they eventually reach a point where they're just too old to bother.

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 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.

Mothers and Cubs

Several months after a female has mated, and if she's gained enough weight (sometimes hundreds of pounds) and her body is in good condition (at least 420 pounds), with plenty of fat from feeding on seals all spring and summer, the fertilized egg becomes implanted in her uterus: this is called delayed implantation. Late in the autumn, 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.



Image 9: Mother polar bear and cubs | © Daniel J. Cox

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; some of these earthen dens, still in use today, are at least 200 years old. 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 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](#)



Image 10: 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. They can weigh well over 100 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 in the animal kingdom.

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.

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 five, 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 five 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: For example, the town of Churchill, Manitoba, on the shores of Canada's Hudson Bay is a community that has adapted to living with polar bears. Every autumn, several hundred bears pass through and 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 behavior.

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 eliminating food rewards, along with guidance on other safety measures, like the use of nonlethal deterrents, including flare guns, handheld flares, noise-makers, and other less lethal short-range deterrent options.



Image 11: A polar bear-safe garbage bin in Churchill | © Erinn Hermesen / 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 itching for 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 behavior 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 Bears and Sea Ice

Polar bears are creatures of sea ice: they need it to survive, and the decline in sea ice due to climate change puts their future at risk.

But [why is sea ice so important to polar bears](#), and how are they adapted to living on it?

- 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 the long claws on their knuckles to carve open breathing holes in the ice. One of the ways 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 need 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.
- Polar bears' paws allow them to navigate the sea ice with ease. The paws' enormous size means they function like snowshoes, enabling the bears to distribute their weight and walk on thin ice without falling through, while their long claws, ideal for seizing seals, also help maintain a grip. In addition, the soles of their paws are covered by soft, small bumps called *papillae* that also help them grip the ice.
- 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.

- Over the last few decades, we have seen a significant decrease in the thickness and extent of Arctic sea ice, with an average loss of 12.8 percent per decade since 1978. Scientists predict that if we continue on our current path, we will witness our first ice-free Arctic summer sometime this century, possibly as soon as mid-century.

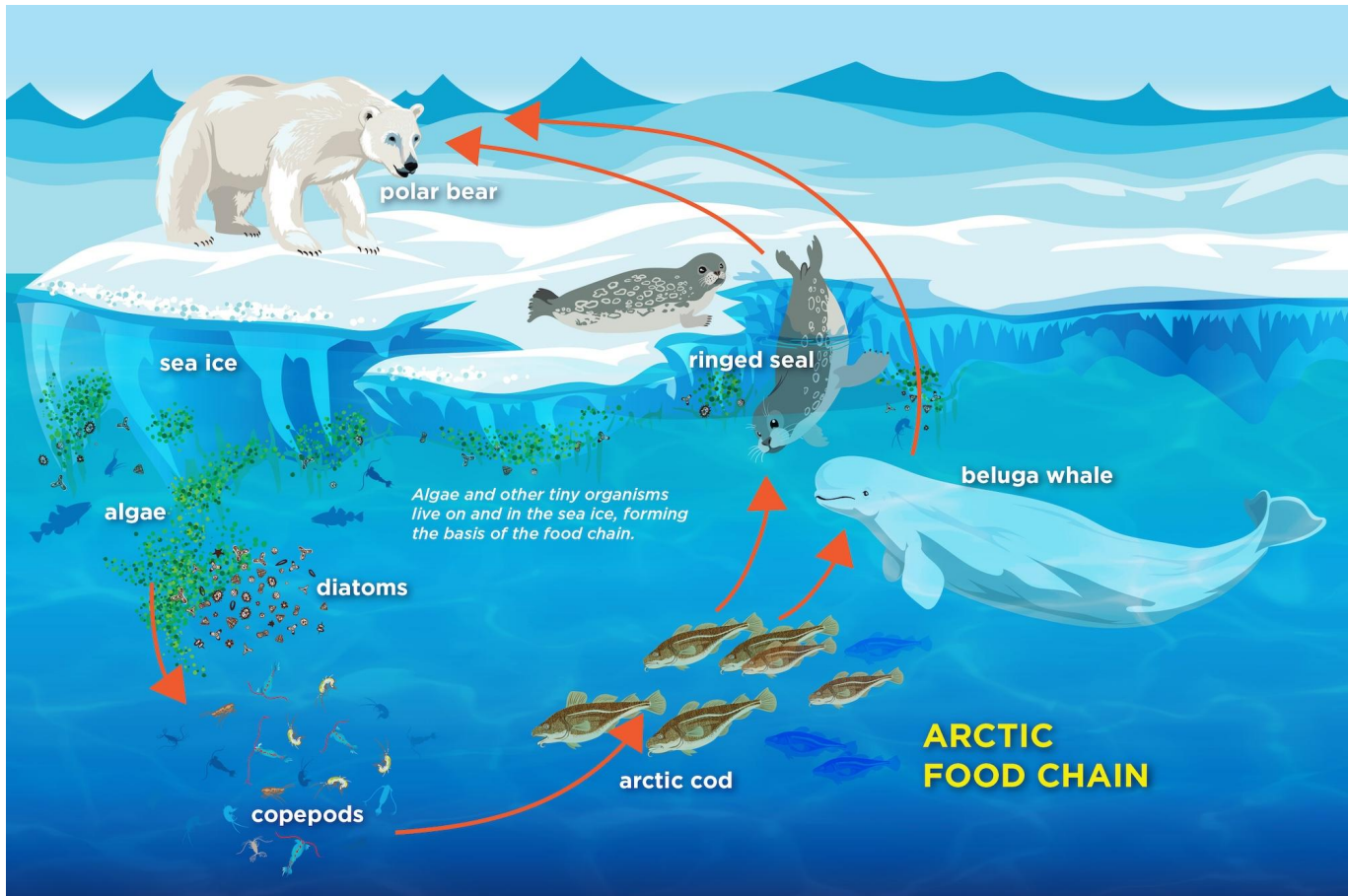


Image 12: The Arctic food chain | Illustration by Peppermint Narwhal

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. 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 four times as fast as 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.

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.

Research tells us that a [majority of people are concerned about climate change](#), but they are [self-silencing](#) because they're convinced they have the minority opinion. If we can empower those who are already concerned about climate change to start talking with their friends and families, we can make a difference in motivating action. We need to talk about climate change, and the more we

do, the more we can find solutions that bring about changes to systems and help ensure the sustainable choice is the easy choice for more people.

Given the outsized impact of fossil fuels and heat-trapping gasses, 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](#)

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, where 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.

Overhunting

Historically, the biggest impact on polar bear populations was overhunting. Bears on Svalbard and in places like northern Alaska were at one point greatly reduced in number by commercial hunting, and, in latter years, sport hunting. They likely rebounded to historic numbers in the decades after the 1973 international [Agreement for the Conservation of Polar Bears](#) was signed. The Agreement halted commercial hunting and significantly curtailed sport hunting.

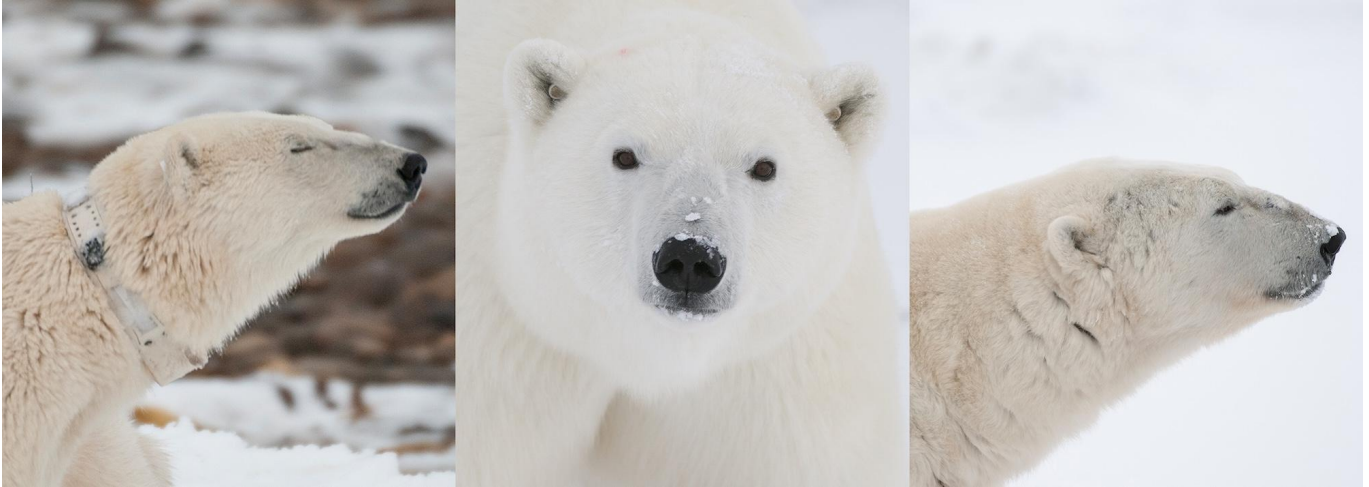
Today, legal harvesting continues on a limited basis for Indigenous peoples in some countries, based on quota systems. Canada allows for very limited sport hunting, representing a small percentage of the overall Canadian harvest. These hunts, in which harvest numbers are based on a population's ability to replenish itself, have long been an important part of indigenous cultural traditions and provide important nutritional benefits in some regions.

During the days of commercial hunting, trade in polar bear pelts and parts was one of the main drivers of overhunting. Today, this trade is illegal in some regions and tightly controlled as part of Indigenous quota systems in others. In recent years, a plunge in demand has further reduced activity on this front; the [IUCN Polar Bear Specialist Group](#), which is composed of scientists from the five polar bear nations, does not regard harvest driven by trade as a current threat.

Ensuring harvest remains sustainable requires careful monitoring and vigilance, however. At their 2024 meeting, the IUCN Polar Bear Specialist Group expressed concerns about the recent move by Nunavut, Canada, to change its harvest ratio from a 2:1 male-female ratio to 1:1. Not only is this potentially not sustainable, it has a wide reach, impacting roughly two-thirds of the global population of polar bears.

Studying Polar Bears

Studying polar bears is extremely challenging. Polar bears wander vast distances through a habitat that is often difficult and dangerous for humans and that, for much of the year, is not only cold but also very dark. So, scientists must find different ways to piece together as much information as they can.



Images 13-15: A GPS collar, GPS ear tags, and a male polar bear

© BJ Kirschhoffer / Polar Bears International

Counting Bears and Gathering Data

One important study area is counting polar bears to determine the size and trends of various populations. One way of doing this is simply to fly along predetermined transect lines with observers seated on either side of the aircraft counting the bears they see. A variation is what is known as “mark-recapture” studies: 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., fur). Researchers may also take fat biopsies that provide information about their health and possible contaminants in their system.

Satellite Collars and Other Tools

Because it is all but impossible to follow a polar bear year-round, scientists use satellite tags to track their movements and behaviors. 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.

Watching on the Ground

Some behaviors 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 autumn, 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 in Arctic Canada; these studies provided much of what we know about some aspects of polar bear behavior, including mating.

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.



Indigenous Knowledge

One group of people who are able to see polar bears in the wild with relative frequency and who are familiar with aspects of their patterns and behaviors are Inuit hunters and other Arctic Indigenous peoples who spend time on the land. Indigenous awareness of polar bears is considered a valuable component of our knowledge base about these animals.

In addition to insights passed down from generation to generation, Indigenous Knowledge (IK) 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.

Zoos

Polar bears in zoos can provide us with some kinds of information that would not be possible to obtain from bears in the wild. One common area of study is energetics: determining how much energy bears consume with different activities. Another includes research into their hearing range. And 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.

Barents Sea Bears

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.

Scientists estimate that there are approximately 2,650 bears in the population, with roughly 1,000 of them in Norwegian territory, and about 250 of those being 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 300 a year until Norway banned hunting when it signed the International Agreement on the Conservation of Polar Bears in 1973.

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 square km 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.

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 from a low of perhaps 500 after they were protected from hunting, and partly because declining sea ice means bears are forced to spend more time on land. Though Svalbard reindeer are fatty, 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, it is energetically impossible that any of these additional terrestrial food sources can come close to matching the sustenance provided by seal blubber.

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.

Barents Sea polar bears face a number of issues. The most significant is 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 Franz Josef Land or Nova Zemlya in Russia. Bears in this region also contain higher levels of chemical pollutants than those in Greenland or Alaska. 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.

Polar Bear Facts and Figures

Polar bears are the largest terrestrial carnivores, but they are also considered marine mammals as they derive all of their sustenance from the [marine food web](#). They are seemingly white but have black skin. They are huge predators that weigh only a few hundred grams when they are born. They live in the frequently frozen Arctic, but their greater challenge is staying cool, not warm.

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

Size

- By any measure, polar bears are huge. Adult males normally weigh between 350 and 600 kg, and on occasion can be even larger. Adult females are smaller, generally weighing between 150 and 290 kg. Adult polar bears are typically 1-1.5 meters at the shoulder, and an adult male can reach over three meters when standing on its hind legs.
- When polar bears are born, however, they are tiny. They weigh around 500 to 700 grams at birth, about the size of a block of butter, but by the time they emerge from their dens three months later, they may weigh as much as 13 kg—the size of a 2-year-old human!

Walkers and Swimmers

- Polar bears travel immense distances. They can travel more than 3,000 km over the course of a season and can have home ranges that exceed 500,000 square kilometers.
- The polar bear's scientific name *Ursus maritimus* means “sea bear,” and the polar bear is officially classified as a marine mammal. 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 involved, especially young ones; cubs are unable to make long swims due to their lack of body fat and strength. Unfortunately, as sea ice retreats, bears are forced to swim longer and longer distances in open water.

Hunting

- Polar bears hunt primarily by using a sense of smell so strong that they can smell prey from over 1 km 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 of food in one sitting.
- Although polar bears eat mostly ringed seals, they will also eat bearded seals and walruses, and have been known to hunt reindeer and belugas, to climb cliffs in search of seabird eggs, to snack on kelp, and to chow down on whale carcasses. When hunting is good, polar bears will eat just the fat on a seal or marine mammal and leave the meat.

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, are known to have done so, though this is rare.
- The mitochondrial DNA of one group of brown bears—known as the ABC bears, from Admiralty, Baranof, and Chichagof Islands in southeast Alaska—is closer to that of polar bears than other brown bears. Researchers believe that, at the end of the last ice age, a group of polar bears was stranded on the islands and interbred with brown bears.

Skin, Fur and Paws

- Polar bear fur is not actually white. It is unpigmented and appears white because it reflects visible light and appears white to the human eye when it is clean and in sunlight.
- The fur allows heat to reach the skin below but prevents much of the heat from radiating back out. The hairs in polar bear fur are hollow, meaning they contain air that is warmed by the heat trapped in the pelt.
- Beneath a bear's fur is a layer of black skin to further capture the heat from sunlight. And beneath the skin is a layer of blubber that can be up to 10 cm thick, to provide further insulation as well as buoyancy for when a bear is swimming.
- So effective is a polar bear's insulation that, even in the frigid Arctic, it can be a bigger challenge for a polar bear to keep cool than stay warm. Particularly in warmer months, polar bears can often be seen laying as flat as possible on ice or in snow to keep cool.
- Polar bears have massive paws that can reach 30 cm across. Tufts of fur between their toes and foot pads help with warmth. And their footpads are covered by soft, small bumps known as papillae that grip the ice and keep the bear from slipping.



Image 16: 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

Population

- It is estimated that there are approximately 26,000 polar bears across the Arctic, divided into 20 subpopulations.
- Accurate estimates are lacking for several populations, and two of the best-studied—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.



Learn about the 19 populations of polar bears and how they're faring: [Polar Bear Status](#)