

AD: Every year that passes, we have more and more studies that show the effects of climate change across the Arctic and all five Arctic nations with polar bears are seeing the same sorts of patterns. We can see what's going to happen to this species. And I, and I think it's not gonna be the same planet if we didn't have polar bears in the wild doing what polar bears do. I think that's just beyond sad.

PS: Welcome to From the Field, a podcast logging real life scientists and their efforts to improve the world, one study at a time. I'm Priya Shelly.

In this episode I speak with biologist Andrew Derocher, a professor of biological sciences at the University of Alberta in Edmonton, Canada. Andrew's research has focused on the ecology of polar bears, their populations and how climate change effects them. When he's in the field, Andrew finds himself traversing the Arctic landscape on tundra buggies and flying in helicopters tracking polar bears in their natural environments.

But well before all his Arctic adventures, Andrew says that growing up, he was simply captivated by nearby wild landscapes surrounding Vancouver and found from there, his interests began to grow in nature and science.

AD: I think like most kids, I was interested in animals, but I can still remember my father was taking a night school course when I was just really small to finish his high school degree. He brought home this book and I still have it actually, it's a, this little notebook on zoology. And I remember thumbing through it and looking at the insides of all these animals. And, and I just thought, this is just really cool. And so that was probably sort of the, the first time when I sort of started to focus on, on animals. And then from there I was just this kid that was just immersed in every book that I could find about wild animals. I grew up in a, in a big city on the west coast, Canada, Vancouver, and you know, there wasn't a lot of nature right in our backyard, but surprisingly back then you could easily get down to places to find streams where salmon were still spawning and lots of wild birds lived in the area. So that was kind of how it started.

AD: At that stage I was probably pretty impressed by being outside and I had made it sort of a career aspiration to be outside. And so I ended up working in and as a sort of a park assistant park ranger type position. And I thought that's where my future laid. And then my parents weren't convinced by that. They sent me the registration materials for local college and I thought, well, I'm going to get laid off in the fall so I might as well consider it. And then once I got into school and took off, it was, you know, the first degree, get your bachelor's, get a master's. And then I just stayed to do a phd and I'm kind of an accidental academic, so I never planned on being in academia. But I was very keen on doing wildlife research and it wasn't specifically polar bears, but they seem to have adopted me.

AD: And the bears were going into hibernate and one of the fellows I was working with said what are you going to do now? And I said, I didn't know I had to look for work. And he says, well, I know this guy who studies polar bears. Is that sound interesting? And of course it sounded kind of interesting and it was pretty exotic sounding. So I thought, yeah, I'll write him a letter. And when I say that, it was actually a long hand letter explaining why I wanted to come to work on polar bears. And like I say, that was over 35 years ago.

the first polar bear I saw in the wild was in 1984. And it was on the coast of Hudson Bay was a big adult male. We went in, we caught the bear, mobilized it, did all these measurements.

AD: And so first off, not having been around a lot of drug animals, it's, it's a little bit daunting when you look at it in the context of of what you've got going on in terms of being next to one of the world's largest predators. But it's also sort of just so overwhelming that you just kind of sit there and kind of think, okay, why am I sitting here next to this bear and what am I actually doing here? I think at that stage, I would say that my ideas were still sort of fairly poorly developed as to what I was actually doing there, which is pretty typical of, of, you know, new researchers moving into a field. You sort of get into an area and you start to settle in and then the longer you stay with a topic area, quite often the more complex your questions become, the more insights you gain about the ecology and I don't think I'm ever gonna run out of questions about polar bears. I'm gonna run out of time.

PS: For over 35 years, Andrew has worked with polar bears in the Arctic Circle. The Arctic is a polar region in the northern most part of our planet. The Arctic Circle consists of eight countries including: portions of Norway, Sweden, Finland, Russia, the United States, Canada, Greenland and a small island off the Northern coast of Iceland. The arctic ocean includes seas and bays which surround these regions that are distinctly covered by perennial ice which experiences seasonal melt. But over the years, climate change has had a drastic effect on the sea ice, causing it to rapidly melt and destruct the habitat.

Throughout his years of studying polar bears, Andrew's scientific questions began to shift and started to look at a pertinent question. How is climate change affecting the polar bears behavior and how much time do they have left?

AD: Yeah. So a lot of our research now focuses on the effects of climate change. And it's interesting because over my research career now, when I first started out, what we were really interested in were what was the effects of harvest on polar bears. So this a very large subsistence harvest of polar bears in Canada and still ongoing now. And that was the major focus of research. And then during a spell, I worked in the Norwegian Arctic for seven years. And about the time I moved over there, it was just becoming clear that polar bears had very high levels of pollution. And so a lot of my research in that period was tied to trying to understand the effects of pollution. But at the same time, we knew that the sea ice was changing, that the Arctic is warming. And back in 1993, a colleague and I wrote a paper about the potential effects of, of a warming climate on polar bears.

I think when we wrote that paper back in 1993, both of us thought that this is something that's long away in the future for future generations of polar bear biologists to, to look at and to monitor. And little did we know that the changes would come so fast to the Arctic in terms of changing sea ice and the responses that the bears would show at that time as well in response is changing sea ice. A lot of our current work is looking at how bears use the sea ice, how they move as the sea ice conditions change. And it's important to consider that, you know, this is an incredibly variable habitat. It's something that changes day to day, a week to week and of course month to month and year to year. So you've got all this variation going on and the barriers are supremely adapted to dealing with this sort of variation.

AD: So one of the things we tried to do when we look at these systems is how is the ice changing and how are the bears responding? And then subsequently, what are the effects on

the bears? So it's pretty obvious if you ask a bear, let's say up north of Alaska where the sea ice conditions have changed a lot to move perhaps an extra 500 miles or 800 kilometers in a year, northward. And then ask them to do that same return migration southward it is the ice reforms it has an energetic cost. And so a lot of our work is trying to look at how the bears are changing their behavior in response to their environment and how well are they able to adapt to the changing conditions and how long might they be able to sustain themselves in those different areas.

AD: And, and at some point we just change the rules so much that the bears can't persist in an area. So the, the simplest way to think about a sea ice from polar bears perspective is it is their habitat. And it's more than just that. It's actually, and the way I like to think about sea ice and explain it to people that haven't been out on the ice in the Arctic is it's more akin to the soil that you have in a forest ecosystem. If you take away the soil and a forest, you know that you're not going to be able to grow the same type of trees. There. The same plants won't come back and then the same wildlife won't come back. In the Arctic if you take away the sea ice. It's not like there's not gonna be anything there. There'll be other species that will come into use those habitats, but it won't include the seals that the bears rely on as their prey. And it certainly won't include the bears. So, and this is exactly what we're seeing in the Arctic now, is a shift in the ecosystem where North Pacific, North Atlantic species are migrating northward to exploit these new habitats for them anyways.

PS: Andrew has noticed one species that's adapted really well to the shift in the ecosystem due to climate change, and that's the harbor seal. Having expanded its territory due to warming trends, they've encroached on the ringed seals territory, one of the polar bear's favorite meals. This relatively new adaptation could give the polar bears an opportunity to add another meal to their menu but it really depends on how many harbor seals make their way into the Arctic and how they effect the ecosystem.

AD: So this is the common seal you'd see off the east and west coast in North America. And they've actually expanded into the Arctic and polar bears are making use of them at times of the year. The problem is they're nowhere near as abundant as the ring seal, which is their primary prey, the sort of the bread and butter of polar bears. And, and so once you take away ring seals, you're going to see a shift in the ecosystem. Sure, there'll be harbor seals there, but they're never nearly as abundant as, as ring seals, which are found pretty much everywhere in the millions across the Arctic. That's incredibly abundant species. So there were sort of in a transition period right now in parts of the polar bear range some populations are doing fine, some are showing very large declines, perhaps over 50%. So it really just depends on where you are in the Arctic and how a specific population is changing. One of the simplest ways to think about it is we have 19 populations of polar bears across the Arctic and there's 19 different scenarios playing out over time.

They may also have access to Beluga whales and Narwal they might have access to harp seals or hooded seals, walrus. So all of these species and actually the populations that seem to be doing okay have this diversity of prey. But again, it's, it's, it's a limited time offer, sort of a deal because the rate of sea ice loss is really quite stunning in many parts of the Arctic.

PS: Access to a blubber rich diet allows the polar bears to traverse vast portions of their habitat in search for their next meal. If the sea ice begins to disappear it becomes more and more

difficult for the bears to keep their fat stores up. If this happens before the seasonal ice melt, it puts the polar bears in a tough spot.

AD: polar bears have a home range size that's somewhere around 150 to 200 times larger than what you would expect in a, an area to grizzly bear to use. So they do cover these huge, huge areas. And one of the reasons they can do this is because they've got this incredibly energy rich diet. And so one of the ways to, to think about the difference between grizzly bears and polar bears, even though both are good arctic species the grizzly bears kind of an energy conserver. They take in very few calories and use as few

Polar bears, on the other hand, have this incredibly rich diet which is predominantly seal blubber or fat. And that allows them to move over great distances. And of course live in an incredibly cold environment. I always sort of put it down to this. I mean, polar bears are tough, but you know and you think about grizzly bears as being a pretty neat animal and pretty tough as well. But when the weather gets bad, grizzly bears just go to sleep. Polar bears just get going and start actually earning a living when it gets cold. So these two species are almost opposites in terms of their life histories.

what polar bears are doing is they're making a living off of eating fat. And to put this in context, I'm an adult polar bear. A big adult male could weigh 500 kilos over a thousand pounds and they can take in about 20% of their body weight in a single meal. So you're talking about a seal like a big bearded seal, easily providing 200 pounds of fat and the bears just basically blimp up on this. But then the really neat thing is of that fat over 90% of it is going to go directly into their own fat cells, almost unmodified. So it's just basically they like, and one of the ways I think about polar bears, they're like a fat vacuum.

They go around the our Arctic killing seals, sucking off this layer of fat and then just sticking it on their own body stores. And so they don't have to kill a lot of seals in a given year, but they have to kill enough to put down a good enough fat store primarily in the spring time when seal hunting is really good. And then they rely on that fat store lay down in the spring to survive through the summer period when sea ice either retreats far to the North or disappears all together. And it's this fat depo that's critical in terms of their life history because when they're not feeding, the bears are using about two pounds or about a kilogram of body mass per day. Most of that's fat stores for energy. So once or on shore, for the most part, they're not finding very much to eat. And so they quickly bleed down this fat reserve. And it's not a problem if they're only on land for perhaps three months or maybe four months. But once you get out to five or six months, then a lot of bears in the population haven't managed to sustain that long duration of fasting. And then of course, that's when we start to see mortality through starvation.

PS: During the Summer months, the bears preserve their energy on land and sometimes that means they're close to human populated towns. One particular town called Churchill in Manitoba experiences such a high number of polar bears, it's internationally known as the polar bear capital of the world. Manitoba is located on the west shore of the Hudson Bay and it experiences an influx of polar bears as they wait for the Bay to freeze. The longer it takes for the ice to freeze, the longer the bears stay in town. Coexistence with the bears is a necessary step to ensure the safety of the residents and bears of Manitoba.

AD: Churchill Manitoba is kind of the best managed polar bear population in the world from, from the perspective of human bear conflicts. And, and basically they didn't have a choice.

Historically, at least when the, when that population was much larger, used to be about 1200 bears. And when there's more bears than people around, it's a, it's pretty clear that you've got some issues going on. And so in the early days, what used to happen is there was a military base there in Churchill and a lot of the bears that came around town were just shot. And so that was sort of the situation, the fifties and sixties and early seventies, and it became clear that that was not a great longterm solution. So on the 1980s, the province of Manitoba developed what they call the polar bear alert program. And that was basically the first things was to scare bears away from town.

So if a bear is near town, you just scare them away using cracker shells or firing guns or trucks. And that works to some extent, but some of these bears are pretty persistent about staying around town, especially if they get a food reward. So back in the early eighties, they decided it was, is maybe an option to catch these bears and then fly them out of town. And so that was done for a little while and they brought in an old DC three, put the bears on, flew themselves. The problem was the bears were back in town about three or four days later. So the next solution was this polar bear jail, or now it's more form of, they call it the polar bear holding facility. And the bears are put in there when they cause problems around town and if the jail fills up, then what they do is then they immobilize the bears put them under a helicopter, fly them north and let them go again.

If you come back to town, you might be held there until the sea ice reforms, then they're released back out onto the sea ice. So it's a very expensive program. It's very labor intensive. It doesn't remove all the risks for the people of Churchill, and we still sometimes have a bare incidences there, but compared to what it would be like if you didn't have that program it's pretty special. So in the context of keeping that population in place, it's been absolutely critical. In Churchill, it is now sort of considered the polar bear capital of the world. It's, it's a huge tourism industry that's grown up around visiting the bears and seeing them from Tundra buggies. So that's kind of a, a neat aspect of it. I'm going to be up there in early November and sort of the peak of the polar bear season. And I tell you though, you're in polar bear habitat there and you don't walk around idly in the middle of the night. And there's a lot of interesting adaptations. People tend to leave their doors unlocked. Just knowing that if a bear is chasing somebody coming up to a lock doors, not a great solution. So there's things like that. You leave your vehicle unlocked in case somebody has to jump into it as well. So there's a lot of interesting sort of human adaptations to the bears as well in that area.

It's, it's an interesting phenomenon because, you know, if you consider people living in the south in North America, I mean, we have pretty low tolerance for having bears in our backyard. But yet in Churchill, it's actually not uncommon to have a bear walk down the street and people kind of expect it. And then of course you've, there's a special hotline you phone and then the wildlife officers come out and catch the bear or chase it away. So it's, it's kind of a unique aspect of living with polar bears.

PS: While towns like Churchill are well prepared for Polar Bear encounters other areas aren't. A little further north from Manitoba is the populated Canadian territory called Nunavut which experiences visits from polar bears as they continue to linger and expand their travels on land due to prolonged ice melt.

AD: One of the big problems we've got though in that population of western Hudson Bay is while the town of Churchill is extremely well set up for dealing with polar bear conflicts the

communities further north in Nunavut haven't got anywhere near the resources that Churchill has. So one of the consequences is as the bears migrate past Churchill that's all well and fine, but with the sea ice forming later and later, every year, the bears are spending more time on land.

And that also means they migrate further northward past these communities. And at that point the bears are definitely a lot more hungry and start to look for food. And of course this is where we start to get a lot more conflicts. So the communities north or have sort of smaller programs, but nowhere near the infrastructure that Churchill has. And so one of the consequences is that the number of problem bear kills in Nunavut is, is increasing in many communities. And it's a real concern. You know, you don't really want to send your kids off to school thinking that there could be a polar bear around the corner and you know, the bears are coming just at the time of year when the days are getting very, very short. So as a lot of darkness, a lot of blowing snow, it's, it's not easy to find a polar bear in a snowstorm. So it's pretty dangerous for some of those communities.

PS: Part of Andrew's work involves public outreach straight from an Arctic tundra buggy where he informs people globally about the polar bear's behaviors and interactions within the impacted areas of Canada. Andrew also takes this opportunity to gather scientific research which can improve the outcome of interactions between polar bears and people.

AD: Yeah. Welcome. What you put, do this. When I go off in the fall mostly what we're doing is I'm doing a fair bit of outreach and public education. So I work with a group called polar bears international as a volunteer scientific advisors. So at that time of year, we're mainly up there. We can do podcasts from right out on the Tundra. So we can be sitting right next to a polar bear and we can be talking about the bears, watching them play fight. And then we can talk to people anywhere. From a scientific perspective. In the autumn, we have several programs that we've got going on. Right now some of my collaborators are deploying satellite telemetry callers on adult female polar bears.

So we only use these on adult females because their body size is at maximum size and we can put a collar on and then we can follow these bears out onto the sea ice. So we'll deploy about 10 of those this fall on these adult females. And then as well the bears that are being handled by the polar bear alert program, they tend to be a lot of sub-adults and some adult males. Some of those bears will be getting a satellite transmitters that are attached onto a small ear tag. So these little radios are about the size of half of a matchbox and we just put them on with a, like a cattle tag onto their ear and they give us about three to four months of information about where the bears are traveling. And one of the questions we're looking at with that study is how many of the bears that are handled around Churchill end up becoming trouble for the communities further north. So we're trying to get a better handle on, on the human bear interactions. How many of those bears are coming back around town? What do they do after they're released? And trying to get a better insight on an handle on how to improve the management of these problem bears that come around town.

So the Churchill program is sort of the Cadillac of, of polar bear management but a lot of the northern communities are slowly developing the same sorts of protocols about basically trying to control attractants trying to deter bears before they get into town. They certainly don't have the same infrastructure like access to helicopters and things like that. But it's, it's coming in and I think if we look across the Arctic, one of the common features that we see is that the number of

human bear conflicts is just going straight up almost everywhere in all of the five Arctic countries. With polar bears, we have more and more human bear conflicts every year.

The more main research program that I've got going right now for fieldwork is actually in the spring time on the CIS in Hudson Bay. And for that project it's all helicopter based. And so we wake up in the morning, we've got a nice research facility on the edge of town that we can park our helicopter out front. We do a weather check and then basically if it's nice, clear sunny day and we can fly we take off and we are tracking bears out on the sea ice. We're usually looking for their foot pads in the snow. And then once we get onto those, we can follow them anywhere from, well, if we're lucky, just some minutes, but sometimes for an hour or more until we finally catch up to the bear and then we shoot a dart into it, put it to sleep, they're down for about an hour and that they're safe to work on and then they're recovering pretty quickly, so we get the heck out of there. But at that time we're deploying again these year tag radios on the bears. We're also taking a whole host of biological samples. So we take hair, blood fat, milk samples, and some of these are for looking at environmental pollutants. Some of them are used as measures of body condition. We also take a whole bunch of body measurements as well, and, and then the bears happily go about their way.

PS: In addition to collecting data for wildlife management there is one public perception that Andrew finds worth addressing to clear up any misinformation. For many of us the polar bear is the poster child of climate change. Whenever climate change and melting ice caps are mentioned in the news or social media, an image of a polar bear isn't too far behind. Though it does promote attention and engagement towards climate change, which is clearly a huge issue of our time, the facts on polar bears aren't necessarily accurate.

Based off of his data, Andrew explains the timeline of polar bears life expectancy during the climate crisis and how the "three generation rule" is used to assess a time frame of potential decline. At the point of this decline, some unfavorable measures may need to be put into effect to protect the polar bear population from extinction.

AD: The interesting thing about polar bears that that confuses a lot of people is they, they know they're at risk from climate change, but there is this sort of perception from a lot of people that like, they're gonna disappear soon. And it's an interesting phenomenon, but no polar bear scientists has ever said that. When we talk about the threats to polar bears, we do it within the context of what we call a three generation rule. And for a polar bear, a generation length is somewhere between about 11 to 14 years. So when we talk about three generations, we're talking 30 to 45 years out into the future.

The basic issue for polar bears is what happens to sea ice. And the sea ice modelers make a pretty grim forecast for many of the parts of the range of polar bears when you start to get out to the mid century sort of timescale. And it's going to be clear that there's not are going to be enough ice in many of the parts of the current range of polar bears and those populations will disappear. They just won't have enough time to accumulate the fat that they need to survive a prolonged fast. And based on our analyses projections, once we get out to a boat 180 to 220 days, sort of in that range, we're going to start to see very, very high mortality across the population. And at that stage, it's just a matter of time before that population would blink out. On the other hand though, even our most sort of pessimistic projections about sea ice, so that would be sort of the business as usual.

We don't do anything about greenhouse gases type of approach is we're still going to have polar bears persisting to the end of the century. And that's about as far as any scientist is willing to project, but we'll still have sea ice, it'll still get cold in the winter in the Arctic. But it's quite likely that we'll have a, a much, much reduced abundance of the species. On the plus side that does give us time to get our act in order. And, and if the planet does start to cool down, then we'd have a nucleus of bears in the wild that could repopulate southern areas if sea ice started to reform. And things got colder over time. And that of course raises a lot of questions about what do we do to help bears in that interim sort of period. And a number of years ago some colleagues and I wrote a paper about what we would do about polar bears in a rapidly changing arctic. So the question here is there are lots of different methods that we apply for conserving species in the wild. And the question is, which ones do we apply to polar bears?

In that context of what do we do about polar bears in a rapidly changing arctic, there's lots of things you can move the bears, you could take them from places where the sea ice is no longer good enough for them and fly them to the High Arctic, let them go. The problem with that is polar bears are incredibly strong at homing. And so a lot of them might just try to get their way back to where they came from. But the other options are, are sort of a little bit more drastic. And some of them would include things like supplemental feeding and it sounds really strange and you'd go out and feed a population of wild polar bears. You wouldn't necessarily have to do it all the time or every year, but perhaps if you wanted to maintain a, a viable population of bears in the High Arctic, as, as the conditions really deteriorate in the south you could put out food piles for the bears.

There is polar bear chow that's used in zoos to feed them. And the idea here would be to supplement their wild food in those years when they would need it to sustain them in the long term. And then at some point, hopefully we, that, you know, the bears could expand southward if, if the climate cooled again, it's a kind of a radical solution and people sort of go, oh, well we would never do that. But if you go into parts of Eastern Europe people already feed their populations of grizzly bears or brown bears in those areas. It's a common practice and they do it to keep the bears away from people but to also maintain a viable population, which is also used for sport hunting. So in that context, we do it already, we feed elk and we feed California condors, so it's, it's not inconceivable that polar bears would get on that list eventually assuming that a, we have the resources and the interest at that time. I, I personally think that once we get into those sorts of conditions, it may be that humanitarian issues and helping people around the world are going to take much greater priority over trying to feed some polar bears in the High Arctic.

PS: No matter how we approach the survival of polar bears in the future, it is important to shift our current actions to reduce carbon emissions and the rapid decline sea ice. The more actionable plans we make now, the less we have to rely on drastic survival methods. It's what keeps Andrew motivated to push for a healthier and happier planet for the generations to come.

AD: You know, having worked on polar bears for over 35 years I'm attached to them sort of scientifically, emotionally. You try to sort of divorce yourself from the situation you to look at your data. Uh you look at the numbers and you try to be objective. From a personal sort of standpoint though, when I sort of reflect on climate change in the Arctic I think future generations are going to judge us very, very harshly because we can see what's coming. We know what the answers are, but we're not willing to pay for the solutions. And that sort of scenario is, is rather distressing from the perspective that I have two children. And the, you know, they're older now,



but they're certainly aware of the issues. Future generations I think are going to wonder, you know, we could see this coming and we knew about it for a long time and yet nobody chose to do anything about it. And I think that's the thing that probably bothers me the most. And I've often, you know, we still have polar bear climate change deniers out there.

It's, you know, it's tough. And I think part of the problem is, you know, I still live in a house. I, I walk to work, but I own a car. I think we need solutions that work for people. And I think more and more we're getting to that point where there are viable alternatives to fossil fuels, but we're not gonna be totally divorced to fossil fuels immediately. So it's a process. I think governments are slow. I actually have more faith in industry coming up with solutions than I do governments just given that the industry has a longterm perspective that they want to be in business for a long time. They have to do things that, that are going to pay off for them. And using less fossil fuels is going to be one of those longterm solutions. Governments, it's a short term cycle. They don't have the long view in mind. And so I'm, I'm much more optimistic about industry and, and lower tiers of government where cities can actually introduce changes much more rapidly than federal governments.

The future for polar bears really depends on what humans do in the coming decade or decades. And the more we reduce greenhouse gases and carbon dioxide levels in the atmosphere, as it's quite clear, is that if we can bring those levels down or at least slow the rate of increase it, it helps polar bears. And I think that the, the optimistic side of me says that I think we can easily see a future a hundred years out where we still have polar bears and hopefully the planet is doing very different things that create a better opportunity for them to recall an ice places that they will have lost in that intervening period. So I don't think it's all as lost, but again, it really depends on what we decide to do as a species in the coming years.