

**PRE ROLL**

*\*atmos fades up\**

*I'm really excited, I've never seen a polar bear before? What a great day-01 this is going to be so much fun*

*\*gate squeaks\**

Dun dun dun dun

*omg omg omg omg. There's a polar bear right in front of me, hello!-01 why did i put on this voice*

Dun dun dun dunnnnnn

I'm Wendy Zuk and you're listening to Science Vs from Gimlet Media... This is the show that pits facts against fluffy white bears ... I'm at Memphis Zoo... and zookeeper Kim Sanders is showing me my very first polar bear.

*He looks like a mythical creature KS Oh I love that. they're so big, it takes your breath away, it takes your words away! Everything, that face you're having right now, I feel that everyday with him.*

She's talking about Payton... a thousand pound<sup>1</sup> polar bear. And I'm at the back entrance of his enclosure - where visitors don't usually get to go. This is where he sleeps and gets fed. And although Payton and I are separated by a thick steel mesh gate... I'm allowed to get really close, close enough to feel his breath on my hand.

<<Breathing>>>

*Oh my gosh, his head is like maybe a hand span away from mine. -04*

<<bear snuffling>>

Payton is a healthy polar bear -- he gets all the food he needs and he spends his days swimming and playing with toys. But away from zoos like this... we're not seeing images of happy polar bears like Payton... In the wild... we're told ... they're starving.<sup>2</sup> Like, late last year [National Geographic released a video](#) of an extremely skinny polar bear... and it went viral<sup>3</sup>.

<<music here>>

This music was playing... as the desperate polar bear searched for food in rusted trash cans... and we were warned that this is what climate change looks like... The feeling is that if we don't act soon... polar bears will go extinct.<sup>4</sup> And the last polar bears that we have will just be in zoos.

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<sup>1</sup> ["Payton" is our big male](#). He is 10 years old and weighs about 1,100 lbs.

<sup>2</sup> [Without action on climate change, scientists](#) predict we could lose wild polar bears by 2100

<sup>3</sup> the guardian released the same images with another 1.5 million

[https://www.youtube.com/watch?v=oiC\\_HG3u-nk](https://www.youtube.com/watch?v=oiC_HG3u-nk)

<sup>4</sup> [At 0:11](#)

Some people have different ideas though. They think these claims are completely overblown ... It's really polar-bearising.

*Without action on climate change, say goodbye to the polar bears... it's totally false*

*There's No Question That Polar Bears Are Thriving*

[The predicted catastrophe failed to materialise](#)<sup>5</sup> .

And a lot of the people saying this stuff are climate change deniers... which makes me think of course that it must be nonsense: but when it comes to polar bears - they kind of have a point<sup>6, 7, 8</sup> ...Because get this? There are around 25,000 polar bears in the wild...<sup>9</sup> and as best as we can tell... over the last ten years [polar](#) bear numbers haven't gone down.<sup>10, 11</sup> . Even the World Wildlife Fund... the big hippies with the panda on their logo... they say that **most** of the polar bear populations are in "healthy numbers"<sup>12</sup>.

So on today's show we're going to find out what is going on here!?! Are polar bears going extinct or not?

When it comes to polar bears there a lot of sad music...

<<Sad music which then turns into Ahhhh>>>

But then there's science.

Ahhhhh

This week marks the tenth anniversary of the polar bears getting listed as threatened under the US Endangered Species Act. Ten years. so you might think back then their numbers were crashing. For the most part, though: they weren't<sup>13</sup>. So why were the polar bears listed as

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<sup>5</sup> [Meet the scientists, economists,](#) engineers, and policy experts who persuaded Trump that man-made global warming is not a crisis, and therefore Barack Obama's war on fossil fuels must be ended; <https://www.youtube.com/watch?v=t3QNP12JTg>

<sup>6</sup> [Some of those subpopulations are declining,](#) others are stable, and some may be increasing.

<sup>7</sup> [The PBSG concluded that one subpopulation](#) (M'Clintock Channel) has increased, six were stable (Davis Strait, Foxe Basin, Gulf of Boothia, Northern Beaufort Sea, Southern Hudson Bay, and Western Hudson Bay), three were considered to have declined (Baffin Bay, Kane Basin, and Southern Beaufort Sea)

<sup>8</sup> [The International Union for Conservation of Nature](#) is the global authority on the status of the natural world and the measures needed to safeguard it.

<sup>9</sup> [Global population of polar bears](#) is currently estimated to be approximately 26,000 (Wiig et al. 2015),

<sup>10</sup> [Global population of polar bears](#) is currently estimated to be approximately 26,000 (Wiig et al. 2015),

<sup>11</sup> [The current global population of polar bears](#) is estimated to be 22000 (Lunn et al., 2002).

<sup>12</sup> [Although most of the world's 19 populations](#) have returned to healthy numbers, there are differences between them. Some are stable, some seem to be increasing, and some are decreasing due to various pressures.

<sup>13</sup> The polar bear was listed due to the threat posed by the loss of sea-ice habitat resulting from the effects of climate change, and the inadequacy of existing mechanisms to curtail that threat (73

threatened? Why all the hot and bother about them back then? To find out... we had to speak to the lawyer who got the polar bears all this attention. <sup>14 15 16 17 18 19</sup>

*I'm Kassie Siegel, I work at the Centre for Biological Diversity*

Kassie is an environmental lawyer ... and as you'd expect - she loves heading out into nature... she used to raft through Alaska... where she told us that the water there is..

*beautiful turquoise blue iconic blue colour, it's just a beautiful wild place...*

And the 1990s... Kassie wanted to save places like this....<sup>20</sup> from Climate Change... which the US Government really wasn't doing anything to stop ...

*it's really frustrating and it's really tough to see all of the missed opportunities-01*

Being an environmental lawyer... Kassie thought: what can I do to help???

*We wanted to force the Government to start addressing climate change*

But how? Well... Kassie and her team took a good look at [US Endangered Species Act](#) ... and they thought they could use in a cheeky way to get action on climate change<sup>21</sup>. You see... it has

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FR 28277). It was the first species listed by FWS under the ESA due to the ongoing and projected impacts of climate change"

[https://www.fws.gov/alaska/fisheries/mmm/polarbear/pdf/PBRT\\_CMP\\_QA\\_final.pdf](https://www.fws.gov/alaska/fisheries/mmm/polarbear/pdf/PBRT_CMP_QA_final.pdf)

<sup>14</sup> 2826+2644+2158+2585+1592+357+2541+284+980+203+907+943+161+1030 = 19211 ([Add these up](#), plus the "unknowns". Also: [After some new population estimates were developed](#) and after more discussion of the possible numbers in areas without estimates, the range was adjusted to 21,500-25,000 in 2001, and further simplified to 20,000-25,000 in 2005.

<sup>15</sup> [Global population of polar bears](#) is currently estimated to be approximately 26,000 (Wiig et al. 2015), we anticipate that the continued loss of sea ice will cause the population to decline (Atwood et al. 2016).

<sup>16</sup> [NB: Greenpeace Canada used polar bears](#) as an icon of climate change in the 1990s. "Since the early 1990s, GPC has used the icon of the polar bear to dramatize the effect climate change will have on the North". But it looks like this didn't catch on in the US.

<sup>17</sup>In 4 September 2000, Time magazine featured two major stories, one entitled "The Big Meltdown," by Eugene Linden Churchill and the other on Kofi Annan, secretary-general of the United Nations. Although each of these main articles appeared in identical form in the Time magazines distributed in the United States, Canada, and [Europe](#), the [U.S. edition used a photo of Kofi Annan](#) on its cover while the Canadian and European editions used a photo of an iceberg and polar bear on its cover

<sup>18</sup> <http://www.iucnredlist.org/details/22823/0>

<sup>19</sup> Final Rule Listing the Polar Bear as a Threatened Species Under the Endangered Species Act (May 15, 2008) [And [NB: Returned as Vulnerable in 2006 by the IUCN](#)]

<sup>20</sup> We started looking in the mid-1990s. Research supporting listing started to appear in the late 1990s, and we filed the first listing petition for a climate threatened species in 2001. [Email with K]

<sup>21</sup> Kassie tells me that her "organization had been litigating under the Endangered Species Act for many years, so it's more that the new idea was to do a listing for a climate threatened species as opposed to newly discovering something in the law – the ESA is actually an extremely short, simple (and elegant!) statute." [To M]

a particular clause in it... that says if a species is officially endangered, the government is required to do something to protect it. So she starts thinking... what if I found an animal that was going to go extinct just because of climate change?<sup>22</sup> Then the **only** way the Government could protect that animal was to try to stop climate change.

<<Exactly exactly>>

And Kassie knew that to get the Government to list an animal as endangered **because of climate change**... you needed more than lawyers and loopholes... you needed to get the public fired up about saving a beautiful and desperate animal. So here's what she needed: a beautiful and desperate animal, going extinct because of climate change. And the right animal was obvious.

*the glacier bay wolf spider. It's kind of obscure*

*WZ: The what?*

*laughing.*

*I'm going to google image this... Oh!!! it's really scary looking. I come from Australia, I'm not squeamish about spiders but this is like...*

If you want a visual on the glacier bay wolf spider. It's like the love child between a wolf and a tarantula<sup>23</sup>.

*i love the glacier bay wolf spider. its charming hairy little legs. But it was kind of obvious to us that it wasn't going to be an icon of climate change*

No... no one was going to rally behind a creature that could give your kids nightmares... So Kassie and her team found another contender. Surely this time they'd hit upon a really iconic animal.

*KS: the seabird, called the kittlitz's murrelet. it's related to the better known marbled murrelet<sup>24</sup>*

*WZ And the Kittlitz, if we were going to describe it, I would say it looks like a pigeon that a bunch of birds have shat on*

*KS: it's a gorgeous, gorgeous little seabird. kind of a mottled gray<sup>2526</sup>-03*

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<sup>22</sup> [Section 4 of the ESA authorizes](#) the Fish and Wildlife Service (FWS) to identify species as either "endangered" or "threatened."<sup>18</sup> Once listed, the FWS must designate the species' critical habitat and develop a recovery plan

<sup>23</sup> <http://www.iucnredlist.org/details/16219/0>

<sup>24</sup> <https://www.audubon.org/field-guide/bird/kittlitzs-murrelet>

<sup>25</sup> [The Kittlitz's murrelet is a small diving seabird](#) in the Auk family. Its summer plumage is mottled gray or tan

<sup>26</sup> [The Kittlitz's murrelet was designated a candidate species](#) for listing as threatened throughout its range under the Endangered Species Act (Federal Register May 4, 2004).

OK, so it's a step up from the wolf spider, but seriously, no one was going to give a crap about a crappy looking bird. Kassie needed something more charismatic ...

Then in the early 2000s... she saw a study<sup>27</sup>. showing that climate change was threatening a big beautiful creature that everyone with a pulsing heart gives a crap about: Polar bears.

<<Ta da>>!

The study didn't say that their numbers all through the Arctic were crashing right now -- but it did say that this was likely to happen **in the future**, thanks to climate change. And here's why: scientists were predicting that sea ice would drastically shrink because of climate change<sup>28,29</sup>. And, it said polar bears need the sea ice. No sea ice. No polar bear.

Kassie set to work petitioning the US government to list polar bears as endangered. ... and even now as she told my producer Heather Rogers and me about that time... she was really excited

*it was great. i could read those papers and write that petition. 12 or 15 hours a day, it was great, often sitting at the dining room table in my polar bear slippers-07*

*HR: No! you wore polar bear slippers?*

*KS I did. Nothing more motivating than polar bears-01*

So... in her polar bear slippers. Kassie filed the petition on 16th of February in 2005<sup>30</sup>. It was late, just after midnight. She sent out a bunch of press releases and went to sleep... and when she woke up. The story had blown up. It was right on the front page of MSNBC.

*There was a big picture of a polar bear it was a great great moment-01*

And over the next few years [all the major US](#) newspapers published [articles](#) about how the polar bears were being threatened [by climate change](#).<sup>31 32, 33 34</sup>. In 2006 a Time magazine cover featured a photo of a forlorn polar bear adrift on melting ice with the headline, "Global Warming: Be Worried, Be VERY Worried."<sup>35</sup> The polar bear was now an official icon of climate change.

<sup>27</sup> [All ursids show behavioural plasticity](#) but given the rapid pace of ecological change in the Arctic, the long generation time, and the highly specialised nature of polar bears, it is unlikely that polar bears will survive as a species if the sea ice disappears completely as has been predicted by some.

<sup>28</sup> [Polar bears \(Ursus maritimus\) rely](#) upon Arctic sea ice as a physical habitat.

<sup>29</sup> [Polar bears prefer multiyear ice for protective cover](#) and for a platform to hunt their favorite food, ringed seals.

<sup>30</sup> I sent it out at 12:01 am on the 16th. So when I woke up, it was early morning on the 16th (the day that the Kyoto Protocol entered into force without the participation of the US)

<sup>31</sup> <https://www.biologicaldiversity.org/news/media-archive/PolarBearsNYT12-27-06.pdf>

<sup>32</sup> <http://www.350.biologicaldiversity.org/news/media-archive/PolarBearVanityFair5-1-08.pdf>

<sup>33</sup> <http://www.biologicaldiversity.org/news/media-archive/PolarBearLAT2-3-08.pdf>

<sup>34</sup> [http://www.biologicaldiversity.org/species/mammals/polar\\_bear/pdfs/ESANewsweek6-9-08.pdf](http://www.biologicaldiversity.org/species/mammals/polar_bear/pdfs/ESANewsweek6-9-08.pdf)

<sup>35</sup> <http://content.time.com/time/covers/0,16641,20060403,00.html>

And school kids started sending letters to congress begging them to support Kassie's petition.

*It was amazing how many classrooms did that*

And in 2008, the polar bear was listed as a threatened species<sup>36 37</sup> which means it was likely to become endangered soon.

*It worked, hey it worked! But I am.. with these kinds of things It's hard to get to sound too excited--So, I was very very glad that polar bears got the attention. But in order to make it mean something we have to solve the problem and we haven't done that.*

Kassie did this whole thing to get the US Government to protect the world from climate change...And over the years -- her cheeky plan obviously wasn't enough. These days it's looking grimmer than ever.

*<<Put the miners back to work, get the mines open>>*

And maybe it isn't surprising that the Endangered Species Act wasn't enough to force the US Government to radically change its energy system. But still, it was a nice try.

So we know that when Kassie started this campaign more than ten years ago, the polar bears weren't dying off in droves. The main reason the bears were listed as threatened was because of what could happen in the future.<sup>38</sup> And guess what? We're in the future now!

*<<Jet pack/ future noise that's clearly not where we are now>>*

So what's happening today? Well over the last decade - as scientists predicted - the Arctic<sup>39</sup> has lost tonnes of sea ice<sup>40 41 42 43</sup> Millions of square kilometers of the stuff... But what's

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<sup>36</sup> [On May 15, 2008, the U.S. Fish and Wildlife Service](#) (FWS) listed the polar bear (*Ursus maritimus*) as a threatened species under the ESA (73 FR 28211).

<sup>37</sup> [Threatened](#) - any species that is likely to become an endangered species within the foreseeable future

<sup>38</sup> [The Secretary cited the significant reduction](#) of sea ice as the reason for the listing, but was careful not to mention the role of global warming

<sup>39</sup> [The Chukchi Sea population is shared with Russia](#) and we do not have a current or reliable abundance estimate. The most recent estimate, based on expert opinion of the IUCN Polar Bear Specialist Group (PBSG) and extrapolation of previous denning surveys on Wrangel Island (Russia), was 2000 bears in 2002 (PBSG 2002)

<sup>40</sup> [As assessed over the period 1979-2014](#), the date that sea ice retreats to the shelf break (150m contour) of the Chukchi Sea has a linear trend of -0.7 days per year.

<sup>41</sup> [Our examination confirms the ongoing loss of Arctic sea ice](#), and we find significant ( $p < 0.001$ ) negative trends in all months, seasons and in the annual mean. The greatest rate of decrease occurs in September, and corresponds to a loss of 3 106 km<sup>2</sup> over 35 years

<sup>42</sup> [Since 1979, that trend has led to a loss of 620,000 square miles](#) of winter sea ice cover, an area more than twice the size of Texas.

happening with the polar bears is more complicated. To understand what's going on we spoke to polar bear researcher... [Karyn Rode from the US Geological Survey](#) and she is someone who gets very close to her research subjects...

*KR They have really thick fur, and they are very warm,*

*WZ What does their breath smell like?*

*KS if they've just recently eaten seal, then they smell like seal, which is a bit fishy otherwise i suppose it's a bit like dog's breath-01*

To get that close to them, Karyn does some pretty adventurous science. She shoots polar bears with a tranquilizer gun. From a helicopter.

*KR We use the helicopter to fly along the tracks because the bears have traveled so far that we would never catch up with them walking...*

She weighs, measures<sup>44</sup>... and takes blood samples from the bears.<sup>45</sup> And things, she says, can get pretty slippery when you're trying to study an unconscious bear.

*KR We're all sliding, It's like having a 1000 pound animal on an ice skating rink*

And while doing all this slipping and sliding... Karyn found that the bears in this part of the Arctic<sup>46</sup>, <sup>47</sup>, <sup>48</sup> ... were for the most part healthy... In fact she found huge fat polar bears that were more than 1300 pounds...

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<sup>43</sup> I took a quick look at September, which the minimum month, and the Beaufort trend is -13,000 sq km per year and the Chukchi trans is -12,900 sq km per year, so yes, "about the same" is good.

<https://nsidc.org/arcticseaicenews/sea-ice-tools/> [Email from WM]

<sup>44</sup> [Immobilized bears were weighed to the nearest kilogram \(kg\)](#) in the Alaskan portion of the SB and CS, but were not weighed in the Canadian portion of the SB. For all bears, straight-line body length, tail length, and zygomatic skull width were measured and age was determined as described in Rode et al. (2010). We measured straight-line body length of adults as an indicator of structural size. Body mass, skull width, and energy density (described below), which can vary annually and seasonally (Rode et al., 2010), were used as measures of condition.

<sup>45</sup> [Levels of blood urea nitrogen \(BUN\)](#) and creatinine were measured in serum to identify bears that had fasted for >7 days

<sup>46</sup> [Thirteen of the 150 CS bears \(annual mean 8.0 4.0%\)](#) during 2008–2011 had urea:creatinine ratios (U:C) indicative of fasting ( $\leq 10.0$ ). ... "In the CS, however, body condition was maintained or improved" "Our spring 2008–2011 observations of CS polar bears in good condition and with high recruitment are consistent with autumn observations of bears from this population on Wrangel Island during the same period (Ovsyanikov and Menyushina, 2010) and with comparisons to other populations"

<sup>47</sup> [Rode et al. 2013 documented stable](#) or improving body condition and reproduction for polar bears captured in the U.S. between 1986-1994 and 2008-2011, a period during which substantial sea ice loss occurred, suggesting the capacity for positive population growth.

<sup>48</sup> [Polar bears, ringed seals, and bearded seals appear to have maintained](#) or improved body condition in the CS despite recent sea ice loss

*KR Those are some of the largest bears that have ever been weighed anywhere in the world<sup>49</sup>*

And Karyn saw mamma bears with healthy baby triplets, which is pretty rare<sup>50</sup>. Karyn compared the data she got with figures from the 1980s, and she says these days this group of bears looks good.

*KR We're not cautious about saying that the evidence right now is that that population is stable*

But before you return your CD of sad polar bear music...

<<Sad Music>>

Karyn told us about a group of bears that are not doing so well... And they're **right** next door to the fatties ... these other bears are in an area called the southern Beaufort Sea....<sup>51</sup> <sup>52</sup> <sup>53</sup> ... and the situation for some of **those** bears was pretty bad..

*KR And we found that in the Beaufort Sea 42 percent of females had not eaten anything in past 7-10 days<sup>54</sup>.*

Almost half of the female bears Karyn studied... hadn't eaten in the past week. And this was during a time when some of them really needed to be eating a lot, because they'd just come out of this polar bear version of hibernation... that only the new mums do.<sup>55</sup>

*KR And they will lose hundreds of pounds in body mass so it's particularly important that those bears when they come out of the den in the springtime would be gaining weight and recovering what they lost*

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<sup>49</sup> [Skull width, body mass, and energy density of polar bears](#) caught in the CS during 2008–2011 were also among the largest of any polar bear population that has been measured to date

<sup>50</sup> "In Hudson Bay: Mean size of cub litters in spring was 1.9 and 13% of litters had three or more cubs." [https://www.researchgate.net/publication/229196509\\_Reproductive\\_biology\\_and\\_ecology\\_of\\_female\\_polar\\_bears\\_Ursus\\_maritimus](https://www.researchgate.net/publication/229196509_Reproductive_biology_and_ecology_of_female_polar_bears_Ursus_maritimus)

<sup>51</sup> [autumn sea ice is now thinner and extends](#) to the coast later in the season, autumn pressure ridge formation may be more limited than in the past.

<sup>52</sup> In the Beaufort and Chukchi Seas, historically the ice would not retreat too far from the shore, at least not for very long. Maybe 100-200 miles for most of the summer and there would probably be some isolated ice floes in between. So it's swimmable for the bears. But now the ice edge is retreating far from the coast, several hundred miles, so the bears may have difficulty getting to the ice and/or their food source may not be as available that far out into the Arctic Ocean. [Email WM]

<sup>53</sup> [Only 8% of polar bears captured in the CS appeared to be fasting in spring](#), compared to 21.4 and 29.3% of bears fasting in the SB in spring 2005 and 2006, respectively"

<sup>54</sup> [The percent of adult females fasting](#) declined from 53% (42 - 64%; n = 55) to 10% (6 - 17%; n = 106) in the CS and increased from 30% (22 - 39%; n = 136) to **42%** (34 - 49%; n = 293) and from 13% (3 - 27%; n = 40) to 33% (22 - 44%; n = 99) in the SB and NB, respectively (Fig. 3).

<sup>55</sup> [Polar bears give birth in snow dens in mid winter](#), and remain in dens until early spring. Survival and development of neonates is dependent on the stable environment within the maternal den.

*WZ: So this was a time when these polar bears should have been gaining weight and instead they were losing weight-01*

*KR That's right, and that to me was really striking... <sup>56</sup> <sup>57</sup>.*

And this contrast -- with some bears doing well, and others not -- is happening across the Arctic. So how is this possible? How are some bears fat and happy, and others not so much?

Well Karyn told us that if you really want to understand what's happening here -- you have to know how the bears catch their dinner: seals.

<<SFX Seal [sound](#)>>

Yes, this is the real sound of a bearded seal.

<<SFX Seal [sound](#)>>

The tricky thing is that... Seals are faster swimmers than polar bears... so the bears can't chase them down in the water.

Instead: to catch the seals, the bears sit on the sea ice waiting for them to pop up for air. They. Wait. And Wait. And wait. And then when a seal pops out - they pounce.

Bottom line:

*KR Polar bears need two things to be able to feed they need the ice to access the seals, and they need the seals.*

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<sup>56</sup> [If female bears fall below a certain weight threshold](#), they will not conceive (ENN 2002).

<sup>57</sup> For example, female bears require about 20% body fat in order to have cubs (<https://academic.oup.com/jmammal/article/93/2/540/924692>). Any amount of fat above that and they continue to have cubs. The size and survival of those cubs is affected by the mom's condition, but cubs continue to get produced. If female body condition drops below that threshold to produce cubs, then you have reproductive failure that will eventually result in population decline. But prior to that you may have a much more subtle decline in cub survival. [Email with K]

And as we mentioned... the Arctic <sup>58</sup> has lost a lot of sea ice<sup>59 60 61 62</sup> So you'd expect that **all** polar bears - across the Arctic - would be in trouble **right now because how are they going to catch the seals?** Well the thing is, that some bears, like the fatties, are still catching seals... And here's why.

Bearded seals love swimming in shallow water. And that's cause they eat things on the ocean floor. And where the fat bears live?

<<KR It's shallow over a really large area>>

And even though there's less ice around, the ice that's still there is covering parts of that shallow water. This means the fatties still have a lot of seals to pounce on from the ice.

As for the bears not doing so well?... The ones in the southern Beaufort Sea? They are not so lucky. The sea ice in their area tends to sits in water that's really deep ... And since those seals like shallow water, that means they're not around the ice<sup>63 64 65 66 67</sup>. OK, so to wrap this in a big

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<sup>61</sup> [Since 1979, that trend has led to a loss of 620,000 square miles](#) of winter sea ice cover, an area more than twice the size of Texas.

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<https://nsidc.org/arcticseaicenews/sea-ice-tools/> [Email from WM]

<sup>63</sup> The southern Beaufort Sea has a very narrow, shallow continental shelf with productive habitat. The majority of the area occupied by southern Beaufort Sea polar bears is deep, Arctic basin waters that have low productivity and minimal availability of bottom-feeding prey, such as bearded seals. When sea ice retreats in the summer in the southern Beaufort sea, it ends up over these deep, Arctic basin waters where prey availability is low (<https://www.ncbi.nlm.nih.gov/pubmed/28835844>). [Email KR]

<sup>64</sup> What is happening to polar bears in the southern Beaufort Sea is two fold: 1. in the spring, they are eating less primarily b/c ringed seals appear to have declined in productivity, and 2. in the summer when sea ice retreats (i.e. melts) to it's lowest extent of the year, the ice in the southern Beaufort Sea retreats toward the North Pole and away from the shallow continental shelf waters off the Alaska and Canada coast that is the preferred habitat of seals and polar bears. Bears that stay with ice during the summer move farther and farther north away from good habitat where data show they are feeding less. So seals are not doing well in the Beaufort AND summer ice is pulling them away from good habitat - combine the two and you have a population that is particularly susceptible to the effects of sea ice loss. The population has experienced very low cub survival in some years and a population decline [From K]

<sup>65</sup> <http://sci-hub.tw//10.1002/jwmg.489>

<sup>66</sup> the Chukchi Sea population has access to a huge continental shelf that is shallow and supports abundant prey. Bears continue to have some ice that remains over the shelf even during the annual sea ice minimum. [Email with KR]

polar bear bow: Where the fat bears live, the remaining ice is still near the bearded seals. And where the skinnier bears are - the seals, aren't around the ice so much. There are other things going on in this area too.

*I think what it tells us is that, that's it is not just the sea ice alone that determines what the population status is going to be-01 that they can lose sea ice, some amount of sea ice in some places and maintain access to prey-02*

When you look at polar bears across the arctic there are lots of small differences kind of like this that help explain how well the bears are doing even though there's less sea ice around<sup>68</sup>.

And you might be thinking... if the ice is melting, why don't they just eat what's on land? Well they are ... like even where the fat bears live... Karyn is noticing more bears are coming onto land more often<sup>69</sup> to look for food<sup>70</sup> ...<sup>71</sup>

*KS They'll eat<sup>72</sup> kind of anything that's around, kelp, bird eggs, berries, caribou, musk ox., fish*

But the problem for the polar bears is that Karyn says this kind of food - for the most part- isn't enough to fill them up. And that's because they need a lot of fat.

*Polar bears have the highest fat diet of any species in the world*

Yeah over thousands of years, polar bears evolved basically be on a keto diet... And that land food isn't fatty enough<sup>73</sup> ...<sup>74</sup> But the seals are - they're basically just big blubber balls.<sup>75</sup>...<sup>76</sup>...

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<sup>67</sup> [an increase in the Davis Strait polar bear population](#) has been attributed to greater availability of secondary prey (i.e., harp seals; *Pagophilus groenlandicus*) concurrent with the lengthening open-water season (Peacock et al. 2013).

<sup>68</sup> <http://pbsg.npolar.no/en/status/population-map.html>

<sup>69</sup> Chukchi Sea, twice as many polar bears are coming to shore in the summer and spending twice as long there and they are primarily resting and waiting for the sea ice to return (<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0142213>).

<sup>70</sup> [Several studies in areas where bears are coming](#) onshore earlier and spending more time on shore have documented localized but intense nest predation of sea birds and geese [[9](#), [10](#), [11](#), [12](#), [13](#)].

<sup>71</sup> [We found that high metabolic rates](#) (1.6 times greater than previously assumed) coupled with low intake of fat-rich marine mammal prey resulted in an energy deficit for more than half of the bears examined.

<sup>72</sup> [Like all bears, polar bears](#) are opportunistic and will take a broad variety of foods when available

<sup>73</sup> [Several studies in areas where bears are coming](#) onshore earlier and spending more time on shore have documented localized but intense nest predation of sea birds and geese [[9](#), [10](#), [11](#), [12](#), [13](#)].

<sup>74</sup> [Like all bears, polar bears](#) are opportunistic and will take a broad variety of foods when available

<sup>75</sup> [Based on an analysis by Rick Thoman of the NOAA National Weather Service](#), as of 19 November, ice extent in the combined Beaufort and Chukchi Seas sector was the lowest ever observed in the sea ice record (Figure 4). This was largely driven by the lack of sea ice within the Chukchi Sea

<sup>76</sup> [we examine spring fasting behavior](#) (i.e., not having fed for  $\geq 7$  days) based on blood serum and creatinine ratios of polar bears in three recognized subpopulations (the Northern Beaufort (NB), SB, and CS) over three decades (1983 -2016)

So polar bears probably need the seals, to catch them, they use the ice.

Karyn is worried that if more and more ice melts...even the populations that look good now... will eventually starve...<sup>77, 78, 79, 80</sup>... So our final question: how long will the sea ice last? ...will the polar bear go extinct? That's coming up after the break.

## BREAK

## SEA ICE

Welcome back. So here's where we are: polar bears rely on sea ice to hunt seals and we've lost a bunch of sea ice in the arctic. But... some polar bears are doing fine at the moment, because they still have lots of seals swimming around the remaining sea ice.

In the future though... scientists around the world expect that because of climate change we will lose more and more sea ice<sup>81</sup>... And if that happens: it won't matter how many seals there are. If there's no sea ice -- the bears struggle to catch them. And many could starve.

So, how long will the sea ice last?

For this we had to get a sea ice guy.

*Ok hello!*

This is **Ignatius Rigor**... Ignatius Rigor! Doesn't he sound like an arctic explorer? He's from the University of Washington in Seattle... and still remembers heading out to the Arctic as a young researcher.

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<sup>77</sup> [Polar bears \(\*Ursus maritimus\*\) are inextricably linked](#) to Arctic sea ice and are sensitive to sea ice loss [6]–[10]. Polar bears rely on sea ice as a platform for hunting, migrating, and mating, but are forced to move to land in regions where sea ice does not seasonally persist

<sup>78</sup> [Declining sea ice in Baffin Bay has resulted](#) in a lengthening of the ice-free season by >12 days per decade during the period 1979–2014

<sup>79</sup> [We found that seasonal ranges of adult females](#) in BB became significantly smaller, by a third to a half, between the 1990s and 2000s. This range contraction coincided with a northward shift during the on-ice season

<sup>80</sup> <http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=605> Both models predict continued decreases in sea-ice thickness and extent (Vinnikov et al., 1999), so that by 2050, sea-ice extent is reduced to about 80% of area it covered at the mid-20th century.

<sup>81</sup>Year-round reductions in Arctic sea ice are projected for all RCP scenarios. The subset of models that most closely reproduce the observations<sup>4</sup> project that a nearly ice-free Arctic Ocean<sup>5</sup> in September is likely for RCP8.5 before mid-century (medium confidence) (Figure 2.1). In the Antarctic, a decrease in sea ice extent and volume is projected with low confidence. {WGI SPM E.5, WGI 12.4.6.1}"  
[http://ar5-syr.ipcc.ch/topic\\_futurechanges.php](http://ar5-syr.ipcc.ch/topic_futurechanges.php)

*Being the first time I saw sea ice, all the different shapes and patterns in the sea ice, was pretty amazing 20 or 30 years later - how long have I been doing this -- I still see myself looking out the window and it's pretty amazing...*

## - LOSING SEA ICE

Over the decades, as he looks out the window, he's seen the ice change... like he says in parts of the arctic it's gotten so much thinner<sup>82 83 84</sup>...

## - BEAT MOVING SEA ICE

And what will happen in the future? Well... Ig told us that to find out scientists look into a crystal ball... no obviously they don't do that. Instead they have these very sophisticated computer models... that are [simulations](#) of all the major things that affect sea ice: like heat coming in from the sun<sup>85 86</sup>, greenhouses gases trapping that heat, the heat melting the ice...the thinner ice melting faster<sup>87 88</sup>,

So you have all these factors that make a difference. And as you can imagine by now... sea ice melts in a really complicated way. Take the winds and the currents. They can MOVE the ice around - which then affects how it melts. Yeah, the sea ice isn't just sitting there anchored in place. It's getting blown about<sup>89</sup>,

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<sup>82</sup> [In the Arctic, reductions in the extent](#) and thickness of sea ice have been observed

<sup>83</sup> [Since 2011, downward trends have continued](#) in sea ice thickness and extent, land ice volume, and spring snow cover extent and duration, while near-surface permafrost has continued to warm

<sup>84</sup> [The decreased spatial extent of the ice cover](#) has been accompanied by large reductions in ice thickness [e.g., Kwok et al., 2009] that are primarily explained by changes in the ocean's coverage of multiyear ice (MYI) [e.g., Maslanik et al., 2011]. In the mid-1980s, MYI accounted for 70% of total winter ice extent, whereas by the end of 2012, it had dropped to less than 20%.

<sup>85</sup> [Arctic air temperatures continue to increase](#) at double the rate of the global temperature increase. The average annual surface air temperature anomaly (+2.0° C relative to the 1981-2010 baseline) over land north of 60° N between October 2015 and September 2016 was by far the highest in the observational record beginning in 1900. This represents a 3.5° C increase since the beginning of the 20th Century.... Even small amounts of human-derived carbon dioxide (CO2) can cause significant chemical changes that other areas do not experience.

<sup>86</sup> [The thermodynamics equations take into account](#) air and ocean temperatures, albedo, and other forces that influence the growth and melt of sea ice.

<sup>87</sup> [Over the last two decades, increased air temperature](#) (Lindsay and Zhang 2005) and advection processes that have moved warm Pacific water into the Arctic Ocean (Shimada et al. 2006) and transported older and thicker sea ice out through Fram Strait (Serreze et al. 2007) have driven a rapid decline in sea ice volume and summer extent

<sup>88</sup> the ice is much thinner, which makes it more responsive to the winds. We've seen pretty strong trends in increasing ice drift speed over the last couple of decades. That's because the thinner ice is weaker and more easily blown around and broken up by the winds (and the ocean waves that the winds kick up) [Email Walt Meier, Senior Research Scientist DAAC Scientist]

<sup>89</sup> [sea ice in the Labrador Sea and Baffin Bay](#) can be transported several hundred kilometers over the course of a winter,

*IG it's pretty amazing what the wind and ocean currents can do even on what may seem like a big chunk of ice-02*

Ig says sometimes you can even hear it moving...

*Normally it's so quiet cos there's nothing else happening out there, but when the ice is moving and it's a windy day there's a background din of crrrrr crunching going on.*

This is actually what it can sound like...<sup>90</sup>

<<Blkdjflasfas>>

And here's why this moving ice is so important: because **where** the currents and the winds push the ice plays a really important role in the polar bears' fate. In a part of the Arctic, the ice can get pushed around and can literally be **pushed out of the Arctic...** out into warmer parts of the ocean where it melts easier<sup>91 92</sup>... And Ig says that over the past few decades -- likely because of climate change -- more and more ice is being pushed out of the Arctic ... and melting<sup>93</sup>...<sup>94 95</sup>

*a lot of the older thicker sea<sup>96</sup> ice just got flushed out of the Arctic pretty quick-02*

When models try to predict the polar's future... they also have to consider that the Arctic isn't melting at the same rate everywhere... Like, in the up in the far north of Canada... Greenland, which is just near by, which has a tonne of ice acts like a huge freezer<sup>97</sup> that helps to cool that part of the Arctic.<sup>98</sup> All that's to say that predicting sea ice in the future... and whether the polar bears might hang on is really really tricky... But let's give it a go... Ig looked at a map where polar bears live now...

<sup>90</sup> [But I have usually heard the more crunching](#) and cracking noises (about 0:20-0:30 seconds) when I have been near a developing ridge, which isn't very often. [Email I]

<sup>91</sup> [When the AO is negative, the jet stream moves south](#), bringing winter weather with it. Last winter, for example, the strong winter storms that hit the Eastern United States and Europe were influenced in part by a strongly negative phase of the AO.

<sup>92</sup> <https://www.climate.gov/news-features/videos/old-ice-arctic-vanishingly-rare>

<sup>93</sup> [The AO exhibits a considerable amount of variability](#) from month-to-month (Fig. 11), and there has been a trend towards higher AO conditions consistent with a tendency towards more cyclonic winds over the Arctic Ocean [NB: Cyclonic is counter clockwise]

<sup>94</sup> [These changes were driven by AO wind anomalies](#), which reduced the size of the Beaufort Gyre, thus decreasing the drift of ice into the Eurasian Arctic, and increasing the advection of multi-year ice away from the Eurasian coast towards the Canadian Arctic and out through Fram Strait

<sup>95</sup> [the changes in surface wind that occurred in association with](#) the high-index state of the AO during the interval 1989–1995 dramatically decreased the average age of sea ice on the Arctic Ocean, thereby setting the stage for the recent minima in arctic sea ice extent.

<sup>96</sup> [Because older ice tends to be thicker](#), it is less likely to melt out during summer than first-year ice.

<sup>97</sup> "The eastern arctic has not warmed up as quickly (more land and Greenland acts like a huge freezer). The western arctic is more exposed to wind and has warmed more rapidly. [Email with GM]

<sup>98</sup> Can see here that in the north of Canada ice is getting thinner, but there's still ice! Which bears can play on <http://psc.apl.uw.edu/research/projects/arctic-sea-ice-volume-anomaly/piomas-monthly-thickness-map>

*Ah let's see... places*

And he told us that according to the models ... sea ice is going to really shrink in a lot of the places where polar bears currently live...

*30 50 years from now, I think once the ice starts going away then we're going to see the changes in these populations also*

Two different research groups, with two different computer models -- have both predicted that by 2050 some areas of the Arctic which now host thousands of polar bears may have too little ice to keep those bears alive.<sup>99 100 101</sup>. So that's 30 years away.

And then if we go further into the future? To the end of the century... what happens then?

*IR: if i was a polar bear and i was going to decide where to buy a house, i would buy a house north of Canada<sup>102 103</sup>, and then i'd hope that the humans pull their heads out of their orifices and shift gears*

*WZ: Why would you put your polar bear house there-05?*

*IR: Because that's the last spot i would expect sea ice to be*

Ig says by the end of the century -- there will probably still be enough ice for polar bears in just a few places. Up north of Canada and around Greenland<sup>104, 105</sup>.

And once they're squished into those places ... scientists are concerned that over the years... their populations will get so small they hit a "point of no return". That is no more polar bears in the wild<sup>106</sup>. But we really don't know when or if that might happen.

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<sup>99</sup> [Similarly, to the east of the CAA](#), the west coast of Greenland and much of Baffin Bay may no longer be suitable habitat for polar bears before 2050, though ice should persist along the east coast of Baffin Island until much later. [[Baffin Bay population >2000](#)]

<sup>100</sup> [When considering more extreme ice-free durations](#) (categories B and D), critical events do not begin to occur until after 2050, with the exception of Kane Basin, which begins to experience break-up in June before 2020

<sup>101</sup> [Polar bears in the PBDE \[rough estimates - "could be home to 8000 polar baers"\] and SIE, home to approximately](#) two thirds of the current world population will likely disappear by mid century.

<sup>102</sup> [for a warming of 2.5 °C there is some sea ice left in the Central Arctic Ocean](#) and at the northern coast of Greenland and the Canadian archipelago (Fig. S3).

<sup>103</sup> [The CAA and Greenland were thought to](#) have the greatest likelihood of sustaining polar bears to the end of the 21st century

<sup>104</sup> [https://link.springer.com/chapter/10.1007/978-3-319-46994-2\\_25](https://link.springer.com/chapter/10.1007/978-3-319-46994-2_25): If the species were to persist, it would likely be restricted to a high-latitude refugium in northern Canada and Greenland—assuming a food web also existed with enough accessible prey to fuel weight gains for surviving onshore during the most extreme years of summer ice melt.

<sup>105</sup> The eastern arctic has not warmed up as quickly (more land and Greenland acts like a huge freezer). The western arctic is more exposed to wind and has warmed more rapidly. [Email with GM]

<sup>106</sup> [The Queen Elizabeth and Norwegian Bay](#) populations retain multiyear ice the longest, and their northerly fjords and channels consistently exhibit the fewest critical ice-free events. Nevertheless, by 2100

*IR: The loss of the sea ice has a pretty profound effect on whether they can survive or not as a species*

*WZ and if there is no sea ice what do you think would happen to the polar bears?*

*IR well. i. am i allowed to use the word toast?-01*

*WZ You are allowed to use the word toast. You can put a swear word in front of it if you want to be naughty?*

*IR No..*

So... are polar bears on the verge of extinction??

For now some populations are holding up - despite losing so much sea ice. Which is a bit of a pleasant surprise. So some of those climate change deniers are **technically** right on this point ... but they're unlikely to be right for much longer. Because polar bears need sea ice - and the sea ice is disappearing. From the science we have now it really is possible that for the young kiddies listening...? You might be alive to hear news of the last wild polar bear... It seems like they won't claw their way out of this.

<<music post>>>

And if we keep losing large chunks of sea ice in the Arctic... we'll have more to worry about than just the polar bears.

I mean, what about the Glacier Bay Wolf Spider?

<<Sad music>>

With its charming hairy little legs????

That's Science Vs Polar Bears.

## CREDITS

To read more about the polar bears and see our transcript, with all of our citations - sign up to our newsletter... head to [Gimletmedia.com/newsletter](http://Gimletmedia.com/newsletter). This episode was produced by me, Wendy Zukerman, our senior producer Kaitlyn Sawrey, and Heather Rogers, with help from Rose Rimler, Shruti Ravindran, and Meryl Horn. Extra help from Saidu Tejan-Thomas. We're edited by Blythe Terrell, extra editing help from Caitlin Kenney. Mix and sound design by Emma Munger. Music written by Bobby Lord and Emma Munger. Recording help from Peter Frick-Wright, Amber Cortes and Katy Sewall. A huge thanks to all of sea ice and polar bear

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all regions of the study area may cross the critical point-of-no-return, putting the persistence of the CAA polar bear populations in jeopardy.

researchers that we contacted for this story, including: Dr Walt Meier, Professor Kent Moore, Dr Ian Stirling, James Wilder, Anthony Pagano, and Dr Peter Boveng. Thanks to Danielle Brigida, Frank Lopez, Gerald Thompson, the Zukerman Family and Joseph Lavelle Wilson...

Next week we look at the little known story of how an American scientist influenced Hitler...

EUGENICS PROMO - people were sterilised, people were killed with this as part of their justification

I'm Wendy Zukerman fact you next time.

*So where is the softest part of them?*

*Behind their ears, that's as soft and fluffy as you want you them to be*