Northern Lights Episode 11

How Arctic Seals Became Climate Scientists

Produced, Edited and Narrated by: Felicity Spoors, University of St Andrews, Scotland

Interviewees:
- Dr Lars Boehme, Assistant Professor at the University of St Andrews & scientist at the Sea Mammal Research Unit, Scotland
- Dr Aqqalu Rosing-Asvid, Research Biologist at the Greenland Institute of Natural Resources, Nuuk, Greenland
- Professor David Holland, Professor of Mathematics at New York University & Director for the Centre for Sea Level Change at New York University Abu Dhabi

Introduced by: Sarah Mackie

Sarah Mackie

In today’s episode, Felicity Spoors takes us on a whistle stop tour of some key Arctic research projects which are giving oceanographers and marine scientists new insights and understanding about the Arctic. From the icy Arctic Ocean to the warmth of university labs and libraries, Felicity explores ways in which scientific research in the Arctic can be undertaken sustainably.

Felicity is a recent graduate of the University of St Andrews in Scotland.

This is Felicity Spoors with: ‘How Arctic Seals Became Climate Scientists’.

Felicity Spoors

Hello everybody and welcome to the next episode of the Arctic Initiative podcast. My name is Felicity, a former student at the University of St Andrews in Scotland where I studied
Marine Ecosystem Management. Joining me today are Dr Lars Boehme, an academic at the University of St Andrews and scientist at the Sea Mammal Research Unit based in Scotland, Dr Aqqalu Rosing-Asvid, who is a research biologist at the Greenland Institute of Natural Resources and last but not least, Professor David Holland, a physical climate scientist and professor of mathematics at New York University and director of the Center for Sea Level Change at New York University Abu Dhabi.

So today we’re going to be thinking about how we can collect important climate data from dangerous locations. Namely, the rough and wild polar oceans ...*Icebreaker audio* Where in winter, you need an icebreaker just to get around!

Now all of my guests have some experience with this and work with an elegant solution to this problem. In short...

**Dr Lars Boehme**

So they are tiny little weather stations on seals.

**Felicity Spoors**

But before we explore that further, lets first think a little bit about the problem.

So, climate change. It’s been cited as one of the biggest threats of our time. Many of us will have heard of the impacts, so we’re thinking rising sea levels, extreme weather, record-breaking temperatures, that kind of thing.

And of course, none feel climate change more so than they do in the polar regions. So both polar oceans in the north and south are warming. The ice sheets in Antarctica and Greenland are both rapidly losing mass. Climate-related changes in the Arctic are also impacting things like native vegetation and distributions animals, so things like reindeer and salmon, which then of course ultimately impacts things like food-security for Arctic residents and indigenous people groups.

Now scientific data, as we’ll hear, is essential for climate studies, and so with that, lets meet our first guest.
Lars, hello! Lovely to have you with us. Can you tell us about your research interests?

**Dr Lars Boehme**

So my research interest started with trying to understand how the heat is transported around the globe in the oceans. So I’m a trained physical oceanographer and I’m interested in our earth system, the environment, how that works, which equations we can use to describe that. But during my journey, I started to become interested in marine mammals for many different reasons because they are absolutely wonderful and amazing what they can do but also because they now help me to understand the climate.

**Felicity Spoors**

So you mentioned Marine mammals there, primarily that’s whales, dolphins and seals right? So, what is the connection between oceanography and marine mammals?

**Dr Lars Boehme**

The connection for me became apparent when I was working in in polar oceans and obviously when I started my career, this is where I wanted to go, and I went into the Arctic and did my research and it was mainly in the summer time because it’s a really remote place. The weather is extreme, the weather is really extreme, so even in the summertime you know, it’s really cold water and you have to get the instruments out and the weather can be bad so its uh, I still enjoy it. I like field work but you thought like “humph really do I have to spend the time here in this cold weather getting frostbite on my fingers?” and everywhere we went we saw marine mammals. So this is where I started to see a connection between ‘hmm there are these fantastic animals, maybe we can help each other?’ And kind of at the same time, the researchers here at the Sea Mammal Research Unit in St Andrews, who were really interested in marine mammals started to realise they needed to know more about their environment these animals are in. So they wanted to know more oceanography. And this is where I started to get really really excited. I suddenly could get data from how salty the ocean is, how cold the ocean is from where these animals are and they are there in the wintertime so I could sit in my warm little office somewhere in Scotland and get the data in near real time,
you know, half an hour after it was recorded from around Greenland and that got me really, really excited.

**Felicity Spoors**
Yeah, that is really exciting. So which marine mammals would be your data collectors of choice then?

**Dr Lars Boehme**
So I, from my oceanography side, I’m more interested in working with seals because they have a nice fur, you can glue something to this fur, and seals change their fur every year. They go through what’s called the moult. So once a year, they change the whole fur and whatever I glue to them will drop off. So it’s not a permanent thing we put on them, but it stays on for maybe 10 month, the tag we glue on.

So I’m looking for animals that dive deep. So in Antarctica, it would be Elephant seals who dive down to 2,000 meters and Weddell seals so 400-500 meters and in the Arctic, it would be Hooded seals or Harp seals, they are kind of the deep divers in the polar oceans, so I get a nice temperature or salinity profile from the upper part of the polar oceans.

**Felicity Spoors**
Aah ok, so you mentioned temperature and salinity there; why is that important to know?

**Dr Lars Boehme**
In oceanography, the most important things we want to measure are temperature and salinity and together with pressure because pressure gives us the depth essentially. And temperature, temperature and salinity gives us density. And the changes in density in the ocean make water move, so this is why I want to have density.

**Felicity Spoors**
Aah I see. Ok, so changing the topic a little bit here to ethics; this kind of research must be an absolute ethical minefield, right? So, what ethical concerns do you have to consider here?
**Dr Lars Boehme**

Ethical concerns always come first. The main part of every project is trying to better understand these animals, so every project starts by trying to figure out what we need to know about these animals. By trying to learn something about them we can hopefully help them in the future. When we have a project like this and really want to understand these animals, we still have to go through what’s called an ethical review. And in the UK and many other countries, what we try to do is we use the principles of the 3 Rs. That’s what it’s called. So it’s replacement. So every project we have to think can we do something else? Do we really have to do it? Or can we replace it by something else – a computer model. The second R is reduction, you know, we don’t have to tag a thousand animals, maybe ten are enough. And the third R is called refinement. So every time we learn something new, we make our method better. Make the tags smaller, or maybe put another sensor in that we learn more so we don’t have to tag that many animals. So these three Rs are really fundamental in animal research.

**Felicity Spoors**

Mmm, yeah it’s good to know that the ethics are considered carefully and that it’s always to the animal’s benefit. So, the last question I have for you is why should we care about this kind of research?

**Dr Lars Boehme**

I think in some areas now, especially in Antarctica but also in the arctic, some of this data coming in is essentially the biggest dataset collected by what’s called the Global Ocean Observing System so it’s essential for these everyday operational models that that help weather forecasting and ocean forecasting for shipping. So it’s really nice to see this this link and especially when you then go to people and they don’t care about marine mammals, you know, why should we not hunt whales or why should we care if seals die in the future? Is because they make your life better at the moment.

**Felicity Spoors**

Yeah, that’s so true. Lars, thank you so much for chatting to me.
So now let’s chat to Aqqalu and David. They both been working together on a pilot study in the Ilulissat Icefjord in Western Greenland doing just this. So David, firstly, can you tell me a little bit about this project of yours and how it all started?

**Professor David Holland**

Yes, it’s, it’s effectively the title is ‘Investigating climate change in the North, using autonomous platforms, including marine mammals.’

At each end of this earth there’s this very large chunk of ice which is very unstable and susceptible to melting. It turns out how that happens is incredibly intricate and complicated, so we’re really interested in the details of how this happens.

It was maybe a decade ago that my wife and I – we work in Greenland on physical climate science, and when passing through the lovely town of Nuuk one sunny day, we, we ran into Aqqalu and started up a conversation and effectively, Denise and Aqqalu arranged to go forward with a programme to tag seals.

**Felicity Spoors**

And Aqqalu, you’ve been researching seals in Greenland for some time then before you met David?

**Dr Aqqalu Rosing-Asvid**

Yeah, we have been tagging seals in Greenland now for quite a few years and we use small data loggers that give a position of the seal, and also collect data on dive behaviour and uh haul-out behaviour and if we want to, we can also make a profile of the water and the temperature and the salinity in the water.

Yeah, when I met David Holland here in Nuuk, uh he asked if there were any seals that would swim right up to the glaciers and stay there for longer periods of time and I, I suggested that the ringed seal would be the best candidate for that.

**Felicity Spoors**

Aah, I didn’t know ringed seals like to swim in front of glaciers. So, what have you been learning about these seals then?
Dr Aqqalu Rosing-Asvid
These ringed seals, we know that some of them at least tend to stay close to the glaciers for longer periods of time, but uh we never really know what they do because some of them they migrate quite a long distance like from Canada to Greenland etc. So we never know what the seal is doing when we tag them. But uh, these seals in the Ilulissat Icefjord they turned out to be quite stationary. And uh, they stay within the fjord throughout the year, which is quite uncommon. They also look somewhat different from other ringed seals and they are quite a lot larger. We have an ongoing DNA study which indicates that these ringed seals are quite different from other ringed seals, so we have been quite lucky to find some seals that are very, very stationary.

Felicity Spoors
Oh wow, ok. So David, anything to add?

Professor David Holland
And on the physical climate side it’s really interesting that the seals are providing vital data on temperature that we really have no other way to access this information.

Felicity Spoors
Okay, so as a physical climate scientist then, why look at Greenland’s fjords in particular?

Professor David Holland
It was remarkable then from remote sensing, satellites or cameras in space, said “hey world, the biggest change on the planet’s happening in these places where the ocean meets the icesheets.” As you might know the Greenland Icesheet, it’s effectively very large chunk of ice sitting on land and one of the thoughts is that going forward, it might melt and change global sea level. And the fastest way it could do that is through these fjords where the ocean waters run along the fjords and interact with the ice sheet. And it’s then when you look at these, if you can imagine this long fjord, choked with all these icebergs and sea ice and things are moving around and falling over and it’s, the question is, can you see whether or not warm
water is under that or not. If it’s a fjord and there’s cold water, then, then it’s not the ocean that’s doing this. The theory was it’s warm water from the ocean doing this, causing this. There was no other obvious reason.

**Felicity Spoors**

Oh okay, yeah that makes sense. And Aqqalu?

**Dr Aqqalu Rosing-Asvid**

Uh yes, we now have almost a ten year long time series provided by the seals and that shows that the water in the icefjord, it can change from being relatively warm to become quite cold within a few months and that has a profound influence on the ecosystem there and uh, the species that are in the fjord and uh, that some of the things that we would like to study more in the coming years. And we also now have this timeseries of uh, dive behaviour from the seals which we can relate to these changes we see in prey availability etc.

**Felicity Spoors**

Oh okay. So do you think that these seals have a future role to play in this kind of climate research?

**Professor David Holland**

Absolutely yes. They provide this really focussed data exactly where we want it, and as compared to autonomous vehicles, there’s a future for that, also you can imagine robots and whatnot. I’m not sure we’re going to build anything close to the intelligence and cuteness of a seal anytime soon.

**Felicity Spoors**

Yeah, no doubt you’re right! And Aqqalu, what’s the thinking going forward then with the ringed seal research in Greenland?

**Dr Aqqalu Rosing-Asvid**
In addition to the project in Ilulissat Icefjord, we also have a similar project on the east coast in a fjord called Sermilik. And there we also have found some relatively stationary ringed seals, which also is a little different from what we’d call a normal ringed seal. Ringed seals are hunted up here in Greenland and uh, the meat is quite important for many local people and it’s of course therefore very important that hunt is sustainable and uh, this new knowledge about some groups or populations of ringed seals that doesn’t mix a lot with the other ringed seals, that of course is quite important for the management.

Felicity Spoors
And lastly, to climate change – David, do you have a take-home message for our listeners?

Professor David Holland
If you look at the last year just ended 2020 we had the most hurricanes ever in the North Atlantic. So we went through all the Latin letters, A through Z, then we started off with the Greek letters and started naming them and got quite well into the Greek alphabet. So we blew away all records because the ocean is just so warm.
Last year had several months that were the record warmest months ever recorded. So record, record, record, record. So coincidence? Natural? That’s a possibility. Unlikely. So, with that we have to keep in mind that we’re possibly seeing an acceleration and so the past century was what it is, that doesn’t mean the forward century is a linear continued version of that. Could be and I would not say that to be alarmist, I would say that out of common sense, it could be dramatically accelerating. In which case, we should be on our toes. My message would be international collaboration and for people not to think it’s someone else’s problem or to think it’s too difficult a problem for them.

Felicity Spoors
Mmm yeah, an excellent point. Thank you David and thank you Aqqalu.

So there you have it. A really, really big thank you to all of my guests. Thank you to the US Geological Survey for the use of their icebreaker audio. Music is by Bluemount Score from
Pixabay and last but not least, a big thank you to all of you for listening to this episode of the Arctic Initiative Podcast.

**Sarah Mackie**

Today’s episode was written and produced by Felicity Spoors.

We would like to thank Dr Lars Boehme, Dr Aqqalu Rosing-Asvid, and Professor David Holland for their time and expertise.

This podcast was created as part of the Harvard Kennedy School’s Arctic Initiative Podcast Project, led by Dr Sarah Mackie.