North At Trent Lecture Series, February 11, 2022
Dr. Grant Gilchrist
Title: How Long Term, Multi-Disciplinary Research has Contributed to the Conservation of Seabirds in a Changing Arctic

Heather Nicol:
So welcome everybody. I'd like to welcome you here to your classroom for some of you and to those of you who are on zoom. I'm Heather Nicol, I'm the director of the Frost Centre for Canadian Studies and Indigenous Studies.

And we are the organization that has been sponsoring the North at Trent Lecture Series which is bringing you tonight your guest speaker, along with a little help from Erica and Graham and and you yourselves. Just by way of introduction, this is the first two North at Trent lecture series that we'll conduct over the next two months.

The north has long been a subject of discussion at Trent University and students and faculty of Trent have examined the North and its myriad contexts. The north at Trent lecture series began in 2011 as a way to connect the Trent community with current research being done here and elsewhere the Frost Centre that I represent is pleased to work with our colleagues to bring a scientific focus to this year's lecture series.

Now, you may be aware that we had over the years since 2011 we found a number of lectures lecture series and for the most part we focus on different topics sometimes cultural sometimes, you know, things like film sometimes policy, all kinds of different themes, but it's been a while, since we've really had a good scientific focus and an ecological focus to the theme of our talks so thank you Erica and Graham for making space in your class curriculum and especially Erica for your health and connecting us with Dr Gilchrist who joins us tonight and then Dr Provencher who will join us on March fourth for the second of the lecture series. So Erica I'm going to turn the mic, the little box over to you and let you introduce our guest speaker.

Erica Nol:
Maybe I'll just hold it.
Yes, so, first of all I'd like to welcome all of you and I'm teaching after the reading break, so I will see you a lot and I think many of you, I probably had in the first year biology course as well, and I see lots of people nodding their heads so anyway it's my delight to be able to introduce Dr Gilchrist to you today, Grant, because I'm going to call them Grant because he's a close friend.

Grant was actually a Trent undergrad in the early 90s, and he was one of my first honor students and He was really, really set on becoming a high school teacher when he came to Trent.

And then we started talking he had multiple interests and, most importantly, he was a climber, a rock climber.

And so I thought ah, I have a colleague who studies seabirds in the Arctic and maybe you'd like to do an honors thesis because he was he expressed interest in doing an honors thesis.

And so we sent him up to Coats Island, which is the far northern end of Hudson Bay.

And that began his life in the North and in fact he stayed there, I mean he has continued to work there for the last 30 years and mostly in that time he did graduate degrees in different places, but I actually PhD at UBC also with my former supervisor so, but he has been a research scientist with environmental climate change, Canada, since that time and he's done all sorts of very interesting things in the field of marine birds.

But lately he's also just so I can read these actually done some really interesting things in terms of engaging Inuit in terms of science and stem so he started or co-started an Inuit field training program increasing the capacity for environmental monitoring among Inuit, which are the northern people.

He worked on federal working group to enhance Inuit participation in science and he's worked in a marine working group doing marine spatial planning, you know the waters in the north and then, most recently, he was a chair of the NSTP program, which is the Northern Scientific Training Program that many undergraduates at Trent actually get funding for to go work in the north and do research, and that is an opportunity when you start to enter and think about fourth year projects that you should consider applying to that program and so Grant was chair and got to evaluate a lot of Trent applications during that time.

So, and I will turn it over to him to explain, much of the science that he has been doing and lots of other fun things I'm sure, and I just want to say that Grant is a fantastic speaker and colleague and has all sorts of talents and afterwards, you should ask him if there are any jobs up north.

Grant Gilchrist:
So everybody can everyone hear me?

First lecture with a mask so I'm going to get used to this, but as Erica mentioned, I was an undergraduate student I took this course, about 35 years ago.

I was here to be a high school teacher and while at Trent I took biology biochemistry, but I also an opportunity to take courses in art history and a lot of courses and interests me with.

Indigenous studies was called the Northern and native studies department at the time but you're going to see some of those themes running through my research Program.

I'm going to be talking about science, but I also want you to consider the creativity of science.

and also the linkages with indigenous particularly Inuit I've worked with my entire career, but before I talk about science, I want to talk about art, so I took an art history course here and I had a.

While a student and before coming to Trent, I had an interest in the Canadian wilderness and canoe tripping. And let's just get the slides to advance.

Yeah so for those on zoom you'll just be seeing my slides, which is not a bad thing.

So I this is Georgian Bay Ontario and I was canoe tripping I had an opportunity to work in Algonquin Park when I was 16 and, while in the art history course I wanted to do a project, an essay on the group of seven who were, as you know, the Canadian artists who explored country in Georgian bay and as part of my essay on one of the artists AJ Cason I actually learned that he was still alive and living in Toronto, he was 92 Now this is before Google and the Internet, so I actually wanted to meet with him and interview him.

So I went to the Bata library and got a telephone book and looked him up and then I got his number and went to my room a landline no cell phones, and had the courage to phone them and I actually got his daughter on the phone and I expressed an interest to come meet with him and I did I drove to Toronto and met

yeah so I met with AJ Cason, I visited in his house in his beautiful house surrounded with group of seven Emily Carr all original work, none of which I'd seen because it hadn't been published and the two of us sat down and had a cup of tea together, so it was really an amazing experience.

so we had a chat and he knew that I was a scientist, with an interest in art.

And he said and so we're talking about the group of seven he was a young man and the courage it took to break out of the mold and do some interesting things so he said okay you sound like a bright young guy.

Your challenge is, what are you going to do and create in my case it's paintings, in terms of science, it might be individual outcomes and, in our case scientific papers.

But then the issue is with those paintings and with those pieces of science, what are you going to achieve with it.

So if you just take them one at a time they don't amount to much if you take my career one painting, at a time it actually doesn't amount to much but to collectively it's you're working towards a body of work.

And if you're good enough and if you're trying to be innovative, whether an art or science which takes creativity, you have to start thinking, what are you going to do with it, and what are you going to change.

The group of seven changed perspectives on Canadian landscape and at first, they were ridiculed, which is also one of the benefits of being a group rather than individual artists or individual scientists, so when you consider this talk like many scientists we're going to emphasize the team and the different elements and expertise that are brought to science groups, because no one can be an expert in everything.

And as a government of Canada research scientist my job description is to conserve marine birds and marine ecosystems in the Canadian Arctic.

Now to do that, I have to attract geneticists demographic population modelers Inuit leaders, the CEOs of mining companies ships captain's air pilots lab and physiologists and so that is an interesting conversation with an artist that actually took with me through my scientific career.

And you think well, what does this have to do with science well actually has to do everything with science because science is as a body of knowledge is trying to be rigorous and defensible and in conservation biology and the types of things I worked with conserving birds, making sure populations are sustained it takes innovative team building creativity.

Especially now, with climate change. You know when I was a student of Trent, there was no climate change and the discourse of school now, it was on it was actually ongoing but we didn't know about it, we weren't learning about it. That came later and then, as it started to gain momentum scientists, like myself, were actually ridiculed and persecuted on social media, much as nurses and medical doctors are being ridiculed for vaccine issues at the moment. But it's gaining momentum.

And when I first went to the Arctic and one of the reasons I went to Trent was its northern focus. I went to the Arctic was a vision of it being pristine and true wilderness, and in a sense, to get away from it all but, in fact, Nunavut is a very busy place.

This is a schematic of mining leases shipping routes aviation routes protected areas it's really a complex place that the interface between industry, climate change, indigenous culture and just a societal pressures almost like a microcosm of everything that's facing the planet and being a research scientist with environment Canada we're literally on the front lines of this.

This is whenever I feel safe and I’ve had the pleasure of working with Erica and northern Hudson Bay and this just gives you a sense that, when you're flying above it looks pristine but every inch of Nunavut is accounted for either through an indigenous land claim agreement, a mining lease or things like that.

So today I’m going to discuss and focus in on the conservation biology of one of the species, I worked with the northern common Eider duck. And it reflects a collaboration with the Greenland Institute of nature, the University in Denmark, Aarhus University , Environment Canada and a number of other collaborators which I’m going to have the pleasure of introducing you to and through the talk I’m going to also emphasize the contribution of graduate students so I’m going to introduce you to the people who've contributed elements and pieces of the puzzle.

First, some early lessons I got my first job in Yellowknife Northwest territories, I was in my 20s I was keen but didn't know much. Fresh out of school and in my office I got a phone call out of the blue from an Inuit leader in Sanikiluaq, Nunavut, a place I knew nothing about, I actually while on the phone I had to look at my map of Nunavut to see where this was. And Lucassie Arragutainaq contacted me because he tracked me down as a seabird biologist to say that the Eider population in their island archipelago in Hudson Bay had declined dramatically like 85 90% population collapse and they wanted to invite me as a government scientist down to work with the Community to determine what occurred.

Now Eiders, I consider them seabirds because they spend so much time at sea, they only lay their eggs coming on land to small islands so they’re social and very gregarious.

And Inuit and people in Newfoundland Atlantic Canada and West Greenland harvest them for meat, eggs and feather down.

So Inuit hunters, this is my early lessons they knew a lot about Eider ecology, much more than I did, and so I flew down there, I had to go Yellowknife Calgary, Calgary Montreal, Montreal up through Quebec then out to the archipelago took me three days to get into the Community.

What had occurred was the Pinatubo volcanic eruption. It occurred in the Philippines, on the other side of the world, a year earlier.

Now the the ash plume, this is the second largest volcanic eruption in a hundred years and the ash plume is 40 kilometers across the diameter here.

It was so massive that this is a picture, taken from the international space station.

And it generated so much ash into the atmosphere this great line that reflected the solar radiation to the atmosphere back out into space and the planet cooled for two years, and this has implications on sea ice in the cryosphere and the circumpolar Arctic the following year.

Now the Inuit didn't know about the Pinatubo volcanic eruption they just knew that they're going through extreme winter, which froze up the polynyas and the open water areas, the eiders needed.

And so they had regional experience but not yet a global perspective and by combining our approaches, we came up with the answer what had occurred.

Now eiders in the Belcher islands of Hudson's Bay one of the only seabirds it spends the entire winter in the Arctic and the reason they do is the strong currents between the islands keep the ocean open.

And so there are areas polynyas these open areas that can support 150,000 eiders in one place, and when they take off in the morning, that sounds like a rocket sounds like a rocket taking off.

a polynya - it's a Russian word and it means pond and it's it's 35 below zero Celsius in this photo so if there is no current they see what freeze over in fact.

When the tide ebbs you can actually watch the ice form and then, when the current shifts the ice breaks up again, but at extreme cold temperatures, some of these foraging areas would freeze over in the birds would effectively die of starvation and freeze to death.

And the Inuit were on the ice detecting this population collapse not Western scientists.

In the years to come we collaborate with the Community we set up observation blinds on the edge of these polynyas we could study birds on the surface, the foraging ecology.

we're in blinds to get out of the wind and we'd have a Coleman stove inside to keep us warm and so the only difference between this box and your home freezer is your home freezers warmer inside.

Because we can only get the temperature up to about minus 25 which is colder than your then your freezer.

But absolutely beautiful.

And we advanced the work and we dropped video cameras and videography below the ice and could film the birds feeding on the sea floor in relation to tidal currents.

This has actually been featured in the BBC living planet series, because once the BBC photographer saw what were doing they joined us and we guided them. But Joel Heath was a PhD student very, very talented multi talented person and he was able to turn this videography into data, to look at how the foraging ecology changed with currents, to look at how resilient these birds were to tidal currents and ice conditions.

When and what happened was these birds have such short day length and such strong currents that they have to forage in - they're very finely tuned.

Because the currents are so strong at the strongest velocities they actually can't get to the bottom, without being swept under the ice to their death, so they have to time the currents

And on the surface, this is a picture of about minus 35 with a 50 km wind, which is about minus 75 degrees Celsius.

I learned that you can't wear rings during this field work because of the conductivity you'll get frostbite. I learned that the hard way.

And I'm just going to explain this is from Joel's thesis.

This is the foraging activity of the birds.

And this, and this is the tidal currents, so this is very high currents very low currents.

Now what we thought would happen is the bird should be foraging when the currents are the least, but what they did instead is they, they would jump into the polynya, when there was still current, feed aggressively.

That they'd fill up with muscles and urchins, and then they'd be digesting the invertebrates because there's a digestive rate capacity, because their muscles.

And then, by the time they're empty they hop and they dive to the bottom, and they fill up again, the second time and then the jump out onto the ice, while the currents are strongest.

So what the birds are doing is they're by adjusting their current adapting to the current they're feeding twice per tidal cycle, not just once, and that made all the difference.

The point here is the things such as tidal occurrence, the cryosphere of snow and ice and the behavioral ecology of birds are all integrated in a very extreme environment.

And the Inuit were there to watch when the ecosystem is changing due to a factor they knew nothing about that we're able to detect.

It also was exciting to go to one of the most extreme field experiences in my career and publish science that was actually taken up broadly. Looking at some of the abiotic factors affecting seabird diving.

This is 3500 eiders just in an open water area taken from a plane, the white birds are males and the brown birds are females and juveniles.

So Joel was even able to turn the video into mathematics and he did a postdoc at UBC looking at social interactions much as starlings fly in air or schooling fish behave.

The take home message, there is listen to people that are out on the land in my case it's Inuit down here, it might be farmers or agricultural sector.

and be open to hearing information from sources beyond Western science, but also know that Western science has techniques and approaches that are often complimentary and together, you can link global patterns with regional implications.

So now I'm going to move to another topic which is one of the reasons that was originally hired by environment Canada was the northern common Eider was considered to be in decline in Nunavut.

Now, the thing with migratory birds, is they're migratory and they often cross international boundaries beyond and outside of Canada and in terms of seabirds.

Unfortunately, for me, they don't go to Florida or Chincoteague [Island] or Mexico or Argentina, they go to places like Greenland and Newfoundland in the winter or the far off shore, so I don't get any winter trips like my shore bird colleagues but I'm not resentful.

Here is a photograph of a Inuit hunter with no life jacket and a homemade rowboat off the coast of Greenland, the flock of eiders and they're heavily harvested in Greenland.

Again they're wonderful to eat Newfoundlanders hunt them aggressively as well and places like the north shore Quebec.

And when it comes to harvest management for people and communities in Nunavut.

This is not recreational harvest like waterfowl hunters down here, it has real implications for what we call food security, many of the meals for Inuit, especially in remote communities are wild game, including eiders and then recent and.

it's shocking but consider that pregnant women, even as late as 2010 wouldn't necessarily have three meals, a day, not even two meals, a day.

they're often eating only once a day and some of those meals would be eiders caribou fish so on, so when we're talking about harvest management and co management of wildlife, it has direct implications to people's health and well being in the north.

There is evidence that the Canadian breeding birds would migrate to winter off the coast of Greenland, the strongly affected by the Gulf Stream.

So, even though it might be 20 or 30 below zero the Ocean is warm enough to support open water that supported the birds and also there's a.

My collaborator in Denmark Fleming Merkel there was an 80% decline in the breeding population in West Greenland and there's also discussion in Canada, that the breeding population had also been in decline.

consider that even 100 years ago biologists recognized that because eiders are so big and fat that they're crippled So if you shoot into a flock of eiders you might kill one but you're going to wound three.

And so it's called crippling loss, and you have to factor that in as well, so it's not just 100 coming back with 10 birds if they're careless there might be 10 or 20 other birds left crippled not retrieved and die later.

So let's look at modern rates of embedded shot and eiders well how do you do that well you take over the airport in Nuuk, Greenland and you send eider ducks through the airport security system in the middle of the night, so this is our sampling design.

And it's very effective.

yeah now I'm not sure you could do that these days, this is before 911 like I'm dating myself but we had a blast so you get all you go to the hunters you get birds and these birds are collected there.

there's a bypass or killed in nets, so these birds haven't been shot they've been drowned in nets and now we're putting them through the airport security.

And 30 to 40% of birds had embedded shot in them, which is just an index of their hunting pressure, meaning birds have been shot once and some of the birds have been shot twice to survive.

So what we needed to do was Denmark, and the Canadian team, the Greenland team, we needed to quantify the linkages between Canada, Greenland and Atlantic Canada.

So we have 400,000 breeding birds in Canada, but where they spend the winter, because the hunting pressure in Atlantic Canada and Greenland's different so we needed a location to start putting bands on birds start generating research program, and this is East bay.

The East Bay migratory bird sanctuary in June, so when everyone down here is barbecuing and cutting grass we're up there still in the snow and the sea ice.

there's an island it's only 800 meters long, and this was the longest the largest eider column in Canada Arctic Canada.

And over the years we've set up infrastructure, including cabins a kitchen cabin and, increasingly, we have an electric bear fence because of the polar bear risk.

But this actually provided a foundation for graduate students and honor students several whom went to Trent and other universities from across Canada.

So I really thank the field crews, which is a mix of Inuit Grad students contractors and university professors.

The Birds leave the flow edge at 2am and they arrived to the island when their prospecting about 3am so we're getting up early.

At dawn and we catch the birds in these big flight net so it's like a miss net.

And we're catching the birds, as they fly around the island prospecting for nest sites and then we put on these colored Darvic bands, so we can.

keep track of the bird, through its entire life, not just if it's hunted, but when it comes back so we get a sense of age behavior and reproductive success.

And the females also get a temporary nasal combination filled nasal tags this enables us to find them again once we release them.

Because when they're sitting on their laid eggs you can't see their legs or their bands they're all look the same they're all just Brown and camouflaged so then we release them as we catch them it's actually great fun.

And here's a female being released and the nasal tags drop off as a summer goes on, so they don't migrate with them.

And then we work from blinds like this, so we can observe where the birds are on the island.

Immediately we realized that 60% of the returns are coming from Greenland and the 40% from Atlantic Canada, but understand that.

The there's a factor in here called band reporting like what proportion if you're a hunter and you don't like the government are you going to report the bands.

Right, it turns out government biologists are equally disliked in both countries, so the banding reporting rate was actually equivalent.

But we wanted to get more detailed and so we we embrace new technology at the time it was called satellite tracking.

And so we worked with veterinarians from Denmark who came across to Canada, we set up a surgical tent and a canvas prospector tent heated by a Coleman stove.

We implanted satellite transmitters and released the birds to the wild and we're able to track them in real time through the Arctic, so it was really fun to go to my office and every Monday morning see where the birds were as they're moving through.

So here's the type of data we get it's very detailed and this shows that again the linkages between Canadian birds on Southampton island.

going to West Greenland to spend the winter, but also important areas in Labrador and these birds are being hunted all the way, including the north shore Quebec.

So just to summarize.

We have birds that are in Canada, where we're banding and they have two wintering areas one in Southwest Greenland and one in Atlantic Canada.

We have birds that breed in Greenland, but they never came across to Canada so that's a Greenland population.

And when we integrated this in a demographic model linking how many birds are out there in the wild with how many birds are hunted and killed, we could clearly see that the Greenland population wasn't sustainable, it was in decline.

and, similarly, the even the birds in Canada were at risk because of potential over harvest.

One of the reasons, was the hunt in Greenland really didn't have any restrictions, there was no bag limit.

And there was hardly any seasonal restrictions, so it was like free game basically like if you could go out if the weather is good enough, and you can go shoot birds fill your boots there's there's no limits.

And that, because these birds don't are long lived and don't reproduce a lot like mallards do is going to have a strong implications and the population seem to be in decline.

So we worked with the Danish Government and Inuit hunters we brought Canadian Inuit, flew them to Greenland to meet and work with Greenlandic Inuit just to emphasize the point that it was a shared population.

And if it was going to continue along these lines hunting wasn't sustainable and that's something no one wanted so collectively we extend the closed season, especially towards the end of the winter, which enabled more females to survive the winter and come back to breed.

Simple but it's all based on math computer modeling and again here we brought in experts to work on the demography of this so we extended the closed season.

So it was a major change in Greenland hunters and with the colonies show signs of recovery.

We set up.

Community based monitoring and West Greenland meaning in it would go survey the colonies close to them, and we continue to monitor colonies and Canada.

So, interestingly, with a change in regulations in 2001 and 2002

Both the Greenland and Canadian populations immediately, we started to recover it was really dramatic it's probably one of the most exciting.

achievements of our team, especially when we overlay the harvest regulations, so this is rates of harvest and you can see, it really dropped off in 2002.

And the population really started recover, so our colony, for example at East Bay went from 2000 to 3000 females to 8000 females, in only six years.

And also, when you consider those females survive and they reproduce and they're young survive and reproduce it goes exponential because we've taken off the limiting factor.

So just when we thought, in a sense, our work was done and I was going to shift priorities on to another species or another conservation issue, we had a dramatic population mortality event at East Bay island and Hudson Bay and this is an avian disease, which was confirmed as avian cholera.

And it killed about 30% of our breeding population in about 10 days.

So now I’m going to discuss a little bit about this disease epidemic.

Now, what is avian cholera? I actually didn't take disease and stuff at Trent I didn't think it was necessary because I work in the Arctic and you don't hear a lot about avian influenza and cholera that's what happens to waterfowl in Utah.

And the prairies when you have all these waterfowl crammed into a reserve, for example, but there is a history of even cholera it seemed to jump from poultry that have been brought from Europe into the wild waterfowl population North America.

was first detected in Texas during the Second World War and spread through the fly ways and there was a different serotype.

And there's this eastern Atlantic serotype.

And it entered into the eider populations first detected in Maine, then the St Lawrence river.

And then up with us in 2004

In northern Quebec and then the Ungava Peninsula and then East Bay, where I work so in a sense, this disease is migrating with the birds and this population had never experienced cholera before so that's why it was particularly deadly.

We wanted to know if this was just a recent event or whether it had occurred previously in the last century.

You know you have to be there was a scientist to detect change right, but if we're absent, what can you say about the past, so what we did is we enlisted Dominique Henri who's a social scientist and she did a part of her PhD on interviewing Community Members about their.

Their oral history oral information about eiders that they know a lot about and it turns out that they had no recollection or no oral history about massive eider declines or these mass die off events.

And that it was first detected in 2004 by them and then by us, so all this to say the Inuit communities in southern.

Southern Arctic northern Quebec and South Baffin island had no previous history with cholera until it arrived, but interestingly, there was a story of a lightning strike that hit an island and executed.

electrocuted all the birds, and that was in 1964 in July and I How do people know that it's like well that's the year I got married and you know, so it was it was very detailed information, but there is no history about cholera.

This is an interesting photograph because it's the juxtaposition between Facebook and you know caribou being butchered in the living room, and this is one of the fun and rich aspects of working in Nunavut because there's so many dimensions to it.

So we're already present on the island, because we're working on harvest dynamics right so we're already set up with banding protocols blinds nasal tell you females, even the herring goals are banded and each year, we would count how many birds died.

Cholera actually changes the behavior of the host organism so as they're getting sick.

They actually get thirsty and they move to fresh water sources like this to drink and they die, and then the bacteria leaves the corpse and sits on the meniscus of the water waiting for the next host to come.

yeah it's pretty yeah so like omicron it doesn't really phase me but.

yeah so here this, this is just to show you the power of a long term study the initially started by hunting for hunting issues.

So we regulated the hunt, and then the population starts to grow right know about that then cholera emerges, and we have a big mass die off event 2006 and then there's another wave right now, you know what waves are about so there's a two waves and now it's dampened out.

Because the birds have antibodies the birds that survived now have antibodies, and so this is a female survival rate based on year, you can see, the dramatic effects of cholera.

juxtaposed now had we not been there, all you would get as a pile of dead ducks right you really wouldn't be able to interpret what was going on.

And so, this gave us an opportunity we were in the site before the epidemic during it and after it, and so was a tremendous research opportunity, so we applied to NSERC to get a special research grant to bring in more collaborators and more students to study this.

We also work with health Canada, because, at the same time there's an avian influenza outbreak in China and Inuit were getting it mixed up.

They were they were are eider safe to eat? is this avian influenza?

CBC national news is confusing us so we worked with health Canada put out newsletters and we did Community reporting to try to let them know that even cholera cannot jump to humans.

And that's so deadly and so quickly lethal that if you shoot a healthy duck the likelihood of even having cholera is almost nil so it's interesting sometimes when you're biologist to work with health, Canada and the public on issues that are relevant.

Now here, is where the NSERC grant and bringing in new students gave us some more opportunities.

We found that the probability of a female dying on the island, increased the more eggs, she laid.

And what happened here is two things could be going on here one is older females lay larger clutches, they arrived to the colony the earliest and are therefore exposed to the disease, the longest.

Another thing is females they're investing a lot of themselves literally in the clutch are.

That could affect their immunity or their response to disease and make them more vulnerable and we can't discern which is which, but it is interesting that the older more experienced most reproductively active females, are the most likely to die during that the epidemic so being a poor breeder actually increase your probability surviving.

When we band we hold birds, sometimes for different durations and we keep track of it, and one of our Grad students looked into this said that the during the pandemic.

The epidemic of the disease, the longer a bird was held under stress, the more likely it would die.

But this pattern only held during the pandemic under normal circumstances, we don't detect this, so it seems like even.

If you're holding a bird and cut during handling like wildlife handling, even if the stress we can't detect it it had implications during a disease.

outbreak, and so, then we adjusted our methods and we now only hold birds for an hour and if they haven't been processed they're released, and this we wrote this up in journal wildlife management, because it has implications for animal care and handling of birds.

So we looked at the temporal dynamics was rare in the Arctic, but now its present the epidemic didn't influence by nesting density, but really the timing of when birds arrived at the colony.

Handling stress lowered long term fitness of individuals and it increased mortality and delayed egg laying but only during the epidemic itself.

The females that laid large clutches are more likely to succumb to the disease.

we're actually looking at this now with our collaborator Vicki Friezen at Queens so we took all these blood samples and she's actually looking for.

This selective sweep that this mortality event occurred, and whether the genetics, of the population, after the epidemic are different than the prior to the epidemic, so we have a PhD student working on that now.

So now we've talked harvest disease volcanic eruptions.

Now it gets really complicated.

And particularly dangerous So when I see people swimming with great white sharks that's not nearly as dangerous as handling bears because bears are smarter they're inquisitive they're curious and they're more individualistic in their approach.

Now we've seen this figure we're talking about global change, and I want to take you in a sense behind the scenes about what a figure like this its implications to ecosystems and the Arctic, and this is just one case study of many.

So the Arctic, especially in the eastern Arctic is warming, this is real data.

And this is the ice season length and one of the regions where Erica and I work, so this is northern Quebec northern Hudson Bay Southampton Island, and this is the ice area that this data represents the Canadian ice service breaks up the Arctic into areas.

The length of the ice.

Ice season length means that over time there's more open water.

The ice period is shorter and since like I graduated from graduate school it's declined by more than a month and a half, which has strong applications for ice associate species like bears.

So I'm studying birds, but I had to learn a lot about bears that turns out for bears the best season for.

Energy intake is late winter, when seal pups are on the ice they're vulnerable they're easy to find.

And the snow it makes the bears they can travel easily on the ice and it's just like a gluttonous feast of seal.

bears put on a lot of fat, and then they head into the summer, once the ice breaks up and they have to fast, so the summer, for a bear is the worst time of year, so if you extend that hot period where they can't really eat it has strong implications on them.

Now our long term study this is two photograph taken in camp on the same day of the year, just to give you a visual of the environmental variation.

Dr Oliver Love from U Windsor he came and joined our team at 2006 and he thought man, this is great no snow shoveling, then the next year here's your shovel get digging.

But what this does is it gives us variation in our long term studies Coates Island is the bottom figure and East Bay Island and in our camps, every day we write what we do.

What we've achieved, and also whether we've encountered bears or not, and so this is showing the bear encounter days over time.

So when I started East Bay the red figure in the late 1990s we slept in dome tents, now we sleep in cabins surrounded by a 13,000 volt electric fence.

Because there's so many bears so there's been a tipping point and bear activity that's being driven by the sea ice going out in the coastal areas around us.

Now we're looking at the number of bear days in relation to sea ice concentration simply put we see more bears on the eider island during the years with early ice melt.

there's this tipping point once the ice is half it gets into the slushy mix the seals have the advantage.

and bears have to swim on land and the first thing they encounter are eider duck colonies and bears they're like they're very opportunistic, and so they remain on the colonies and eat eggs.

This was one of the first examples of the changing climate impacting the cryosphere and impacting ecosystem and into specific interactions especially predator prey reaction interactions.

So this is a female and her cub and a male taken from within the fence.

we're often outnumbered now by bears and in the distance is the mainland and that's where Erica works and there's another shore bird camp there.

Interestingly, these changes were detected and small bird and other parts in the circumpolar Arctic the number of so other teams.

saw this paper, and they also looked into their own information, and this is the bear interactions and their camps, over time, so it's a issue throughout the circumpolar Arctic.

Cody Day joined the team, and he looked at the interactions of how climate change is impacting eider duck ecology.

Especially in terms of population size, so the more bears there are.

The less we've been up to success and eider populations are going to decline, but because of earlier springs and longer breeding seasons.

The the number of birds surviving and being able to breed are increasing.

So, climate change and environmental issues don't always generate negative implications what Cody is doing is he's looking at the bear implications.

And the timing of breeding and the clutch size, which is going up and finding that at the moment it's kind of creating a neutral population effect.

Now this is all mainly done at one island and, of course, as an ecologist you want to look at the landscape and how broad are these.

Things so East Bay gives us a field site where we can look at detailed interactions between bears and eiders and so on, but we wanted to get out there on the landscape and we did this by going.

and tapping into Inuit communities with Inuit field assistants and doing coastal surveys by freighter canoe this photograph was taken in July and Jennifer Provencher who you'll meet in the next lecture participated in these surveys as well.

So these are two long term studies Southampton and Coats and all the black dots are eider colonies visited by our field teams, most of the people on the crews were Inuit from the local communities.

This is one of the most extensive coastal seabird surveys in the circumpolar Arctic and it's all done out of freighter canoes.

I’m going to take a moment here, because this is the eider colony size and how things are starting to change.

bears are most disruptive to the large eider colonies, where there's a lot of birds in one tight location and when birds are distributed on small islands that takes bears more time and more effort to reach them.

So bears mainland distance is where the island is in relation to Baffin island and bears are coming out of the islands from the ocean, not the land, so the first islands, they come to are the ones furthest off shore.

Before the biggest predator risk was foxes coming from the mainland, but now, with changing ice dynamics, the biggest predator issue is now polar bears, coming from the sea and we'd expect the biggest colonies originally were very far off shore.

away from foxes, but now we're starting to see that the change in colony size over the next last 20 years is shifting.

So the blue is birds moving away from those offshore big colonies and moving towards the coast away from the bears.

And some of the colonies that are growing, the most are near Inuit communities where there's a bear free zone so we're already starting to see.

The shift in eider distribution in response to the increased predator pressure of bears.

And that eiders are starting to disperse from a few large colonies to more smaller colonies, which make it more time consuming for bears to make the rounds and since swimming from one island to the next.

Now, when I first started working with eider ducks there's so many hundreds of small rocky islands in the Canadian Arctic and West Greenland that I thought habitat was never limiting for this bird.

That they could just move from one island to the next, but I was wrong because I wasn't thinking carefully enough and I hadn't been to enough islands to see the differences among them.

A key difference is some islands, because these are recently glaciated right they've only been free a glaciation for the last 10,000 years or so, which is biologically and geographically recent and in these island archipelago some are bald rock and some have moss and peat.

And we started to think that the birds are actually changing the ecosystems, through their nutrient input brought from the sea.

And those large colonies that have been established for hundreds of years.

The more we're starting to think that the the moss which would retain water and fresh water for the birds to drink they're actually changing the ecosystem and the island environment to to improve their nesting habitat, which would then attract more birds over time.

So Nick Clyde surveyed a lot of these islands and he did a lot of sampling of soil peat and water chemistry.

And he found this is active nests so from 10 pairs to 400 pairs and percent cover is the plant cover.

So there's a strong relationship between vegetated islands and colony size controlling for where the island is in relation to the coast.

And how big the surface area of the islands were it is there's so many islands, we could control for those things and that's one of the pleasures of working with islands they're very discreet and, unlike fields of the jungle very discreet, and it really lends itself to scientific inquiry.

Soil depths again, increased so the more in the larger an act of the colony, the more vegetation the deeper the depth of the soil.

And that has strong implications, because the soil is made up of peat and sphagnum moss which retains water.

And so, one of the biggest challenges for nesting eider duck is, it has to sit on the nest for 21 to 24 days without leaving if it leaves the eggs gets stolen by herring gulls.

And so they really want to avoid having to leave the nest to take a drink.

So they nest near ponds and sometimes their trips to have a drink are only a few minutes at a time, so they get off the nest they conceal their eggs, they run and take a drink and they run back to the nest.

And they hop back on and so fresh water is a really big deal for common eiders and the deeper the peat, the more the ponds retain water over the course of the summertime.

The other thing is the nutrients and the nitrogen brought by the birds, through their droppings.

Is has to be brought every year because the rain can wash it away and the winters can wash it away so an active colony has very recent nitrogen inputs and a really rich moss and plant community.

And remember, bears are disrupting all of this because of the timing of ice is changing and the bears are coming out of the islands.

So you can see the vegetation around the pond edge that's all driven by hundreds of years of nutrient input from ducks.

So here's the positive feedback mechanisms all based on the published manuscripts and the lab chemistry.

So you have eiders arrive, and they might be attracted to an island, because it has a pond in the first place, that they can land on they bring nutrients from the sea with their droppings and their feathers and they're eggshells, and the detritus of a colony.

The nutrients help contribute to the development of soil and plants as that builds up more nutrients are retained and the soil starts to build up even more.

The soil and the pond edges, contribute to the ponds getting deeper, which in turn has a positive attractive principle and to bring more eiders to the colony, and so that generates this positive feedback mechanism, when you multiply by centuries changes the ecosystem of the islands.

Now here's something that got this is one of those scientific opportunities when you get approached this is Kathryn Hargan she was in a lab and she is a Paleobotanist.

And what she did is she took sediment cores of the ponds and looked at the nutrient influences those ponds going back to the 1600s.

So remember the nutrients are coming from birds and one thing that she discovered is there is this dramatic decline in nutrient inputs, particularly after 1900 on many of these islands in the Hudson straight.

And I said well that makes sense, the population is collapsing around 1900 because the advent of rifles shotguns and boats in Greenland.

So they're going from shooting birds out of kayaks to motor boats and and firearms and so when we overlay the increase of harvest pressure on the nutrient response and then breeding colonies in Canada there's this relationship.

So that and that is an index to show you can see, when the Canadian breeding population was being hammered by the advent of this tremendous growth in harvest in Greenland.

And all that is sitting in pond sediments that information so we're even able to do retrospective ecological inquiry based on new laboratory techniques by collaborating with other labs.

Which brings us back to that harvest issue I started the talk with so it's still ongoing.

So I'm just ending now these red dots are our fixed field stations, these are cabins and bear fences and some basic infrastructure.

Now many of our cabins would appear to you like they're like a garden shed where you put your wheelbarrow and your rake in your backyard, but when is blowing 120 kilometers an hour and there's wet snow it's really comfortable to get into a cabin.

As well I started off sleeping in tents because it's kind of exciting, but if you're spending so much of your time trying to stay warm and dry you're you're losing your energy and your stamina that you can devote to fieldwork so when we put these cabins in place.

People were safer they had more stamina more sense of humor and it really generated an upsurge in productivity and then it also attracted other collaborators, because a professor doesn't want to send their students into dangerous environments where they're poorly supported.

These are important things, whether you're working in the jungles of India on fish or the Arctic or points in between.

A lot of this science, because it has implication for climate change and changing ecosystems has been featured in things such as the Arctic Councils Arctic biodiversity assessment.

Sometimes I'm asked like What does all this do where does it all go and does it matter any of it, and so this is circumpolar scientists from many different disciplines.

converging our findings in one document and then there'd be a synthesis document for the press to make it easily accessible to the public, and these events have strong implications and it's rewarding to be a part of it.

We also before the pandemic would meet in person and some of these studies on eiders because there are circumpolar species, we could repeat these studies in other locations, I remember Erica when I started working eiders she said I wouldn't work on it everyone's working on it.

Like there's competition and how can you do it and that's true, but the but is because everyone's working on eiders in Norway and Russia and Iceland.

Then you can integrate data sets and you can see, and compare my birds migrate the birds in Iceland do not, what implications to those types of things have.

We also you know, wrote up papers looking at circumpolar reviews of seabirds that.

Never could have been done and actually the Internet really helped with this, because it enabled us to collaborate more than we could, in the days of faxes and so on.

So just to end this is Lucassie Arragutainaq he's a friend of mine, and he was one of the key field assistance and team leaders in the winter work in the belcher islands.

You know the ratio of field staff is four Inuit to one Western southern based scientist and he joked that his job is to keep me alive for the field work.

And he'd often say warm enough, you know, and when I first went out by wore a snow goose parka you know the really expensive ones, and I froze.

Because it had pockets and zippers which would fill with snow and the cold would penetrate.

And so, as the field work went on all the field crew would wear these eider down parka, and one of our research grants, we got the money to have seamstresses in the Community, make us parkas so that all the field crew could be completely decked out in eider down.

Now Lucassie had rarely left Sanikiluaq in his lifetime he's my age he'd been out of the Community, perhaps four times.

And only to Winnipeg for health reasons or to accompany his wife for delivery of their babies or something.

And so I had the opportunity to invite him to join us at an Arctic net conference in Quebec.

Arctic net is an NSERC research program multi disciplinary studies, many people at Trent are involved with this it's social housing, health.

ecology snow and ice research, and so I thought Luke would be really excited to come to a conference that was entirely dedicated to the Arctic.

In the face issues, particularly facing Inuit so I asked him as we sat in the Chateau in Quebec City, what do you think of this conference like isn't it it's cool.

And he said Oh well, every room I go into there's a scientist at the front talking.

All you do is talk. You should talk less than you should do more.

So he was quietly moving from room to room the scientists are all excited by our discoveries and our contributions.

But the people, some of whom that we're working towards to help support my case sustainable harvest wildlife co management and so on were less than impressed.

Because they weren't, seeing as much action so that is maybe a take home message, a message I first heard at Trent, because the multi-disciplinarity of the school and its interest in the north and.

I really appreciate coming, as you can imagine, coming full circle, to come back, maybe 30 years later, and give a lecture on some of the things we've been working on since but also just see how the multi- disciplinarity of Trent geography indigenous studies art history and the different sciences.

I hope you can see some of the themes running through a science program in the north so thanks, very much for coming, and I really appreciate the invitation to give this lecture.