Darwin had Galapagos finches. Norway has… house sparrows?

It's September 17 1835, and Charles Darwin — yes, *that* Darwin — is rowing to land with three shipmates from the HMS Beagle to the volcanic shores of San Christobel, one of the Galapagos Islands.

The crew scrambled through a crazy landscape covered with lava. They're on the hunt for giant Tortoises to eat. But as ship's naturalist, Darwin had a different job.

In the five weeks the Beagle spent sailing among the different islands of the Galapagos, Darwin tells us he " industriously collected all the animals, plants, insects, & reptiles" he could. Among those creatures were 31 finches, of nine different varieties.

Those birds were Darwin's finches. They had weirdly different beaks, which had evolved so they could eat different kinds of foods on the island. Like cactus finches have longer, more pointed beaks than other finches so they can pluck food from spiny cactuses. Before Darwin, people thought that species arose from the hand of God. Darwin's finches helped show how species can physically evolve over time as they adapt and respond to their environment. Case closed, right?

Well… what if I told you that now, nearly 200 years later, the spirit of Darwin — the quest to understand the mechanisms that allow creatures to adapt to and survive in the natural world — is alive and well on a bunch of idyllic Norwegian islands straddling the Arctic Circle? And that instead of finches, researchers are looking at

Steffi:Well they are relatively small. They are gray, brown, black males have a spot on their chest… well they are very non spectacular birds. I think they are everywhere because they seem to be following humans.

Nancy: That's Stefanie Muff, an associate professor of mathematics at NTNU, and the bird she is describing is the house sparrow.

Which, in case you didn't know, is the most widespread bird on the planet. And yet for the last three decades, these non-spectacular birds, living on a bunch of spectacular Norwegian islands, have given us cool new insights into how the natural world works.

CUE podcast music

Nancy: I'm Nancy Bazilchuk, and you're listening to *63 Degrees North*, an original podcast from NTNU, the Norwegian University of Science and Technology.

Today I'm going to tell you three stories from studies of the world's most widespread bird, on islands astride the Arctic Circle. Think Darwin, but in Norway.

These stories have it all: Dogged researchers finding and counting thousands of house sparrows, year after year, on remote, idyllic islands — and how what they've learned can help us manage threatened and endangered species.

Clever experiments where researchers were able to make evolution happen in real time — and then watch what happened when they let nature run its course.

And last but not least: House sparrow dating preferences, and rogue sparrow fathers who court exhausted sparrow mothers — and then father children with the cute little she-bird next door.

AX: Sound from the field….
Henrik: Okay. So now we need to set up this ringing and measuring lab. We, I think we can do it in the back of the car today because the weather is pretty good. Scale for body mass.

Stefanie:We need color rings somewhere.

Henrik: That bag, you can take out the color rings, and I have the metal rings here.

Nancy: That's Stefanie working with Henrik Jensen, a professor at NTNU's Department of Biology, at the Centre for Biodiversity Dynamics.

Henrik: So what was the number of the nest again?

Stefanie: Four, four, six, four.

Henrik: Four six seven… Yup. Right. I said one egg, four chicks, those are 11 days, no dead chicks. And then you just continue with the rings and stuff.

Nancy: Every summer since 1993, biologists have travelled north from Trondheim to islands off the coast of Helgeland to collect data on house sparrows. They capture baby birds, measure different parts of their bodies, take a tiny blood sample, and then put a

unique combination of colored rings on their legs that help researchers identify the birds throughout their lifetime. The blood samples have let them make family trees for sparrows on the island, so they can see who is related to whom.

It may sound like easy work — catching birds, taking a few samples, and letting the birds go, but you have to get to the nests to catch the chicks. And house sparrows, when they nest on farms, they like to nest up high, under the roofs of the barns. Stefanie again.

Stefanie:

So now we are on one of the farms on one of the islands. It's a classical Norwegian farm with some chickens and lambs, cows, horses. And Henrik has climbed up. So he really uses climbing gear and climbs up the walls under the roof to check the nests.

Nancy:

Even though she's mainly working on statistical analysis for the project, Stefanie went to Helgeland to see how the researchers do their field work. I gave her and Henrik microphones for their smart phones and asked them to do some recording

Stefanie:

We found two nests, where there were chicks. There were a nest with four chicks, but one was dead. So he could take out three of them and ring them, weigh them, measure them, take a small blood sample. And then he put them back up in the nest. They were just five days. So I was surprised how small the birds are, and it's already possible to put a metal ring on their leg and to take a blood sample that we can use to genotype them later on.

Nancy: All told, they have done this with roughly 23,000 birds since the project first began in 1993. The place where they're mostly working has 18 different islands in an area that's a little smaller than the country of Luxembourg. Some islands have farms on them, and some don't. It's a really beautiful part of Norway because the beaches are white and the water is a clear azure blue. If it wasn't so cold you might think you were in the Caribbean.

And then, there's the people.

Thor Harald: The hospitality of people in Northern Norway is famous. From the first time I came there in 1992 I felt so welcome.

Nancy: That's Thor Harald Ringsby, an associate professor at NTNU's Department of Biology, at the Centre for Biodiversity Dynamics. He was one of the original researchers who started up the House Sparrow project.

Henrik: Now they say that it's not spring until we arrive in the beginning of May.

Nancy: Henrik Jensen again.

Nancy: So, welcoming people, beautiful landscape and common, easy-to-work with birds. That had researchers thinking of all kinds of questions they could answer about the house sparrow that would also illuminate larger biological questions. Like the first big question:

Henrik: What is happening in fragmented and smaller populations? What processes are important here? How can we maybe understand better how to preserve threatened populations?

Nancy: This requires a little explanation, so hang with me. The house sparrow populations on the different islands in Helgeland are spatially separated of course, because they're on islands, surrounded by the sea. This physical separation allows researchers to use the island-dwelling house sparrows as proxies, to explore important biological concepts about threatened populations, because threatened species are often separated into smaller sub populations.

But what often separates threatened species is habitat destruction by human activities, like logging or urban expansion. Biologists call all of the sub populations of an area a metapopulation, because they are the same species in the same area but are separated, too. Thor Harald explains why this is important.

Thor Harald: The whole archipelago is a metapopulation consisting of many smaller island populations that are connected because of the exchange of dispersers between them.

Nancy: Dispersers, that's key. In natural populations, like the Helgeland house sparrows, some birds may roam. In threatened populations, the animals may not be able to disperse on their own, but people could help them.

Thor Harald: With a certain probability every local population will go extinct. But also, with a certain probability an empty habitat will be recolonized after being extinct

for some time. In a viable metapopulation it is therefore crucial that the recolonization is higher than the extinction rate.

Nancy: This is why the researchers have been collecting basic information on the house sparrow populations on the different islands over many years. It's a way for them to see if they can understand what allows some sub populations to thrive, while others may dwindle in numbers and even go locally extinct.

Thor Harald: A basic starting point is to understand what determines fluctuations in population sizes from one year to the next. to understand the underlying ecological drivers of these fluctuations we need to know for instance which ecological factors determines the probability of surviving as a fledgling, if you have just hatched.

Nancy: That's why Henrik is climbing up the sides of barns, counting chicks in the nests.

AX from the field:
Henrik: OK, so now we have some chicks from the nest here, on the farm, and we put on first a metal ring (metallic rustling sound of ring clamps). So this ring number is 8P14498. And each bird needs to have a separate code, a separate combination of metal and color rings.

Nancy: Year after year, of measuring which birds live, which birds die, helps tell researchers that.

Thor Harald: One important lesson from the house sparrow project is that there is lot of variation in the quality of habitats both in time and in space. These parameters are vital in order to understand how we can design management plans and protect threatened species.

Nancy: So here's the takeaway:

Thor Harald: When we design a conservation area or plan to manage spatially fragmented populations, one general message is that you have to be sure conserve that a sufficient area of the habitats where the species actually is present.

Nancy: Thor Harald Ringsby

Thor Harald: But also to conserve areas where the species is not present at the moment, but still is needed due to the balance of extinctions and recolonizations that I mentioned earlier.

You must also be aware the variation in habitat quality: Some of the populations will be more important because they are very productive and generate many emigrants, which will recolonize empty populations, keeping declining populations alive by supporting them with immigrants.

Nancy: It took the biologists five years at the very beginning of the project to provide the kind of scientific underpinning to support this more general assertion.

AX: Another bit of appropriate sound from the field

Nancy: Then there was the project where researchers actually tried to drive evolution in house sparrows by making them get bigger and smaller.

Thor Harald:And the core question here was focusing on whether there actually is an optimal body size for a population shaped by natural selection over time. What decides the size of individuals, why aren't they smaller or larger than what we observe? Is it costly in terms of reproduction or survival to deviate from the average body size in the population. These were the underlying questions when we planned the selection experiments.

Nancy: These are the kinds of questions that Darwin himself might have asked. What puts the limits on sizes for a species? Why aren't house sparrows as big as house cats? To answer this question, the researchers needed to actually physically remove different birds from different islands. They didn't want to mess with the Helgeland populations, because they had so much information from years of research there on the birds and their natural habitat. So …

Henrik: We did some experiments further down, further South, along the coast selecting for large and small birds on two different islands.

Nancy: Henrik Jensen

Henrik: This is a unique thing that we can do with the house sparrows. is that people are not so worried about it. It's not really threatened in Northern Norway, so it's not a conservation issue. And it's living very close to humans, it's easy to capture all the

sparrows in a population, measure them, decide who will sort of go back to the population and decide who will have to move away.

So we did this for four different years around 2002.....We know that in the winter, the sparrows are very closely connected to the farms because it's like, okay, living on a farm gives you shelter gives you food. It's warm there. It's, it's a very nice place to stay in the winter. So we went there in the winter in February, and then we went to the different farms. And then we saw, okay, here's a lot of sparrows on this farm. If the weather was bad, all were inside, and we could just close the doors and the windows and put up mist nets, special nets to capture birds and then capture almost the whole population in one day or just a couple of days. So we captured the birds and we took them to an abandoned farm where we had sort of sealed everything off and made it into a sort of holiday home for the sparrows.

Nancy: A holiday home, how lovely! Who knew?

Henrik: So they stayed there until all the sparrows, basically on this island, were captured and then we have measured them, so we knew the distribution there. Okay. In the, this is a large sparrow on this island. This is a small one. This is the mean sparrow size on this Island. And we could then decide, okay, we want this 40% of the larger sparrows to be put back. And we put them back where they came from. And then we removed the 60% smaller ones to maybe a 100 kilometers away to another holiday home. Well, that was into nature, but in the area with farms, so they could live on these farms instead. So that was like selecting for the larger and we did the same or opposite thing on an island where we selected for small.

Nancy: And... evolution worked!

Henrik: As we expected, because we know size has a genetic component, we saw an increase in size where we selected for large birds. We saw a decrease in size where they selected smaller birds. So that's sort of good to see that, okay. Yeah. These simple equations for how evolution should work. It works also in nature where we have a lot of environmental variation compared to what you have in farm animal breeding, for example.

Nancy: Still, these were wild birds where researchers were like a super strong environmental force, removing all of the small or large birds from a population. So what happened to the birds when the researchers stopped?

Henrik: But the most interesting with this experiment was what happened afterwards, because then, okay, we thought if there isn't, well, if nature isn't really driving the body

size to some optimal size, they should just stay large and stay small afterwards. But this is not what happened. They very quickly went back to the original size on these two islands, almost as fast as we selected to make them large and small. And this means that in nature, there is some sort of, there are some forces that keep the size of birds, for example, an optimal size and the forces to keep them on this optimal size is it's very, very strong.

MORE AX here from field House sparrows cheeping

Nancy: Henrik and his colleagues also realized they could kill two birds with one stone, so to speak. Since they were moving birds anyway, they realized they could investigate what happens when you transplant creatures from one isolated population to another — like you might need to do to save an endangered species. What do you need to think about? What doesn't work?

Henrik: So when we did this body size experiment, we also combined it with a translocation experiment. So some of the birds that were removed away from these islands where we wanted to make birds large and small, we moved them to another archipelago where we had removed half the sparrows and put these translocated birds, to look at what happens when you translocate individuals into a new population. And then it turns out that they contribute, but less than you would expect.

Nancy: And here's where we get into…. sparrow dating preferences! Because if biologists are moving individuals from a threatened species to a new area with other individuals of that species so that they can boost population numbers or reduce inbreeding, they want those creatures to hook up! But that's not quite the way things worked.

Henrik: Because we removed half the birds, we made the population smaller than the carrying capacity, or maybe the optimal population size, so we thought, okay, when we translocate birds, this will be more like a conservation management action. Okay. You have smaller, you have populations that have decreased. What happens when we want to translocate birds or individuals there, will the population increase and what will translocated birds do? Do they contribute with genes, for example, like some sort of genetic rescue experiment? And they contributed a little but, not as much as we expected, suggesting that there are mechanisms, maybe social mechanisms that make these translocated males less interesting for the local females.

Nancy: Yup, the new guys just weren't that interesting, as it happened. Except when the big patch of black on their breasts was really, really big. Biologists call that patch a chest badge.

Henrik: So it was only the males, the translocated males with a very large badge or black chest badge that were successful. The other ones didn't really produce any offspring. And this is a, we knew from before that males, with this large black badge, they are more popular among females than the ones with a smaller badge.

Nancy: Who knew? Fashion statement!

Henrik: Knowing about the preferences of females might be important if you want to do some translocation to try to rescue a population. Maybe it's better to translocate females, or at least not the bad males, if you want them to contribute with genetic variation.

Nancy: This wasn't the only thing researchers found out. It turns out that the male birds with the big black badges, which are preferred by females, can be real scoundrels.

Thor Harald: Dominant males with large badge sizes, they are also interested in doing other things than feeding their own young, they would rather be around and try to be the parent of clutches in the neighborhood. So they have this extra pair copulation mechanism where they are being a father to the neighbor's chicks and young

Nancy: So they are running around with other females?

Thor Harald: Yeah, instead of feeding their own chicks.

Nancy: So those bad boys are busy messing with the neighboring female birds! What would Darwin say about that?

Thor Harald: I think that he would be excited about the results - and I think that he would have been surprised about all the knowledge within ecology and evolution that can be extracted from a common species like the house sparrows in northern Norway. Even though the house sparrow is among the most common bird species that lives close to humans it may easily be ignored by many people. But the house sparrow can actually tell us a lot about ecological and evolutionary mechanisms that are common in nature but are challenging to study in the wild. And we can use the house sparrow as a model species where the results contribute to the current scientific discussions with insight about processes that also is going on in other species in the wild.

Nancy: I'm sure I'm not the first science journalist, or scientist for that matter, who would love to have a time machine to go back and actually talk to Darwin — to see what he would think about the house sparrow research. But of course we do have a kind of time machine — a message from the past — in the form of Darwin's writings. And if this quote from his life's work, "The Origin of Species," is any indication, he would have been wowed.

"Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows," he wrote. "There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed laws of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved."

Nancy: I'm Nancy Bazilchuk, and you've been listening to 63 Degrees North, an original podcast by the Norwegian University of Science and Technology.

You can imagine that with nearly thirty years of research, we've only scratched the surface here. If you want to know more about the House Sparrow project, you can find links on our show notes page, along with links to some of the academic articles that are related to the findings I've described.

This is the last episode of the first season of 63 Degrees North. We've been testing the concept to see if it is something we want to keep doing. If you've enjoyed the podcast, leave us a rating on your podcast app and tell your friends! It will help us as we decide whether to do a second season.

This podcast was written, recorded and edited by me, Nancy Bazilchuk, with tons of help and encouragement from my terrific NTNU colleagues Anne Sliper Midling, Kolbjørn Skarpnes, Ingrun Furuhaug, Nina Tveter, Christian Fossen and Siv Anniken Røv, and Randi Lillealtern, from Historiebruket. Thanks also to the 17 researchers, from NTNU and abroad, who were willing to be interviewed. Editorial help and sound design by Historiebruket. Thanks for listening.