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Ron Lisnet

Katherine Ruskin

Brian Olsen

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## S5E11: Why might Maine lose two species of songbirds?

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**Run Time:** 00:31:00

Maine may lose two tidal marsh songbird species in the next few decades. Salt marsh sparrows face extinction, while Acadian Nelson's sparrows are threatened with extirpation — localized eradication with the possibility of survival elsewhere. Their populations along the Eastern Seaboard have been declining as sea level rise destroys their habitats and, according to a new University of Maine-led study, mercury exposure inhibits their reproduction.

In the final episode of Season 5 of “The Maine Question,” Kate Ruskin, a lecturer in ecology and environmental science at UMaine who spearheaded the recent mercury exposure study, and Brian Olsen, who is now an associate provost at the university, discuss the challenges these songbirds face, and what can be done to prevent their loss. They also describe their fieldwork and the benefits for students who participate in it.

### Transcript

[background music]

Brian Olsen: This was one of those things where we're just trying to figure out all of the threats to see if we can relieve the pressure on the species in any way. When you get to that point where you can see the loss of the species completely from the planet, the next question is, what can we do?

Ron Lisnet: That's Brian Olsen, a bird biologist and associate provost at the University of Maine, talking about two species of birds that inhabit salt marshes in Maine and along the Eastern Seaboard. Among the threats these birds and their habitats are facing, mercury exposure. I'm Ron Lisnet, and this is “The Maine Question” podcast.

At first glance, the saltmarsh sparrow and Acadian Nelson's sparrow don't draw that much attention in Maine salt marshes. They're certainly not big and showy, like a great blue heron or an egret. They're small and secretive and hard to spot. These diminutive birds are facing some big problems, however.

Mercury exposure has led to a 10 percent decrease in nest survival. These two populations are in decline already due to a much bigger problem, sea level rise, which can flood their nests in the grasses of these marshes. Kate Ruskin, a lecturer in ecology and environmental

science at UMaine, led this study that looked at the effects of mercury, climate change, and other factors.

These and other issues had been the subject of a growing body of research, led by UMaine, involving several universities and government agencies, such as US Fish and Wildlife. The future for these songbirds, who live in a very selective and vulnerable place, doesn't look bright. Poisonous chemicals and sea level rise fueled by climate change are global problems.

The plight of these birds may seem insignificant, but there are things that can be done to help them -- allowing marshes to adapt to rising sea levels naturally, changing where and how roads and bridges are built, just to name a few mitigating factors. Of course, the benefits that saltmarsh and Acadia Nelson's sparrows experience will be felt by other species, including humans.

Brian Olsen and Kate Ruskin talked to us about their study, the challenge of doing this fieldwork with birds that are great at hiding in marsh grasses, the opportunities for students to get involved in this kind of research, and what the future might hold for these two tiny songbirds.

Thank you so much for joining us as the semester ends here. Tell us about these birds. How and where do they live? Are they migratory? Why did you pick these two particular species to focus your research on? Brian, do you want to start, maybe?

Brian: Sure. These two birds are interesting in a lot of different ways. One of the reasons that I got into studying them initially is that my research program has been focused throughout my entire career on adaptation to changing conditions. Both of these species have adapted to some impressive conditions for a terrestrial bird.

They're living in an environment that's incredibly wet. They're acting like egrets or herons at points. They're acting like little song sparrows at different points. They've pulled off lots of different adaptations because of that.

Then the other part that's fairly interesting is that their populations are separated from each other a lot all across the coast because they exist in this marsh here and then there's a stretch of coastline with no marsh and then another little marsh and then a stretch of coastline with no marsh.

They live in these little bubbles of habitat and that allows for evolution to happen slightly differently here versus there versus further down the coastline. Those two things are interesting from the perspective of somebody who's curious about evolution and curious about how critters get better adapted to the environment around them as they change.

Ron: Katherine, where do you find them? Do they stay tight, or do they migrate? What are their lives like?

Kate Ruskin: They're these little brown birds that run much more than they fly. They're like mice out in the salt marshes, which are these grasslands at the edge of the ocean. That's because there aren't any trees in the marsh. There're no shrubs, for the most part. It's a lot of grasses, and they run around among the grasses.

They do migrate. They spend their winters down in the Carolinas, Georgia, Florida, and they breed up here in the Northeast. The saltmarsh sparrows are only found in the summer of breeding season between Maine and Virginia. Their whole population worldwide is reliant upon what we do with our marshes here in the Northeast, US.

Brian: They're one of the very few migratory species that are found within the United States the entire year. Most of our migratory species are either someplace not in the US during the summer or someplace not in the US during the winter, at least some portion of their population.

All of the saltmarsh sparrows are here, which gives an interesting conservation twist, which is to say, we can't rely on anyone else to help us with the conservation problem with saltmarsh sparrows. It's our responsibility alone.

Ron: What is the big picture question that you are both posing in terms of this research?

Kate: For this project, we wanted to look at whether these two species, saltmarsh sparrows and Acadian Nelson's sparrows, the Nelson's sparrows that nest here in the Northeast along the coast, are experiencing negative... Basically, what mercury exposure are they experiencing between Maine and New Jersey?

Is there any link between the mercury they're experiencing and their reproductive success, which we measured by seeing whether their nests survived or not?

Ron: Brian, there's been past studies looking at these birds in terms of climate change, sea-level rise, other things. How did that fold into this present research?

Brian: This was what was one of those things where we're trying to figure out all of the threats to see if we can relieve the pressure on the species in any way. The modeling that we've done trying to predict how their populations are doing, aren't very rosy.

We have predicted extinction within the next few decades for saltmarsh sparrows and extirpation for Acadian Nelson's sparrows as well. When you get to that point where you can see the loss of the species completely from the planet, the next question is, what can we do? We want to have all the tools on the table.

One of the things to do is not to just identify the largest factor that's threatening them, which in this case is 100 percent sea-level rise and modifications we've made the marshes that prevent marshes from responding dynamically to sea-level rise, but to say, "OK, in situations where that's not the case, is there anything else that we can do to help out as well?"

We have a series of different studies that going on to address different, more minor causes and this is one of those.

Ron: Kate, what was the headline from this study? How much of an effect is mercury having on these birds?

Kate: First, we found that they are experiencing mercury exposure across this range, Maine to Virginia. It's heterogeneous or variable. Even birds that are breeding or building their nests in the same marsh, but as little as four kilometers apart, can have very different mercury exposures up to eight times greater in one bird versus another. That was interesting.

Then when we looked at the relationship between mercury that a female was exposed to and the likelihood of whether her nest would survive or not, we found that, yes, there is a negative relationship between a female's mercury exposure and the likelihood of her nest surviving.

However, this effect pales in comparison to that of water level. Therefore, sea-level rise is by far the greatest threat to the species despite the fact that, yes, we found a relationship between mercury and nest survival.

Ron: Now, Brian, these are both sparrows, but in a sense, are they canaries as well? Do they tell us what is happening to other species that share this habitat, and what might be happening to us?

Brian: That's one of the take-homes from the variability from marsh to marsh, and from area of marsh to area of marsh, is that that is happening because the amount of mercury is variable across those different marshes as well. By looking at the birds, we can see that some marshes have more mercury in it than others, and that it happens over a very small scale.

That means that either the mercury that is going into the system is different or the way that system is responding to the mercury to make it more available to species is different as we go from one marsh to another.

That's the same for everything that's in the food web from the insects, the spiders, the birds, the fish that are growing up there that are going out into the estuary. We are

basically at this point using birds to tell us how degraded, and how mercury-prone is the system. The answer is some systems are more degraded than others.

Kate: A silver lining there is that it points to the fact that taking conservation action on a small spatial scale can have big impacts and positive impacts for these birds because we're seeing such high levels of variation from one marsh to another.

We see similar patterns when we look at their nest survival in response to water level. It means we can take a small patch of habitat, improve it, and it can have a big effect on that population.

Ron: Kate, take us into the field. How do you do this work?

Kate: It's a ton of fun. First of all, you spend a lot of time mucking through marshes, which many people avoid because they are smelly, and buggy, and you're likely going to get your feet wet when the water tops over your boots. You muck around and search for nests. These species are both very secretive about their nest.

The females will run around in the marsh grasses, try to avoid being seen. You work very hard to find their nest, and then you recheck them every three days to determine whether a nest succeeded or failed. If it failed, why? Was it flooding, or did a predator get to the nest? We catch the females with mist nets. These very fine mesh nets.

We collect a teeny tiny amount of blood and then used a machine to calculate how much mercury was in that blood. Then we were able to again characterize what's the mercury exposure that these birds are facing across their range? Is there any relationship with the nest survival for the females?

Ron: Now, Brian, you're wearing a tie and you do a lot of administrative stuff these days. How about being in the field for you? Is that something you look forward to and enjoy?

Brian: Yeah, for sure. There's something about peeking into the private lives of animals and getting into their space and trying to see how they live, that is both incredibly interesting, but also it's a real peaceful experience that can fill your soul in certain ways.

It's definitely something that I encourage other folks to do when they can to try to get into the life of some other species and see how they pull it off. I would say that these particular species are interesting to get into. They are unique among songbirds in a lot of different ways.

We have this bizarro songbird hanging out on our Atlantic Coast that's unlike any other little brown bird that you'd see anywhere across North America, where they don't hold territories. They're constantly crossing over each other's area. The males and females don't really have pair bonds. They don't form up couples, like most other songbirds do.

The females do all of the work with a young, which is completely different from almost every other songbird. They are on record as one of the most promiscuous birds on the planet where if you look at any given nest, that usually has, say, between three and five eggs, there's a good chance that every single egg has a different father, and then the mother takes care of everything after that.

When you go to these marshes, if you're there at the right time of the tidal cycle and the right time of the year, they can be incredibly active for birds flying all over the place, tumbling around with each other, chasing each other. It's an area that's full of behavior in a way that you might not see in a regular field somewhere else where the songbirds are.

They have their perch. They sing. They go down to their little nest that's in the same area. They have their home. Someone else has their home. It's a total free for all in the tidal marsh. As the tides come in and suddenly there's no land, and the tides go out, and then there's land again.

Their whole perspective on what is space and what is their space and how they interact with other individuals within their marsh is fundamentally different from a lot of other species. I feel it's been a real privilege for me to be able to get in there and experience this alternate reality on what how you can pull off a living.

Ron: Kate, are these birds so specialized in the way they live that they're going to have a hard time adjusting to the scale and the pace of changes happening in their world?

Kate: Yes. Unfortunately, work by the group that Brian and I are both part of, the Saltmarsh Habitat & Avian Research Program, has investigated how the saltmarsh bird in particular is doing in terms of their population's changes over time. What we found is that they are likely to be extinct by 2060, driven largely by sea-level rise.

That's because they live in the tidal marsh, which is mostly just grasses. That means they build their nest just a few inches above the ground. The tidal marsh floods around here in Maine about once a month. These birds are incredible in that they've managed to adapt so that they can complete their breeding cycle between the monthly high tide events.

In less than 28 days, they can go from no nest to a female building a nest, soliciting calculation from all the males that are flying around, laying the eggs, incubating the eggs, feeding the chicks, and chicks being ready to leave the nest again in less than a month. As sea level is rising, it's taking that window when the high marsh is not flooded and making it shorter and shorter.

They're having trouble keeping up as a result. Again, there's not really shrubs or trees in the tidal marsh, so they don't really have anywhere to go within the tidal marsh that is

immune to flooding or will give them the window that they need. That's what we're seeing is driving their population decline.

Ron: Brian, it's really a sad story, in a way. You think these are just two little birds, but they're struggling and to see them feel the effects of all these things going on around them, it has to be disturbing somewhat.

Brian: It is, and it's important, too, to realize where we can make an impact and also where we should take responsibility, too.

It's easy to say, "Oh, sea-level rise. OK, it's human-driven climate change, but that's not anything related to us here in Maine or us here at a certain marsh in New Jersey, or something like that. There's nothing we can do about this massive global force that's pushing up on our shorelines." At the same time, there are marshes around the world that are keeping up with sea-level rise.

That as sea level rises, the tides still bring in sediments that build the surface of the marsh up at the same speed that sea level is rising. There are marshes that are doing OK. We actually have examples of that in New England. There's some tidal marshes on islands off of Cape Cod that are keeping track with sea-level rise.

They're rising as fast, and the sparrows are doing quite well there. The sparrows there, their populations are stable. That's partially because they're on these barrier islands that have no roads. They have maybe a tiny little house or no houses at all.

There's plenty of sediment that the tides can bring in and help the sea level to rise, whereas the case across most New England marshes, in particular, is if you go to any marsh that's down on the coast, you'll see that there are roads across it. Train tracks across it. There are bridges of various shapes and sizes.

What these end up doing, not only allowing us to pass over this area, but it holds back the tidal water, and it holds back the sediment that comes down rivers, and it holds back the sediment that comes up from the estuary with the tides.

We're doing two things, which is, our actions as a species have increased sea level rise, but at the same time, our actions locally have prevented the building materials the marsh needs to keep up with that first thing. It's a combination of those two factors. There are things that we can do, especially in New England, to help these species from blinking off the planet. It will take a lot of work.

If we can figure out the bridge and road crossing question, which are structures that need to be replaced periodically, anyway, if we can have those conversations and decide that it's important enough for us to allow the sediment to get back into marshes, then we can make a change in how likely it is that this species will be around.



Ron: This question could be for both of you or either of you. Tell us about the program this is part of that at UMaine. What other kinds of research is done? Are students involved? What are some of the big questions that this project folds into?

Kate: This project is a small part of a larger research effort, again, called the Saltmarsh Habitat & Avian Research Program. That's a research collaborative that spans more than a handful of academic institutions, many government organizations, like Fish and Wildlife Service, states Departments of Inland Fisheries & Wildlife, for example.

All of us on this project, SHARP for short, are looking at tidal marsh birds and trying to figure out how are their populations doing, if they're not doing well, why, and then what can we do? As marshes are restored, we're monitoring them before and after restoration action to figure out is it helping the birds? Is it resulting in population growth for the birds?

Many, many students are involved. I was a graduate student on this project. I started the sampling work in 2011 in my first year of my PhD here at the University of Maine. We've had one dozen, two dozen graduate students graduate as part of this project, hordes of undergrads every year, dozens.

This is a big project where we've got boots on the ground from Maine to Virginia. Much of that work is driven by graduate students, dictating the research questions, leading the field crews, and then undergraduate students, especially at the University of Maine.

Just as an offhand guess, I would say we've probably employed 20 to 30 -- no, probably more than that -- undergrads. Yeah, way more than that, especially if you count data entry during the school year, honoring species. It's truly staggering how much student involvement has driven this project and made it successful.

In terms of the other things that we're doing, all sorts. Where are the birds? How are their populations doing over, first 10 years, and now we're looking at 20 years, because we have a good dataset from around the year 2000? Demographic monitoring, where we're finding nests, tracking them over multiple years, the same individuals.

We are looking at restoration actions. We're even trying things like building islands of marsh that will float. That's largely led by Bri Benvenuti, a former grad student on the project who now works for the US Fish and Wildlife Service here in Maine. We're soliciting any and all harebrained ideas for how to help these birds so we can test it, and hand managers concrete plans about how to help these birds.

Ron: This issue obviously is a bit troubling, but what's it like to see these undergraduate students? Maybe this is the first time they've done work like this. To see that light turned on for them, is that a nice side benefit to what is a difficult issue?

Brian: Oh, for sure. It's so great to work with students and to allow folks to experience science on the ground for the first time. This project is interesting because it has this strongly applied realm. Students that are committed to conservation and to preserving the diversity of life on the planet get very excited about being able to get in there and make a difference.

We also have a lot of basic science research going on as well to understand how species evolve. We've got folks working in the lab on genomic questions and looking at how species respond to increases in salinity in their body and to increases in temperature.

We have a undergraduate who's working on an independent project right now, Cassie Ferri, who is working down in New Jersey and running around and recording songs of seaside sparrows and looking at how warmer temperatures during the day as the climate changes is impacting how well they can defend their territories and sing, and how well they can pull their songs off, especially on the really hot days.

She gets to do that Secret Lives of Sparrow gig and see the individual males, where they live, and how their songs work, and who their neighbors are, and who they fight with, and who they're friends with, and all of that.

At the same time, that research is going to give us an eye into how species, in general, respond to increases in temperature. That's been an eye-opening experience for them, for her, and also it's been great for the ideas that she's brought to the team that has changed probably what the next student project might end up being.

Ron: Now Brian, we teach you about not wearing a tie, but of course, you have a little bit of a different role now. You're involved in the Provost Office and academics writ large here at UMaine. Has this given you any insight into how this research fits into the larger picture? UMaine is known as a major public research university. This is just one small example of how that plays out.

Brian: Absolutely. One of the major parts of my job right now is to make sure that we're making all of the connections that we can between the research that the University of Maine does and our undergraduate education mission.

We have this ability to not only have our research serve the planet and serve the people of the state of Maine, but also at the same time, allow our students to be part of that, to help make that change. Also, to learn how to be a professional in their field by being involved in authentic activities that are done for folks outside the university.

Speaking of undergraduates like Cassie, we want to give as many, if not all, of our students at UMaine the option of not only just taking coursework and being trained to do a thing after they leave, but to start doing that thing, to start doing that professional practice.

As early as they can in their career, we have been launching what we're calling research learning experiences that start in the very first year of a student's time at UMaine so that they can jump right into real authentic scholarly enterprise, so that they can get better at it, too.

We don't just find these students that are doing great work that jump in their senior year, but if they start in their first year, they can get better at becoming researchers so that they can give back more to the state and to the people that the research serves. When they graduate and leave, they have a deeper, richer history of training behind them.

From my own perspective, the research that I do informs how I interpret the material in the classes when I teach it, and it gives me a different context.

I hope that that's the same for the students involved, too, which is to say, when a student spends their summer out in the marsh and learns the secret lives of sparrows, when they come back and take an animal behavior course in fall, they have a completely different lens to interpret that theory. It means something to them.

They can also say, "Oh, you said this was an idea that how do I connect it to the sparrows that I saw this summer." Now there is a participatory process within their learning rather than just passively being told what they should learn in order to do well on their tests. I think that research and being involved in research makes it clear why we learn what we learn.

It makes it clear why we would want to get better at it, and what that would accomplish. I don't think that we can start that too early. That's something that's a little bit unique about the University of Maine, as saying this is not an experience that we're trying to...

You can prove yourself worthy after washing dishes for two or three years before you can jump into a research enterprise. Instead, we're saying, "No, this is an important part of your educational process, and we want you to start the first semester that you're here."

Kate: They have hands-on experience and job skills, too. That's huge. I started doing field research and learned how to band a bird between my junior and senior year of college only because all students in my department got a grant to do a research project. I didn't know that research was a way to make a living, that field ecology was a way to make a living before that.

I think it's wonderful at the University of Maine where we have a land-grant mission, as well as sea grant, space grant, and so many research projects active here in Maine. Now, a lot of support from the university at large to bring even more of those experiences to undergrads.

It's not just the top-performing students or the ones who've paid their dues over many years, who get to hold a bird or learn how to measure the diameter of a tree. They get to use those tools in their first and second years, and it's everybody. That's a wonderful thing. Again, I wouldn't be here if it weren't for that research experience and I had no idea it was out there.

I'm excited to see more UMaine undergrads. When I was a PhD student, all but one of my technicians had never touched a bird before they worked with me. It was so special to get to give students that experience where they learn to handle them and band them and measure them and catch a wild bird for the first time in their lives.

Ron: This is a profession for both of you, but do you both consider yourselves birders? How would somebody that is a birder or just interested in wildlife, how can they see these creatures?

Brian: I would consider myself a birder, and I'll let Kate speak for herself. It is interesting because not all ornithologists are birders, and not all birders are ornithologists, for sure. I am a bird nerd. I will admit it in public. If you want to see these, because they're migratory, it has to be in the summer, and then you need to find a tidal marsh. You need to have patience.

It's helpful if you can know what their songs are because you might be able to hear them even if you can't see them. They are, like Kate had mentioned, very secretive. They may be singing from underneath the grass even, and you can't really see them from the edge of the marsh.

The upside to those road crossings is, it does give us access if you don't want to get your feet wet. Walking road edges that cross marshes with an ear open and an eye open for movement will really help.

There's not a lot of songbirds that are out in the middle of marshes. If you are out in the middle of a tidal marsh and you see a small songbird flying around, especially songbirds that are chasing each other, there's a pretty good chance that you're looking at either a saltmarsh sparrow or a Nelson's sparrow.

The Nelson's sparrows also do dramatic flight displays. They fly up real high up in the air while they're singing. When that happens, which is a lot more around the June time frame, earlier on in the breeding season, that makes it easier for them to see as well. Plus, it's just an interesting behavior to be able to witness.

Ron: How about you, Kate?

Kate: Your best bet will be to go to Eastern Trail in Scarborough Marsh, in Southern Maine. It's an old rail trail. It goes right through the marsh. One of the study plots where we

collected samples for this study, and all of our research is just 50, 100 meters off the trail there. I can confidently tell you there are birds there, saltmarsh and Acadian Nelson's sparrows.

They are hard to see, and they are hard to hear. Their songs, both of them are described as these whisper songs. I've heard the saltmarsh sparrow described as if you take droplets of water and throw on a hot frying pan, so I encourage you to look up the song before you go. Bring binoculars or a scope.

There is a Maine Audubon Society facility right there so that you can ask for help. They organize bird walks as well. Then, you can definitely see one between June and August, June and July being the best times here in Maine.

Ron: Fascinating work. We thank you so much for talking to us about it.

Kate: Thank you.

Brian: Thank you very much.

[music]

Ron: Thanks for joining us for this final episode of season five of The Maine Question. We're already hard at work on some great episodes for season six, which will begin in later January 2022. You can find The Maine Question on Apple and Google Podcasts, Spotify, Stitcher, and SoundCloud, UMaine's Facebook and YouTube pages, as well as Amazon Music and Audible.

We'd love to hear your questions or comments. Send them along to Maine Question @maine.edu. This is Ron Lisnet. We'll catch you next time on The Maine Question.

[music]

*The University of Maine in Orono is the flagship campus of the University of Maine System, where efforts toward racial equity are ongoing, as is the commitment to facing a complicated and not always just institutional history. The University recognizes that it is located on Marsh Island in the homeland of the Penobscot nation, where issues of water and its territorial rights, and encroachment upon sacred sites, are ongoing. Penobscot homeland is connected to the other Wabanaki Tribal Nations — the Passamaquoddy, Maliseet, and Micmac — through kinship, alliances, and diplomacy. The university also recognizes that the Penobscot Nation and the other Wabanaki Tribal Nations are distinct, sovereign, legal and political entities with their own powers of self-governance and self-determination.*