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S5E8: How are ticks threatening Maine's moose?

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S5E8: How are ticks threatening Maine's moose?

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The moose has become so synonymous with Maine that it serves as the state animal. Residents and tourists alike scout the forests and mountains to catch at least a glimpse of this majestic mammal, and their odds aren't too slim. Maine has the highest wild moose population in the lower 48 states, with 60,000–80,000 roaming the woods. Their population is considered stable, but it faces a tiny, yet lethal, threat: winter ticks.

Moose populations along the southern edge of their range in the U.S. have been declining due to winter ticks, or moose ticks, and other parasites. Some moose carry as many as 70,000 ticks. Calves are especially at risk, as those with heavy tick loads often die in their first winter. Pauline Kamath, an assistant professor of animal health, is studying the impact of ticks on moose survival. On this episode of "The Maine Question," she speaks with host Ron Lisnet about winter ticks and how they threaten the viability of Maine's state animal.

Transcript

[background music]

Pauline Kamath: The issue for moose is that this allows for very high infestation levels to be reached on a single animal, where sometimes you can see moose that have winter tick infestations up to about 70,000 ticks or more.

If you try to imagine this many ticks feeding on a single animal, just think about how much blood that animal will lose.

Ron Lisnet: That's Pauline Kamath, an assistant professor of animal health, talking about the devastating effect that winter ticks can have on moose. I'm Ron Lisnet, and this is "The Maine Question" podcast from the University of Maine.

It's hard to think of an icon that is more associated with the State of Maine than a wild moose. Lobsters may be in that conversation, but there is something about a moose that just draws people in. Maybe it's the combination of its immense size and stature combined with an almost goofy look.

Over the past century, this majestic creature has made a comeback. The population dipped to an estimated 2,000 animals around 1900. Today, Maine is estimated to have 60 to 80,000 moose roaming around in the woods. The highest population in the lower 48.

There is a significant threat to Maine State animal, however. The winter or moose tick has been on the rise in recent years. It's highly adapted to its namesake host, and growing in numbers due in part to warming temperatures and less severe winters.

The tick can drain the animal of blood. It can cause severe itching that leads moose to rub much of their fur off, creating what some are calling ghost moose. This effect is particularly devastating for young calves. When they're infested like this, many simply don't have the energy and strength to survive the winter.

Pauline Kamath is studying this phenomenon, how it's trending, and what it might mean for Maine's moose. Her work is funded by the Morris Animal Foundation, the National Science Foundation, and USDA National Institute of Food and Agriculture.

We talk to her about working with this symbol of Maine, and how she's collaborating with state wildlife officials and getting input from hunters and the general public.

Pauline, thanks so much for taking the time to talk to us. I'm curious at how you arrived at this spot that you were studying these creatures in this way, and looking at these issues that you've decided to tackle.

Maybe you can break down what it is exactly that you do at its most basic level? What do you study, and how were you drawn into doing this work and being at this spot right now?

Pauline: I study the ecology and evolution of infectious diseases and wildlife, as well as domestic animals. At that interface, in particular, I'm interested in understanding what factors increase disease risk and spread within wildlife, as well as between those wild and domestic animals.

I'm interested also in understanding how these parasite infections affect the health of their animal host, as well as how infectious parasites or pathogens and their hosts evolve or change genetically in response to one another. How I got here? I guess, in my undergraduate, I was fascinated with infectious diseases and genetics in humans.

Originally, I intended to go to med school and pursue a career in research on one or the other on genetics and human diseases. However, through coursework, I was introduced to the fields of ecology and evolution, and we were drawn to the more complex questions and all the messiness of it. [laughs]

I'm trying to disentangle all of these possible factors that influence disease outcomes in a natural environment outside of a lab. This eventually led me to pursue a PhD in Wildlife Disease

Ecology at UC Berkeley, and where I did a project that was focused on a bacterial disease called anthrax in wild herbivore populations in Southern Africa.

From there, I have now focused on a number of diseases of parasites that affect birds and mammals. Some of these projects are international, while others are focused here in Maine, like the moose winter tick problem.

Ron: You mentioned that these are messy problems. Is that part of the allure, that complexity, that if it's a multi-layered, you're not come going to come up with the answer next Tuesday kind of thing, right?

Pauline: Exactly. Every time I do a research project or try to answer a particular question, I end up having more questions [laughs] because there are so many factors that influence infectious disease dynamics in natural systems in reality.

Ron: In terms of the moose study you're doing, maybe you can just give us the cocktail napkin pitch. Paint the big picture for us in terms of ticks in Maine and beyond, and how that interplays with moose. What are we looking at here?

Pauline: In moose, the tick that's causing the problem is called the winter tick and some may call it the moose tick. This tick is a very different species of tick that is adapted specifically to moose. Its lifecycle's also different in that some ticks need multiple hosts to complete their lifecycle, but the winter tick just needs one host.

It spends its whole life on typically a moose and then falls off into the environment when it gets to the stage of having to lay eggs.

The issue for moose is that this allows for very high infestation levels to be reached on a single animal, where sometimes you can see a moose that have winter tick infestations up to about 70,000 ticks or more. Sometimes, higher.

If you try to imagine these many ticks feeding on a single animal, think about how much blood that animal will lose. For animals trying to survive the winter with limited food resources, when they lose this much blood, this can lead to death, particularly, in those young moose calves.

What's been seen over the past decade are these increase in epizootics. What I mean by that is the loss of over a certain percentage. I think it was 50 percent of calves due to winter ticks during the winter.

This frequency of these winter tick epizootics has been increasing over this time period. Overall, this loss of calves can mean a decreased productivity in the moose population.

What we're trying to focus on is trying to understand the effects of these winter ticks on survival, and long-term population trends in the moose population, but also considering some of the other factors that are involved.

Ron: What are the trend lines in terms of the tick population? Are they on the rise? Is that situation changing quickly?

Pauline: If we think about ticks in general, we know that tick population generally, and to point diseases in Maine and the United States, in general, are increasing and spreading geographically.

For example, like the blacklegged tick, which is the vector for the Lyme disease bacteria have expanded along the coasts in the northeasterly direction and appear to be increasing in abundance in distribution, possibly due to changes in climate. Similar trends are expected for other ticks.

We don't have a good idea of winter ticks, and how they're changing in response to climate, but any tick that requires an environmental stage where they have to survive in the environment is going to be susceptible to changes in climate.

Also, they're going to respond to how their animal host response to climate. They need both the host and to be able to survive in the environment.

I don't have a good answer for you about how quickly that situation is changing except for what we are seeing in terms of its effects on the moose population, which does seem to imply that it is getting worse quickly.

Ron: Just observing this, it must be horrifying in a way to see these animals suffer in this way and just have their blood drained out of them, and basically that's what's happening.

Pauline: Yeah, certainly.

Ron: One of the things we've heard about in terms of all this is the concept of ghost moose, which are found in the woods and are not in very good shape and have suffered greatly. Can you talk about that?

Pauline: It's a moose that has had these severe winter tick infestations, and because of those infestations, they've lost a lot of their fur. They look like meningeal there. Sometimes, look a little thin.

Because of the loss of fur, they almost look white, white like a ghost. It has a severe effect on not just the loss. Winter ticks themselves are not just causing a huge amount of blood loss, but they're also reducing their winter coat.

During the winter, when they need, they have higher energetic demands. If you imagine, not just that, it alters their behavior. When you have much greater ticks on you, the moose are scratching and spending more time doing that versus looking for food.

The combination of that blood loss, along with the increased energy demands, works together to have negative effects on the animal.

Ron: I know you're a scientist and you have to remain neutral, but just on a human level, you have to look at that and think what a horrible way to go.

Pauline: It's terrible to see. Hopefully, we can figure out the problem and try to reduce these populations of winter ticks and their effects on moose, but yeah, it's terrible.

Ron: Are we looking at a multi-pronged problem when it comes to ticks and their effect on moose? They're causing mortality in young moose, but they're also allowing other diseases and parasites to have gained a foothold, so to speak.

Pauline: This is a question that we are interested in tackling. Much of the prior research has focused on the effects of winter ticks themselves on moose, which are indeed a major factor in moose health.

What we're also understanding is the interaction of these other parasite infections. What we call co-infections or multiple infections of different parasites on the health outcome of moose.

In particular, there's a large proportion of moose in Maine that are infected with this bacteria and a plasma, which infects the blood cells of its host. This is an area that we've been focusing on.

We have hypothesized that for moose that are already suffering from blood loss due to winter ticks infection of its remaining blood cells with this parasite may further decrease probability of survival for the animal. Preliminary work suggests that it might.

We are also interested in trying to understand the interactions with a couple of other parasites in moose, such as the tapeworm, a caucus brain worm also known as a meningeal worm, and lungworm, for example.

Ron: How is the moose population doing with all this going on? Is it holding steady? What are the trend lines look like there?

Pauline: In general, Maine moose population is large. It's the most densed population in the lower 48 states. Generally, they're doing well in that regard.

The idea that biologists are going with here is that they think that the high population density has allowed for the support of some of these winter tick populations to perpetuate that in the

landscape. There has been recently, more in the last 5, 10 years or so, they've been noticing some declines in population due to that.

The concern is thinking about if that continues with these high populations of winter tick affecting moose that we might see some more dramatic declines. There are other populations that have winter ticks that have seen declines in response to that like in New Hampshire, for example.

Ron: Tell us how you go about doing your work? This is a large animal that probably is uncooperative in terms of dealing with people and such, so how do you do what you do?

Pauline: Clubbed with a large team of researchers, both here at UMaine and the Maine Department of Inland Fisheries and Wildlife as well as we have collaborators at some other institutions including University of New Hampshire that have done a lot of previous research on winter ticks and moose.

They, with the Maine Department of Inland Fisheries and Wildlife, had conducted a long-term survival study since about 2014 and are now continuing to do some work to look at the effects of increasing hunting pressure on moose densities and parasite prevalence.

By working with the state agency that's already got this large project underway, we are currently obtaining biological samples, including blood and tissue and ticks as well from both the live captures. Now, we're also working in collaboration or in cooperation with hunters during the fall moose hunt.

With these samples that we're getting from both the hunter harvest and the live capture, we are performing diagnostic tests in the labs. We take those samples back to the lab, and we determine pathogen infection status.

Then we use this other data that has been collected during the sampling, including data on individual age, sex, weight, location, to try to bring in these other factors that can explain that individual variation and parasite infections. Then together modeling that to understand how they might ultimately influence survival in the population trajectory.

Ron: You're working with Maine wildlife officials from IF and W. Tell us what role they play? To get samples from a live moose, that must be quite a thing to witness that, but they have people, that's what they do, right?

Pauline: The Maine Department of Inland Fisheries and Wildlife, it's led by moose biologist, Lee Kantar, have been capturing and collaring moose for many years. They hire a professional helicopter team to do this as accessing moose in the winter in the remote North Woods can be really challenging.

They're primarily focused on capturing moose calves as that's the demographic part that is most affected by winter ticks. They collar and track these animals and determine whether they'll survive the winter. I enjoy working with the state agency folks as it challenges me to think about relevant questions that have an application to the wildlife management needs and address those needs.

Ron: Maybe talk a little bit about some factors that might make moose more likely to survive. Can the effect of ticks be managed or mitigated? You talked about the density and how that plays into it. Are there other things that might help the moose make it through the winter?

Pauline: That's a tough one. [laughs] In terms of managing the effects of winter ticks on moose, the only option would be to disrupt the winter tick population cycle.

Previous work has found that that changes in tick abundance are related to that interaction between moose density and the onset length and length of winter, as well as the summer conditions that affect the ticks and the tick survival in the environment.

Because we can't really manage ticks easily through changing climate, the only option would be to manage their populations by reducing the moose population density, which I mentioned already. By doing this, Maine Department of Inland Fishery and Wildlife this year, who just offered an adaptive hunt, which just happened.

The idea of this is to see if reducing moose density could reduce winter ticks and then increase calf survival over time. They are doing this comparative study that looks at one area where they've done this adaptive hunt in comparison to an area next to it that has not had the adaptive hunt.

That hopefully will give us answers to some questions about whether they can manage the disease in this way by trying to manage the density of the moose population itself.

Ron: You talked about working with hunters. Can you just talk about basically involving citizens and the public in helping to do the science of this?

Pauline: We just started this effort to get additional samples from hunters across the State of Maine, mostly because we had data only from one core area in the North Woods area of Maine. We wanted to get a better sense of the distribution of some of these parasites and prevalence and see how it varies across the state.

One of my grad students is leading this effort, Elena Woods, who put massive amount of time into organizing, putting together, sampling kits with instructions, and selecting hunters that were interested, I believe, over a 500 or so, across the state.

She got all these kits out and then not only has had to put all that effort in on the front end, but then had to coordinate with the agency biologists involved with the hunting, the registration

station owners, and the hunters themselves to again get those samples back and get them in good shape for her to analyze them.

In terms of detecting parasites, the hunters bring their moose into these stations because they're required to register their moose after the hunt. We just ask them to drop off kit. The stations are spread out across the state, so I can see how it's going to be a challenge to get them all back.

It's amazing that there's been an incredible response from the hunters. They're very interested in the study. They've really been excited. A lot of them have been excited about collecting and helping out. That's been really fun.

Ron: What is it like to work with this iconic creature? Why do you think people are drawn to moose?

Pauline: Moose are just really a fantastic animal to work with. Just look at them, their physical stature [laughs] has been both very odd and impressive. Particularly, they've long muzzles and their flap of skin under their throat and the size in their huge antlers.

Moose are also, not just the way they look, but they're very special as a symbol of Maine as Maine's official state animal. They're extremely important to Indigenous communities as part of their cultural heritage.

What also makes them interesting is that they're like this solitary, elusive animal that makes them a bit more mysterious. It's always exciting to even just see one. You feel lucky if you get to see one because you don't get that opportunity very often.

Ron: Are you drawn to them the more you work with them? Do you find them more fascinating as this work continues?

Pauline: More I think about study in animal, I get more and more interested [laughs] and learning more about it for sure.

Ron: Talk about how this work fits into the larger body of work done in your department in Animal and Veterinary Science here at UMaine. There's a lot of people working on a lot of different things, but how does this fit into the big picture there?

Pauline: At UMaine, I'm also part of a group that is involved with this initiative, the One Health Initiative. Just to explain what that is, One Health is this concept that the health of humans is connected to the health of domestic animals and wildlife as well as to the health of the environment.

There are a number of faculty in my program or my department, as well as across the whole university that are working as part of this initiative, and so trying to make these connections between environmental, agricultural, and public health.

For example, I'm also involved in another collaborative project with the faculty of my department both in the School of Food and Agriculture and the School of Biology and Ecology, looking at the effects of climates on microbes and small rodents, and how these very often on-farm environments, so bringing it back to where they may pose a risk to domestic livestock.

My research does try to make those links between the agricultural, veterinary, medical, and public health sectors and also emphasizes the importance of considering those links.

Ron: As we look out into the future, obviously, with climate change and the way tick populations are trending, that looks to be a challenge. Maybe talk a little bit about what you think the future holds for moose and some of the trends you're studying. Where do you think we're headed with all of this?

Pauline: We hope the future is promising for moose. Maine does have a very large population, which we hope will be adaptable to environmental change. Hopefully, by modeling these population impacts, we can aim to understand the long-term viability of the population.

We are also currently planning a genome-wide association study that will hopefully be able to identify the genetic variability as a risk factor that can be informative for understanding that adaptive potential of the population into the future.

[background music]

Pauline: My hope is that there's a very good outlook for moose in the future and that we are able to come up with solutions because there's always a solution hopefully to this problem.

Ron: Fascinating challenging work, and thanks for sharing it with us.

Pauline: Yes, of course, no problem. It's great speaking to you, Ron.

Ron: Thanks for joining us. There's plenty of places to go if you want to hear other episodes or subscribe to our series, Apple and Google Podcasts, Spotify, Stitcher, and SoundCloud, UMaine's Facebook and YouTube pages, as well as Audible, and Amazon Music.

Questions or comments, send them along to mainequestion@maine.edu. This is Ron Lisnet. We'll catch you next time on The Maine Question.

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.