Tracey: [00:00](https://www.rev.com/transcript-editor/Edit?token=geZ_HmiPw1GVuLkno0hkkkNjs4M9e-GnidDRZCrpIgIf-QWVv8Ra1XQqXZeDovcZUkysI4PGzf597idaMIQdrKvfk7c&loadFrom=DocumentDeeplink&ts=0.56) Hello, and welcome to NC State's Audio Abstract. I'm your host, Tracey Peake. If I were to tell you that there were parasites out there that needed protection, would your response be, "But why?" Fortunately, Skylar Hopkins, an assistant professor of Applied Ecology here at NC State, is here to answer that question and talk about all things parasite. Welcome, Skylar.

Skylar: [00:25](https://www.rev.com/transcript-editor/Edit?token=GMBDFFilTPHKyCh0h4W_vIR4hQ1gK7pWR8CV9aejRTo7fHhSm7RKSKuXr1Fb8VzNqqT3BuqUuITxZ3q3327M-9U0alw&loadFrom=DocumentDeeplink&ts=25.74) Hi, Tracey and listeners. Thanks so much for having me in to chat today.

Tracey: [00:30](https://www.rev.com/transcript-editor/Edit?token=ppRi_LVfBSuRTx2RGoCF6PHdRPTLNd2i51HzSmrT09DVP-vF1KzoTloOnsEogqeCN1TdNerc9OevA7Zz33HJgbXcT1Q&loadFrom=DocumentDeeplink&ts=30.39) I am very happy to have you here because the topic of your research is not one that I had encountered in the past. You focus on helpful parasites. Now, I'm assuming that does not mean head lice, so what types of parasites are we talking about here?

Skylar: [00:46](https://www.rev.com/transcript-editor/Edit?token=baTFqoJy9quc_lN7BZbNyOoNVXqcepDQ3txlc9zYXG7fKT-fiNmYeEYhH0uGY1-Y8txlkFJCwZeZs4mdYxbr0RyI9IY&loadFrom=DocumentDeeplink&ts=46.96) Parasite is a term that we apply to really any organism that lives on or in another organism, and it gets its resources from that single host organism. And so by that definition, they're actually 15 different animal phyla that contain parasites. That's everything from lice to mites to intestinal worms to parasitoid wasps. In fact, we actually think that about 40% of all animal species in the world might be parasitic during at least one part of their life cycle, and so that's perhaps millions of parasitic animal species.

 A tiny fraction of all of those species impact people or our domesticated species, and another tiny fraction cause wildlife population declines. And we're not advocating for conserving any of those harmful parasite species. In fact, I actually spent a lot of my time researching how to control or eradicate those few parasite species. But all the other parasite species that use wildlife hosts are important parts of global biodiversity and they might play important roles in ecosystems.

Tracey: [01:59](https://www.rev.com/transcript-editor/Edit?token=xFxe0TRxGQwEi7vv5PzF-Y4Erz91B4AB0HoS_ZM1yAQ6Dpb8U6ahnffaVWCHB1f2cTlg3NwQjyRlb6725KFKAHQaQis&loadFrom=DocumentDeeplink&ts=119.89) Can you give me one or two examples of a helpful parasite that we might come across in our daily lives?

Skylar: [02:09](https://www.rev.com/transcript-editor/Edit?token=A-nQyvKJF5mohrYBDW7GJQDzqBGkl9A0CLWFYwxolZ9BiuE5Ar2YJdNrB7w_c1M0HafdC6FK9G1Aq1j0OYIVKRKj5jo&loadFrom=DocumentDeeplink&ts=129.65) Yes. Parasites actually save us a lot of money every year. For example, we know that parasitoid wasps in infect and kill crop pests like caterpillars, and that saves us billions of dollars per year in the agricultural sector that we'd otherwise need to spend on pesticides.

 We also know that parasites are really deeply connected in food webs, such that they really play important roles in energy flow within ecosystems. We're not exactly sure what would happen if we lost a big chunk of the parasite biodiversity from ecosystems, but we do know that food webs would change a lot and we're not really sure what consequences that would have.

Tracey: [02:53](https://www.rev.com/transcript-editor/Edit?token=nRVu60U71RQHuml-mCkYgQ9sHZMlvynfsm-DqQghUzLpLWNQEKa7n09h_FZt0t69QZYUZP2OQxMAZ66PkygsnKB8PWg&loadFrom=DocumentDeeplink&ts=173.74) You talked about the extinction of some of these parasite species. How often does this happen? I've never thought about having to worry about a parasite species becoming extinct. Is this a common occurrence?

Skylar: [03:28](https://www.rev.com/transcript-editor/Edit?token=ir3Qk_6dfC3G_ikPky92JYr0WjDMapRuEu_kftXmUqTLQrFKtUGaC2zqu1aVqhGjEeGtzr8U9HmZddflzeZAMJE5F5U&loadFrom=DocumentDeeplink&ts=208.87) Like any other species, parasites can go extinct due to primary drivers of extinction. If they have a free-living aquatic stage and the water body that they live in is polluted or the climate gets too dry or too hot, that parasite species could go extinct. And we actually think that perhaps 10% of parasite species will go extinct by 2070 because of those kinds of primary causes.

 And then parasites can also go extinct if their host species become too rare or if they go extinct, and that's called coextinction. When you add in co extinction, we estimate that perhaps one out of three of all parasite species would go extinct by 2070.

 All of that is modeling predictions, and so it's kind of hypothetical. It's based on data, but we're not exactly sure. But we do know that some parasite species have already gone extinct. For example, from looking at parasite DNA inside fossilized poo from the giant moa, which are these huge flightless birds that went extinct in what's now present-day New Zealand, we know that those moa had parasite species that we don't know from any birds that currently exist in New Zealand today. And that suggested those parasites went coextinct with the moa. Or as I like to put it, moa extinctions cause even moa parasite extinctions.

Tracey: [04:57](https://www.rev.com/transcript-editor/Edit?token=6M_ACfsB0FuB-QKqA0jfXp6Bj2hnm58Akk8wkSZp3plBmSmEH7yRVcWeI_1Od4z215JTMaAv_HVES2zp5mdZ83_wu04&loadFrom=DocumentDeeplink&ts=297.29) Oh, very nice. That's very nice. Yeah, so I was wondering about that. How many species, and you may not have an easy answer to this, but do you know how many species have parasites that are specific to them?

Skylar: [05:17](https://www.rev.com/transcript-editor/Edit?token=ckUrCbFUYxzki2Izh5egnuv-yr4IN-Ud0G95tdcYNlfLiho6htMxFjJnhw6UnFWQh8KOYgDYPH0tw_7v4KYR_dETpT0&loadFrom=DocumentDeeplink&ts=317.03) That's a really great question and it's an area of active research. We know that every animal that we've ever looked at on the planet has parasite species, but sometimes parasite species can use many different host species and sometimes they can only use one host species. And so those latter cases are called specialist parasites.

 And yeah, we're not really sure how many parasite species in the world are specialists, and we're also not really sure how specialist parasites are distributed in host communities. We have this idea that specialist parasites are more likely to exist on really common host species because that resource is so abundant that they can specialize on it. Whereas really rare host species might not be good to specialize on because they might be really hard to find. We kind of has some ideas about where specialist parasite species might exist, but we're not sure how many of them exist total in the world.

Tracey: [06:25](https://www.rev.com/transcript-editor/Edit?token=UfgbhsOu2CQbhM9sNWf_YjxaHQLwIuteaWY-fb_wJW1zEBhNitxYbG1oKtTKrRpMUnGOeM4RkzveQJCwwyiiVgOgmnI&loadFrom=DocumentDeeplink&ts=385.2) And that leads me to my next question, which is, if we need to protect the helpful parasites, how would you go about doing that? What does that look like?

Skylar: [06:38](https://www.rev.com/transcript-editor/Edit?token=lE0hFaulTYUsb_hoI3i0km05tTUKAmZm93yeTPD1UGHtP3DIn3SsgA2ax5lAniNdzpbTHcaBV2JJiDjy1amxa1-8amE&loadFrom=DocumentDeeplink&ts=398.19) We just published this global parasite conservation plan, and we suggest 12 different steps for parasite conservation. That's kind of a lot of steps to go through, so I'll just mention some ways that we think that we could piggyback parasite conservation on most conservation efforts. We get parasite conservation without actually doing a lot more than we're currently already doing for hosts.

 For example, when we're working with endangered host species, like when we translocate them or we bring them into captive breeding programs, we often use medications to remove all of their parasites like their lice and their worms. And in the past, we've actually driven some parasites extinct by doing this. We think that the California condor louse was accidentally eliminated when we brought the last remaining Condors into captivity and removed all of their lice.

 Now, sometimes we do need to remove parasites that are endangering their host species, but in case of the California condor louse, and probably other endangered species, the parasites aren't really harming their hosts. And so we should at least have protocols that allow us to think about parasite conservation. Or at least if we're going to drive the parasite extinct, that we do it on purpose, not accidentally.

Tracey: [08:00](https://www.rev.com/transcript-editor/Edit?token=HCaZj6romM0dwsGVIrdyJIB-Vt9y64BxIFAHdDxISpgEoxySrr6B_043e3_SVROLTuplvPHRBDp4gooTwi3gVb2dfyQ&loadFrom=DocumentDeeplink&ts=480.73) If it were a parasite that actively harms a species you're trying to conserve, get rid of it. If not, let it be.

Skylar: [08:12](https://www.rev.com/transcript-editor/Edit?token=yXX1iH13fgsnNMHQLzN5SaJtmtN_B4OUFpRQuWT7e_o2eLlF2eGpAfuvCqmFC6jFtd6uZc5DhAnEZkzutKeem6xJt6w&loadFrom=DocumentDeeplink&ts=492.48) Yes, definitely. Yep, and that can actually be beneficial for conserving the host species too. For example, if we raise a host species in captivity and it never gets exposed to any parasites, and then we try to release it into the wild where that host will encounter parasites for the first time, their immune systems might not be able to handle it, right? And so getting rid of all of the parasites isn't necessarily a good thing for the host and it's definitely not a good thing for the parasites.

Tracey: [08:41](https://www.rev.com/transcript-editor/Edit?token=HpS4umdYNhJgU8XHtHoFFyAFQNYrOd1UXe9NbZDSczITeAk0SyE99y7D3wN-TtDvmO1Ot4fEXCNLHLrOU6ROKBM8MN0&loadFrom=DocumentDeeplink&ts=521.99) Is that sort of your main focus, making sure that if we're kind of piggybacking on conservation, generally, for these endangered or threatened species and making sure that the parasite is coming along for the ride are also being protected?

Skylar: [09:01](https://www.rev.com/transcript-editor/Edit?token=UK5BJCeKdIMBcwL7mPd1CP_xguTDCVSB31KYEu-XgoJMzLv6nkjBfuYA3TzF5C3M0gtjhyshDsQXua3AveoPKdtg5bw&loadFrom=DocumentDeeplink&ts=541.53) Yeah. We think that's certainly the easiest way to go. It's sort of the path of least resistance because it doesn't require a lot of extra money or resources that we're already doing. Overall, we suggest that there really these four main themes where we need to do better. We need to do better at collecting data about parasite species. A lot of parasite species haven't even been discovered yet or given names, and so that's just something that we need to work on globally.

 We need to do a better job of identifying which parasite species are threatened, so potentially even listing them like on the IUCN Red List, which currently has very, very few parasites, only a tiny handful. We can get better at conservation practice, like adding parasites into these protocols. When we're bringing host species into captivity, we don't immediately get rid of all their parasite species unless we need to.

 And then also just outreach and education. For example, if you look at conservation textbooks which we’re using to educate the next generation of conservationists, there's very little coverage about parasites and all of it is negative, all of it is about all the bad things that parasites do to wildlife species. But again, that's just a very small fraction of all parasite species, and so really we need to educate conservation practitioners more about the good things that parasites do, the important roles that they play within ecosystems.

Tracey: [10:34](https://www.rev.com/transcript-editor/Edit?token=LzSife2PAwbkem0ihYCxabjRIyyAjoeHm_wGxhRIRNNy9PkIqc2qIkvgU5aJW6NmG22HzT4IbuPMI9csZrY_5v137io&loadFrom=DocumentDeeplink&ts=634.68) Is there a top 10 list of parasites that need protecting?

Skylar: [10:39](https://www.rev.com/transcript-editor/Edit?token=t3ZRGQdtc00PDP5gu17pY7CJnlxGqJ0dMbrhXLM1hoJdzJ43476XC5V_zANImuMcxo1jS2ZrCu7tvA91jlNOcnJnaB0&loadFrom=DocumentDeeplink&ts=639.74) Not really. Only a few parasite species have ever been evaluated and placed on the IUCN Red List of endangered species, and those parasite species aren't necessarily the most endangered in the whole world. It's just that they're the ones that we've formally evaluated so far.

Tracey: [10:58](https://www.rev.com/transcript-editor/Edit?token=7Dypfd_WbeYhk1ilc-NgWrCelHu-A4FRcSrBhjEe-znnANJ0jeZ6-05Jv_rWLqkXBFPlLixU1idMUTvZ7ITeXKfYR1Y&loadFrom=DocumentDeeplink&ts=658.83) Okay. Are there any that we would be familiar with on there?

Skylar: [11:03](https://www.rev.com/transcript-editor/Edit?token=jGYz0nn3MOm9CHj7jXXpSzR1DGuq13JShMjJ-ulZS-8RyS-0s3TXGNayr7TdNTky1XKoPv8Aux_Vo796jhSAkUYnwOc&loadFrom=DocumentDeeplink&ts=663.94) No. Unfortunately, most parasite species don't really have common names. Any parasite species that you probably know the name of is probably a parasite that infects people or dogs and cats or other domesticated species. And so yeah, most wildlife parasites are completely unfamiliar to most people, even most biologists, right? It's a very, very small group of people who know sort of the common names or the scientific names of most parasite species.

Tracey: [11:36](https://www.rev.com/transcript-editor/Edit?token=6p18JsFEwQ2QFgXE9B1uh_3eqY_XWgssiLSsr_lODXsltS1swP8uLDNXBQwaL2IIPh_xP0wD5e5hDfZk_beZORnLk8Y&loadFrom=DocumentDeeplink&ts=696.68) Okay. Well, I guess I'm kind of relieved about that really. I don't think I need familiarity with a lot more parasite species beyond the ones that I have, but I'm glad that there's someone out there looking out for these guys. And finally, do you have a favorite parasite and what is the coolest thing that you know about parasites?

Skylar: [12:00](https://www.rev.com/transcript-editor/Edit?token=3So1p2_2HC2fYF2AmuLiywkl0kIWi4n31_xRetQ38Z8RhbAeDYa-PXKvJg3VoYNo_Kr00ZGf0AjdwUOmFM0UZLrRq4s&loadFrom=DocumentDeeplink&ts=720.09) Well, so following up on parasites not having names, people always ask me what my favorite parasite is and there is one parasite or symbiotic organism that I studied the most, and it has a scientific name it's called Chaetogaster limnaei but it doesn't have it doesn't have a common name so it's really hard for you to talk to people about it because I have to use this name that doesn't really mean anything to anyone. But it's this tiny, transparent worm and it lives on aquatic snails, right on their face. And it's really neat because it eats other parasite species as they try to infect the snail. It can actually be beneficial to the snail now because it's eating those other parasite species.

Tracey: [12:42](https://www.rev.com/transcript-editor/Edit?token=ZLOjGrGg37EjeGDiiu4Pq7kLWaT_P2nGhk7au_iSeld05y2eiq6Ye7Zko17_fF4G_lkh8WwuAFZcy7xK5dRy_MrWXMY&loadFrom=DocumentDeeplink&ts=762.41) Yeah. If you could deal with a worm on your face I guess that's a good thing.

Skylar: [13:02](https://www.rev.com/transcript-editor/Edit?token=r-peDBPo7esEn-4lp0x5RjwX27-zpV6pk4KVHRqfEjIBqO8KC4MU89LytNCoPm5wIIbQM_11EezTpyDHe9eqJAgHwRc&loadFrom=DocumentDeeplink&ts=782.67) We have that for things like birds, there's a committee that decides like, what will we call this bird altogether, but there isn't one for parasite species. I've been thinking maybe I should just give it a name myself and then hope that it sticks, but I haven't done that yet.

Tracey: [13:25](https://www.rev.com/transcript-editor/Edit?token=VG2gPv-wPHnvTu6F5nvXwRq3bmU_SSAVS9JXZ7iEse8ALObnzTafQ0QJtB1_umxlidVTEP3p3C2so9TBKS-WfurudqY&loadFrom=DocumentDeeplink&ts=805.16) Exactly. Well, yeah, I see the parasite-naming committee formation in your future. I would love to be able to talk to people about the snail face worm-

Skylar: [13:38](https://www.rev.com/transcript-editor/Edit?token=O7rihPluiwDtrMe_Zxd6muXQrKx7tZuEvex_WwEV8j38GKZcgx3Ev97dy4303JiSJlqB0DG7DCViSxSiko-UEaDA9VI&loadFrom=DocumentDeeplink&ts=818.18) Yes.

Tracey: [13:41](https://www.rev.com/transcript-editor/Edit?token=CewUIX2I1HAHPKFiTAtWkfIle8YD28wUVnwwglHgZx_loRGJ75-cvHveCalEb2_gvLuEVl0fzpNX2pOyuYFSz79mJBc&loadFrom=DocumentDeeplink&ts=821.82) ... With a pronounceable name. I think that would be great. Well, thank you so much for being here today, Skylar. This has been very eye opening for me and it's helping me think about parasites in kind of a different way, which is good, which is good. They're not all terrible.

Skylar: [14:00](https://www.rev.com/transcript-editor/Edit?token=iDEatzbA29Jvn48ZtxXqANB1ISm3jKk5MD8hWkh08aWz1rRqChB2L20Qxpt0vWVy21ueYXIgDY4_Bn9d3QMiy6VSM1I&loadFrom=DocumentDeeplink&ts=840.82) That's true. Actually, most of them aren't terrible. It's just a few that are terrible that's giving the rest of them a bad name.

Tracey: [14:06](https://www.rev.com/transcript-editor/Edit?token=ORx15teLx0XiWcR4hHW58_JQpUOTQwocXLat5RRefenVkjdIUlc11WeQhuX1s4n7qqWmLUNFm4y3BgHVfeE4Qv10eBg&loadFrom=DocumentDeeplink&ts=846.96) We have been speaking today with Skylar Hopkins, an assistant professor of Applied Ecology here at NC State. This has been Audio Abstract. I'm your host, Tracey Peake. Thank you so much for listening.