

Hey to all you fish enthusiasts out there. Whether you're an avid angler or just curious about fish, we'd like to welcome you to Fish of the Week, your audio almanac of all the fish. It's Monday, January 17 2022. And this year, we're excited to take you on a week by week tour fish across the country, with guests from all walks of life. I'm Katrina Liebich with the US Fish and Wildlife Service in Alaska,

and I'm Guy Eroh. What's a moth's favorite fish? You know, I think it just might be a lamprey.

Oh, there you go. Okay, so this episode is about sea lamprey, which is a really interesting multifaceted fish in terms of how it's perceived and how it can play a beneficial role in some places in an incredibly destructive role in others. We've got two great guests with us to help us dig into these nuances. We've got Dr. Steve Coghlan, who I know from my days working on Atlantic salmon in coastal Maine, where sea lamprey are actually found naturally. And we've got Dr. Marc Gaden, who works in the Great Lakes region where they're invasive. Steve is an associate professor of freshwater fisheries ecology at the University of Maine and Marc's the communications director and legislative liaison for the Great Lakes Fishery Commission. He also teaches at the University of Michigan. So welcome you to we're really happy to have you on the show.

Great to be here. Thanks.

Thank you.

So we talked about Alaska's lampreys this last year on an episode with Trent Sutton and Sabrina Garcia. And sea lampreys are similar in their general appearance, but we'd love if one or both of you could weigh in on what these fish look like, and anything about their anatomy or lifecycle that's going to be important to our discussion.

Well, the sea lampreys are alien looking. They look like a snake with a grotesque alien mouth ringed with sharp teeth and a sharp tongue in the middle that acts like a drill. The teeth anchor the side of a fish. The mouth is a suction cup. It's a very strong suction cup. The tongue in the middle flicks out and drills its way through the scales and skin of the fish so the lamprey can feed on the fishes blood and body fluids. They are pretty nasty looking creatures. But as I'm sure we'll talk about in this podcast, they have their role in the ecosystem and they have a very negative role in ecosystems that they've invaded.

Last time we had the lamprey guests on talking about Alaska's lampreys, I asked him this question, and I want to ask it to you too. There is some debate out there about how we define what is and is not a fish and the lamprey sometimes fall outside of that definition. I'm curious what your guys' thoughts on it. If you do include them as a fish, what informs that decision, and then what distinguishes them from teleost and even some of the more ancient fishes?

Um, I would call them a fish. Of course, if you call them a fish, you have to add a whole lot of other organisms in there as fish that you normally wouldn't. Some people would call them primitive but their, you know, other people would call them ancestral. They do have a very ancestral body plan. They have a notochord and rudimentary vertebrae and a rudimentary cranium structure. They don't have true

jaws, so they do have seven gill arches and seven external gill slits. And of course the first two gill arches are what evolved into jaws in Gnathostomes. So I guess it depends on where you draw the line. I guess if you're a strict cladist or phylogeneticist, you probably wouldn't call lamprey fish if you don't call, you know, humans and other tetrapods fish too. But they swim and they mostly breed water so sure they're a fish.

Certainly since they invaded the Great Lakes going back into the sort of the 1930s and on as people talked about them, they call them lamprey eels. And you know, if you were an eel, you'd be "who you call it an eel?" with regard to that, because they don't they're not eels, of course, and they're not related to eels, they look a lot like eels, but even to this day, people that we talk to, they'll call them you know, "those eels, you got to get those eels" and, and the like.

And they overlap the range of the American eel, which is a native species and Steve's neck of the woods, which we've talked about as well too. But yeah, similar body shape, similar size. I think eels are a little bit bigger, American eels, but definitely very different species. Okay, Steve, we'd love it if you could ground us in terms of where sea lampreys are native, and what they're like where they're native. I know your work over the years has been illuminating some of the ways they might actually be helpful from a habitat standpoint, and we'd love to hear more about that.

Sure. The native range is recorded from is as far south as Florida. There are some streams that flow into the into the Gulf of Mexico that are reported have lamprey in them, but they don't seem to be there anymore. But probably on the Atlantic side of Florida, maybe the St. Johns River, all the way up the Atlantic seaboard of North America, through Labrador over to the North Atlantic, Northern Europe, into Russia and into the Mediterranean as well. And then I know that there's a debate in the literature, sometimes very acrimonious, whether or not sea lamprey are native to Lake Ontario Finger Lakes, and Lake Champlain watersheds. But they are certainly native here on the North American Atlantic Seaboard.

What's the role in the freshwater systems there.

So in freshwater, the ammocetes, the larval form of the sea lamprey, they'll feed on dead and decaying plant and animal matter. And also algal cells. Sometimes they're called a filter feeder, but they don't really filter out of the water column, they sort of vacuum up off the bottom, and they'll live in the freshwater streams, you know, anywhere from three to 15 years or so. They transform into what are called transformers or microphthalmia. And as they're going downstream, much like a salmon smolt would, they begin to tolerate saltwater and they undergo physiological changes and coloration changes and they get big eyes. But they might actually start taking their first parasitic meal to give them a little energy boost going down to the open ocean, though, as juveniles there'll be parasitic out in the open ocean, when they come back into freshwater as mature adults, they stop feeding. So essentially, except for that first or second blood meal as they're going downstream, they are not parasitic in fresh waters, they eat dead and decaying plant, and animal matter. One important role is even if they're not feeding in in freshwater, as they're mature adults, they do die after they spawn. So they have the potential to deliver marine derived nutrients and energy. Much like Pacific salmon would. Different time of the year and probably not in as huge of abundance as most Pacific salmon runs are or used to be.

So they can deliver nutrients and energy on their spawning run upwards, they can essentially serve as vectors out of freshwater and riparian derived nutrients and energy as they transform.

What are the different types of fish that are used to them parasitizing?

they've been recorded on all sorts of things, you know, fish, but you know, sharks and whales and whatnot, I believe seals or sea lions as well. But pretty much you know, anything, anything that swims could potentially be parasitized on.

I got a I got a question for Marc. So I was I was reading around a little bit online. And I read that this past November. So November 2021, was the 100th anniversary of the first capture of a sea lamprey above Niagara Falls, which unfortunately marked the start of a pretty big problem for the fishes native to the Great Lakes. You know, once we kind of helped them around that that large barrier that was pretty much impossible for them to get over on their own. Can you talk a little bit about the history of their invasion into the Great Lakes like how they got in and just kind of timeframe?

There has been a debate in the literature as it was already noted in whether they're native to Lake Ontario. The general consensus, or at least where we are right now in the debate is that they're not and they made it to the Finger Lakes first, through a breach of canals or some communication manmade between the Hudson River and the Finger Lakes watershed primarily through the Erie Canal in the Susquehanna River and so on. But nevertheless, Niagara Falls did form a formidable barrier to sea lampreys and any other fish and that was breached in 1919 when there was a major renovation to the Welland Canal, that's the canal that bypasses Niagara Falls, it's a series of locks to get distance, of course between the elevations of the two lakes. And it was a really not just a renovation, but kind of a redo entirely of the canal such that it allowed the lamprey to have access then to Lake Erie and then the three upper Great Lakes. So it was on November 8 1921, a few years after that renovation occurred when Alexander Crew outside of Merlin Ontario, caught a lamprey with his catch. And he knew immediately that it was not the same as native lamprey that he was used to catching once in a while and his net. So he turned it over to University of Toronto, and they confirmed it was the dreaded sea lamprey. So the invasion that of Lake Erie and the upper lakes had begun basically at that point. It wasn't until they started making their way into Lake Huron and Lake Michigan where the habitat is much better. And the preferred prey is much more abundant that commercial fisherman at the time began to take notice and really watching horror as the invasion proceeded. And as their livelihoods were affected in very, very stark ways. We have other invasive species in the Great Lakes that we've seen that are more insidious and you don't really know what they're doing because they maybe have a bottom low end of the foodweb effect, but these sea lamprey were leaving big, gaping, bloody scars on the fish, they were killing large numbers of fish, you'd get fish looking like Swiss cheese where you know, nearly 100% of the fish would have multiple sea lamprey wounds on them. And when that starts happening, and you have catches going down, because of that the word gets out very quickly among the commercial fishing community. And that's when people really started paying attention. But 1921 was the beginning of that invasion of Lake area in the upper Great Lakes.

Yeah. And Steve talked a little bit about the prey that they have access in the Atlantic Ocean. And we think about the Great Lakes. I mean, it's the same lifecycle right they're in freshwater, they migrate out

to the Great Lakes into that big kind of pelagic system. That's freshwater, but the species that they're targeting are smaller. We've got like lake trout, you've got your whitefishes. Can you talk a little bit about just yeah, what species were impacted?

Well, first of all, his invasions go was a perfect storm. This species was able to take full advantage of what the Great Lakes had to offer. And it was not pretty to the people of the region and to the ecology of the system. So they have nearly unlimited spawning habitat in the Great Lakes. A lot of the streams that we've already did, the types of streams that are needed are quite abundant in the Great Lakes rocky upstream where they can build the nests and lay the eggs and silty downstream where the larvae can burrow. Also nearly an unlimited food supply. The lamprey do prefer the fish like lake trout, other trout species and salmon after they were introduced in the 1960s, but also white fish and burbot, walleye, yellow perch and even sturgeon. You think fish as big as a sturgeon sea lamprey might be nothing more than a mosquito bite on it, but they will kill about 30% of the sturgeon they attack and that's particularly problematic because the sturgeon they need to grow to a ripe old age before they are able to reproduce so the lamprey could really have an effect on sturgeon. And then the third thing that one being habitat second being open buffet, if you will. The third is nothing at least past that larval MSC phase was keeping them in check. The fish were defenseless against that the sea lampreys are much bigger than the native lampreys in the lakes. And not all of the native lampreys are even parasitic. But the fish there that might have been able to survive an attack from something like a silver chestnut Lamprey, which are native would have no defense against the much larger sea lamprey that would be able to kill that fish and then move on to another fish and another fish until it was ready to move into that spawning phase. In the Great Lakes, they've adapted entirely to freshwater, they'll spend their entire lifecycle in that in freshwater, they don't swim out to the ocean, people ask, for example, well, maybe we should just close the Welland Canal or the St. Lawrence Seaway or something. They spend their entire lifecycle in freshwater. And they've essentially made the Great Lakes home and they treat the open lakes as if it were the open ocean.

I was in Atlantic City a few years back, you know, playing the tables winning some money, I started up a conversation with a guy who, who was doing some research on lampricides in the Great Lakes trying to get rid of these guys. I thought that was an interesting mechanism to try to remove them. I'd like to learn more about it.

Back in the 1940s when it became apparent that the lamprey sea lampreys were there to stay in the Great Lakes, the biologists and the scientists and the powers that be were trying to figure out what can we do about this? And with invasive species, even to this day, the answer is virtually nothing. They're going to spread make more of themselves. Invasive species, if they make a new ecosystem home, you just better be prepared to live with it and kind of better understand what's going to happen there. They convened some conferences in the mid 1940s that basically said "everything in the kitchen sink, let's give it a try." So they tried mechanical barriers. They tried big sieves in the rivers to capture those transforming lamprey. They tried these crude electrical barriers that you know we look back and it wasn't much different than kind of throwing your toaster in the river and you know seeing what you zap there. They would short out they would short out the power grid they get the odd moose I think and they tried just about everything and nothing was working. And not only that, but it was uncoordinated So Michigan was trying its little thing and Ontario it's. And the lamprey would just swim to Minnesota or

something. So they also thought well, why not kill them before they transform you know? If you can get them before they go out into the open lake and kill the fish. then that's a good approach. And some in the in the '40s poopoo'd the idea, "There's no way you're ever going to find something selective." It's really easy to kill fish, but it's really hard to kill what targeting, they started a process around 1950. And they would do some rudimentary chemical testing: battery, pickle jar tests, they were called. They would get a couple of trout or a couple of bluegill or a couple of something. And then some larval lamprey put them in the jar, weigh out some chemical, throw it in there and come back in the morning and see what was still living. Most of the time it was the lamprey were just fine and the fish were dead or both were dead. But of course, when they started zeroing in on the fish being just fine in the lamprey being harmed, that's when they were on to something. They tested about 10,000 different chemicals. They were dogged. They discovered in 1957. The technician at the time knew it was unique, because instead of writing power was reported out, he just wrote "special" on the bottom of the slip. It was a pretty miraculous discovery. And it's been used to this day. So from about 1958 to today.

What is it about these chemicals that are able to home in on the lampreys and not the other fish? And then also we have the native lampreys, are they being killed, too? And is there any concern about trying to sustain those populations?

Sort of the cliffnotes version of it is that lamprey being more primitive than the other fishes of the Great Lakes are unable to metabolize the lampricide. So whereas fish will, will process it, and metabolize it, it's lethal to the lamprey. Does it harm native lamprey? Yes. They're primitive as well. So that is something that is of deep concern to the people who control sea lampreys in the Great Lakes because it is a lampricide, not a Sea Lampicide. On the plus side, the habitat doesn't always overlap perfectly. So the steps that we take to minimize the exposure of the native lampreys to the lampricide we do take steps to do that.

Could you both talk a little bit about what's going on in the fish passage world in terms of both controlling sea lampreys and restoring habitat for native fishes?

So yeah, dams, the biggest dam removal project to start it all off was on the Kennebec River. But more recently, it's been the Penobscot River Restoration Program, which is removed to mainstem dams, installed better fish passage of some others to allow sea run fish, not only sea lamprey, but a lot of other things access or better access to their historic habitat. Of course, Katrina knows that very well. And one of the least studied fish would be Sea Lampreys> So sea lamprey probably have the benefit sort of coming along for the ride of restoration efforts that are more targeted towards the more charismatic species. So we really don't know how well lamprey have responded to dam removal on a large scale except for one or two small studies in the Northeast, and they seem if there are lamprey nearby in the watershed, they don't home they stray quite a bit. They do require a signal from other lampreys, a chemical to actually queue in. So if dams are removed in a watershed that already contain lamprey, it seems to happen pretty quickly we're adults will come back up and spawn and reseed with larvae. But we don't have a lot of good information here in the in the Northeast.

In the Great Lakes region, we are schizophrenic about dams. I'll say that right out. Where the you know, we talked about lampricides as a lamprey control technique. But the other main control technique

that we have in the Great Lakes are barriers and dams. We have built about 70 throughout the basin for lamprey control purposes, purpose built, there are 1000s and 1000s of dams, culverts, blockages of some kind or another throughout the Great Lakes basin that we had nothing to do with. But they do serve a function of controlling invasive species, particularly sea lampreys. If you can deny lamprey access to their spawning grounds, you don't have to treat above that barrier with the lampricide. So the plus side of dams as they are sometimes the only things protecting upstream reaches in the Great Lakes from invasive species. The downside of dams is exactly what we've been talking about. And that is they thwart conductivity, on fish need access to rivers, and we have the Fishery Commission have not just the dual role of controlling lampreys, but also to taking steps to restore fisheries of the Great Lakes. And you're not going to restore fisheries if you have poor connectivity. So we love dams because of what they do for the lamprey control and we absolutely despise dams because of what they do to thwart conductivity. Now, we're not just complaining about it, we've launched a project in Traverse City, Michigan, called "fish pass" it's the only place on the planet where this is being done, where we're trying to find a way to sort a mixed assemblage of fish that swimming toward a barrier. You know, think about what swimming toward a barrier in the Great Lakes, you'll have a mix of walleye and salmon and sturgeon and suckers and invasive fish like sea lampreys that are swimming toward that and get blocked by a dam. Some of those you want to get past. And some of them you definitely don't want to get passed. So we've launched a project where we're going to spend the next 10 years testing technologies below a barrier to see if there are things that can be done, whether it's technology or methods or whatever, that can sort these fish automatically pass the things that you want to pass and block the things that you want to block. If we can solve this problem with something that's very exportable to other parts of the world.

Also probably good to know that that lamprey have very different passage issues than a lot of other fish do. They don't jump so they can't surmount certain obstacles, but they can wriggle up and suction other obstacles that other fish couldn't jump if there's no plunge pool below. So certain dams might exclude lampreys versus the other fishes very differently.

We're talking to the folks out in Alaska about those lampreys we talked a lot about the native communities and how they use them. Do people use sea lampreys for anything?

Yes, they do for a variety of things. Most recently, they're of commercial value. They catch them there's a few places in Maine where they still catch them for biological supply companies and they inject him with you know, elastomers so students in their anatomy class can dissect Lamprey, so they're, they're done for that. The ammocetes are used for bait in some cases. Historically, they were much more valued as a food fish here, certainly among the the Native Americans and the the earliest European colonists. And they've been valued as a food fish very highly over in Europe. And of course, there's a story about King Henry, you know, dying of lamprey poisoning or something like that,

Over consumption. Yes.

Surfeit of lamprey was how it was called. So a surfeit of lamprey.

Yeah, he really liked them apparently.

There's a tradition of the city of Gloucester in England that they would present the reigning monarch on special events with a lamprey pie. And that dates back hundreds and hundreds of years. So essentially, the Middle Ages, I got a call about the year 2000. For a jubilee year for the Queen Elizabeth was going through and they said, "well, we need to make a pie and they're now protected in the UK. So we can't make a lamprey pie to present to the Queen, which we've been doing almost unabated since the Middle Ages. Can you help us?" And I was like, "yeah, how many do you want?" and we sent over the pie, it was made by publican. And in the city of Gloucester. It was very nicely presented pie. And we did the same thing in 2012. And that one made the BBC and the CBC and other radio and I, I do press for the Great Lakes Fishery Commission as well. And I've never, in my almost 27 years doing this now never had a story more viral than the lamprey pie that was presented to the Queen.

From which of our lakes, are these British people buying our lampreys?

Well, you know, what I told the folks in Gloucester is that we get them from a trap out of Lake Huron, which would essentially, you know, 50/50 chance that it came from a Commonwealth country, you know, so, you know, the Canadian Lamprey,

I would wonder if maybe you could talk about some of the things that you can use to distinguish the sea lamprey from some of the native lampreys in the Great Lakes. So someone runs into one they can know whether it's a problem lamprey one that'd be good to, you know, make a pie? Or if it's one that they should let keep doing its own thing.

I'm glad you asked that question, because we do appreciate the value of the native Lamprey, just like any native species in the Great Lakes and in some cases is not that easy to tell the difference between like a silver lamprey or a chestnut Lamprey, and in a sea lamprey. And we try and remind people who fish in the basin that just because you have a grotesque alien mouth and look like a snake, doesn't mean that you don't play an important role in the ecosystem and protecting those species and recognizing their function in the ecosystem is very important to us, and people who are managing the fishery. We do talk about that and we take as many steps as possible to avoid the situation that was described earlier of exposing the native lamprey to the lampricides. But the fact is, you can't always do that and that is always a challenge there, we have produced just hot off the press. And when I say that I'm literally like ran to the front office, because it's just brand new printed. But if the guide is called lampreys of the Great Lakes, and it does distinguish between the native invasive lampreys, and literally like this was delivered yesterday, we hope this will be a guide to help people understand not only the value of the native lampreys, but how to tell the difference. And so we put in here, you know, like, they're the models are different, and the shapes are different. And the sizes you can see is, you know, we put them kind of relative size,

Just for the folks listening, Marc was holding up, like a bifold brochure that had the mouth. So we had like five or six, it looked like circular, disc shaped mouths and the shape of the lamprey, you can, yeah, get an idea of what their bodies look like and their coloration. So that's, that looks pretty cool.

First time we've ever done that. And I think I hope it helps with the education part of it.

Do you get a digital copy of that, that we could share with people when we put this out?

I think the answer is certainly yes. In fact, it might even be on the website by now.

Kind of the final question for you two. Is there anything that you haven't mentioned so far that you'd like to tell the public just kind of take homes about Sea Lamprey,

you know, we're sensitive to the fact that two of the main control techniques are chemical lampricides and dams. And certainly, we're in a dam removal phase, not a dam construction phase, and we're trying to think about how the future could go in terms of lamprey control that could be cost effective and still remain as selective as possible. And pheromones could be the one key to that where you could use their own you know, sort of odors to attract them into traps or something.

I mean, I guess I could rattle off a list of benefits or good things about lamprey you know, delivery of marine derived nutrients and, and sorting sediments on the bottom through Ness building and creating complex depth and velocity profiles for insects and fish to occupy and linkages between fresh and seawater and forests. And I'm sure Marc can tell you a lot of the bads. But um, you know, that's, that's from our perspective, you know, stepping back and looking over evolutionary time, I mean, they've been around, more or less for hundreds of millions of years, they have been quite successful, more so than a lot of other species. Even today, many or most lamprey somewhere, if not, their entire range are threatened for exactly the same reasons that are charismatic fish like Atlantic salmon, American shad, sturgeons are threatened. So that should give them some intrinsic value beyond what we like or don't like about them. But they're really neat creatures. I think if you give them space, removing dams, allowing access to habitat, not polluting, they can thrive maybe more resilient than some of our other species, but they're threatened to in a lot of parts of the range, so let's not let's not forget that.

Okay, one thing that really stands out to me from this conversation is that disasters can really lead to innovation and ongoing cooperation and collaboration. And that's always a really good thing when it comes to fisheries management. So thanks again for joining us. And we hope folks get out there and enjoy all the fish and learn about the nuances with species like this one that we talked about today. So if you live in the Great Lakes, go ahead and make a lamprey pie and tell us how it goes. Thanks, you guys.

Yeah, thanks for coming in.

Thank you.

Great to join you.

Thanks for listening to Fish of the Week! My name is Katrina Liebich. And my co host is Guy Eroh. A production partner for this series is Citizen Racecar. Produced and story edited by Charlotte Moore. Production management by Gabriela Montequin. Post production by Alex Brower. Fish of the Week! is a production of the US Fish and Wildlife Service Alaska Region Office of External Affairs. As the



Sea Lamprey feat. Stephen Coghlan and Marc Gaden

Service reflects on 150 years of fisheries conservation, we honor thank and celebrate the whole community, individuals tribes, the state of Alaska, our sister agencies, fish enthusiast scientists and others who have elevated our understanding and love as people and professionals of all the fish.