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. Monday, May 8 2023. And we're on a week by week tour of 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 and this week I'm here to tell you that you don't need to go to the gym to spy some good muscles just need to pop on a snorkel and jumping your local river. Because this week we're talking about freshwater mussels.

Nice.

And now this is the second time on Fish of the Week where we've done an episode on non fish. In Season One, we talked about signal crayfish and their effects on salmon up in Alaska. This week, we think we can get away with talking about freshwater mussels because they have such a strong connection with lots of native fish in this country.

To help us out, we're very pleased to welcome our guest Sara Seagraves, Sara's a mussel biologist with our Mammoth Spring National Fish Hatchery in Arkansas. Very happy you can join us there.

Thanks, I'm happy to be here.

So I think our fish fans out there are really gonna get a kick out of how far mussels will go to attract and do fish into helping them reproduce. That said, we're gonna have some fun with this topic. So to kick things off, I thought we could set the stage and pretend we're a logperch. And we've just learned about logperch a few weeks ago with Jamie Roberts. So we're this fish are going about our business using our piggy snout to flip over rocks and look for food. And one of those rocks isn't a rock at all. It's a freshwater mussel. So Sara, what happens next?

Yes, freshwater mussels have kind of a unique lifecycle in that they have a parasitic life stage that requires a host in order for them to effectively reproduce. And so in the case of the logperch, when the logperch is nudging rock on the bottom of the river, and he comes in contact with the snuffbox, the snuffbox will actually latch on to its snout. And once it latches down onto the snout of the logperch, it starts to pump in those larva, also known as glochidia. And those will then attach to the gills of the logperch. They'll kind of become encysted on the gills, that fish will start to lay a coating down over those and they'll live there usually a few months. Not only do they require the nutrients that they draw from the fishes, blood that's in their gills and stuff, but that's what they use in order to move and migrate. So when they're attached to these fish, the fissure, of course, moving up and downstream. And as they mature, they turn into a juvenile and they drop off. More than likely they're not dropping off in the same mussel bed that their parents are in. So that does help with our genetic flow throughout those rivers.

It's important to because these muscles are pretty sedentary as adults and can't really move themselves upstream. So if they didn't have these fish to carry, they go kitty and the babies just drifted downstream after several generations, or eventually be no more mussels in the river at all, you know,

bugs like mayflies and stone flies, they tend to fly upstream to lay their eggs and that's for a similar reason. Yeah. So when I think of parasites I think about something that really drains and can injure the host is that the case with these about

when it comes to the gills you can actually over infest the fish. So what they do when they clamp down on those gills is that they're actually taking away parts of the gill that could transfer oxygen from the blood into the fish. There's definitely a fine line. But they figured out this is how many we can attach on the fish and the other ones kind of get flicked off so when it's a natural infestation in the river more than likely they're not going to over attached.

yeah and it's in their best interest not to kill their host fish that's taking care of their glochidia.

That'd just be bad evolution right there.

What kind of hardware do these glochidia have to be able to attach? Because they seem like you're talking about little tiny, microscopic little mussel? How's that thing able to hold on to a fish's gills?

Yeah, so if you have a whole bunch of them in a petri dish, it kind of looks like a bunch of salt or grains of sand in the bottom. So when you look at them under a microscope, I like to describe them to my kids as they kind of look like PacMan. Freshwater Mussels are bivalves meaning they have two shells, right and there's a hinge on them. So when they open and close, it looks like a PacMan going through the maze, eating the little dots. Some of them are basically just clamping down and using the ligaments to kind of hold them in place but others have books that actually embed into that gill tissue.

Gotcha.

So the one with a logperch. That was just one example of a mussel that has a very specific fish host and it looks like there's about 300 or so freshwater mussel species in the US and Canada. And Sara, we were wondering if you could give us an overview of kind of the overall strategies that mussels use to get their larva where they need to be.

Well, I'm fortunate living in the southeastern region that we actually are kind of in a hotbed for freshwater mussels. The southeastern region has about 270 species. The unique thing about their lifecycle is that they do require that host fish in order to reproduce or there is actually a species it's called a salamander mussel, it uses a mudpuppy rather than a fish. But they will, depending on the species produce a lure, which would attract the fish to come in for it. There are some species of mussels that are part of the Lampsili family and they produce what's known as a mantle lure. The mantel is just kind of the fleshy material that lines the inside of the shell. But there will be an extra little flap of that mantle that looks similar to a minnow or a darter. Maybe even a crayfish might also be what's called a conglutinate or a super conglutinate. And that's just a huge packet of all those baby mussels, the larval stage that are stuck together with unfertilized eggs, and those might mimic an insect larva, or a small fish a darker that their host fish would be attracted to. And then when it sees it, it'll attack trying to get that food source. And when it does, that packets of those glochidia will explode and get flushed over the gills of the fish. Those lures are really common for muscles that utilize big game

fish like bass. But then there are even some species of fish like a freshwater drum that we know is kind of a shell cracker. They have almost like teeth inside their mouth that they can use to bust mussel shells to get down to the meat. And so there are some species of freshwater mussel where the mama mussel actually sacrifices herself, in order for her offspring to have a chance to live. So when it's time for them when they're glochidia, their larva, are ready to go. The mussel will just lay out on the substrate on the bottom of the river that it's in and then those drum will come along and actually eat the mom. But once they crushed through that shell the glochidia are then flushed through the gills and stuff.

Dang. What about you mentioned the ones it's like an egg packet that kind of looks like maybe you said an invertebrate or something like that. Do those also like kind of pop when the fish goes to eat those?

Yeah, they do. The ones that we just call a conglutinate they might look a little like maybe a maggot or a small grub worm of some sort. And they would just be spit out along the bottom of the substrate on the rocks. And then when the darters come along and eat those are the other small fish that are keying in on those insects come along and eat those conglutinate packets, bursts, and they get flushed over it. But then when you have the species that produce the super conglutinates those are the ones that look more like another fish like maybe a minnow and they'll actually have a mucous coating and still be attached to the female mussel using a mucous strand. And so the mom will spit it out into the water column and the current from the water actually makes it move or swim. So it's like the minnow is swimming along in the water and then the bigger fish like the bath would see it would come in to eat it and when it does, then it cause that can gluten it or super conglutinate to burst open as well. And they insist which just means that once they attach to the gills if it's a viable host, the host will form a layer of skin or Gill membrane over that. Some fish actually overwinter those glochidia. So they might come on to the fish and say October and they'll live through November, December, January, usually falling off in the early spring. So it could be up to several months. When they transform into the juvenile stage and they fall off, they feed via what's called Pedal movement. The way I like to describe it to the kids that I work with is if you can imagine your entire body being filled with your tongue. That's kind of what a mussel's body is like. So it's called a foot but they use it to anchor themselves in the substrate. But when they're juveniles, they actually will use it to collect food to scrape the food off of the rocks and the sand that they're buried in, and then they'll pull their foot back inside and they'll process the food there. They'll grow for years and years. They put down growth rings kind of similar to a tree. It's not always super accurate, but you can get a gauge for how old a muscle is based on those.

For the people listening at home, if you're not familiar with the Unionid mussels, just how lifelike some of these lures are that they produce. Like it's incredible. Go look them up, because the way that they're even pigmenting these conglutinates or their mantle tissue. It looks more like the live fish than a lot of fishing lures I've seen. Like it's incredible, especially for these animals that really don't have eyes. They've just they've managed to evolve these super lifelike lures. I've seen them like look like crawfish, where they scuttle about their mantle tissue across the bottom. And of course, they couldn't be planning any of this...

That's what I was wondering, too. I mean, I don't understand how a muscle could actually imitate like, actually how something looks number one, and then how it actually behaves or moves in the water. Like that is just crazy.

Evolution baby.

So crazy. Like how can I do that?

That's a really good question. I don't think I've figured out exactly how they do it yet, either.

That's insane.

The Freshwater Mollusk Conservation Society, their website has a lot of great info and Dr. Chris Barnhart that was a professor at Missouri State University, he has some really phenomenal videos of these lures that the mussels use to attract the fish.

So the first mussel you mentioned was called a snuffbox. That's a pretty interesting name. Where does that come from? And then where are some of the other interesting names and some of these species we got around here?

Yes. So when new species are discovered, the scientist or the person that discovers them gets to name them. And so in the case of freshwater mussels, a lot of times those names come from whatever the biologist thinks they look like when they collect them. So you know, in the case of the snuff box, it's a relatively small mussel, usually no more than a few inches in size. But it looks like the little containers that people in the olden days would carry their snuff or tobacco in. One of my personal favorites is called a monkey face. And the shape of the shell with all the bumps on it and the ridges, if you hold it just right, it looks kind of like the head of a baboon. So that's how that one got its name, one that the kids that I work with at the hatchery get a kick out of is called a rabbit's foot. And it kind of resembles the lucky rabbits that you would carry on your keychain.

So so one is called the fat pocket book. Yep, I thought that was pretty funny. And a pig toe.

So in pig toes, pistol grips is another one. I think there's some heel splitters out there.

There are! Yeah, lots and lots of fun common names. Another one is a spectacle case, the shape of it kind of looks like a case you would carry your glasses in.

What is scientifically the name of this family of mussels, and what is their geographic distribution.

Here in the US we have two groups of mussels. Two families, the Unionids and the Margaritiferids. The Unionids are by far the most abundant group of mussels, and they do occur worldwide, almost all of the mussels that we have fall into the unionid group.

And do the Margaritiferids, do those also do these kind of lure display that have the same sort of lifecycle? Or is it different?

So the lifecycle is going to be the same. But in addition to those lure producing mussels, you do have some that are more of a host fish generalist, and they're going to be more of a broadcast spawner. So some don't use a lure at all. They just spit their babies out into the water and hope a fish swims through it. There's not as many of those as there are for those hosts specific mussels.

We've talked a lot about all the cool things that the female muscles do. But what are the dudes up to all this time?

I mean there a dude! No, I'm sorry. I'm kidding. That was totally inappropriate. So in the lifecycle of the muscle, the males are going to be primarily upstream of the females and their only job is to spit their seeds or sperm out into the water column and hope that the female siphons it in when she is filtering for food.

That's interesting. We've been learning a lot about the things that impact fish and one of those things is dams. I mean, we also get invasive species and climate change. What is impacting mussels? Is it some of the same things I mean, if I'm thinking about fish movement, and a host fish is declining. How has that impacted his mussels?

Yeah, absolutely. So you know, about 70% of all the freshwater mussels that we have in the United States are listed in some form or fashion. So their populations have declined, they may be declined to the point that they are actually extinct or they're federally endangered, or they may just be more of a species of concern where their numbers have started to decline. But hopefully, we can get in there, and we can help them out before they reach that threatened or endangered list. But historically, a lot of the decline was related to overharvest of mussels. So before plastics were common metals were harvested, their shells were used to make buttons. There was also what we know as the pearl boom, where somebody had actually found a pearl inside a freshwater mussel shell. And so everybody started going out and collecting these mussels, well, the only way to tell if they have a pearl in them is to crack them open. And once they're open, they can no longer feed, you've ripped apart part of the ligaments in there that hold the mussel shell closed, which allows them to siphon water. So the mussel inevitably is going to die, and you more than likely didn't find an actual pearl inside there. So those are some historic reasons for the declines. Nowadays, we're looking more at habitat degradation, pollution, the introduction of invasive species, like the zebra mussel, a lot of the habitat degradation is either from the construction of a dam, where we've turned a river into a lake or reservoir. So we've changed their habitat, a lot of it is related to sedimentation from where we clear cut along a river bank, and then it floods and we lose a lot of that bank, the sediment overloads the stream, it can suffocate the mussels. But when it comes to the dams, we're changing their habitat, but we're also impacting the migration of the host fish. And so if you have a host fish that has been completely separated from the mussel that needs it, in order to reproduce, that's absolutely going to affect that mussel population. So if it doesn't have a secondary host, or you know, a few other hosts that it can utilize to grow, then you very well could lose that population of the species of mussel that you're concerned about.

You mentioned in there zebra mussels, which when you hear about freshwater mussels in the news, I'll be honest, I hear a lot more about these invasives than I do the natives. So how can people know if

they're looking at a cool native mussel, or one of these invasive mussels or even other invasive bivalves like corbicula clams?

Yeah, so corbicula are fairly easy to identify from a native freshwater mussel. Most of the time your clam species are going to have more about like concentric ring. So when I mentioned earlier that you can kind of tell the growth of a mussel by counting the rings like you would on a tree, on freshwater mussels, those rings are not even all the time. But on clam or corbiculas, those circles are going to be very evenly spaced along the outside of the shell. So that's probably the easiest way to tell the difference in your corbicula versus your freshwater mussels. Corbicula also tend to not be as big as the native freshwater mussels. Some species or freshwater mussels, I've seen as big as my head.

Dang!

Some of them are and your corbicula are going to stay, you know, maybe the size of a quarter or a little bit larger would be about the biggest corbicula I've ever seen. They're usually pretty small. Zebra mussels though, when you see a zebra mussel, you're not going to find just one single zebra mussel. They use something called a basal thread or a basal filament to attach to substrate. And so it's basically like cement. And they will attach to a piece of substrate whether it is a rock, or a boat hole, a bridge pylon, dam, or a water pipe or even a freshwater mussel. It doesn't matter to them, what they're attaching to, they're just going to glue themselves in place. And when they do, you will usually see you know, 20, 30, 40...hundreds of them depending on the size of the substrate they're attaching to.

Okay, so the native ones, you're gonna find them solitary and what kind of habitat are they gonna be in.

So the native mussels, they're not necessarily solitary, you'll find them in a bed of mussels, but obvious individuals that are buried down into the substrate, we like to call them living rocks, because if you don't really know what you're looking for, and you're just looking at the bottom of a river, you see a lot of gravel and cobble. Most of the time that's kind of what those muscles are going to look like a normal person floating down the river or swimming in the river. Might think there's a rock laying there, but if they picked it up, it's an actual freshwater mussel and it'll be buried usually about half or two thirds of its body down in there, but they can burrow down into the substrate quite a long distance. And they'll use the interstitial spaces are the areas in between the sediment and the rocks to get water and nutrients, that that's how they can survive drought, they can withstand cold temperatures, if the water that they're in tends to freeze, they can burrow down into that substrate. So you might have a bed that is, you know, a couple 100 meters long or bigger, and there might be a thousand mussels within that bed, but they're not all going to be attached to something, they're going to be individual almost like rocks scattered out into the substrate.

It's cool. When I think about the Fish and Wildlife Service's National Fish Hatcheries, you know, fish come to mind first, but aren't there a lot of them kind of moving towards raising mussels or kind of doing science around the species and recovering some of those endangered ones? I know you work at a hatchery, maybe you can just kind of help us understand the role that hatcheries are playing at least the federal ones in the conservation of mussels.

Yeah, there are a lot of hatcheries, both at the federal and the state level, at least here in Arkansas that are working with mussels. And we can do that in kind of a number of ways. One, you know they require a host fish. So a hatchery may be raising fish to reintroduce them into a river or to increase the population. But it might also be to ship to another hatchery that needs that particular fish. In order to raise freshwater mussels, you can have a hatchery that just strictly raises host fish. But you can also have hatcheries that have mussels on site. Our facility does actually have some intensive culture space. So we have labs that are designated strictly for reproducing freshwater mussels, we invest the fish, we have them in aquariums inside our lab, we monitor them on a daily basis to check and see if those glochidia, the mussel larva, if they're still attached, did they fall off? Have they transformed into a juvenile? Typically when a test like that is going on, it's because we're trying to determine what that host fish is. But sometimes it's just because the host fish maybe is a really sensitive fish that doesn't do well, you know, in our ponds, or if they're around a lot of other species of fish, maybe they get stressed out or we have floods, so we can control the environment better inside a lab. But then we also have facilities that utilize the reservoirs. Maybe they're a cold water hatchery that is below a dam. They primarily raised trout, but they can use the marinas on the lakes to actually hold their cages. And so they would take the fish like a bath infested with the mussel glochidia and put the bass in a cage. And then usually about six to seven weeks later, that's a long enough time for a lot of these species to transform into juveniles, they would fall off the fish, we go open the cage, let the fish out. And then in the bottom of the cage is a layer of sand. So the juveniles fall into that that's their substrate where they're getting bacteria and algae and stuff to eat off of. And we'll leave them out there to let them grow throughout the summer into the fall. And then at that point, they're usually big enough to be able to see them with the naked eye. And so we can go kind of get numbers figured out exactly how many juveniles we were able to reproduce. Sometimes we'll go ahead and leave them there over the winter, maybe one two years until they're large enough for us to tag and then we'll stock them. So even though our primary focus is raising fish, because so many of our species are imperiled, we're also trying to raise those and reintroduce them because they're good for the water that our fish live in.

That's awesome. Are you guys able to do in vitro with these mussels? Like if a fish house isn't available and say you've got like a threatened or endangered species? Is there any of that technology happening?

yet? So we here at Mammoth Spring don't use in vitro, but there are a lot of facilities that are starting to do that. I know kind of one of the pioneers into the in vitro side of things. It's kind of really worked all the kinks out it His name is Monty McGregor, and he does a lot of work with that where they'll put it like a gel of sorts of medium inside a petri dish and in that medium usually contains some sort of animal blood. I think one that's really common as they use rabbit serum. And so they would put that in with the medium and then the block kitty would then use the nutrients that it's getting out of that rabbit serum to grow. That's so cool.

Question for you. Did you first become interested in mussels or fish?

All I ever wanted to be growing up was a marine biologist. And it wasn't until I was in college that I got into freshwater mussels. I was working in a lab at Arkansas State University and my brother had gotten me the job because he was a few years older than me and he worked there. And we had a postdoc that

decided he was going to make the first ever brother sister mussel team. And I told him, there was no way that was going to happen. He is also a malacologist, he works for the Arkansas Highway Department. He works for their environmental division. They go out and do surveys of the river look for muscles, they look for here the Ozark Hellbender, endangered fish species. And if they find those populations in the area that they're wanting to build their road or their bridge, then they have to find either new habitat or a different place for that bridge. I've been helping him so I had kind of gotten a little bit of an interest in them. And the same postdoc who's now a professor offered me a project to work on to get my master's degree. So he got his wish turns my brother and myself into the first ever brother, sister mussel team. And that was almost 15 years ago.

You guys are working a lot with the states. Is there coordination between states and hatcheries kind of on what y'all are doing to conserve the species?

Yeah, Arkansas Game and Fish has a state malacologist. We work with him on going out and surveying for mussels, finding the females that we're going to use to get the glochidia from. A lot of times he'll be out doing surveys and he'll bring us whatever mussel he wants us to be working on. Our sister hatcheries here in Arkansas that are more cold water, he'll go and really help them with their infestations of the fish. So we definitely work pretty close together with our state partners.

Is there anything folks should know about eating freshwater mussels? If you find these mussels in a creek? I know you've mentioned a number of them are imperiled. I mean, how should folks kind of approach what they're doing in these waterways where there are muscles, which presumably, you know, they're all across the United States. We have a few species up here in Alaska, even.

I know here in Arkansas, you have to have a fishing license, but there are still some commercial harvest people out there. So they get their commercial harvest permit and can take mussels in larger quantities, but it's very species specific. So I don't really recommend it anyway, just based on how the mussel feed. People that I know that have eaten freshwater mussels, it's not going to be like eating an oyster or a mussel that's, you know, grown in saltwater. They tend to be pretty gritty and chewy, from what I've heard. But if you're going to harvest them, with almost 70% being listed, you would definitely need to know what species you are taking because there could be a fine associated with it.

So why should people care about freshwater mussels? Just a quick summary a take home message for folks?

Yeah, I mean, I'm kind of partial to them because it's what I study, but freshwater mussels really are important to our aquatic habitats. So if you're somebody that likes to go out and enjoy swimming, or kayaking, canoeing, fishing, freshwater mussels help keep our aquatic systems clean. They filter out a lot of the toxins and stuff that are in the water. So we call them one of nature's kidneys, or natural filters. They're actually helping clean the water. They're also very sensitive. So they're used as a biological indicator, so they can let us know if a river system or a lake system isn't healthy. We go out to a river and we see a bunch of newly dead or fresh dead mussels where the shells are open, but the meat is still inside, then we know more than likely, there was some sort of contamination in them that killed them. Also, we drink water on a daily basis. And if those water sources are dirty or contaminated,

it takes a lot more to make that water safe and clean for us to consume it. So if we've got nice populations of freshwater mussels, in our rivers and our lakes and our ponds around where we're at, then overall our environment around us is a lot safer and healthier.

You have a read Russell the Mussel?

I have read Russell the Mussel.

What do you think of it?

It's a good one. I think everybody should read Russell the Mussel at some point.

That's a kids book put out by Fish and Wildlife Service. I'm pumping the brand here, pumping the shield, Katrina.

Thank you Guy. Thank you, Sara. It was great having you on learn a lot. And this was fascinating.

Yeah, it was fun.

All right, get out there and enjoy all the fish, especially those fish hosts who helped keep all of our amazing freshwater mussels alive and well like the logperch, bass and freshwater drum

Enjoy the mussels too. May as well.

Yes, and them too.

[laughs]

Thanks for listening the Fish of the Week! My name is Katrina Liebich and my co host is Guy Eroh. Our production partner for this series is Citizen Racecar. Produced and story edited by Tasha AF Limley. 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 Regional Office of External Affairs. We honor, thank and celebrate the whole community, individual tribes states, our sister agencies, fish enthusiasts, scientists and others who have elevated our understanding and love as people and professionals of all the fish.

Okay, a little bonus for you guys. These are the freshwater mussels currently listed as threatened or endangered and I apologize I've got kind of a slow mouth and I apologize any muscles whose names I mispronounce so here we go [reads list from here: https://ecos.fws.gov/ecp/report/species-listings-by-tax-group?statusCategory=Listed&groupName=Clams&total=123]