



The Naturalist

Interview with Anthony Schroeder about Native Sponge Monitoring

Hey everyone. Welcome to The Naturalist podcast by the University of Minnesota Extension. I'm Nate Meyer, your host today, and we are going to be talking with Dr. Anthony Schroeder from the University of Minnesota Crookston about his work with a team of researchers to find and describe Freshwater Sponges in Minnesota. We'll also share some ideas about where you can learn more and get involved.

Nate

Hi Tony, welcome to The Naturalist Podcast.

Tony

Hi, thank you so much for having me.

Nate

Listeners, you heard it right. I said freshwater sponges...in Minnesota. I understand that sponges are among the simplest kinds of animals and scientists have identified around 200 species of freshwater sponges worldwide, with around 32 of those in North America. But I was admittedly surprised to learn that freshwater sponges have been living in Minnesota for thousands of years. Tony, can you tell us more about what sponges are and where we might find them in Minnesota?

Tony

Sure. So as you had mentioned, freshwater sponges are the simplest of animals, and yes they are in fact animals. Although they are something that, for the most part, are not modal, at least in adult form. They are, in larval forms, capable of swimming through water columns and things like that. But once they're adults, they will end up on substrate in the bottom of lakes and rivers in the State of Minnesota, and for which they will grow. They are filter feeders. So they basically will remove things from the water by just filtering them. So they have cells that are specific to be able to just bring in water and then they take whatever is in the water, like bacteria and bunches of other small organisms, that they can then feed off of.

And freshwater sponges, there's some really, really fascinating things about them in terms of being able to live in Minnesota that I think it's just important to talk about, or to recognize, is that obviously we have changes in season. We have various types of climate, and so they've been able to adapt to live in rivers and lakes throughout this state. And go through a really fascinating life cycle, for which they are able to go through and they can grow. And

usually in the summer, and then in the fall, usually in the late fall, they'll go through and regress. And at which time they will go through and produce these what we call gemmules. Which they're capable of going through an asexual reproduction by producing these gemmules that have basically a small sponge cell in them. And they'll release those into the water column in the fall. And then those sponges, those gemmules, can then hatch and produce a new larval sponge that can then swim around in the water column come spring again. And then they'll attach to substrate; like rocks, sunken logs, in some cases even into sort of like a mucky bottom of a lake or river. And then they'll grow up again in that next summer and you can go out and find them in those various locations within lakes and rivers.

Nate

So how would I know a sponge if I saw one?

Tony

Interesting enough, sponges are one of those organisms that have not classically been studied. And so, just being able to go out into a lake or river and recognize something as being a sponge is not an easy thing. And a lot of times what people will do is they'll confuse a freshwater sponge for just being algae. But a lot of times if you go out and you see something that's like green that's growing up over a rock, if you feel it a lot of times if it's algae it will feel really slimy. Instead, because of the skeleton of a freshwater sponge, it's actually a very hard type animal, and so you can actually feel it has substance, it's not slimy at all. Instead, they have these what they call spicules that provide this really neat skeleton of the sponge and provides the support and structure for it. But in terms of just being able to go out and recognize it, if you haven't seen them, you probably won't recognize it as being a sponge.

Nate

How did you get interested and involved in studying sponges?

Tony

There's a couple of things that I just want to provide a little bit of a context for kind of how that project started. There was a group of us at the University of Minnesota Crookston, who were just talking about some various things and some different ideas, and we have a chemist who worked at the University Minnesota Crookston, who had studied marine sponges. And we were just talking one day and we came and we discovered that, or we had mentioned that, oh, by the way, there are also sponges in freshwater. And he said, really? And he said, yeah. And he said, well, do you think they're in the state of Minnesota? And so we went then to the literature and found that in the 70s, early—by the late 70s, early 80s, there was some researchers actually from the University of Minnesota who had looked into sponges at a very small area in the state and found some. But otherwise, there had been no work done on freshwater sponges in the state since that time.

But within that, we were like, oh, that sounds like something that would be really interesting that maybe we could look into. And when we went further into the literature, we found out that freshwater sponges are not explored that frequently even worldwide, let alone, you know, in Minnesota. And so we thought oh, this would be a really great project. But not only did we think it was just a great project just because of the interest about the thing, hey, freshwater sponges—not very many people know about it, is that at the University of Minnesota Crookston, we are solely an undergraduate institution. That's all we have are undergrads. And so it works out that because it's not studied a lot, that the freshwater sponges are not studied a lot, that we're able to really have sort of a nice sort of little niche setup where we can have students and give them really quality research opportunities to study things and develop, you know, find out like what's the distribution of sponges? Are there potentially new species? And really give them good quality research opportunities that at Crookston we're capable of doing, because there's so many cool questions that you can ask with freshwater sponges.

Nate

So when you think about developing this undergraduate research niche, what do you think are some of the things you're working to discover about sponges, or what problems are you trying to solve?

Tony

I think one of the important things that I haven't mentioned so far that is really important to recognize about freshwater sponges, is that because they're filter feeders, they're reliant on the things that are present in the water to be able to survive. And one of the things that's been shown within the literature is that sponges are really good indicators, are really good bioindicators of water quality. So they're not going to survive in waters that are highly polluted, for example. And so we're really using this as a good understanding of saying okay, well where are sponges within the State of Minnesota? Where are they not located? And trying to start to link that to the chemistry of the water, as well as looking at other aspects that might influence their distribution that hasn't been done so much in other locations, but certainly hasn't been done in the State of Minnesota. And so that's kind of our first overarching goal as it just relates to using freshwater sponges as a bioindicator. But then further from the research standpoint is that as you mentioned early on, at the beginning of the podcast, is that although there's 250 freshwater sponges that are—been described worldwide, there only 32 of them that have been described in North America. And so we would hope that in the Land of 10,000 Lakes, plus however many rivers, is that there might actually be freshwater sponges that have never been found or described, even here in the state.

Nate

I understand that your team includes biologists and chemists, and your methods involve collecting, freeze drying, DNA sequencing...this all sounds pretty cool. I wonder if you

could give our listeners a peek behind the scenes. How do you go about your work, and what are one or two cool tools, methods or strategies that you use in your sponge research?

Tony

Sure, probably the easiest to just kind of go through an overview of what it is that we do. So, it's usually as a biologist myself, and then we have just a host of undergraduates that work within the lab, that that work also during the summer. And so we'll go out to various lakes and rivers. And so far we've basically covered—well, we've collected over 100 sponge samples in the state, and we've literally gone from Southwest Minnesota all the way to Northwest Minnesota to Northeast. Man, we've covered all areas of the State of Minnesota so far.

So when we do that, what we'll do is we'll go out, we'll go into and wade into different rivers, for example, or usually into shallow regions of lakes where which we know is usually a rocky area or has sunken trees, those sort of things. Because we've done enough collections now we have a good sense of kind of where we would expect to find them, and those sort of things. And so we'll go out, we'll do our collections will put—we'll bring them in, put them into bottles, into separate bottles, so that we never mix sponges together or anything like that, and then we bring them back to the lab. And when we bring them back to the lab, we separate them out for different sorts of subsampling after we've done the collections. And so one set of the part of the sponge will go just for DNA analysis. Another part will go for morphological analysis.

So one of the things that I had mentioned earlier is that the sponges have this spicule skeleton. And for a really long time, the only way that they would ever go through and do any sort of analysis in terms of being able to identify species was through morphology, and that was it. And so we would go through and they would digest all the rest of the organic material and just leave the skeleton behind. And so we still do that process. So, we will still go through and prepare spicules so that we can do the morphology as well. And then, as mentioned we'll go through and then freeze dry the rest of the sponge. We'll remove all the water from it and we give that freeze dried sample then to the chemists. And they go through then and they'll extract the chemicals from the sponge that they're producing and then they'll use various types of analytical chemistry techniques to be able to identify the types of compounds that the sponges are actually making or using to be able to do different things.

Now one of the things that's kind of cool about this process is that marine sponges, historically if you look at the literature, are known to go through and produce a lot of interesting bioactive chemicals. And there is some information or some question about whether or not it's actually the sponge itself that's doing it or if it's some of the microbes that are associated with them. But they're known to produce some really interesting bioactive

chemicals. And so the chemists will use some high end analytical chemistry techniques to be able to identify these different compounds.

And then for us on the biology side, as I mentioned, we do...we prepare the spicules for morphology analysis and then we extract DNA from the samples and then we use mitochondrial DNA, because there's just significantly more mitochondria within the cells, and we use a very highly variable region that's classically been used for being able to barcode or identify species. And then we can compare that to these databases for which there's different sponge information out there, and then we can start to identify is it a potentially new species of sponge or not.

Nate

You've talked a lot about involving undergraduate students in your research. Our listeners also love to learn more about and help with environmental stewardship. So what are one or two things you suggest they could do to help with your efforts?

Tony

So, we're able to, obviously, collect samples, or sponges, from about late June through late September. But one of the things that we've recognized is that in the Land of 10,000 Lakes and rivers and things like that, is that our small cohort of people who are working on this project at the University of Minnesota Crookston cannot do the sampling at the extent that we would like to be able to do it. And so one of the kind of things that we've tried to do now is we've moved to even more so to try to start encouraging citizen scientists. People who like to just get out on the water and go see about trying to collect animals, or see what's in the water and that kind of stuff, to actually start helping us go out and collect sponges.

And so we, one of the things that we're working towards, and we've tried to get funding to do, is to set up various opportunities like town halls, where we can teach the general public, as well as the Master Naturalists, about sponges. And have other people throughout the State of Minnesota go out, like when you're just going into the lake for a swim, or you want to go fishing and stuff like that. Like when you get done, hey, maybe we should go look for sponges. And so we're setting up, for example, various kits and things like that for people who are interested in just going out doing some collections. And then going ahead and sending them to us at the University of Minnesota Crookston. We would go through and do the genetic analysis, the spicule analysis, a little bit of the chemistry analysis and then from that we would then also in turn, you know, provide information to those people who did the collections. Like oh, you found this type of sponge in the State of Minnesota. Had it been found before, had it not been found before, and all those sort of things as kind of a way to really give us a really good extent to what type of sponges are in the state. As well as even then further linking into the water quality by having such a greater sample size than what we could ever be able to do just at the University of Minnesota Crookston.

Nate

So I have a last question for you. I suspect you're familiar with social media apps. So I want to ask, what is a hashtag or a message that you wish would really take off? Like millions of people are sharing it.

Tony

I would just like to see a hashtag that says, #freshwatersponge. Just because so many people would go, what the hell you talking about? So that would maybe be the one that I would be interested in. Although, problem is that at this time, you know, in 2020 with everything that's going on in the world, there's certainly a lot of other things that would be maybe significantly better that I would definitely be in favor of also having a hashtag. But as it relates to the work, I would just #freshwatersponge.

Nate

Thanks for listening to this episode of The Naturalist. Huge thanks to Dr. Anthony Schrader for joining us today. Search for freshwatersponges.crk.umn.edu to learn more and to get involved in the project he talked about.

This episode was recorded over zoom from our homes during the coronavirus and pandemic in 2020. We hope you enjoyed the opportunity for some advanced training during your daily walk, while gardening, or while sitting at your desk. Give us a thumbs up or drop a comment to let us know you value the podcast, pass it along to others. We look forward to sharing another episode soon. In the meantime, stay safe, be healthy and we hope you enjoy nature in place.